

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner

2009 ENGINE**Engine - 2.5L - Escape & Mariner****SPECIFICATIONS****MATERIAL SPECIFICATIONS****MATERIAL SPECIFICATIONS**

| Item | Specification | Fill Capacity |
|--|---------------|--|
| High Temperature 4x4 Front Axle and Wheel Bearing Grease XG-11 | WSS-M1C267-A1 | - |
| 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 | 4.25L (4.5 qt) includes filter change |
| Multi-Purpose Grease XG-4 and/or XL-5 | ESB-M1C93-B | - |
| Silicone Brake Caliper Grease and Dielectric Compound XG-3-A | ESE-M1C171-A | - |
| Silicone Gasket and Sealant TA-30 | WSE-M4G323-A4 | - |
| Silicone Gasket Remover ZC-30 | - | - |
| Thread Sealant with PTFE TA-24 | WSK-M2G350-A2 | - |

GENERAL SPECIFICATIONS**GENERAL SPECIFICATIONS**

| Item | Specification |
|--|--------------------------------|
| Displacement | 2.5L |
| No. of cylinders | 4 |
| Bore/stroke | 89.0/100.0 |
| Firing order | 1-3-4-2 |
| Oil pressure (hot @ 2,000 rpm) | 200-268 kPa (29-39 psi) |
| Compression ratio | 9.7:1 |
| Engine weight (without accessory drive components and flexplate or flywheel) | 115.8 kg (255.3 lb) |
| Engine and transaxle assembly weight (without accessory drive components) | 203.8 kg (449.3 lb) |
| Cylinder Block | |
| Cylinder bore diameter | 89.0-89.03 mm (3.503-3.505 in) |
| Cylinder bore maximum out-of-round | 0.008 mm (0.0003 in) |

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| | |
|--|---|
| Main bearing bore diameter | 57.018-57.040 mm (2.244-2.245 in) |
| Head gasket surface flatness | 0.1 mm/general 0.05 mm/200 x 200 (0.004 in/general) (0.0019 in/7.87 x 7.87) |
| Piston | |
| Diameter (1) | 88.965-88.975 mm (3.5025-3.5029 in) |
| Diameter (2) | 88.975-88.985 mm (3.5029-3.5033 in) |
| Diameter (3) | 88.985-88.995 mm (3.5033-3.5037 in) |
| Piston-to-bore clearance | 0.025-0.045 mm (0.0009-0.0017 in) |
| Ring groove width - top | 1.203-1.205 mm (0.0473-0.0474 in) |
| Ring groove width - 2nd | 1.202-1.204 mm (0.0473-0.0474 in) |
| Ring groove width - oil | 2.501-2.503 mm (0.0984-0.0985 in) |
| Piston skirt coating thickness | 0.008-0.016 mm (0.0003-0.0006 in) |
| Piston Pin | |
| Diameter | 19.995-20.0 mm (0.8265-0.8267 in) |
| Length | 54.7-55.0 mm (2.1535-2.1653 in) |
| Piston-to-pin clearance | Floating pin |
| Pin-to-rod clearance | Clip |
| Cylinder Head | |
| Cylinder head flatness | 0.08 (0.0031 in) maximum overall, a maximum of 0.05 mm (0.0019 in) within 150 mm (5.9 in) |
| Valve lift @ zero lash (exhaust) | 7.7 mm (0.30 in) |
| Valve lift @ zero lash (intake) | 8.8 mm (0.35 in) |
| Valve guide diameter | 5.509-5.539 mm (0.216-0.218 in) |
| Valve seat width - intake/exhaust | 0.99-1.84 mm (0.038-0.072 in) |
| Valve seat angle | 45 degrees |
| Valve seat runout | 0.075 mm (0.0029 in) |
| Valve lash adjuster bore diameter | 31.00-31.03 mm (1.220-1.221 in) |
| Cam bore diameter | 25.015-25.040 mm (0.984-0.985 in) |
| Valve | |
| Valve head diameter - intake | 34.85-35.15 mm (1.372-1.383 in) |
| Valve head diameter - exhaust | 29.85-30.15 mm (1.175-1.187 in) |
| Valve stem diameter - intake | 5.470-5.485 mm (0.2153-0.2159 in) |
| Valve stem diameter - exhaust | 5.465-5.480 mm (0.2151-0.2157 in) |
| Valve stem-to-guide clearance - intake | 0.0027 mm (0.00010 in) |
| Valve stem-to-guide clearance - exhaust | 0.0029 mm (0.00011 in) |
| Valve face runout | 0.05 mm (0.0019 in) |
| Valve face angle | 45 degrees |
| Valve Spring - Compression Pressure | |
| Intake and exhaust (installed) | 17.5 kg (38.667 lb) |
| Intake (valve open) 8.9 mm (0.35 in) of lift | 44 kg (97.032 lb) |
| Exhaust (valve open) | 7.4 mm of lift 42 kg (93.338 lb) |

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| | |
|--|-----------------------------------|
| Free length | 44.92 mm (1.768 in) |
| Assembled height | 37.9 mm (1.492 in) |
| Crankshaft | |
| Main bearing journal diameter | 51.978-52.002 mm (2.046-2.047 in) |
| Production repair | 51.730-51.750 mm (2.036-2.037 in) |
| Main bearing clearance | 0.016-0.047 mm (0.0006-0.0015 in) |
| Connecting rod journal diameter | 51.978-52.002 mm (2.046-2.047 in) |
| Production repair | 51.730-51.750 mm (2.036-2.037 in) |
| End play | 0.220-0.450 mm (0.007-0.018 in) |
| Rings | |
| Width - top | 1.17-1.185 mm (0.0460-0.0466 in) |
| Width - 2nd | 1.197-1.199 mm (0.0471-0.0472 in) |
| Width - oil | 2.38-2.45 mm (0.093-0.096 in) |
| Ring gap (in bore) - top | 0.16-0.31 mm (0.006-0.012 in) |
| Ring gap (in bore) - 2nd | 0.31-0.46 mm (0.012-0.018 in) |
| Ring gap (in bore) - oil | 0.2-0.7 mm (0.007-0.027 in) |
| Valve Tappet | |
| Diameter | 30.97-30.98 mm (1.2192-1.2196 in) |
| Tappet-to-valve clearance - intake | 0.22- 0.28 mm (0.008-0.011 in) |
| Tappet-to-valve clearance - exhaust | 0.27-0.33 mm (0.010-0.013 in) |
| Tappet-to-bore clearance | 0.02-0.06 mm (0.0007-0.0023 in) |
| Camshaft | |
| Lobe lift - intake | 8.24999 mm (0.324 in) |
| Lobe lift - exhaust | 7.80007 mm (0.307 in) |
| Runout (1) ⁽¹⁾ | 0.03 mm (0.001 in) |
| Thrust clearance | 0.09-0.24 mm (0.003-0.009 in) |
| Journal diameter | 24.96-24.98 mm (0.982-0.983 in) |
| Journal-to-bore clearance | 0.035-0.080 mm (0.001-0.003 in) |
| Connecting Rod | |
| Bearing clearance | 0.027-0.052 mm (0.001-0.002 in) |
| Bearing thickness | 1.496-1.520 mm (0.058-0.059 in) |
| Crank bore diameter | 55.023-55.047 mm (2.166-2.167 in) |
| Pin bore diameter | 20.965-20.985 mm (0.825-0.826 in) |
| Length (center-to-center) | 151.8 mm (5.976 in) |
| Side clearance | 1.95-3.05 mm (0.076-0.120 in) |
| Axial clearance | 0.14-0.36 mm (0.005-0.014 in) |
| (1) No. 3 Journal - Supported by No. 1 and No. 5 journals. | |

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

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| Description | Nm | lb-ft | lb-in |
|---|-----|-------|-------|
| A/C compressor mounting bolts | 25 | 18 | - |
| Accessory drive belt idler pulley and bracket bolts | 25 | 18 | - |
| Accessory drive belt idler pulley bolt | 25 | 18 | - |
| Accessory drive belt tensioner bolts | 25 | 18 | - |
| Air Cleaner (ACL) outlet pipe-to-Throttle Body (TB) clamp | 4 | - | 35 |
| Balance shaft bolts ⁽¹⁾ | - | - | - |
| Bellhousing-to-engine bolts | 48 | 35 | - |
| Blocker heater | 40 | 30 | - |
| Camshaft bearing cap bolts ⁽¹⁾ | - | - | - |
| Camshaft sprocket bolts | 72 | 53 | - |
| Clutch hydraulic line | 25 | 18 | - |
| Clutch hydraulic line bracket-to-transaxle bolt | 3 | - | 27 |
| Coil-on-plug stud bolts | 8 | - | 71 |
| Connecting rod cap bolts ⁽¹⁾ | - | - | - |
| Coolant outlet bolts | 10 | - | 89 |
| Coolant pump bolts | 10 | - | 89 |
| Coolant pump pulley bolts | 20 | - | 177 |
| Crankcase vent oil separator bolts | 10 | - | 89 |
| Crankshaft Position (CKP) sensor bolts ⁽¹⁾ | - | - | - |
| Crankshaft pulley bolt ⁽¹⁾ | - | - | - |
| Crankshaft rear oil seal retainer bolts ⁽¹⁾ | - | - | - |
| Cylinder head bolts ⁽¹⁾ | - | - | - |
| Cylinder Head Temperature (CHT) sensor | 12 | - | 106 |
| Dampener bolts | 40 | 30 | - |
| Driveshaft bolts | 37 | 27 | - |
| EGR tube | 55 | 41 | - |
| EGR valve bolts | 20 | - | 177 |
| Engine front cover bolts ⁽¹⁾ | - | - | - |
| Engine front cover-to-oil pan bolts ⁽¹⁾ | - | - | - |
| Engine mount bolts | 55 | 41 | - |
| Engine mount bracket bolt | 115 | 85 | - |
| Engine mount bracket nuts | 115 | 85 | - |
| Engine Oil Pressure (EOP) switch | 15 | - | 133 |
| Engine plug bolt | 20 | - | 177 |
| Engine support crossmember bolts | 90 | 66 | - |
| Engine support crossmember nut | 175 | 129 | - |
| Engine-to-bellhousing bolts | 48 | 35 | - |
| Exhaust manifold heat shield bolts | 10 | - | 89 |

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| | | | |
|--|-----|----|-----|
| Exhaust manifold nuts ⁽¹⁾ | - | - | - |
| Exhaust manifold stud bolts | 17 | - | 150 |
| Flexplate bolts ⁽¹⁾ | - | - | - |
| Flywheel bolts ⁽¹⁾ | - | - | - |
| Fuel rail stud bolts | 23 | 17 | - |
| Generator electrical connection nut | 6 | - | 53 |
| Generator mounting bolt and nuts | 47 | 35 | - |
| Ground eyelet bolt | 10 | - | 89 |
| Ground strap bolt | 10 | - | 89 |
| Intake manifold bolts | 18 | - | 159 |
| Intermediate shaft bearing retainer nuts | 27 | 20 | - |
| Knock Sensor (KS) bolt | 20 | - | 177 |
| Lateral support crossmember bolts | 115 | 85 | - |
| LH splash shield bolts | 9 | - | 80 |
| LH transaxle mount bolt | 103 | 76 | - |
| Lower front cover timing hole plug | 12 | - | 106 |
| Main bearing beam bolts ⁽¹⁾ | - | - | - |
| Oil filter adapter bolts | 25 | 18 | - |
| Oil filter cover (replaceable element filter type) | 33 | 24 | - |
| Oil filter drain plug | 10 | - | 89 |
| Oil filter (spin on filter type) ⁽²⁾ | - | - | - |
| Oil pan-to-bellhousing bolts ⁽¹⁾ | - | - | - |
| Oil pan bolts ⁽¹⁾ | - | - | - |
| Oil pan drain plug | 28 | 21 | - |
| Oil pump drive chain tensioner bolt | 10 | - | 89 |
| Oil pump drive chain tensioner shoulder bolt | 10 | - | 89 |
| Oil pump bolts ⁽¹⁾ | - | - | - |
| Oil pump screen and pickup tube bolts | 10 | - | 89 |
| Oil pump sprocket bolt | 25 | 18 | - |
| Oil squirts | 4 | - | 35 |
| Power Distribution Box (PDB) cable nut | 12 | - | 106 |
| Power Transfer Unit (PTU) bolts | 70 | 52 | - |
| PTU bracket bolts | 45 | 33 | - |
| PTU bracket-to-engine bolts | 40 | 30 | - |
| PTU heat shield bolts | 11 | - | 97 |
| PTU lower LH bolt | 45 | 33 | - |
| Pressure plate bolts | 29 | 21 | - |
| Radio capacitor bolt | 20 | - | 177 |
| Radio capacitor nut | 10 | - | 89 |
| Rear transaxle mount bolt | 115 | 85 | - |

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|--|----|----|-----|
| RH splash shield bolts | 9 | - | 80 |
| Shift cable bracket bolts | 22 | 16 | - |
| Spark plug | 12 | - | 106 |
| Starter motor bolts | 35 | 26 | - |
| Starter motor solenoid battery nut | 12 | - | 106 |
| Starter motor solenoid nut | 5 | - | 44 |
| Starter motor ground wire nut | 25 | 18 | - |
| Thermostat housing bolts | 10 | - | 89 |
| Timing chain guide bolts | 10 | - | 89 |
| Timing chain tensioner bolts | 10 | - | 89 |
| Torque converter nuts | 35 | 26 | - |
| Transaxle-to-engine bolts | 48 | 35 | - |
| Transaxle-to-PTU bolt | 48 | 35 | - |
| Upper engine bracket-to-PTU bolts | 45 | 33 | - |
| Upper front cover timing hole plug | 10 | - | 89 |
| Valve cover bolts ⁽¹⁾ | - | - | - |
| Variable Camshaft Timing (VCT) oil control solenoid bolt | 10 | - | 89 |
| VCT system oil filter plug | 17 | - | 150 |

(1) Refer to procedure for specification.

(2) Lubricate the spin on oil filter gasket with clean engine oil. Tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.

DESCRIPTION AND OPERATION

ENGINE

The 2.5L (153 CID) 4-cylinder engine has the following features:

- Dual overhead camshaft
- Four valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- Aluminum cylinder head
- Aluminum cylinder block
- Electronic ignition system with coil-on-plug 4 ignition coils

The 2.5L engine is a 4 valve-per-cylinder, dual overhead camshaft engine. The engine uses a coil-on-plug ignition system. The cylinder block is made of aluminum and the bearing caps are integrated into the ladder assembly. An aluminum oil pan bolts to the bottom of the lower cylinder block and to the transmission to provide greater strength. The camshafts are mounted in the cylinder heads and act against valve tappets to open and close the valves. The camshafts are driven off the front of the cylinder head by one timing chain. The chain is driven by a sprocket that is located on the crankshaft. The piston assembly is an aluminum piston with a cast iron connecting rod. The oil pump is driven by the crankshaft via a dedicated chain that is driven by the same

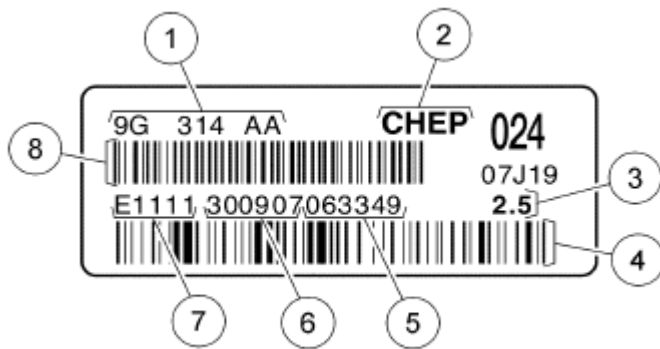
sprocket that drives the timing chain.

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. The Ford Master Parts Catalog contains a complete listing of the codes and their applications.

Engine Code Information Label

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



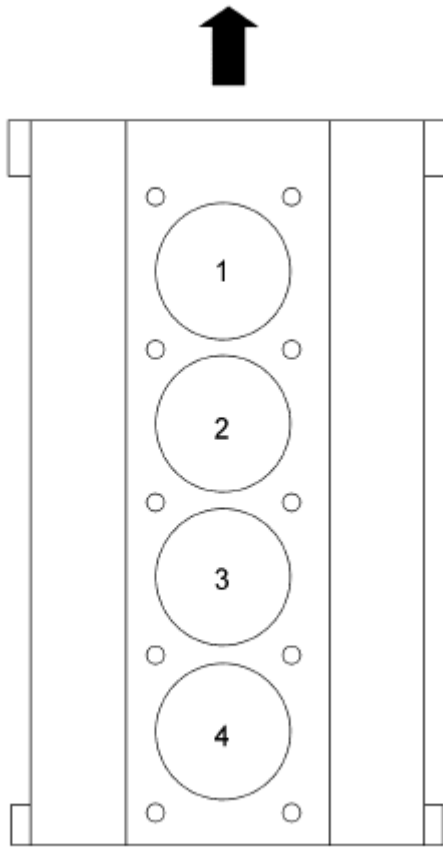
N0096817

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

ITEM DESCRIPTION

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

Engine Cylinder Identification



N0070002

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 4 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.
- supply fuel from the fuel tank with a fuel pump mounted in the fuel tank.

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 injection supply manifold.

PCV System

All engines are equipped with a closed-type PCV system recycling the crankcase vapors to the 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 the cylinder head.
- 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.

DIAGNOSIS AND TESTING

ENGINE

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

GENERAL PROCEDURES

VALVE CLEARANCE CHECK

1. Remove the valve cover. For additional information, refer to **VALVE COVER**.
2. Remove the 5 bolts, the pin-type retainer (not shown) and the RH splash shield.
 - To install, tighten to 9 Nm (80 lb-in).

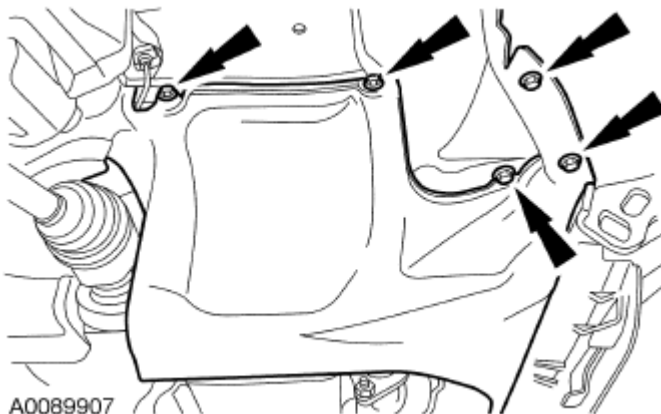


Fig. 3: Locating RH Splash Shield Bolts
Courtesy of FORD MOTOR CO.

NOTE: Turn the engine clockwise only, and only use the crankshaft bolt.

NOTE: Before removing the camshafts, measure the clearance of each valve at base circle, with the lobe pointed away from the tappet. Failure to measure all clearances prior to removing the camshafts will necessitate repeated removal and installation and wasted labor time.

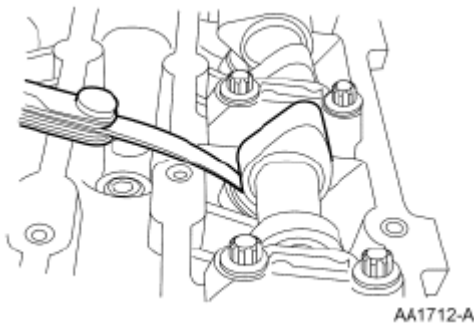


Fig. 4: Measuring Clearance Of Valve
Courtesy of FORD MOTOR CO.

3. Use a feeler gauge to measure the clearance of each valve and record its location.

NOTE: The number on the valve tappet only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

NOTE: The nominal clearance is:

- intake: 0.25 mm (0.0095 in).
- exhaust: 0.30 mm (0.0115 in).

4. The acceptable clearances after being fully installed are:
 - intake: 0.22-0.28 mm (0.008-0.011 in).
 - exhaust: 0.27-0.33 mm (0.010-0.013 in).

Select tappets using this formula: tappet thickness = measured clearance + the existing tappet thickness - nominal clearance.

Select the closest tappet size to the ideal tappet thickness available and mark the installation location.

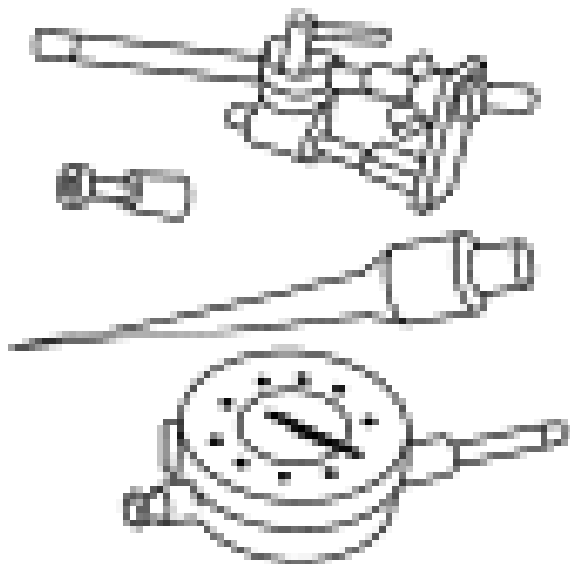
5. If any tappets do not measure within specifications, install new tappets in these locations. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **VALVE**

TAPPETS.

BALANCE SHAFT BACKLASH

Special Tool(s)

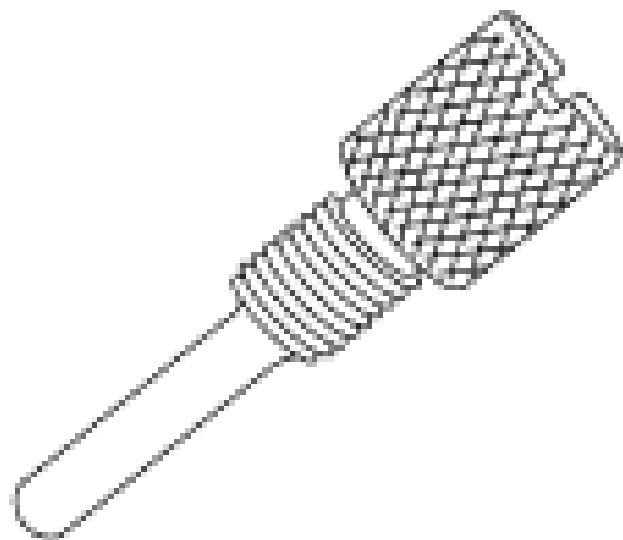
SPECIAL TOOL REFERENCE CHART



ST1214-A

Dial Indicator Gauge with Holding Fixture
100-002 (TOOL-4201-C)

Timing Peg, Crankshaft TDC
303-507

**ST2638-A**

1. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg. The engine is now at Top Dead Center (TDC).

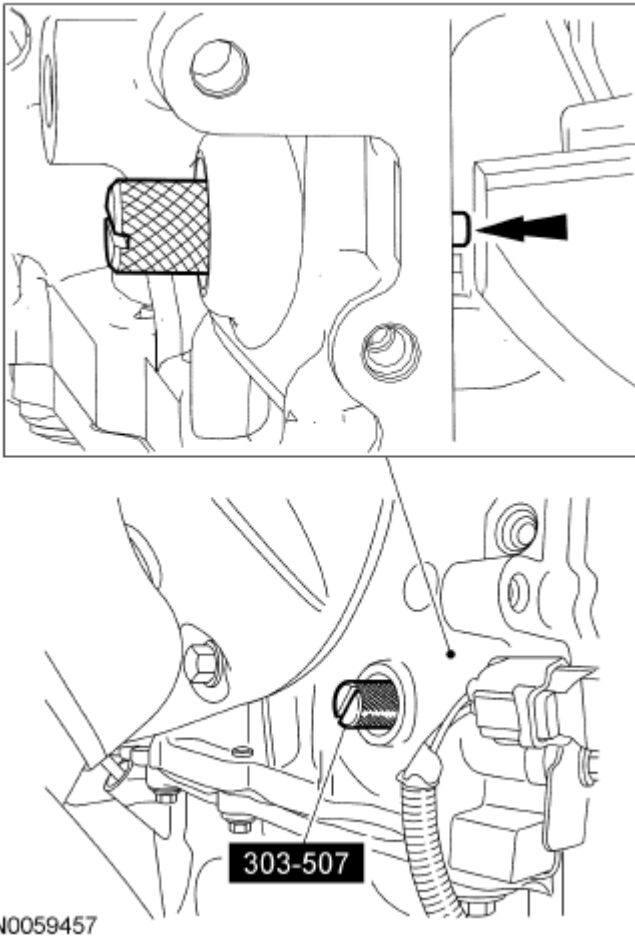


Fig. 5: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

2. Mark the balancer unit and shafts on the top for reference that the balancer unit is at TDC.

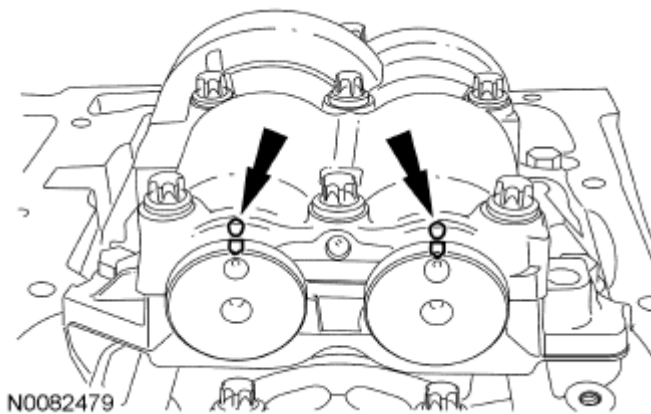


Fig. 6: Locating Balancer Unit And Shafts Reference Mark
Courtesy of FORD MOTOR CO.

NOTE: Due to the precision interior construction of the balancer unit, it should not be disassembled.

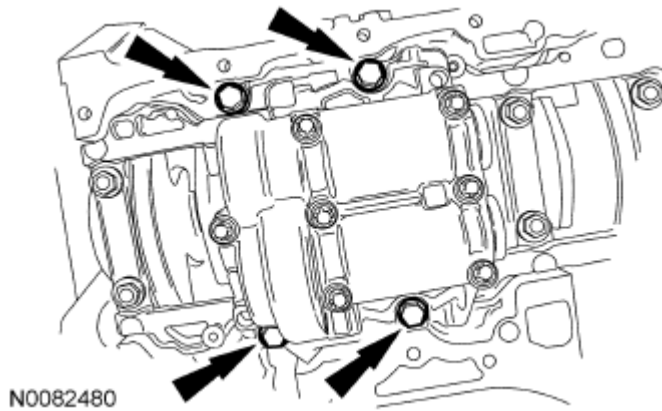


Fig. 7: Locating Balancer Unit Bolts
Courtesy of FORD MOTOR CO.

3. Remove the 4 bolts and the balancer unit.
4. Remove the adjustment shims from the seat faces of the balancer unit.

NOTE: Visually inspect the balancer unit gear for damage and verify that the shaft turns smoothly. If there is any damage or malfunction, replace the balancer unit.

5. Install the master adjustment shims (No. 50) on the seat faces of the balancer unit.
6. With the balancer unit shaft marks at the TDC position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

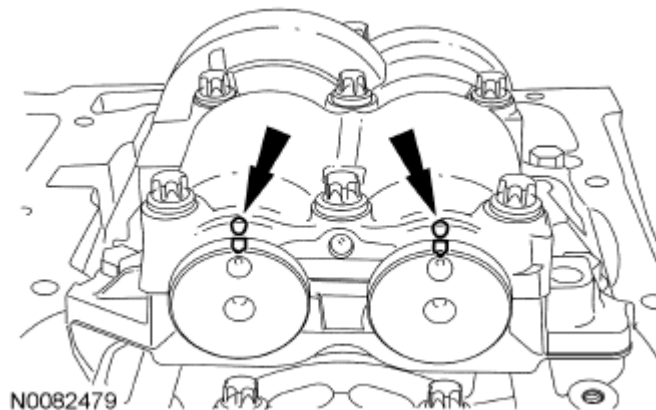


Fig. 8: Locating Balancer Unit Shaft Marks At TDC Position
Courtesy of FORD MOTOR CO.

7. Install the balancer unit bolts.

- Tighten in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

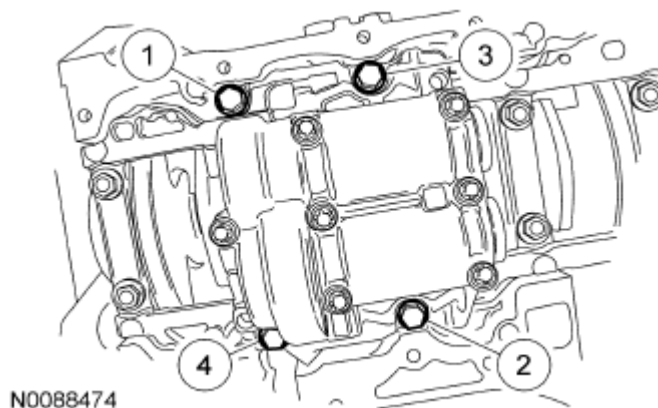


Fig. 9: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

8. Remove the Crankshaft TDC Timing Peg.
 - Rotate the crankshaft to confirm that there are no meshing problems between the balancer unit gear and the crankshaft gear.

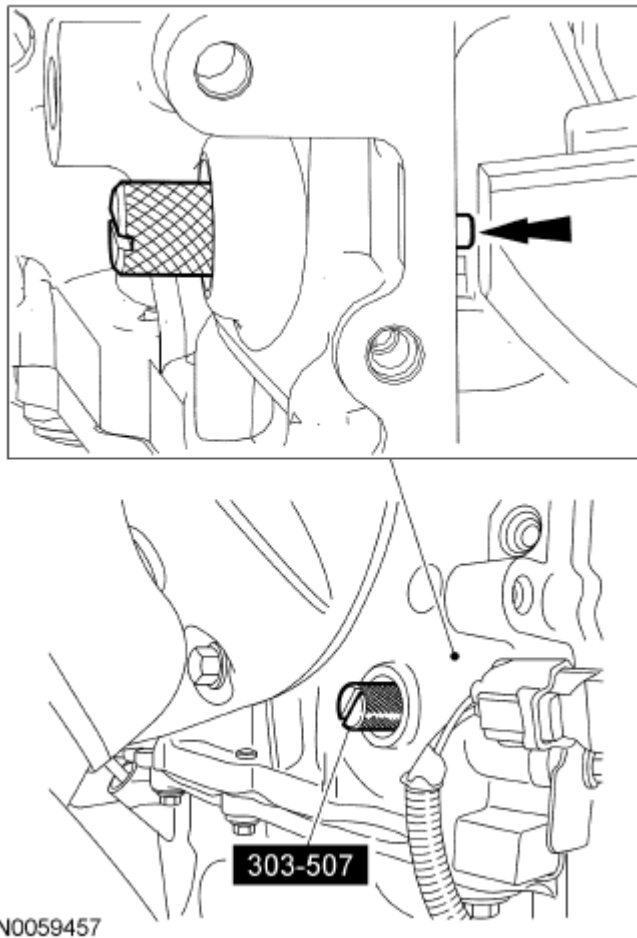


Fig. 10: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

9. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg.
 - Remove the Crankshaft TDC Timing Peg.

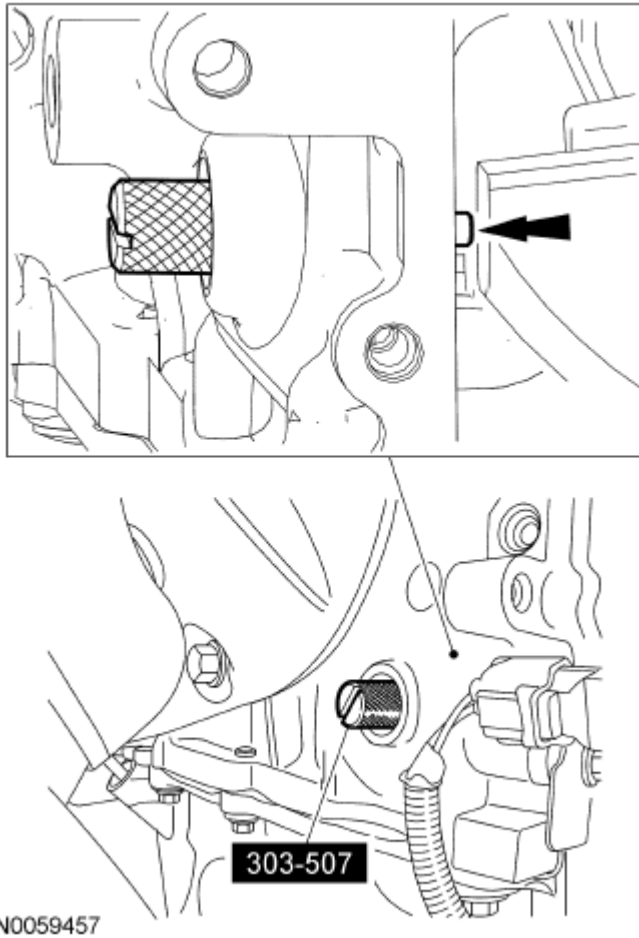


Fig. 11: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

- NOTE:** Measure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.
- NOTE:** The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.
- NOTE:** For an accurate measurement while measuring the gear backlash, insert a screwdriver as shown into the crankshaft No. 1 crank weight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.

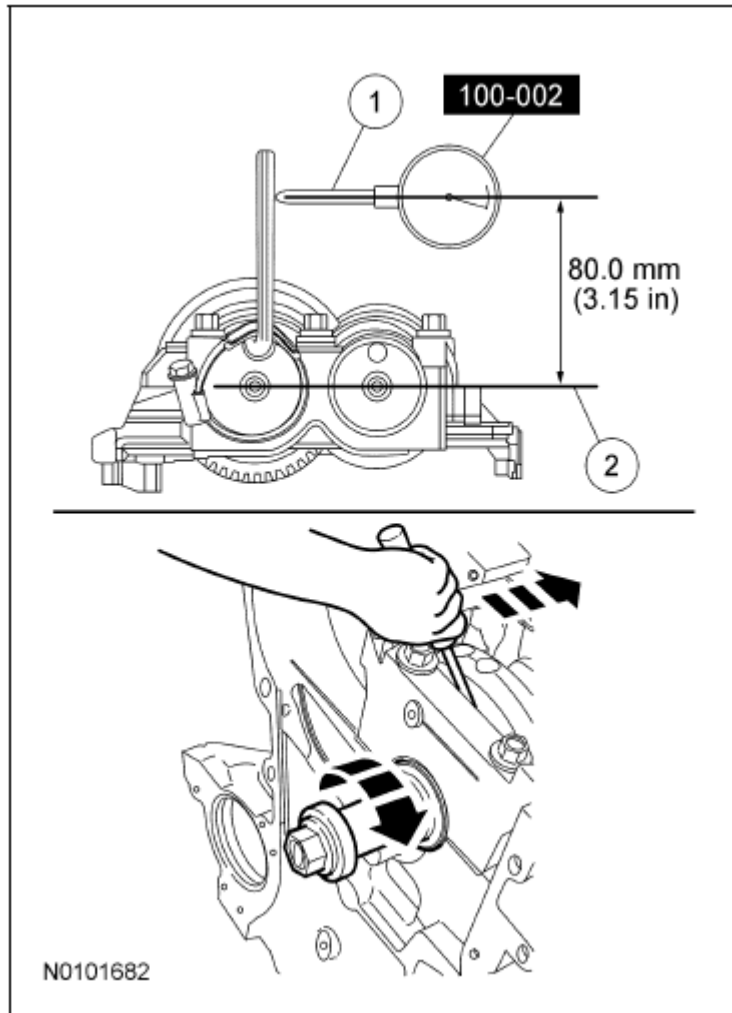


Fig. 12: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

10. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.
 - Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
 - Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.

NOTE: If maximum backlash exceeds 0.101 mm (0.003 in), install a new balancer unit.

11. Using the backlash measurement, select the proper shims from the Adjustment Shim Selection Table.
 - Remove the balancer unit from the cylinder block.
 - Install the selected adjustment shims on the seat faces of the balancer unit.

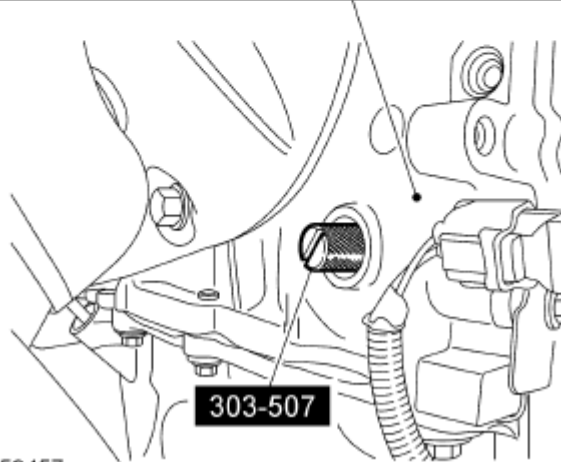
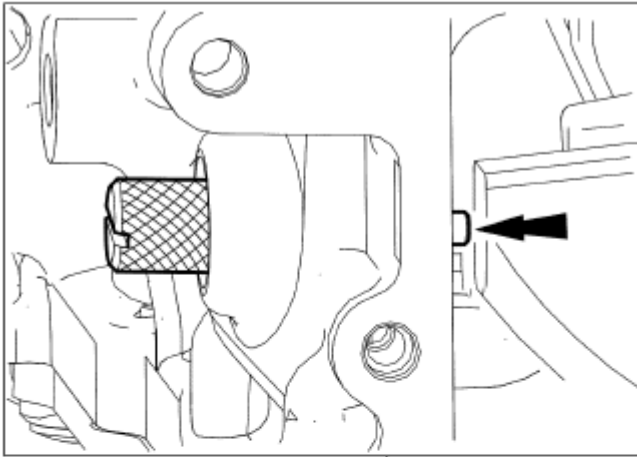
ADJUSTMENT SHIM SELECTION TABLE

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner

| Backlash mm (in) | Selection shim (No.) | Shim thickness mm (in) |
|------------------------------|-----------------------------|-------------------------------|
| 0.516-0.528 (0.0203-0.0207) | 15 | 1.15 (0.0452) |
| 0.502-0.514 (0.0197-0.0202) | 16 | 1.16 (0.0456) |
| 0.489-0.500 (0.0192-0.0196) | 17 | 1.17 (0.0460) |
| 0.475-0.487 (0.0187-0.0191) | 18 | 1.18 (0.0464) |
| 0.462-0.473 (0.0181-0.0186) | 19 | 1.19 (0.0468) |
| 0.448-0.460 (0.0176-0.0181) | 20 | 1.20 (0.0472) |
| 0.435-0.446 (0.0171-0.0175) | 21 | 1.21 (0.0476) |
| 0.421-0.433 (0.0165-0.0170) | 22 | 1.22 (0.0480) |
| 0.408-0.419 (0.0160-0.0164) | 23 | 1.23 (0.0484) |
| 0.394-0.406 (0.0155-0.0159) | 24 | 1.24 (0.0488) |
| 0.381-0.392 (0.0150-0.0154) | 25 | 1.25 (0.492) |
| 0.367-0.379 (0.0144-0.0149) | 26 | 1.26 (0.0496) |
| 0.354-0.365 (0.0139-0.0143) | 27 | 1.27 (0.0499) |
| 0.340-0.352 (0.0133-0.0138) | 28 | 1.28 (0.0503) |
| 0.327-0.338 (0.0128-0.0133) | 29 | 1.29 (0.0507) |
| 0.313-0.325 (0.0123-0.0127) | 30 | 1.30 (0.0511) |
| 0.300-0.311 (0.0118-0.0122) | 31 | 1.31 (0.0515) |
| 0.286-0.298 (0.0112-0.0117) | 32 | 1.32 (0.0519) |
| 0.272-0.284 (0.0107-0.0111) | 33 | 1.33 (0.0523) |
| 0.259-0.271 (0.0101-0.0106) | 34 | 1.34 (0.0527) |
| 0.245-0.257 (0.0096-0.0101) | 35 | 1.35 (0.0531) |
| 0.232-.0243 (0.0091-0.0095) | 36 | 1.36 (0.535) |
| 0.218-0.230 (0.0085-0.0090) | 37 | 1.37 (0.539) |
| 0.205-.0216 (0.0080-0.0085) | 38 | 1.38 (0.0543) |
| 0.191-0.203 (0.0075-0.0079) | 39 | 1.39 (0.0547) |
| 0.178-0.189 (0.0070-0.0074) | 40 | 1.40 (0.0551) |
| 0.164-0.176 (0.0064-0.0069) | 41 | 1.41 (0.0555) |
| 0.151-0.162 (0.0059-0.0063) | 42 | 1.42 (0.0559) |
| 0.137-0.149 (0.0053-0.0058) | 43 | 1.43 (0.0562) |
| 0.124-0.135 (0.0048-0.0053) | 44 | 1.44 (0.0566) |
| 0.110-0.122 (0.0043-0.0048) | 45 | 1.45 (0.0570) |
| 0.097-0.108 (0.0038-0.0042) | 46 | 1.46 (0.0574) |
| 0.083-0.095 (0.0032-0.0037) | 47 | 1.47 (0.0578) |
| 0.070-0.081 (0.0027-0.0031) | 48 | 1.48 (0.0582) |
| 0.056-0.068 (0.0022-0.0026) | 49 | 1.49 (0.0586) |
| 0.043-0.054 (0.0016-0.0021) | 50 (master) | 1.50 (0.0590) |
| 0.029-0.041 (0.0011-0.0016) | 51 | 1.51 (0.0594) |
| 0.015-0.027 (0.0005-0.0010) | 52 | 1.52 (0.0598) |
| 0.002-0.014 (0.00007-0.0005) | 53 | 1.53 (0.0602) |
| 0.000-0.000 (0.0000-0.0000) | 54 | 1.54 (0.0606) |

12. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg. The engine is now at TDC.



N0059457

Fig. 13: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

13. With the balancer unit shaft marks in the TDC position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

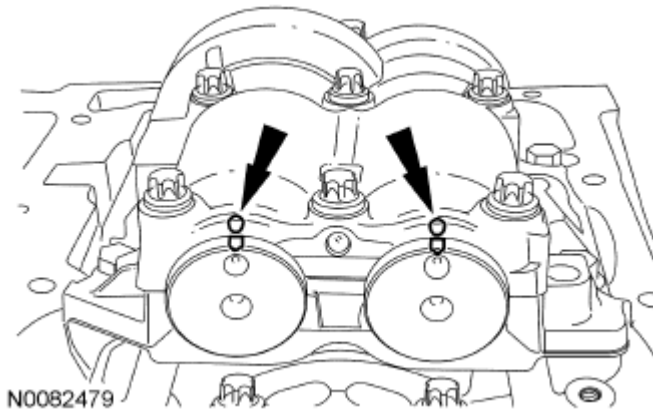


Fig. 14: Locating Balancer Unit Shaft Marks At TDC Position
Courtesy of FORD MOTOR CO.

14. Install the balancer unit bolts.
- Tighten in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

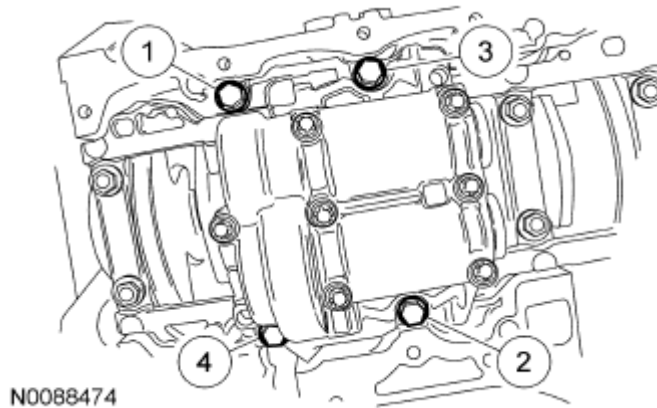


Fig. 15: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Remeasure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.

NOTE: The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.

NOTE: For an accurate measurement while measuring the gear backlash, insert a screwdriver as shown into the crankshaft No. 1 crank weight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.

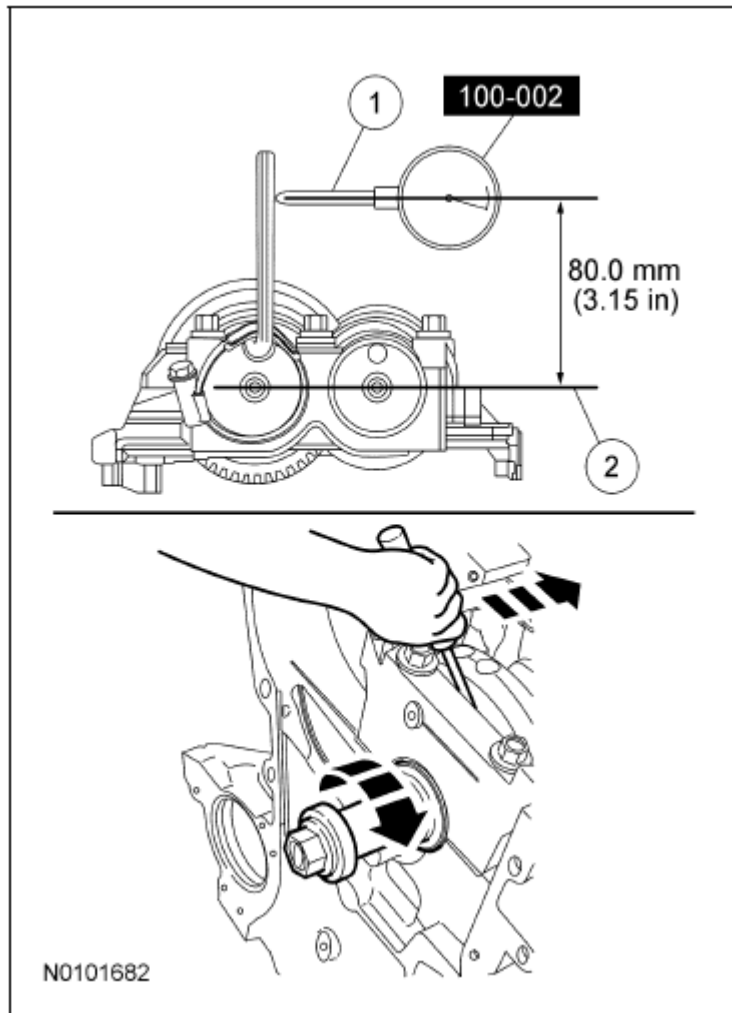


Fig. 16: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

15. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.
 - Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
 - Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.
 - If the backlash exceeds the specified range of 0.005 to 0.101 mm (0.00019 to 0.0039 in), install a new balancer unit and repeat the procedure.

IN-VEHICLE REPAIR

INTAKE MANIFOLD

Intake Manifold (View 1 of 2)

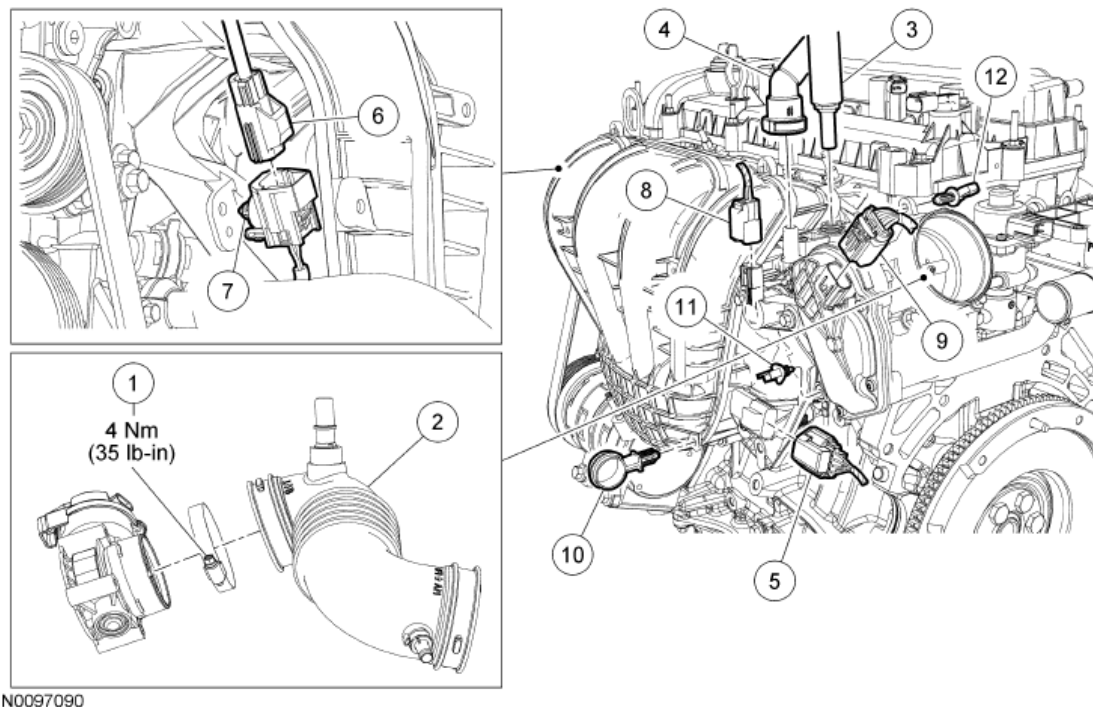
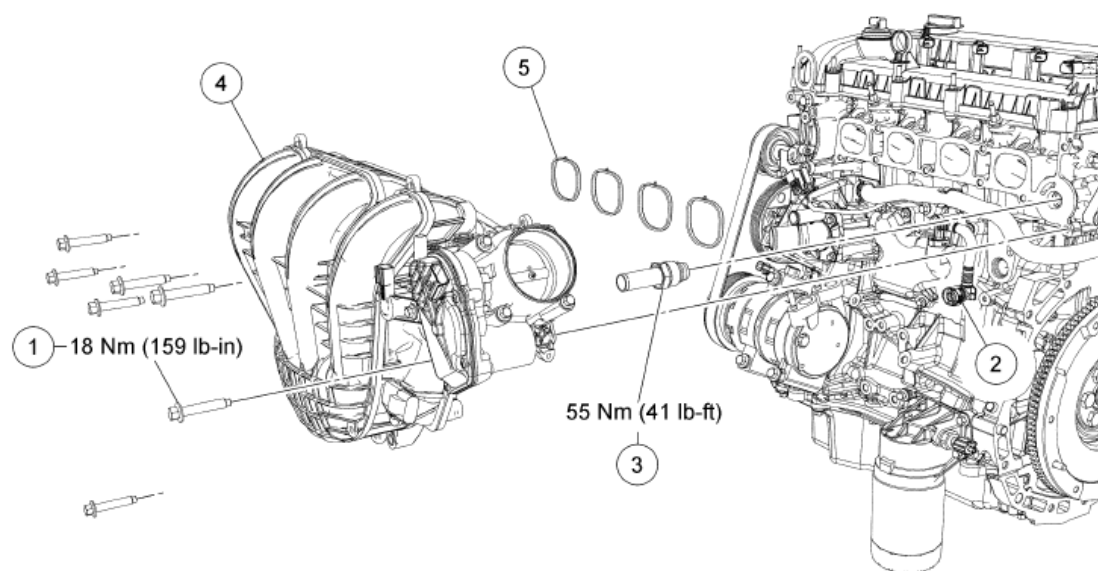


Fig. 17: Identifying Intake Manifold Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|--|
| 1 | 9C632 | Air Cleaner (ACL) outlet pipe-to-Throttle Body (TB) clamp |
| 2 | 9B642 | ACL outlet pipe |
| 3 | 19D848 | Vacuum supply hose |
| 4 | 9D289 | Fuel vapor return hose |
| 5 | 14A464 | Manifold Absolute Pressure (MAP) sensor electrical connector (part of 12C508) |
| 6 | 14A464 | Knock Sensor (KS) electrical connector (part of 12C508) |
| 7 | 14A624 | Wire harness pin-type retainer (part of 12C508) |
| 8 | 14A464 | Evaporative Emission (EVAP) canister purge valve electrical connector (part of 12C508) |
| 9 | 14A464 | Electronic throttle control electrical connector (part of 12C508) |
| 10 | 18K580 | Heater hose retainer |
| 11 | 13A506 | Wire harness pin-type retainer |
| 12 | 14197 | Wire harness pin-type retainer |

Intake Manifold (View 2 of 2)



N0100884

Fig. 18: Identifying Intake Manifold Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | W500311 | Intake manifold bolt (7 required) |
| 2 | 6A785 | Crankcase vent oil separator tube (part of 6A785) |
| 3 | 9E470 | EGR tube |
| 4 | 9424 | Intake manifold |
| 5 | 9461 | Intake manifold gasket |

Removal and Installation

1. With vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the fuel rail. For additional information, refer to **FUEL CHARGING & CONTROLS - 2.5L**.
3. Disconnect the vacuum supply hose.
 - Depress the quick release locking ring.
 - Pull the vacuum hose out of the quick release fitting.

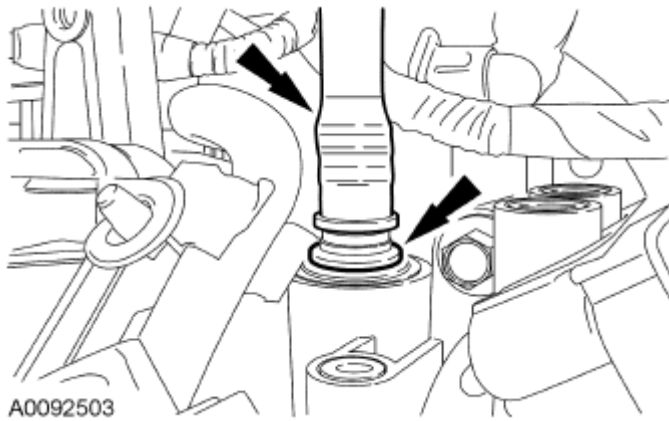


Fig. 19: Locating Vacuum Hose And Quick Release Fitting
Courtesy of FORD MOTOR CO.

4. Disconnect the fuel vapor return hose from the intake manifold.
5. Disconnect the Manifold Absolute Pressure (MAP) electrical connector.
6. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.
7. Disconnect the electronic throttle control electrical connector.
8. Disconnect the Knock Sensor (KS) electrical connector.
 - Detach the wire harness pin-type retainer.
9. Detach the heater hose pin-type retainer.
10. Detach all wiring harness pin-type retainers from the intake manifold and position the wiring harness aside.
11. Loosen the clamp and disconnect Air Cleaner (ACL) outlet pipe from the Throttle Body (TB).
 - To install, tighten to 4 Nm (35 lb-in).
12. Remove the intake manifold lower bolt.
 - To install, tighten to 18 Nm (159 lb-in).

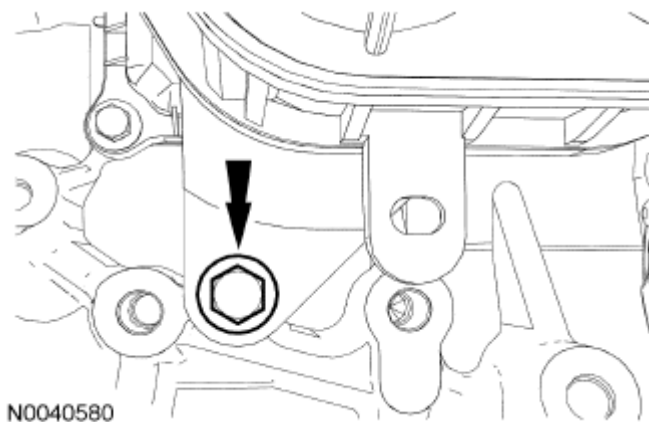


Fig. 20: Locating Intake Manifold Lower Bolt
Courtesy of FORD MOTOR CO.

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13. Remove the 6 bolts and position the intake manifold aside to access the crankcase vent oil separator tube and the EGR tube.
 - To install, tighten to 18 Nm (159 lb-in).
14. Squeeze the 2 crankcase vent oil separator tube tabs and disconnect the tube from the intake manifold.
15. Remove the EGR tube.
 - To install, tighten to 55 Nm (41 lb-ft).
16. Remove the intake manifold and gaskets.

NOTE: If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.

17. To install, reverse the removal procedure.
 - Inspect and install new intake manifold gaskets if necessary.

VALVE COVER

Material

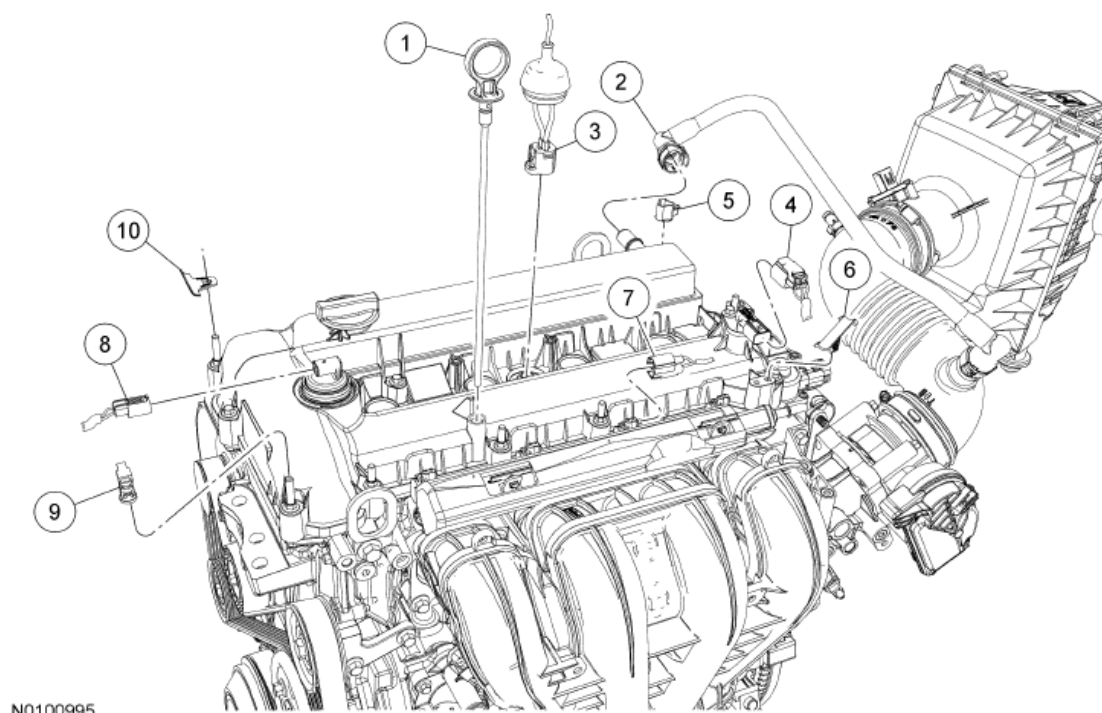
ITEM SPECIFICATION

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

Valve Cover (View 1 of 2)

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2009 ENGINE Engine - 2.5L - Escape & Mariner



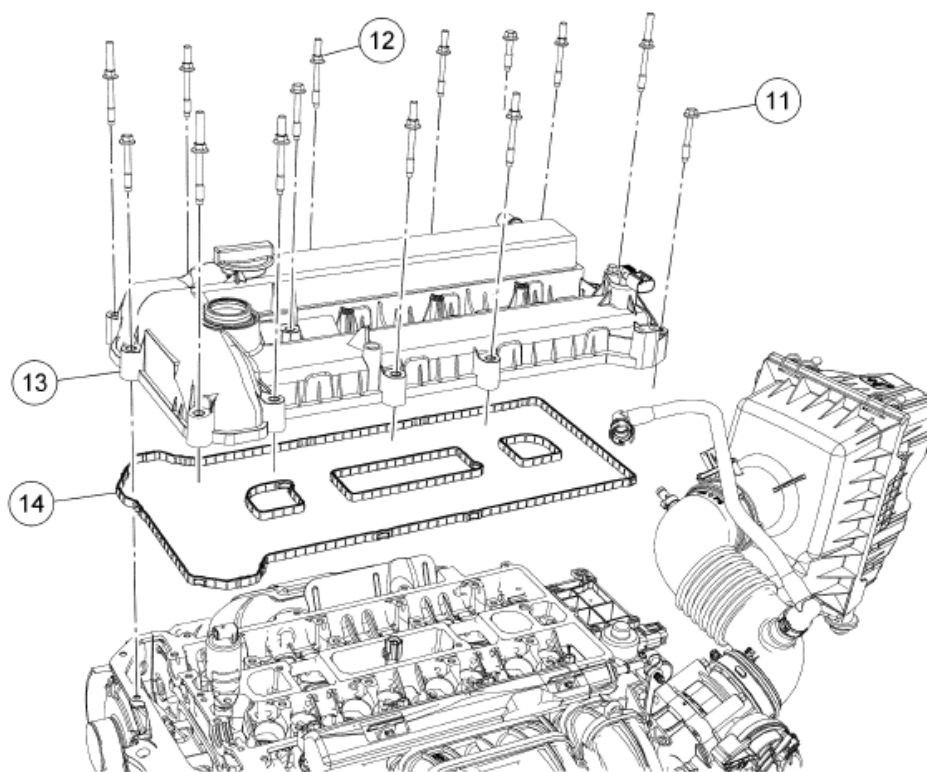
N0100995

Fig. 21: Identifying Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | 6750 | Oil level indicator |
| 2 | 6853 | Crankcase vent hose |
| 3 | 14A464 | Cylinder Head Temperature (CHT) sensor electrical connector (part of 12C508) |
| 4 | 14A464 | Camshaft Position (CMP) sensor electrical connector (part of 12C508) |
| 5 | 14A464 | Wire harness retainer (part of 12C508) |
| 6 | 13A506 | Wire harness retainer (part of 12C508) |
| 7 | 14A464 | Radio capacitor electrical connector (part of 12C508) |
| 8 | 14A163 | Variable Camshaft Timing (VCT) oil control solenoid electrical connector (part of 12C508) |
| 9 | 14A163 | Wire harness retainer (part of 14290) |
| 10 | 14A464 | Wire harness retainer (part of 12C508) |

Valve Cover (2 of 2)



N0086490

Fig. 22: Identifying Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|------------------------------------|
| 11 | 6C293 | Valve cover retainer (10 required) |
| 12 | 6C295 | Valve cover retainer (4 required) |
| 13 | 6582 | Valve cover |
| 14 | 6K260 | Valve cover gasket |

Removal

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 can cause engine failure.

1. Remove the oil level indicator.
2. Remove the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.
3. Disconnect the crankcase vent hose.
4. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.
5. Disconnect the Camshaft Position (CMP) sensor electrical connector.
6. Disconnect the radio capacitor electrical connector.

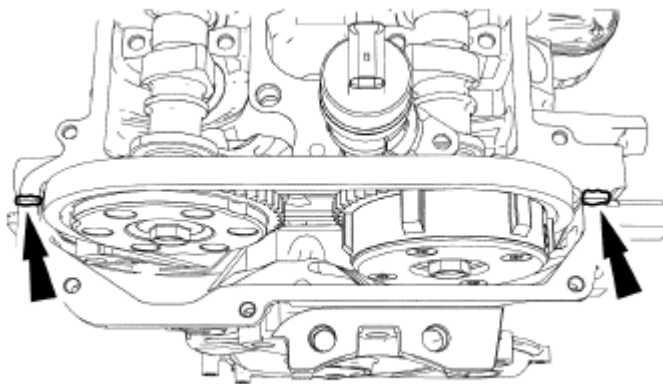
7. Disconnect the Variable Camshaft Timing (VCT) solenoid electrical connector.
8. Detach all of the wiring harness retainers from the valve cover studs and position the harness aside.
9. Remove the 14 valve cover retainers, the valve cover and gasket.

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.

1. Clean and inspect the sealing surfaces.

NOTE: The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep.



N0045151

Fig. 23: Locating Silicone Gasket And Sealant Applying Locations
Courtesy of FORD MOTOR CO.

2. Apply silicone gasket and sealant to the locations shown.

NOTE: Clean and inspect the gasket. Install a new gasket, if necessary.

3. Install the valve cover, gasket and retainers.
 - Tighten in the sequence shown to 10 Nm (89 lb-in).

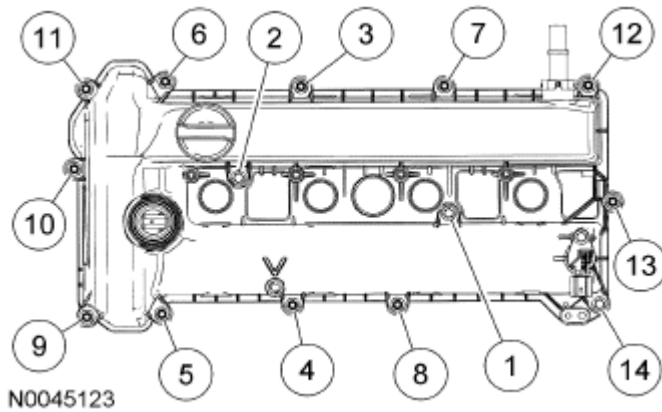


Fig. 24: Identifying Valve Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Position the wiring harness and attach all of the wiring harness retainers to the valve cover studs.
5. Connect the VCT solenoid electrical connector.
6. Connect the radio capacitor electrical connector.
7. Connect the CMP sensor electrical connector.
8. Connect the CHT sensor electrical connector.
9. Connect the crankcase vent hose.
10. Install the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.
11. Install the oil level indicator.

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

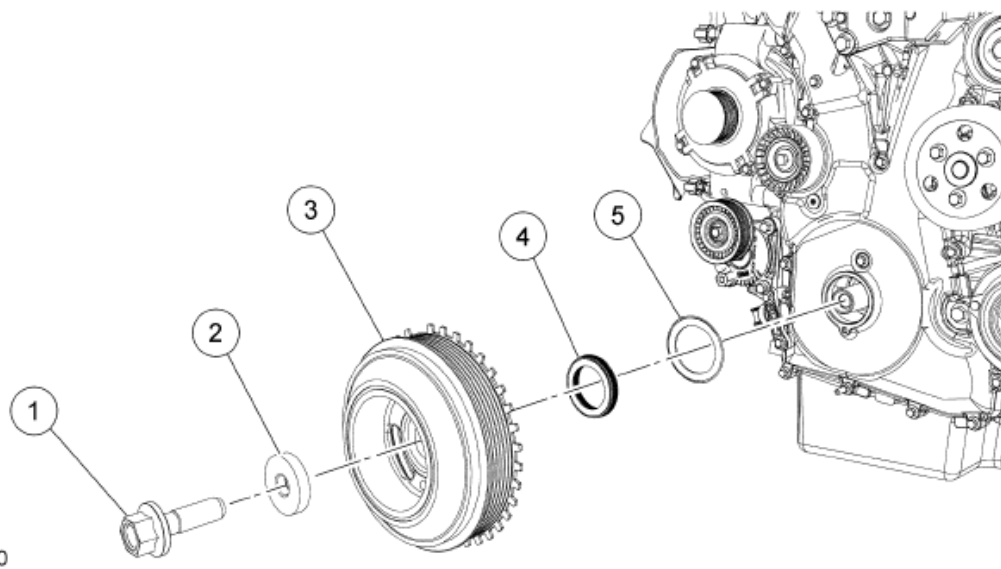


Fig. 25: Identifying Crankshaft Pulley And Crankshaft Front Seal
Courtesy of FORD MOTOR CO.

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ITEM DESCRIPTION

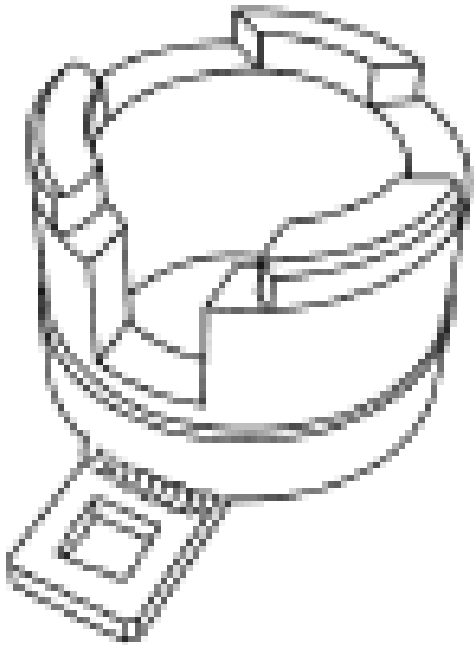
| Item | Part Number | Description |
|------|-------------|--|
| 1 | 6K340 | Crankshaft pulley bolt |
| 2 | - | Crankshaft pulley washer (part of 6K340) |
| 3 | 6316 | Crankshaft pulley |
| 4 | 6700 | Crankshaft front seal |
| 5 | 6378 | Diamond washer |

CRANKSHAFT PULLEY

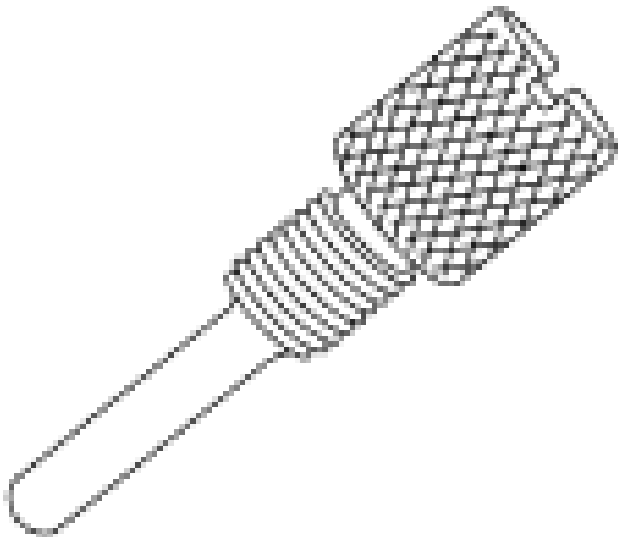
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|---|---|
|  ST2645-A | Alignment Plate, Camshaft 303-465 (T94P-6256-CH) |
| | Holding Tool, Crankshaft Damper 303-1416 |



ST3054-A

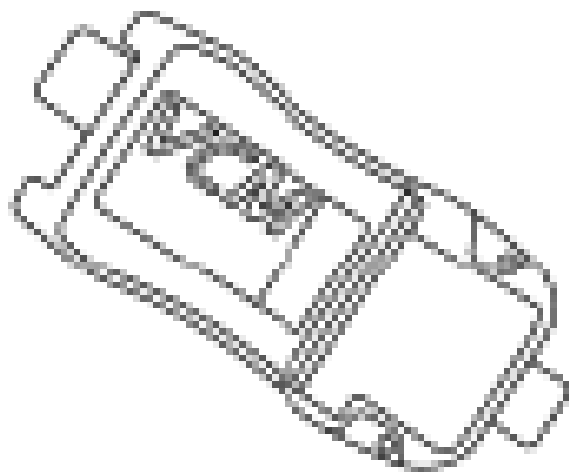


ST2638-A

Timing Peg, Crankshaft TDC
303-507

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2834-A

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

General Equipment

GENERAL EQUIPMENT REFERENCE

6 mm x 18 mm bolt

Material

ITEM SPECIFICATION

| 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: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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 can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the front RH wheel and tire. For additional information, refer to **WHEELS & TIRES**.
3. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
4. Remove the valve cover. For additional information, refer to **VALVE COVER**.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

5. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

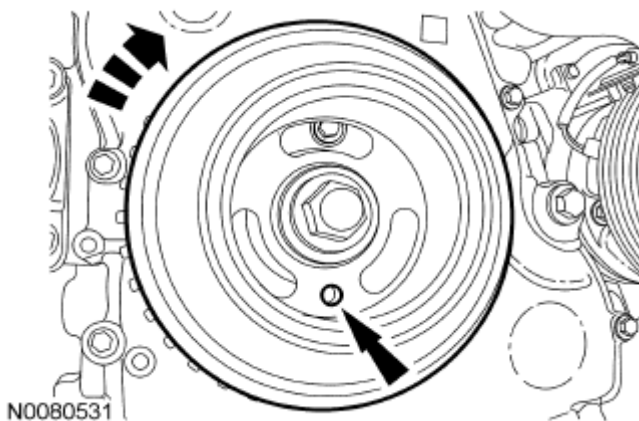


Fig. 26: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

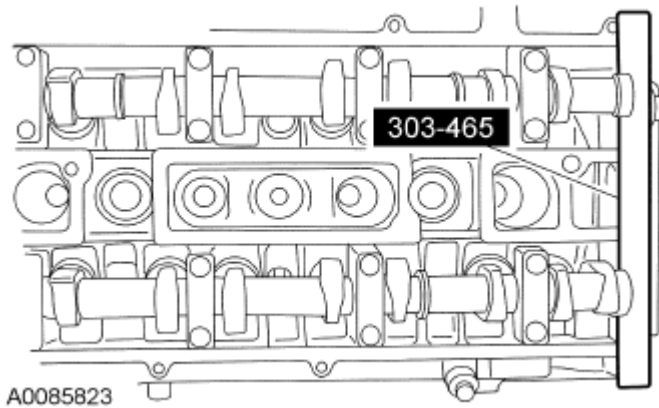


Fig. 27: Identifying Camshaft Alignment Plate In Slots On Rear Of Both Camshafts
Courtesy of FORD MOTOR CO.

6. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.
7. Remove the engine plug bolt.

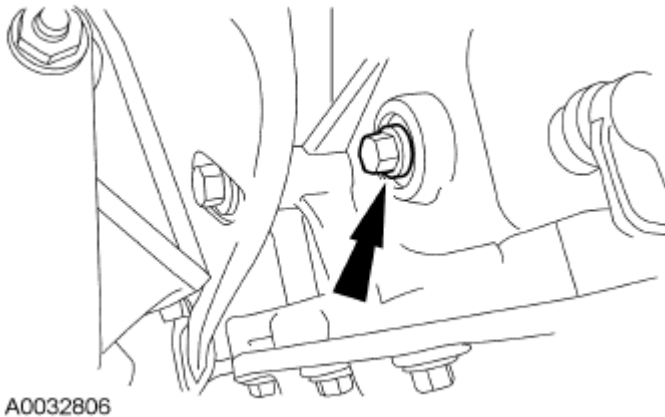


Fig. 28: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the crankshaft pulley removal and installation.

Install the Crankshaft TDC Timing Peg.

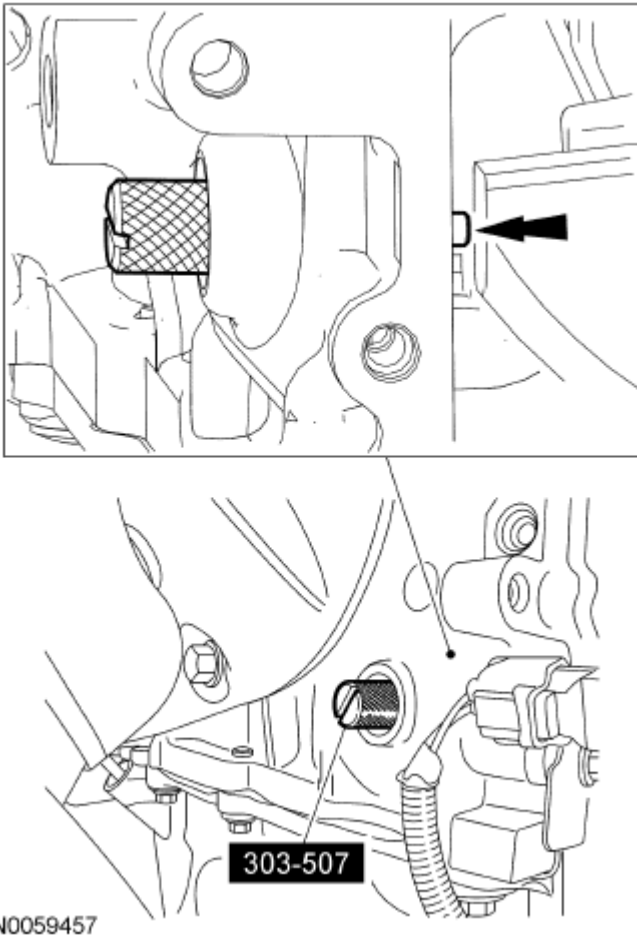


Fig. 29: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during removal of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool, and the bolt should be removed using an air impact wrench (1/2-in drive minimum).

NOTE: The crankshaft sprocket diamond washer may come off with the crankshaft pulley. The diamond washer must be replaced. Remove and discard the diamond washer. If the diamond washer is not installed, engine damage may occur.

8. Use the Crankshaft Damper Holding Tool and a suitable 1/2-in drive hand tool to hold the crankshaft pulley. Use an air impact wrench to remove the crankshaft pulley bolt.
 - Remove and discard the crankshaft pulley bolt and washer.
 - Remove the crankshaft pulley.
 - Remove the diamond washer and discard.

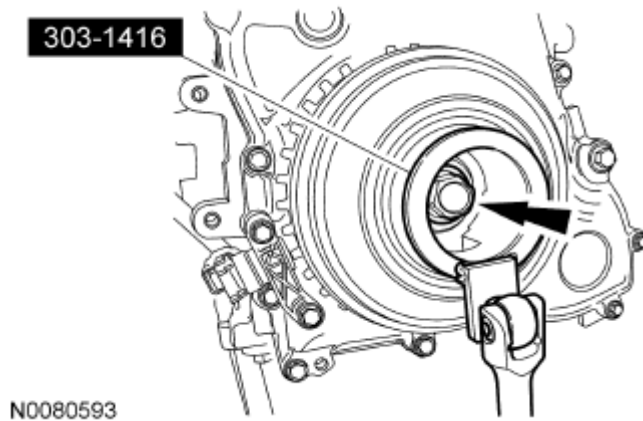


Fig. 30: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

Installation

1. Install a new diamond washer.

NOTE: Do not install the crankshaft pulley bolt at this time.

NOTE: Apply clean engine oil on the seal area before installing.

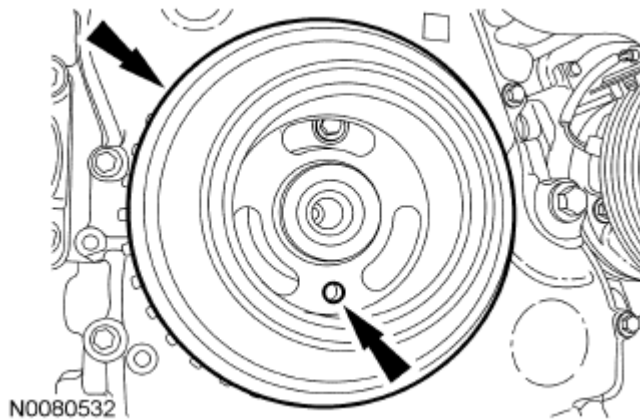


Fig. 31: Positioning Crankshaft Pulley Onto Crankshaft With Hole In Pulley At 6 O'Clock Position
Courtesy of FORD MOTOR CO.

2. Position the crankshaft pulley onto the crankshaft with the hole in the pulley at the 6 o'clock position.

NOTE: Only hand-tighten the 6 mm x 18 mm bolt or damage to the front cover can occur.

NOTE: This step will correctly align the crankshaft pulley to the crankshaft.

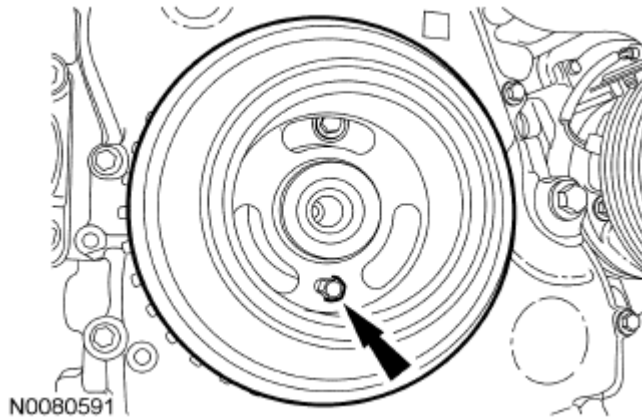


Fig. 32: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

3. Install a 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during installation of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be installed using hand tools only.

NOTE: Do not reuse the crankshaft pulley bolt.

4. Install a new crankshaft pulley bolt. Use the Crankshaft Damper Holding Tool and a suitable 1/2-in drive hand tool to hold the crankshaft pulley, tighten the crankshaft pulley bolt in 2 stages:
 - Stage 1: Tighten to 100 Nm (74 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

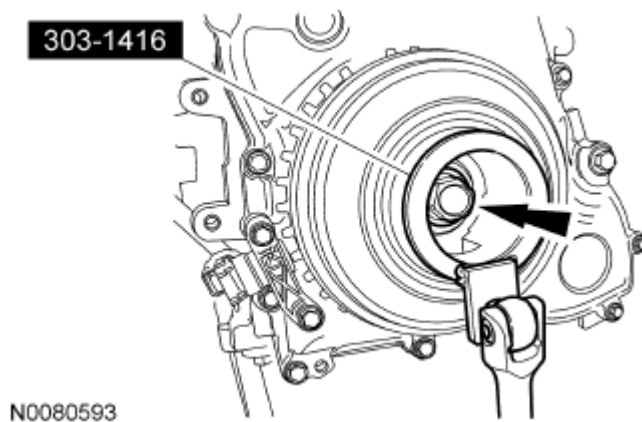


Fig. 33: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

5. Remove the 6 mm x 18 mm bolt.

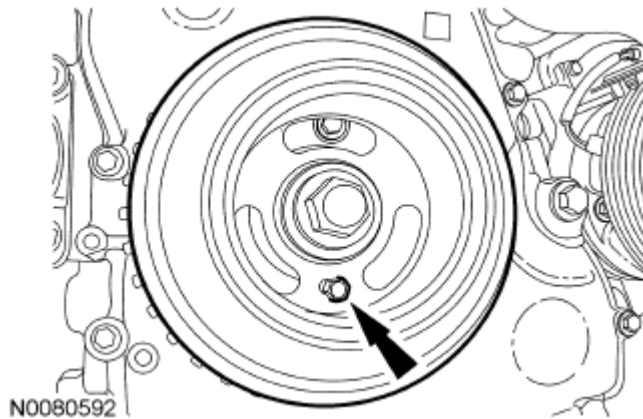


Fig. 34: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

6. Remove the Crankshaft TDC Timing Peg.

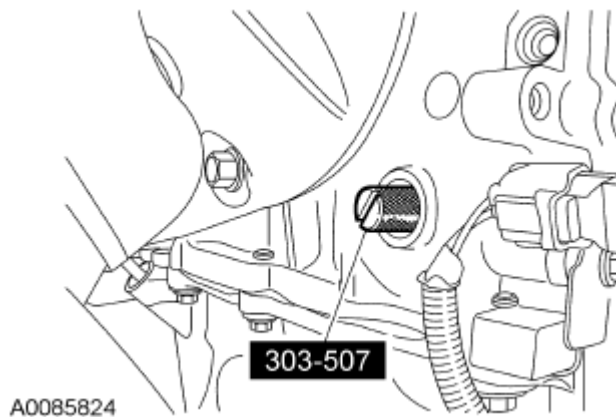


Fig. 35: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

7. Remove the Camshaft Alignment Plate.

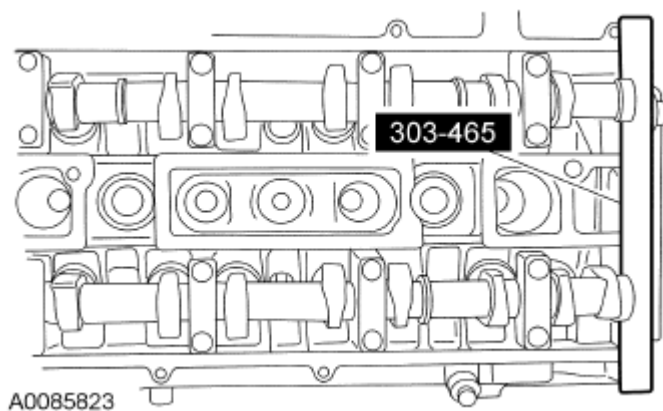


Fig. 36: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

NOTE: Only turn the engine in the normal direction of rotation.

8. Turn the crankshaft clockwise one and three-fourths turns.
9. Install the Crankshaft TDC Timing Peg.

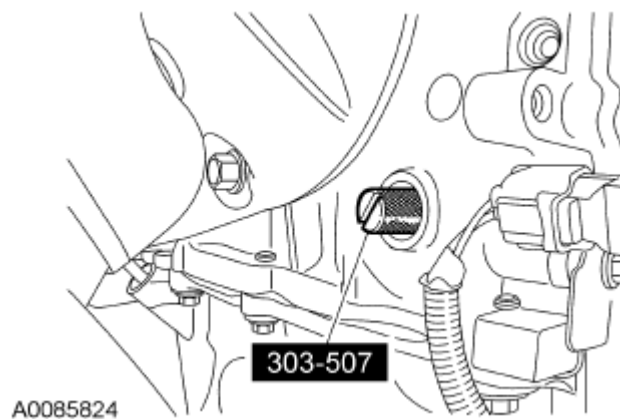


Fig. 37: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

NOTE: Only turn the engine in the normal direction of rotation.

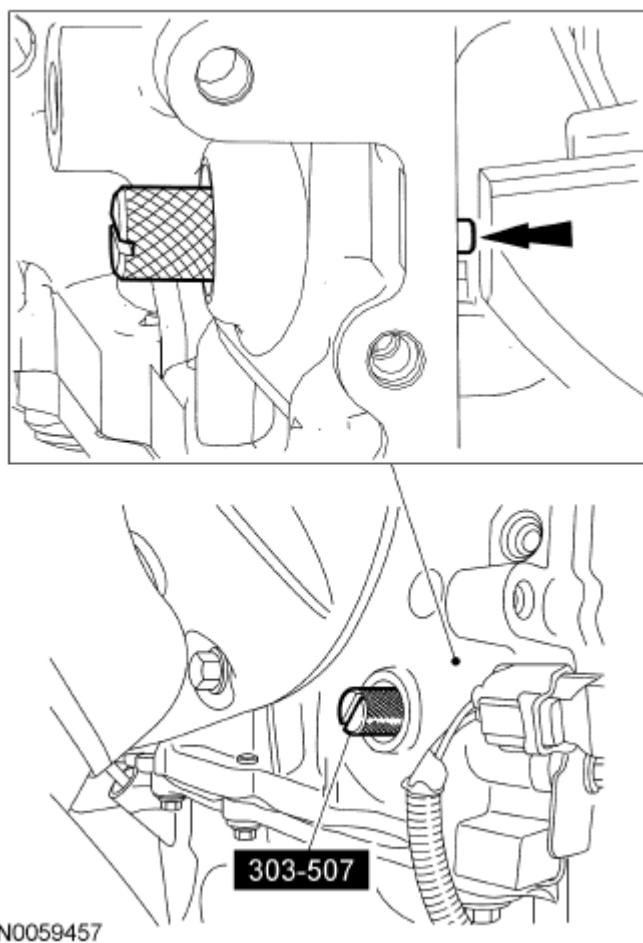


Fig. 38: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

10. Turn the crankshaft clockwise until the crankshaft contacts the Crankshaft TDC Timing Peg.

NOTE: Only hand-tighten the bolt or damage to the front cover can occur.

11. Using the 6 mm x 18 mm bolt, check the position of the crankshaft pulley.
 - If it is not possible to install the bolt, the engine valve timing must be corrected by repeating this procedure.

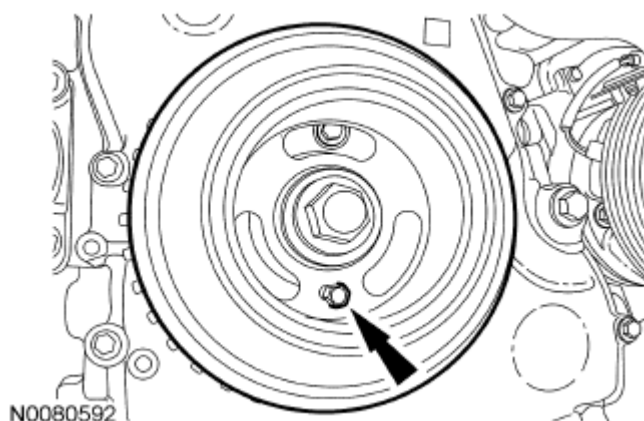


Fig. 39: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

12. Install the Camshaft Alignment Plate to check the position of the camshafts.
 - If it is not possible to install the Camshaft Alignment Plate, the engine valve timing must be corrected by repeating this procedure.

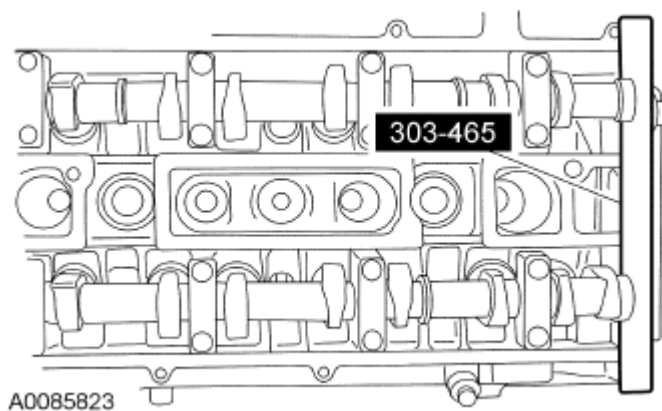


Fig. 40: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

13. Remove the Camshaft Alignment Plate.

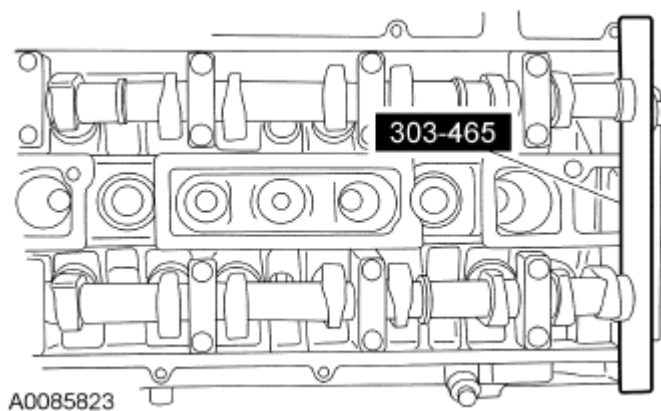


Fig. 41: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

14. Remove the 6 mm x 18 mm bolt.

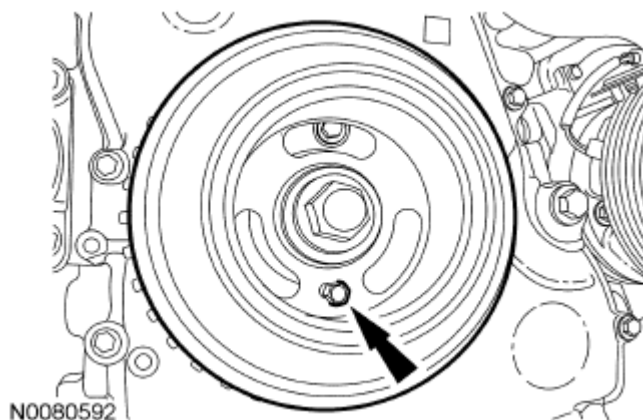


Fig. 42: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

15. Remove the Crankshaft TDC Timing Peg.

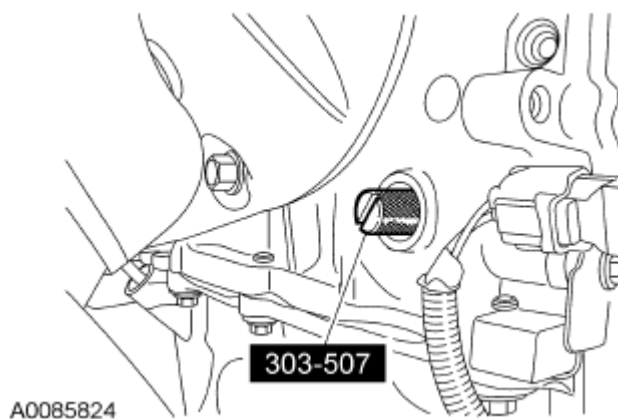


Fig. 43: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

16. Install the engine plug bolt.
 - Tighten to 20 Nm (177 lb-in).

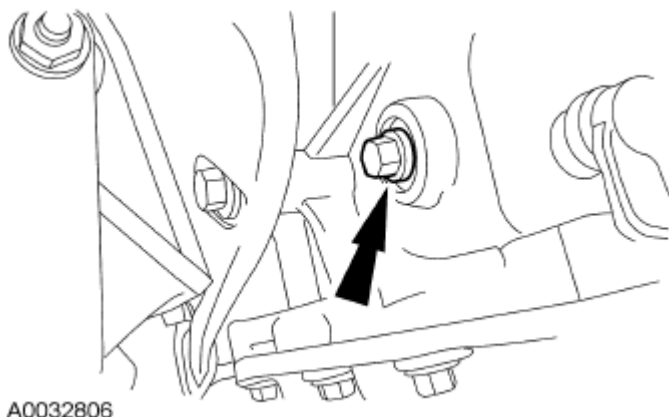


Fig. 44: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

17. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
18. Install the front RH wheel and tire. For additional information, refer to **WHEELS & TIRES**.
19. Install the valve cover. For additional information, refer to **VALVE COVER**.
20. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

CRANKSHAFT FRONT SEAL

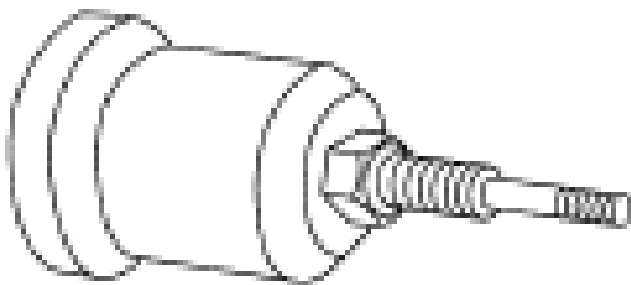
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

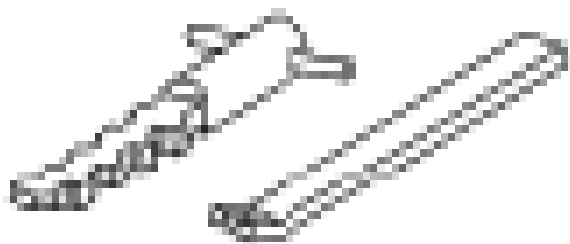
| | |
|--|---|
| | Installer, Camshaft Front Oil Seal 303-096 (T74P-6150-A) |
|--|---|

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1917-A



ST1385-A

Remover, Oil Seal
303-409 (T92C-6700-CH)

Material

ITEM SPECIFICATION

| 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: Do not loosen or remove the crankshaft pulley bolt without first installing the

special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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 can cause engine failure.

1. Remove the crankshaft pulley. For additional information, refer to **LOWER END COMPONENTS - EXPLODED VIEW, CRANKSHAFT PULLEY AND CRANKSHAFT FRONT SEAL** and **CRANKSHAFT PULLEY**.

NOTE: Use care not to damage the engine front cover or the crankshaft when removing the seal.

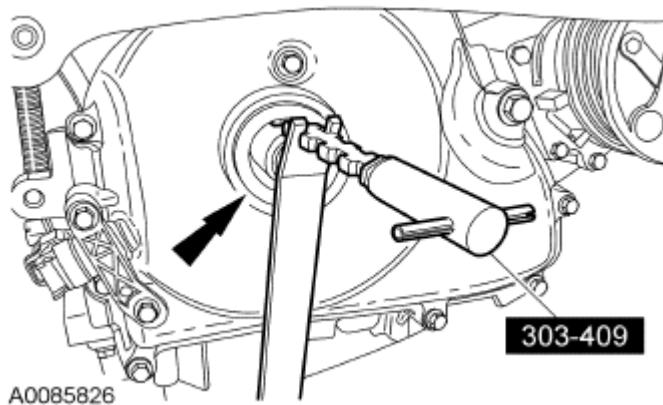


Fig. 45: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

2. Using the Oil Seal Remover, remove the crankshaft front oil seal.

Installation

NOTE: Remove the through-bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

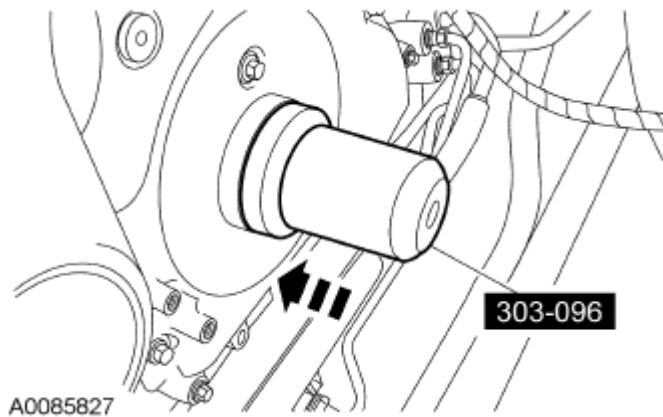
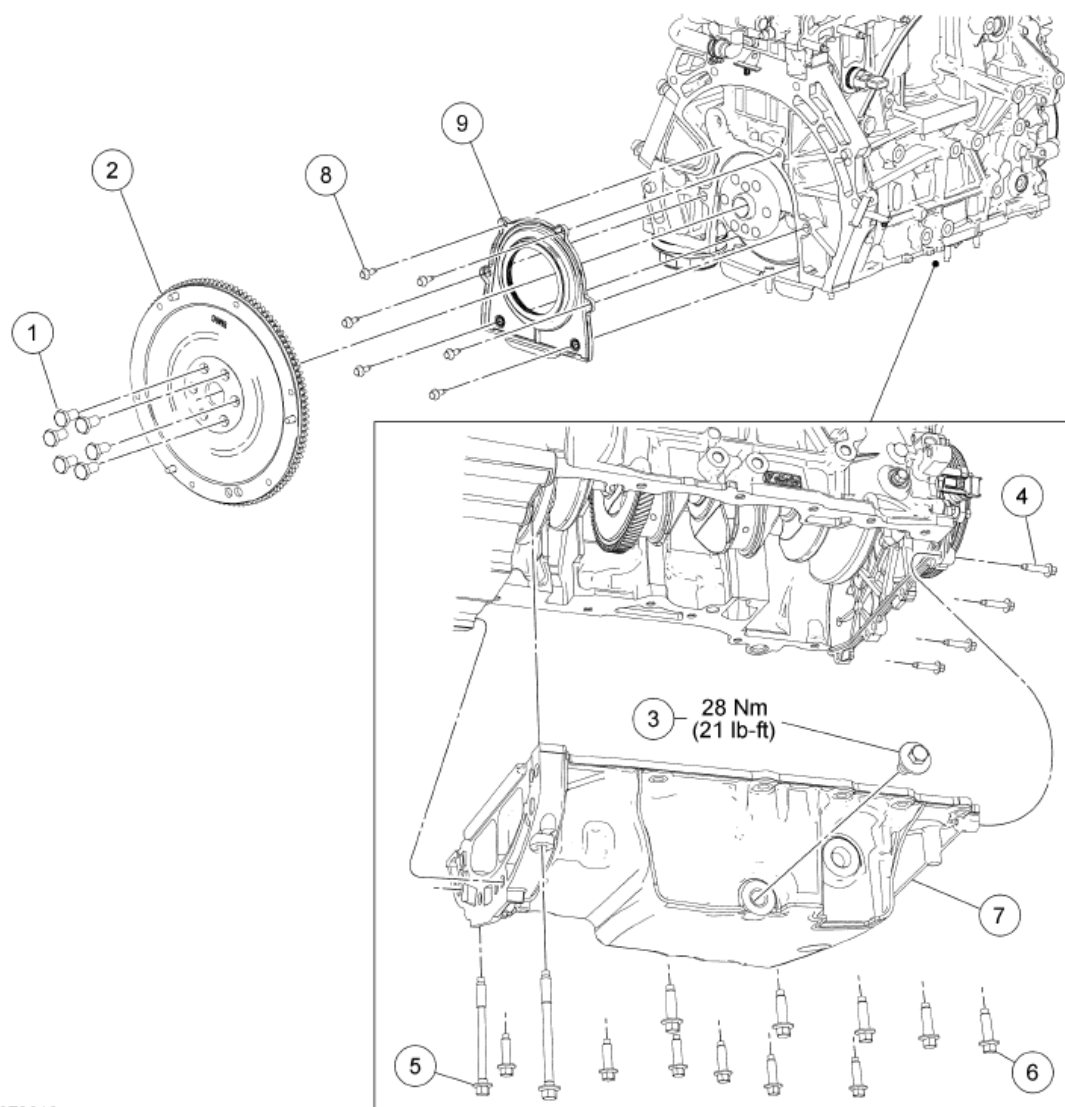


Fig. 46: Installing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

1. Using the Camshaft Front Oil Seal Installer, install the crankshaft front oil seal.
2. Install the crankshaft pulley. For additional information, refer to **LOWER END COMPONENTS - EXPLODED VIEW, CRANKSHAFT PULLEY AND CRANKSHAFT FRONT SEAL** and **CRANKSHAFT PULLEY**.

LOWER END COMPONENTS - EXPLODED VIEW, FLEXPLATE, FLYWHEEL AND CRANKSHAFT REAR SEAL



N0073619

Fig. 47: Exploded View Of Flexplate, Flywheel And Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|--|
| 1 | 6379 | Flexplate or flywheel bolt (6 required) |
| 2 | 6K375/6K390 | Flexplate or flywheel |
| 3 | 6730 | Oil pan drain plug |
| 4 | W500215 | Engine front cover bolt (4 required) |
| 5 | W706284 | Oil pan bolt (2 required) |
| 6 | W500224 | Oil pan bolt (11 required) |
| 7 | 6675 | Oil pan |
| 8 | W500212 | Crankshaft rear oil seal with retainer plate bolt (6 required) |
| 9 | 6K318 | Crankshaft rear oil seal with retainer plate |

FLEXPLATE

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the automatic transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F35**.
3. Remove the 6 bolts and the flexplate.

Installation

NOTE: Special bolts are used for installation. Do not use standard bolts.

1. Install the flexplate and tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

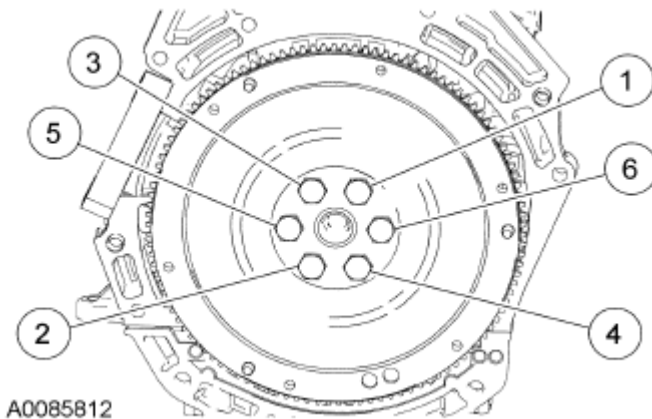


Fig. 48: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the automatic transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F35**.

FLYWHEEL

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the manual transaxle and clutch. For additional information, refer to **CLUTCH** and **MANUAL TRANSAXLE/TRANSMISSION**.

3. Remove the 6 bolts and the flywheel.

Installation

NOTE: Special bolts are used for installation. Do not use standard bolts.

1. Install the flywheel and tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

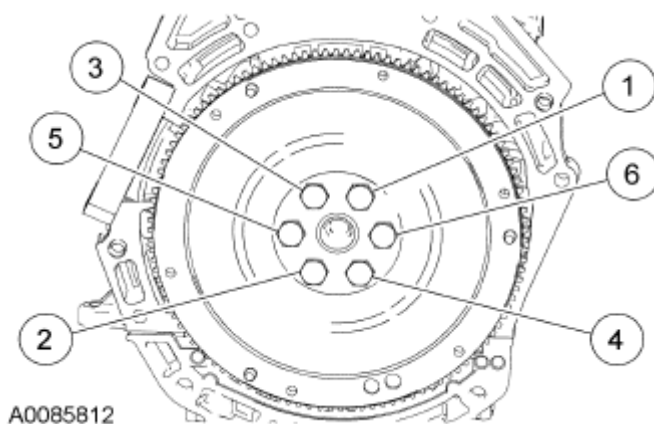


Fig. 49: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

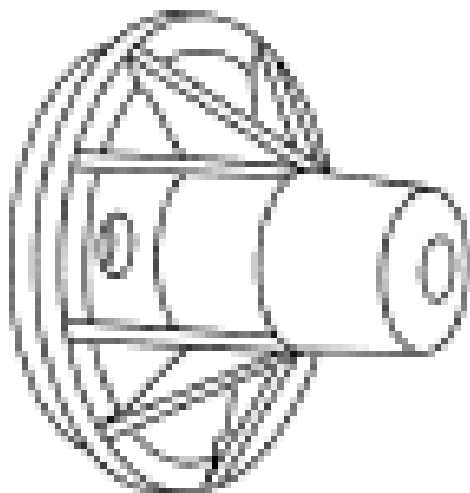
2. Install the clutch and manual transaxle. For additional information, refer to **CLUTCH** and **MANUAL TRANSAXLE/TRANSMISSION**.

CRANKSHAFT REAR SEAL

Special Tool(s)

SPECIAL TOOL REFERENCE CHART

Installer, Crankshaft Rear Main Oil Seal



ST1506-A

303-328 (T88P-6701-B1)

Material**ITEM SPECIFICATION**

| 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 |

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the flexplate or flywheel. For additional information, refer to **FLEXPLATE** or **FLYWHEEL**.
3. Drain the engine oil.
 - Install the drain plug.
 - Tighten to 28 Nm (21 lb-ft).

NOTE: If the oil pan is not removed, damage to the rear oil seal retainer joint can occur.

4. Remove the 17 bolts and the oil pan.
5. Remove the 6 bolts and the crankshaft rear oil seal with retainer plate.

Installation

1. Using the Crankshaft Rear Main Oil Seal Installer, position the crankshaft rear oil seal with retainer plate onto the crankshaft.

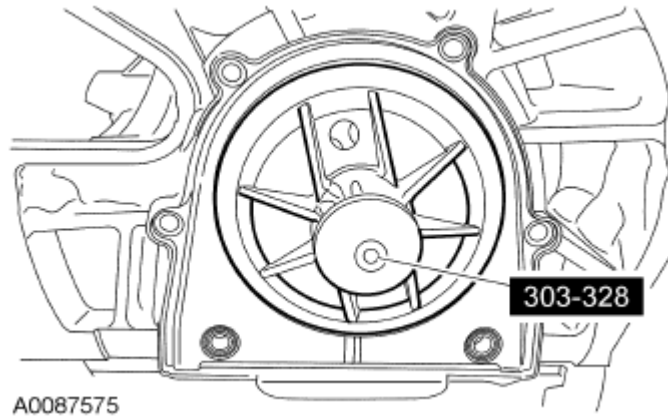


Fig. 50: Identifying Crankshaft Rear Main Oil Seal Installer
Courtesy of FORD MOTOR CO.

2. Install the crankshaft rear oil seal with retainer plate and bolts.
 - To install, tighten in the sequence shown to 10 Nm (89 lb-in).

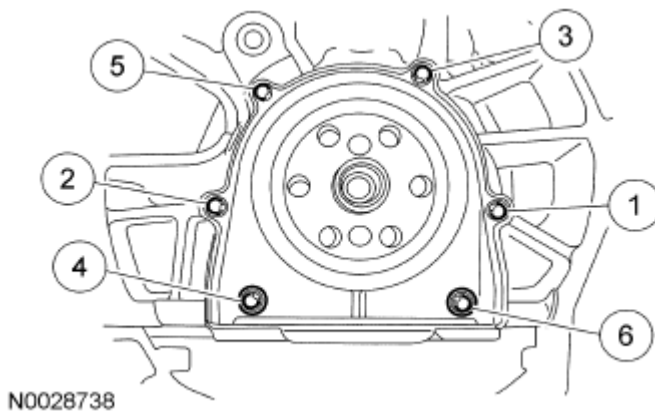


Fig. 51: Identifying Crankshaft Rear Oil Seal With Retainer Plate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

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 traces of sealant.

3. Clean and inspect all the oil pan and cylinder block mating surfaces.

NOTE: If the oil pan is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

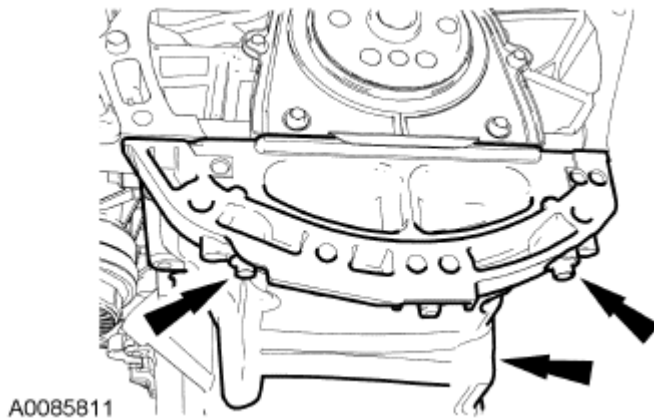


Fig. 52: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

4. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan. Install the oil pan. Install the 2 oil pan bolts finger-tight.
5. Install the 4 bolts.
 - To install, tighten to 10 Nm (89 lb-in).

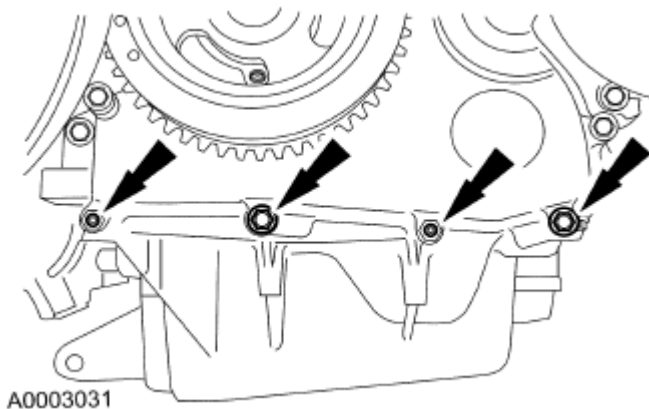


Fig. 53: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

6. Install the remaining oil pan bolts and tighten the oil pan bolts in the sequence shown to 25 Nm (18 lb-ft).

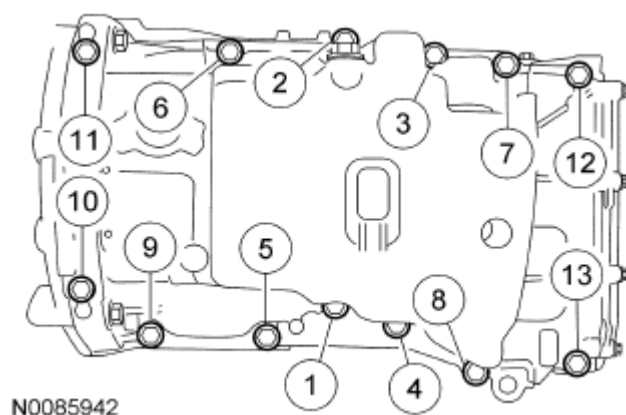


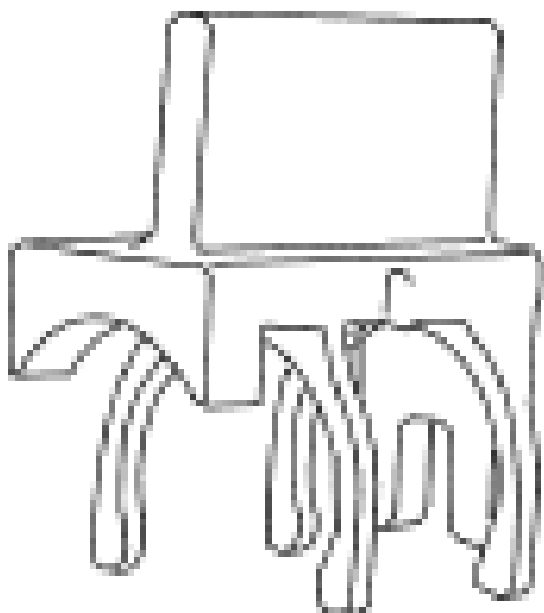
Fig. 54: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

7. Install the flexplate or flywheel. For additional information, refer to **FLEXPLATE** or **FLYWHEEL**.
8. Fill the engine with clean engine oil.

ENGINE FRONT COVER

Special Tool(s)

SPECIAL TOOL REFERENCE CHART

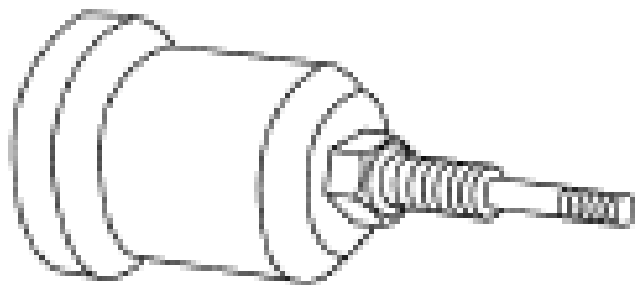


ST3055A

Aligner, Crankshaft Sensor
303-1417

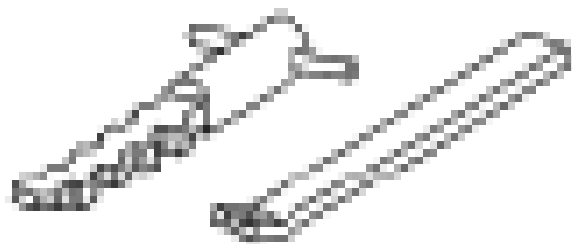
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



Installer, Camshaft Front Oil Seal
303-096 (T74P-6150-A)

ST1917-A



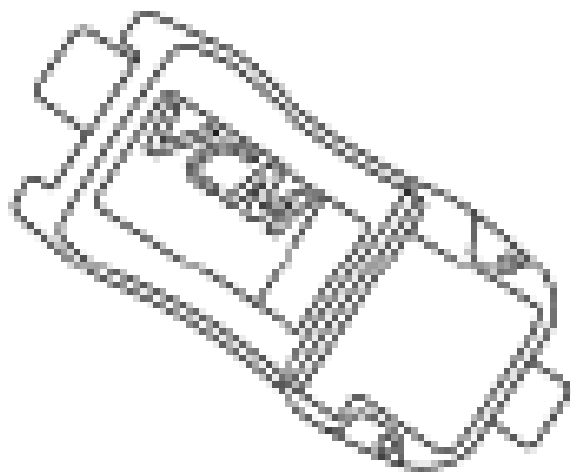
Remover, Oil Seal
303-409 (T92C-6700-CH)

ST1385-A

Vehicle Communication Module (VCM) and
Integrated Diagnostic System (IDS) software
with appropriate hardware, or equivalent scan
tool

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2834-A

General Equipment

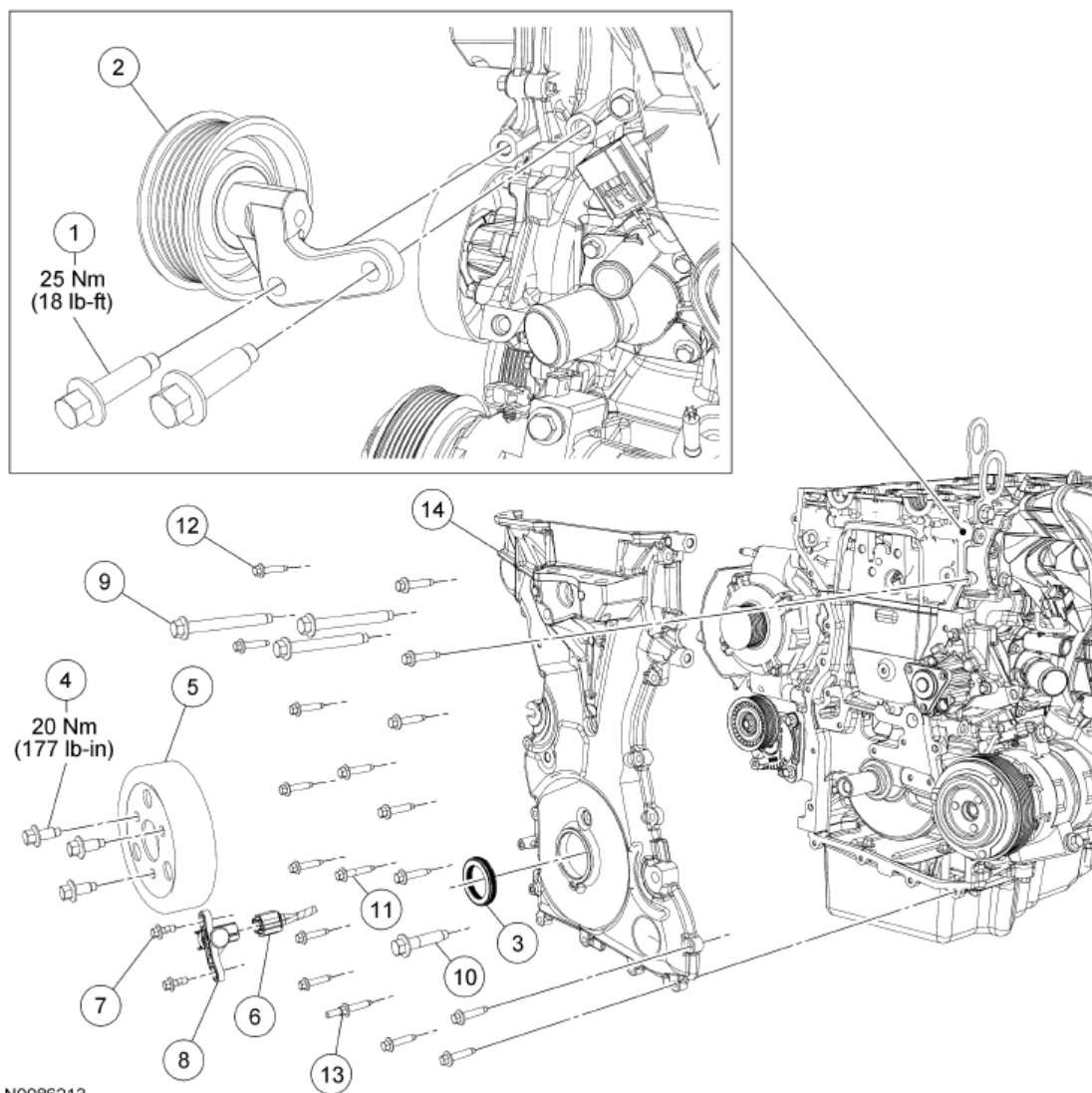
GENERAL EQUIPMENT REFERENCE

6 mm x 18 mm bolt

Material

ITEM SPECIFICATION

| 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 |



N0086213

Fig. 55: Exploded View Of Engine Front Cover
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|--|
| 1 | W500224 | Accessory drive belt idler pulley bolt (2 required) |
| 2 | 19A216 | Accessory drive belt idler pulley and bracket |
| 3 | 6700 | Crankshaft front seal |
| 4 | W500221 | Coolant pump pulley bolt (3 required) |
| 5 | 8509 | Coolant pump pulley |
| 6 | 14A464 | Crankshaft Position (CKP) sensor electrical connector (part of 12C508) |
| 7 | W701219 | CKP sensor bolt (2 required) |
| 8 | 6C315 | CKP sensor |
| 9 | W500328 | Engine front cover bolt (3 required) |

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| | | |
|----|---------|---------------------------------------|
| 10 | W500320 | Engine front cover bolt |
| 11 | W500300 | Engine front cover bolt |
| 12 | W500215 | Engine front cover bolt (16 required) |
| 13 | - | Engine front cover stud bolt |
| 14 | 6019 | Engine front cover |

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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 can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the accessory drive belt and the smooth idler pulley. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
3. Remove the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.
4. Remove the engine mount. For additional information, refer to **ENGINE MOUNT**.

NOTE: Use care not to damage the engine front cover or the crankshaft when removing the seal.

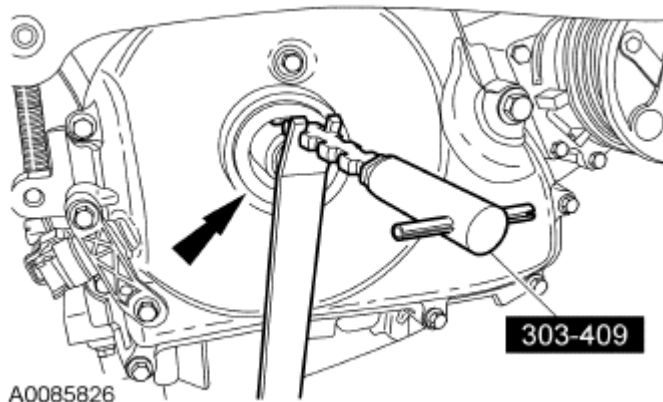
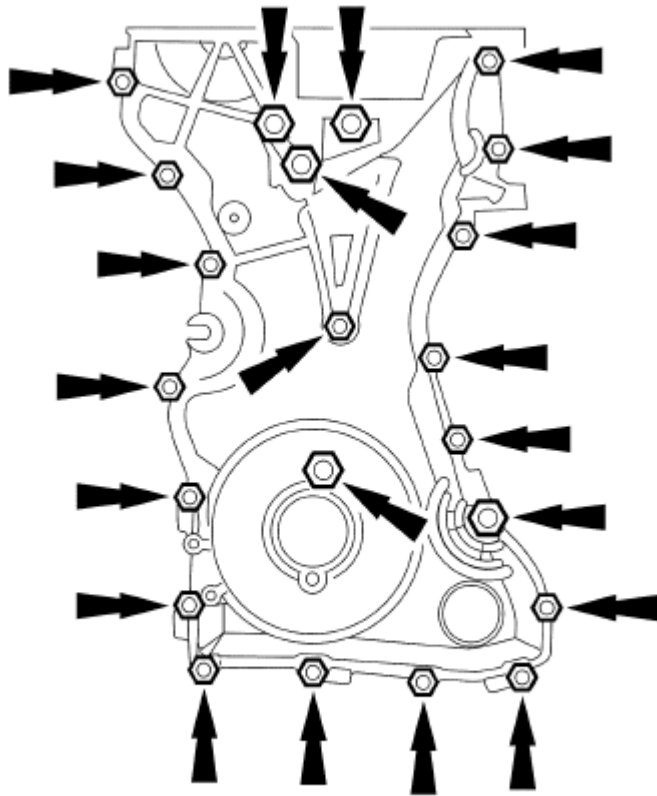


Fig. 56: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

5. Using the Oil Seal Remover, remove the crankshaft front oil seal.
6. Remove the 3 bolts and the coolant pump pulley.
7. Remove the 2 bolts and the accessory drive belt idler pulley and bracket.
8. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
9. Remove the 2 bolts and the CKP sensor.
10. Remove the bolts, stud bolt and the engine front cover.



A0087412

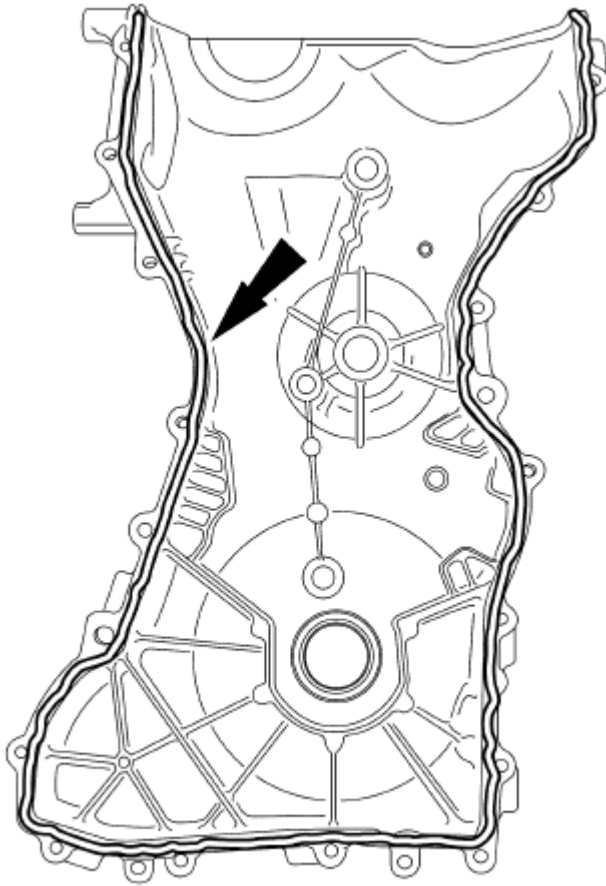
Fig. 57: Locating Engine Front Cover Bolts And Stud Bolt
Courtesy of FORD MOTOR CO.

Installation

NOTE: Do not use metal scrapers, wire brushes, power abrasive disks or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths.

1. Clean and inspect the mounting surfaces of the engine and the front cover.

NOTE: The engine front cover must be installed and the bolts tightened within 4 minutes of applying the silicone gasket and sealant.



A0032803

Fig. 58: Locating Front Cover Silicone Gasket And Sealant Bead
Courtesy of FORD MOTOR CO.

2. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the cylinder head and oil pan joint areas. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the front cover.
3. Install the engine front cover. Tighten the bolts in the sequence shown, to the following specifications:
 - Tighten the 8-mm bolts and stud bolt to 10 Nm (89 lb-in).
 - Tighten the 13-mm bolts to 48 Nm (35 lb-ft).

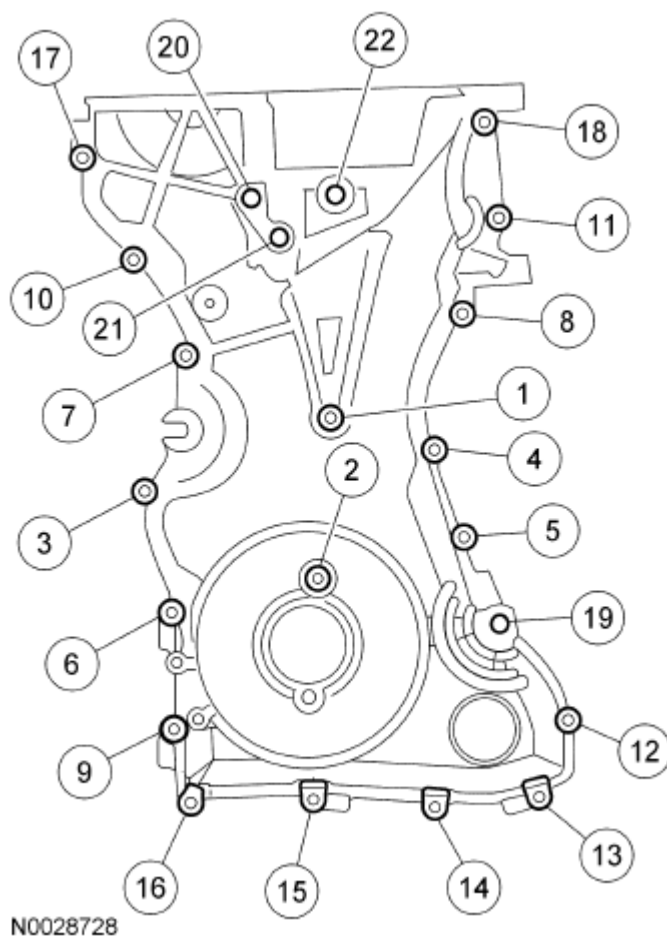


Fig. 59: Identifying Engine Front Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Install the accessory drive belt idler pulley and bracket and the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).
5. Install the coolant pump pulley and bolts.
 - Tighten to 20 Nm (177 lb-in).

NOTE: Remove the through bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

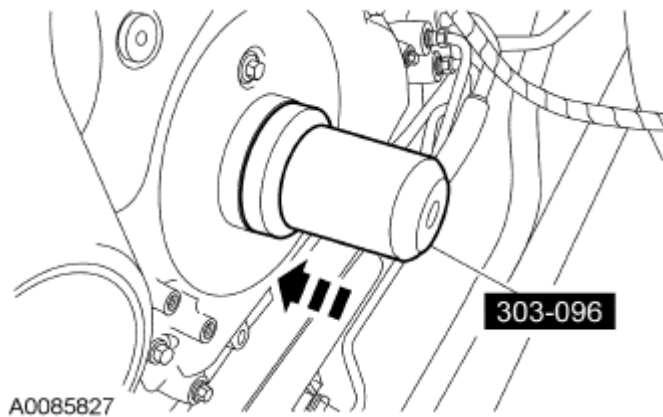


Fig. 60: Installing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

6. Using the Camshaft Front Oil Seal Installer, install the crankshaft front oil seal.
7. Install the engine mount. For additional information, refer to **ENGINE MOUNT**.
8. Install the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.

NOTE: Only hand-tighten the bolt or damage to the front cover can occur.

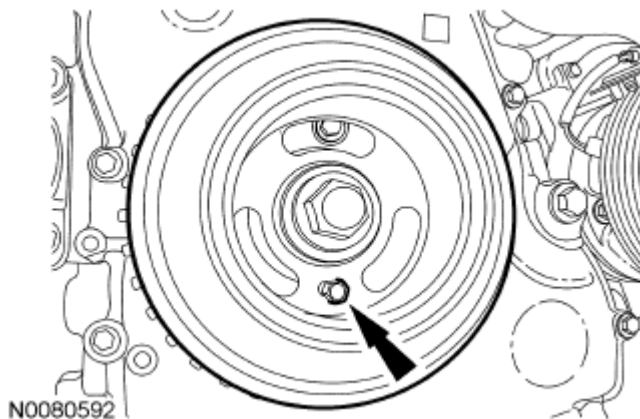


Fig. 61: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

9. Install a 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.
10. Install the CKP sensor and the 2 bolts.
 - Do not tighten the bolts at this time.

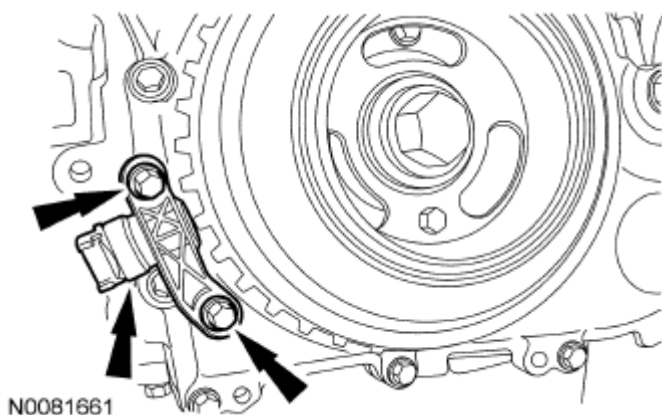


Fig. 62: Locating CKP Sensor And Bolts
Courtesy of FORD MOTOR CO.

11. Using the Crankshaft Sensor Aligner, adjust the CKP sensor.
 - Tighten the 2 CKP bolts to 7 Nm (62 lb-in).

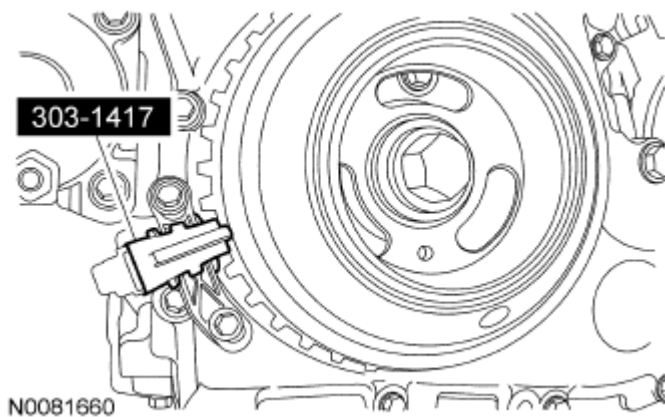


Fig. 63: Identifying Crankshaft Sensor Aligner
Courtesy of FORD MOTOR CO.

12. Connect the CKP sensor electrical connector.
13. Remove the 6 mm x 18 mm bolt.

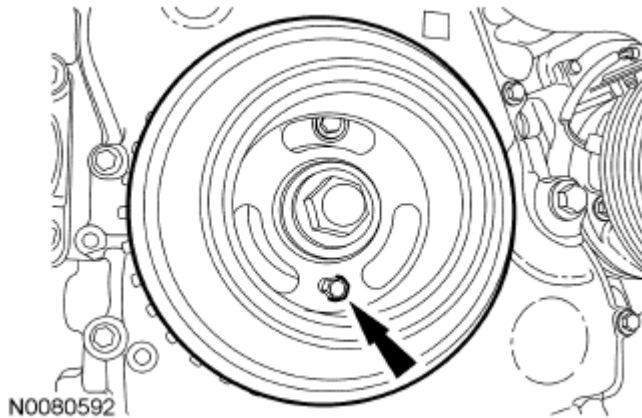


Fig. 64: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
 Courtesy of FORD MOTOR CO.

14. Install the accessory drive belt and smooth idler pulley. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
15. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

TIMING DRIVE COMPONENTS

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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 can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.
3. Compress the timing chain tensioner in the following sequence.
 1. Using a small pick, release and hold the ratchet mechanism.
 2. While holding the ratchet mechanism in the released position, compress the tensioner by pushing

- the timing chain arm toward the tensioner.
3. Insert the paper clip into the hole to retain the tensioner.

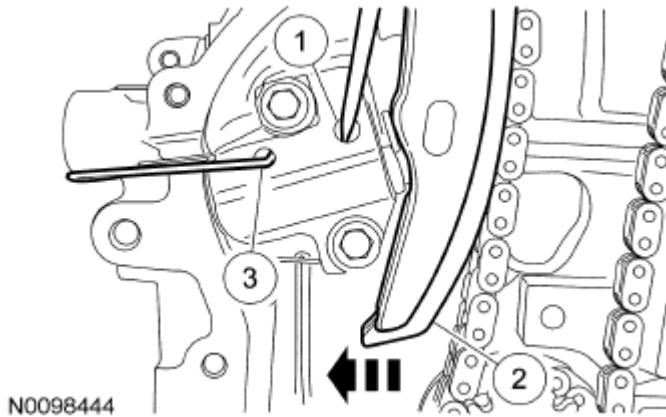


Fig. 65: Identifying Timing Chain Tensioner Compress Sequence
Courtesy of FORD MOTOR CO.

4. Remove the 2 bolts and timing chain tensioner.

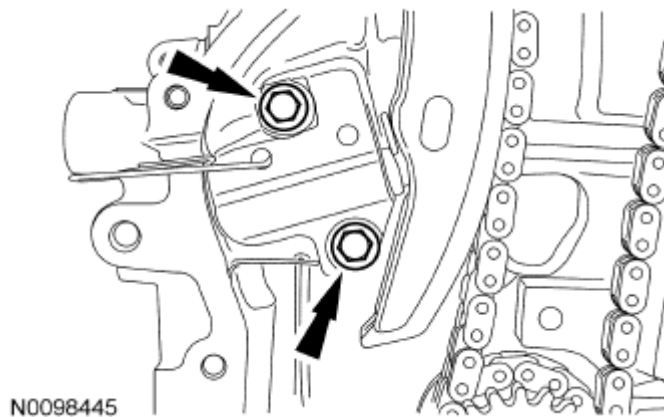


Fig. 66: Locating Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

5. Remove the timing chain tensioner arm.

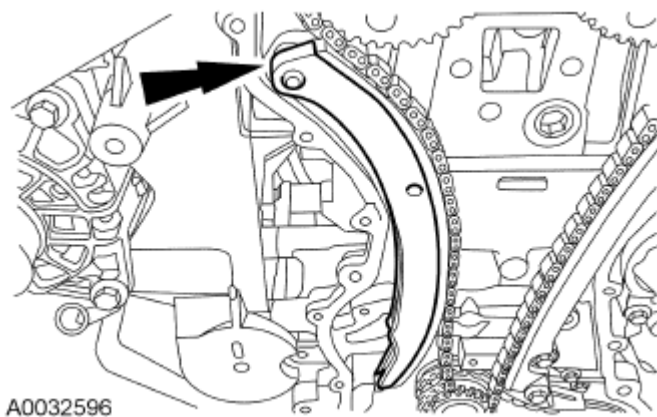


Fig. 67: Locating Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

6. Remove the timing chain.

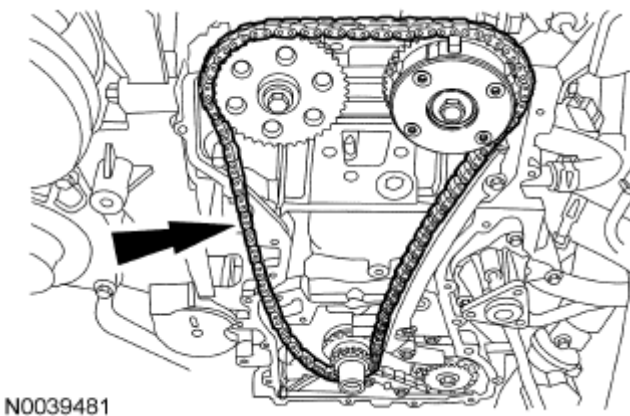


Fig. 68: Locating Timing Chain
Courtesy of FORD MOTOR CO.

7. Remove the 2 bolts and the timing chain guide.

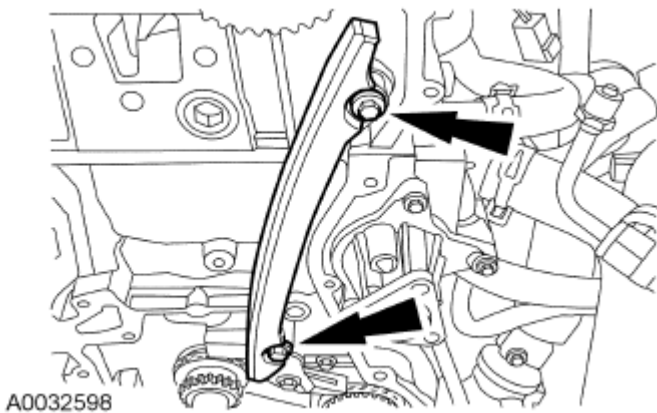


Fig. 69: Locating Timing Chain Guide Bolts

Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

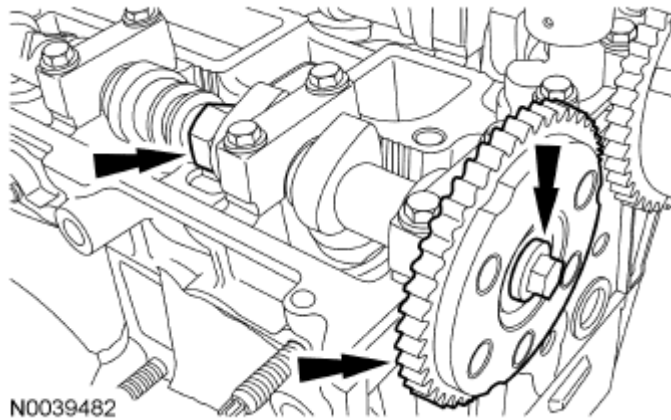


Fig. 70: Locating Flats On Camshaft, Bolt And Exhaust Camshaft Sprocket

Courtesy of FORD MOTOR CO.

8. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

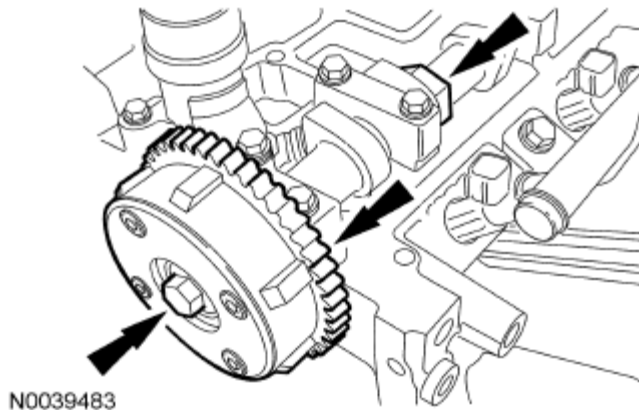


Fig. 71: Locating Flats On Camshaft, Bolt And Camshaft Phaser And Sprocket

Courtesy of FORD MOTOR CO.

9. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the camshaft phaser and sprocket.

Installation

1. Install the camshaft sprockets and the bolts. Do not tighten the bolts at this time.

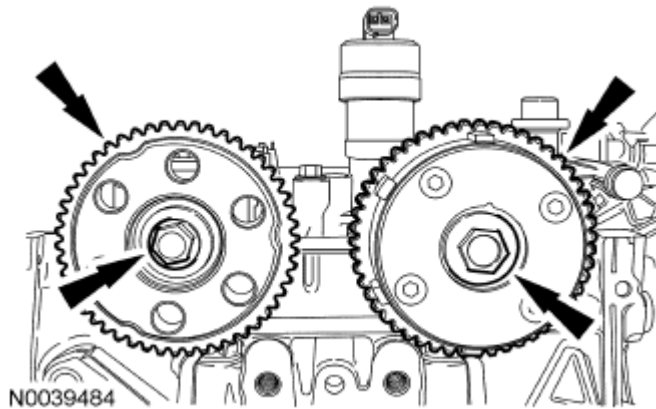


Fig. 72: Locating Camshaft Sprockets And Bolts
Courtesy of FORD MOTOR CO.

2. Install the timing chain guide and the 2 bolts.
 - To install, tighten to 10 Nm (89 lb-in).

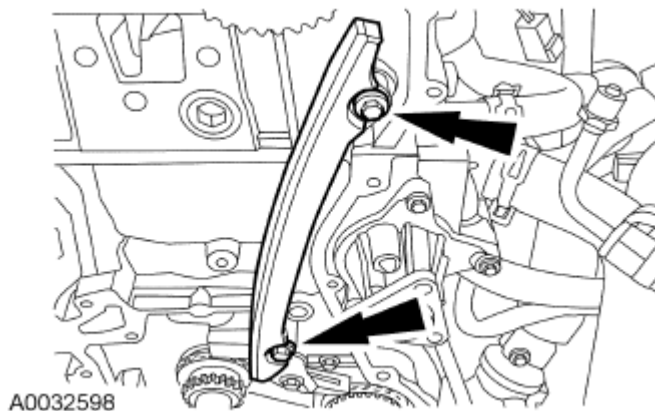


Fig. 73: Locating Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

3. Install the timing chain.

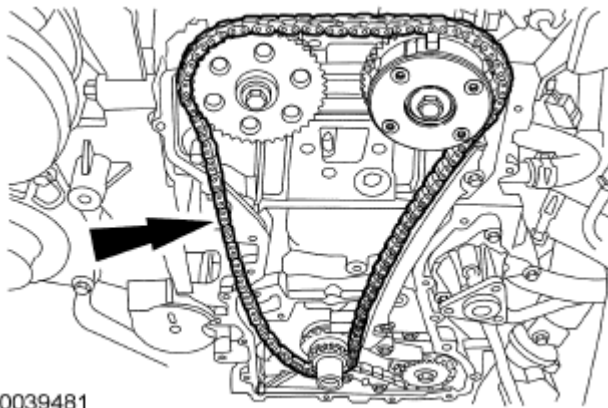


Fig. 74: Locating Timing Chain
Courtesy of FORD MOTOR CO.

4. Install the timing chain tensioner arm.

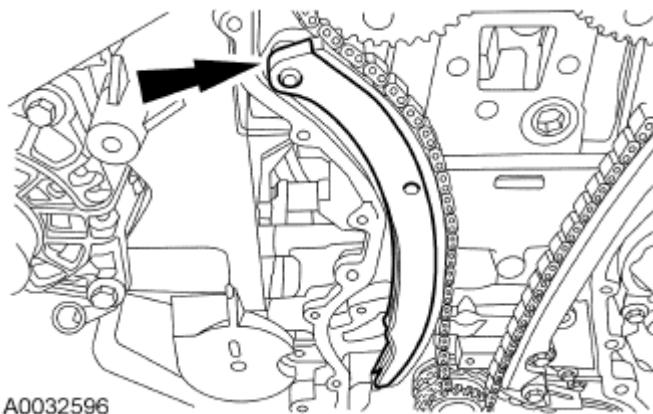
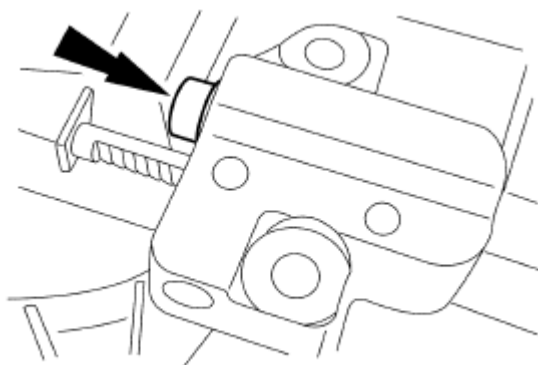


Fig. 75: Locating Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

NOTE: If the timing chain plunger and ratchet assembly are not pinned in the compressed position, follow the next 4 steps.

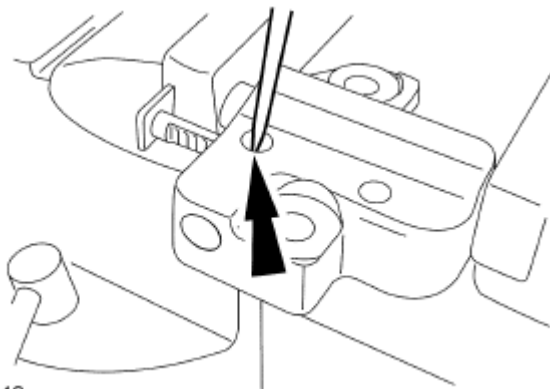
NOTE: Do not compress the ratchet assembly. This will damage the ratchet assembly.



A0032539

Fig. 76: Locating Timing Chain Tensioner Plunger
Courtesy of FORD MOTOR CO.

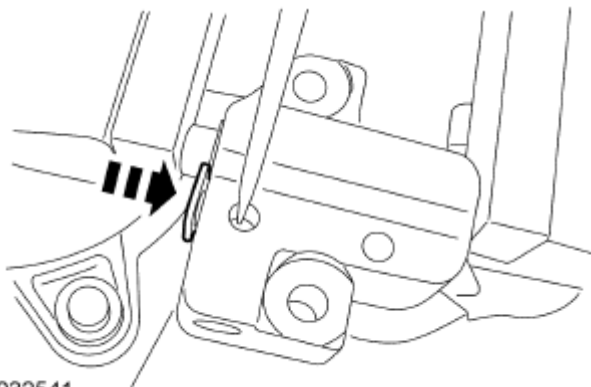
5. Using the edge of a vise, compress the timing chain tensioner plunger.
6. Using a small pick, push back and hold the ratchet mechanism.



A0032540

Fig. 77: Pushing Back And Hold Ratchet Mechanism
Courtesy of FORD MOTOR CO.

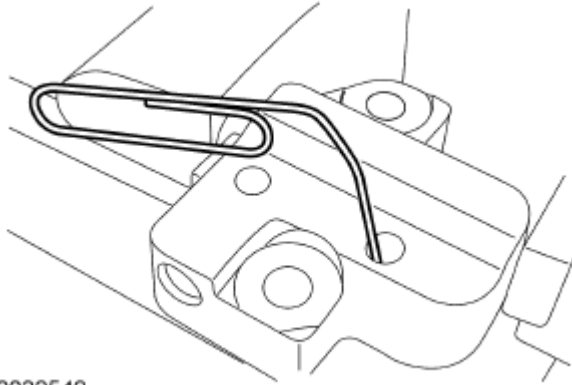
7. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.



A0032541

Fig. 78: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

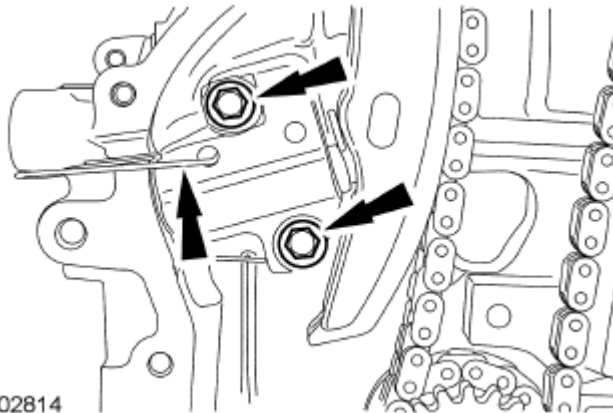
8. Install a paper clip into the hole in the tensioner housing to hold the ratchet assembly and the plunger in during installation.



A0032542

Fig. 79: Installing Paper Clip Into Hole In Tensioner Housing To Hold Ratchet Assembly And Plunger
Courtesy of FORD MOTOR CO.

9. Install the timing chain tensioner and the 2 bolts. Remove the paper clip to release the piston.
 - Tighten to 10 Nm (89 lb-in).



A0002814

Fig. 80: Locating Timing Chain Tensioner Bolts And Paper Clip
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

10. Using the flats on the camshafts to prevent camshaft rotation, tighten the bolts.
 - Tighten to 72 Nm (53 lb-ft).

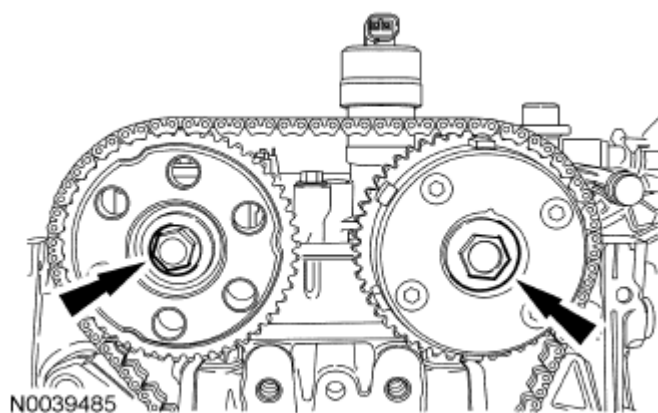


Fig. 81: Locating Camshafts Bolts
Courtesy of FORD MOTOR CO.

11. Install the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM OIL FILTER

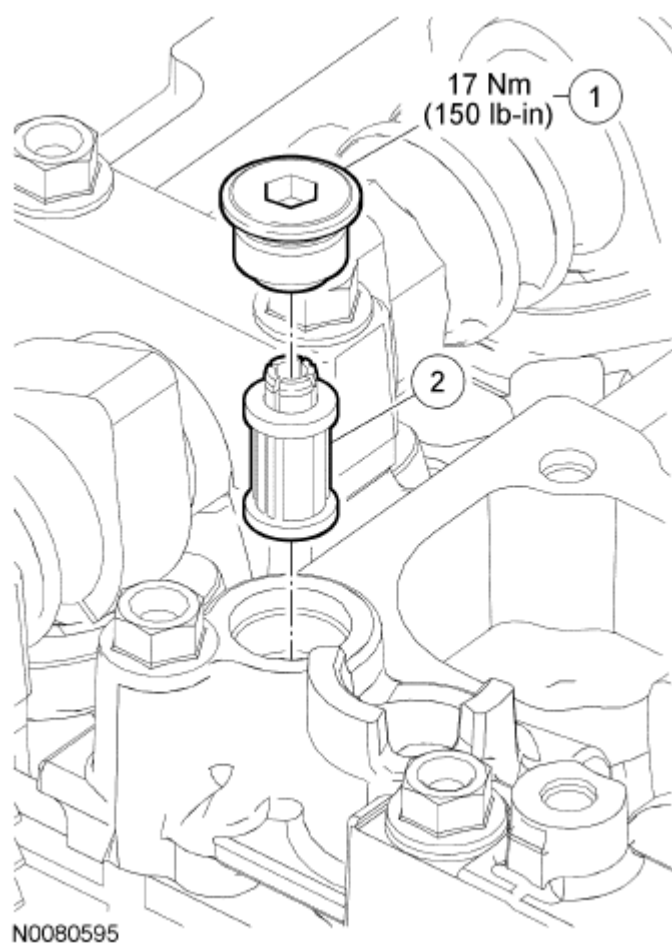


Fig. 82: Identifying Variable Camshaft Timing System Oil Filter

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | W710451 | Variable Camshaft Timing (VCT) system oil filter plug |
| 2 | 6C683 | VCT system oil filter |


Removal and Installation

1. Remove the Variable Camshaft Timing (VCT) oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L**.
2. Remove the VCT system oil filter plug and the VCT system oil filter from the intake camshaft thrust cap.
 - To install, tighten to 17 Nm (150 lb-in).
3. To install, reverse the removal procedure.

CAMSHAFTS

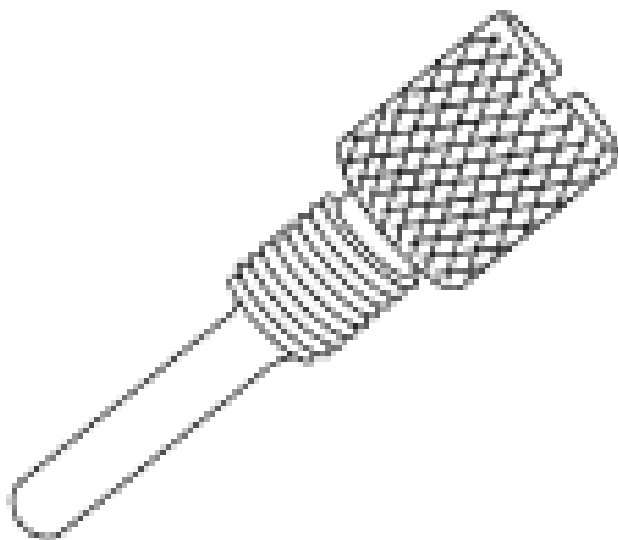
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|---|---|
|  <p>ST2645-A</p> | <p>Alignment Plate, Camshaft 303-465 (T94P-6256-CH)</p> |
| | <p>Timing Peg, Crankshaft TDC 303-507</p> |

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2638-A

General Equipment

GENERAL EQUIPMENT REFERENCE

6 mm x 18 mm bolt

M6 x 30 mm bolt

Material

ITEM SPECIFICATION

| 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 |
| Silicone Gasket and Sealant TA-30 | WSE-M4G323-A4 |

Removal

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 can cause engine failure.

NOTE: Do not rotate the camshafts unless instructed to in this procedure. Rotating the camshafts or crankshaft with timing components loosened or removed can

cause serious damage to the valves and pistons.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .
3. Remove the Variable Camshaft Timing (VCT) oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L** .
4. Remove the front RH wheel and tire. For additional information, refer to **WHEELS & TIRES** .
5. Check the valve clearance. For additional information, refer to **VALVE CLEARANCE CHECK**.

NOTE: **Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.**

6. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

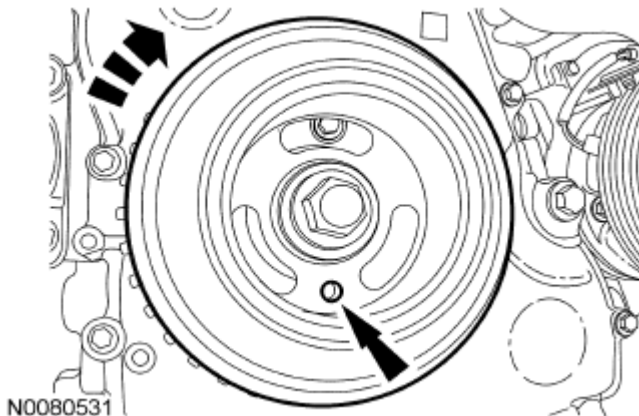


Fig. 83: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

NOTE: **The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.**

NOTE: **The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.**

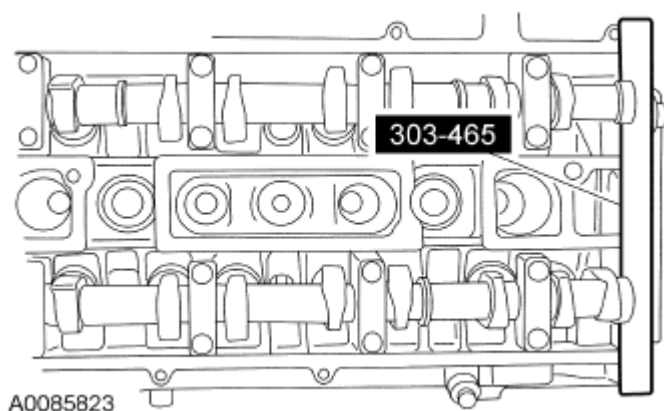


Fig. 84: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

7. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.
8. Remove the engine plug bolt.

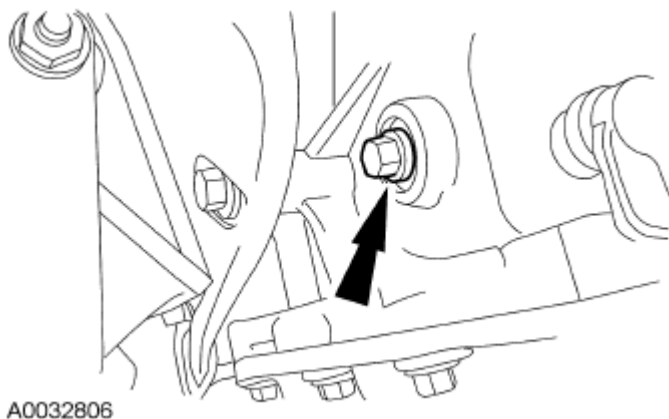
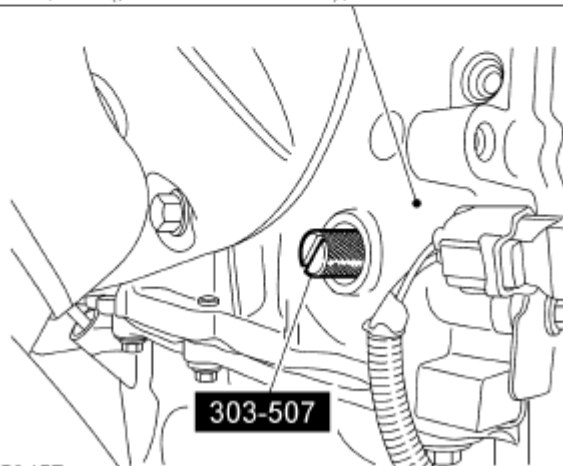
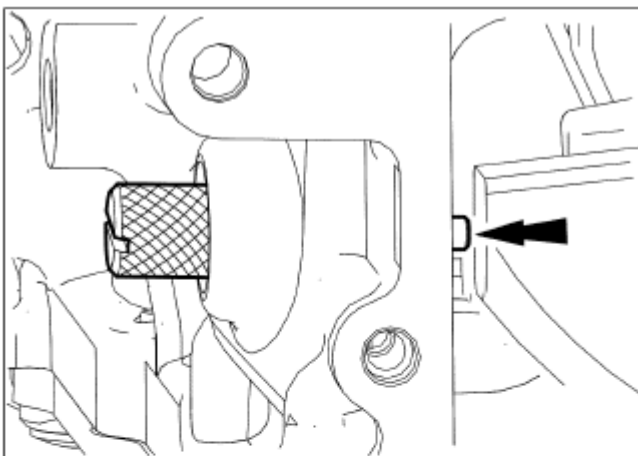


Fig. 85: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the camshaft removal and installation.

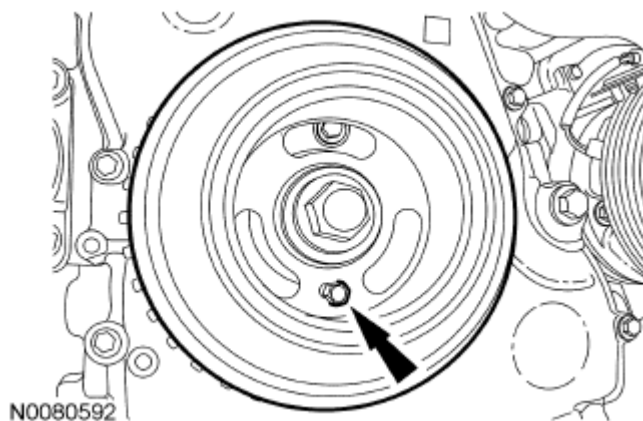


N0059457

Fig. 86: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

9. Install the Crankshaft TDC Timing Peg.

NOTE: Only hand-tighten the bolt or damage to the front cover can occur.



N0080592

Fig. 87: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

10. Install a 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.
11. Remove the lower front cover timing hole plug from the engine front cover.

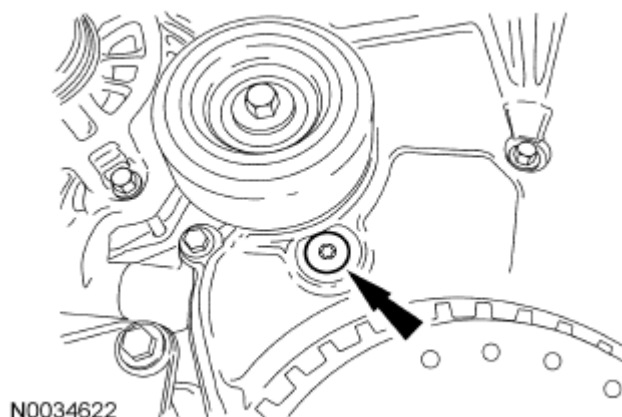


Fig. 88: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Remove the upper front cover timing hole plug from the engine front cover.

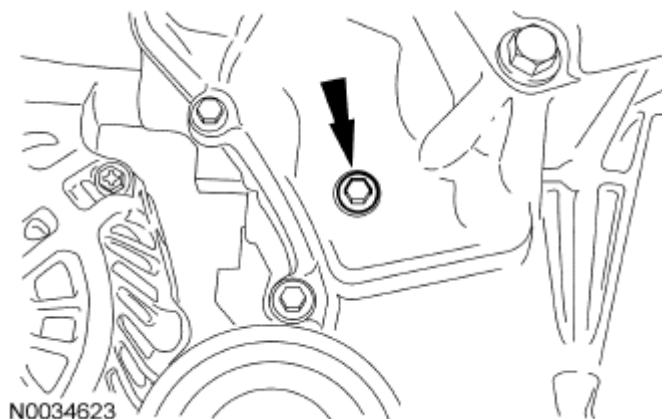
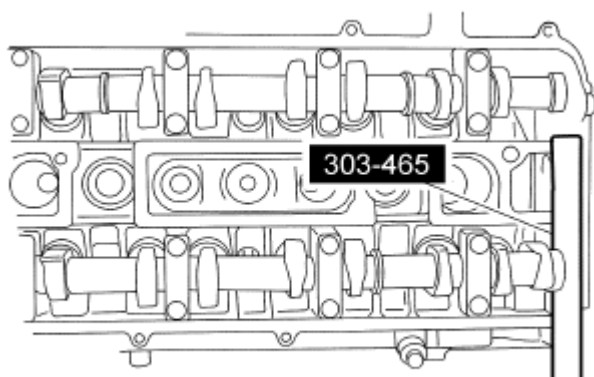


Fig. 89: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Reposition the Camshaft Alignment Plate to the slot on the rear of the intake camshaft only.



N0036032

Fig. 90: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

NOTE: Releasing the ratcheting mechanism in the timing chain tensioner allows the plunger to collapse and create slack in the timing chain. Installing an M6 x 30 mm bolt into the upper front cover timing hole will hold the tensioner arm in a retracted position and allow enough slack in the timing chain for removal of the exhaust camshaft gear.

14. Using a small pick tool, unlock the chain tensioner ratchet through the lower front cover timing hole.
 - Using the flats of the camshaft, have an assistant rotate the exhaust camshaft clockwise to collapse the timing chain tensioner plunger.
 - Insert an M6 x 30 mm bolt into the upper front cover timing hole to hold the tensioner arm in the retracted position.

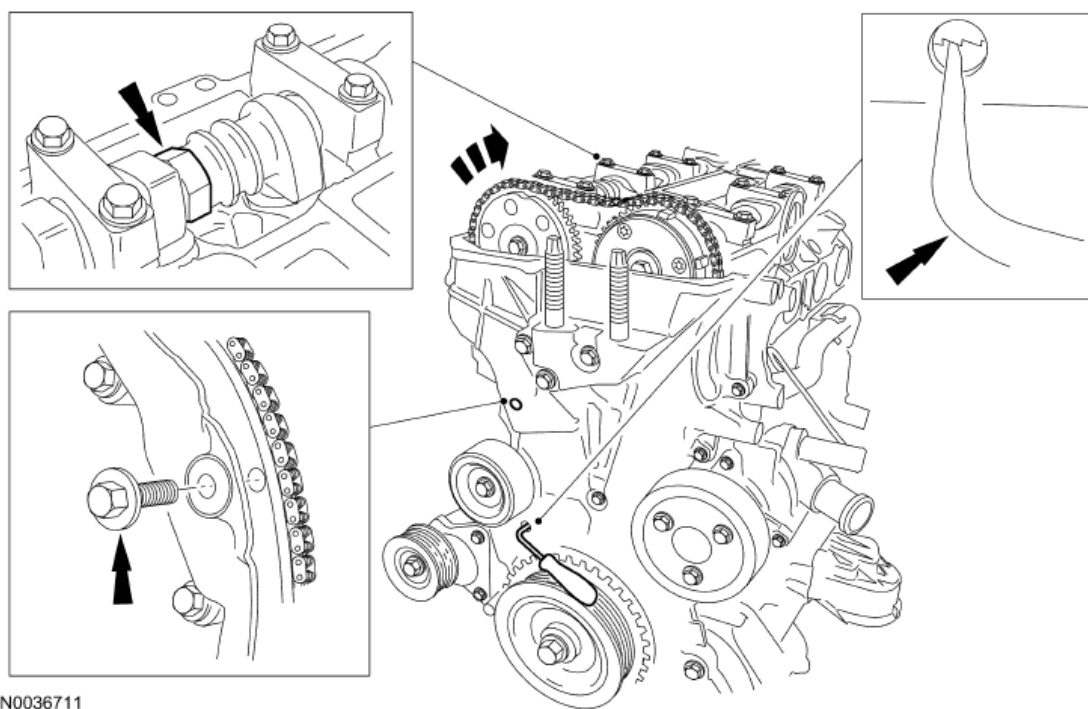
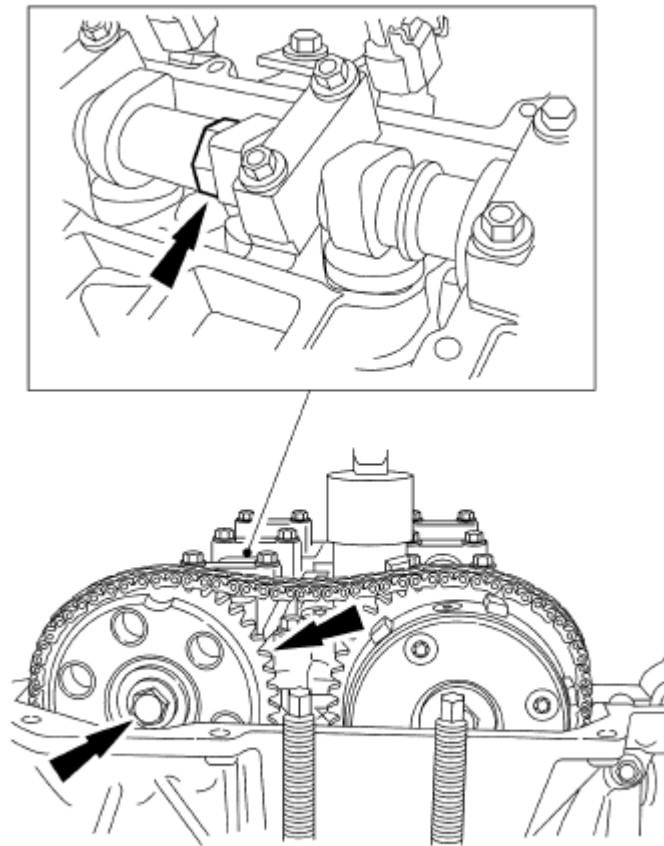


Fig. 91: Unlocking Chain Tensioner Ratchet Through Lower Front Cover Timing Hole
Courtesy of FORD MOTOR CO.

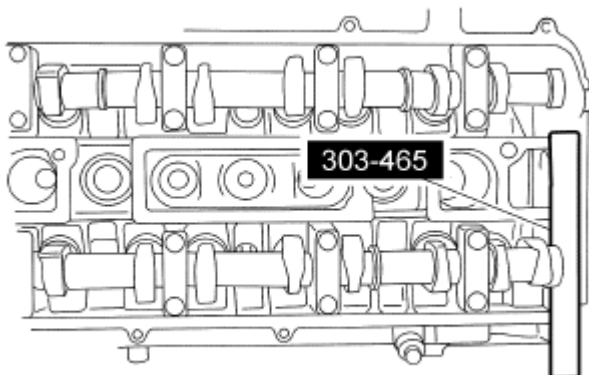
15. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft drive gear.



N0035983

Fig. 92: Locating Flats On Camshaft To Prevent Camshaft Rotation
Courtesy of FORD MOTOR CO.

16. Remove the Camshaft Alignment Plate.



N0036032

Fig. 93: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

17. Remove the timing chain from the intake camshaft drive gear.

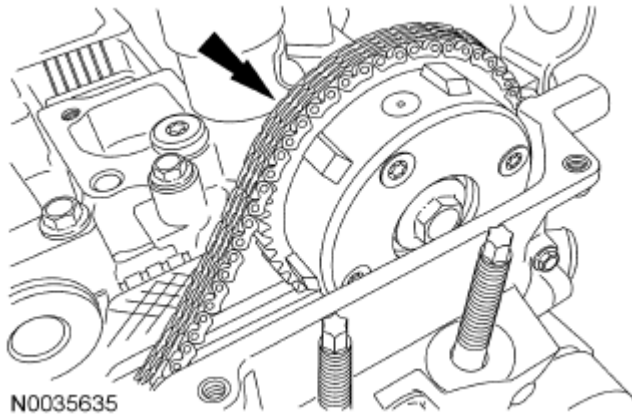


Fig. 94: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

18. Mark the position of the camshaft lobes on the No. 1 cylinder for installation reference.

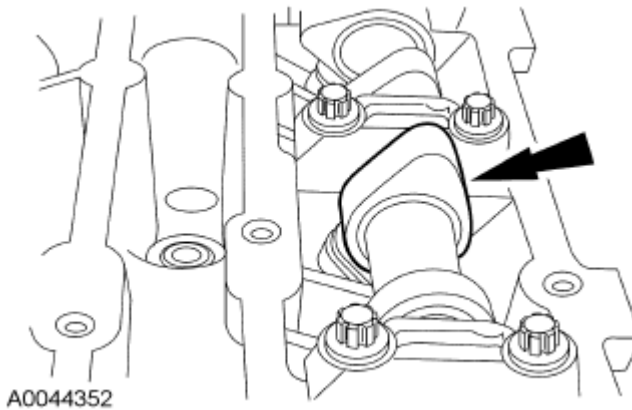


Fig. 95: Locating Camshaft Lobes
Courtesy of FORD MOTOR CO.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

19. Remove the camshafts from the engine.
- Loosen the camshaft bearing cap bolts, in sequence, one turn at a time until all tension is released from the camshaft bearing caps.
 - Remove the bolts and the camshaft bearing caps.
 - Remove the camshafts.

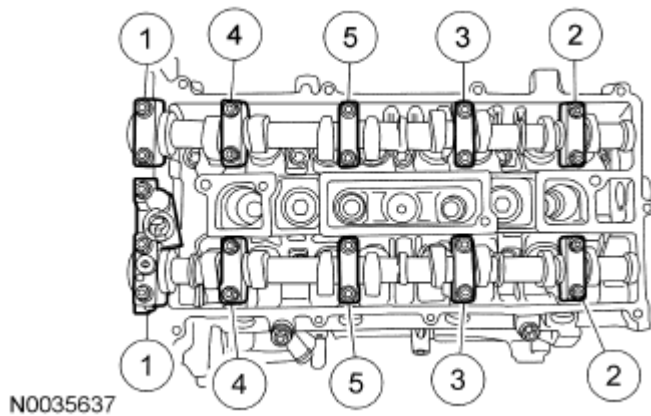


Fig. 96: Identifying Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

20. If removal of the camshaft phaser and sprocket is necessary, mark the sprocket and camshaft for reference during installation.
 - If necessary, place the camshaft in a soft-jawed vise. Remove the bolt and the camshaft phaser and sprocket.

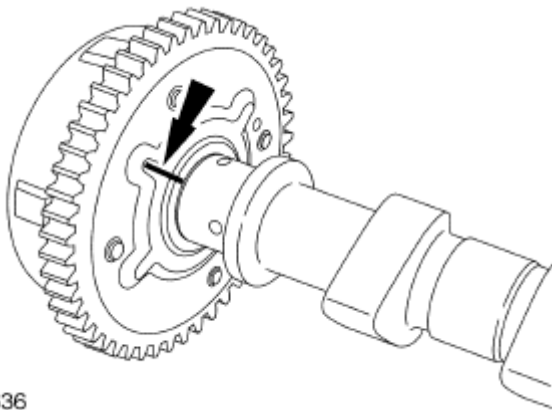


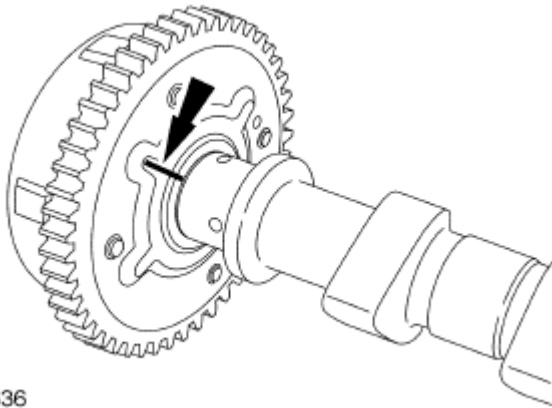
Fig. 97: Identifying Sprocket And Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

Installation

NOTE: If new parts are installed, transfer the reference marks made during disassembly to the new parts.

1. If necessary, position the camshaft in a soft-jawed vise and install the camshaft phaser and sprocket and the bolt
 - Align the reference marks on the camshaft phaser and sprocket and the camshaft.

Tighten the bolt to 72 Nm (53 lb-ft).



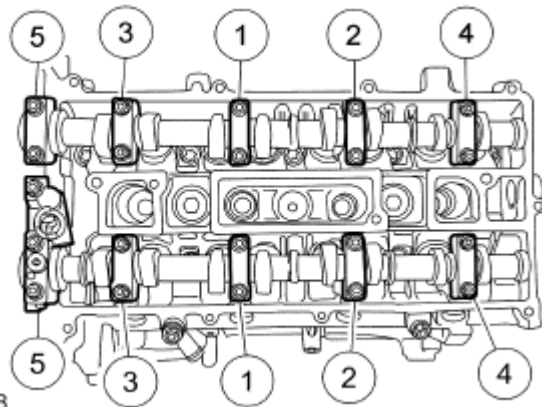
N0035636

Fig. 98: Identifying Sprocket And Camshaft Reference Mark
 Courtesy of FORD MOTOR CO.

NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

2. Install the camshafts and bearing caps in their original location and orientation. Tighten the bearing caps in the sequence shown in 3 stages:
 - Stage 1: Tighten the camshaft bearing cap bolts one turn at a time, until finger-tight.
 - Stage 2: Tighten to 7 Nm (62 lb-in).
 - Stage 3: Tighten to 16 Nm (142 lb-in).



N0035638

Fig. 99: Identifying Camshaft Bearing Cap Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

3. Install the Camshaft Alignment Plate.

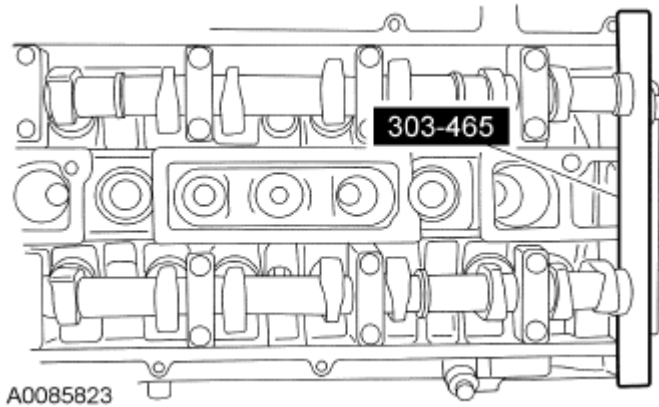


Fig. 100: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

4. Install the timing chain on the intake camshaft drive gear.

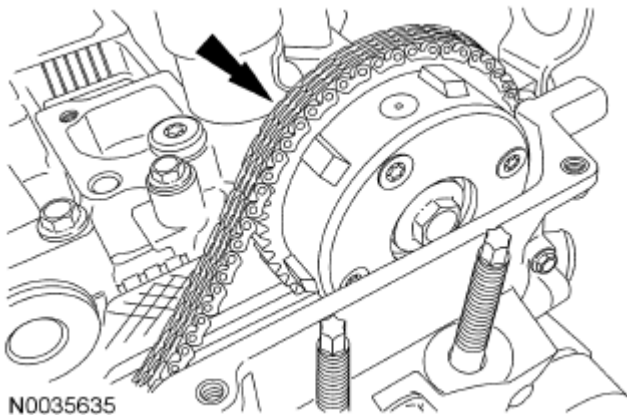


Fig. 101: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

NOTE: The timing chain must be correctly engaged on the teeth of the crankshaft timing sprocket and the intake camshaft drive gear in order to install the exhaust camshaft drive gear onto the exhaust camshaft.

5. Position the exhaust camshaft drive gear in the timing chain and install the gear and bolt on the exhaust camshaft.
 - Hand-tighten the bolt.

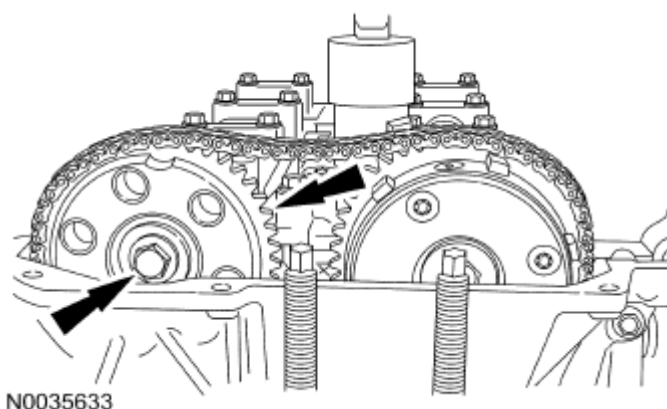


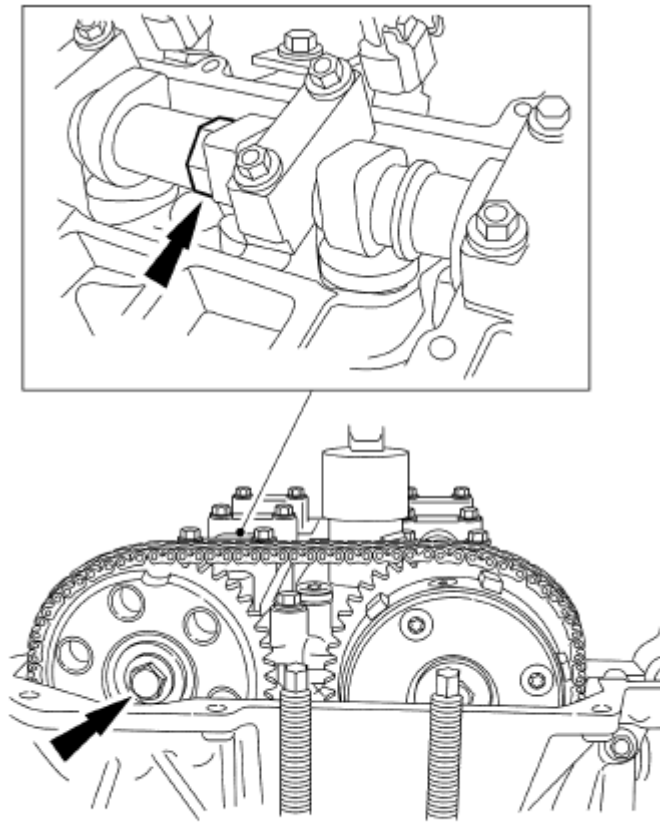
Fig. 102: Locating Exhaust Camshaft Drive Gear And Bolt
Courtesy of FORD MOTOR CO.

NOTE: Releasing the tensioner arm will remove the slack from the timing chain.

6. Remove the M6 x 30 mm bolt from the upper front cover timing hole to release the tensioner arm.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

7. Using the flats on the camshafts to prevent camshaft rotation, tighten the bolts.
 - Tighten to 72 Nm (53 lb-ft).



N0035634

Fig. 103: Locating Flats On Camshafts And Camshaft Bolts
Courtesy of FORD MOTOR CO.

8. Remove the Camshaft Alignment Plate.

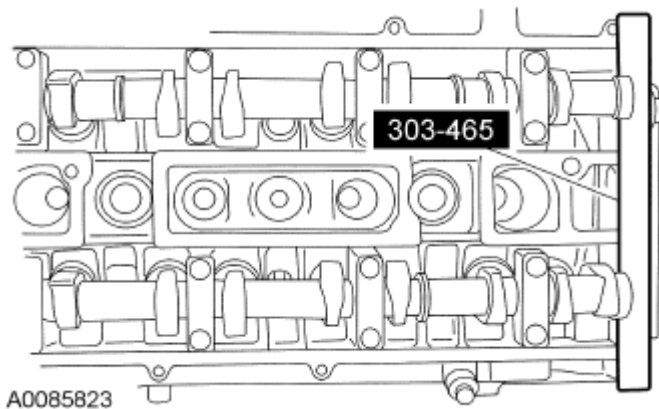


Fig. 104: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

9. Remove the 6 mm x 18 mm bolt.

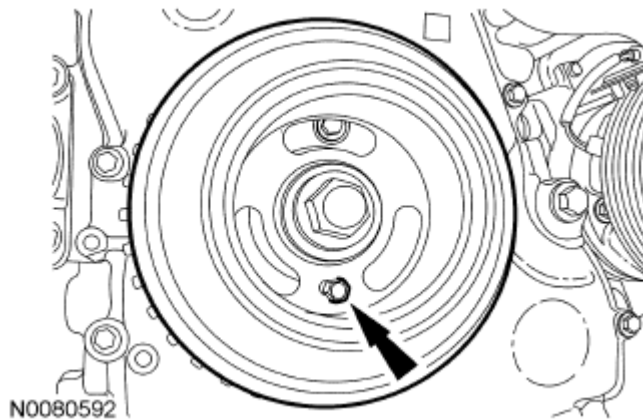


Fig. 105: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

10. Remove the Crankshaft TDC Timing Peg.

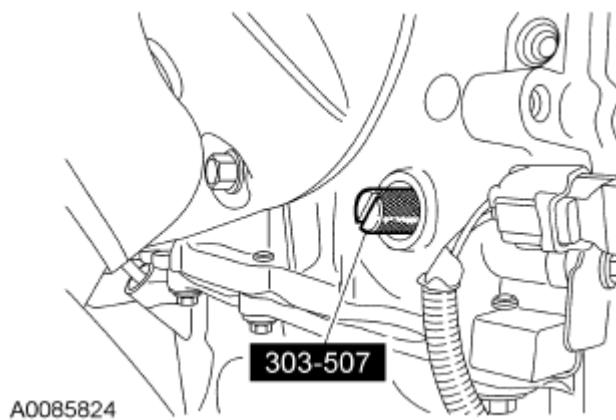


Fig. 106: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

11. Install the upper front cover timing hole plug.
 - Tighten to 10 Nm (89 lb-in).

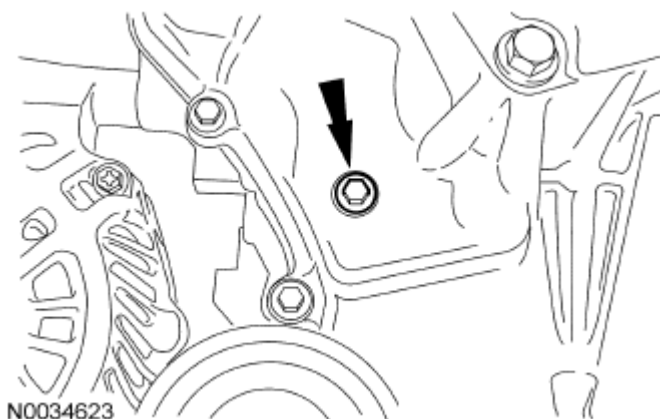


Fig. 107: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Apply silicone gasket and sealant to the threads of the lower front cover timing hole plug.
 - Install the plug and tighten to 12 Nm (106 lb-in).

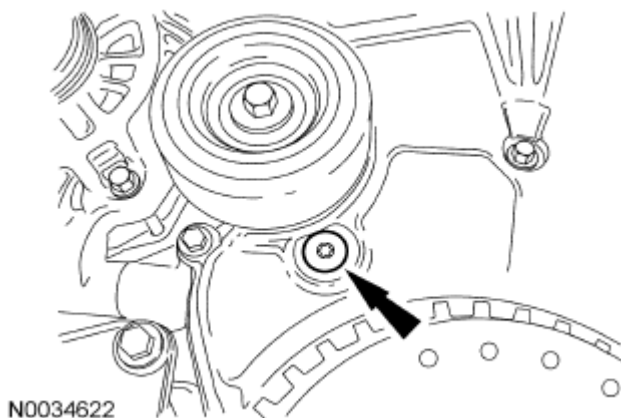


Fig. 108: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Install the engine plug bolt.
 - Tighten to 20 Nm (177 lb-in).

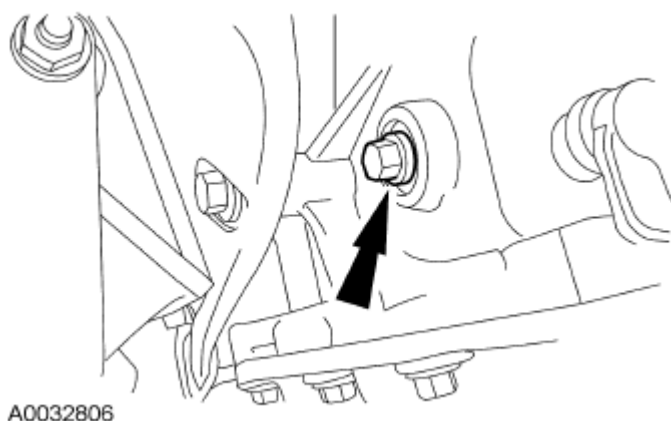



Fig. 109: Locating Engine Plug Bolt
 Courtesy of FORD MOTOR CO.

14. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .
15. Install the front RH wheel and tire. For additional information, refer to **WHEELS & TIRES** .
16. Install the VCT oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L** .

CAMSHAFT PHASER AND SPROCKET

Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|--|--|
|  <p>ST2645-A</p> | <p>Alignment Plate, Camshaft 303-465 (T94P-6256-CH)</p> |
| | |

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2638-A

Timing Peg, Crankshaft TDC
303-507

General Equipment

GENERAL EQUIPMENT REFERENCE

6 mm x 18 mm bolt

M6 x 30 mm bolt

Material

ITEM SPECIFICATION

| 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 |
| Silicone Gasket and Sealant TA-30 | WSE-M4G323-A4 |

Removal

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 can cause engine failure.

NOTE: Do not rotate the camshafts or crankshaft unless instructed to do so in this procedure. Rotating the camshafts or crankshaft with timing components

loosened or removed can cause serious damage to the valves or pistons.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .
3. Remove the Variable Camshaft Timing (VCT) oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L** .
4. Check the valve clearance. For additional information, refer to **VALVE CLEARANCE CHECK**.

NOTE: **Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.**

5. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

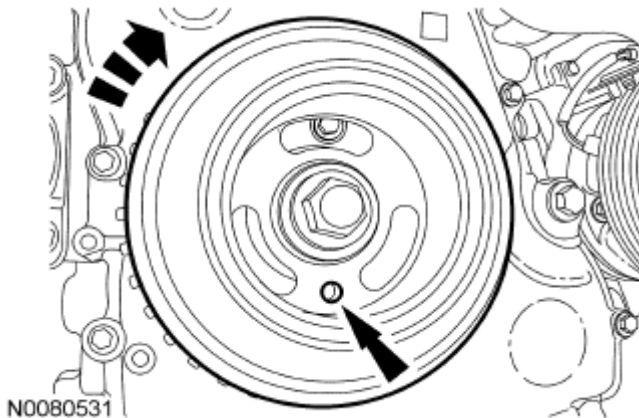


Fig. 110: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

NOTE: **The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.**

NOTE: **The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.**

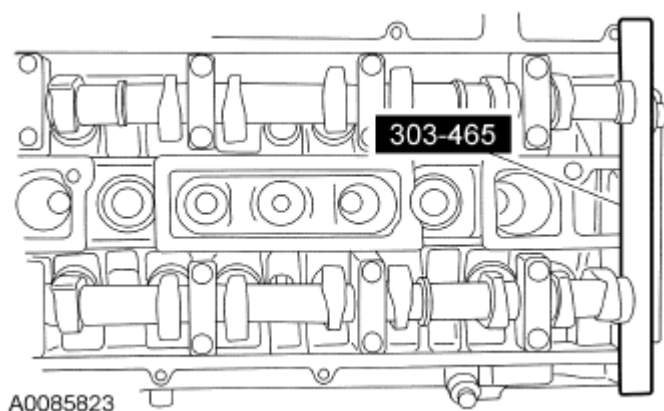


Fig. 111: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

6. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.
7. Remove the engine plug bolt.

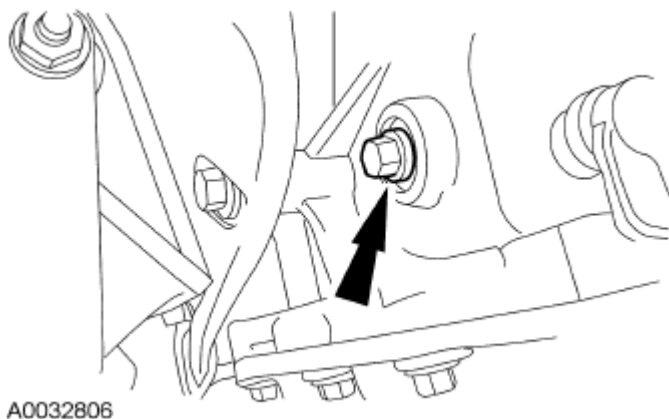
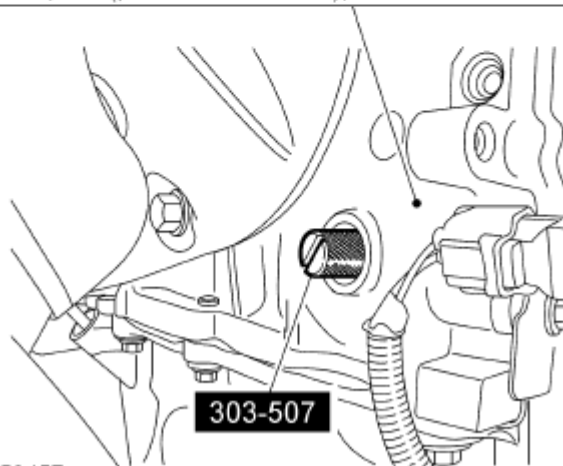
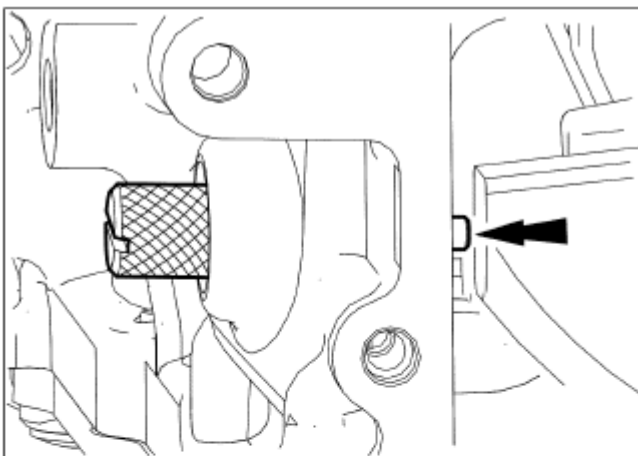


Fig. 112: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the camshaft removal and installation.



N0059457

Fig. 113: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

8. Install the Crankshaft TDC Timing Peg.

NOTE: Only hand-tighten the bolt or damage to the front cover can occur.

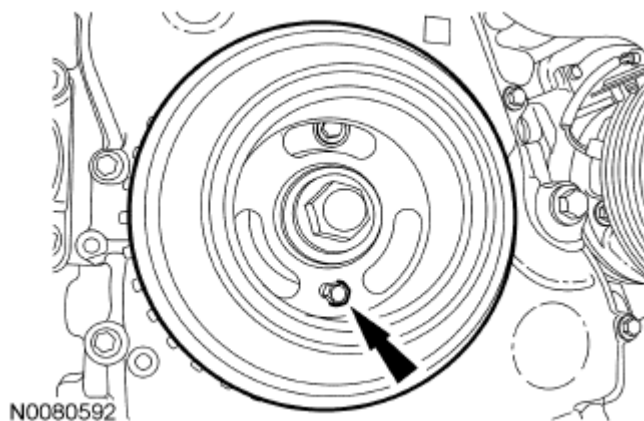


Fig. 114: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

9. Install a 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.
10. Remove the lower timing hole plug from the engine front cover.

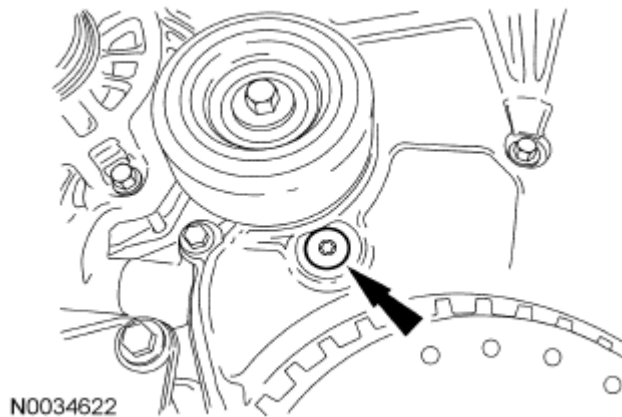


Fig. 115: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

11. Remove the upper timing hole plug from the engine front cover.

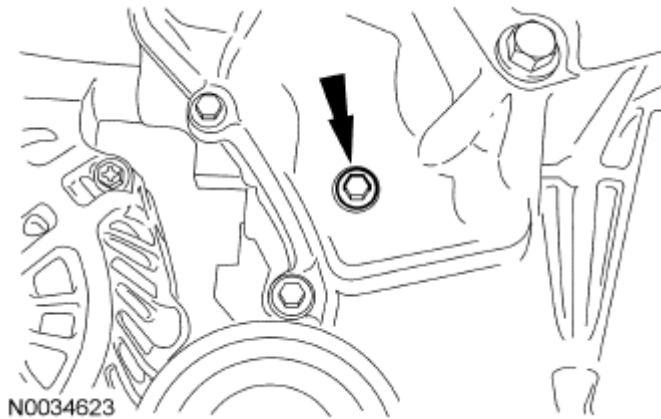
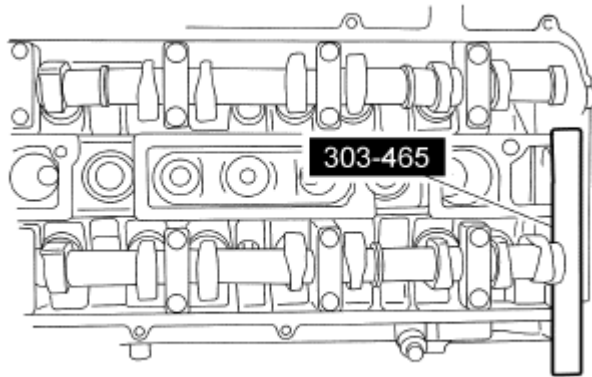


Fig. 116: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Reposition the Camshaft Alignment Plate to the slot on the rear of the intake camshaft only.



N0036032

Fig. 117: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

NOTE: Releasing the ratcheting mechanism in the timing chain tensioner allows the plunger to collapse and create slack in the timing chain. Installing the M6 x 30 mm bolt into the upper front cover timing hole will lock the tensioner arm in a retracted position and allow enough slack in the timing chain for removal of the exhaust camshaft gear.

13. Using a small pick tool, release the timing chain tensioner ratchet through the lower front cover timing hole.
 - Have an assistant rotate (using the flats of the camshaft) the exhaust camshaft clockwise to collapse the timing chain tensioner plunger.
 - Insert the M6 x 30 mm bolt into the upper front cover timing hole to hold the tensioner arm in the retracted position.

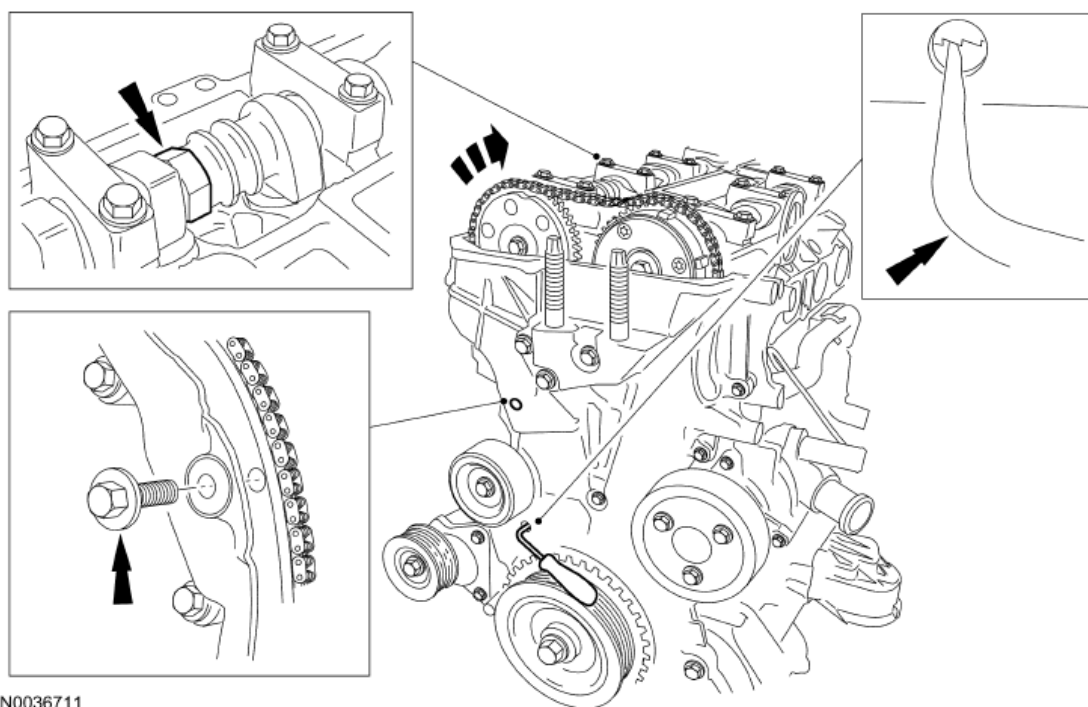
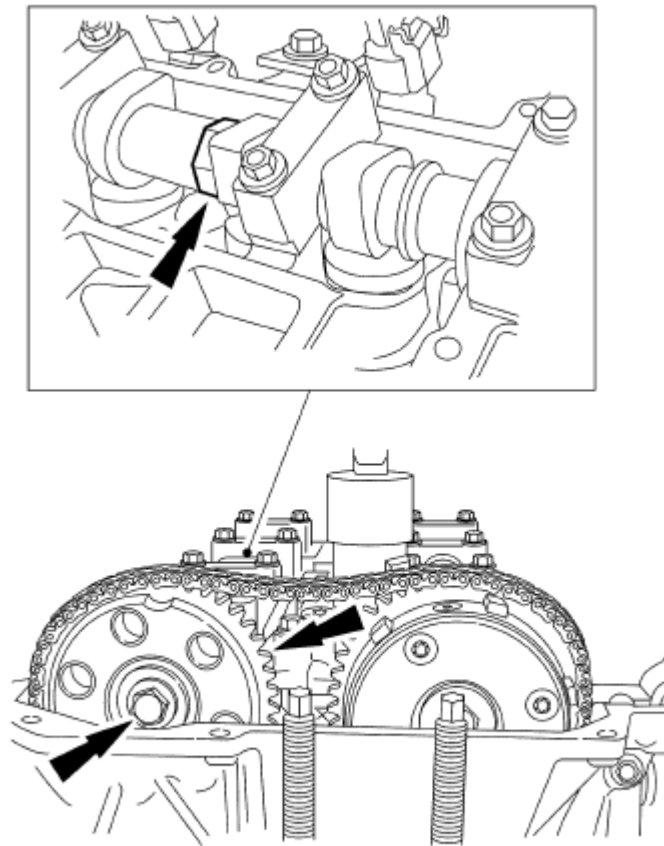


Fig. 118: Releasing Timing Chain Tensioner Ratchet Through Lower Front Cover Timing Hole

Courtesy of FORD MOTOR CO.

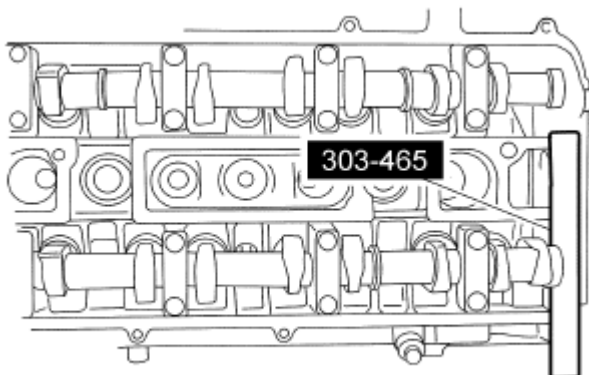
14. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft drive gear.



N0035983

Fig. 119: Locating Flats On Camshaft To Prevent Camshaft Rotation
Courtesy of FORD MOTOR CO.

15. Remove the Camshaft Alignment Plate.



N0036032

Fig. 120: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

16. Remove the timing chain from the intake camshaft drive gear.

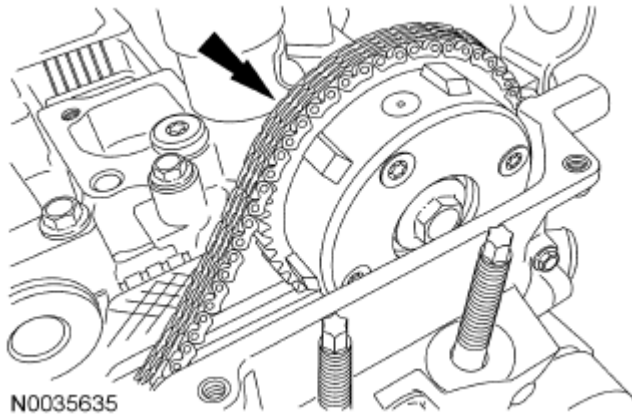


Fig. 121: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

17. Mark the position of the camshaft lobes on the No. 1 cylinder for installation reference.

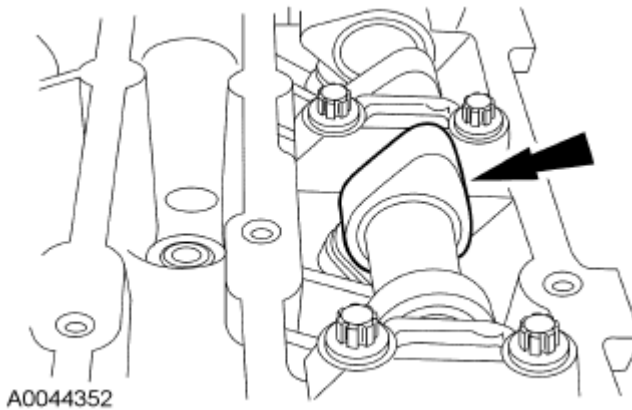


Fig. 122: Locating Camshaft Lobes
Courtesy of FORD MOTOR CO.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the intake camshaft.

18. Remove the intake camshaft from the engine.
- Loosen the intake camshaft bearing cap bolts, in the sequence shown, one turn at a time until all tension is released from the camshaft bearing caps.
 - Remove the bolts and the camshaft bearing caps.
 - Remove the intake camshaft.

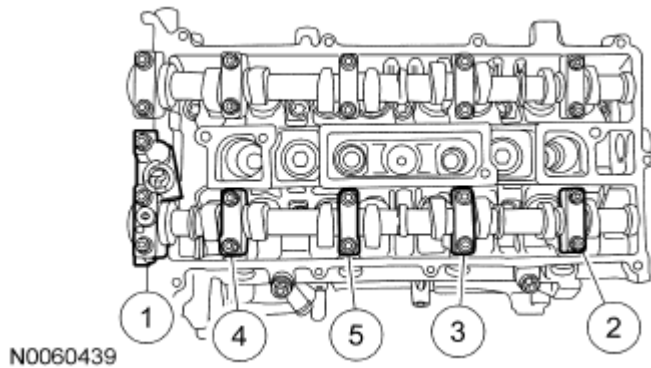


Fig. 123: Identifying Intake Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

19. Mark the camshaft phaser and sprocket and the camshaft for reference during installation.

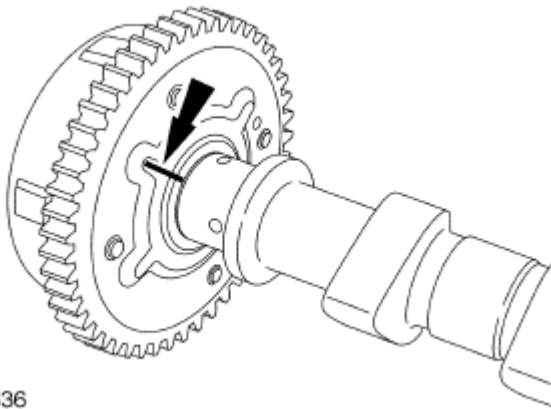


Fig. 124: Identifying Sprocket And Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

20. Place the camshaft in a soft-jawed vise.

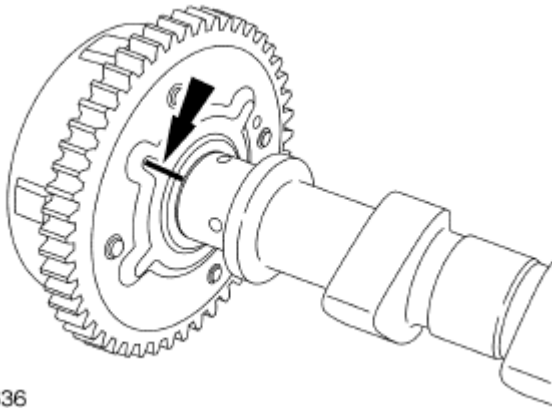
Remove the bolt and the camshaft phaser and sprocket.

Installation

NOTE: If new parts are installed, transfer the reference marks made during disassembly to the new parts.

1. Position the camshaft in a soft-jawed vise. Install the camshaft phaser and sprocket and the bolt.
 - Align the reference marks on the camshaft phaser and sprocket and the camshaft.

Tighten the bolt to 72 Nm (53 lb-ft).



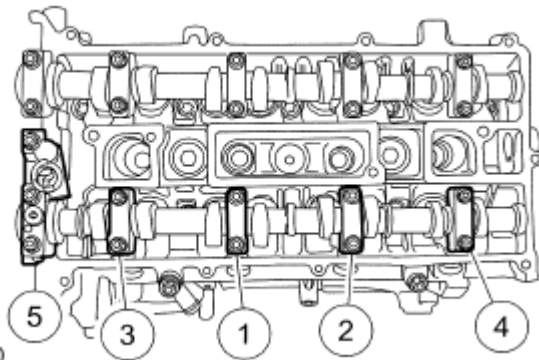
N0035636

Fig. 125: Identifying Sprocket And Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

NOTE: Install the intake camshaft with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the intake camshaft journals and bearing caps with clean engine oil.

2. Install the intake camshafts and bearing caps. Tighten the intake camshaft bearing caps in the sequence shown in 3 stages:
 - Stage 1: Tighten the intake camshaft bearing cap bolts until finger-tight.
 - Stage 2: Tighten to 7 Nm (62 lb-in).
 - Stage 3: Tighten to 16 Nm (142 lb-in).



N0060440

Fig. 126: Identifying Intake Camshafts Bearing Caps Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the Camshaft Alignment Plate.

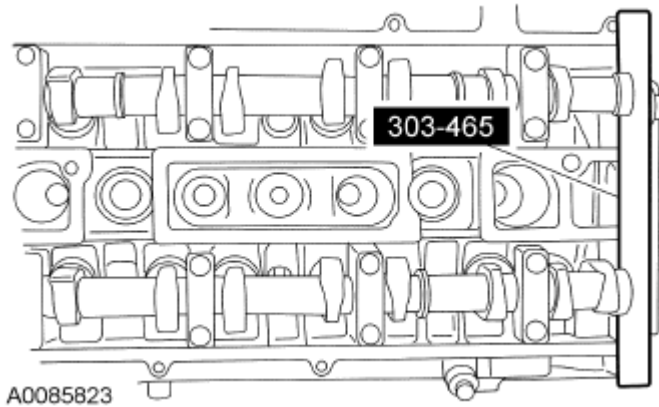


Fig. 127: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

4. Install the timing chain on the intake camshaft drive gear.

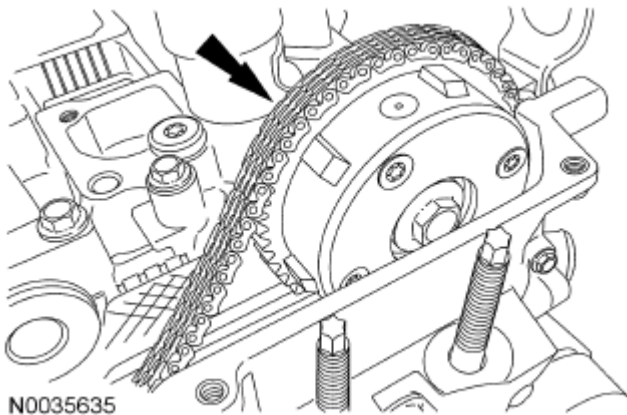


Fig. 128: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

NOTE: The timing chain must be correctly engaged on the teeth of the crankshaft timing sprocket and the intake camshaft drive gear in order to install the exhaust camshaft drive gear onto the exhaust camshaft.

5. Position the exhaust camshaft drive gear in the timing chain and install the gear and bolt on the exhaust camshaft.
 - Hand-tighten the bolt.

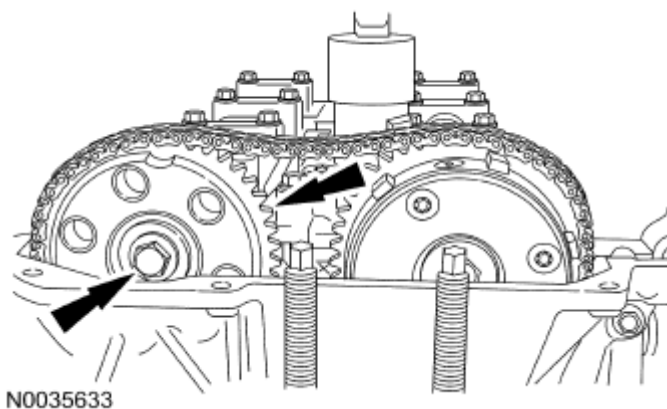
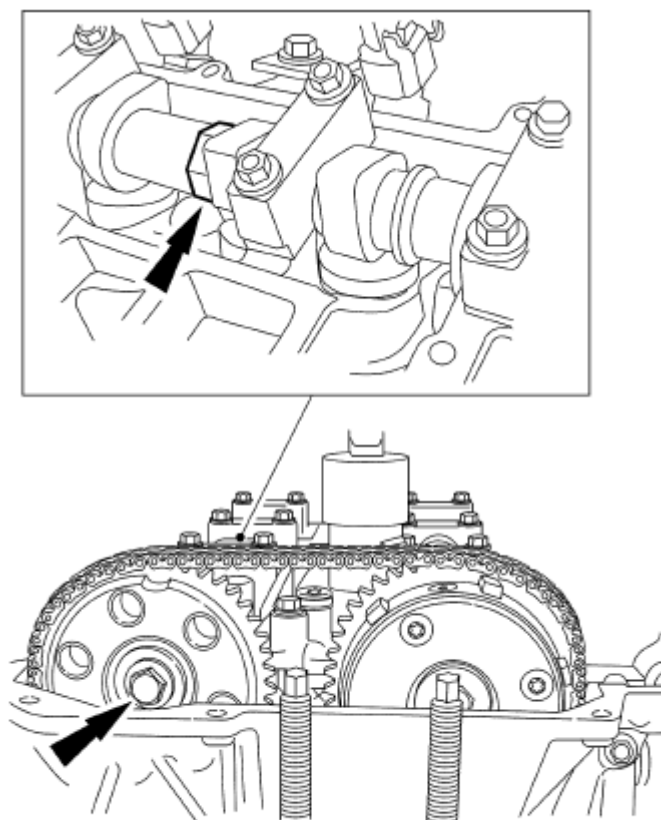


Fig. 129: Locating Exhaust Camshaft Drive Gear And Bolt
Courtesy of FORD MOTOR CO.

NOTE: Releasing the tensioner arm will remove the slack from the timing chain.

6. Remove the M6 x 30 mm bolt from the upper front cover timing hole to release the tensioner arm.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.



N0035634

Fig. 130: Locating Flats On Camshafts And Camshaft Bolts
Courtesy of FORD MOTOR CO.

7. Using the flats on the camshaft to prevent camshaft rotation, tighten the exhaust camshaft drive gear bolt to 72 Nm (53 lb-ft).
8. Remove the Camshaft Alignment Plate.

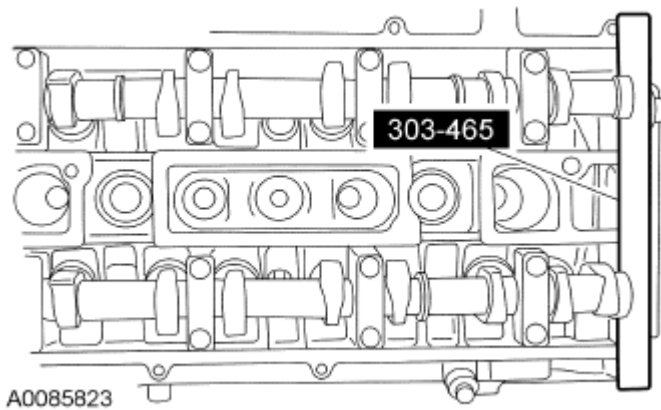


Fig. 131: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

9. Remove the 6 mm x 18 mm bolt.

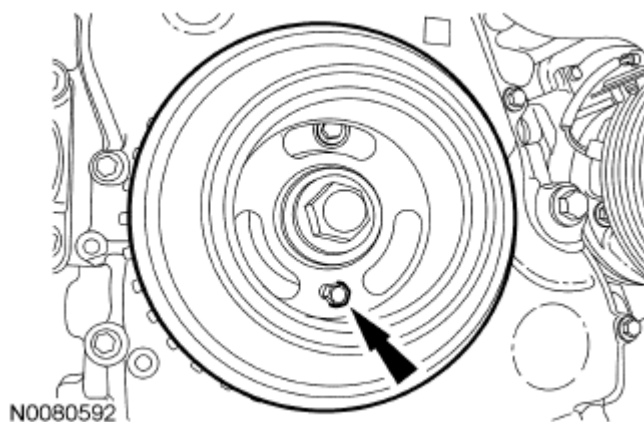


Fig. 132: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

10. Remove the Crankshaft TDC Timing Peg.

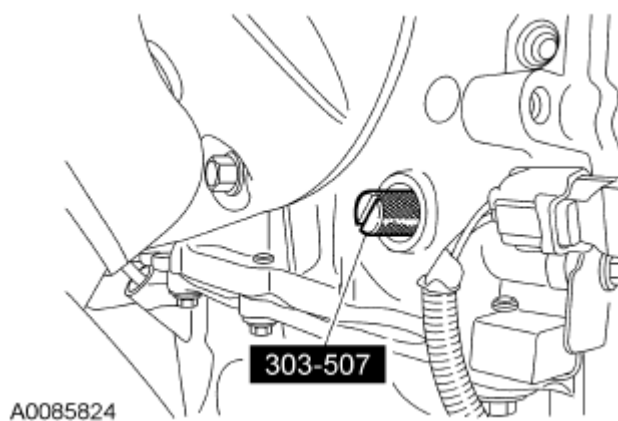


Fig. 133: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

11. Install the upper timing hole plug in the engine front cover.
- Tighten to 10 Nm (89 lb-in).

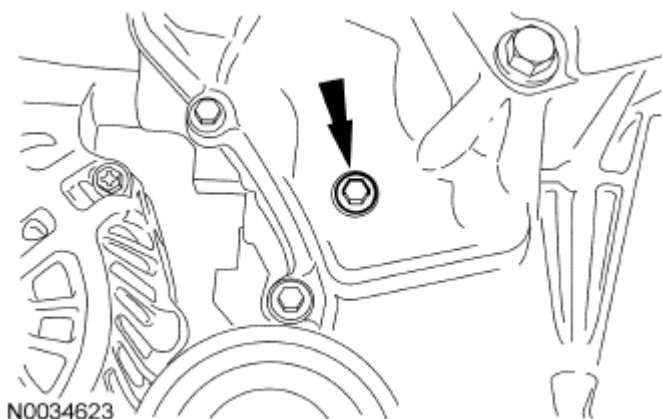


Fig. 134: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Apply silicone gasket and sealant to the threads of the lower timing hole plug.
 - Install the lower timing hole plug in the engine front cover.
 - Tighten to 12 Nm (106 lb-in).

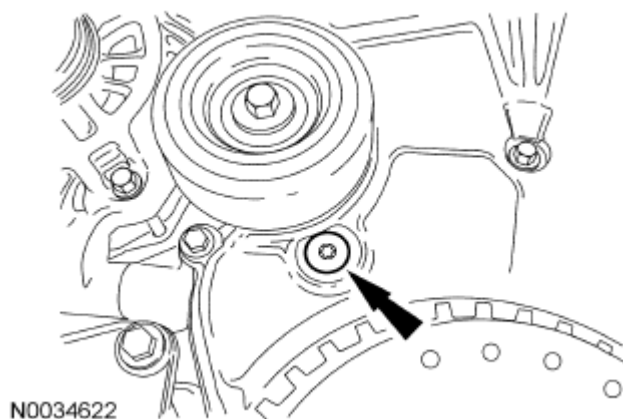


Fig. 135: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Install the engine plug bolt.
 - Tighten to 20 Nm (177 lb-in).

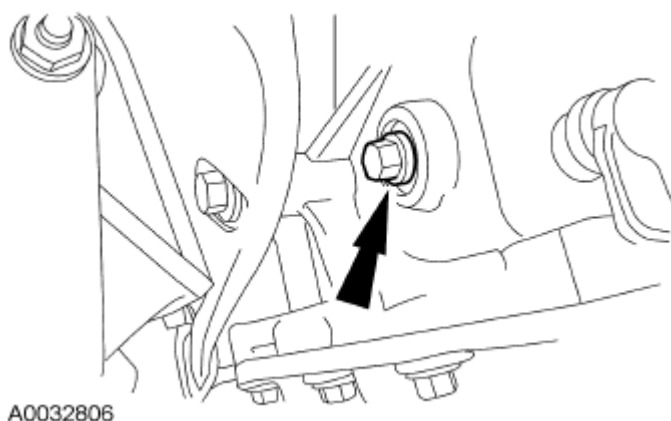
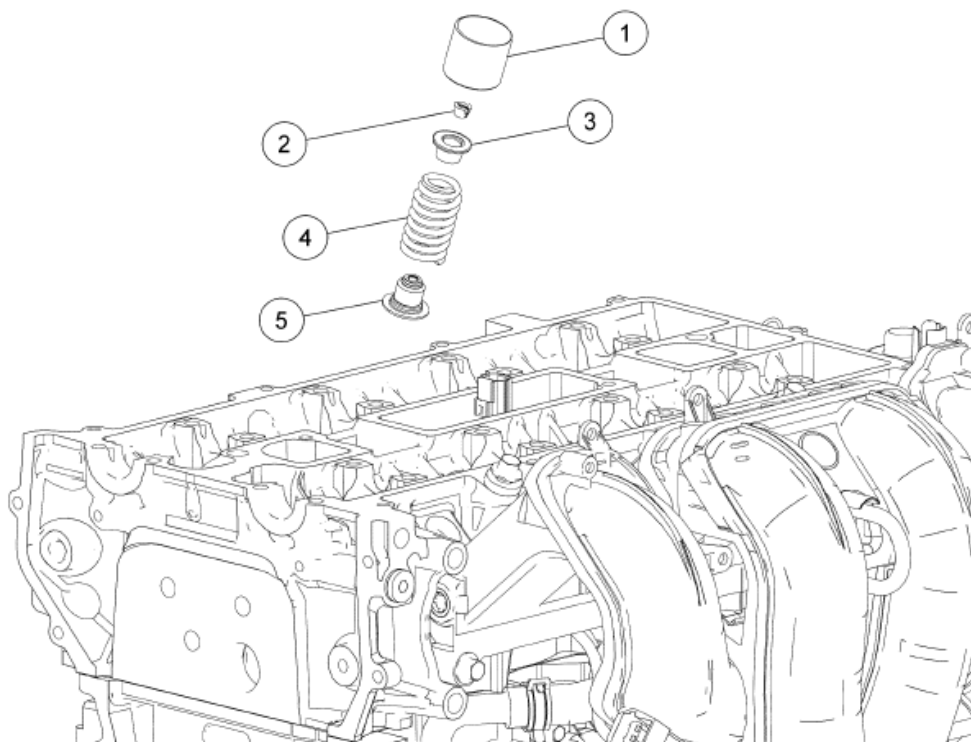


Fig. 136: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

14. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .
15. Install the VCT oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L** .

VALVE TRAIN COMPONENTS - EXPLODED VIEW



N0068038

Fig. 137: Identifying Valve Train Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

2009 Mercury Mariner

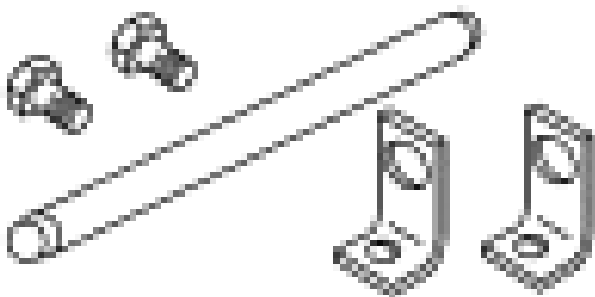
2009 ENGINE Engine - 2.5L - Escape & Mariner

| Item | Part Number | Description |
|------|-------------|-------------------------------------|
| 1 | 6500 | Valve tappet (16 required) |
| 2 | 6518 | Valve collet (16 required) |
| 3 | 6514 | Valve spring retainer (16 required) |
| 4 | 6513 | Valve spring (16 required) |
| 5 | 6517 | Valve seal (16 required) |

VALVE SPRINGS

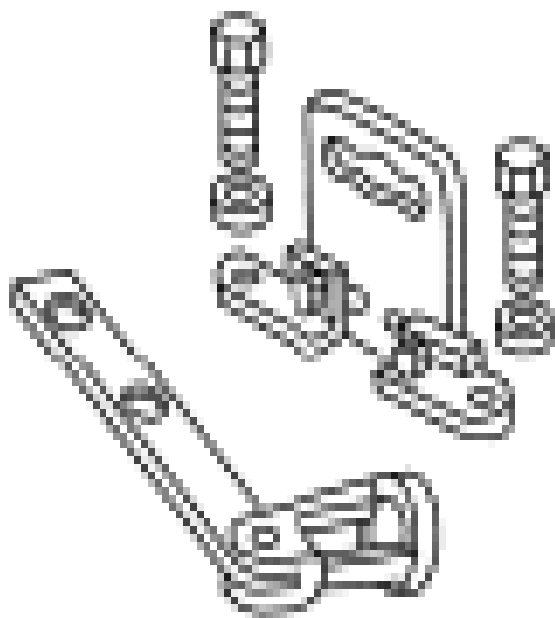
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

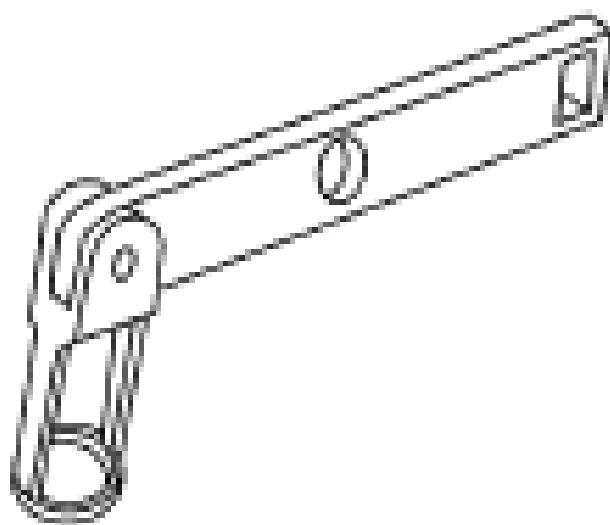
| | |
|---|---|
|  <p>ST1981-A</p> | Compressor, Valve Spring 303-300 (T87C-6565-A) |
| | Compressor, Valve Spring 303-350 (T89P-6565-A) |

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1907-A



ST1902-A

Compressor, Valve Spring
303-472 (T94P-6565-AH)

Material

ITEM SPECIFICATION

| Item | Specification |
|------|---------------|
|------|---------------|

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner

| | |
|--|------------------|
| 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 |
| Multi-Purpose Grease XG-4 and/or XL-5 | ESB-M1C93- B |

Removal

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 can cause engine failure.

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

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

3. Remove and inspect the valve tappets. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
4. Remove the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.

NOTE: Use compressed air at 7 to 10 bars (100-150 psi). Do not disconnect the compressed air from the cylinder until the valve spring, valve spring retainer and valve collet is installed. Any loss of air pressure will allow the valve to fall into the cylinder.

5. Connect the compressed air supply to cylinder No. 1.

NOTE: Place all parts in order to one side.

6. Apply compressed air to the cylinder and remove the valve spring.
 - Using the Valve Spring Compressors, compress the valve spring and remove the valve collet, using some multi-purpose grease and a small screwdriver.
 - Remove the valve spring retainer and the valve spring.

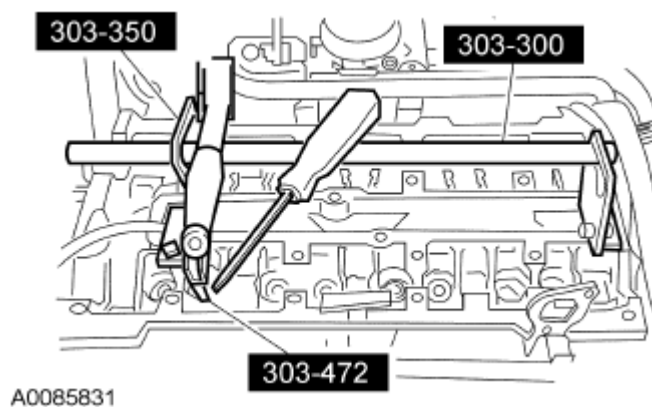


Fig. 138: Removing Valve Spring Retainer And Valve Spring
Courtesy of FORD MOTOR CO.

Installation

NOTE: Check the seating of the valve collet.

1. Using the Valve Spring Compressors, install the valve spring.
 - Insert the valve spring and the valve spring retainer.
 - Compress the valve spring and install the valve collet using some multi-purpose grease and a small screwdriver.

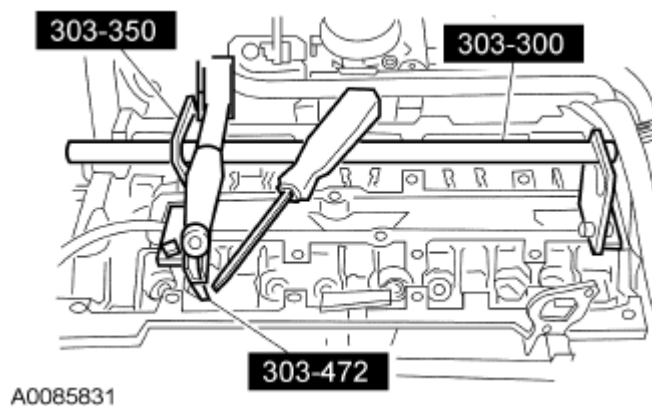


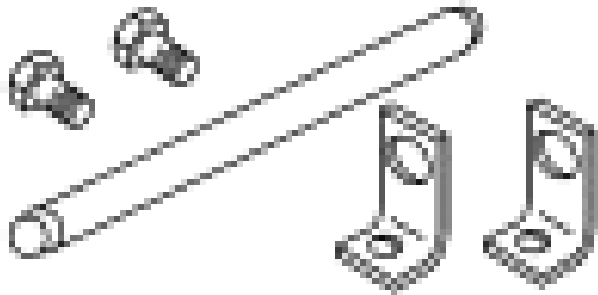
Fig. 139: Inserting Valve Spring And Valve Spring Retainer
Courtesy of FORD MOTOR CO.

2. Disconnect the compressed air supply.
3. Repeat the appropriate removal and installation steps for all of the other cylinders.
4. Install the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.
5. Coat the valve tappets with clean engine oil and insert them.
6. Install the camshafts. For additional information, refer to **CAMSHAFTS**.

VALVE SEALS

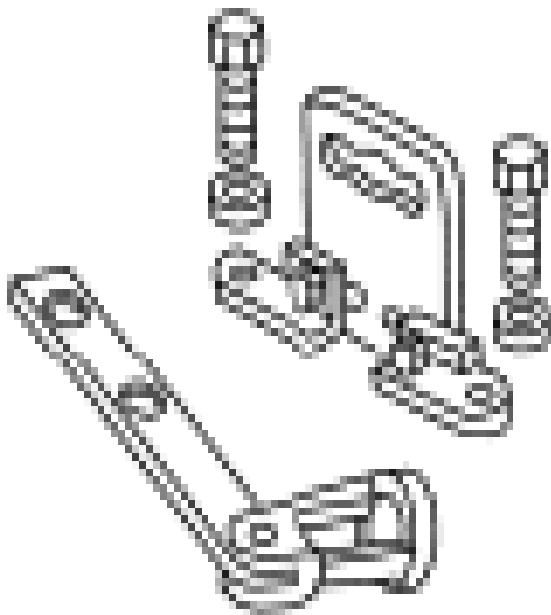
Special Tool(s)

SPECIAL TOOL REFERENCE CHART



ST1981-A

Compressor, Valve Spring
303-300 (T87C-6565-A)

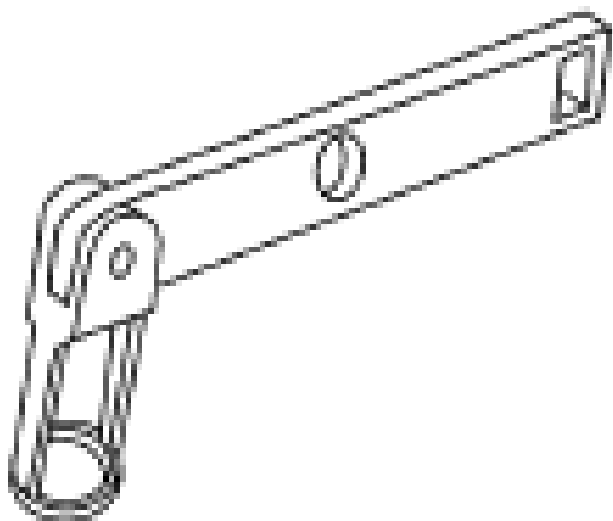


ST1907-A

Compressor, Valve Spring
303-350 (T89P-6565-A)

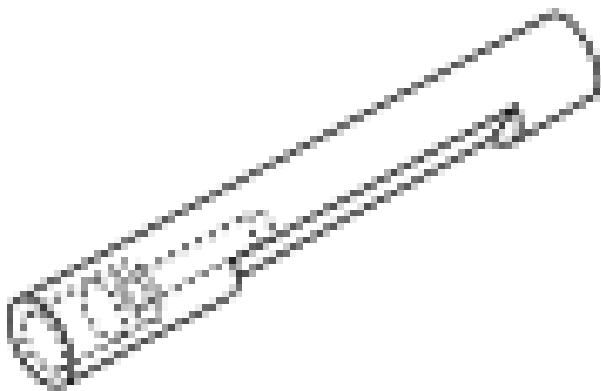
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1902-A

Compressor, Valve Spring
303-472 (T94P-6565-AH)



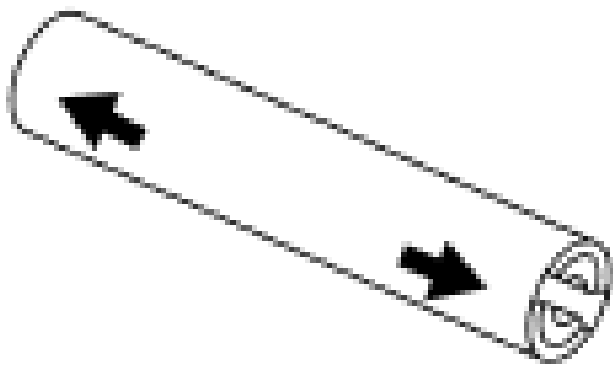
ST1903-A

Installer, Valve Stem Oil Seal
303-470 (T94P-6510-CH)

Remover, Valve Stem Oil Seal
303-468 (T94P-6510-AH)

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2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1904-A



ST1187-A

Slide Hammer
307-005 (T59L-100-B)

Material

ITEM SPECIFICATION

| 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 |
| Multi-Purpose Grease XG-4 and/or XL-5 | ESB-M1C93-B |

Removal

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 can cause engine failure.

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

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

3. Remove and inspect the valve tappets. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
4. Remove the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.

NOTE: Use compressed air at 7 to 10 bars (100-150 psi). Do not disconnect the compressed air from the cylinder until the valve spring, valve spring retainer and valve collet is installed. Any loss of air pressure will allow the valve to fall into the cylinder.

5. Connect the compressed air supply to cylinder No. 1.

NOTE: Place all parts in order to one side.

6. Apply compressed air to the cylinder and remove the valve spring.
 - Using the Valve Spring Compressors, compress the valve spring and remove the valve collet, using some multi-purpose grease and a small screwdriver.
 - Remove the valve spring retainer and the valve spring.

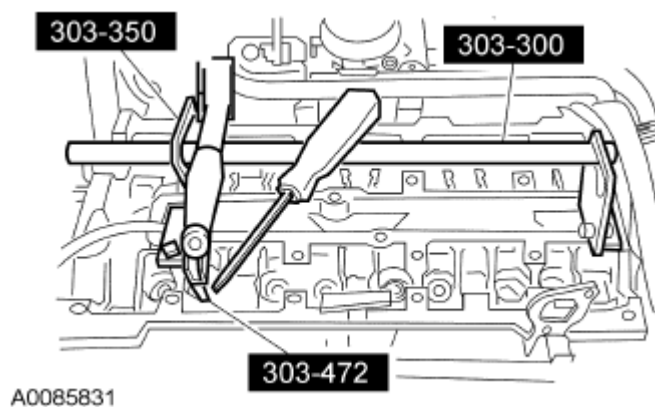


Fig. 140: Removing Valve Spring Retainer And Valve Spring
Courtesy of FORD MOTOR CO.

7. Using the Valve Stem Oil Seal Remover and Slide Hammer, remove and discard the valve seal.

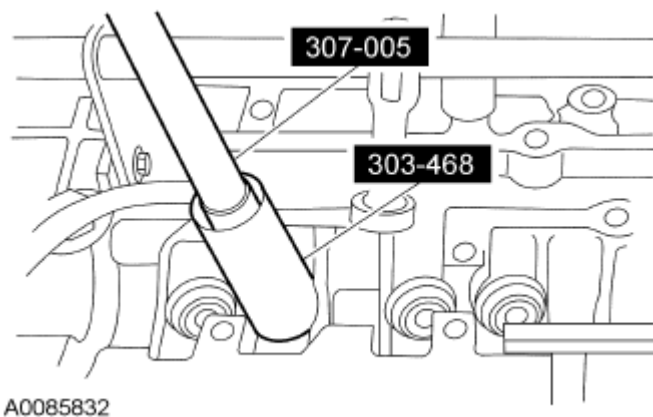
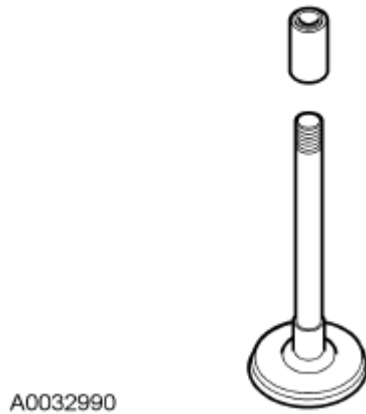


Fig. 141: Removing Valve Seal
Courtesy of FORD MOTOR CO.

Installation

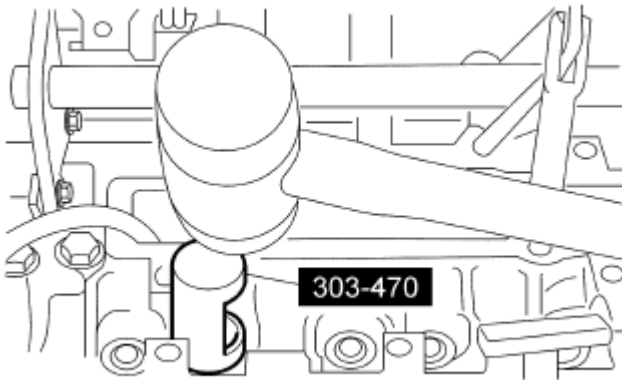
1. Install the valve stem seal installation sleeve.



A0032990

Fig. 142: Identifying Valve Stem Seal Installation Sleeve
Courtesy of FORD MOTOR CO.

2. Using the Valve Stem Oil Seal Installer, install the valve seal.



A0085833

Fig. 143: Installing Valve Seal
Courtesy of FORD MOTOR CO.

NOTE: Check the seating of the valve collet.

3. Using the Valve Spring Compressors, install the valve spring.
 - Insert the valve spring and the valve spring retainer.
 - Compress the valve spring and install the valve collet using some multi-purpose grease and a small screwdriver.

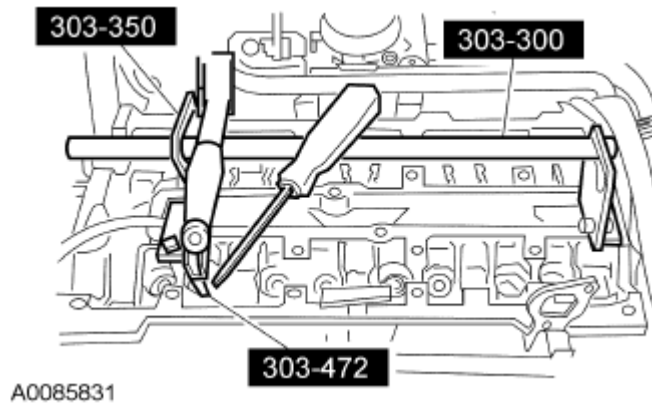


Fig. 144: Inserting Valve Spring And Valve Spring Retainer
 Courtesy of FORD MOTOR CO.

4. Disconnect the compressed air supply.
5. Repeat the appropriate removal and installation steps for all of the other cylinders.
6. Install the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.
7. Coat the valve tappets with clean engine oil and insert them.
8. Install the camshafts. For additional information, refer to **CAMSHAFTS**.

VALVE TAPPETS

Material

ITEM SPECIFICATION

| 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 and Installation

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 can cause engine failure.

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

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.


NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

3. Remove and inspect the valve tappets. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
4. To install, reverse the removal procedure.
 - Coat the valve tappets with clean engine oil prior to installation.

CYLINDER HEAD

Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|---|---|
|  <p>ST2645-A</p> | <p>Alignment Plate, Camshaft 303-465 (T94P-6256-CH)</p> |
|---|---|

Material

ITEM SPECIFICATION

| 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 | - |

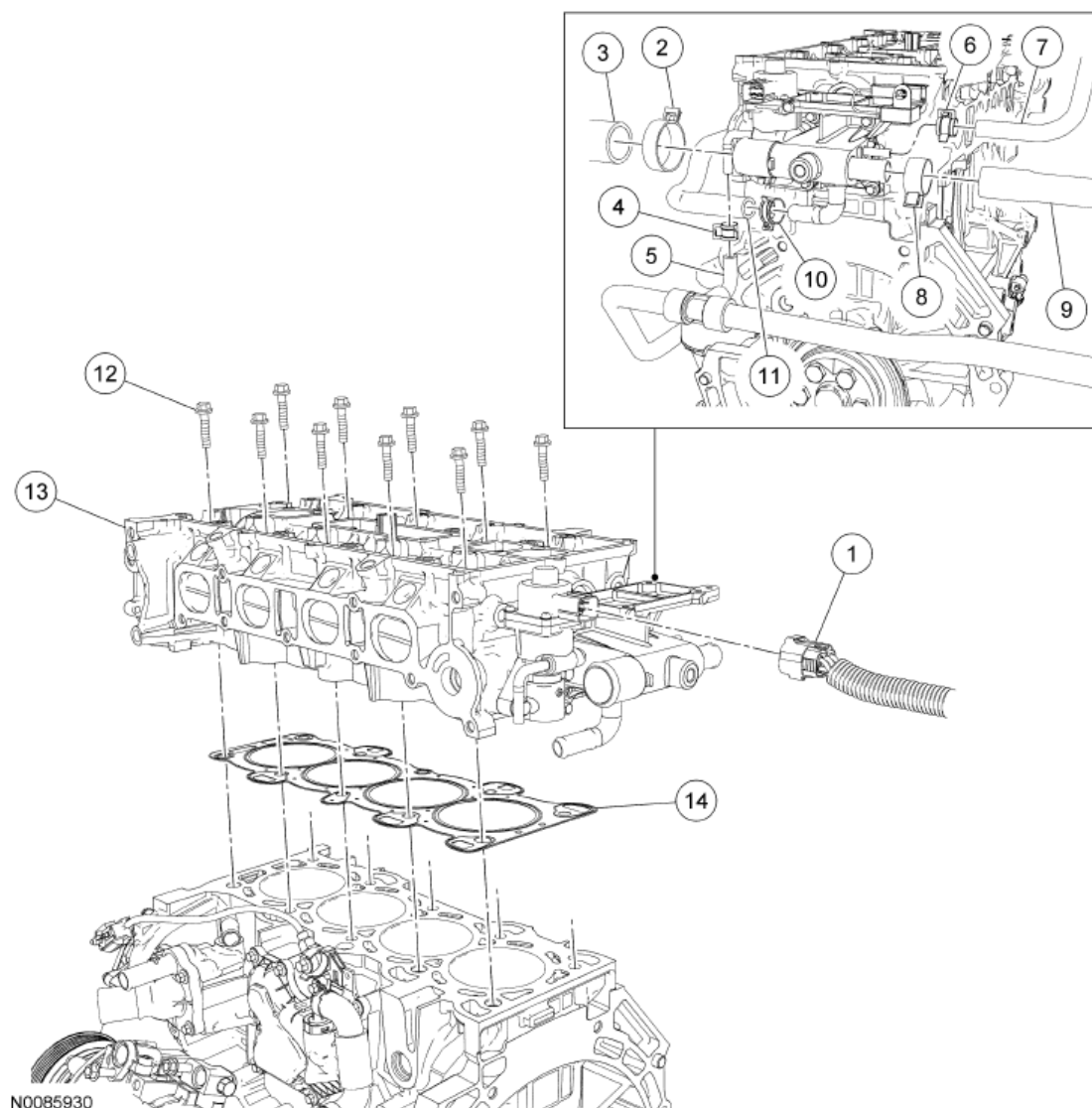


Fig. 145: Exploded View Of Cylinder Head
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | 14A464 | EGR valve electrical connector (part of 12B637) |
| 2 | 8287 | Upper radiator hose clamp |
| 3 | 8260 | Upper radiator hose |
| 4 | W52592 | EGR coolant tube clamp |
| 5 | 18K580 | EGR coolant hose (part of heater hose) |
| 6 | - | Engine coolant vent hose clamp (part of 8W005) |
| 7 | 8W005 | Engine coolant vent hose |
| 8 | - | Heater hose clamp (part of 18K580) |
| 9 | 18K580 | Heater hose |

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| | | |
|----|---------|----------------------------------|
| 10 | W525958 | Bypass hose clamp |
| 11 | 8A582 | Bypass hose |
| 12 | 6065 | Cylinder head bolt (10 required) |
| 13 | 6049 | Cylinder head |
| 14 | 6051 | Cylinder head gasket |

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .
3. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING** .
4. Remove the Variable Camshaft Timing (VCT) oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L** .
5. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.
6. Remove the Camshaft Alignment Plate.

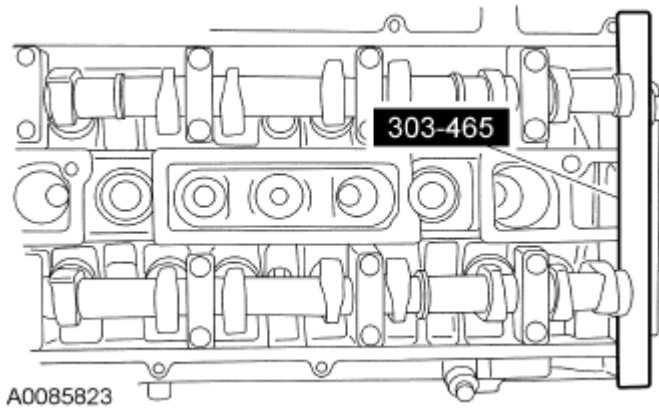


Fig. 146: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

7. Mark the position of the camshaft lobes on the No. 1 cylinder for installation reference.

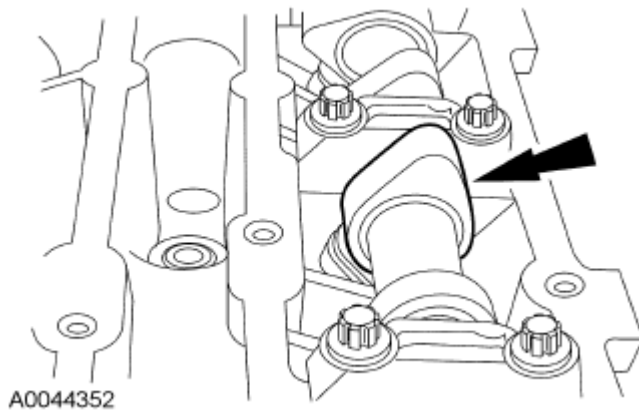


Fig. 147: Locating Camshaft Lobes
Courtesy of FORD MOTOR CO.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

8. Remove the camshafts from the engine.
- Loosen the camshaft bearing cap bolts, in sequence, one turn at a time until all tension is released from the camshaft bearing caps.
 - Remove the bolts and the camshaft bearing caps.
 - Remove the camshafts.

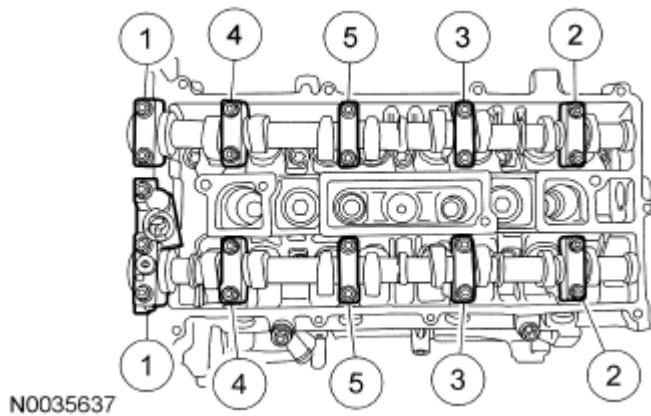


Fig. 148: Identifying Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

9. Remove the valve tappets.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

10. Inspect the valve tappets. For additional information, refer to ENGINE SYSTEM-GENERAL INFORMATION.
11. Remove the intake manifold. For additional information, refer to INTAKE MANIFOLD.
12. Remove the generator. For additional information, refer to CHARGING SYSTEM.
13. Remove the exhaust manifold. For additional information, refer to EXHAUST MANIFOLD.
14. Disconnect the EGR valve electrical connector.
15. Disconnect the EGR coolant hose from the EGR valve.
16. Disconnect the upper radiator hose, coolant bypass hose, heater hose and coolant vent hose from the engine coolant outlet.
17. Remove the 10 bolts and the cylinder head.
 - Discard the bolts and the cylinder head gasket.

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 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.

1. Clean the cylinder head-to-cylinder block mating surface 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 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.
2. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
3. Clean the cylinder head bolt holes in the cylinder block. Make sure all coolant, oil or other foreign material is removed.
4. Apply silicone gasket and sealant to the locations shown.

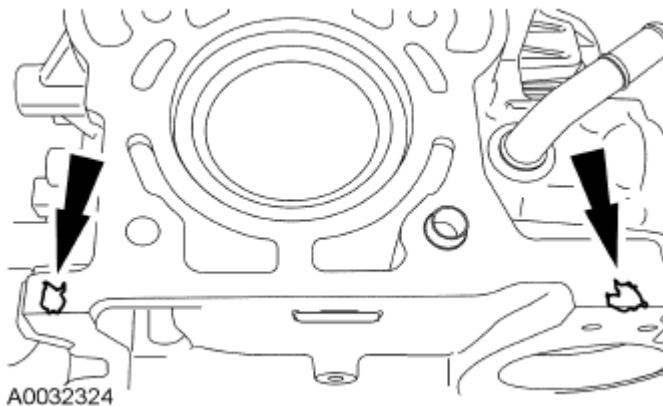


Fig. 149: Locating Silicone Gasket And Sealant Apply Locations
Courtesy of FORD MOTOR CO.

5. Install a new head gasket.

NOTE: The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

NOTE: Lubricate the bolts with clean engine oil prior to installation.

6. Install the cylinder head and 10 new bolts. Tighten the bolts in the sequence shown in 5 stages:

- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten to 15 Nm (133 lb-in).
- Stage 3: Tighten to 45 Nm (33 lb-ft).
- Stage 4: Turn 90 degrees.
- Stage 5: Turn an additional 90 degrees.

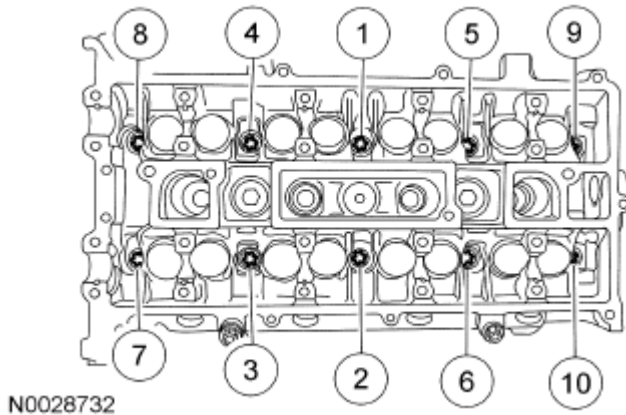


Fig. 150: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

7. Connect the upper radiator hose, coolant bypass hose, heater hose and coolant vent hose to the engine coolant outlet.
8. Connect the EGR coolant hose to the EGR valve.
9. Connect the EGR valve electrical connector.
10. Install the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD**.
11. Install the generator. For additional information, refer to **CHARGING SYSTEM**.
12. Install the intake manifold. For additional information, refer to **INTAKE MANIFOLD**.

NOTE: Lubricate the valve tappets with clean engine oil.

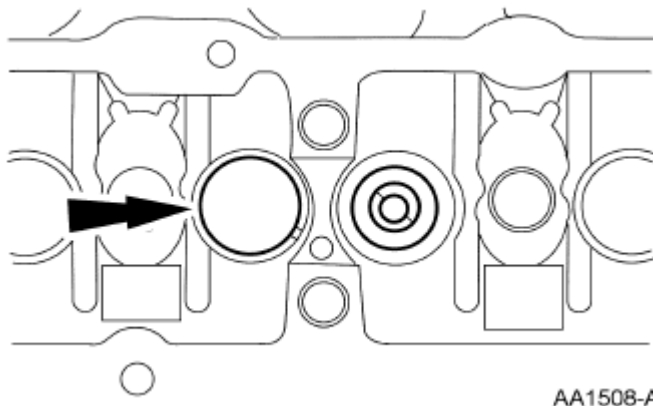


Fig. 151: Locating Valve Tappets Positions
Courtesy of FORD MOTOR CO.

13. Install the valve tappets in their original positions.

NOTE: Install the camshafts with the alignment notches in the camshafts lined up so the camshaft alignment plate can be installed. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Failure to follow this procedure can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

14. Install the camshafts and bearing caps in their original location and orientation. Tighten the bearing caps in the sequence shown in 3 stages:
- Stage 1: Tighten the camshaft bearing cap bolts, one turn at a time, until finger-tight.
 - Stage 2: Tighten to 7 Nm (62 lb-in).
 - Stage 3: Tighten to 16 Nm (142 lb-in).

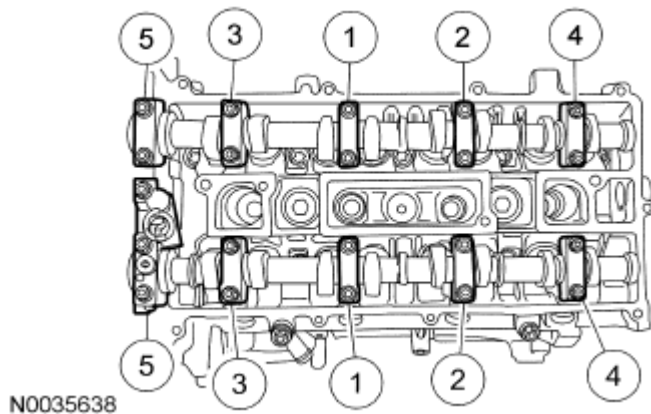


Fig. 152: Identifying Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

15. Install the Camshaft Alignment Plate.

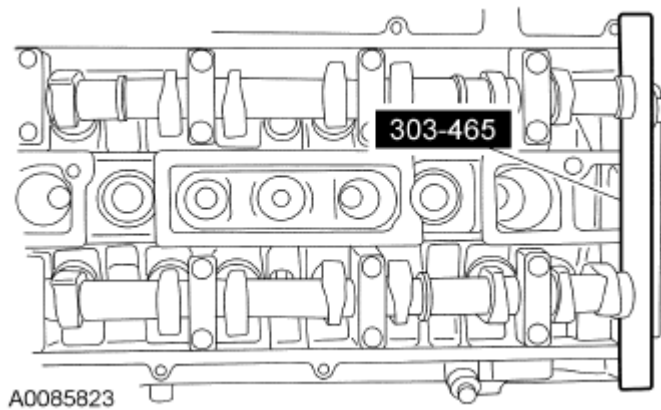


Fig. 153: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

16. Install the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.
17. Install the VCT oil control solenoid. For additional information, refer to **ELECTRONIC ENGINE CONTROLS - 2.5L**.
18. Fill and bleed the engine cooling system. For additional information, refer to **ENGINE COOLING**.

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

Oil Filter Adapter, Oil Filter Element and Engine Oil Pressure (EOP) Switch

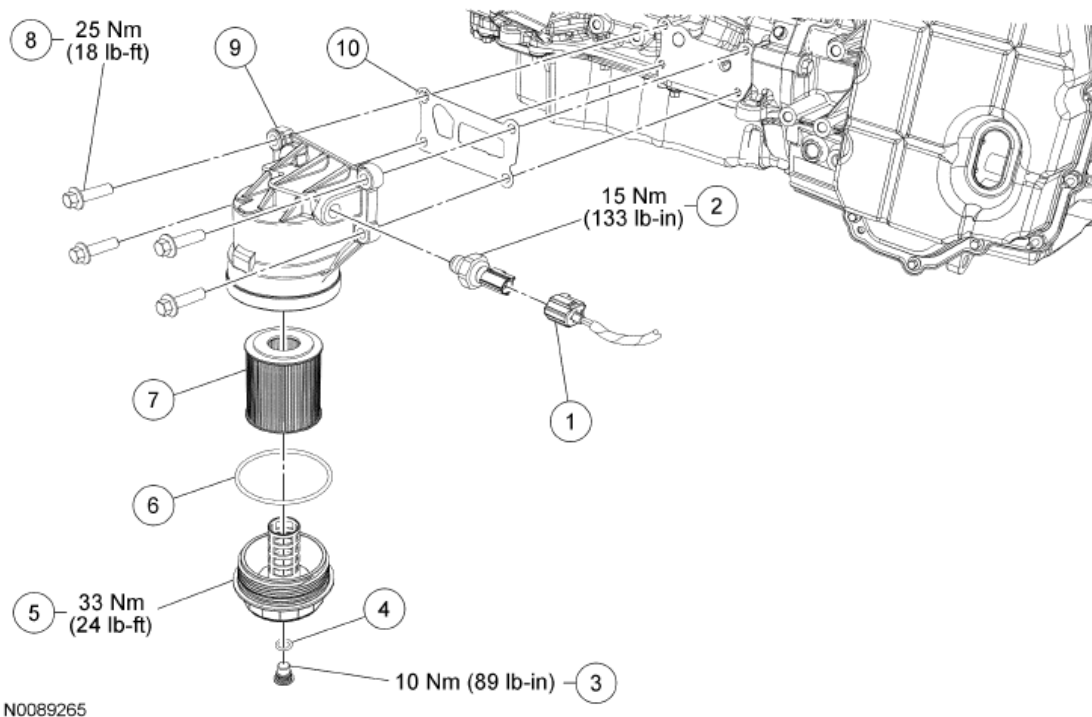


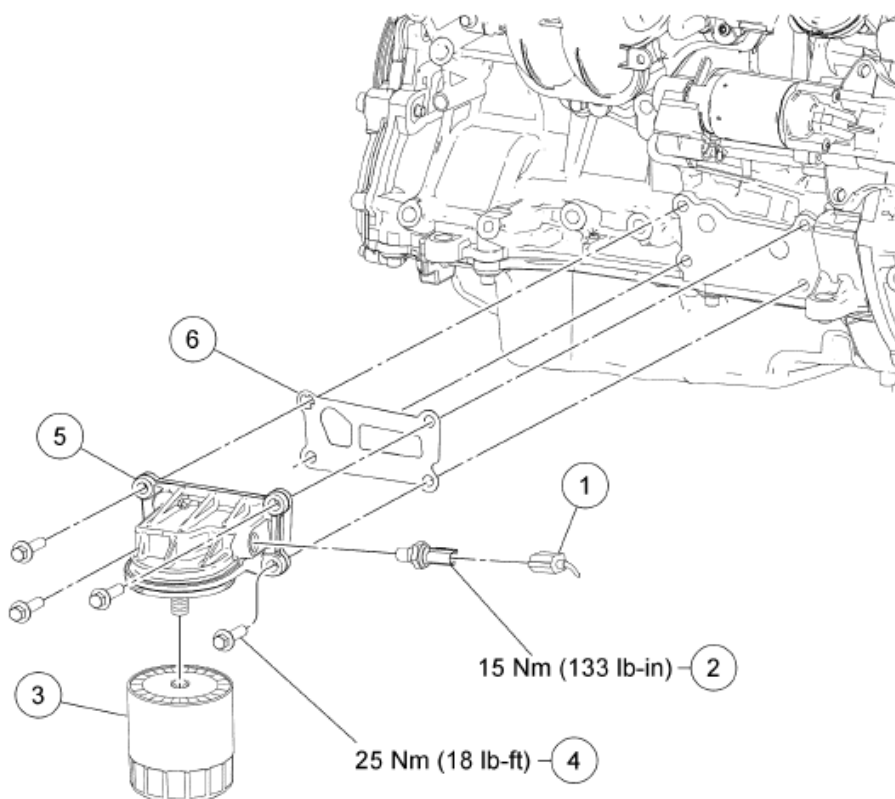
Fig. 154: Identifying Oil Filter Adapter, Oil Filter Element And Engine Oil Pressure Switch

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 | EOP switch |
| 3 | 6C684 | Oil filter drain plug |
| 4 | W707718 | Oil filter drain plug O-ring seal |
| 5 | 6A832 | Oil filter cover |
| 6 | 6885 | Oil filter cover O-ring seal |
| 7 | 6744 | Oil filter element |
| 8 | W500225 | Oil filter adapter bolt (4 required) |
| 9 | 6884 | Oil filter adapter |
| 10 | 6A636 | Oil filter adapter gasket |

Oil Filter Adapter, Spin on Oil Filter and Engine Oil Pressure (EOP) Switch



N0087737

Fig. 155: Identifying Oil Filter Adapter, Spin On Oil Filter And Engine Oil Pressure Switch
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|-------------|
| | | |

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| | | |
|---|---------|--|
| 1 | 14A464 | Engine Oil Pressure (EOP) switch electrical connector (part of 12C508) |
| 2 | 9278 | EOP switch |
| 3 | 6731 | Spin on oil filter |
| 4 | W500225 | Oil filter adapter bolt (4 required) |
| 5 | 6884 | Oil filter adapter |
| 6 | 6A636 | Oil filter adapter gasket |

Oil Pan, Oil Pump Screen and Pickup Tube, Front Wheel Drive (FWD) Vehicles

NOTE: Automatic transmission shown, manual transmission similar.

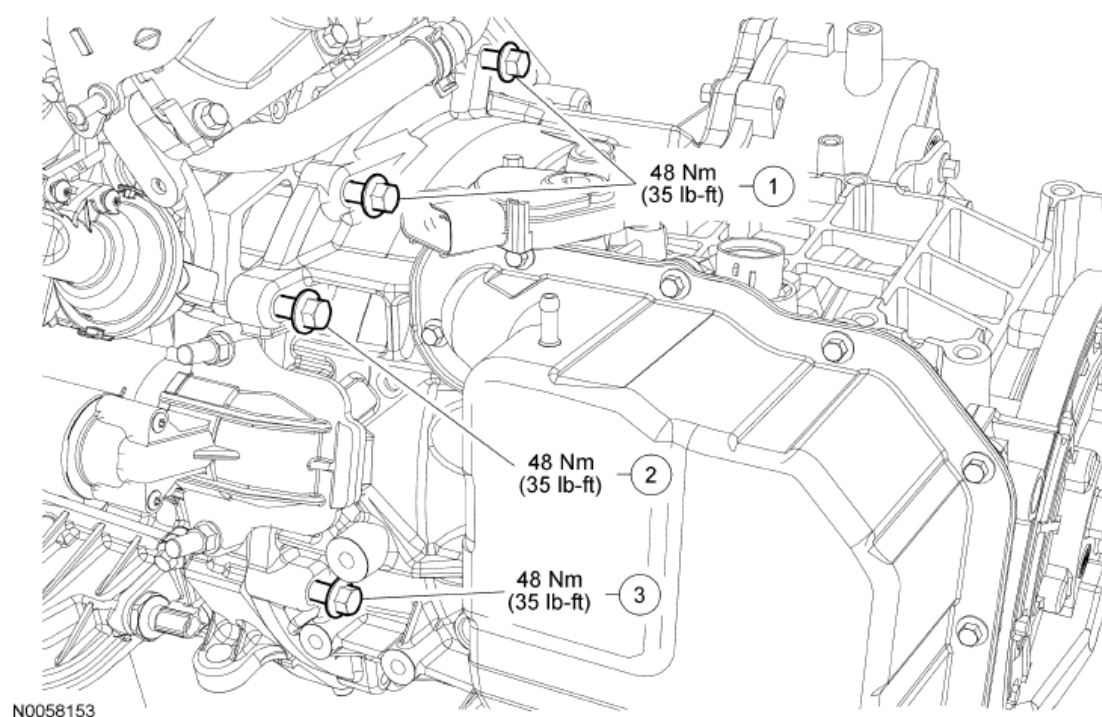


Fig. 156: Identifying Bellhousing-To-Engine Bolts

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|-----------------------------------|
| 1 | W500121 | Upper bellhousing-to-engine bolts |
| 2 | W500121 | LH bellhousing-to-engine bolt |
| 3 | W500125 | LH bellhousing-to-engine bolt |

Oil Pan, Oil Pump Screen and Pickup Tube, All-Wheel Drive (AWD) Vehicles

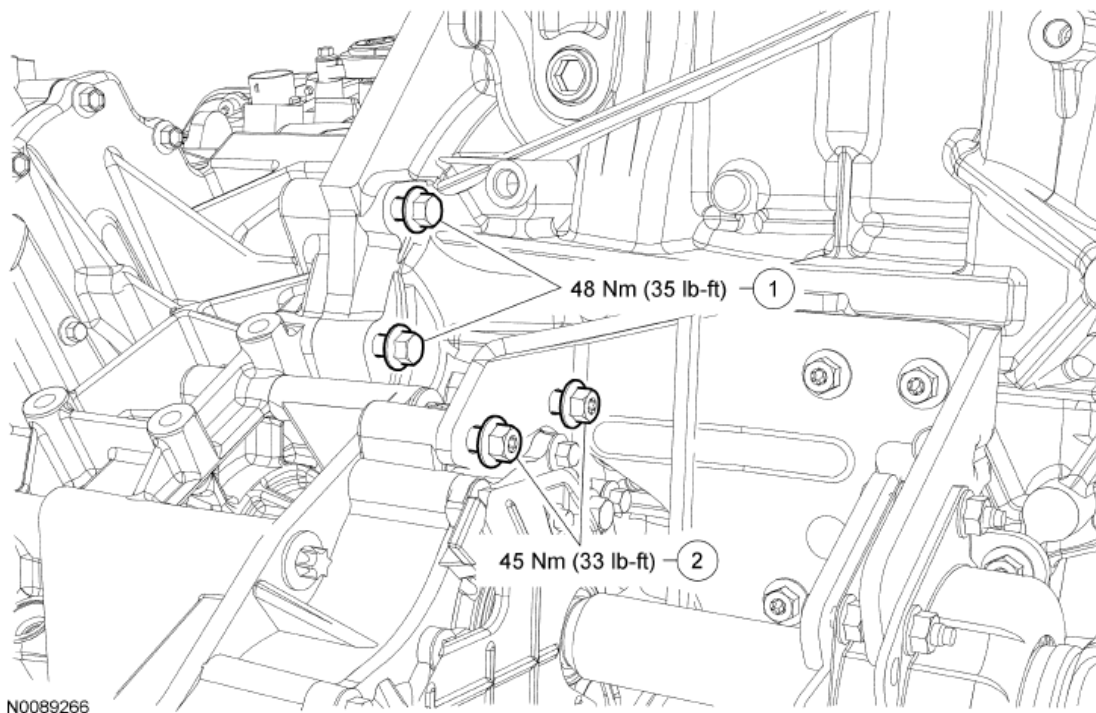


Fig. 157: Identifying Bellhousing-To-Engine Bolts And Engine Bracket-To-Power Transfer Unit Bolts
 Courtesy of FORD MOTOR CO.

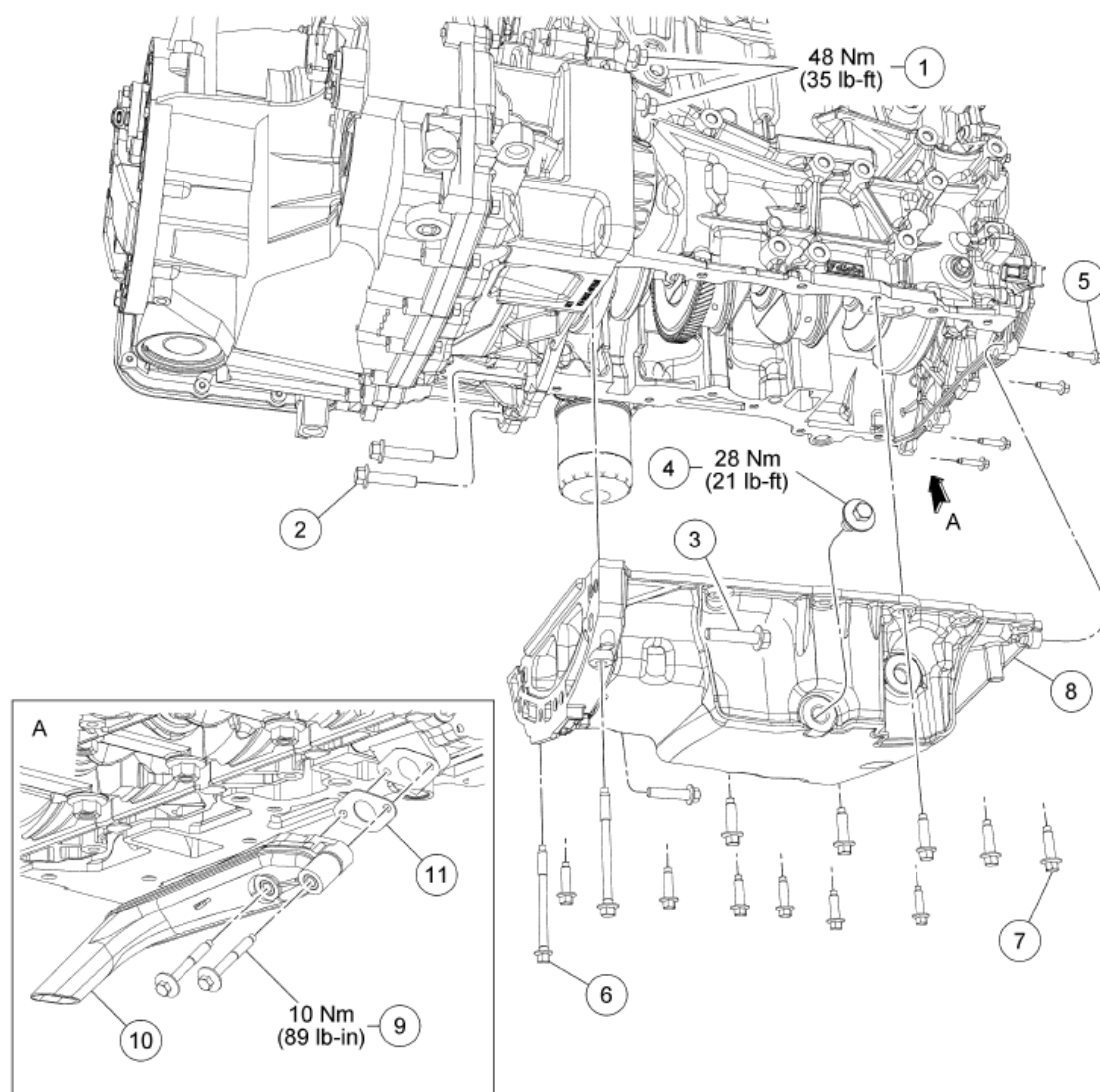
ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | W500125 | RH engine-to-bellhousing bolts (2 required for automatic transaxle) (1 required for manual transaxle) |
| 2 | W707386 | RH engine bracket-to-Power Transfer Unit (PTU) bolts |

Oil Pan, Oil Pump Screen and Pickup Tube

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N0089267

Fig. 158: Identifying Oil Pan, Oil Pump Screen And Pickup Tube
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

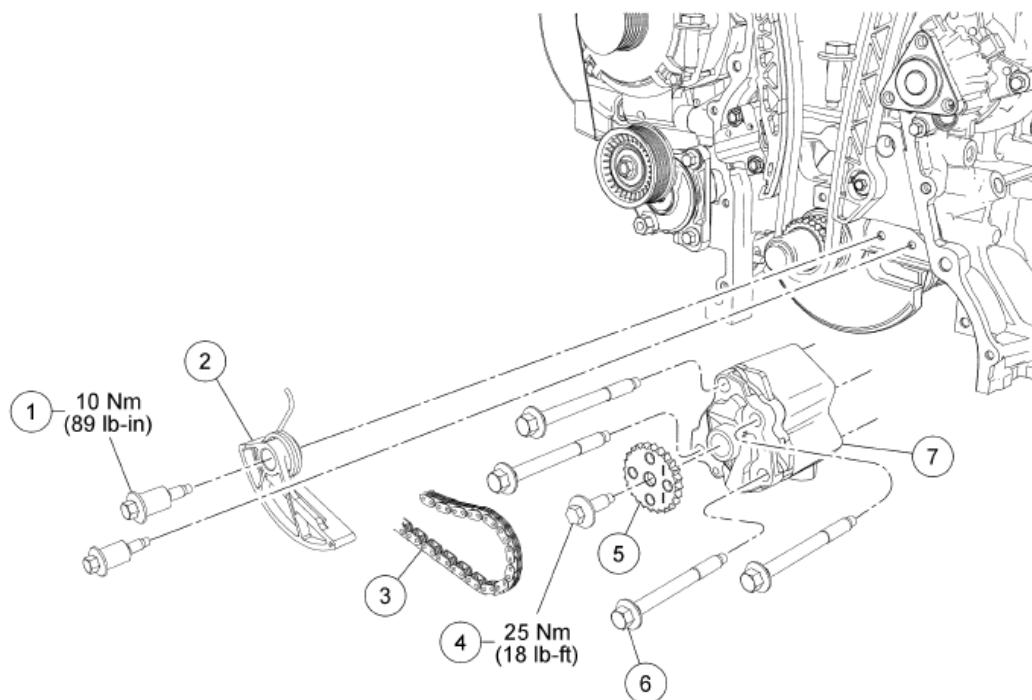
| Item | Part Number | Description |
|------|-------------|---|
| 1 | W500120 | RH engine-to-bellhousing bolts (Front Wheel Drive (FWD) vehicles) |
| 2 | W500121 | Bellhousing-to-oil pan bolt (2 required) |
| 3 | W500121 | Oil pan-to-bellhousing bolt (2 required) |
| 4 | 6730 | Oil pan drain plug |
| 5 | W500215 | Engine front cover-to-oil pan bolt (4 required) |
| 6 | W706284 | Oil pan bolt (2 required) |
| 7 | W500224 | Oil pan bolt (11 required) |
| 8 | 6675 | Oil pan |
| 9 | W706282 | Oil pump screen and pickup tube bolt (2 required) |

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| | | |
|----|------|--|
| 10 | 6622 | Oil pump screen and pickup tube |
| 11 | 6625 | Oil pump screen and pickup tube gasket |

Oil Pump



N0070733

Fig. 159: Identifying Oil Pump
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | W703651 | Oil pump drive chain tensioner shoulder bolt (2 required) |
| 2 | 6C271 | Oil pump drive chain tensioner |
| 3 | 6A895 | Oil pump drive chain |
| 4 | W704397 | Oil pump sprocket bolt |
| 5 | 6652 | Oil pump sprocket |
| 6 | W703647 | Oil pump bolt (4 required) |
| 7 | 6600 | Oil pump |

OIL FILTER ELEMENT

Material

ITEM SPECIFICATION

| 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: This procedure is for the cartridge type oil filter only.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Loosen the oil filter drain plug.
3. Using a cup-style oil filter wrench, loosen the oil filter cover one turn.
4. Remove the oil filter drain plug and drain the engine oil from the oil filter and adapter.
 - Remove and discard the oil filter drain plug O-ring seal.
5. Remove the oil filter cover and oil filter element.
 - Discard the oil filter element.
 - Remove and discard the oil filter cover O-ring seal.

Installation

1. Wipe clean the oil filter cover and mounting surface on the oil filter adapter.

NOTE: Lubricate the new oil filter cover O-ring seal with clean engine oil.

2. Install a new oil filter cover O-ring seal.

NOTE: Do not overtighten the oil filter cover. Overtightening the oil filter cover may damage the cover or O-ring seal and result in an oil leak.

3. Install a new oil filter element and the oil filter cover.
 - Using a cup-style oil filter wrench, tighten to 33 Nm (24 lb-ft).

NOTE: Lubricate the new oil filter drain plug O-ring seal with clean engine oil.

4. Install a new oil filter drain plug O-ring seal.

NOTE: Do not overtighten the oil filter drain plug. Overtightening the oil filter drain plug may damage the drain plug, O-ring seal or cover and result in an oil leak.

5. Install the oil filter drain plug.
 - Tighten to 10 Nm (89 lb-in).

OIL FILTER ADAPTER

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the 5 bolts, the pin-type retainer (not shown), and the RH splash shield.
 - To install, tighten to 9 Nm (80 lb-in).

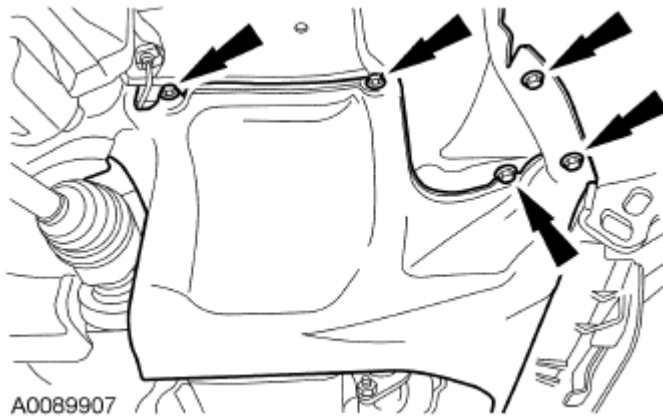


Fig. 160: Locating RH Splash Shield Bolts
Courtesy of FORD MOTOR CO.

3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. If equipped, remove the oil filter element. For additional information, refer to **OIL FILTER ELEMENT**.
5. If equipped, remove the spin on oil filter.
 - To install, lubricate the spin on oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.

NOTE: Discard the gasket.

6. Remove the 4 bolts and the oil filter adapter.
 - To install, tighten to 25 Nm (18 lb-ft).
7. To install, reverse the removal procedure.

ENGINE OIL PRESSURE (EOP) SWITCH**Material****ITEM SPECIFICATION**

| Item | Specification |
|--------------------------------|---------------|
| Thread Sealant with PTFE TA-24 | WSK-M2G350-A2 |

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the 5 bolts, pin-type retainer (not shown) and the RH splash shield.
 - To install, tighten to 9 Nm (80 lb-in).

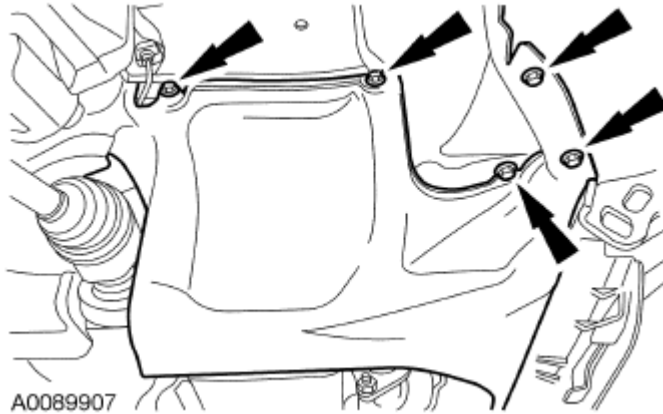


Fig. 161: Locating RH Splash Shield Bolts
 Courtesy of FORD MOTOR CO.

3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. Remove the EOP switch.
 - To install, tighten to 15 Nm (133 lb-in).
5. To install, reverse the removal procedure.
 - Apply thread sealant to the EOP switch threads.

OIL PAN

Material

ITEM SPECIFICATION

| 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 |

Removal

All vehicles

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

2. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L**.

NOTE: To prevent damage to the transmission, do not loosen the transmission-to-engine bolts more than 5 mm (0.19 in).

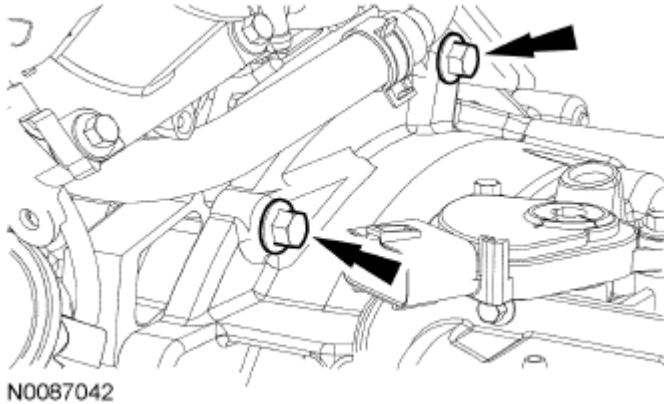


Fig. 162: Locating Upper Bellhousing-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Loosen the 2 upper bellhousing-to-engine bolts 5 mm (0.19 in).

All-Wheel Drive (AWD) vehicles

4. Working from the top of the vehicle, loosen the 2 RH engine-to-bellhousing bolts 5 mm (0.19 in).

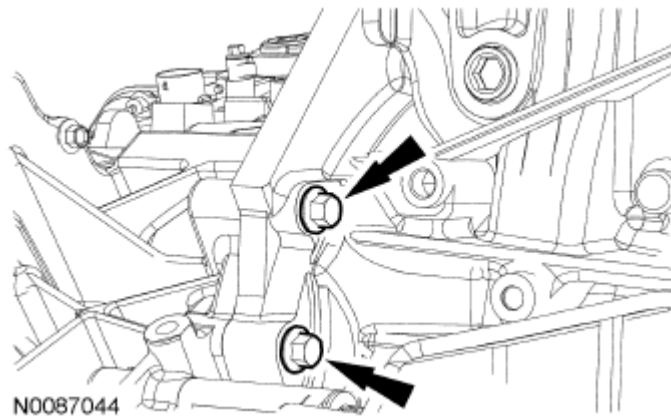


Fig. 163: Locating RH Engine-To-Bellhousing Bolts
Courtesy of FORD MOTOR CO.

5. Working from under the vehicle, loosen the 2 RH engine bracket-to-Power Transfer Unit (PTU) bolts 5 mm (0.19 in).

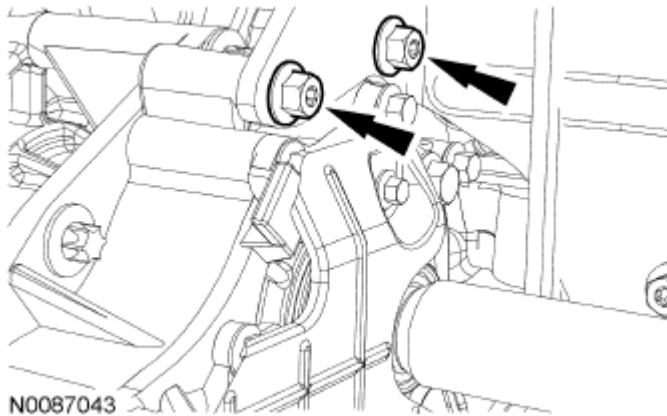


Fig. 164: Locating RH Engine Bracket-To-Power Transfer Unit Bolts
Courtesy of FORD MOTOR CO.

All vehicles

6. Remove the 7 retainers (5 shown) and the LH splash shield.

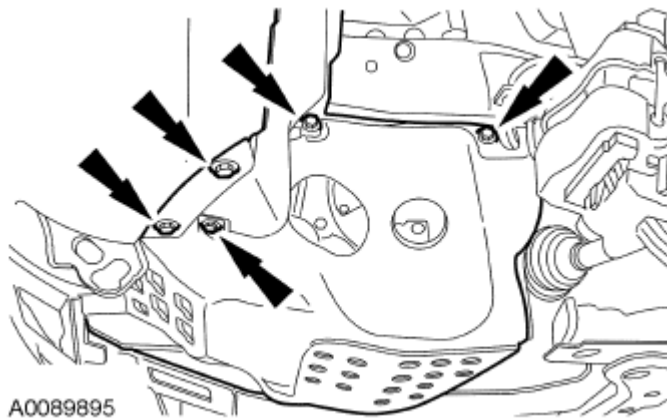


Fig. 165: Locating Retainers And LH Splash Shield
Courtesy of FORD MOTOR CO.

7. Loosen the 2 LH bellhousing-to-engine bolts 5 mm (0.19 in).

Front Wheel Drive (FWD) vehicles

8. Loosen the 1 (manual transaxle) or 2 (automatic transaxle) RH engine-to-bellhousing bolt 5 mm (0.19 in).

All vehicles

9. Remove the 2 oil pan-to-bellhousing bolts.
10. Remove the 2 bellhousing-to-oil pan bolts.
11. Slide the transaxle rearward 5 mm (0.19 in).

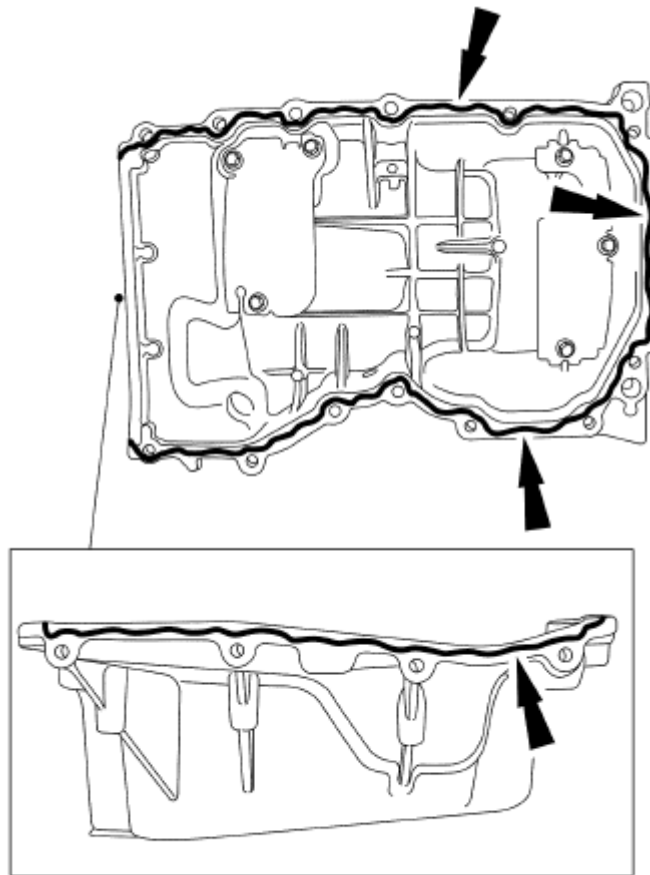
12. Drain the engine oil.
 - Install the drain plug.
 - Tighten to 28 Nm (21 lb-ft).
13. Remove the 4 engine front cover-to-oil pan bolts.
14. Remove the 13 bolts and the oil pan.

Installation**All vehicles**

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 traces of sealant.

1. Clean and inspect all mating surfaces.

NOTE: If the oil pan is not secured within 10 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 10 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.



N0085941

Fig. 166: Locating Silicone Gasket And Sealant Bead On Oil Pan-To-Engine Block And Oil Pan-To-Engine Front Cover Mating Surface
 Courtesy of FORD MOTOR CO.

2. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan-to-engine block and to the oil pan-to-engine front cover mating surface.
3. Position the oil pan onto the engine and install the oil pan bolts finger-tight.

NOTE: The engine front cover-to-oil pan bolts must be tightened first to align the front surface of the oil pan flush with the front surface of the engine block.

4. Install the 4 engine front cover-to-oil pan bolts.
 - Tighten to 10 Nm (89 lb-in).

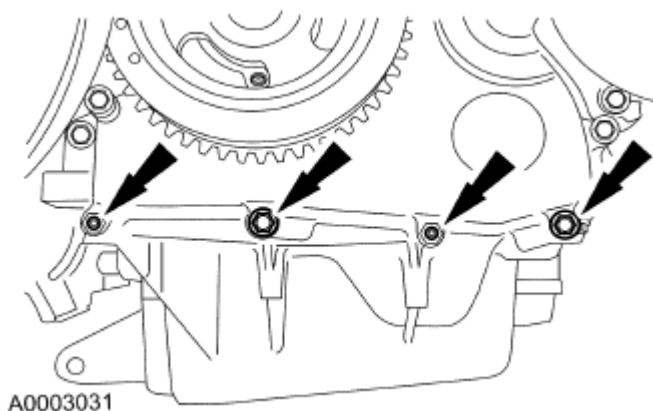


Fig. 167: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

5. Tighten the oil pan bolts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).

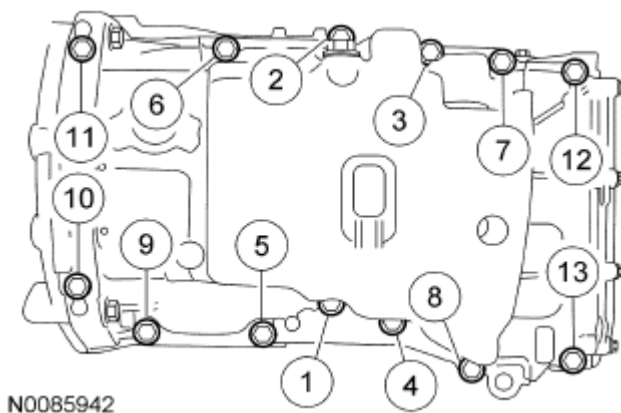


Fig. 168: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

FWD vehicles

6. Alternate tightening the 1 LH bellhousing-to-engine and 1 RH engine-to-bellhousing bolts to slide the transaxle and engine together.
 - Tighten to 48 Nm (35 lb-ft).
7. Tighten the 1 remaining LH bellhousing-to-engine bolt.
 - Tighten to 48 Nm (35 lb-ft).
8. Tighten the 1 remaining RH engine-to-bellhousing bolt (automatic transaxle).
 - Tighten to 48 Nm (35 lb-ft).

AWD vehicles

9. Alternate tightening the 1 RH engine-to-PTU bracket bolt and 1 LH bellhousing-to-engine bolt to slide transaxle and engine together.
 - Tighten the PTU bracket bolt to 45 Nm (33 lb-ft).
 - Tighten the LH bellhousing bolt to 48 Nm (35 lb-ft).
10. Tighten the remaining RH engine-to-PTU bracket bolt.
 - Tighten to 45 Nm (33 lb-ft).
11. Tighten the 1 remaining LH lower bolt.
 - Tighten to 48 Nm (35 lb-ft).

All vehicles

12. Install the 2 bellhousing-to-oil pan bolts.
 - Tighten to 48 Nm (35 lb-ft).
13. Install the 2 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).
14. Install the LH splash shield and the 7 retainers (5 shown).
 - Tighten to 9 Nm (80 lb-in).

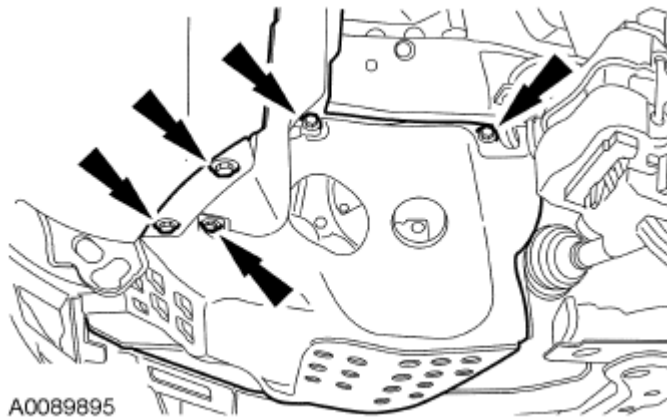


Fig. 169: Locating Retainers And LH Splash Shield
Courtesy of FORD MOTOR CO.

AWD vehicles

15. Working from the top of vehicle, tighten the 2 RH engine-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).

All vehicles

16. Tighten the 2 upper bellhousing-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).
17. Install the ACL outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION &**

FILTERING - 2.5L .

18. Fill the engine with clean engine oil.

OIL PUMP SCREEN AND PICKUP TUBE**Removal and Installation**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **OIL PAN**.

NOTE: Discard the gasket and clean and inspect the gasket mating surfaces.

3. Remove the 2 bolts and the oil pump screen and pickup tube.
 - To install, tighten to 10 Nm (89 lb-in).
4. To install, reverse the removal procedure.

OIL PUMP**Material****ITEM SPECIFICATION**

| 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 |

Removal

1. With the engine in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.
3. Drain the engine oil, then install the drain plug.
 - To install, tighten to 28 Nm (21 lb-ft).
4. Remove the 4 oil pan-to-bellhousing bolts.
5. Remove the 13 bolts and the oil pan.

NOTE: Discard the gasket and clean and inspect the gasket mating surfaces.

6. Remove the 2 bolts and the oil pump screen and pickup tube.

- To install, tighten to 10 Nm (89 lb-in).
7. Remove the oil pump drive chain tensioner.
 1. Release the tension on the tensioner spring.
 2. Remove the 2 shoulder bolts and the tensioner.

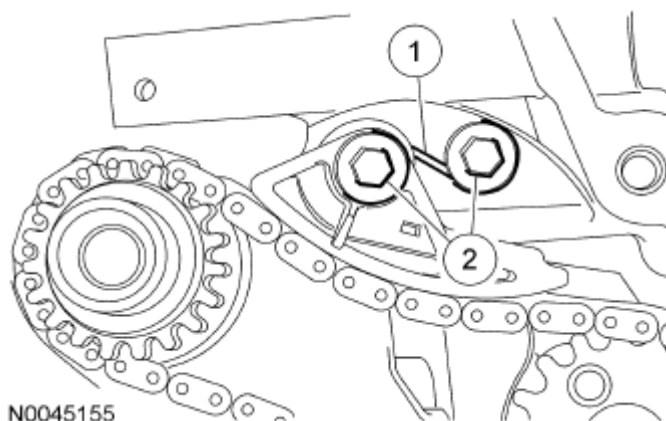


Fig. 170: Locating Oil Pump Drive Chain Tensioner Shoulder Bolts
Courtesy of FORD MOTOR CO.

8. Remove the chain from the oil pump sprocket.
9. Remove the bolt and oil pump sprocket.
10. Remove the 4 bolts and the oil pump.

Installation

NOTE: **Clean the oil pump and cylinder block mating surfaces with metal surface prep.**

1. Install the oil pump assembly. Tighten the 4 bolts in the sequence shown in 2 stages:
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten to 20 Nm (177 lb-in).

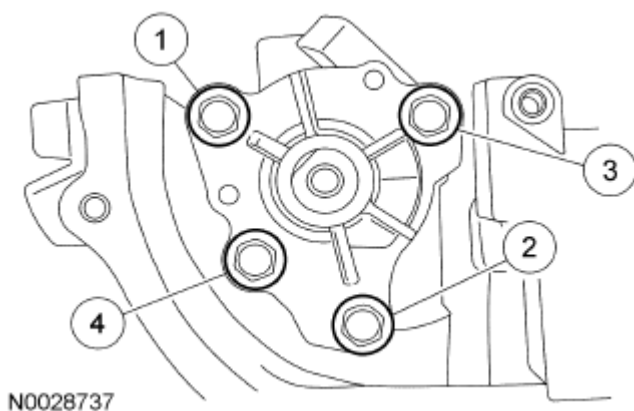


Fig. 171: Identifying Oil Pump Assembly Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the oil pump sprocket and bolt.
 - Tighten to 25 Nm (18 lb-ft).
3. Install the chain onto the oil pump sprocket.
4. Install the oil pump drive chain tensioner shoulder bolt.
 - Tighten to 10 Nm (89 lb-in).

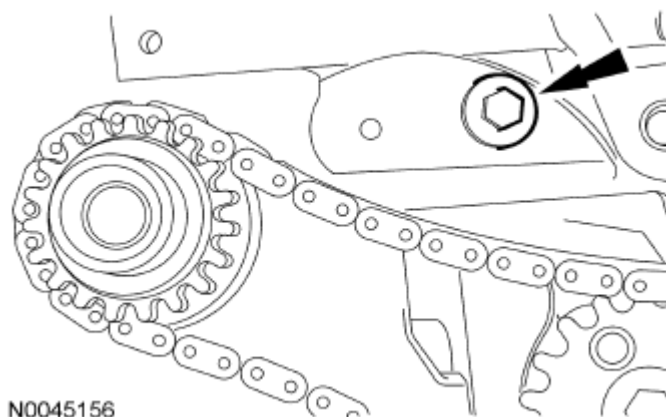


Fig. 172: Locating Oil Pump Drive Chain Tensioner Shoulder Bolt
Courtesy of FORD MOTOR CO.

5. Install the oil pump drive chain tensioner and bolt. Hook the tensioner spring around the shoulder bolt.
 - Tighten to 10 Nm (89 lb-in).

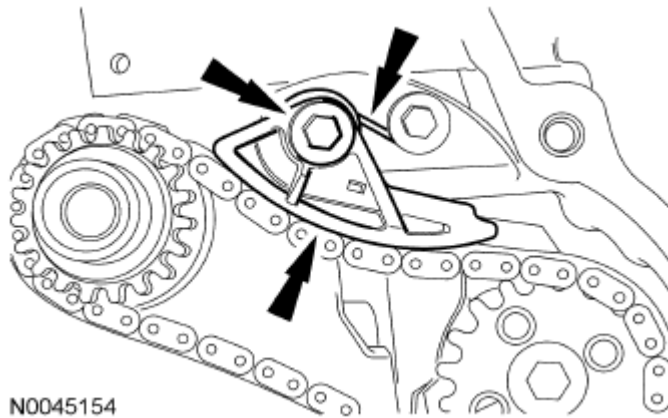


Fig. 173: Locating Oil Pump Drive Chain Tensioner, Bolt And Tensioner Spring
Courtesy of FORD MOTOR CO.

6. Install the oil pump screen and pickup tube and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

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 traces of sealant.

7. Clean all mating surfaces with metal surface prep.

NOTE: If the oil pan is not secured within 10 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 10 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

8. Apply a 2.5 mm (0.09 in) bead of sealant gasket and sealant to the oil pan.
 - Position the oil pan onto the engine and install the 2 rear oil pan bolts finger-tight.

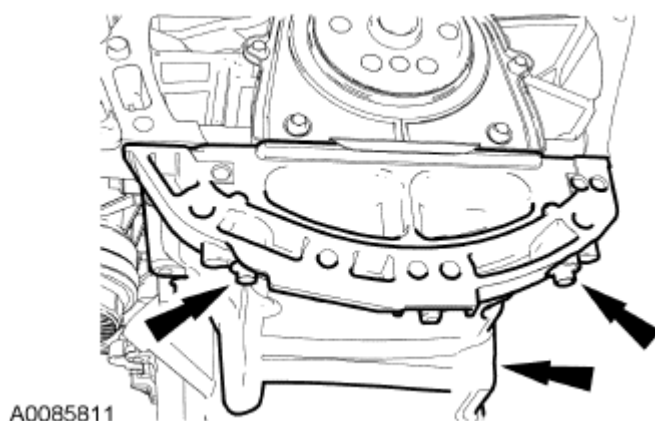


Fig. 174: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

9. Using a suitable straight edge, align the front surface of the oil pan flush with the front surface of the engine block.

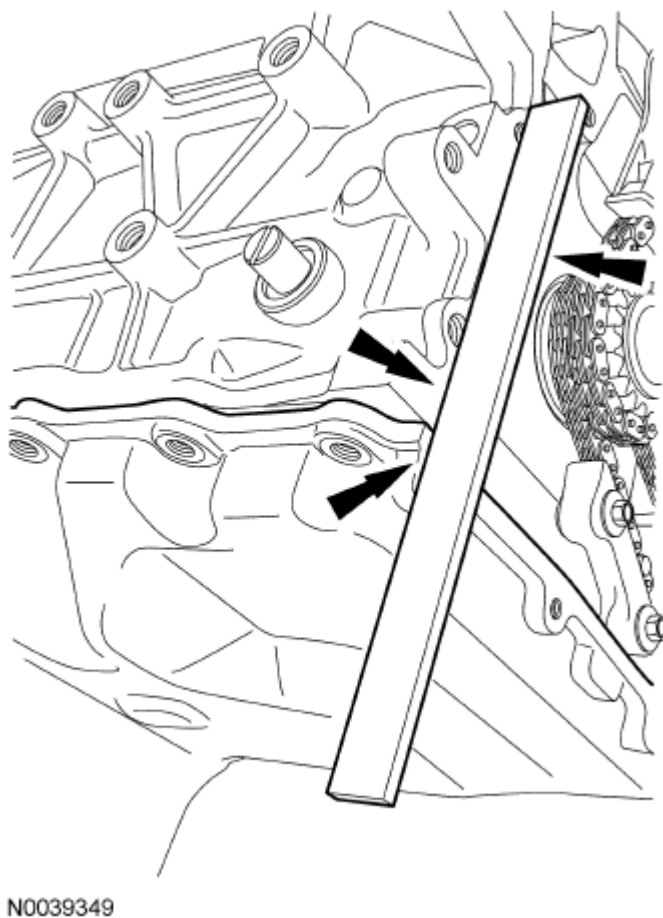


Fig. 175: Aligning Front Surface Of Oil Pan Flush With Front Surface Of Engine Block
Courtesy of FORD MOTOR CO.

10. Install the remaining oil pan bolts.
 - Tighten in the sequence shown to 25 Nm (18 lb-ft).

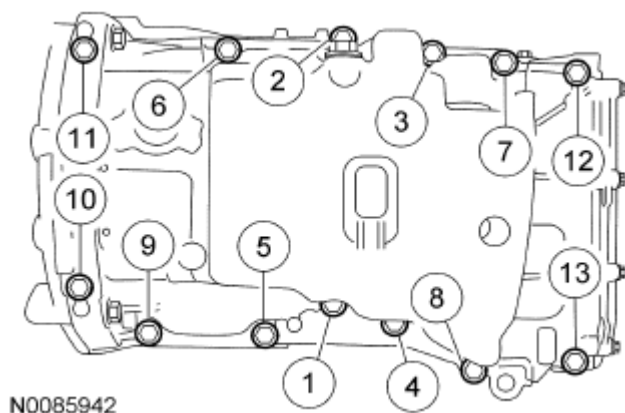


Fig. 176: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Install the 4 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).
12. Install the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.
13. Fill the engine with clean engine oil.

EXHAUST MANIFOLD

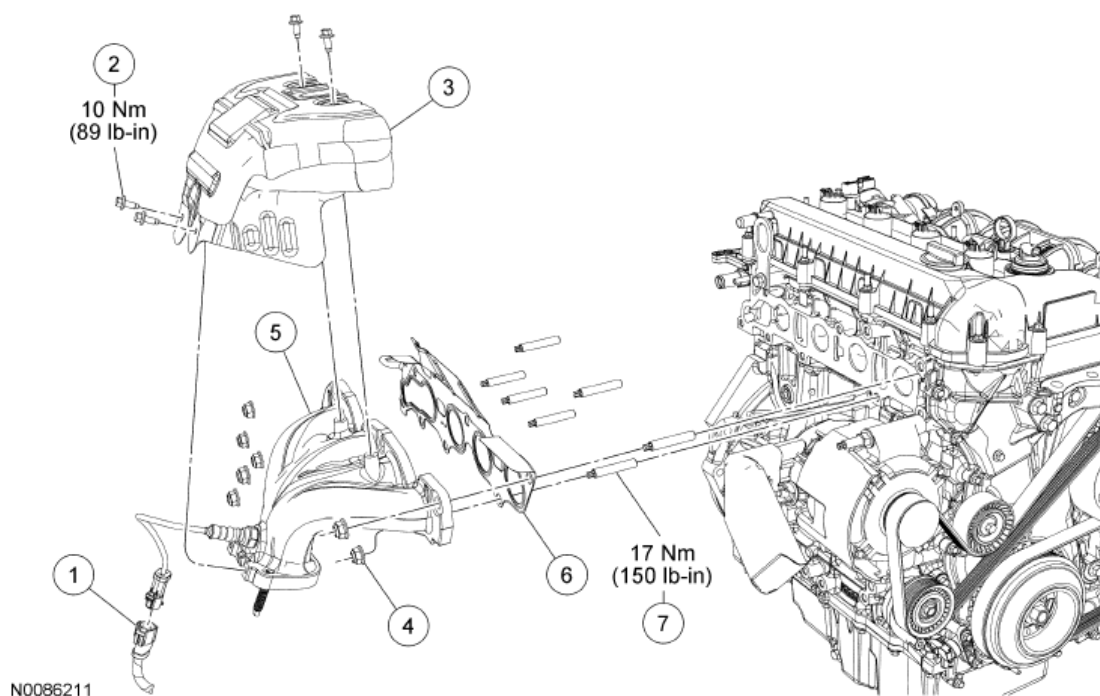


Fig. 177: Exploded View Of Exhaust Manifold

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---|
| 1 | 14A464 | Heated Oxygen Sensor (HO2S) electrical connector (part of 12C508) |
| 2 | W713299 | Exhaust manifold heat shield bolt (4 required) |
| 3 | 9N454 | Exhaust manifold heat shield |
| 4 | W713652 | Exhaust manifold nut (7 required) |
| 5 | 9430 | Exhaust manifold |
| 6 | 9448 | Exhaust manifold gasket |
| 7 | W704474 | Exhaust manifold stud (7 required) |

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM**.
3. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.
4. Remove the 4 exhaust manifold heat shield bolts and the heat shield.
5. Remove and discard the 7 exhaust manifold nuts.
6. Remove the exhaust manifold and discard the exhaust manifold gasket.
7. Remove and discard the 7 exhaust manifold studs.
8. Clean and inspect the exhaust manifold. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.

Installation

1. Install the 7 new exhaust manifold studs.
 - Tighten to 17 Nm (150 lb-in).

NOTE: Failure to tighten the catalytic converter nuts to specification before installing the converter bracket bolts will cause the converter to develop an exhaust leak.

NOTE: Failure to tighten the catalytic converter nuts to specification a second time will cause the converter to develop an exhaust leak.

2. Install a new exhaust manifold gasket, the exhaust manifold and 7 new nuts in the sequence shown in 2 stages:
 - Stage 1: Tighten to 48 Nm (35 lb-ft).
 - Stage 2: Tighten to 48 Nm (35 lb-ft).

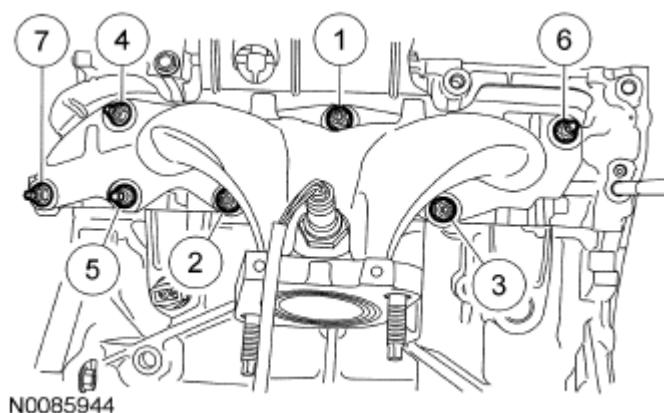


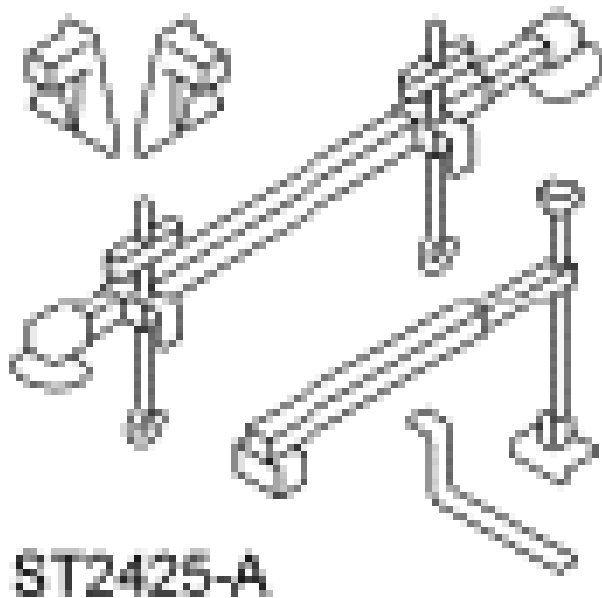
Fig. 178: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the exhaust manifold heat shield and the 4 bolts.
 - Tighten to 10 Nm (89 lb-in).
4. Connect the HO2S electrical connector.
5. Install the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM**.

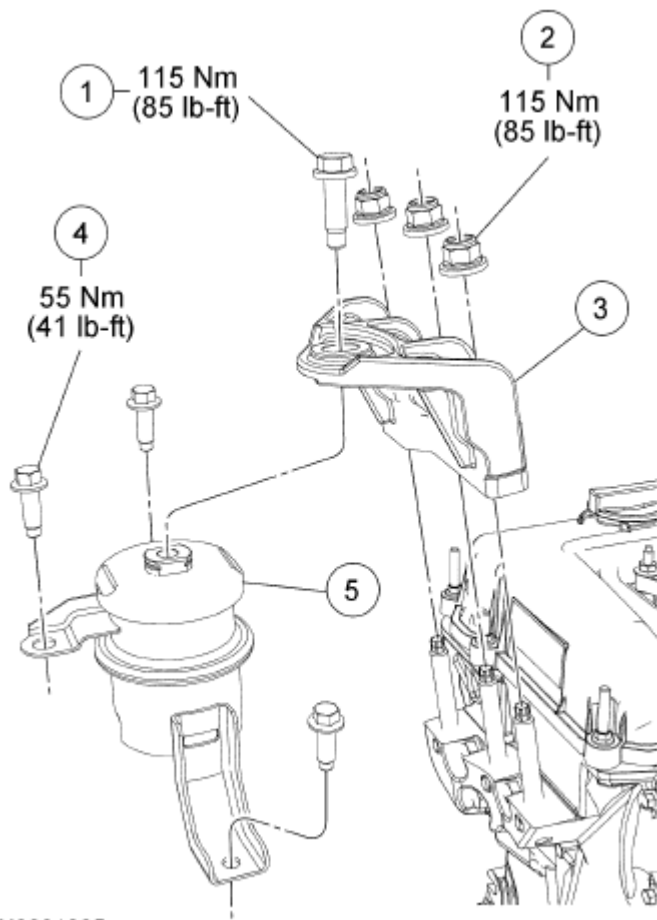
ENGINE MOUNT

Special Tool(s)

SPECIAL TOOL REFERENCE CHART



Support Bar, Engine
303-F072



N0061865

Fig. 179: Identifying Engine Mount Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---------------------------------------|
| 1 | W710824 | Engine mount bracket bolt |
| 2 | N807144 | Engine mount bracket nut (3 required) |
| 3 | 6A094 | Engine mount bracket |
| 4 | W500233 | Engine mount bolt (3 required) |
| 5 | 6068 | Engine mount |

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Install the Engine Support Bar.

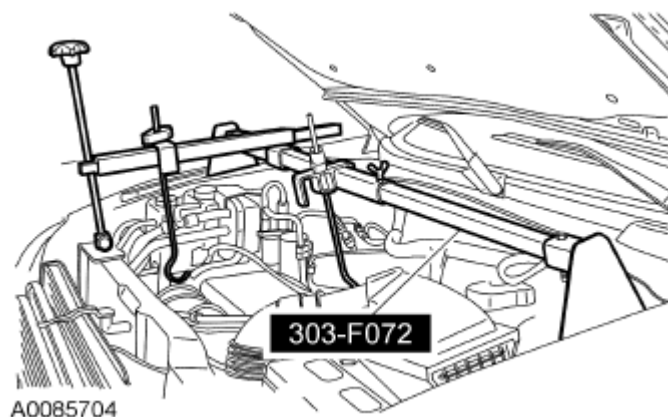


Fig. 180: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

3. Remove the engine mount bracket bolt.
 - To install, tighten to 115 Nm (85 lb-ft).
4. Use the Engine Support Bar to raise the engine 25 mm (0.98 in).

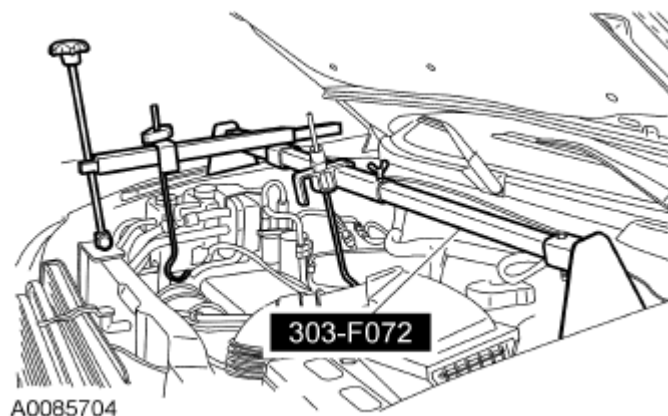


Fig. 181: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

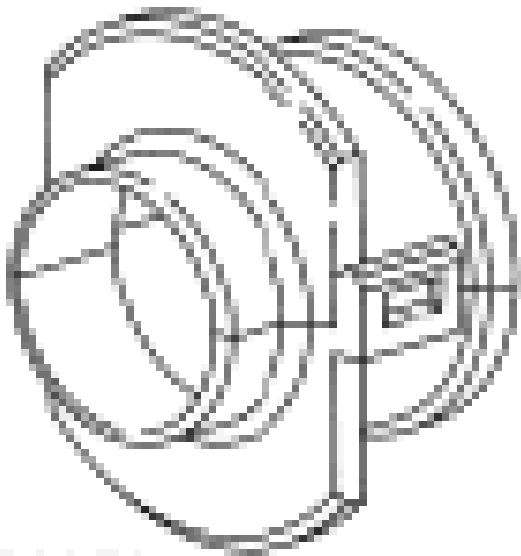
5. Remove the 3 nuts and the engine mount bracket.
 - To install, tighten to 115 Nm (85 lb-ft).
6. Remove the 3 bolts and the engine mount.
 - To install, tighten to 55 Nm (41 lb-ft).
7. To install, reverse the removal procedure.

REMOVAL AND INSTALLATION

ENGINE - AUTOMATIC TRANSAXLE

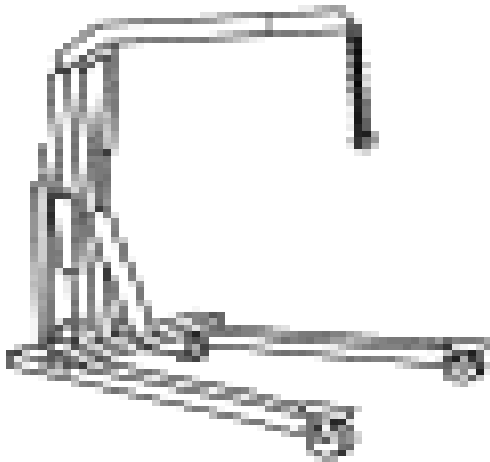
Special Tool(s)

SPECIAL TOOL REFERENCE CHART



ST2670-A

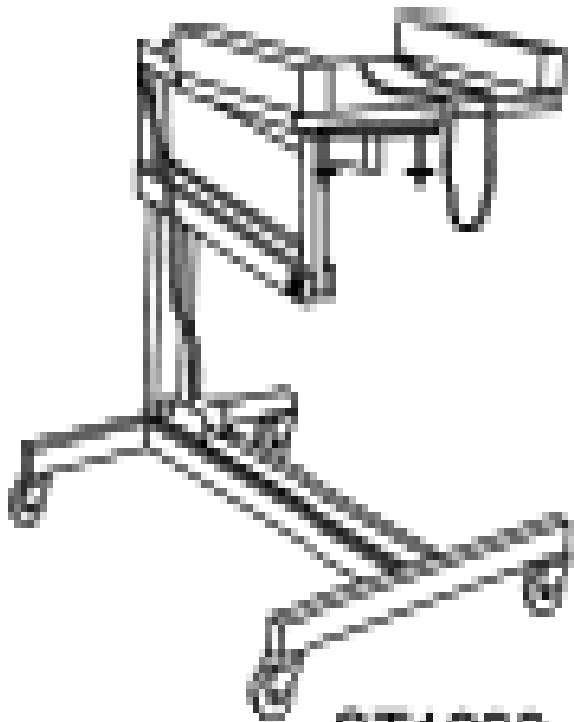
Disconnect Tool, Transmission Cooler Line
307-569



Heavy Duty Floor Crane
014-00071 or equivalent

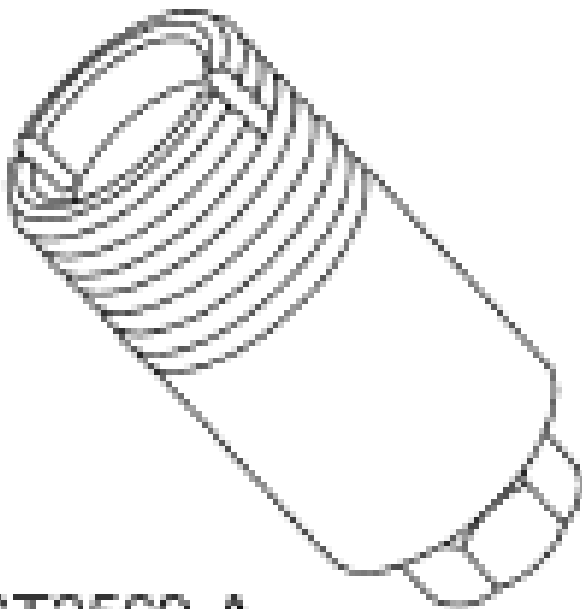
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1293-A

Powertrain Lift
014-00765 or equivalent

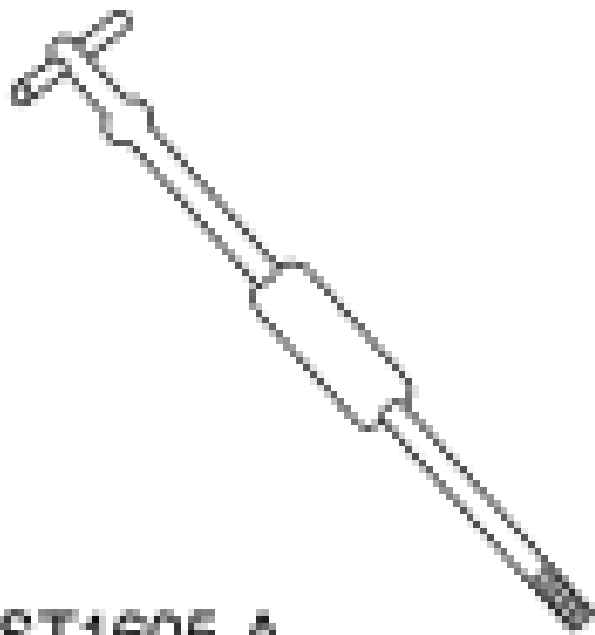


ST2569-A

Remover, Halfshaft Oil Seal
308-428

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



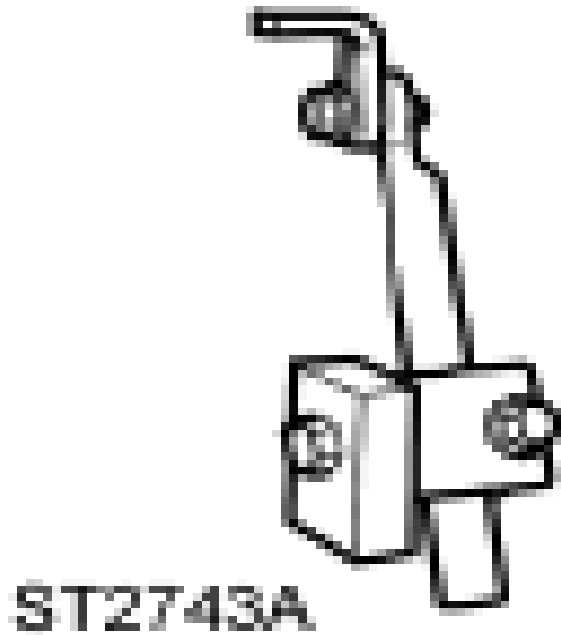
ST1605-A

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



ST1605-A

Spreader Bar
303-D089 (D93P-6001-A3) or equivalent

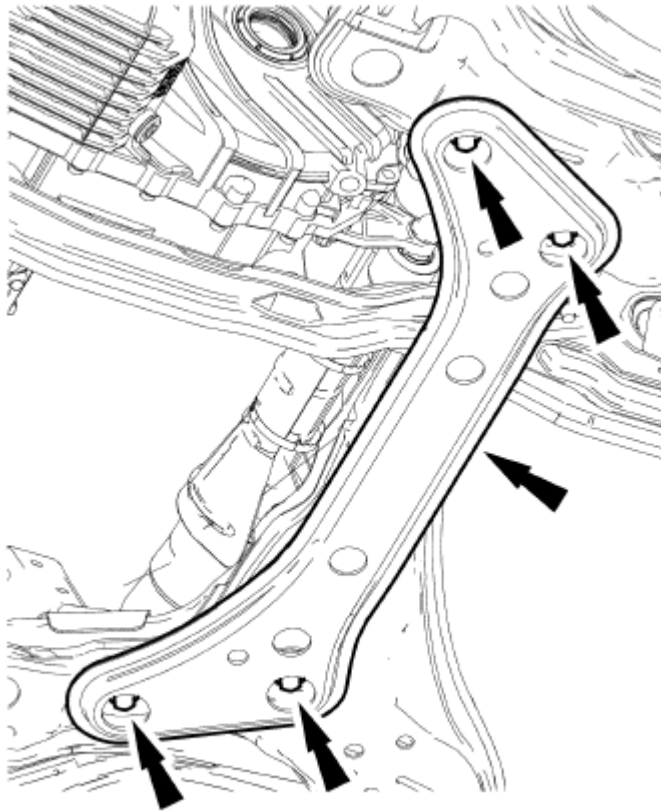


Universal Adapter Brackets
014-0001 or equivalent

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

All vehicles

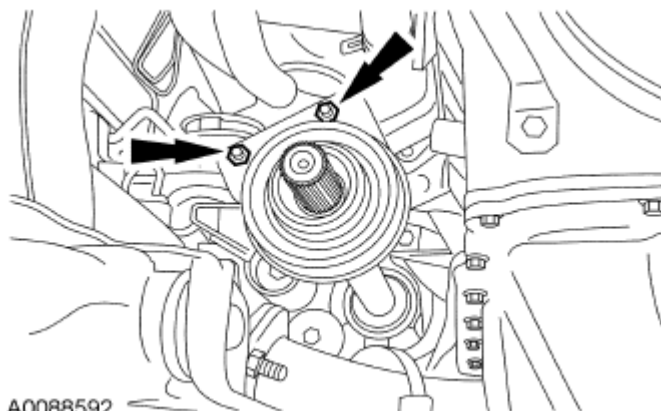
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .
3. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L** .
4. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .
5. Drain the engine oil.
 - Install the drain plug.
 - To install, tighten to 28 Nm (21 lb-ft).
6. Remove the RH and LH halfshafts. For additional information, refer to **FRONT DRIVE HALFSHAFTS** .
7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** .
8. Remove the bolts and the lateral support crossmember.



A0087403

Fig. 182: Locating Lateral Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

9. Remove the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM**.
10. Remove the 2 intermediate shaft bearing retainer nuts.



A0088592

Fig. 183: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of FORD MOTOR CO.

NOTE: On All-Wheel Drive (AWD) vehicles, the Power Transfer Unit (PTU) seal must be replaced every time the intermediate shaft is removed.

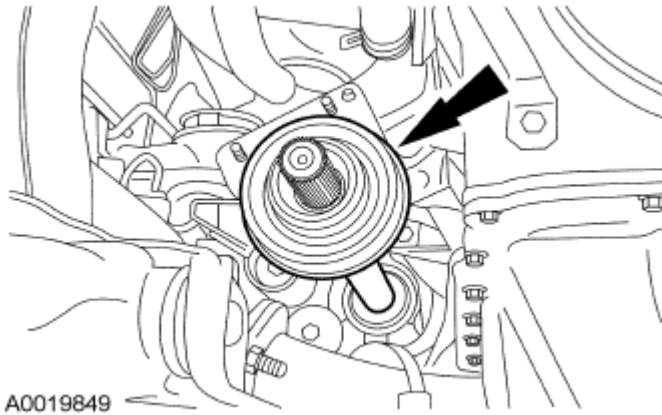


Fig. 184: Locating Intermediate Shaft
Courtesy of FORD MOTOR CO.

11. Remove the intermediate shaft.
12. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .
13. Press the locking tab to release the generator air duct and remove.

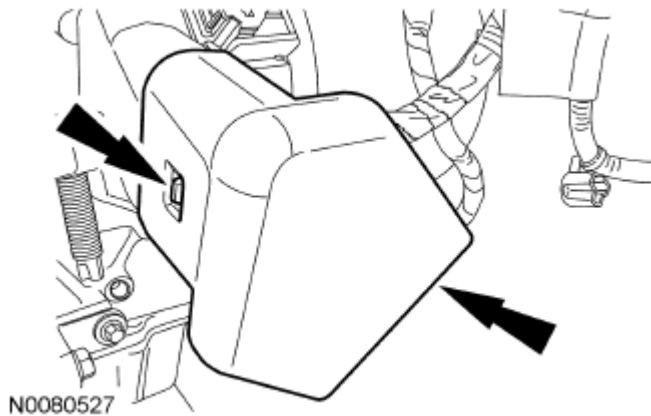


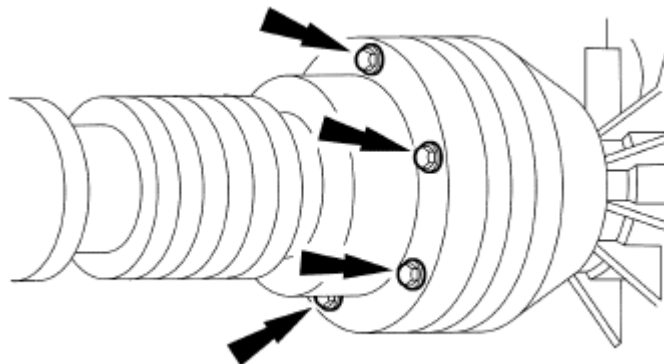
Fig. 185: Locating Locking Tab And Generator Air Duct
Courtesy of FORD MOTOR CO.

14. Remove the drain plug and drain the transmission fluid. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F35** .

All-Wheel Drive (AWD) vehicles

15. Drain the Power Transfer Unit (PTU). For additional information, refer to **TRANSFER CASE-POWER TRANSFER UNIT (PTU)** .
16. Index the driveshaft to the yoke and remove the 6 bolts holding the driveshaft to the PTU and position

aside with mechanic's wire.

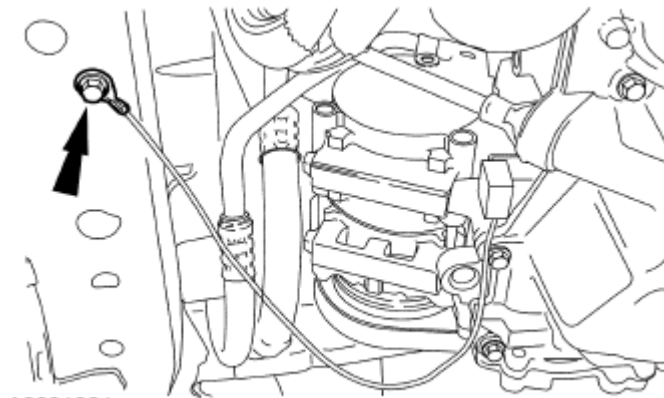


A0088564

Fig. 186: Locating Bolts Holding Driveshaft To PTU
Courtesy of FORD MOTOR CO.

All vehicles

17. If equipped, remove the bolt and ground eyelet.



A0091801

Fig. 187: Locating Ground Eyelet Bolt
Courtesy of FORD MOTOR CO.

18. Disconnect the transaxle electrical connector.

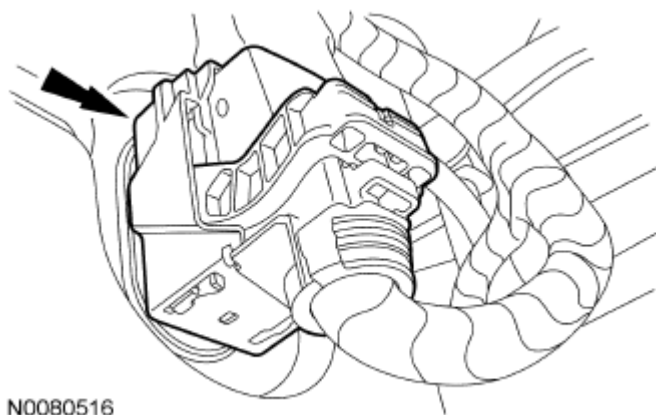


Fig. 188: Locating Transaxle Electrical Connector
Courtesy of FORD MOTOR CO.

19. Detach the wiring harness retainer from the transaxle stud bolt.

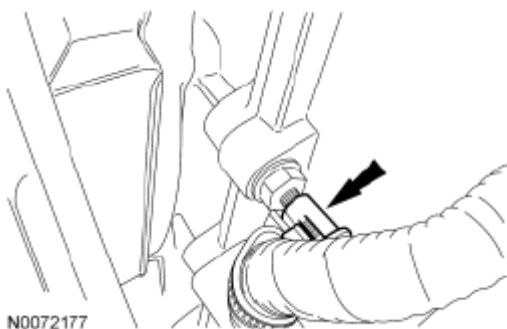


Fig. 189: Locating Wiring Harness Retainer On Transaxle Stud Bolt
Courtesy of FORD MOTOR CO.

20. Disconnect the Turbine Shaft Speed (TSS) sensor electrical connector.

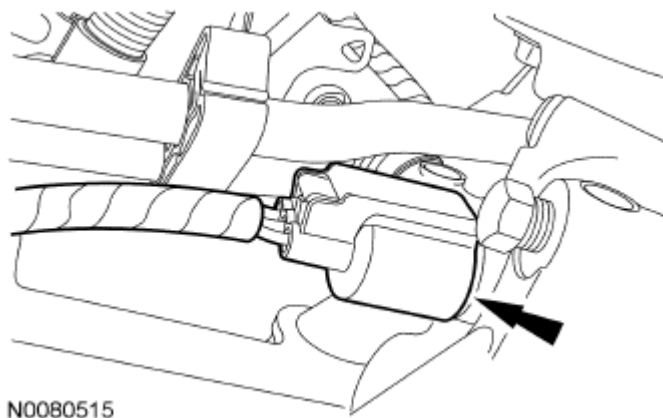


Fig. 190: Locating Turbine Shaft Speed Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

21. Remove the 2 secondary latches from the transaxle fluid cooler tubes.

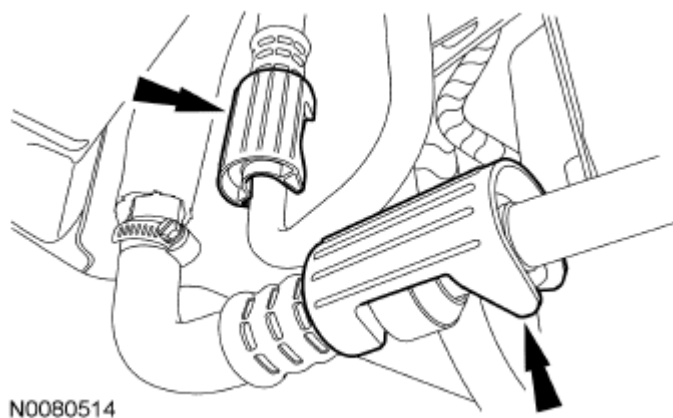


Fig. 191: Locating Secondary Latches On Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

22. Using the Transmission Cooler Line Disconnect Tool, disconnect the 2 transaxle fluid cooler tubes (1 shown).

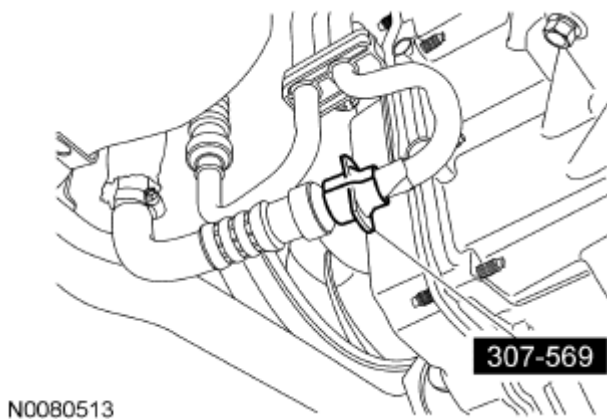


Fig. 192: Identifying Transmission Cooler Line Disconnect Tool
Courtesy of FORD MOTOR CO.

23. Remove the Power Distribution Box (PDB) cover.

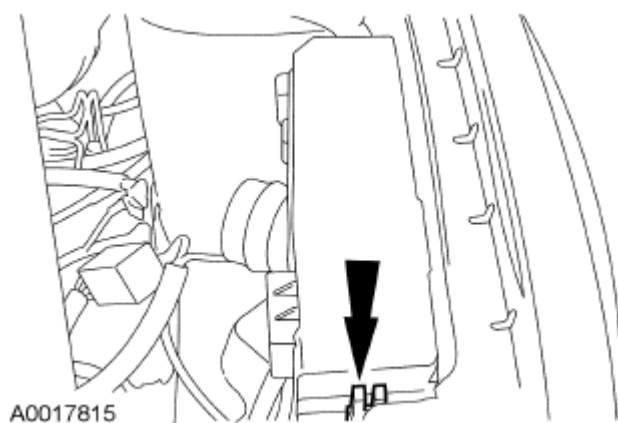


Fig. 193: Locating Power Distribution Box Cover
Courtesy of FORD MOTOR CO.

24. Remove the nut and disconnect the cable from the PDB.

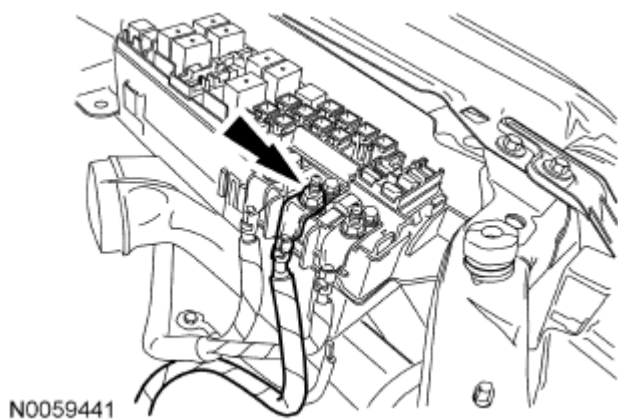


Fig. 194: Locating PDB Cable Nut
Courtesy of FORD MOTOR CO.

25. Disconnect the electrical connector from the PDB.

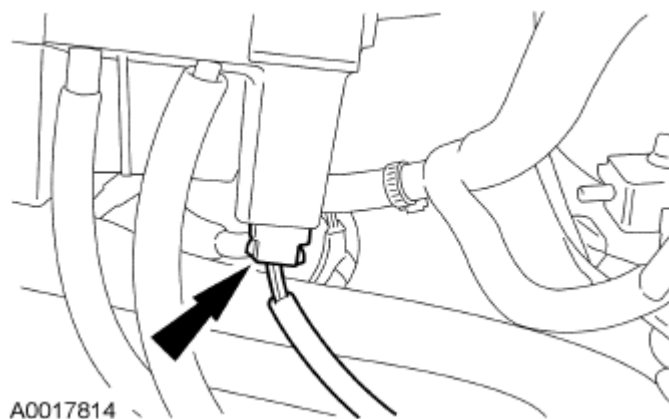


Fig. 195: Locating PDB Electrical Connector
Courtesy of FORD MOTOR CO.

26. Remove the bolt and the ground strap.

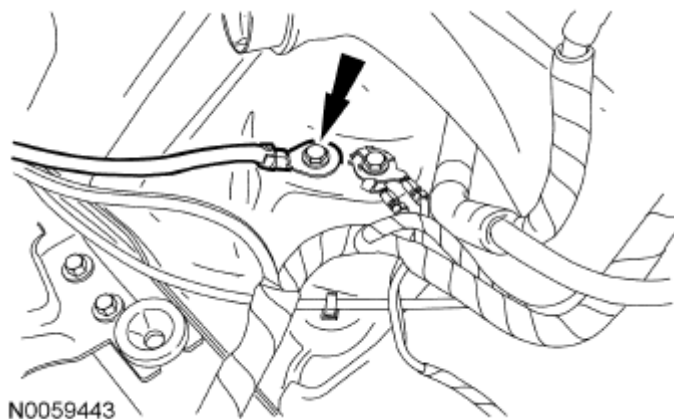


Fig. 196: Locating Ground Strap Bolt
Courtesy of FORD MOTOR CO.

27. Detach the 2 wiring harness retainers from the battery tray bracket and position the wiring harness aside.

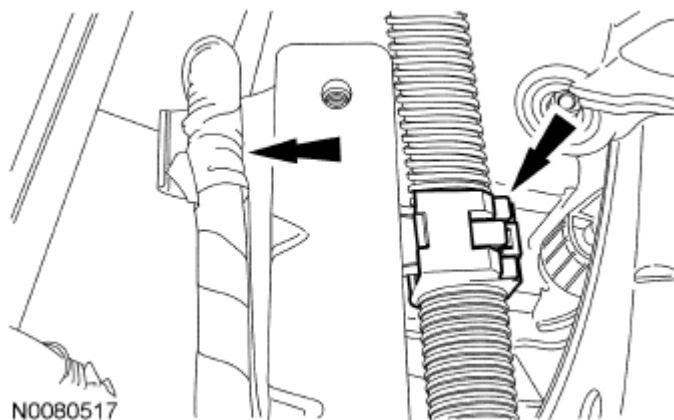


Fig. 197: Locating Wiring Harness Retainers On Battery Tray Bracket
Courtesy of FORD MOTOR CO.

28. Disconnect the shift cable from the transaxle manual lever.

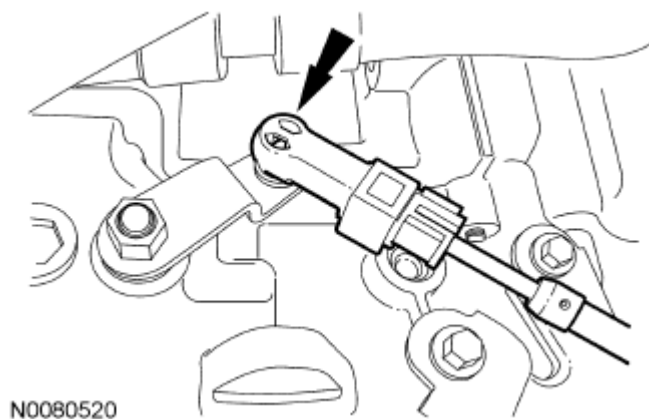


Fig. 198: Locating Transaxle Manual Lever Shift Cable
Courtesy of FORD MOTOR CO.

29. Pinch the 2 tabs and remove the transmission shift cable from the bracket.

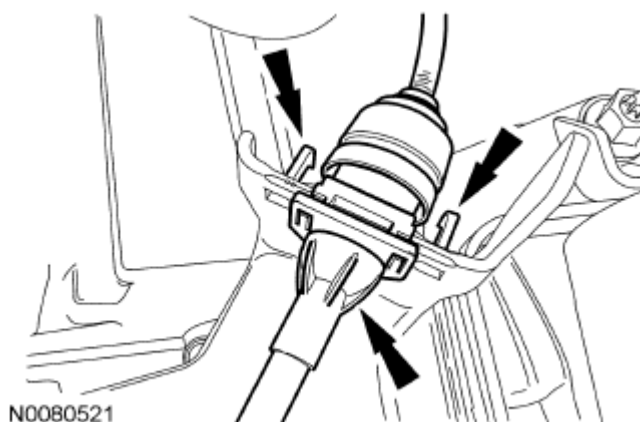


Fig. 199: Locating Transmission Shift Cable Tabs And Bracket
Courtesy of FORD MOTOR CO.

30. Detach the shift cable pin-type retainer and position the shift cable aside.

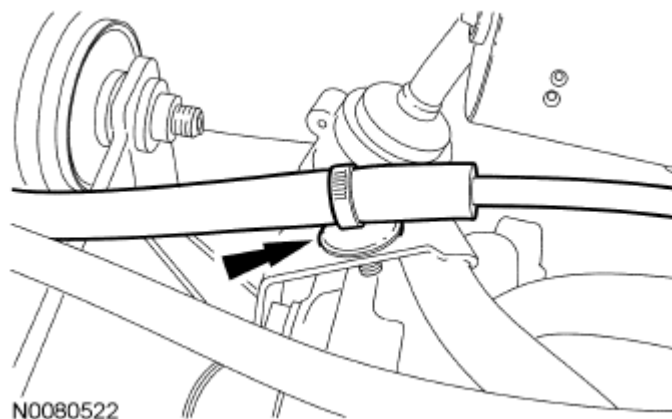


Fig. 200: Locating Shift Cable Pin-Type Retainer
Courtesy of FORD MOTOR CO.

31. If equipped, disconnect the block heater electrical connector. Detach all the block heater wiring harness retainers and position the wiring harness aside.

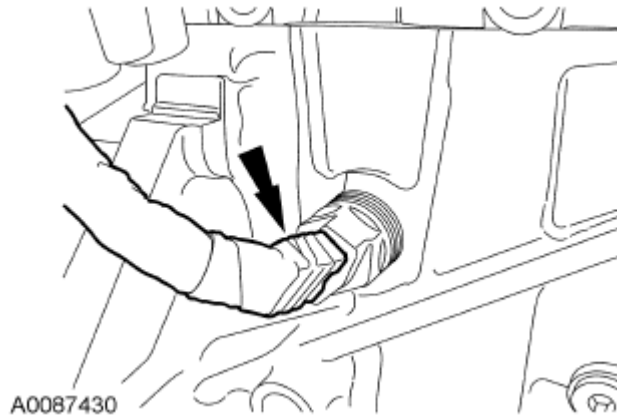


Fig. 201: Locating Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

32. Disconnect the upper radiator hose.

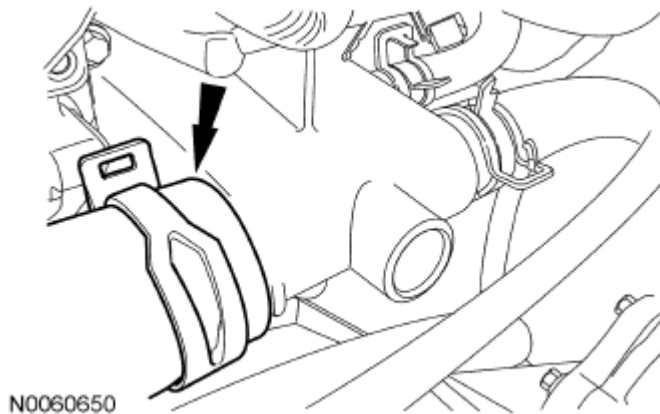


Fig. 202: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

33. Detach the heater hose support strap from the stud.

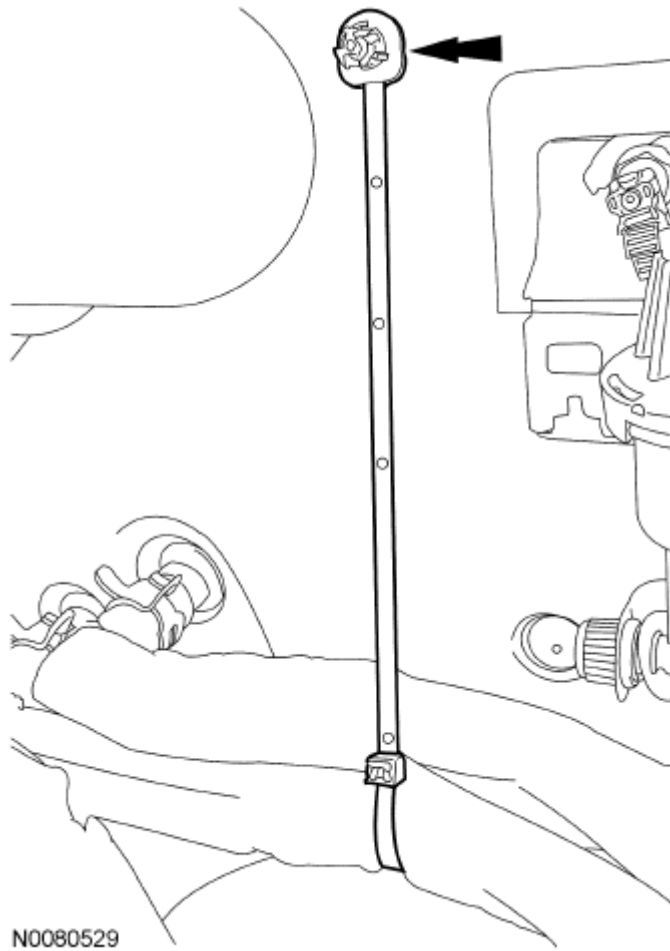


Fig. 203: Locating Heater Hose Support Strap Stud
Courtesy of FORD MOTOR CO.

34. Disconnect the heater hoses from the heater core.

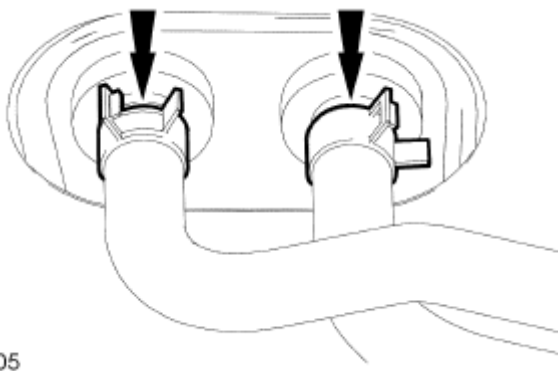


Fig. 204: Locating Heater Core Hoses
Courtesy of FORD MOTOR CO.

35. Disconnect the vacuum supply tube and position aside.

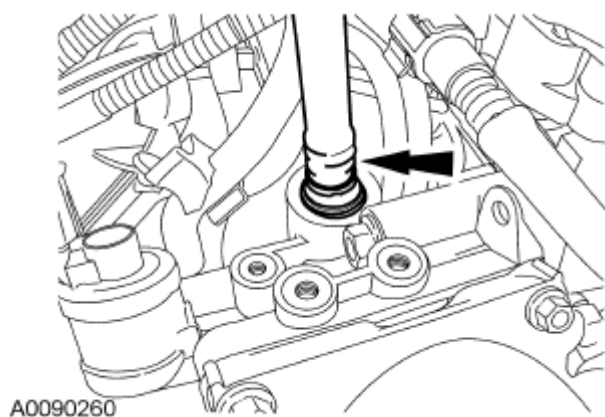


Fig. 205: Locating Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

36. Disconnect the fuel vapor return tube.
- Detach the fuel vapor tube retainer from the wire harness.

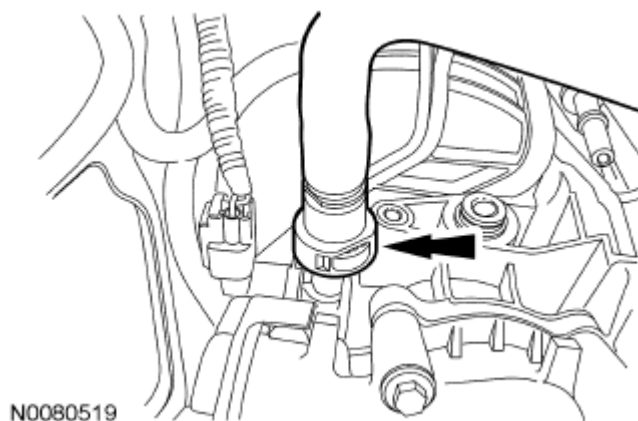


Fig. 206: Locating Fuel Vapor Tube Retainer
Courtesy of FORD MOTOR CO.

37. Disconnect the fuel supply tube quick connect coupling. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .

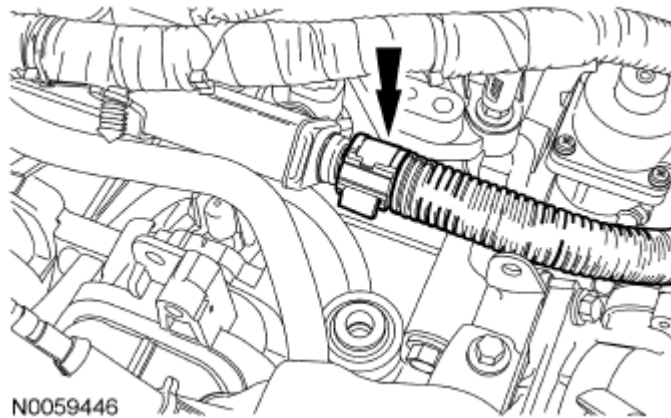


Fig. 207: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

38. Disconnect the PCM electrical connector and the wire harness retainer.

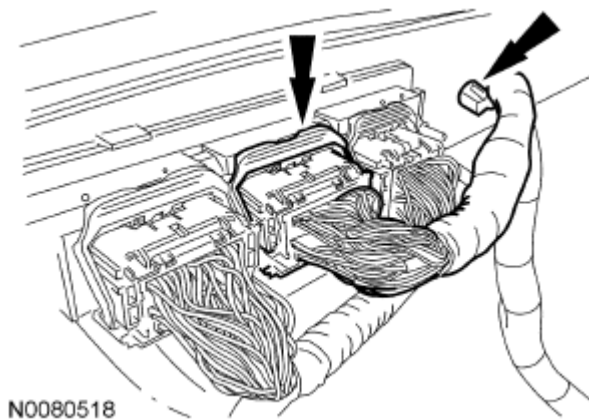


Fig. 208: Locating PCM Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

39. Disconnect the engine control harness electrical connector.

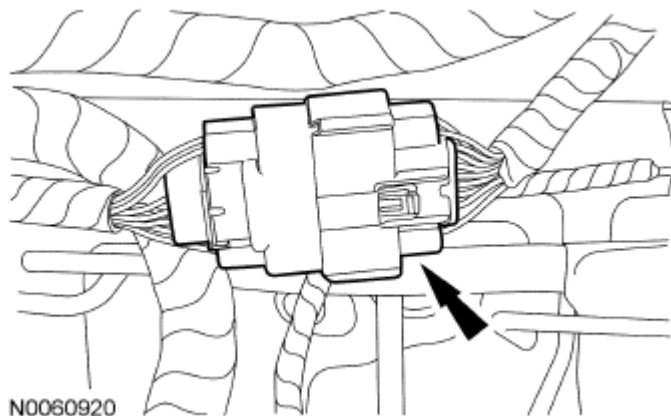


Fig. 209: Locating Engine Control Harness Electrical Connector
Courtesy of FORD MOTOR CO.

40. Disconnect the generator electrical connector and the 2 retainers.

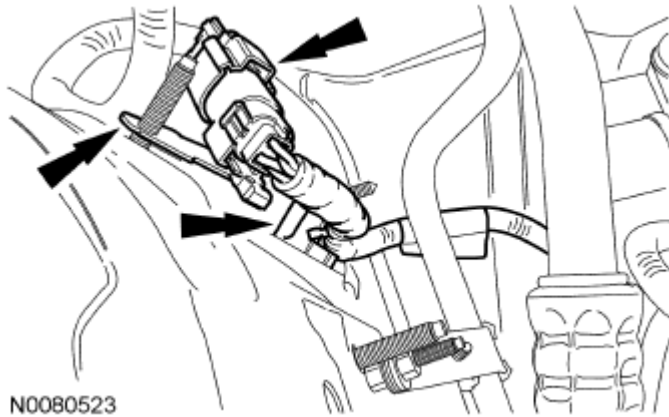


Fig. 210: Locating Generator Electrical Connector And Retainers
Courtesy of FORD MOTOR CO.

41. Disconnect the A/C compressor electrical connector and remove the 3 bolts. Position the A/C compressor aside and support the compressor with a length of mechanic's wire.
- Detach the wire harness retainer.

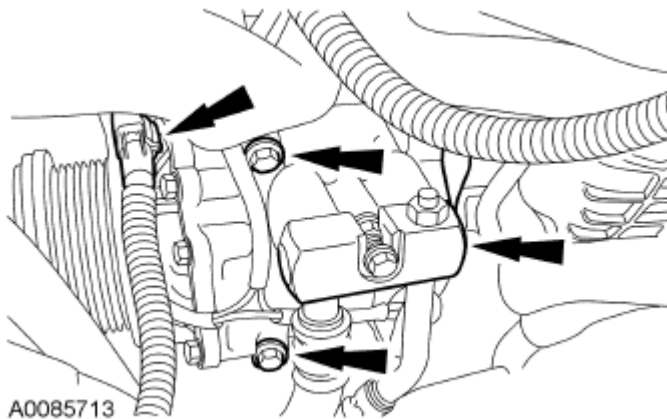


Fig. 211: Locating A/C Compressor Electrical Connector And Bolts
Courtesy of FORD MOTOR CO.

42. Disconnect the lower radiator hose from the radiator.

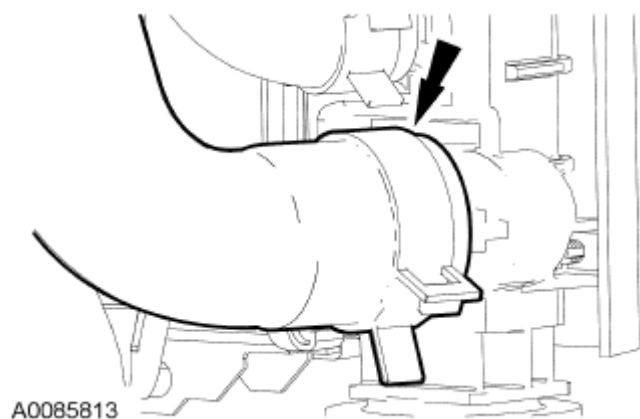


Fig. 212: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

43. Remove the front roll restrictor bolt and the 2 bolts for the engine support crossmember.

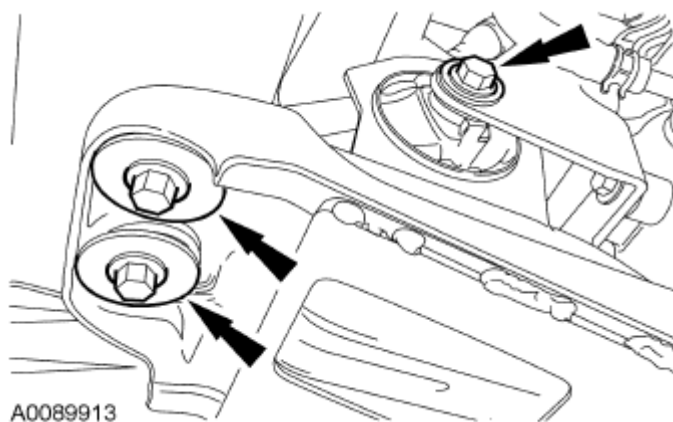


Fig. 213: Locating Front Roll Restrictor Bolt And Engine Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

44. Remove the rear nut and the engine support crossmember.
- Discard the nut.

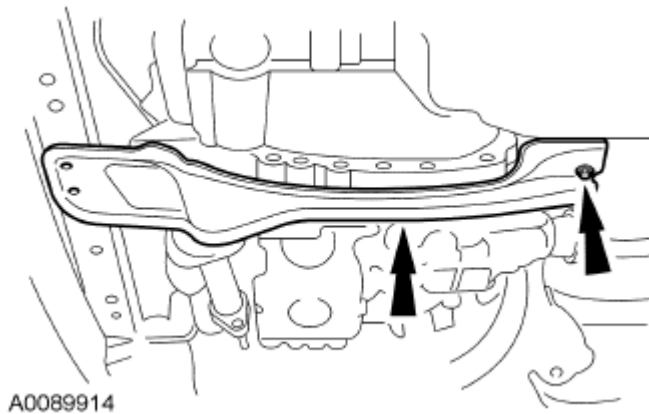


Fig. 214: Locating Rear Nut And Engine Support Crossmember
Courtesy of FORD MOTOR CO.

45. If equipped, remove the 3 bolts and the dampener.

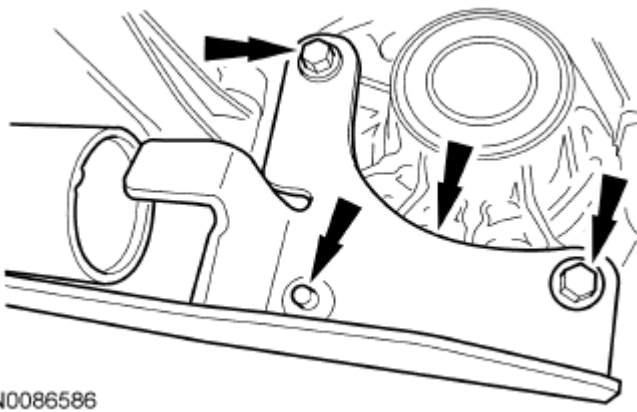


Fig. 215: Locating Dampener Bolts
Courtesy of FORD MOTOR CO.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.

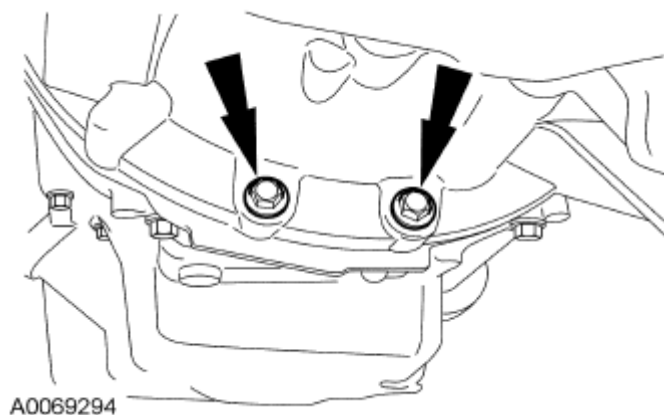


Fig. 216: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

46. Remove the 2 transaxle-to-engine bolts.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.

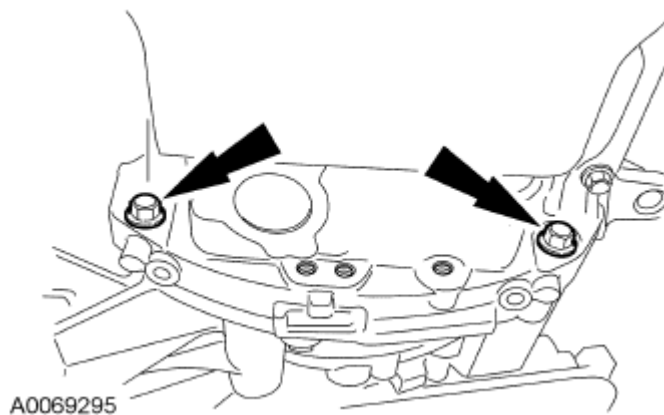


Fig. 217: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

47. Remove the 2 transaxle-to-engine bolts.

AWD vehicles

48. Remove the 4 PTU bracket-to-engine bolts.

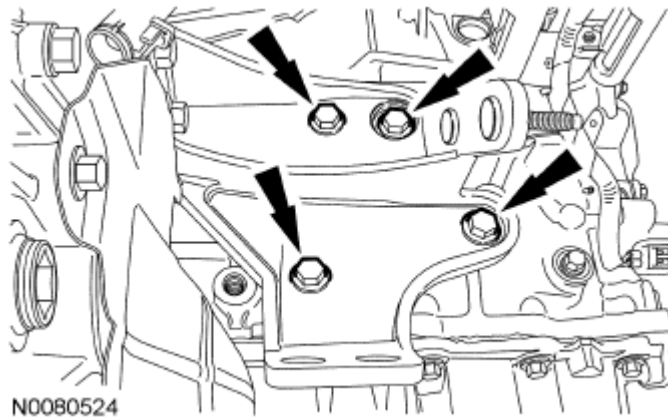


Fig. 218: Locating PTU Bracket-To-Engine Bolts
Courtesy of FORD MOTOR CO.

49. Remove the PTU bracket-to-engine bolt.

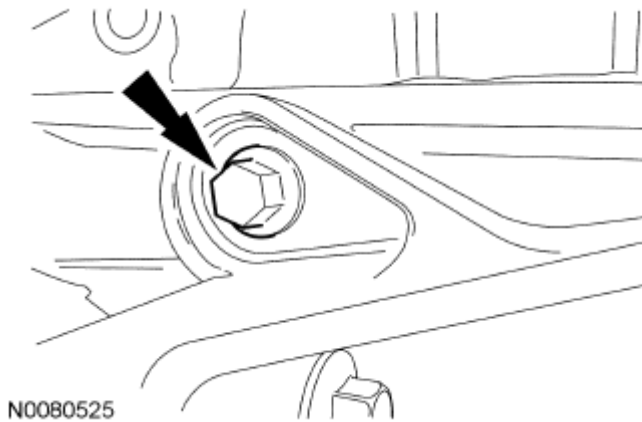


Fig. 219: Locating PTU Bracket-To-Engine Bolt
Courtesy of FORD MOTOR CO.

50. Remove the 2 PTU bracket-to-PTU bolts and remove the bracket.

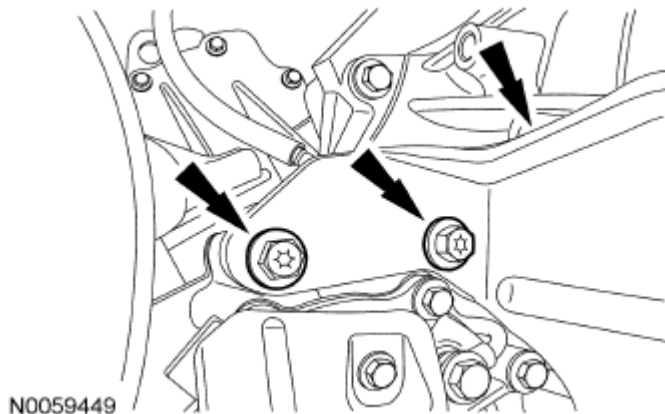


Fig. 220: Locating PTU Bracket-To-PTU Bolts And Bracket
Courtesy of FORD MOTOR CO.

All vehicles

51. If equipped, remove the spin on engine oil filter.

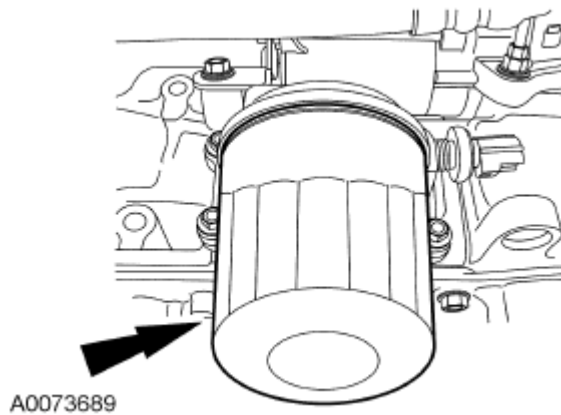


Fig. 221: Locating Engine Oil Filter
Courtesy of FORD MOTOR CO.

52. If equipped, remove the oil filter element. For additional information, refer to **OIL FILTER ELEMENT**.
53. Using the Powertrain Lift and Universal Adapter Brackets, secure the engine to the lift table.

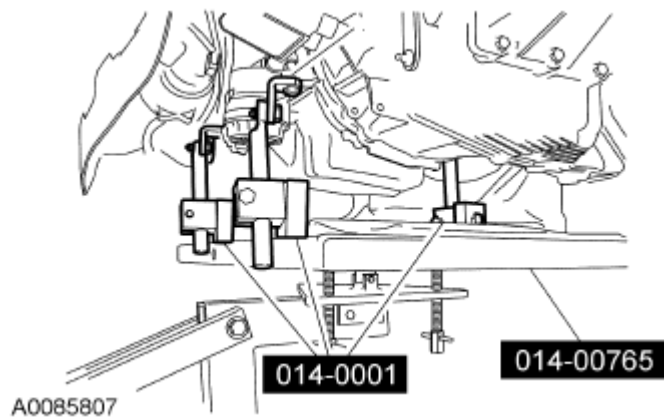


Fig. 222: Identifying Powertrain Lift And Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

54. Remove the engine mount bracket bolt.

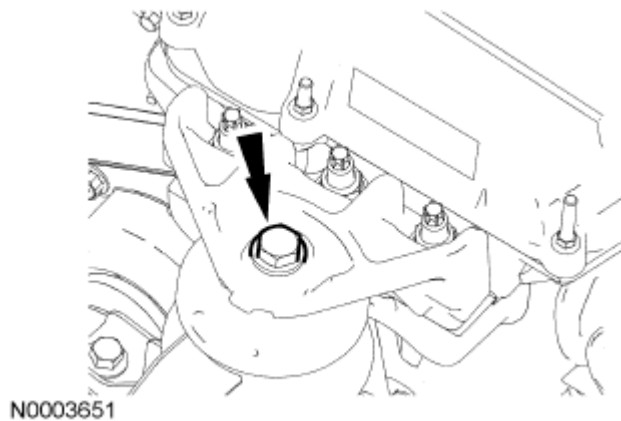


Fig. 223: Locating Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

55. Remove the 3 nuts and the engine mount bracket.

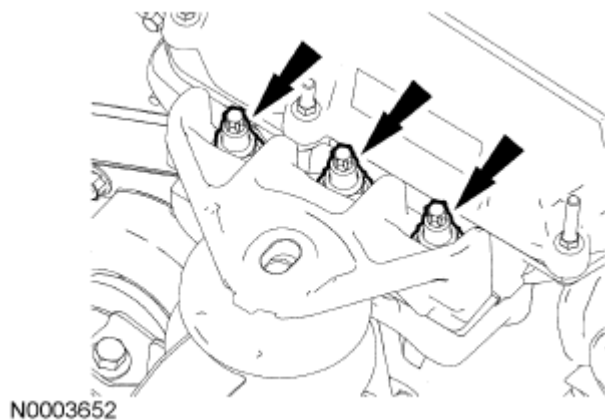


Fig. 224: Locating Engine Mount Bracket Nuts
Courtesy of FORD MOTOR CO.

56. Remove the bolt from the transaxle rear mount.

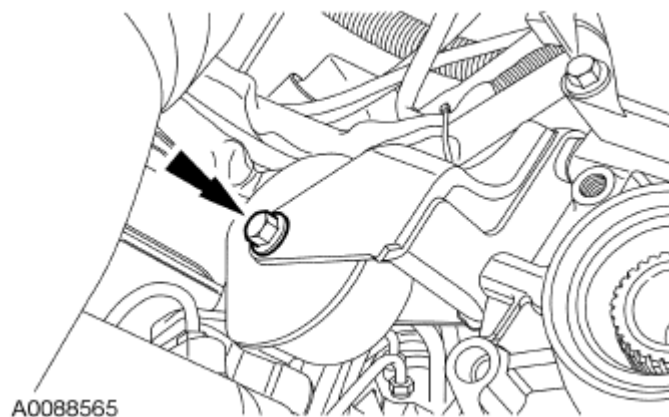


Fig. 225: Locating Transaxle Rear Mount Bolt
Courtesy of FORD MOTOR CO.

57. Remove the bolt from the LH transaxle mount.

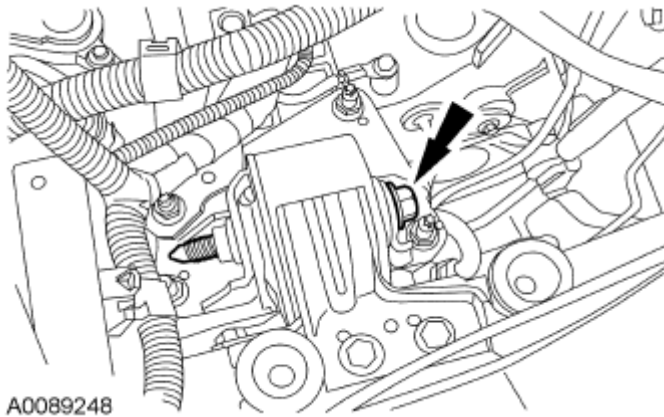


Fig. 226: Locating LH Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

58. Lower the engine and transaxle from the vehicle.
59. Disconnect the starter terminals.
1. Remove the battery cable nut.
 2. Remove the starter solenoid terminal nut.

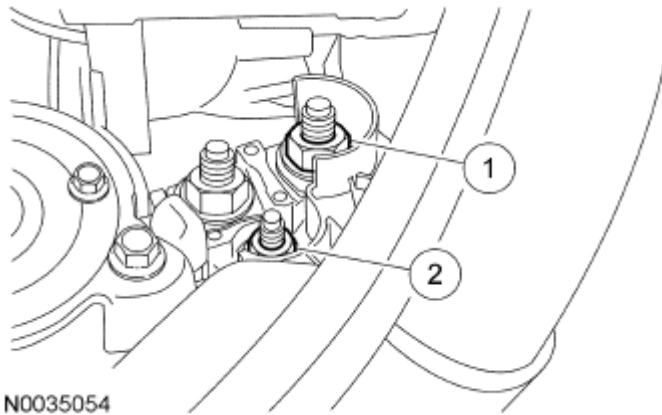


Fig. 227: Identifying Battery Cable Nut And Starter Solenoid Terminal Nut
Courtesy of FORD MOTOR CO.

60. Remove the nut and the ground wire.

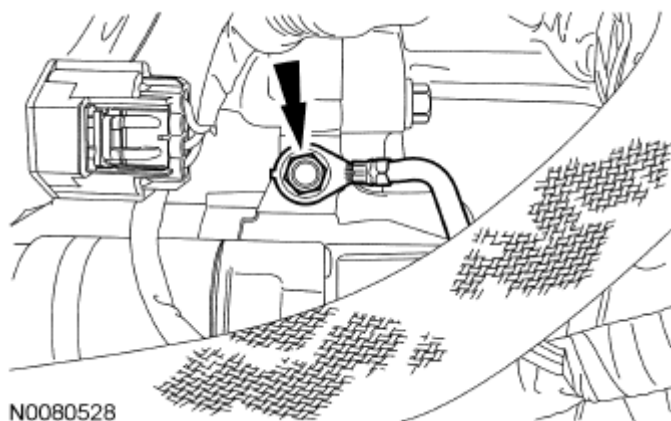


Fig. 228: Locating Ground Wire Nut
Courtesy of FORD MOTOR CO.

61. Remove the 2 stud bolts and remove the starter.

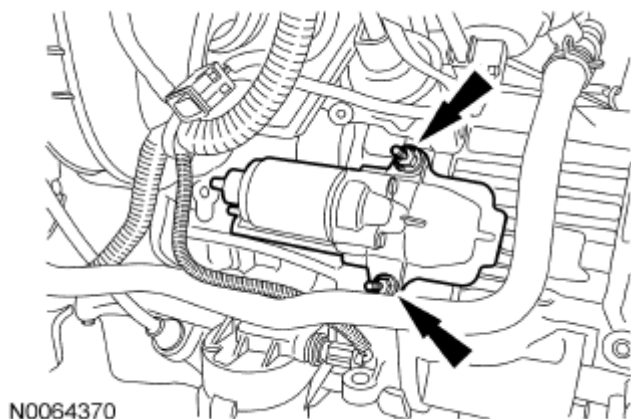


Fig. 229: Locating Starter Stud Bolts
Courtesy of FORD MOTOR CO.

62. Remove the starter motor isolator.

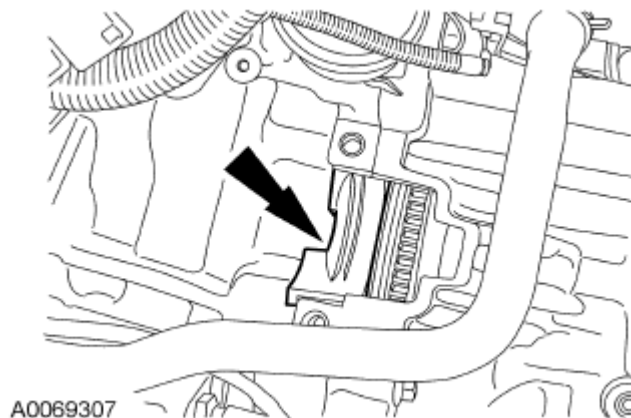


Fig. 230: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

AWD vehicles

63. Detach the PTU vent hose retainer.

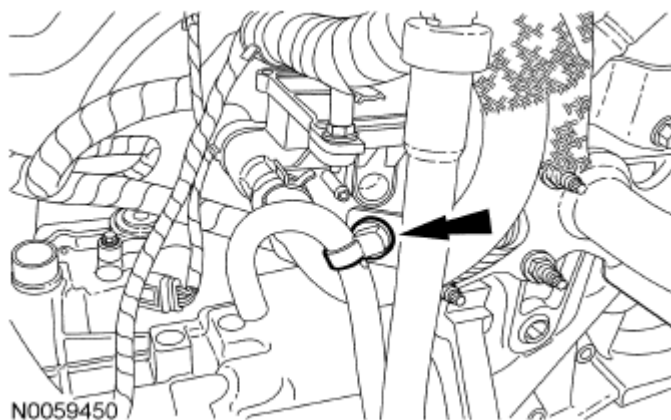


Fig. 231: Locating PTU Vent Hose Retainer
Courtesy of FORD MOTOR CO.

64. Remove the LH lower PTU bolt.

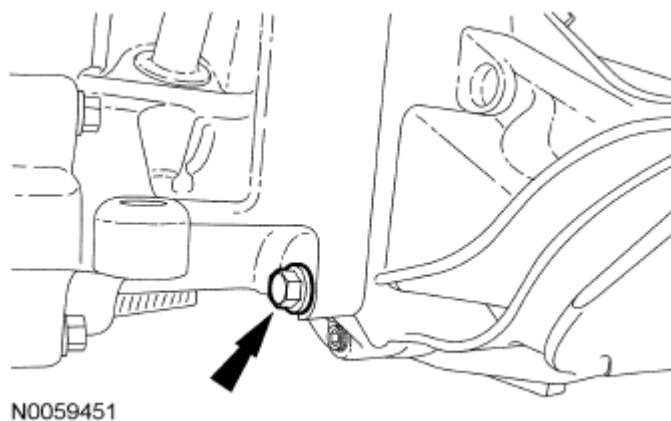


Fig. 232: Locating LH Lower PTU Bolt
Courtesy of FORD MOTOR CO.

65. Remove the 3 RH PTU bolts and the PTU.

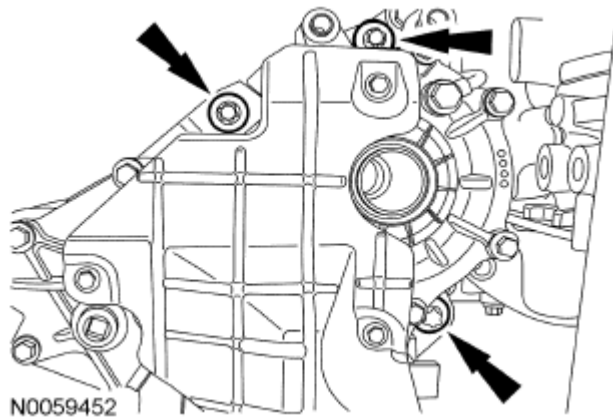


Fig. 233: Locating RH PTU Bolts And PTU
Courtesy of FORD MOTOR CO.

66. Remove the 3 bolts and the PTU heat shield.

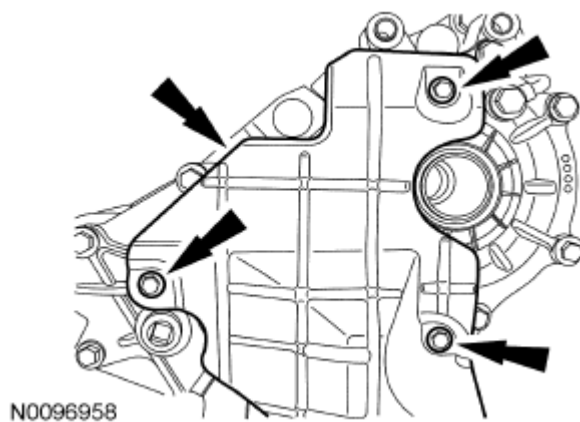


Fig. 234: Locating PTU Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

67. Using the Halfshaft Oil Seal Remover and Slide Hammer, remove the intermediate shaft seal.

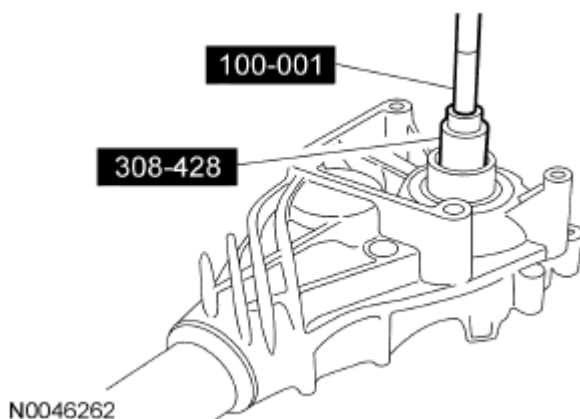


Fig. 235: Removing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

All vehicles

68. Remove and discard the 4 torque converter nuts.

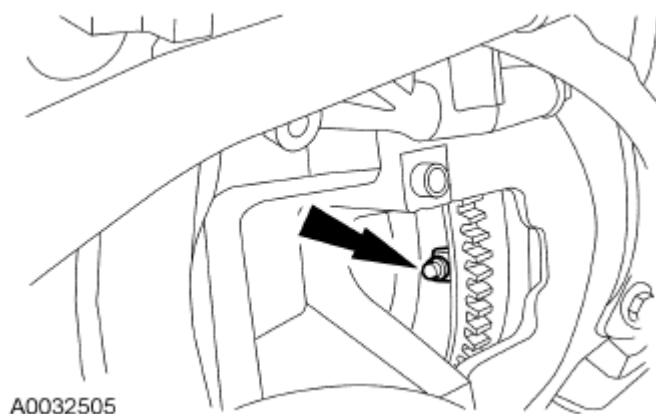


Fig. 236: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

69. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine and transaxle from the lift table.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.

70. Remove the remaining 6 engine-to-transaxle bolts and separate the engine and transaxle.

ENGINE - MANUAL TRANSAXLE

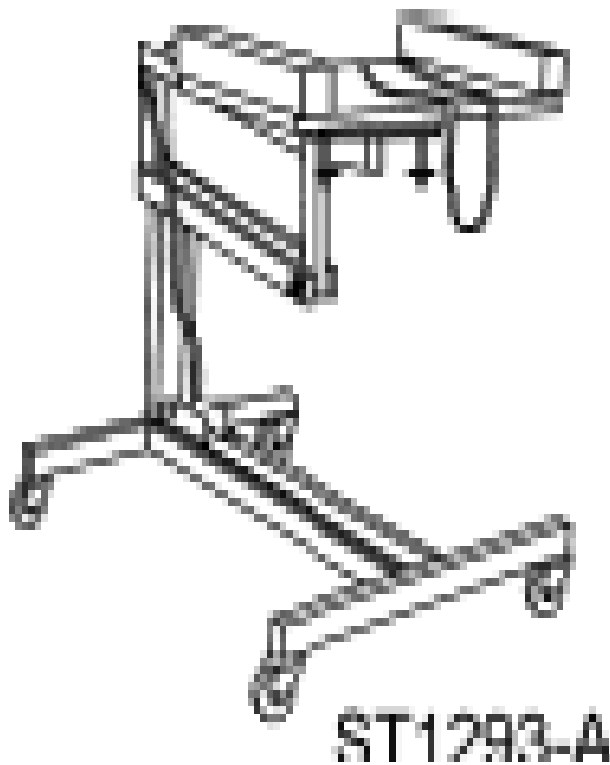
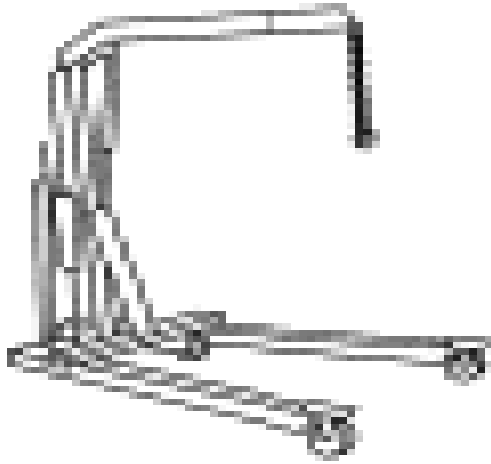
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

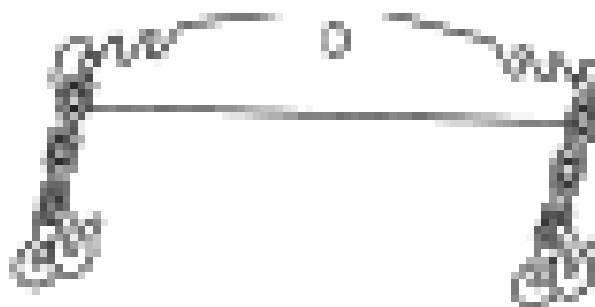
| | |
|--|---|
| | Heavy Duty Floor Crane 014-00071 or equivalent |
|--|---|

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner

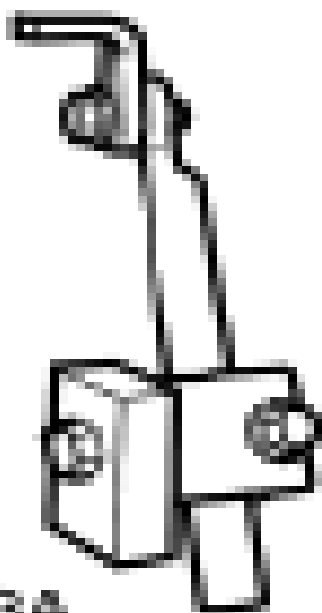


Powertrain Lift
014-00765 or equivalent



Spreader Bar
303-D089 (D93P-6001-A3) or equivalent

ST1A07.A



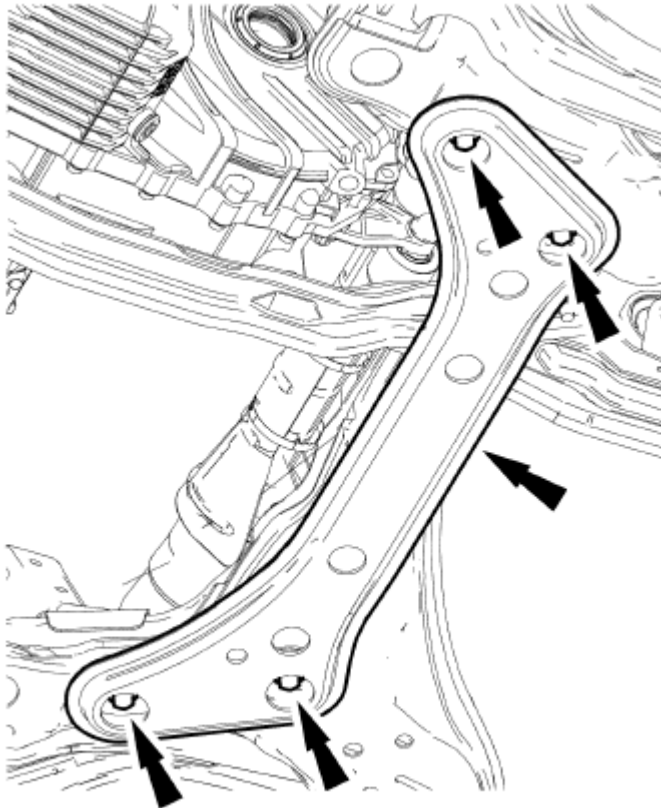
Universal Adapter Brackets
014-0001 or equivalent

ST2743A

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these 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**.

2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .
3. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L** .
4. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .
5. Drain the engine oil.
 - Install the drain plug.
 - Tighten to 28 Nm (21 lb-ft).
6. Remove the LH half shaft and the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** .
7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** .
8. Remove the 4 bolts and the lateral support crossmember.



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Fig. 237: Locating Lateral Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

9. Remove the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM** .
10. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L** .

11. Press the locking tabs to release the generator air duct and remove.

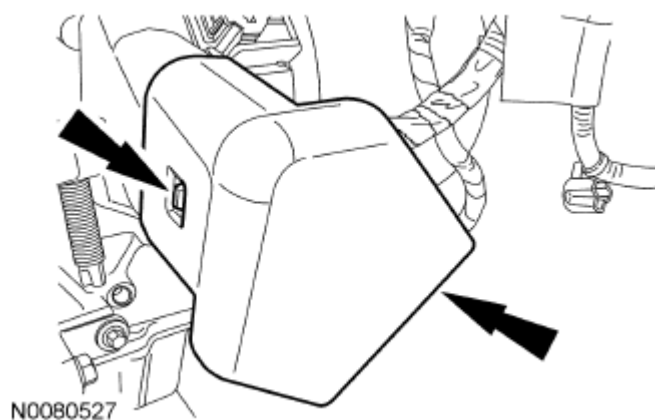


Fig. 238: Locating Locking Tabs And Generator Air Duct
Courtesy of FORD MOTOR CO.

12. If equipped, remove the bolt and ground eyelet.

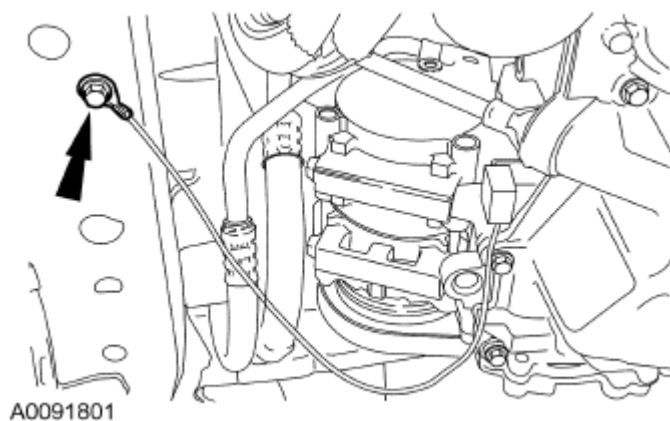


Fig. 239: Locating Ground Eyelet Bolt
Courtesy of FORD MOTOR CO.

13. Remove the Power Distribution Box (PDB) cover.

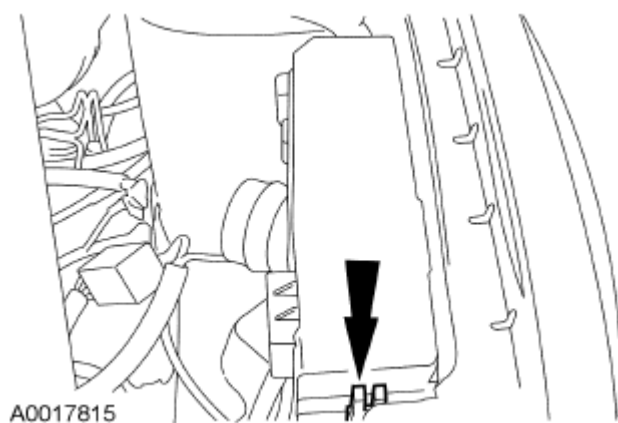


Fig. 240: Locating Power Distribution Box Cover
Courtesy of FORD MOTOR CO.

14. Remove the nut and disconnect the cable from the PDB.

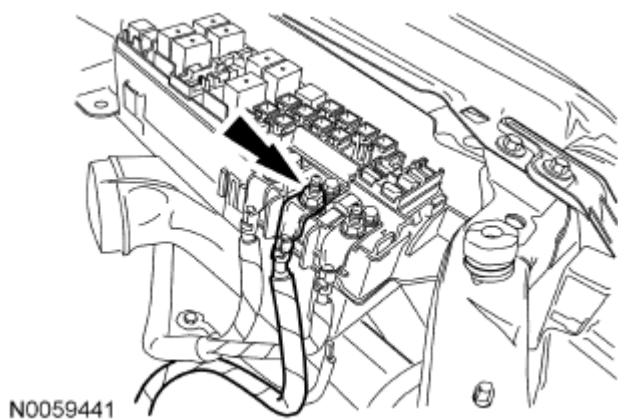


Fig. 241: Locating PDB Cable Nut
Courtesy of FORD MOTOR CO.

15. Disconnect the electrical connector from the PDB.

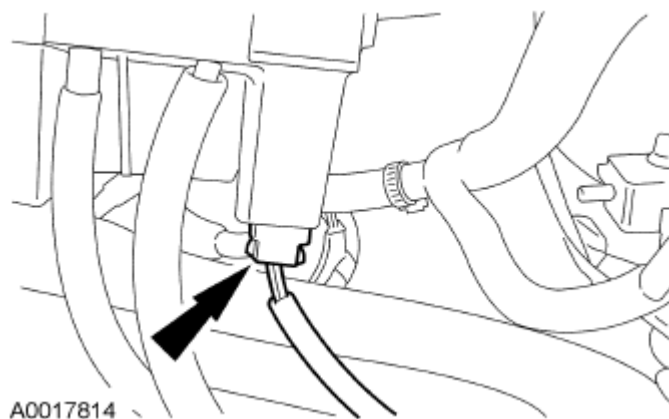


Fig. 242: Locating PDB Electrical Connector
Courtesy of FORD MOTOR CO.

16. Remove the bolt and the ground strap.

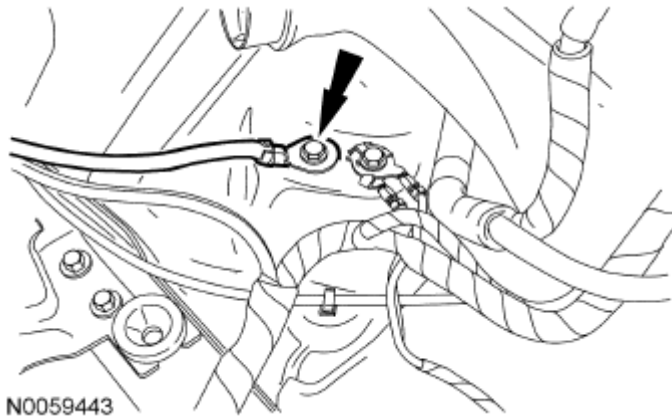


Fig. 243: Locating Ground Strap Bolt
Courtesy of FORD MOTOR CO.

17. Detach the 2 wiring harness retainers from the battery tray bracket and position the wiring harness aside.

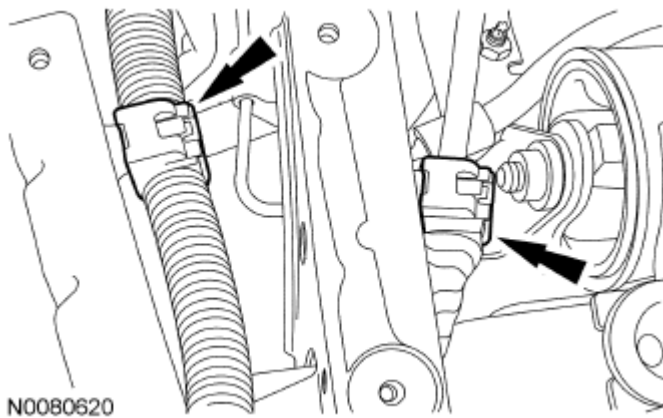


Fig. 244: Locating Wiring Harness Retainers On Battery Tray Bracket
Courtesy of FORD MOTOR CO.

18. Position the clutch hydraulic line aside.
1. Remove the clutch hydraulic line bracket-to-transaxle bolt.
 2. Disconnect the clutch hydraulic line from the clutch slave cylinder.
 - Plug the hydraulic line.
 3. Position the clutch hydraulic line aside.

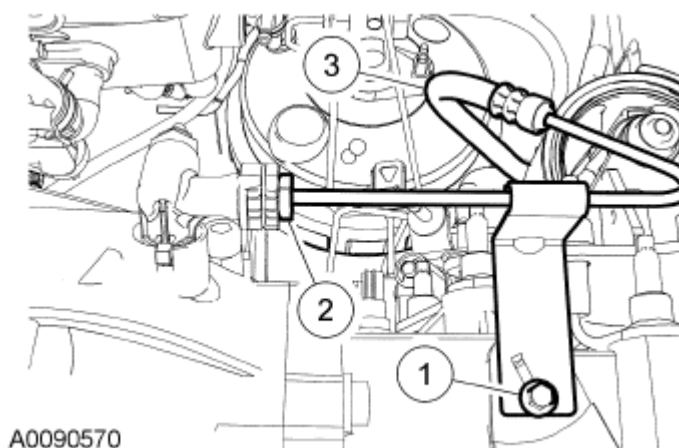


Fig. 245: Identifying Clutch Hydraulic Line
Courtesy of FORD MOTOR CO.

19. Disconnect the Vehicle Speed Sensor (VSS) electrical connector and the 2 pin-type retainers.

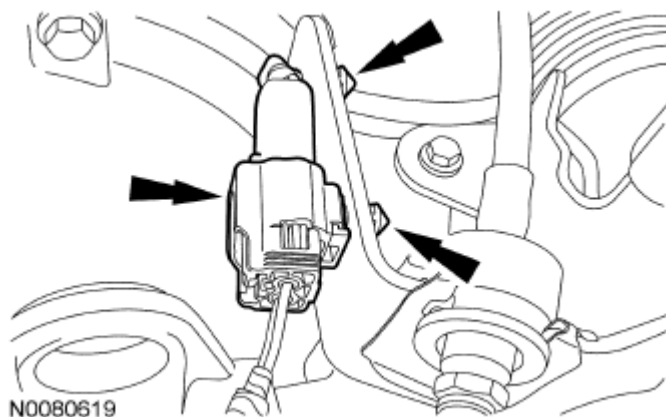


Fig. 246: Locating Vehicle Speed Sensor Electrical Connector And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

20. Detach the 2 wiring harness retainers and disconnect the reversing lamp indicator switch electrical connector.

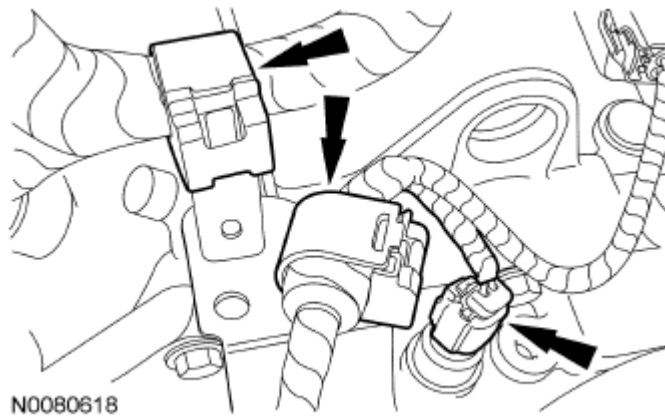


Fig. 247: Locating Wiring Harness Retainers And Reversing Lamp Indicator Switch Electrical Connector

Courtesy of FORD MOTOR CO.

21. Disconnect the shift cables.

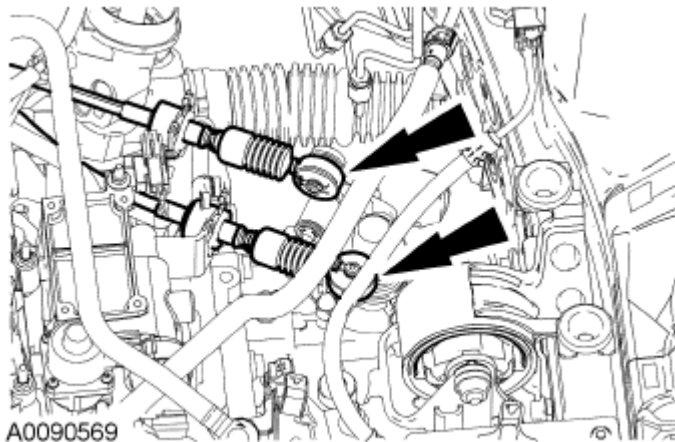


Fig. 248: Locating Shift Cables

Courtesy of FORD MOTOR CO.

22. Remove the 3 shift cable bracket bolts.
 - Position the bracket aside.

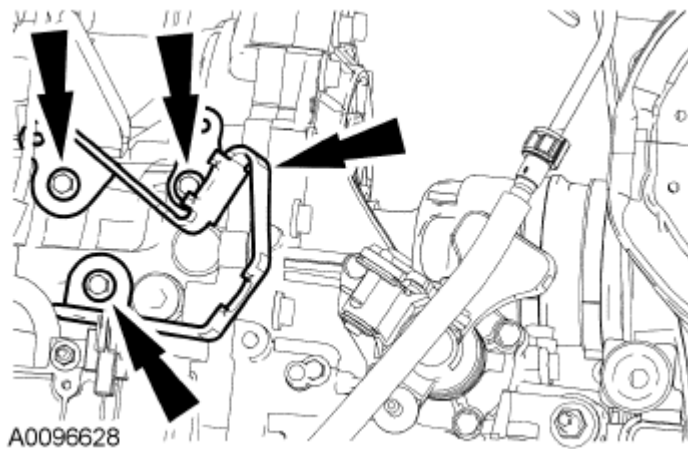


Fig. 249: Locating Shift Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

23. If equipped, disconnect the block heater electrical connector.
- Detach all the block heater wiring harness retainers and position the wiring harness aside.

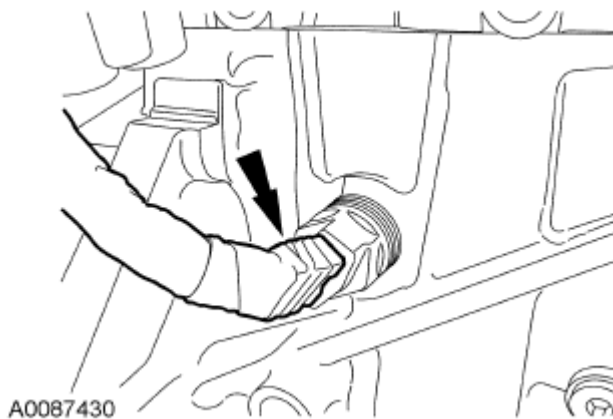


Fig. 250: Locating Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

24. Disconnect the upper radiator hose.

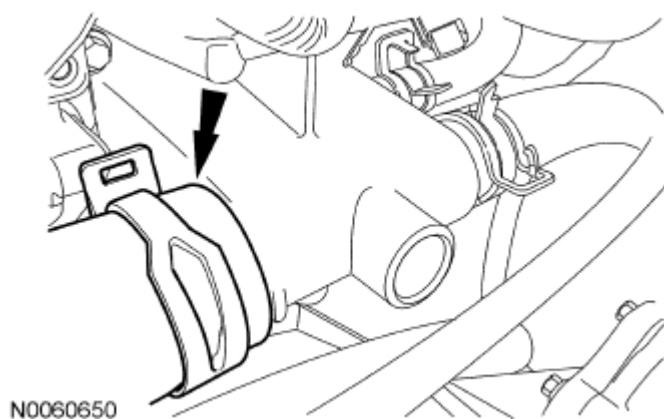


Fig. 251: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

25. Detach the heater hose support strap from the stud.

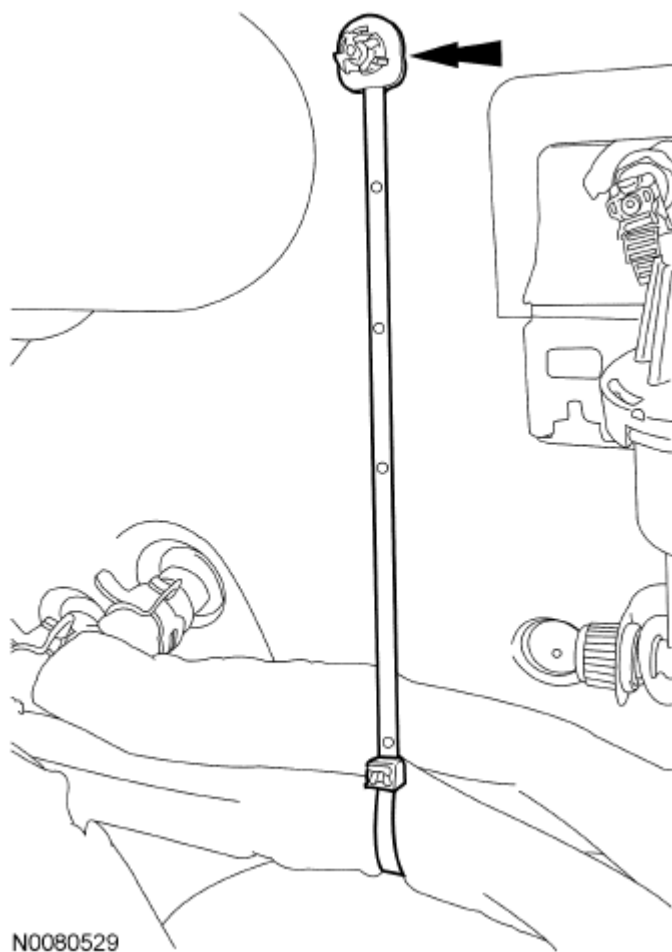
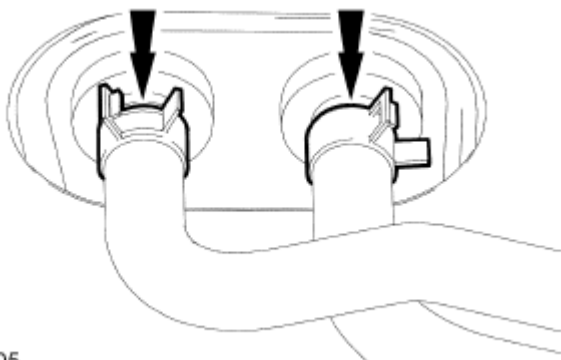


Fig. 252: Locating Heater Hose Support Strap Stud
Courtesy of FORD MOTOR CO.

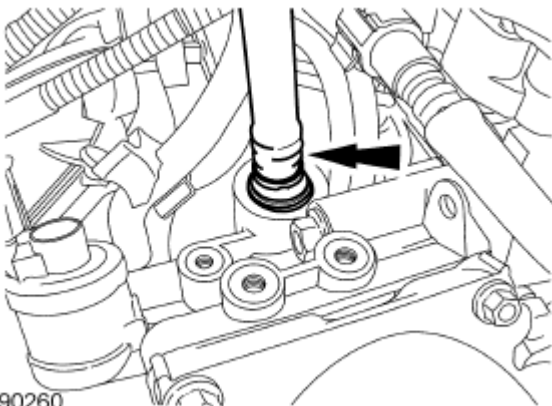
26. Disconnect the heater hoses from the heater core.



A0085705

Fig. 253: Locating Heater Core Hoses
Courtesy of FORD MOTOR CO.

27. Disconnect the vacuum supply tube and position aside.



A0090260

Fig. 254: Locating Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

28. Disconnect the fuel vapor return tube.
- Detach the fuel vapor tube retainer from the wire harness.

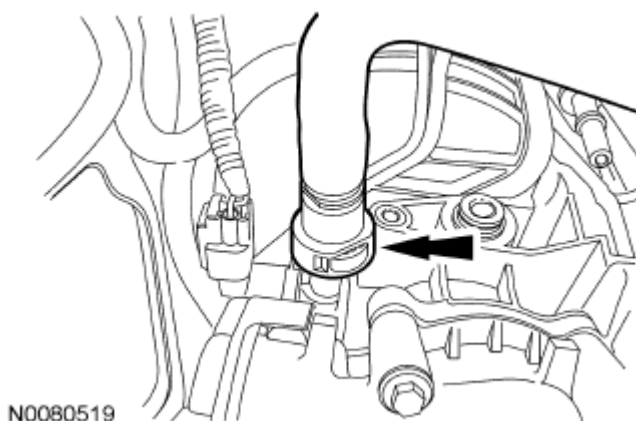


Fig. 255: Locating Fuel Vapor Tube Retainer
Courtesy of FORD MOTOR CO.

29. Disconnect the fuel supply tube. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .

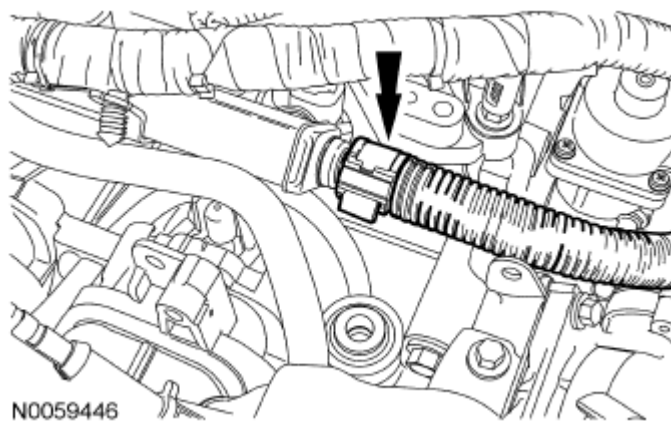


Fig. 256: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

30. Disconnect the PCM electrical connector and the wire harness retainer.

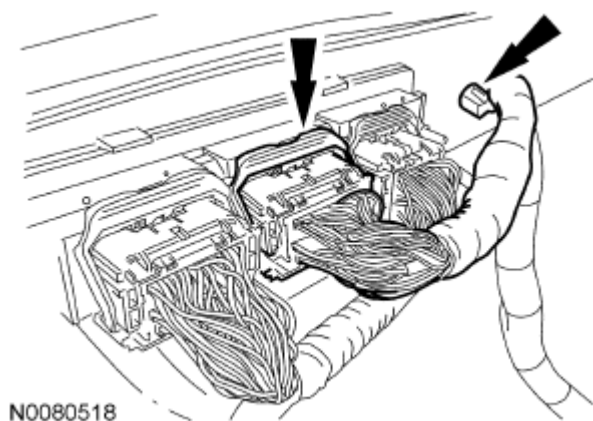


Fig. 257: Locating PCM Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

31. Disconnect the engine control harness electrical connector.

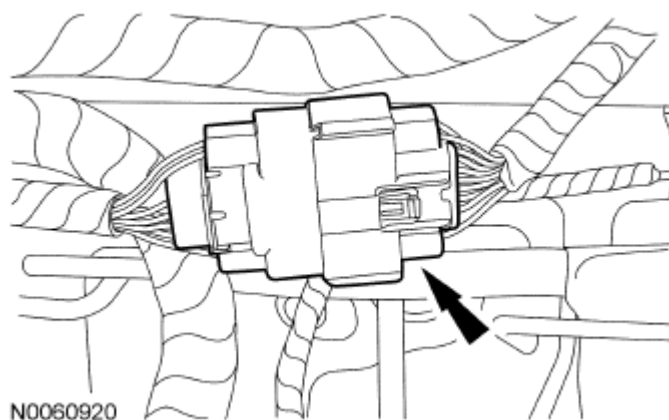


Fig. 258: Locating Engine Control Harness Electrical Connector
Courtesy of FORD MOTOR CO.

32. Disconnect the generator electrical connector and the 2 retainers.

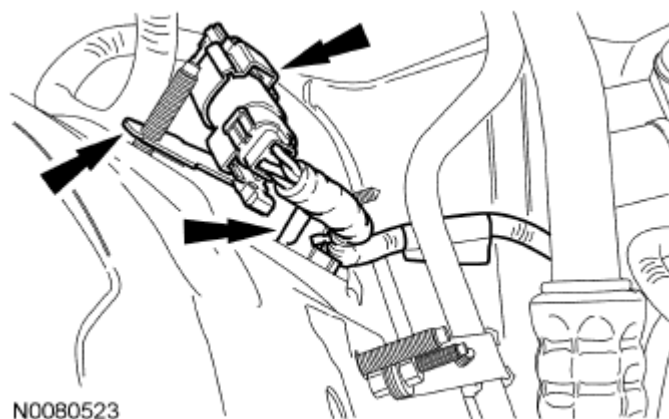


Fig. 259: Locating Generator Electrical Connector And Retainers
Courtesy of FORD MOTOR CO.

33. Disconnect the A/C compressor electrical connector and remove the 3 bolts. Position the A/C compressor aside and support the compressor with a length of mechanic's wire.

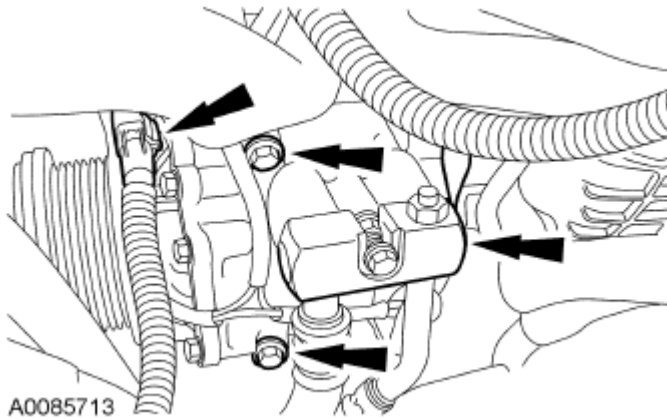


Fig. 260: Locating A/C Compressor Electrical Connector And Bolts
Courtesy of FORD MOTOR CO.

34. Disconnect the lower radiator hose from the radiator.

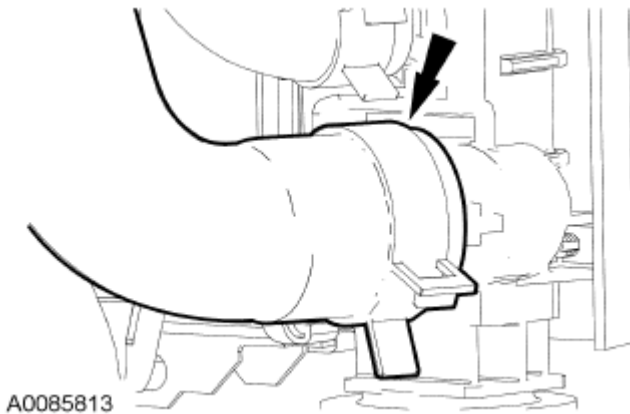


Fig. 261: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

35. Remove the front roll restrictor bolt and the 2 bolts for the engine support crossmember.

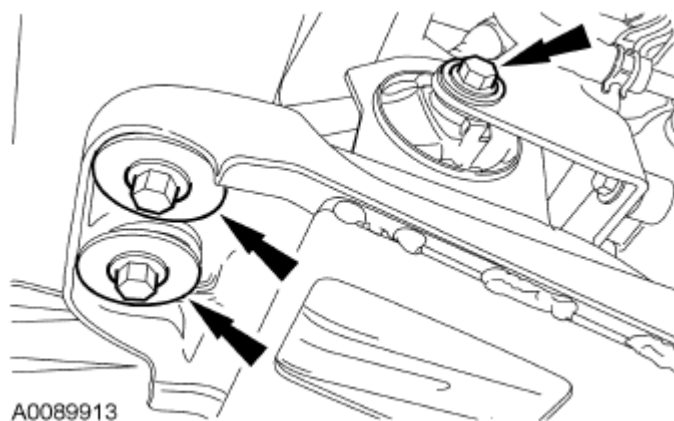


Fig. 262: Locating Front Roll Restrictor Bolt And Engine Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

36. Remove the rear nut and the engine support crossmember.
- Discard the nut.

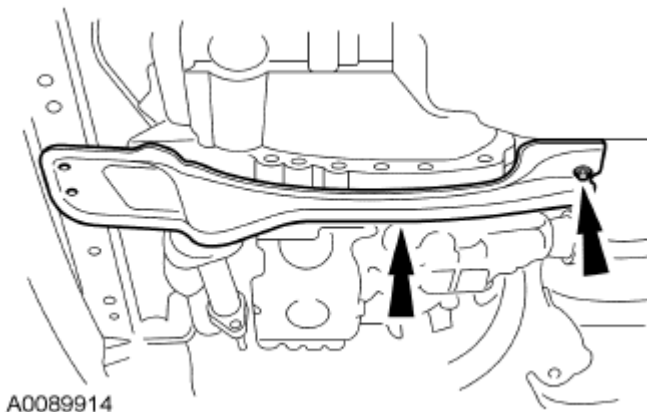


Fig. 263: Locating Rear Nut And Engine Support Crossmember
Courtesy of FORD MOTOR CO.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.

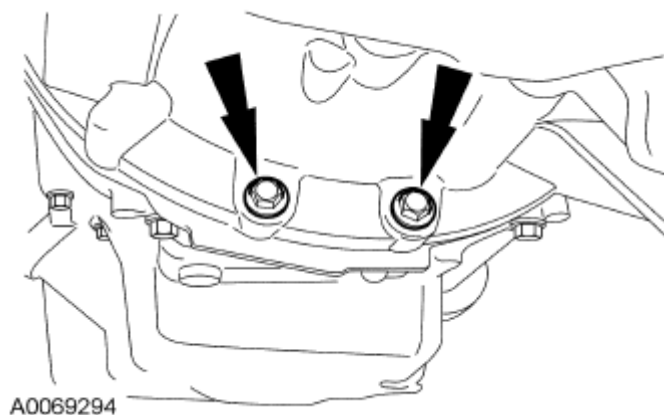


Fig. 264: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

37. Remove the 2 transaxle-to-engine bolts.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.

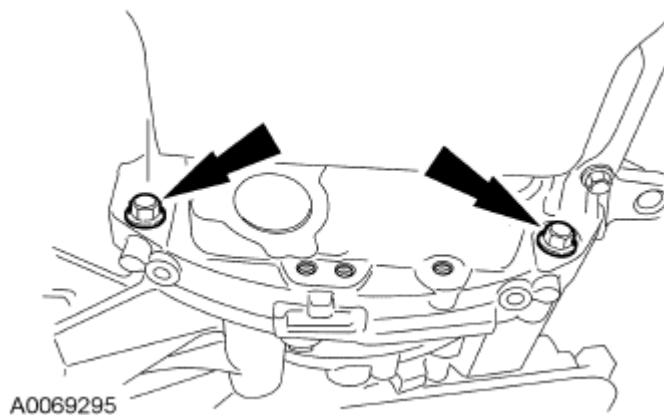


Fig. 265: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

38. Remove the 2 engine-to-transaxle bolts.
39. If equipped, remove the spin on engine oil filter.

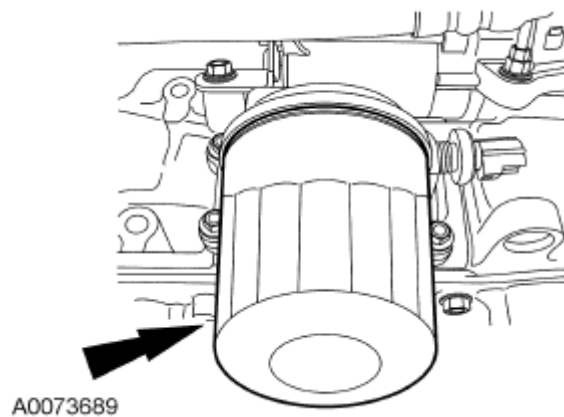


Fig. 266: Locating Engine Oil Filter
Courtesy of FORD MOTOR CO.

40. If equipped, remove the oil filter element. For additional information, refer to **OIL FILTER ELEMENT**.
41. Using the Powertrain Lift and Universal Adapter Brackets, secure the engine to the lift table.

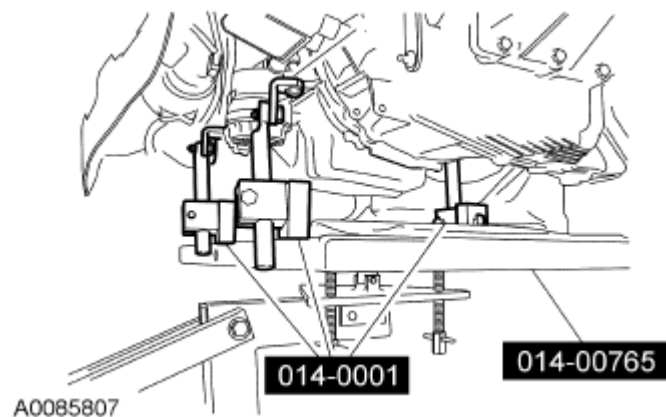


Fig. 267: Identifying Powertrain Lift And Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

42. Remove the engine mount bracket bolt.

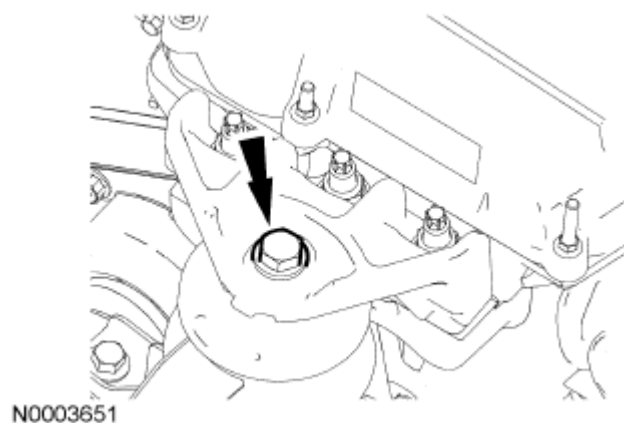


Fig. 268: Locating Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

43. Remove the nuts and the engine mount bracket.

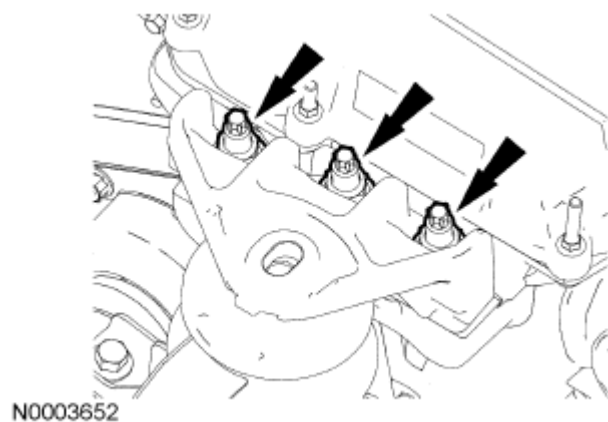


Fig. 269: Locating Engine Mount Bracket Nuts
Courtesy of FORD MOTOR CO.

44. Remove the bolt from the transaxle rear mount.

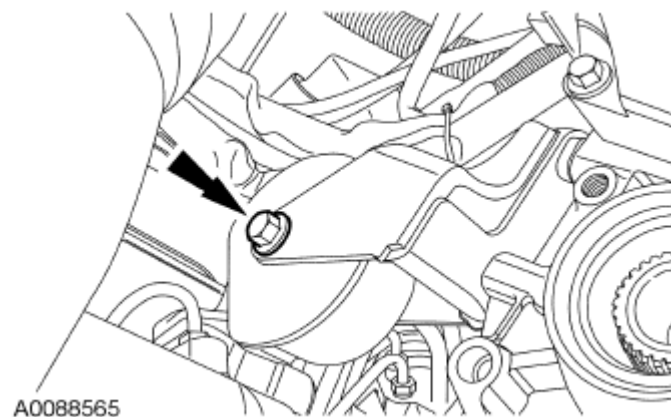


Fig. 270: Locating Transaxle Rear Mount Bolt
Courtesy of FORD MOTOR CO.

45. Remove bolt from the LH transaxle mount.

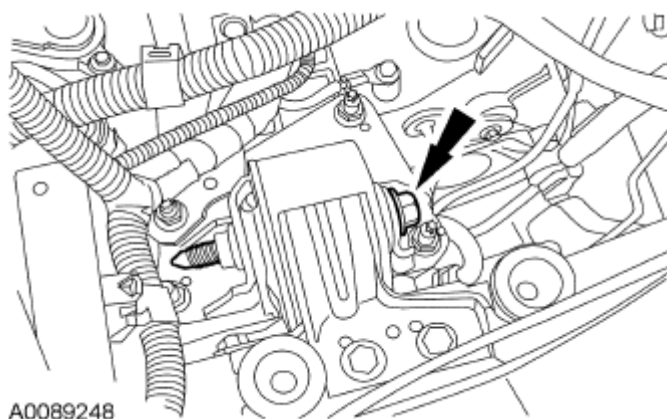


Fig. 271: Locating LH Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

46. Lower the engine and transaxle from the vehicle.
47. Disconnect the starter terminals.
 1. Remove the battery cable nut.
 2. Remove the starter solenoid terminal nut.

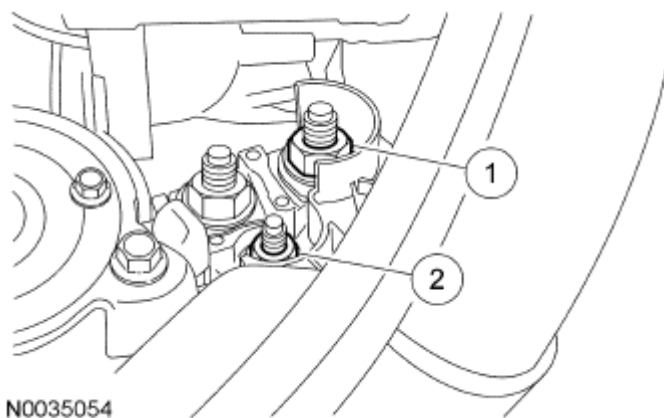


Fig. 272: Identifying Battery Cable Nut And Starter Solenoid Terminal Nut
Courtesy of FORD MOTOR CO.

48. Remove the nut and the ground wire.

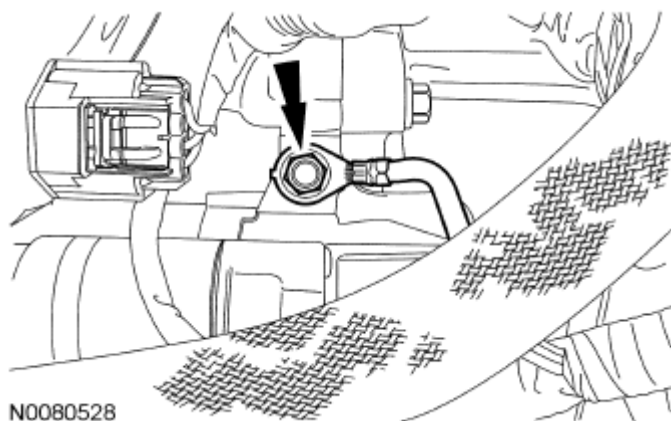


Fig. 273: Locating Ground Wire Nut
Courtesy of FORD MOTOR CO.

49. Remove the 2 stud bolts and remove the starter.

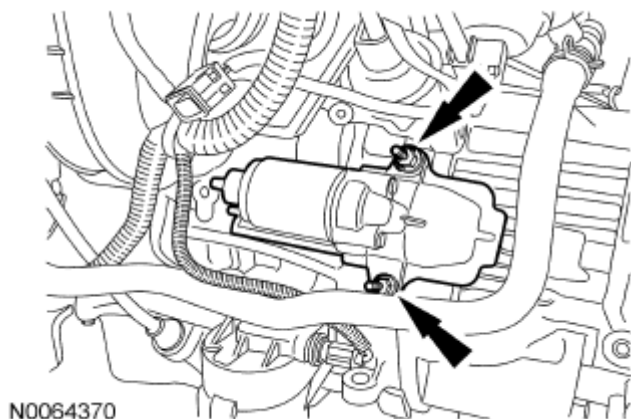


Fig. 274: Locating Starter Stud Bolts
Courtesy of FORD MOTOR CO.

50. Remove the starter motor isolator.

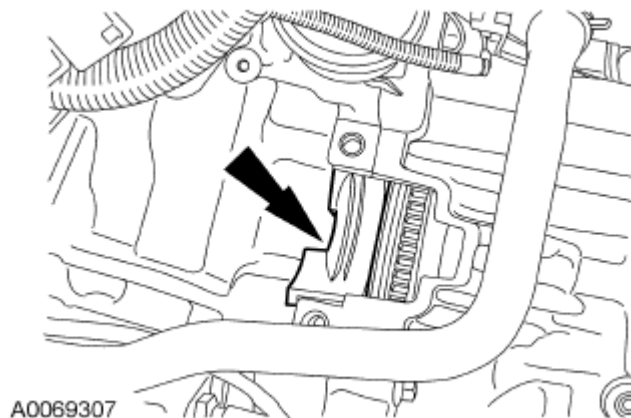


Fig. 275: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

51. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine and transaxle from the lift table.

NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.


52. Remove the remaining 5 engine-to-transaxle bolts and separate the engine and transaxle.

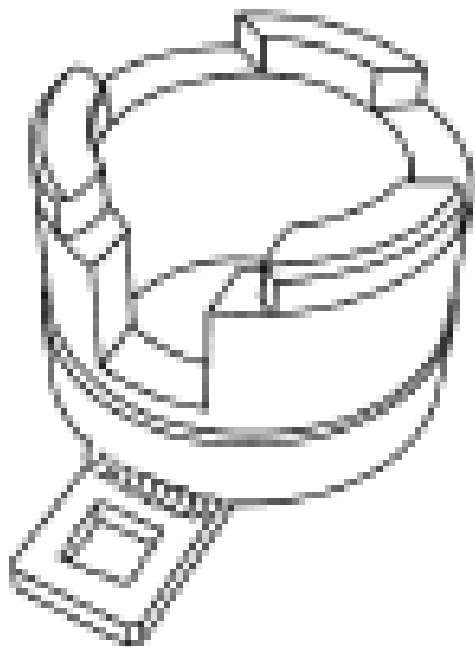
DISASSEMBLY AND ASSEMBLY

ENGINE

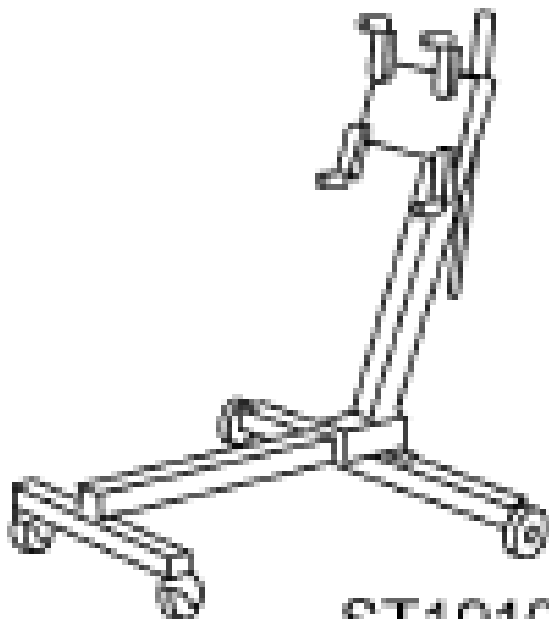
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|--|---|
|  ST2645-A | Alignment Plate, Camshaft 303-465 (T94P-6256-CH) |
| | Holding Tool, Crankshaft Damper 303-1416 |



ST3054-A

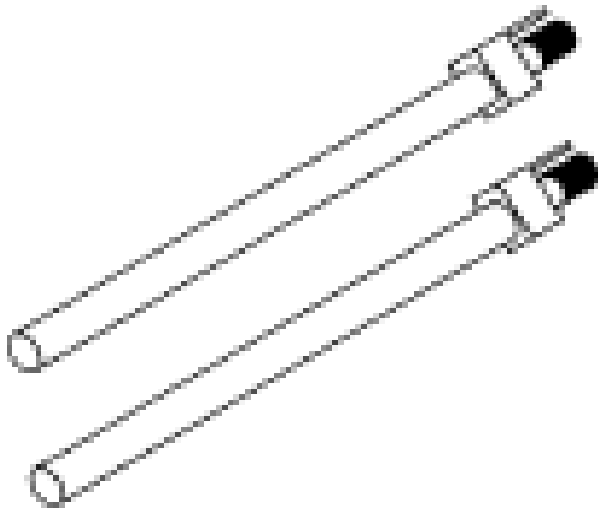


ST1910-A

Engine Stand
014-00232 or equivalent

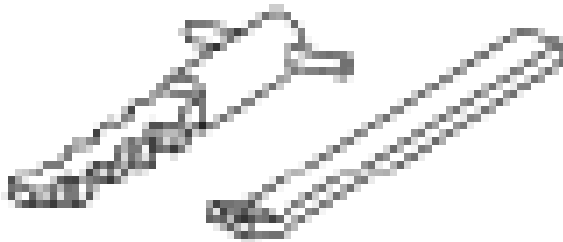
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1982-A

Installer, Connecting Rod
303-462 (T94P-6136-AH)



ST1385-A

Remover, Oil Seal
303-409 (T92C-6700-CH)

Timing Peg, Crankshaft TDC



303-507

- NOTE:** Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.
- 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, can cause engine failure.
- NOTE:** Due to the precision fit and timing of the balancer shaft assembly, it cannot be removed from the engine block.
- NOTE:** For additional information, refer to the exploded views under the Engine Assembly procedure.

Vehicles with manual transaxle

WARNING: The clutch disc and clutch pressure plate are heavy and may fall if not held when the bolts are removed. Failure to follow this

instruction may result in serious personal injury.

NOTE: Loosen the bolts evenly to prevent pressure plate damage.

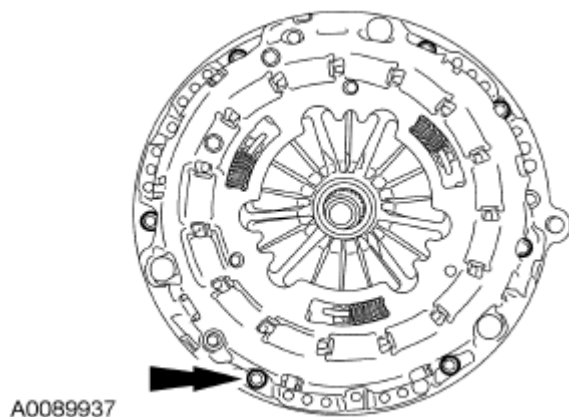


Fig. 276: Locating Clutch Pressure Plate Bolts
Courtesy of FORD MOTOR CO.

1. Remove the bolts, clutch pressure plate and clutch disc.
2. Remove the bolts and the flywheel.

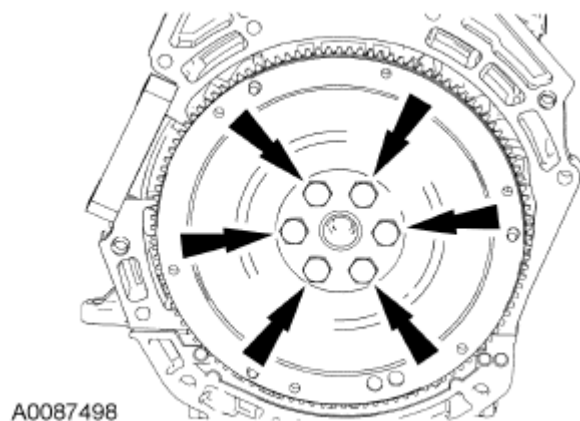


Fig. 277: Locating Flywheel Bolts
Courtesy of FORD MOTOR CO.

Vehicles with automatic transaxle

3. Remove the bolts and the flexplate.

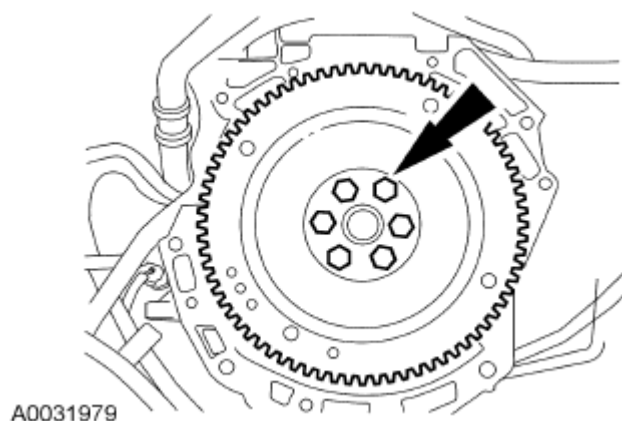


Fig. 278: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

All vehicles

4. Mount the engine on a suitable stand.
5. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
 - Detach the wiring harness-to-engine retainer.

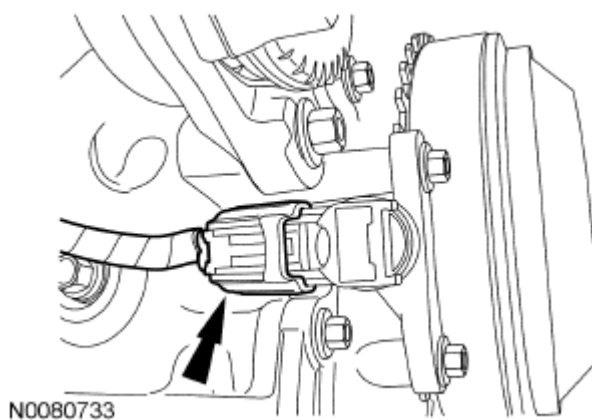


Fig. 279: Locating Crankshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

6. Disconnect the generator electrical connection and the 2 wiring harness retainers.

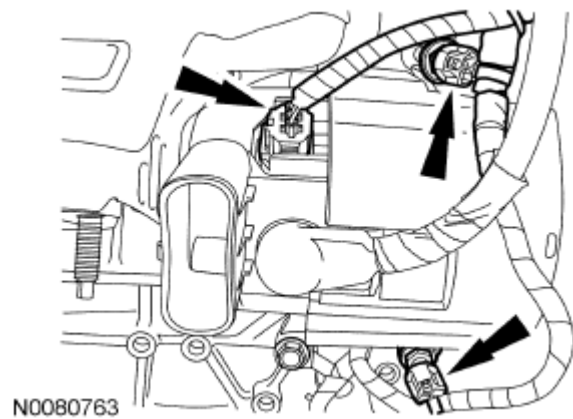


Fig. 280: Locating Generator Electrical Connection And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

7. Remove the nut and the generator wiring harness.



Fig. 281: Locating Nut And Generator Wiring Harness
Courtesy of FORD MOTOR CO.

8. Remove the 2 nuts, 1 bolt and the generator.

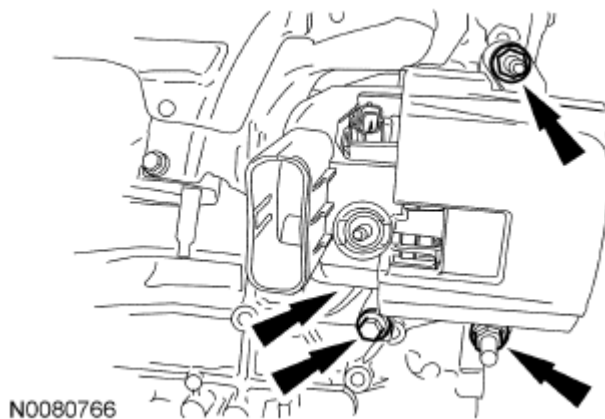


Fig. 282: Locating Nuts, Bolt And Generator
Courtesy of FORD MOTOR CO.

9. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.

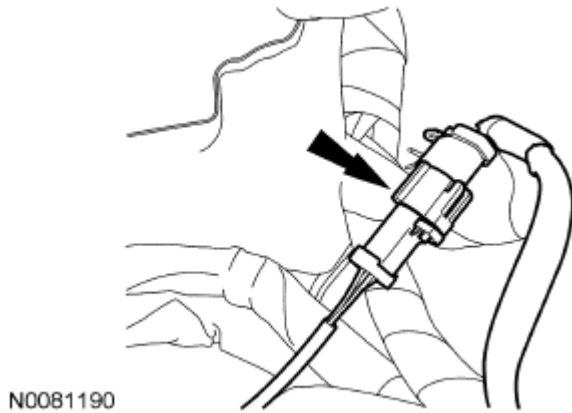


Fig. 283: Locating Heated Oxygen Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

10. Remove the 4 exhaust manifold heat shield bolts and the heat shield.

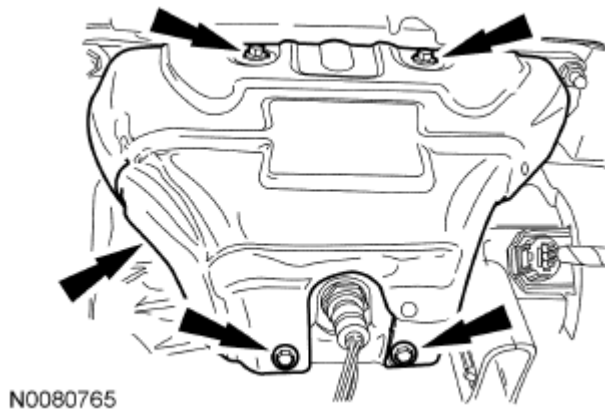


Fig. 284: Locating Exhaust Manifold Heat Shield Bolts And Heat Shield
Courtesy of FORD MOTOR CO.

11. Remove and discard the 7 exhaust manifold nuts.

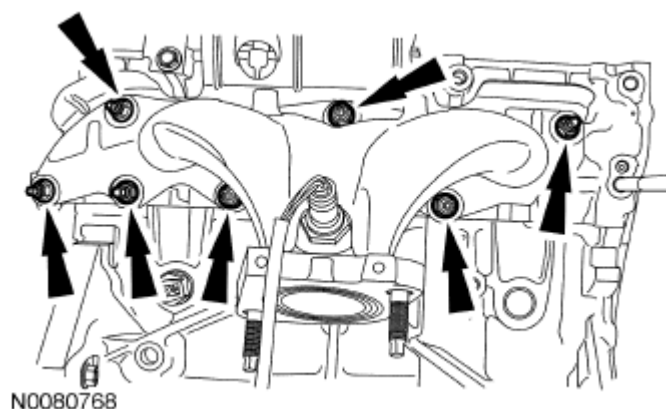


Fig. 285: Locating Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

12. Remove the exhaust manifold and discard the exhaust manifold gasket.
13. Remove and discard the 7 exhaust manifold studs.

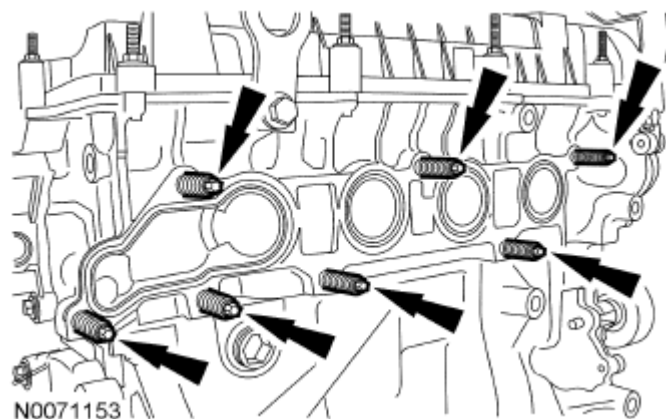
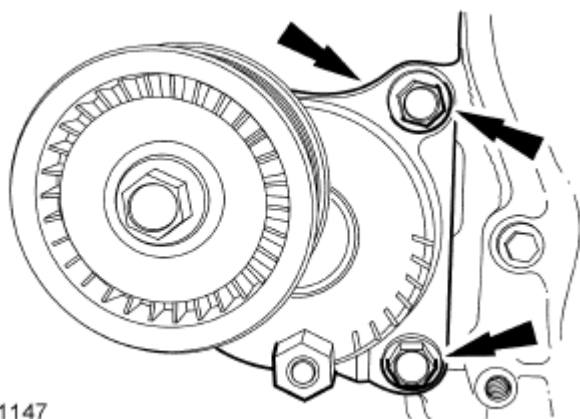


Fig. 286: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

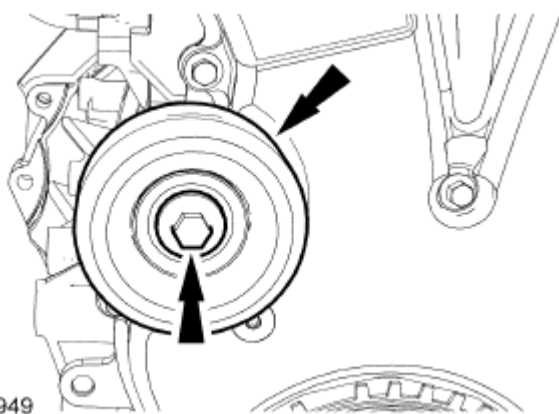
14. Clean and inspect the exhaust manifold. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
15. Remove the 2 bolts and the accessory drive belt tensioner.



N0081147

Fig. 287: Locating Bolts And Accessory Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

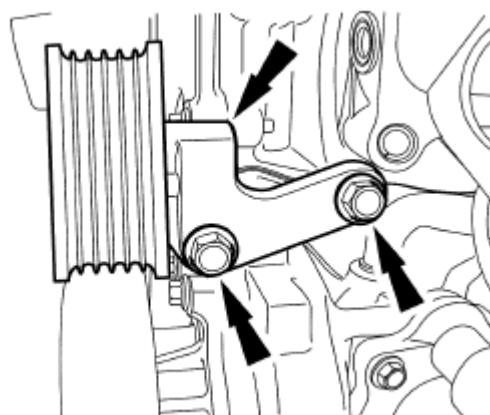
16. Loosen the bolt and remove the accessory drive belt idler pulley.



A0089949

Fig. 288: Locating Bolt And Accessory Drive Belt Idler Pulley
Courtesy of FORD MOTOR CO.

17. Remove the 2 bolts and the accessory drive belt idler pulley and bracket.



N0080526

Fig. 289: Locating Bolts And Accessory Drive Belt Idler Pulley Bracket
Courtesy of FORD MOTOR CO.

18. Remove the 3 bolts and the coolant pump pulley.

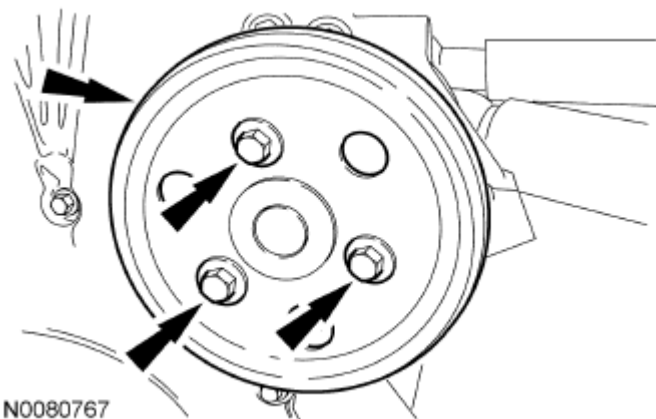


Fig. 290: Locating Bolts And Coolant Pump Pulley
Courtesy of FORD MOTOR CO.

19. Remove the bolts and the coolant pump.

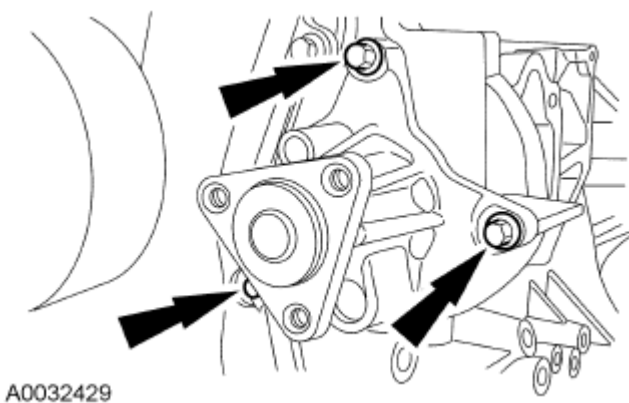


Fig. 291: Locating Bolts And Coolant Pump
Courtesy of FORD MOTOR CO.

20. Remove the 3 bolts and the thermostat housing assembly.

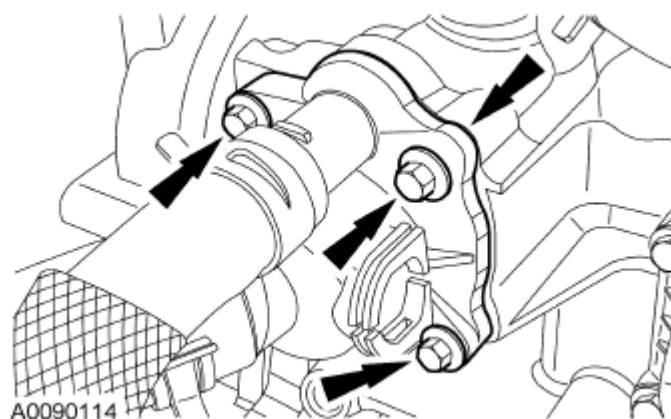


Fig. 292: Locating Bolts And Thermostat Housing Assembly
Courtesy of FORD MOTOR CO.

21. Remove the coolant tube retainer from the intake manifold.

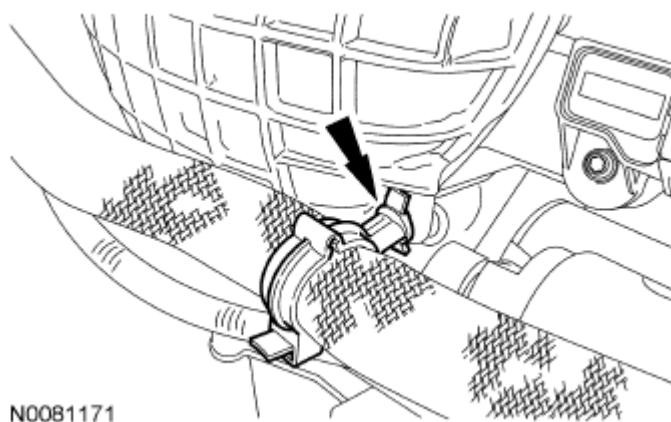


Fig. 293: Locating Coolant Tube Retainer
Courtesy of FORD MOTOR CO.

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

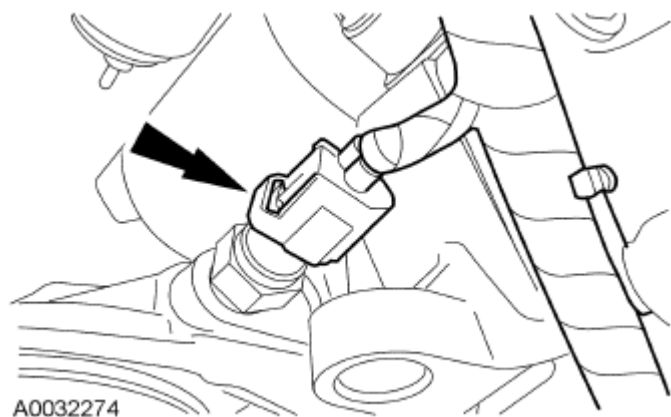


Fig. 294: Locating Engine Oil Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Spin on oil filter adapter shown, element oil filter adapter similar.

23. Remove the 4 bolts and the oil filter adapter.
- Discard the gasket.

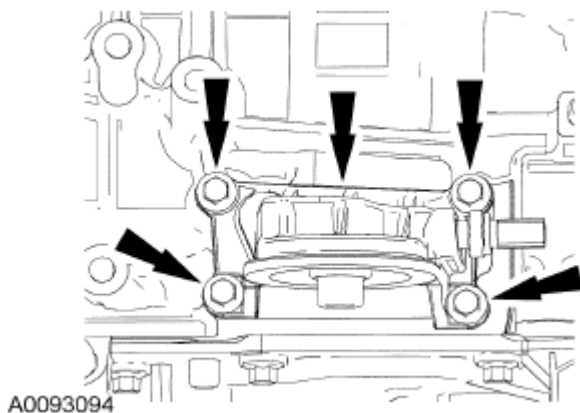


Fig. 295: Locating Bolts And Oil Filter Adapter
Courtesy of FORD MOTOR CO.

24. If equipped, remove the bolt and capacitor.

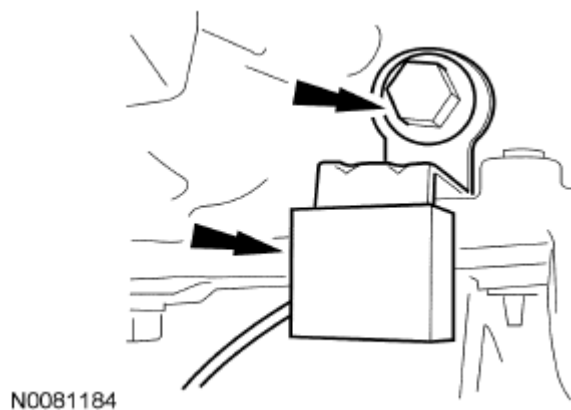


Fig. 296: Locating Bolt And Capacitor
Courtesy of FORD MOTOR CO.

25. Disconnect the Variable Camshaft Timing (VCT) electrical connector.

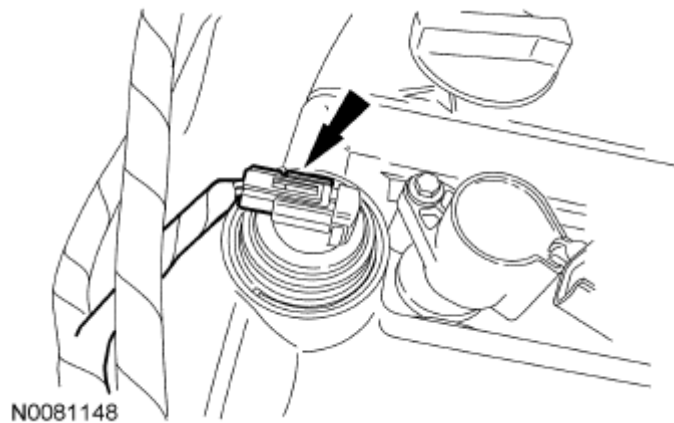


Fig. 297: Locating Variable Camshaft Timing Electrical Connector
Courtesy of FORD MOTOR CO.

26. Detach the wiring harness retainers from the RH side valve cover stud bolts.

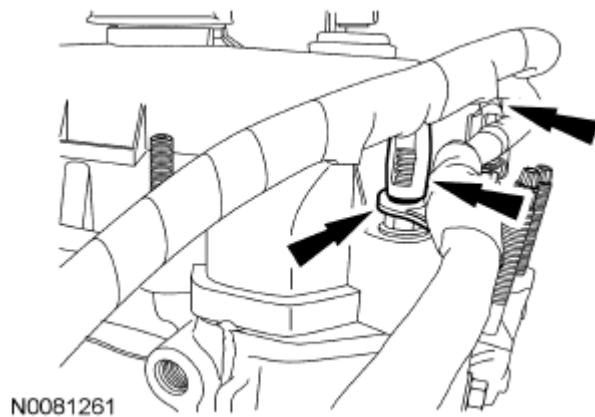


Fig. 298: Locating Wiring Harness Retainers And RH Side Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

27. Disconnect the crankcase vent hose from the valve cover.

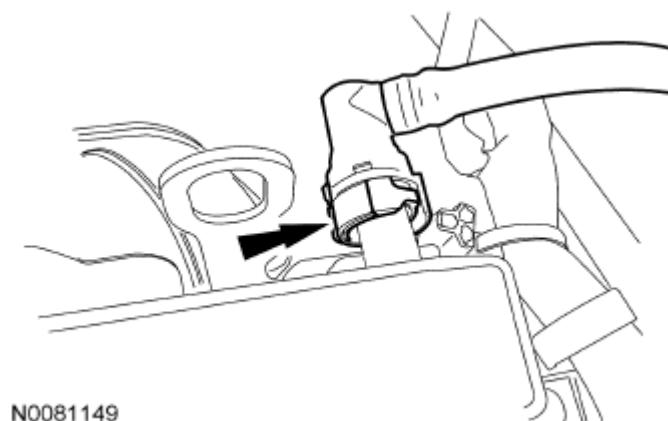


Fig. 299: Locating Crankcase Vent Hose
Courtesy of FORD MOTOR CO.

28. Detach the wiring harness retainers from the LH side valve cover stud bolts.

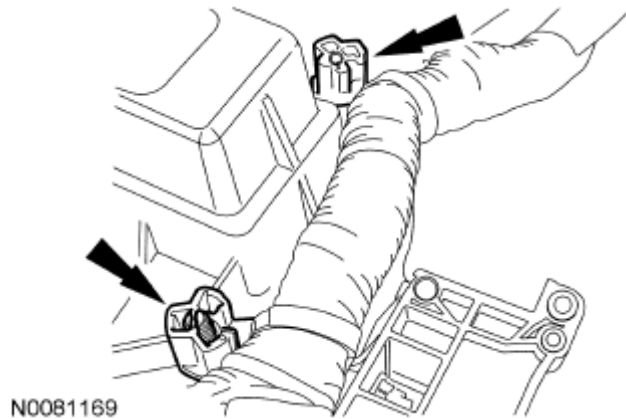


Fig. 300: Locating Wiring Harness Retainers And LH Side Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

29. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector.

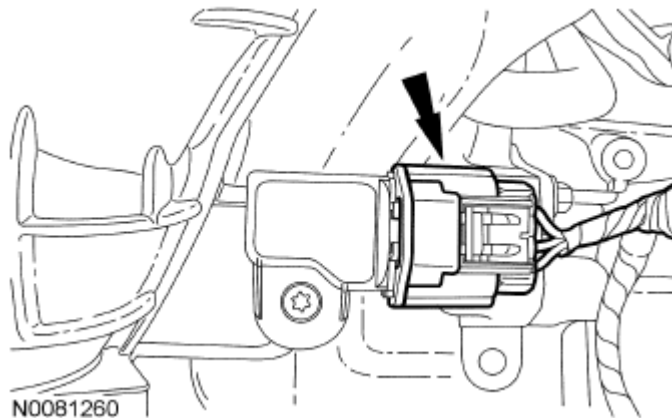


Fig. 301: Locating Manifold Absolute Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

30. Disconnect the electronic throttle control and Evaporative Emission (EVAP) canister purge valve electrical connectors.

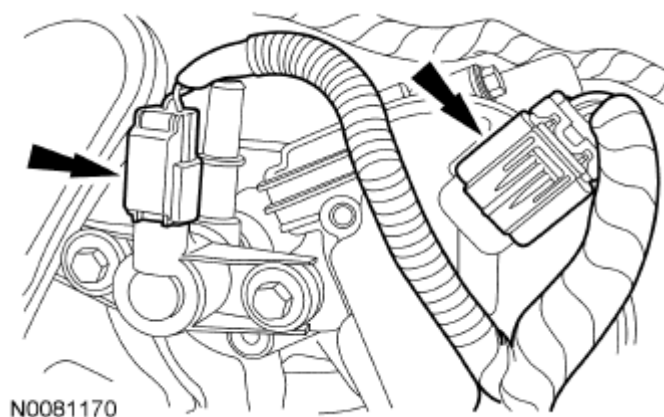


Fig. 302: Locating Electronic Throttle Control And Evaporative Emission Canister Purge Valve Electrical Connectors
Courtesy of FORD MOTOR CO.

31. Disconnect the EGR valve electrical connector.

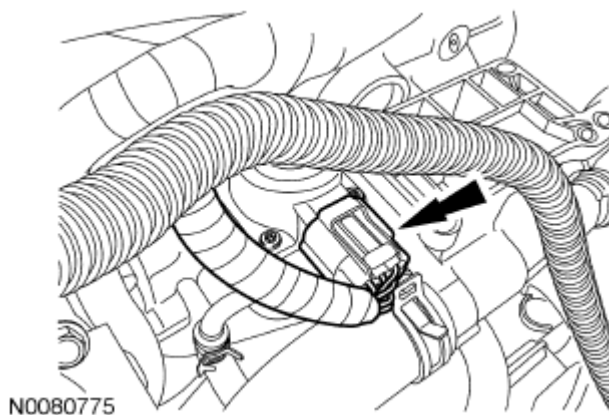


Fig. 303: Locating EGR Valve Electrical Connector
Courtesy of FORD MOTOR CO.

32. Disconnect the Knock Sensor (KS) and detach the 2 wiring harness retainers.

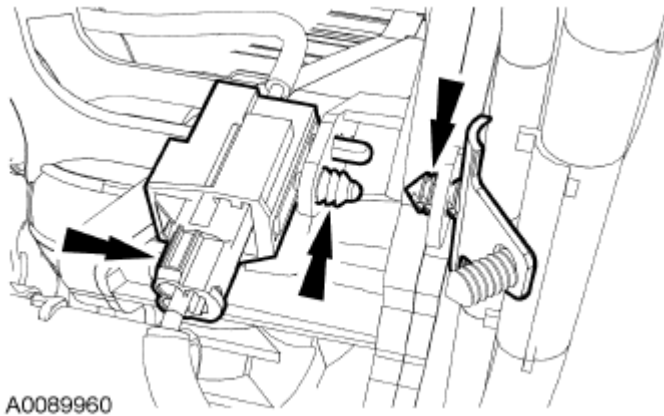


Fig. 304: Locating Knock Sensor And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

33. Detach all the wiring harness retainers from the intake manifold.
34. Disconnect the 4 coil-on-plugs and Camshaft Position (CMP) sensor electrical connectors.

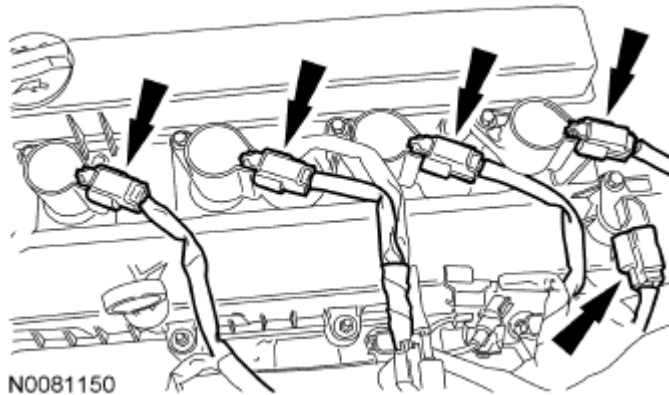
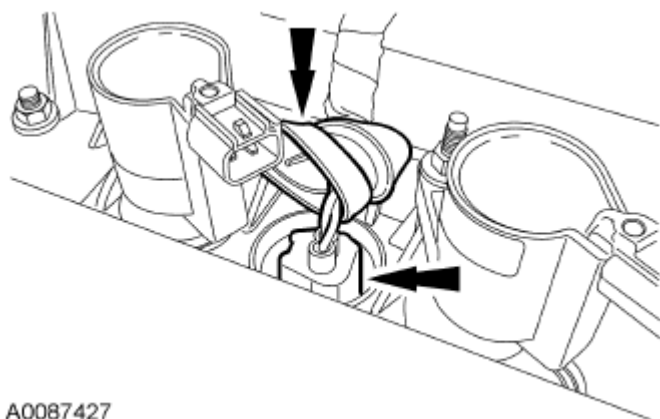


Fig. 305: Locating Coil-On-Plugs And Camshaft Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

35. Position the rubber boot aside and disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.

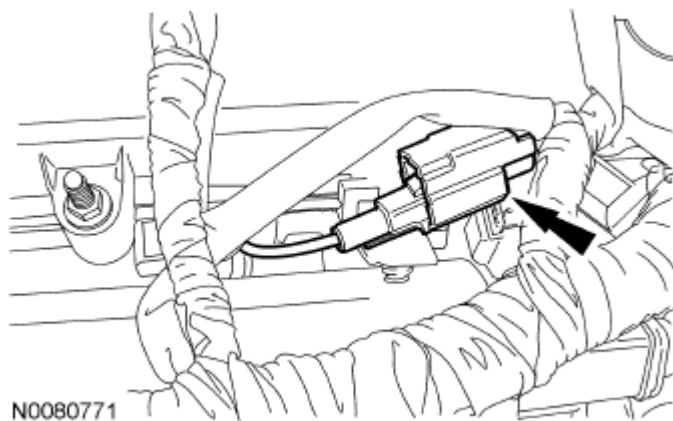


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Fig. 306: Locating Rubber Boot Aside And Cylinder Head Temperature Sensor Electrical Connector

Courtesy of FORD MOTOR CO.

36. Disconnect the radio capacitor electrical connector.



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Fig. 307: Locating Radio Capacitor Electrical Connector

Courtesy of FORD MOTOR CO.

37. Disconnect the 4 fuel injector electrical connectors.
- Detach the 2 wiring harness retainers and remove the wiring harness assembly.

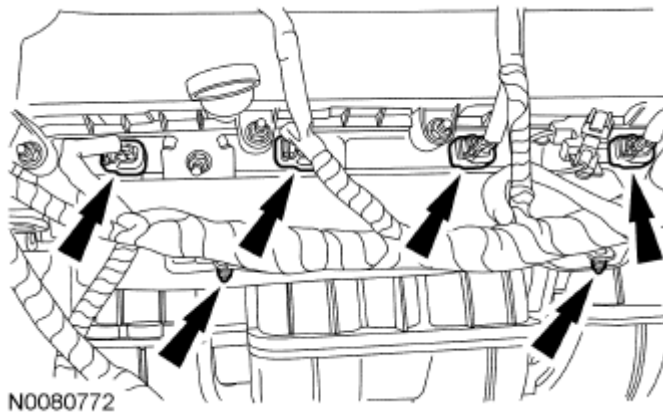


Fig. 308: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

38. Remove the fuel rail insulator.

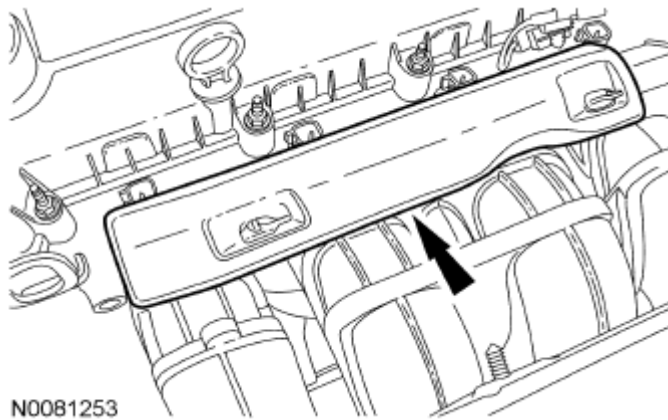


Fig. 309: Locating Fuel Rail Insulator
Courtesy of FORD MOTOR CO.

39. Remove the nut and the radio capacitor.

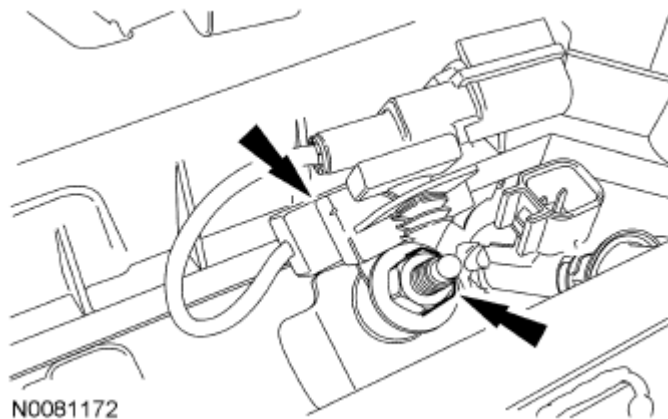


Fig. 310: Locating Nut And Radio Capacitor
Courtesy of FORD MOTOR CO.

40. Remove the 2 stud bolts, fuel rail and fuel injectors as an assembly.

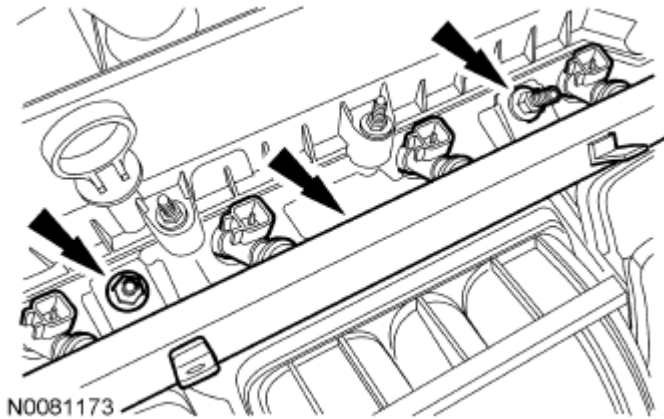


Fig. 311: Locating Stud Bolts, Fuel Rail And Fuel Injectors
Courtesy of FORD MOTOR CO.

41. Remove the 8 bolts (3 shown) and position the intake manifold aside.

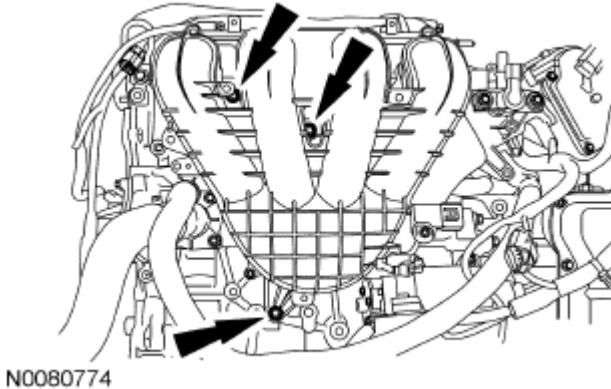


Fig. 312: Locating Bolts And Intake Manifold
Courtesy of FORD MOTOR CO.

NOTE: If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.

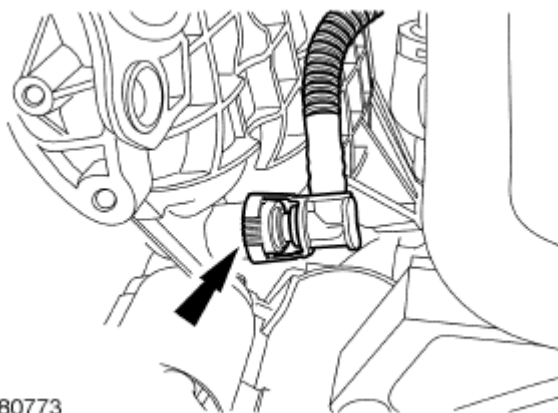


Fig. 313: Locating Crankcase Vent Oil Separator Tube
Courtesy of FORD MOTOR CO.

42. Squeeze the 2 crankcase vent oil separator tube tabs and disconnect the tube from the intake manifold.
43. Remove the EGR tube.

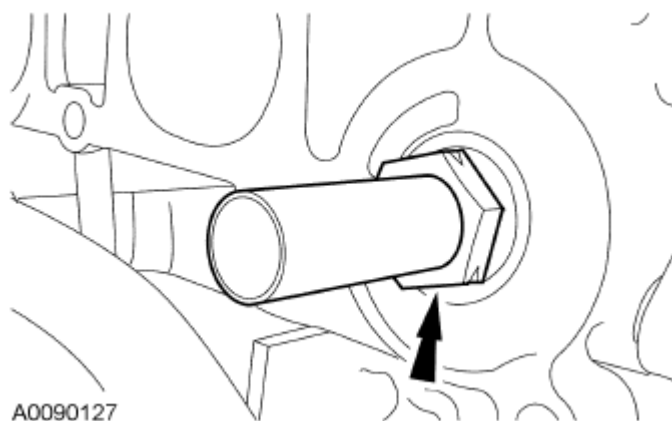


Fig. 314: Identifying EGR Tube
Courtesy of FORD MOTOR CO.

44. Disconnect the coolant hose.

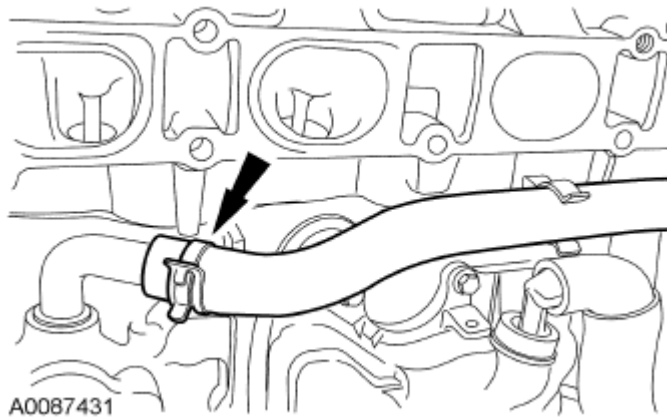


Fig. 315: Locating Coolant Hose
Courtesy of FORD MOTOR CO.

45. Disconnect and remove the coolant hose.

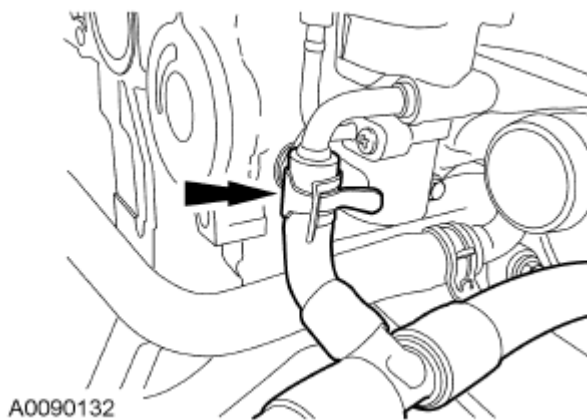


Fig. 316: Locating Coolant Hose
Courtesy of FORD MOTOR CO.

46. Disconnect and remove 2 the coolant hoses.

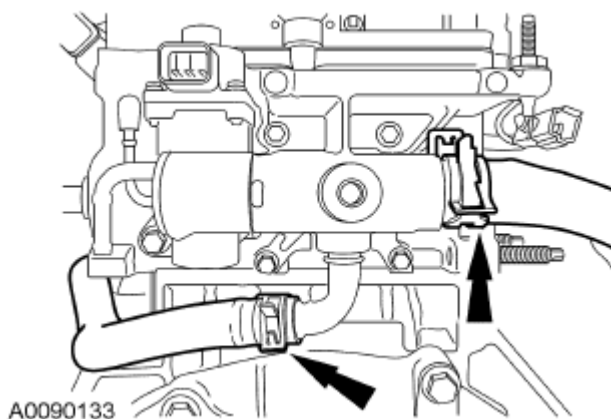


Fig. 317: Locating Coolant Hoses
Courtesy of FORD MOTOR CO.

47. Remove the bolt and the KS.

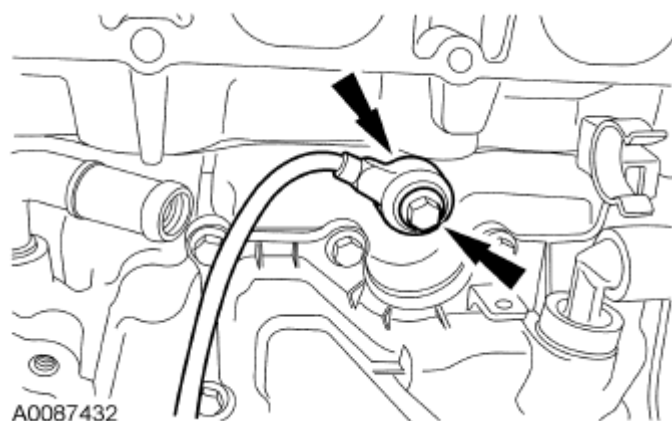


Fig. 318: Locating Bolt And KS
Courtesy of FORD MOTOR CO.

48. Remove the 8 bolts and the crankcase vent oil separator.

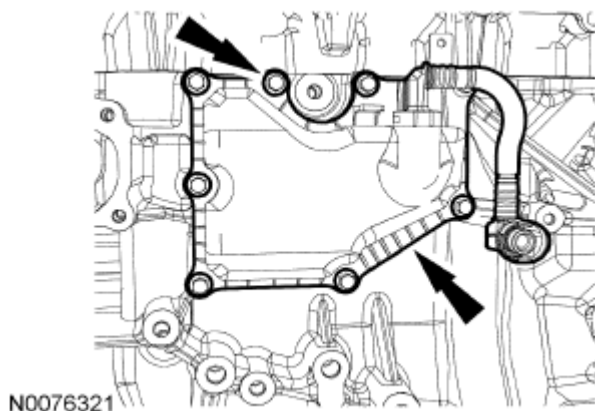


Fig. 319: Locating Bolts And Crankcase Vent Oil Separator
Courtesy of FORD MOTOR CO.

49. If equipped, remove the block heater.

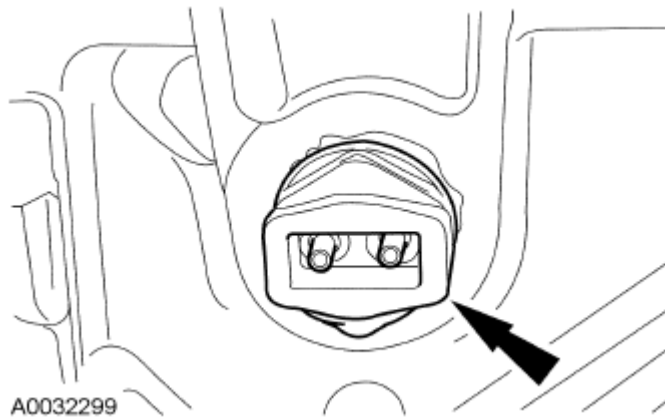


Fig. 320: Locating Block Heater
Courtesy of FORD MOTOR CO.

50. Remove the oil level indicator.

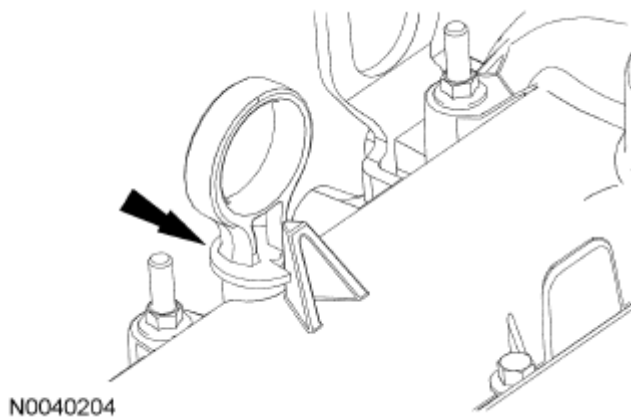
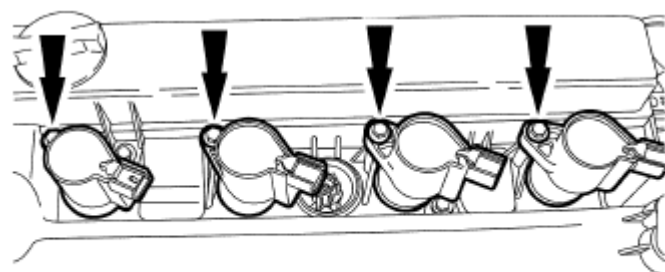


Fig. 321: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

NOTE: When removing the ignition coil-on-plugs, a slight twisting motion will break the seal and ease removal.



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Fig. 322: Locating Bolts And Coil-On-Plugs
Courtesy of FORD MOTOR CO.

51. Remove the 4 bolts and the 4 coil-on-plugs.

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

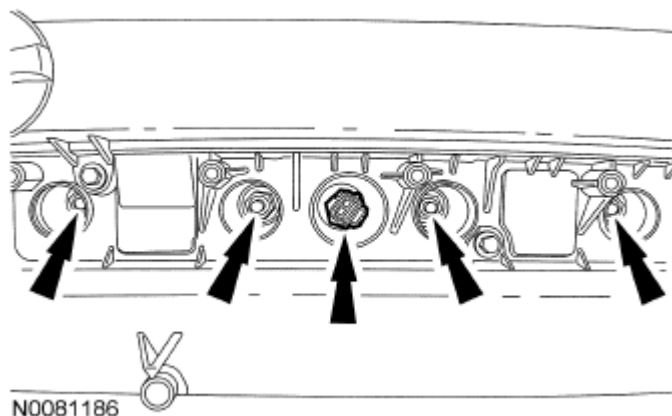


Fig. 323: Locating Spark Plugs And CHT Sensor
Courtesy of FORD MOTOR CO.

52. Remove the spark plugs and the CHT sensor.
53. Remove the 12 retainers and the valve cover.

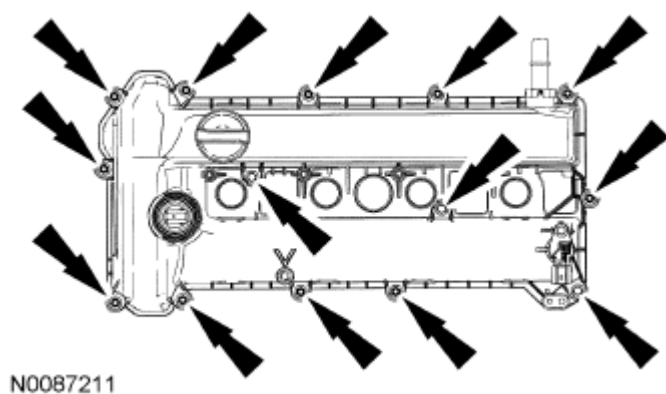


Fig. 324: Locating Retainers And Valve Cover
Courtesy of FORD MOTOR CO.

54. Remove the bolts and the CKP sensor.

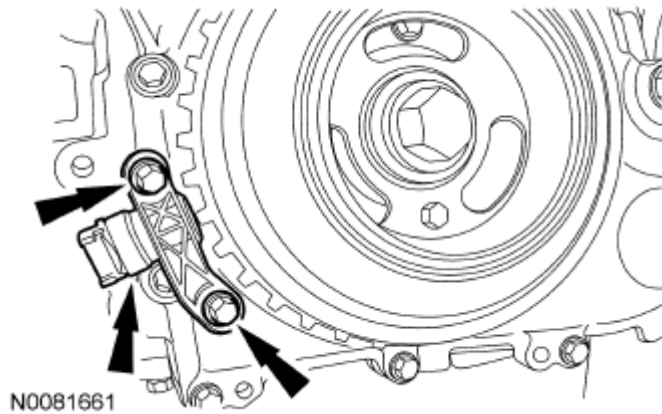


Fig. 325: Locating CKP Sensor And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

55. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

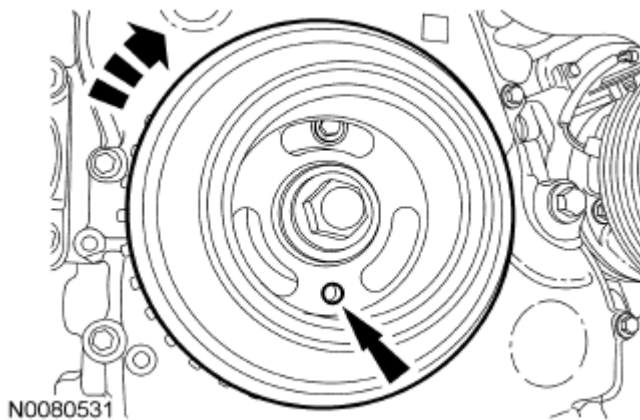


Fig. 326: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

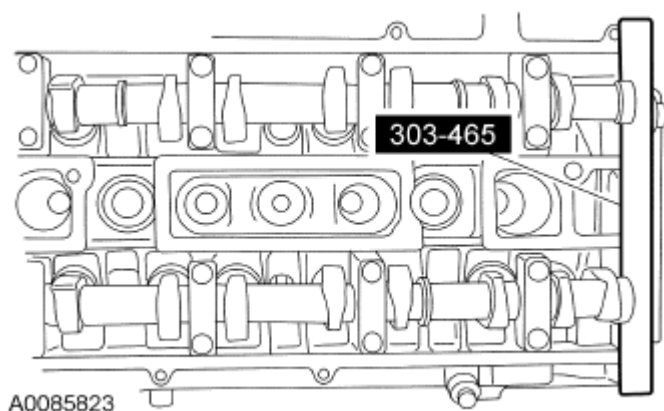


Fig. 327: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

56. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.
57. Remove the engine plug bolt.

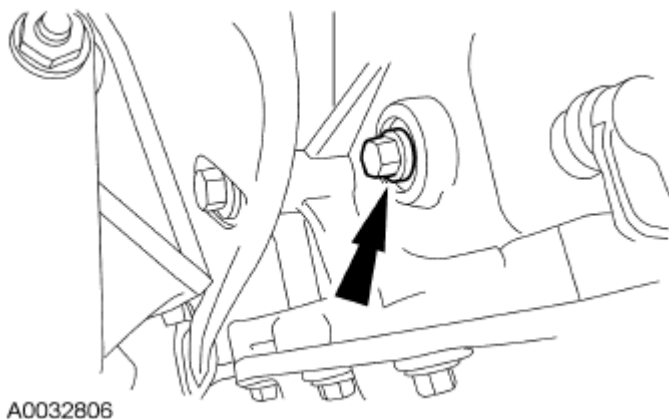


Fig. 328: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during disassembly.

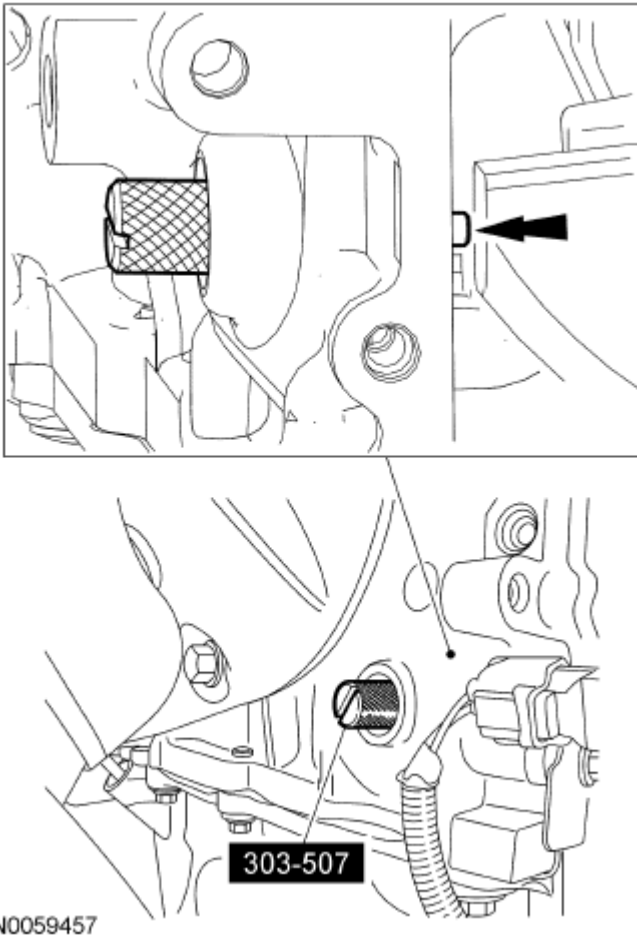


Fig. 329: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

58. Install the Crankshaft TDC Timing Peg.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during removal of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be removed using an air impact wrench (1/2-in drive minimum).

NOTE: The crankshaft sprocket diamond washer may come off with the crankshaft pulley. The diamond washer must be replaced. Remove and discard the diamond washer. If the diamond washer is not installed, engine damage may occur.

59. Use the Crankshaft Damper Holding Tool and a suitable 1/2-in drive hand tool to hold the crankshaft pulley. Use an air impact wrench to remove the crankshaft pulley bolt.

- Remove and discard the crankshaft pulley bolt and washer.

- Remove the crankshaft pulley.
- Remove the diamond washer and discard.

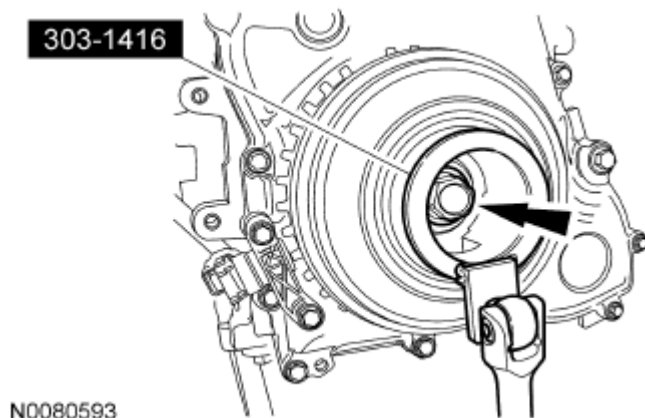


Fig. 330: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

NOTE: Use care not to damage the engine front cover or the crankshaft when removing the seal.

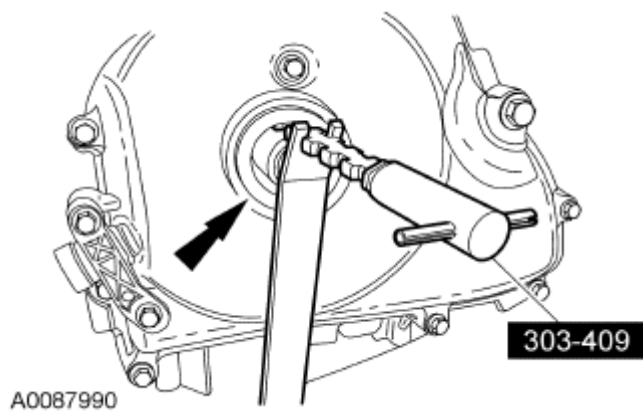
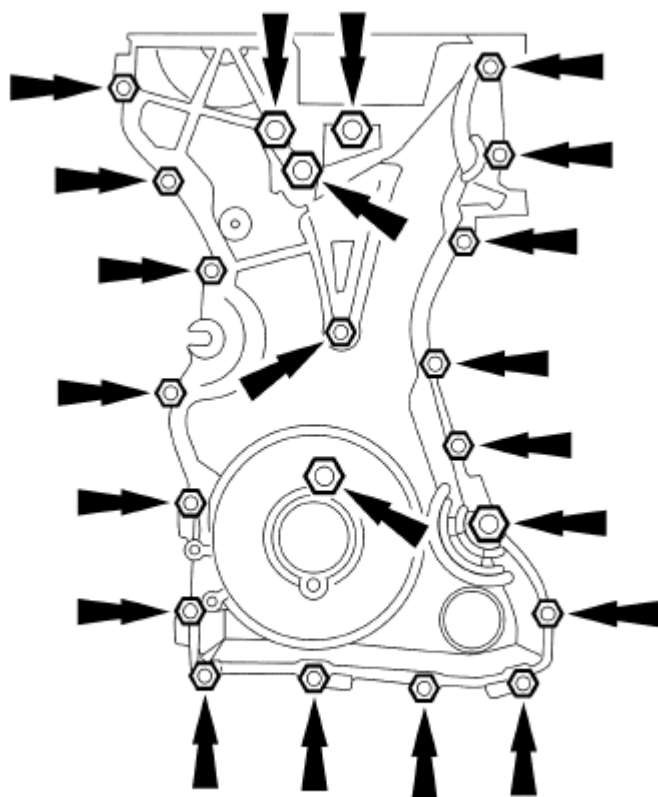


Fig. 331: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

60. Using the Oil Seal Remover, remove the crankshaft front oil seal.
61. Remove the 22 bolts and the engine front cover.



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Fig. 332: Locating Engine Front Cover Bolts And Stud Bolt
Courtesy of FORD MOTOR CO.

62. Compress the timing chain tensioner in the following sequence.
1. Using a small pick, release and hold the ratchet mechanism.
 2. While holding the ratchet mechanism in the released position, compress the tensioner by pushing the timing chain arm toward the tensioner.
 3. Insert a paper clip into the hole to retain the tensioner.

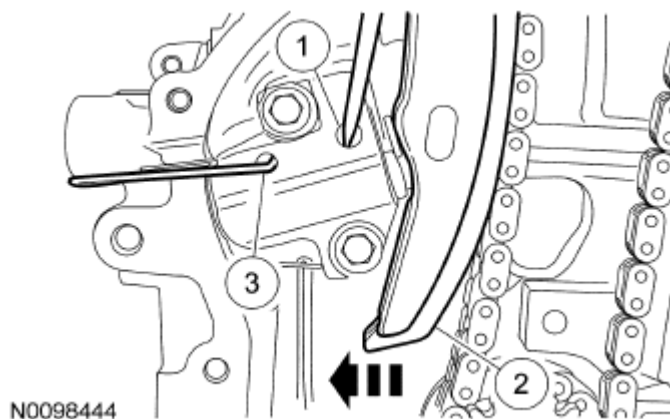


Fig. 333: Identifying Timing Chain Tensioner Compress Sequence
Courtesy of FORD MOTOR CO.

63. Remove the 2 bolts and the timing chain tensioner.

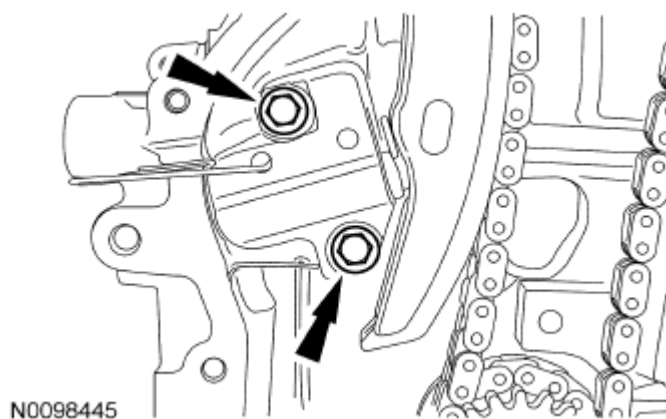


Fig. 334: Locating Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

64. Remove the RH timing chain guide.

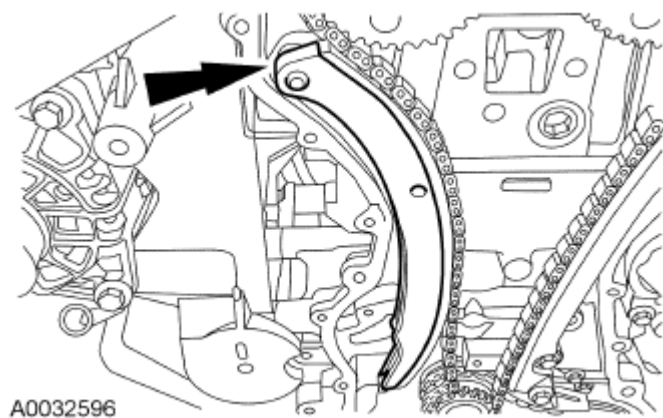


Fig. 335: Locating RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

65. Remove the timing chain.

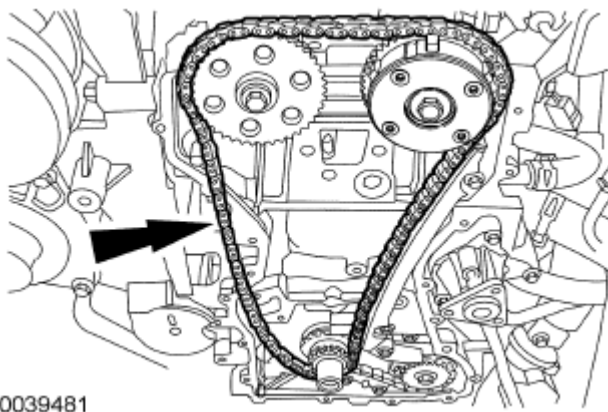


Fig. 336: Locating Timing Chain
Courtesy of FORD MOTOR CO.

66. Remove the bolts and the LH timing chain guide.

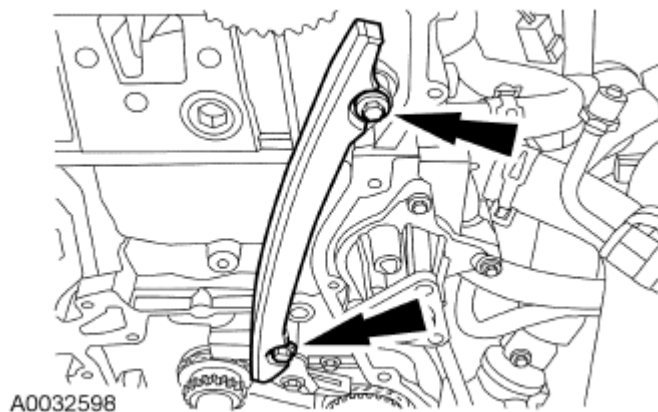


Fig. 337: Locating Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

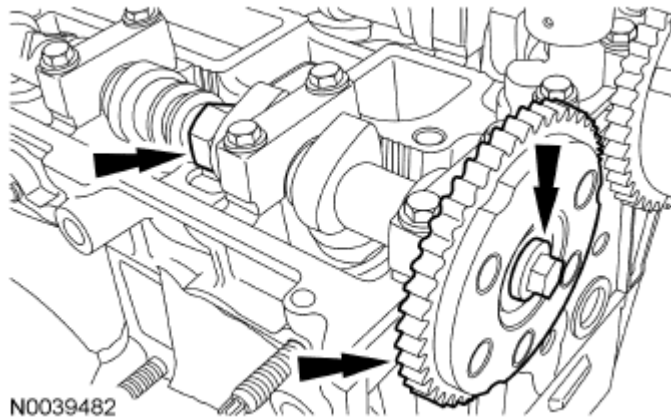


Fig. 338: Locating Flats On Camshaft, Bolt And Exhaust Camshaft Sprocket
Courtesy of FORD MOTOR CO.

67. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

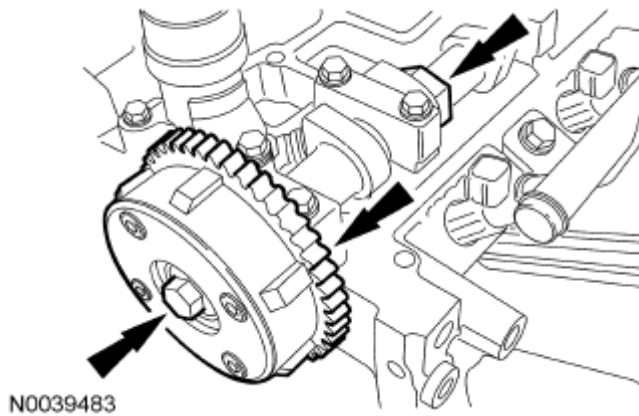


Fig. 339: Locating Flats On Camshaft, Bolt And Camshaft Phaser And Sprocket
Courtesy of FORD MOTOR CO.

68. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the camshaft phaser and sprocket.
69. Remove the oil pump drive chain tensioner.
 1. Release the tension on the tensioner spring
 2. Remove the tensioner and the 2 shoulder bolts.

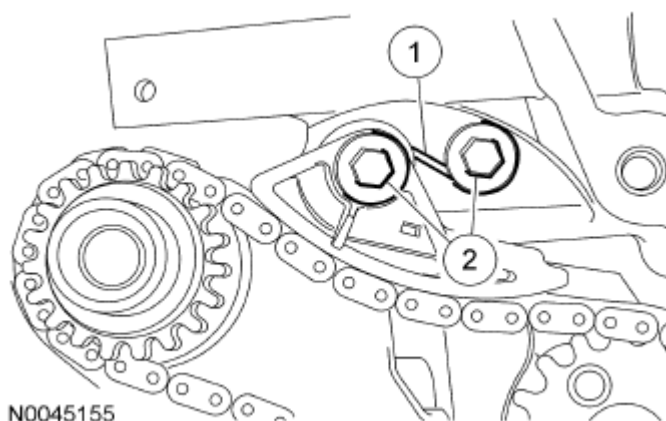


Fig. 340: Locating Oil Pump Drive Chain Tensioner Shoulder Bolts
Courtesy of FORD MOTOR CO.

NOTE: Remove and discard the crankshaft sprocket diamond washer located behind the crankshaft sprocket.

NOTE: The oil pump chain sprocket must be held in place.

70. Remove the oil pump chain and sprockets.

1. Remove the bolt.
2. Remove the chain and sprockets.

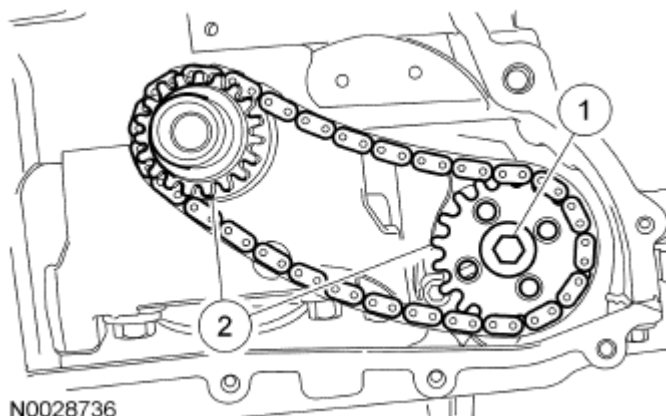


Fig. 341: Identifying Bolt And Sprockets
Courtesy of FORD MOTOR CO.

71. Mark the position of the camshaft lobes on the No. 1 cylinder for assembly reference.

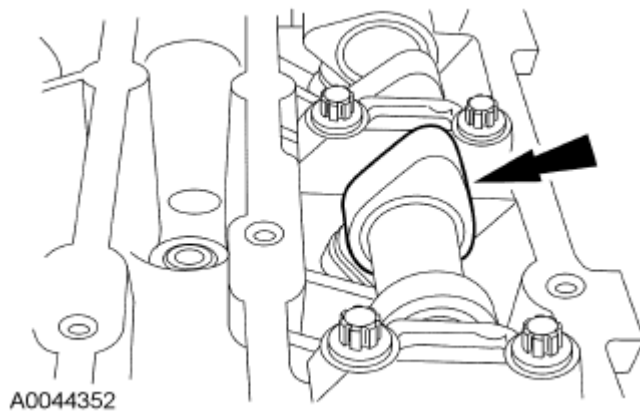


Fig. 342: Locating Camshaft Lobes
Courtesy of FORD MOTOR CO.

72. Remove the bolt and the VCT solenoid.

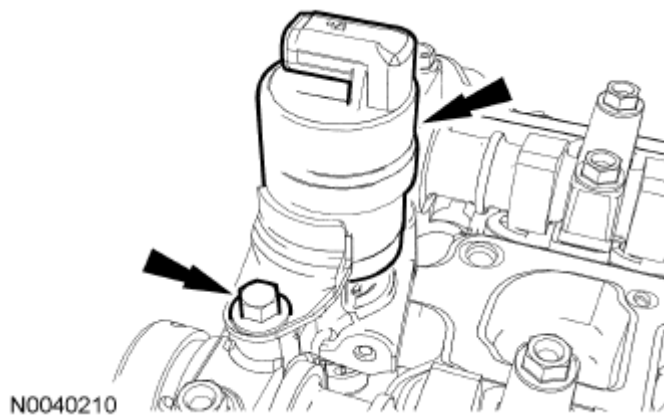


Fig. 343: Locating Bolt And VCT Solenoid
Courtesy of FORD MOTOR CO.

73. Remove the plug and the VCT system oil filter from the intake camshaft thrust cap.

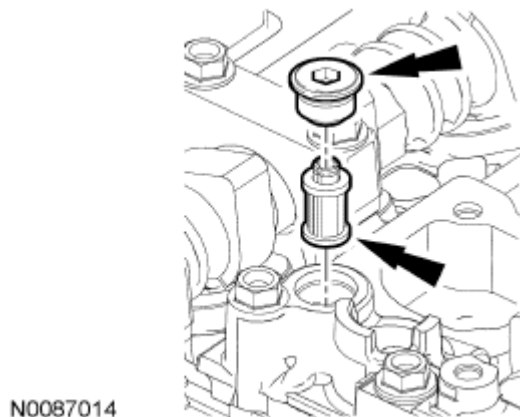


Fig. 344: Locating Plug And VCT System Oil Filter
Courtesy of FORD MOTOR CO.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

74. Remove the camshafts from the engine.

- Loosen the camshaft bearing bolts in the sequence shown, one turn at a time. Repeat until all the tension is released.
- Remove the camshaft bearing caps.
- Remove the camshafts.

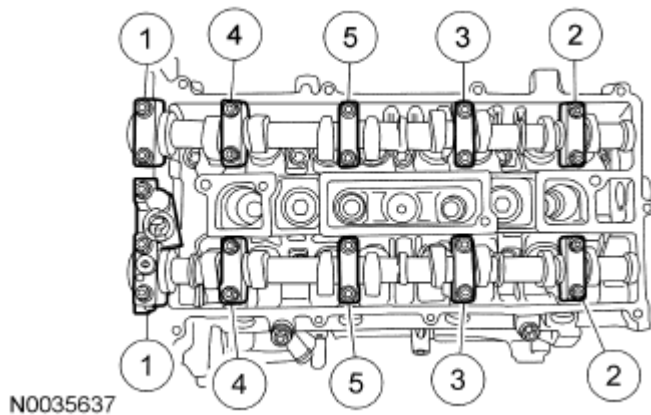


Fig. 345: Identifying Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

75. Remove the cylinder head.

- Remove and discard the cylinder head bolts.
- Remove the cylinder head.
- Remove and discard the cylinder head gasket.

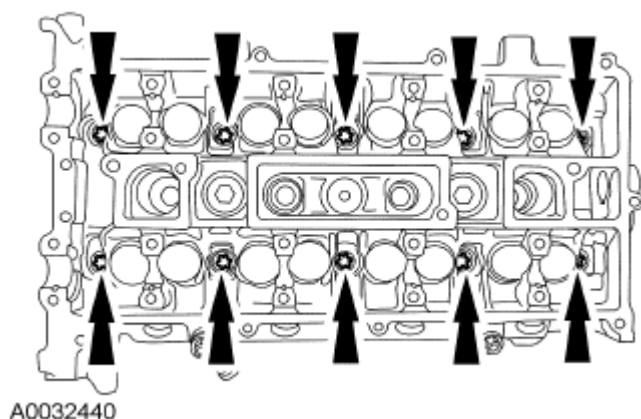


Fig. 346: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

76. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION** .
77. Remove the cylinder head alignment dowels.

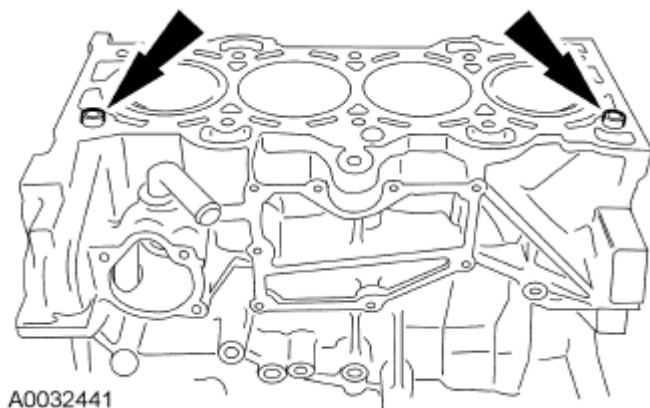
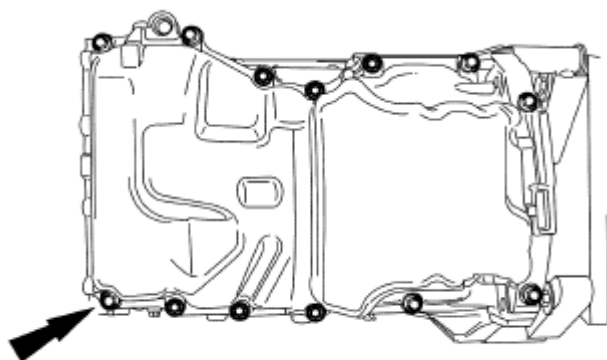


Fig. 347: Locating Cylinder Head Alignment Dowels
Courtesy of FORD MOTOR CO.

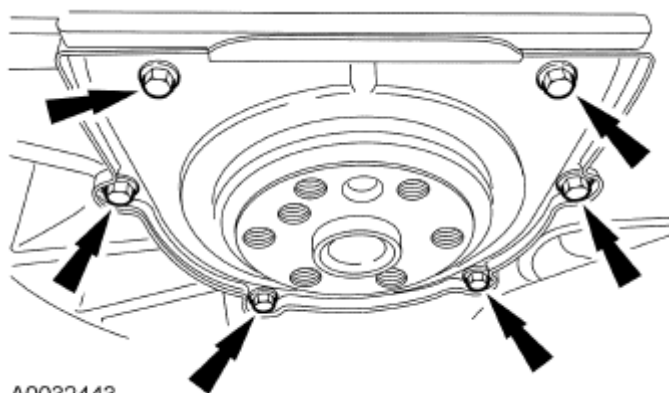
78. Remove the bolts and the oil pan.



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Fig. 348: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

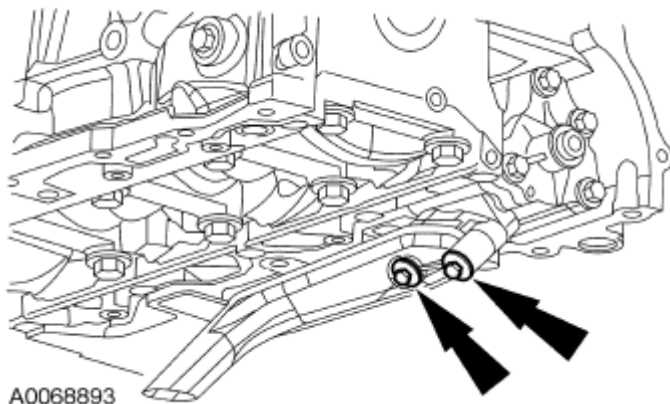
79. Remove the bolts and the rear crankshaft seal.



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Fig. 349: Locating Bolts And Rear Crankshaft Seal
Courtesy of FORD MOTOR CO.

80. Remove the bolts, oil pump pickup tube and gasket.
- Discard the gasket.



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Fig. 350: Locating Oil Pump Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

81. Remove the bolts and the oil pump.

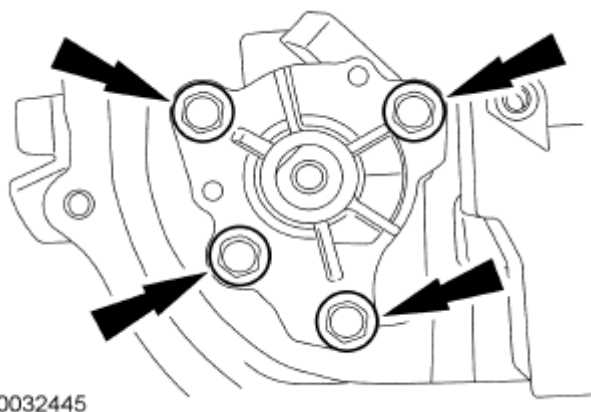


Fig. 351: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

82. Make sure the Crankshaft TDC Timing Peg is still installed and the engine is still at TDC.
- Rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg.

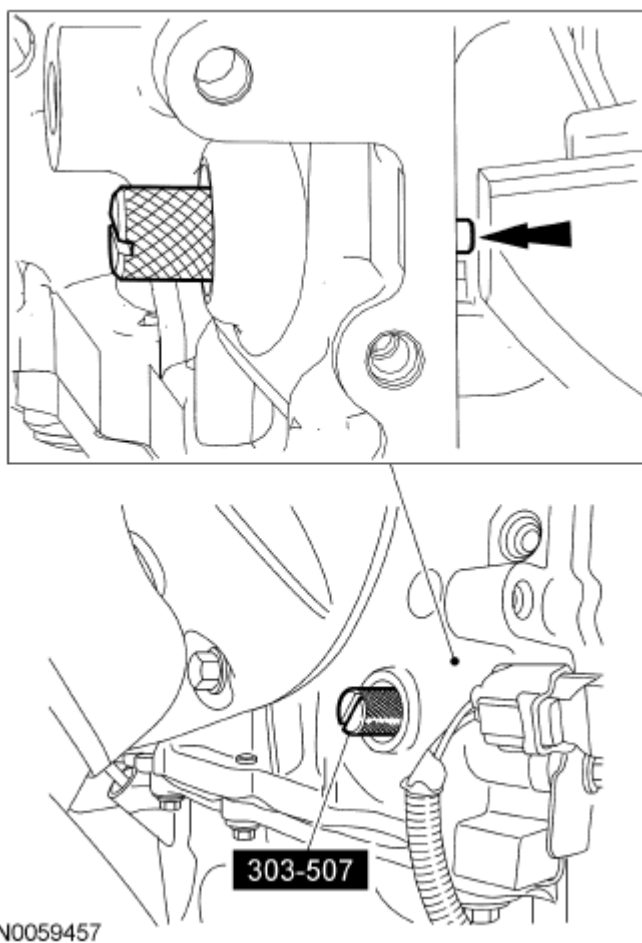


Fig. 352: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

83. Mark the balancer unit front shafts on the top for reference that the balancer unit is at TDC.

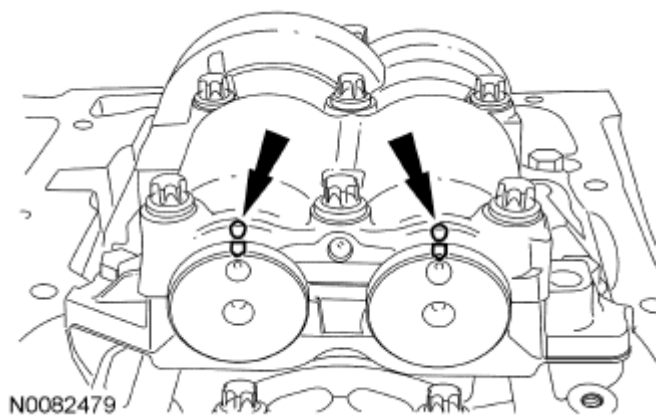


Fig. 353: Locating Balancer Unit Shaft Marks At TDC Position
Courtesy of FORD MOTOR CO.

NOTE: Due to the precision interior construction of the balancer unit, it should not be disassembled.

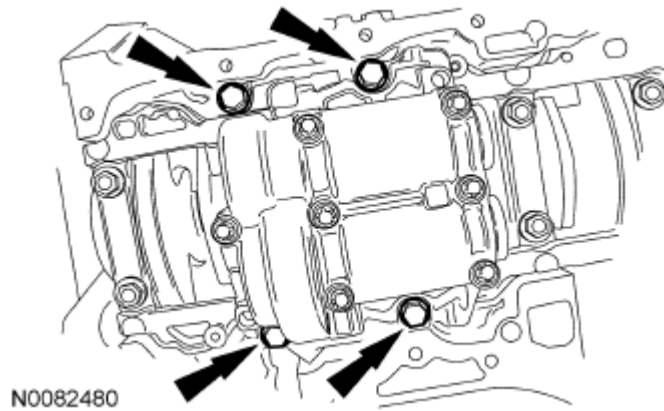


Fig. 354: Locating Balancer Unit Bolts
Courtesy of FORD MOTOR CO.

84. Remove the 4 bolts and the balancer unit.
85. Remove the Crankshaft TDC Timing Peg.

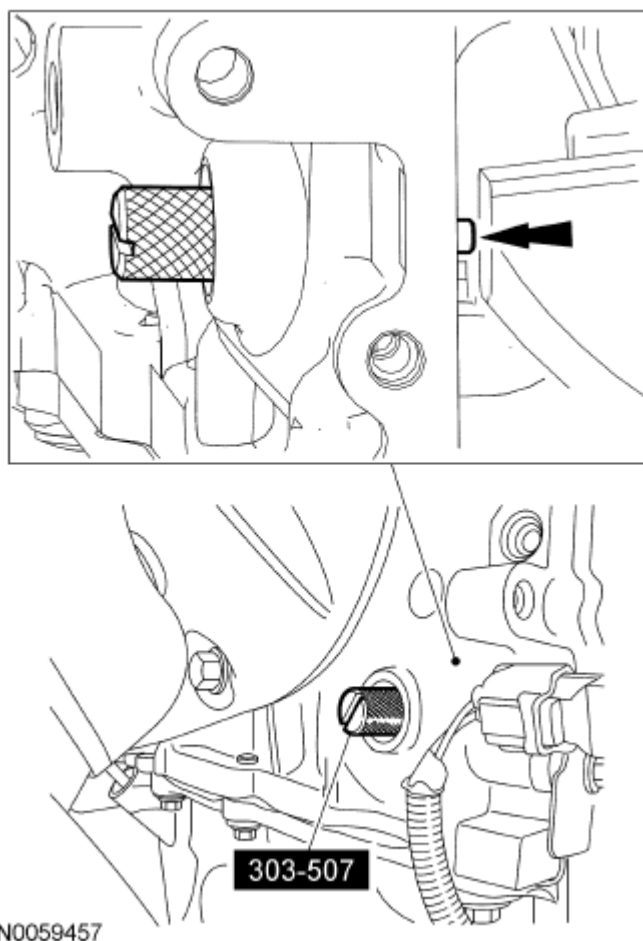


Fig. 355: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

86. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following manufacturer's instructions.

NOTE: Clearly mark the connecting rods, connecting rod caps and connecting rod bearings in numerical order for correct orientation for reassembly.

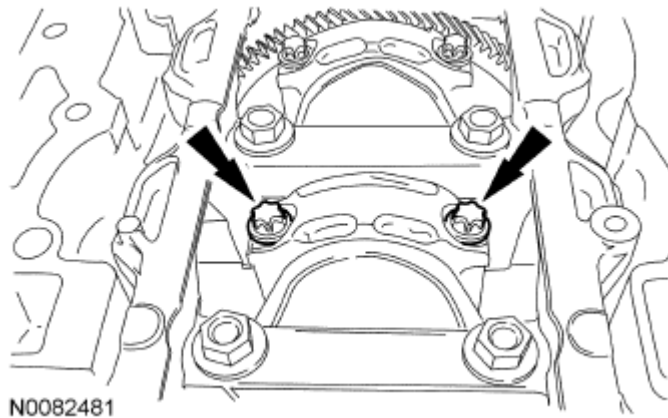


Fig. 356: Locating Connecting Rod Cap Bolts
Courtesy of FORD MOTOR CO.

87. Remove the connecting rod cap bolts and cap.

NOTE: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.

88. Using the Connecting Rod Installer, remove the piston/rod assembly from the engine block.

- Repeat the previous 2 steps until all the piston/rod assemblies are removed from the engine block.

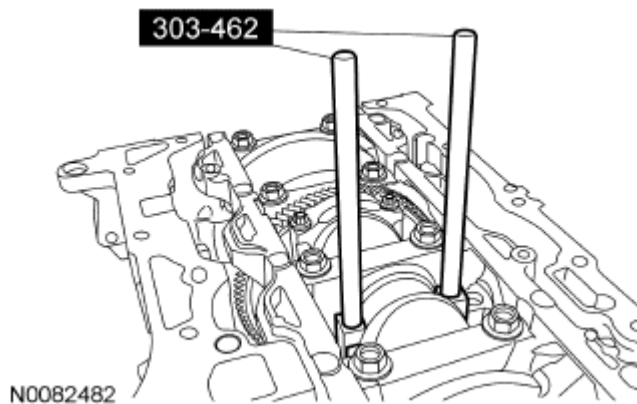


Fig. 357: Identifying Connecting Rod Installer
Courtesy of FORD MOTOR CO.

89. Remove the bolts in the sequence shown.

- Remove the main bearing beam.
- Discard the bolts.

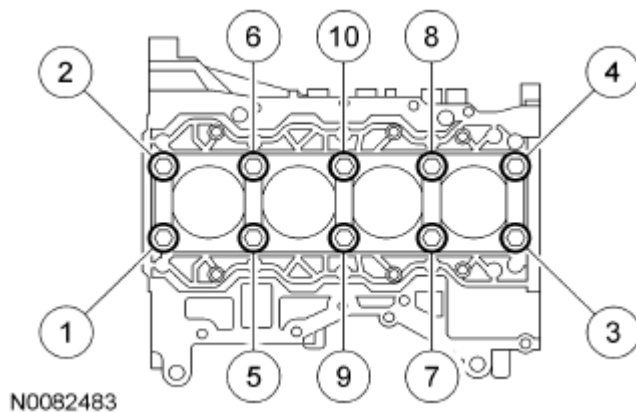


Fig. 358: Locating Main Bearing Bolts Removal Sequence
Courtesy of FORD MOTOR CO.

90. Remove the crankshaft from the engine block.

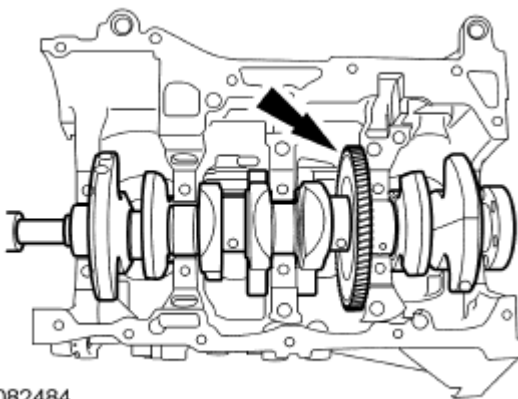


Fig. 359: Locating Crankshaft
Courtesy of FORD MOTOR CO.

NOTE: If the main bearings are being reused, mark them in order for correct orientation and reassembly.

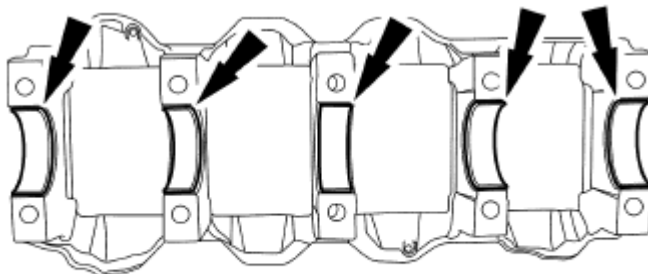


Fig. 360: Locating Main Bearings

Courtesy of FORD MOTOR CO.

91. Remove the main bearings from the main bearing beam.

NOTE: If the main bearings are being reused, mark them in order for correct orientation and reassembly.

NOTE: The center bulkhead has the thrust bearing.

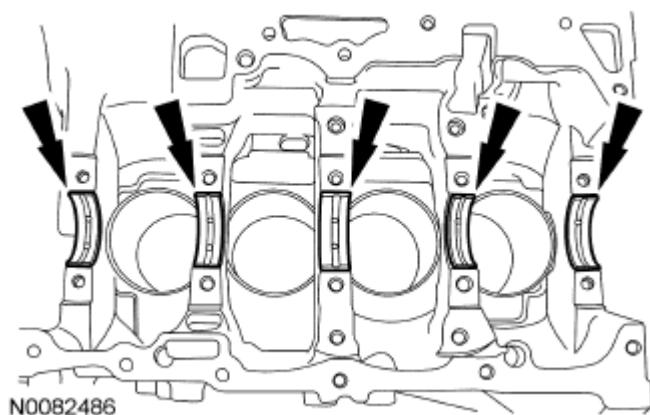


Fig. 361: Locating Main Bearings
Courtesy of FORD MOTOR CO.

92. Remove the main bearings from the cylinder block.

NOTE: If the oil squirts are being reused, mark them in order for correct location during reassembly.

NOTE: The front bulkhead does not have an oil squirt.

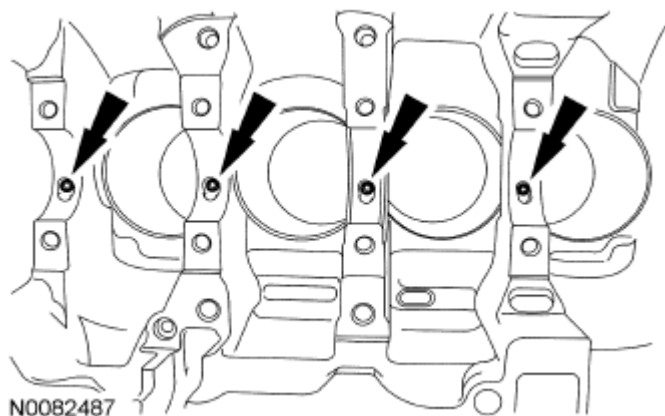


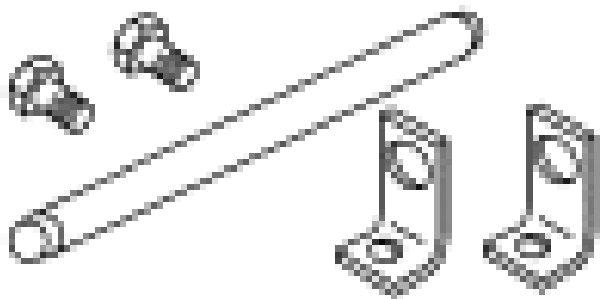
Fig. 362: Locating Oil Squirts
Courtesy of FORD MOTOR CO.

93. Remove the 4 oil squirts.
94. Inspect the cylinder block, main bearing beam, pistons and connecting rods. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

CYLINDER HEAD

Special Tool(s)

SPECIAL TOOL REFERENCE CHART



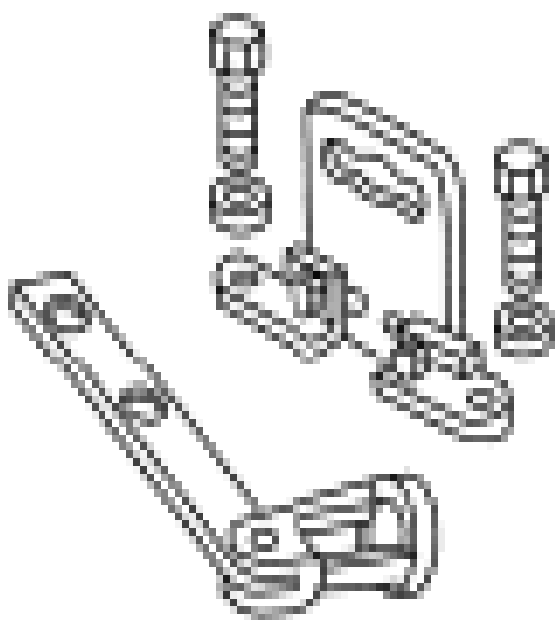
ST1981-A

Compressor, Valve Spring
303-300 (T87C-6565-A)

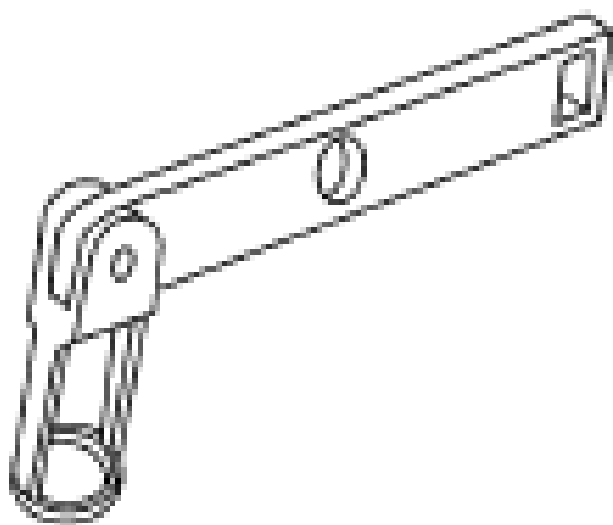
Compressor, Valve Spring
303-350 (T89P-6565-A)

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ST1907-A

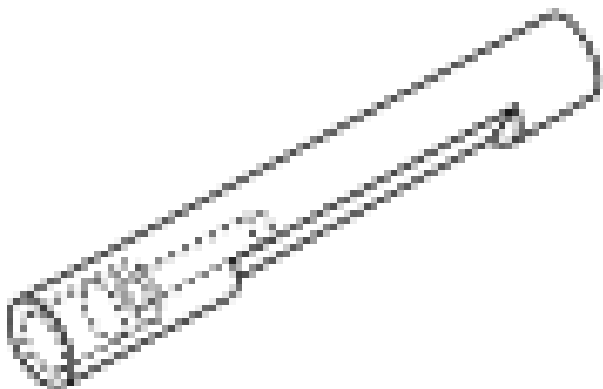


ST1902-A

Compressor, Valve Spring
303-472 (T94P-6565-AH)

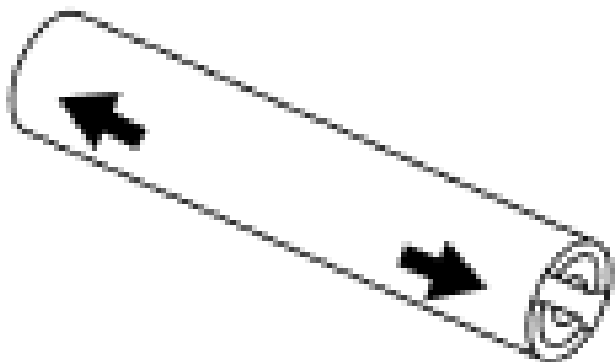
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ST1908-A

Installer, Valve Stem Oil Seal
303-470 (T94P-6510-CH)



ST1904-A

Remover, Valve Stem Oil Seal
303-468 (T94P-6510-AH)

Slide Hammer
307-005 (T59L-100-B)

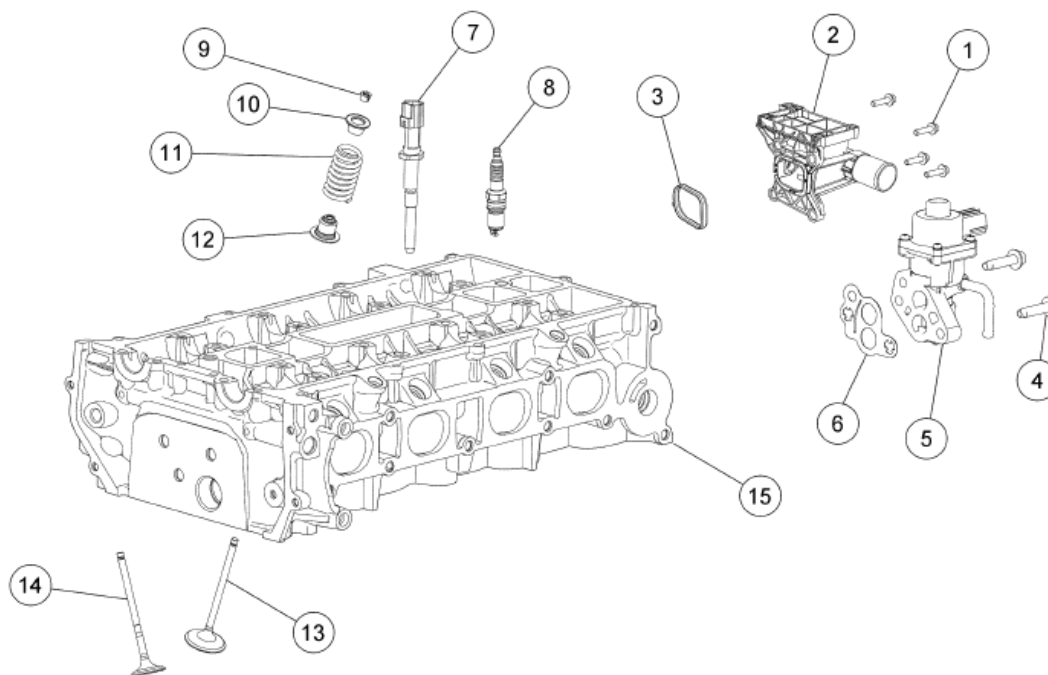


ST1187-A

Material

ITEM SPECIFICATION

| 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 |
| Multi-Purpose Grease XG-4 and/or XL-5 | ESB-M1C93-B |



N0100885

Fig. 363: Identifying Cylinder Head Components

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Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|--|
| 1 | W500015 | Coolant outlet bolt (4 required) |
| 2 | 8K556 | Coolant outlet |
| 3 | - | Coolant outlet gasket (part of 8K556) |
| 4 | W500225 | EGR valve bolt (2 required) |
| 5 | 9D475 | EGR valve |
| 6 | 9D476 | EGR valve gasket |
| 7 | 6G004 | Cylinder Head Temperature (CHT) sensor |
| 8 | 12405 | Spark plug (4 required) |
| 9 | 6518 | Valve collet (16 required) |
| 10 | 6514 | Valve spring retainer (16 required) |
| 11 | 6513 | Valve spring (16 required) |
| 12 | 6517 | Valve seal (16 required) |
| 13 | 6505 | Intake valve (8 required) |
| 14 | 6507 | Exhaust valve (8 required) |
| 15 | 6049 | Cylinder head |

Disassembly

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components removed for locations.

1. Remove the 4 bolts and the coolant outlet.
 - Discard the gasket.
2. Remove the 2 bolts and the EGR valve.
 - Discard the gasket.
3. Remove the Cylinder Head Temperature (CHT) sensor.

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

4. Remove the spark plugs.

NOTE: Use a small screwdriver and multi-purpose grease to remove the valve collets.

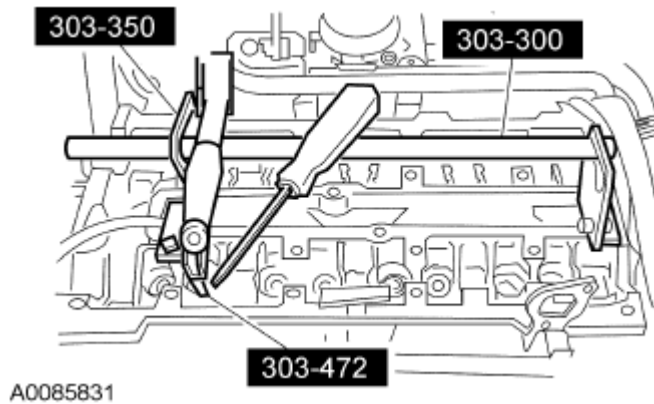


Fig. 364: Removing Valve Spring Retainer And Valve Spring
Courtesy of FORD MOTOR CO.

5. Using the Valve Spring Compressors, compress the valve springs and remove the valve collets, valve spring retainers and the valve springs.
6. Inspect the components, if necessary. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.
7. Remove the valves.
8. Using the Valve Stem Oil Seal Remover and Slide Hammer, remove and discard the valve seals.

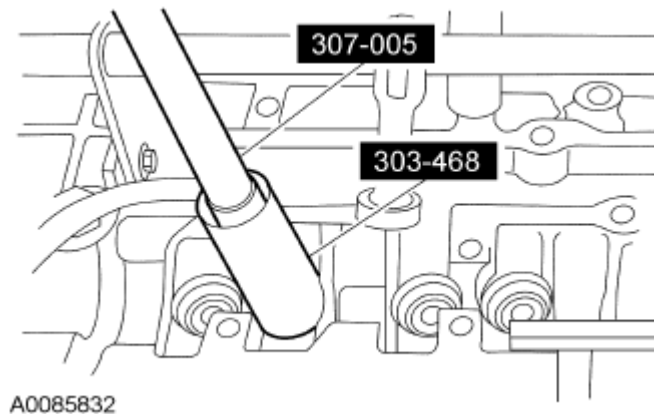


Fig. 365: Removing Valve Seal
Courtesy of FORD MOTOR CO.

9. Inspect the valves. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**. Install new parts, as necessary.

Assembly

NOTE: Coat the valve stems with clean engine oil.

1. Install the valves.

NOTE: Use the protector provided with the replacement kit to prevent damage to the valve seals. Lubricate the valve stems and guides with clean engine oil.

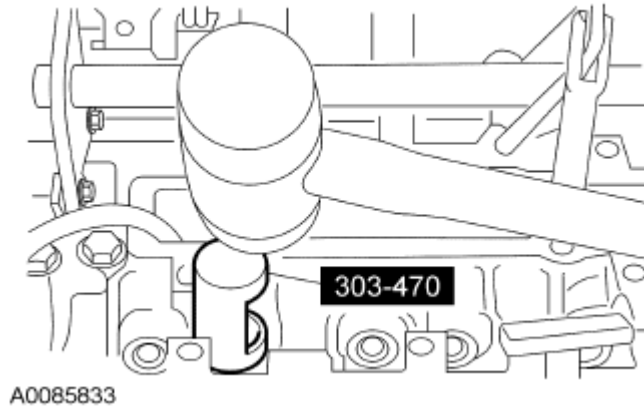


Fig. 366: Installing Valve Seal
Courtesy of FORD MOTOR CO.

2. Using the Valve Stem Oil Seal Installer, install the valve seals.

NOTE: Check the seating of the valve collets.

3. Using the Valve Spring Compressors, install the valve springs.
 - Insert the valve springs and the valve spring retainers.
 - Compress the valve springs and install the valve collets, using multi-purpose grease and a small screwdriver.

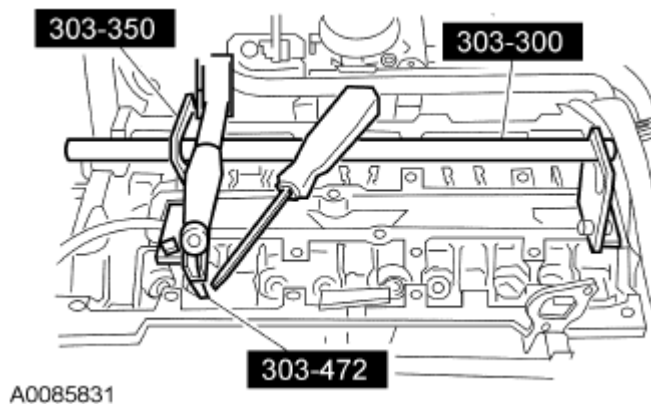


Fig. 367: Inserting Valve Spring And Valve Spring Retainer
Courtesy of FORD MOTOR CO.

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

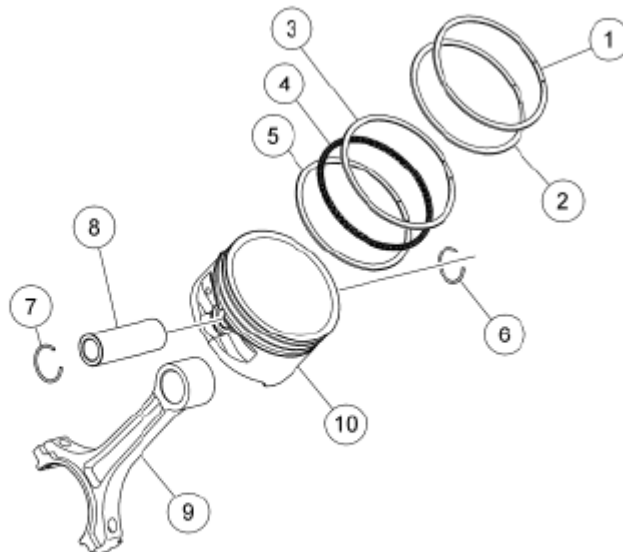
4. Install the spark plugs.
 - Tighten to 12 Nm (106 lb-in).
5. Install the CHT sensor.
 - Tighten to 12 Nm (106 lb-in).
6. Using a new gasket, install the EGR valve and 2 bolts
 - Tighten to 20 Nm (177 lb-in).
7. Using a new gasket, install the coolant outlet and 4 bolts.
 - Tighten to 10 Nm (89 lb-in).

PISTON

Material

ITEM SPECIFICATION

| 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 |



N0010114

Fig. 368: Exploded View Of Piston
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|-------------------------------|
| 1 | 6150 | Piston compression upper ring |

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| | | |
|----|------|---------------------------------------|
| 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 piston rings from the piston.
 - Discard the piston rings.
2. Remove the 2 piston pin retainers and the piston pin.

NOTE: If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.

3. Separate the piston from the connecting rod.
4. Clean and inspect the piston and connecting rod. For additional information, refer to **ENGINE SYSTEM-GENERAL INFORMATION**.

Assembly

NOTE: The arrow on the top of the piston points towards the front of the engine.

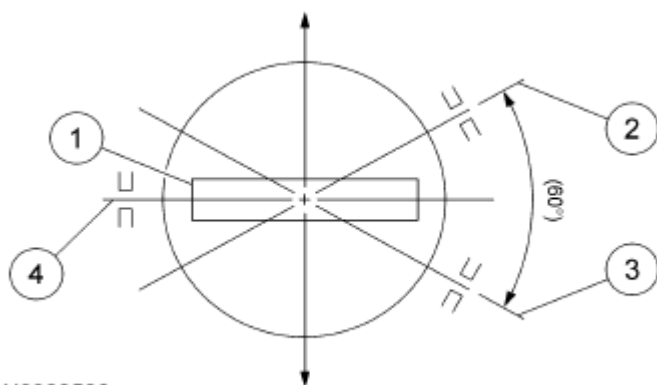
1. Align the piston-to-connecting rod orientation marks, and position the connecting rod in the piston.
2. Lubricate the piston pin and pin bore with clean engine oil.
3. Install the piston pin in the piston and connecting rod assembly.
4. Install the piston pin retaining clips in the piston.
5. Lubricate the piston and the new piston rings with clean engine oil.

NOTE: The piston compression upper and lower ring should be installed with the paint mark on the outside diameter circumference of the ring to be positioned on the right side of the ring gap. The lower compression ring can also be installed with the undercut side downward.

NOTE: The upper and lower compression ring gaps are not controlled for installation.

6. Install the piston rings onto the piston as shown.

1. Piston pin
2. Upper oil control ring gap location
3. Lower oil control ring gap location
4. Center line of the piston pin bore and the expander gap



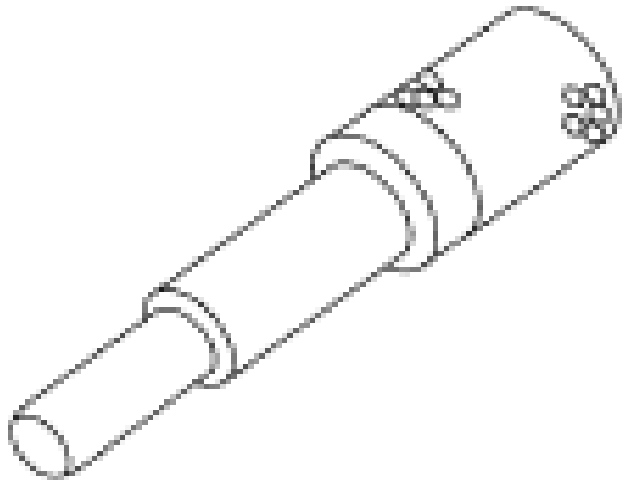
N0082528

Fig. 369: Identifying Piston Ring Gap Location
Courtesy of FORD MOTOR CO.

ENGINE

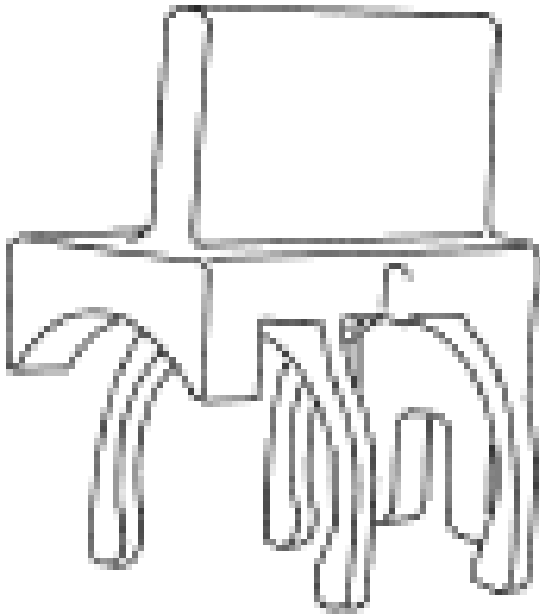
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|--|---|
|  <p>ST1751-A</p> | <p>Aligner, Clutch Disc 308-006 (T71P-7137-H)</p> |
| | |

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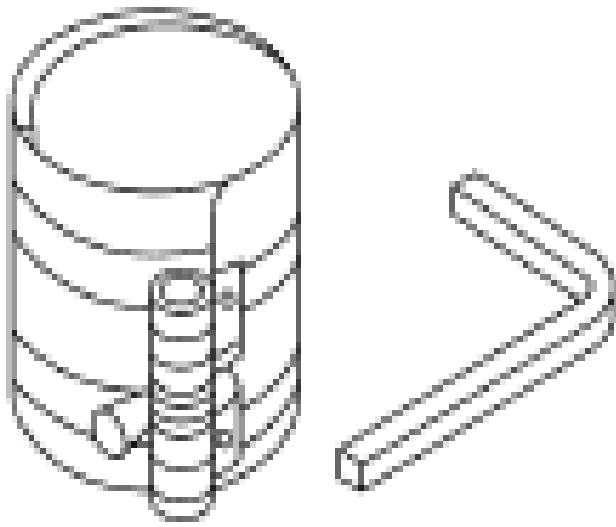
ST3055A

Aligner, Crankshaft Sensor
303-1417



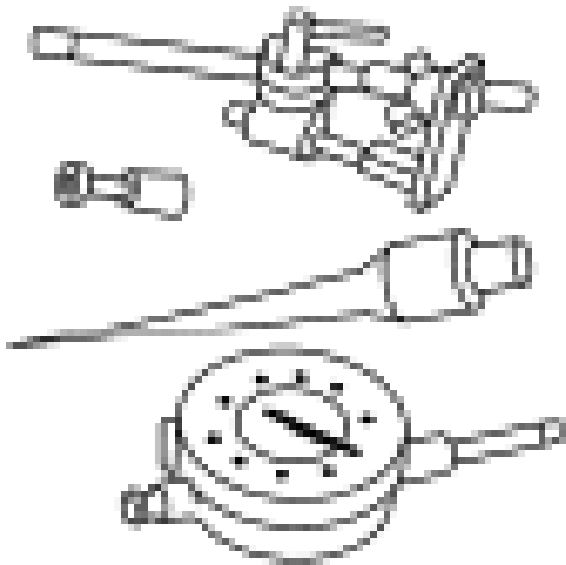
ST2645-A

Alignment Plate, Camshaft
303-465 (T94P-6256-CH)



Compressor, Piston Ring
303-D032 (D81L-6002-C)

ST1376-A

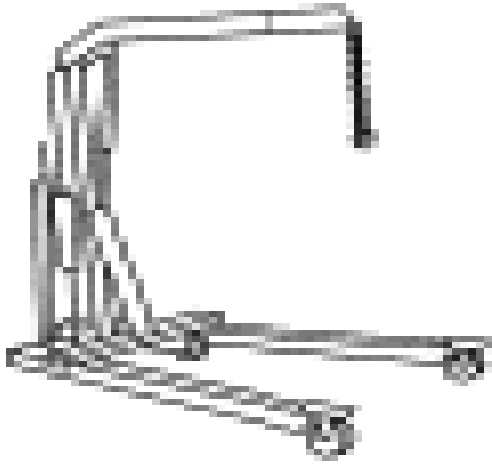


Dial Indicator Gauge with Holding Fixture
100-002 (TOOL-4201-C)

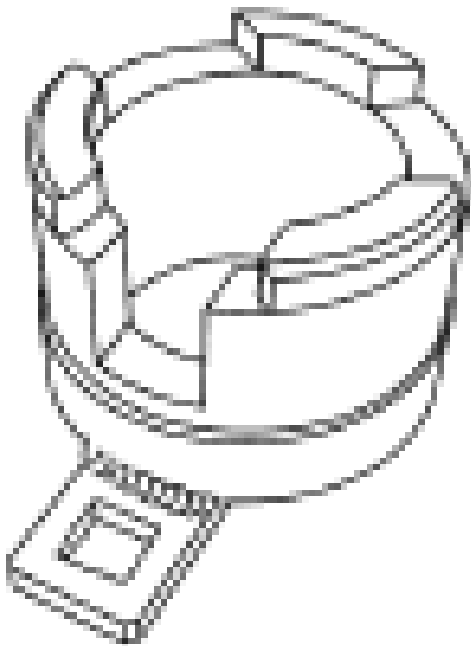
ST1214-A

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Heavy Duty Floor Crane
014-00071 or equivalent

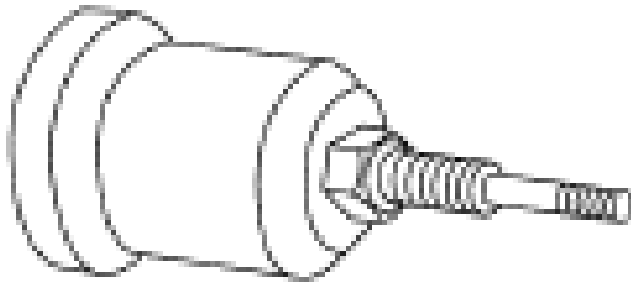


ST3054-A

Holding Tool, Crankshaft Damper
303-1416

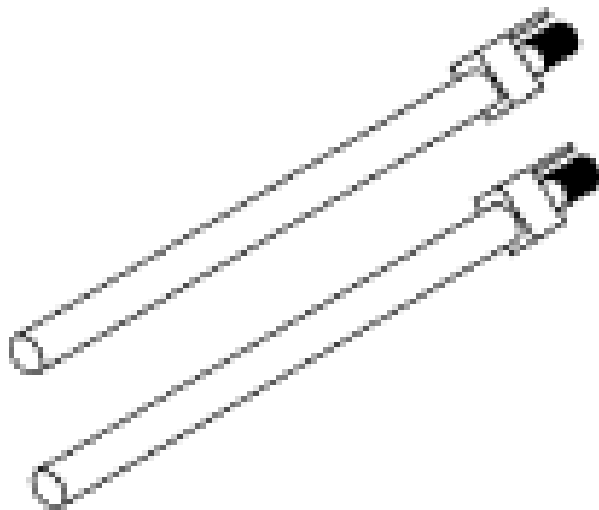
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Installer, Camshaft Front Oil Seal
303-096 (T74P-6150-A)

ST1917-A



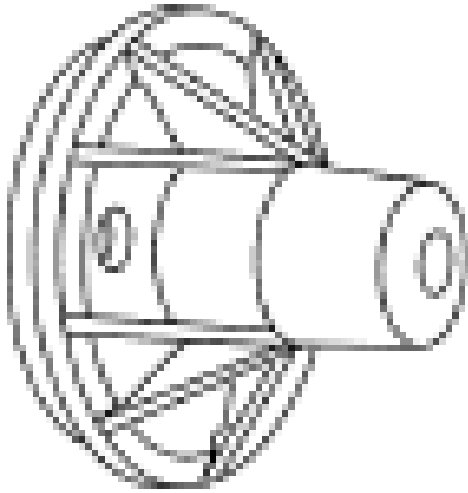
Installer, Connecting Rod
303-462 (T94P-6136-AH)

ST1982-A

Installer, Crankshaft Rear Main Oil Seal

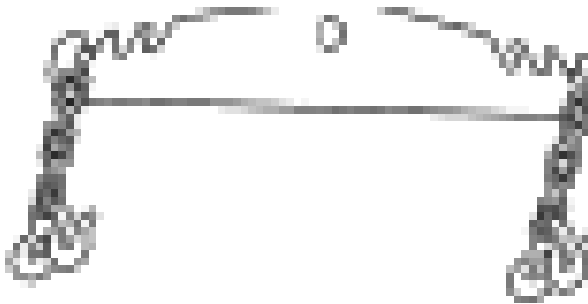
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ST1506-A

303-328 (T88P-6701-B1)



ST1507-A

Spreader Bar
303-D089 (D93P-6001-A3) or equivalent

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ST2638-A

Timing Peg, Crankshaft TDC
303-507

General Equipment

GENERAL EQUIPMENT REFERENCE

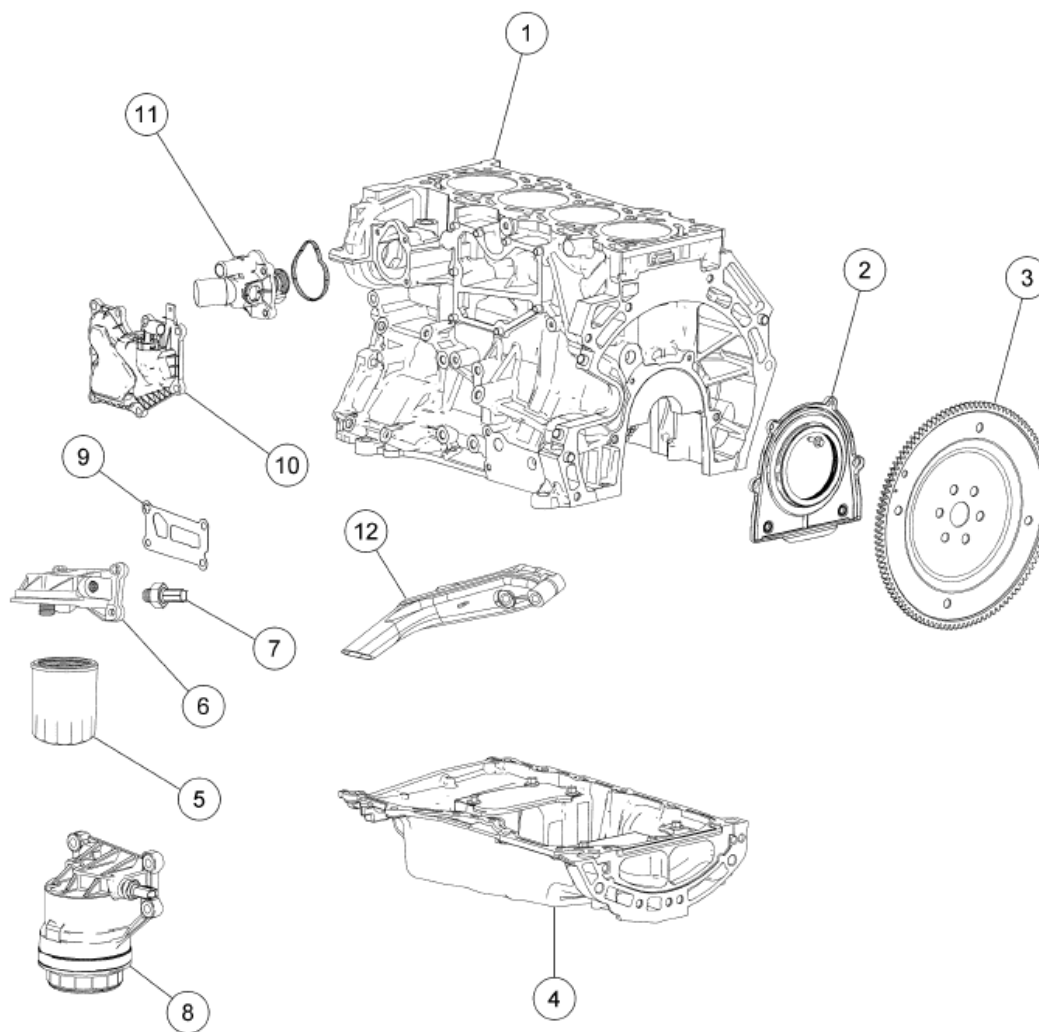
6 mm x 18 mm bolt

Material

ITEM SPECIFICATION

| Item | Specification |
|--|---------------|
| High Temperature 4x4 Front Axle and Wheel Bearing Grease XG-11 | WSS-M1C267-A1 |
| 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 Brake Caliper Grease and Dielectric Compound XG-3-A | ESE-M1C171-A |
| Silicone Gasket and Sealant TA-30 | WSE-M4G323-A4 |
| Silicone Gasket Remover ZC-30 | - |

Lower Engine Block (View 1)



N0086491

Fig. 370: Exploded View Of Lower Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|---------------------------------------|
| 1 | 6010 | Cylinder block |
| 2 | 6K318 | Crankshaft rear oil seal and retainer |
| 3 | 6477 | Flywheel/flexplate |
| 4 | 6675 | Oil pan |
| 5 | 6714 | Oil filter |
| 6 | 6884 | Spin on oil filter adapter |
| 7 | 9278 | Engine Oil Pressure (EOP) switch |
| 8 | 6884 | Element oil filter adapter |
| 9 | 6A636 | Oil filter adapter gasket |

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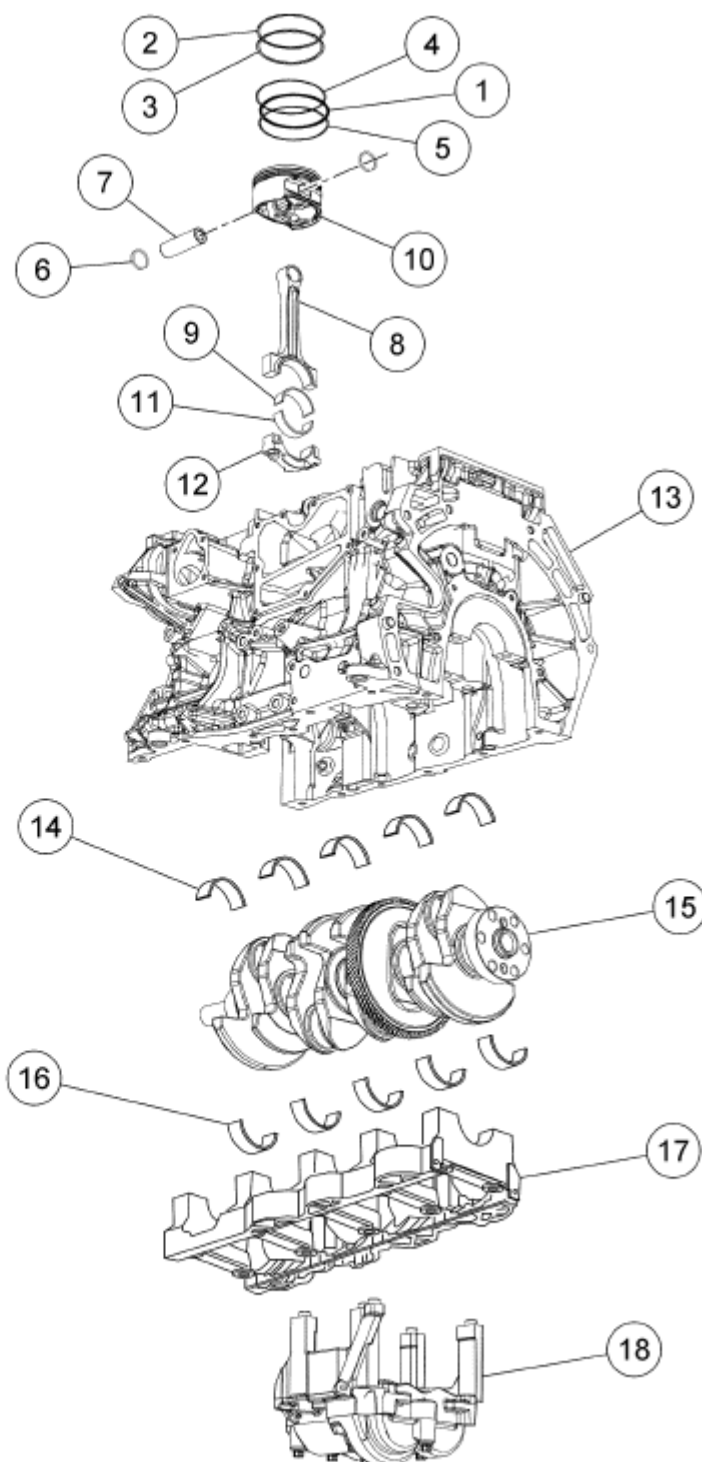
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| | | |
|----|-------|---------------------------------|
| 10 | 6A785 | Crankcase vent oil separator |
| 11 | 8575 | Thermostat assembly |
| 12 | 6622 | Oil pump screen and pickup tube |

Lower Engine Block (View 2)

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N0105927

Fig. 371: Exploded View Of Lower Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|-------------|
| | | |

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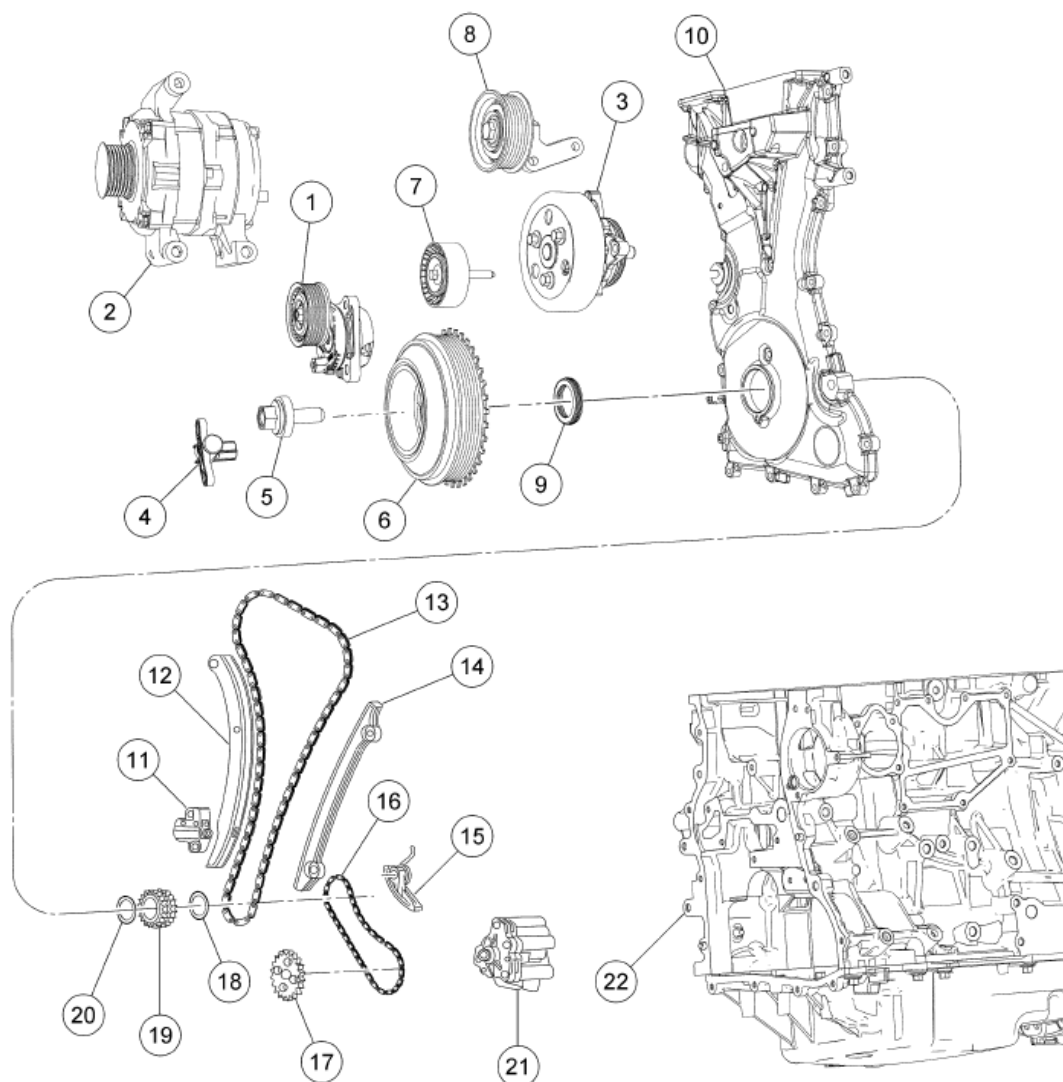
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| | | |
|----|-------|---|
| 1 | 6161 | Piston oil control spacer (4 required) |
| 2 | 6150 | Piston compression upper ring (4 required) |
| 3 | 6152 | Piston compression lower ring (4 required) |
| 4 | 6159 | Piston oil control upper segment ring (4 required) |
| 5 | 6159 | Piston oil control lower segment ring (4 required) |
| 6 | 6140 | Piston pin retainer (8 required) |
| 7 | 6135 | Piston pin (4 required) |
| 8 | 6200 | Connecting rod (4 required) |
| 9 | 6211 | Connecting rod upper bearing (4 required) |
| 10 | 6110 | Piston (4 required) |
| 11 | 6211 | Connecting rod lower bearing (4 required) |
| 12 | 6210 | Connecting rod cap (4 required) |
| 13 | 6010 | Cylinder block |
| 14 | 6333 | Cylinder block crankshaft main bearing (5 required) |
| 15 | 6303 | Crankshaft |
| 16 | 6333 | Crankshaft main bearing beam bearing (5 required) |
| 17 | 6F098 | Main bearing beam |
| 18 | 6K360 | Balance shaft assembly |

Front Engine Block

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N0085945

Fig. 372: Exploded View Of Front Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|----------------------------------|
| 1 | 6B209 | Accessory drive belt tensioner |
| 2 | 10300 | Generator |
| 3 | 8501 | Coolant pump and pulley |
| 4 | 6C315 | Crankshaft Position (CKP) sensor |
| 5 | 6K340 | Crankshaft pulley bolt |
| 6 | 6316 | Crankshaft pulley |
| 7 | 6C348 | Smooth idler pulley |
| 8 | 19A216 | Idler pulley and bracket |
| 9 | 6700 | Crankshaft front seal |

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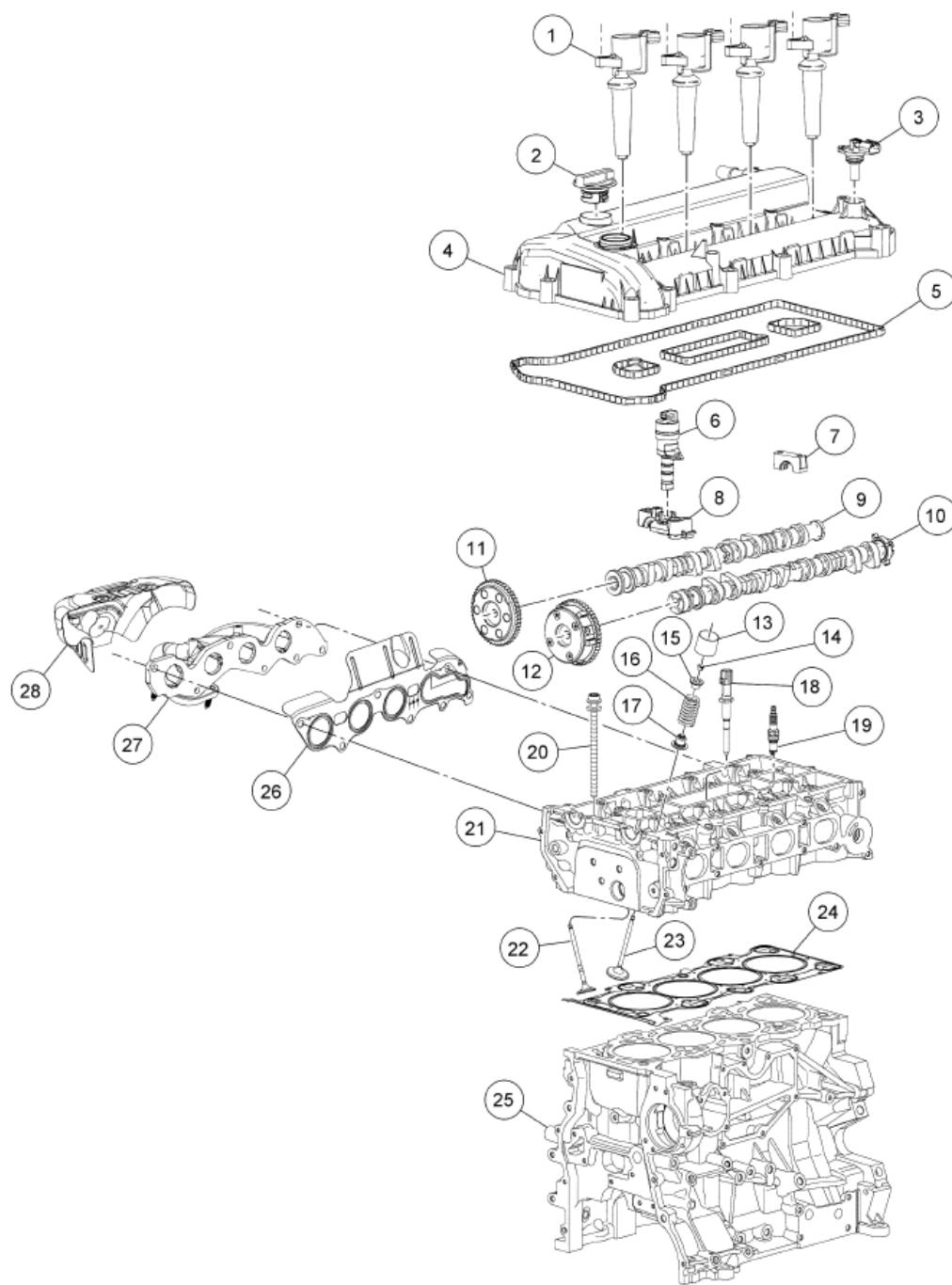
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| | | |
|----|-------|----------------------------|
| 10 | 6019 | Engine front cover |
| 11 | 6K254 | Timing chain tensioner |
| 12 | 6K255 | Timing chain tensioner arm |
| 13 | 6268 | Timing chain |
| 14 | 6K297 | Timing chain guide |
| 15 | 6C271 | Oil pump chain tensioner |
| 16 | 6A895 | Oil pump chain |
| 17 | 6652 | Oil pump drive gear |
| 18 | 6378 | Diamond washer |
| 19 | 6306 | Crankshaft sprocket |
| 20 | 6378 | Diamond washer |
| 21 | 6600 | Oil pump |
| 22 | 6010 | Cylinder block |

Cylinder Head

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N0086212

Fig. 373: Exploded View Of Lower Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|------------------------------------|
| 1 | 12A366 | Coil-on-plug assembly (4 required) |
| | | |

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| | | |
|----|--------|---|
| 2 | 6766 | Oil filler cap |
| 3 | 12K073 | Camshaft Position (CMP) sensor |
| 4 | 6M293 | Valve cover |
| 5 | 6M293 | Valve cover gasket |
| 6 | 6M280 | Variable Camshaft Timing (VCT) oil control solenoid |
| 7 | 6A284 | Camshaft bearing cap (9 required) |
| 8 | 6A258 | Camshaft bearing cap |
| 9 | 6A272 | Camshaft (exhaust) |
| 10 | 6A271 | Camshaft (intake) |
| 11 | 6C251 | Camshaft sprocket |
| 12 | 6C525 | VCT actuator |
| 13 | 6500 | Valve tappet (16 required) |
| 14 | 6518 | Valve collet (16 required) |
| 15 | 6514 | Valve spring retainer (16 required) |
| 16 | 6513 | Valve spring (16 required) |
| 17 | 6A517 | Valve stem seal (16 required) |
| 18 | 6G004 | Cylinder Head Temperature (CHT) sensor |
| 19 | 12405 | Spark plug (4 required) |
| 20 | 6065 | Cylinder head bolt (10 required) |
| 21 | 6049 | Cylinder head |
| 22 | 6505 | Exhaust valve (8 required) |
| 23 | 6507 | Intake valve (8 required) |
| 24 | 6051 | Head gasket |
| 25 | 6010 | Cylinder block |
| 26 | 9448 | Exhaust manifold gasket |
| 27 | 9430 | Exhaust manifold |
| 28 | 9N454 | Exhaust manifold heat shield |

Intake Manifold

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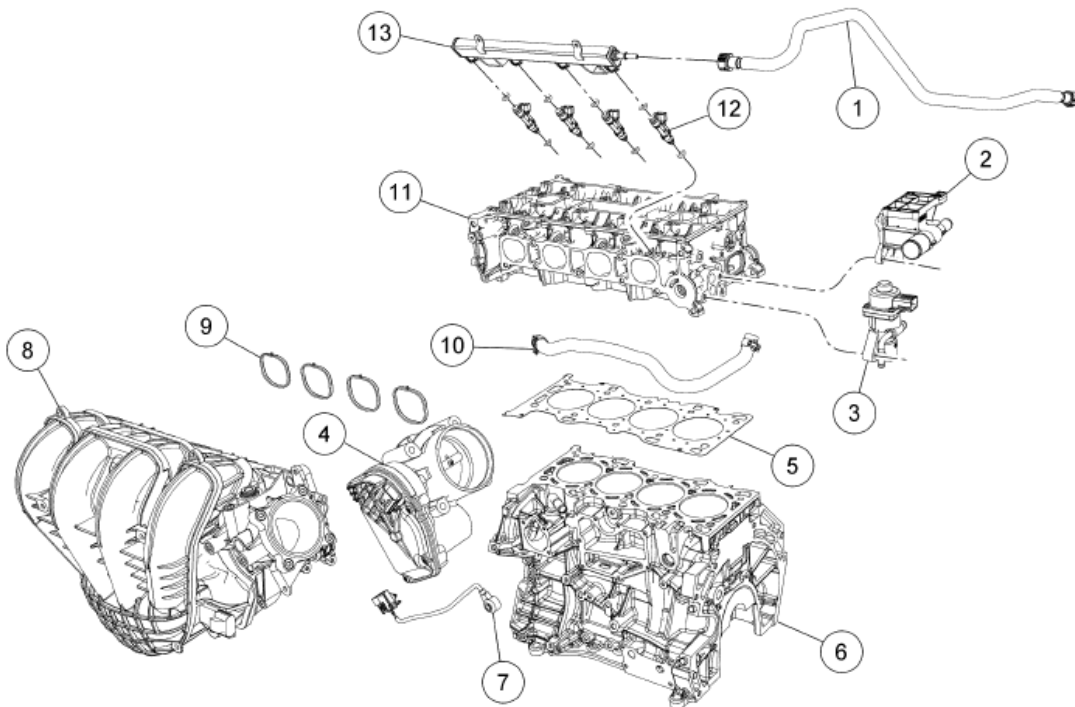


Fig. 374: Exploded View Of Intake Manifold
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

| Item | Part Number | Description |
|------|-------------|----------------------------|
| 1 | 9288 | Fuel supply tube |
| 2 | 8K556 | Coolant outlet |
| 3 | 9D475 | EGR valve |
| 4 | 9E926 | Electronic throttle body |
| 5 | 6051 | Cylinder head gasket |
| 6 | 6010 | Cylinder block |
| 7 | 12A699 | Knock Sensor (KS) |
| 8 | 9424 | Intake manifold |
| 9 | 9439 | Intake manifold gasket |
| 10 | 8A582 | Coolant hose |
| 11 | 6049 | Cylinder head |
| 12 | 9F593 | Fuel injector (4 required) |
| 13 | 9H487 | Fuel rail |

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft

sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage may occur.

NOTE: During engine repair procedures, cleanliness is extremely important. All parts must be thoroughly cleaned and any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: Assembly of the engine requires various inspections/measurements of the engine components (engine block, crankshaft, connecting rods, pistons and piston rings). These inspections/measurements will aid in determining if the engine components will require replacement. For additional information, refer to ENGINE SYSTEM-GENERAL INFORMATION .

All vehicles

NOTE: If the oil squirts are being reused, they must be installed in the same location as marked during disassembly.

NOTE: The front bulkhead does not have an oil squirt.

1. Install the 4 oil squirts.
 - Tighten to 4 Nm (35 lb-in).

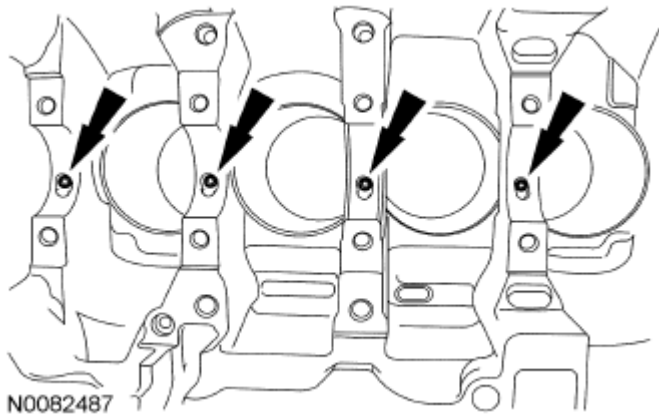


Fig. 375: Locating Oil Squirts
Courtesy of FORD MOTOR CO.

2. Measure each of the crankshaft main bearing journal diameters in at least 2 directions and record the smallest diameter for each journal.

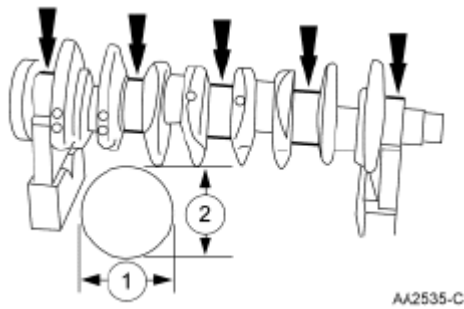


Fig. 376: Measuring Crankshaft Main Bearing Journal Diameters
Courtesy of FORD MOTOR CO.

3. Position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear face of the engine block.

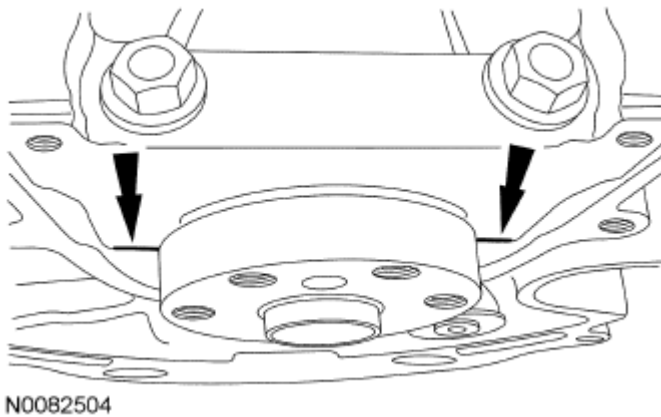


Fig. 377: Locating Main Bearing Beam In Engine Block
Courtesy of FORD MOTOR CO.

4. Using the original main bearing beam bolts, install and tighten the 10 main bearing beam bolts.
 - Tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.

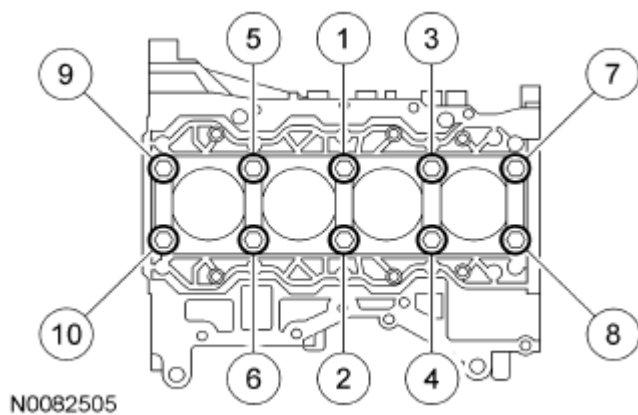


Fig. 378: Identifying Main Bearing Beam Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

5. Measure each crankshaft block main bearing bore diameter.
 - Remove the bolts and the main bearing beam.
 - Discard the main bearing beam bolts.

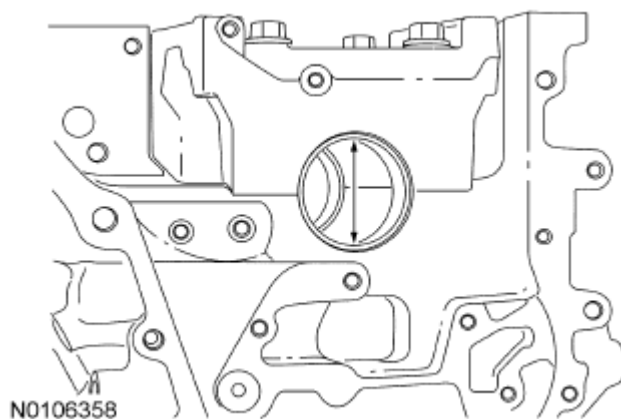


Fig. 379: Measuring Crankshaft Block Main Bearing Bore Diameter
Courtesy of FORD MOTOR CO.

6. Using the chart, select the crankshaft main bearings.

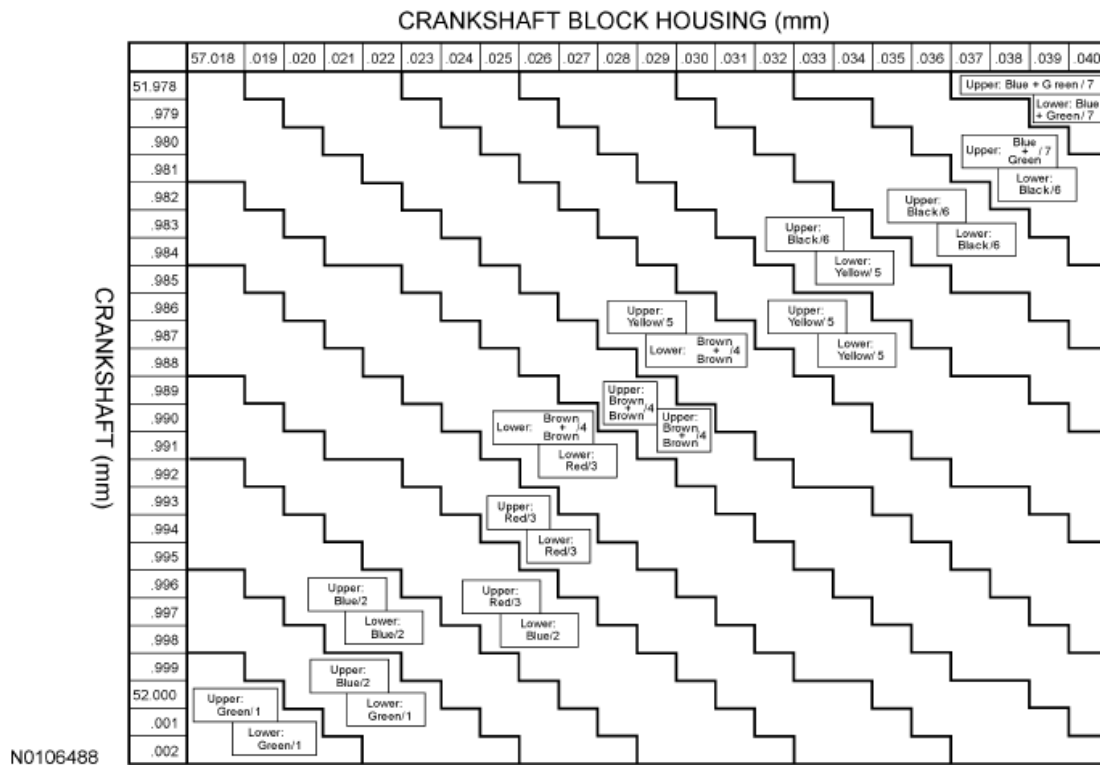


Fig. 380: Crankshaft Main Bearings Chart
Courtesy of FORD MOTOR CO.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

7. Using the original connecting rod cap bolts, install the connecting caps and bolts.
 - Tighten the bolts in 2 stages.
 - Stage 1: Tighten to 29 Nm (21 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
8. Measure the connecting rod large end bore in 2 directions. Record the smallest measurement for each connecting rod.
 - Remove the bolts and the connecting rod cap.
 - Discard the connecting rod cap bolts.

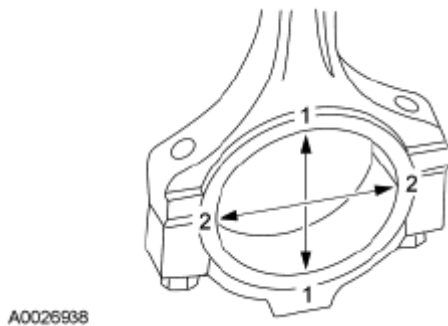


Fig. 381: Measuring Connecting Rod Large End Bore In Two Directions
 Courtesy of FORD MOTOR CO.

9. Measure each of the crankshaft connecting rod bearing journal diameters in at least 2 directions. Record the smallest measurement for each connecting rod journal.

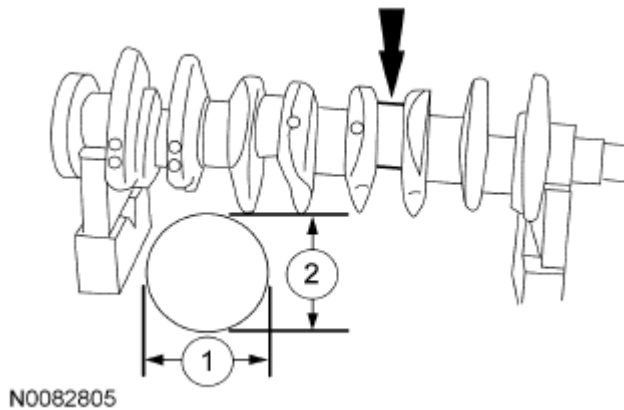


Fig. 382: Measuring Crankshaft Connecting Rod Bearing Journal Diameters In At Least Two Directions
 Courtesy of FORD MOTOR CO.

10. Using the chart, select the correct connecting rod bearings for each crankshaft connecting rod journal.

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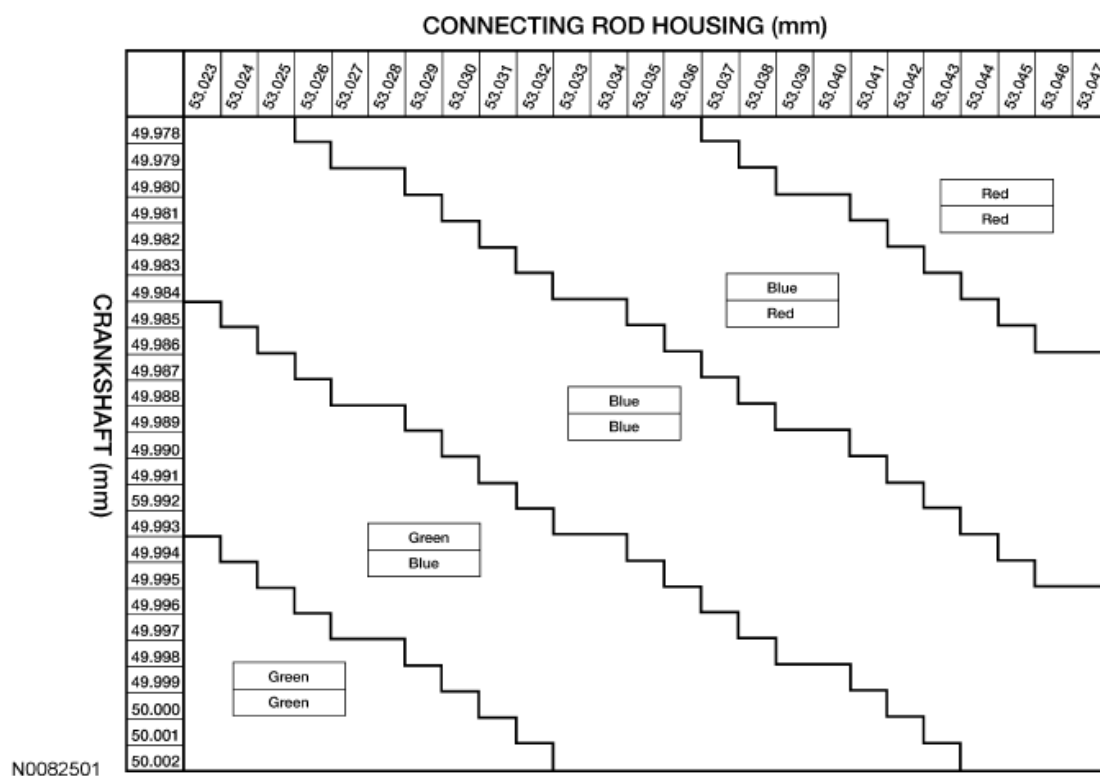


Fig. 383: Connecting Rod Bearings Chart
Courtesy of FORD MOTOR CO.

- 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.
- NOTE:** If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.
- NOTE:** The center bulkhead is the thrust bearing.

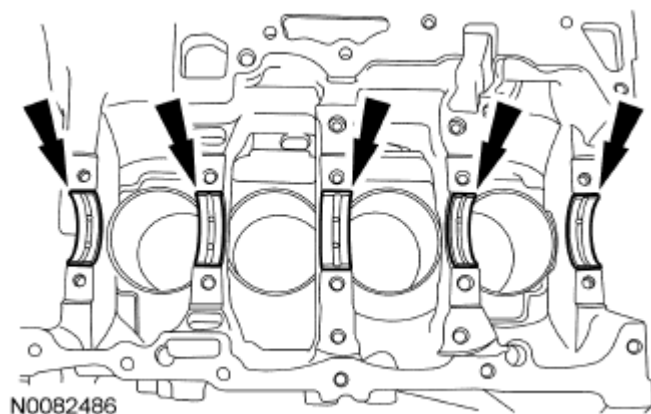
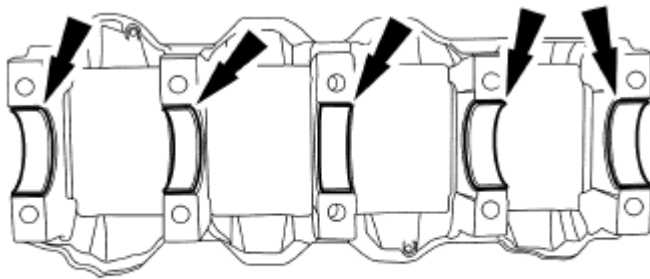


Fig. 384: Locating Main Bearings
Courtesy of FORD MOTOR CO.

11. Lubricate the upper crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the cylinder block.

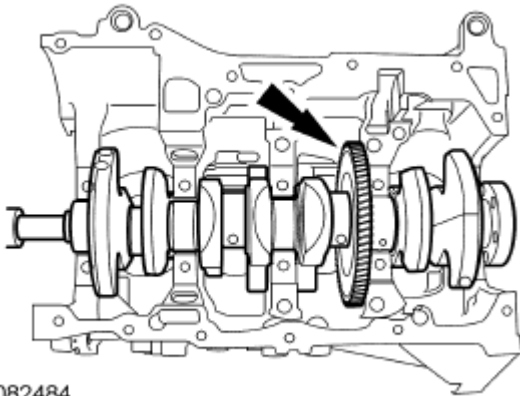
NOTE: If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.



N0082485

Fig. 385: Locating Main Bearings
Courtesy of FORD MOTOR CO.

12. Lubricate the crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the main bearing beam.
13. Lubricate journals on the crankshaft with clean engine oil.
14. Position the crankshaft in the cylinder block.



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Fig. 386: Locating Crankshaft
Courtesy of FORD MOTOR CO.

15. Lubricate the 10 main bearing beam side fit surfaces (front 2 shown) with clean engine oil.

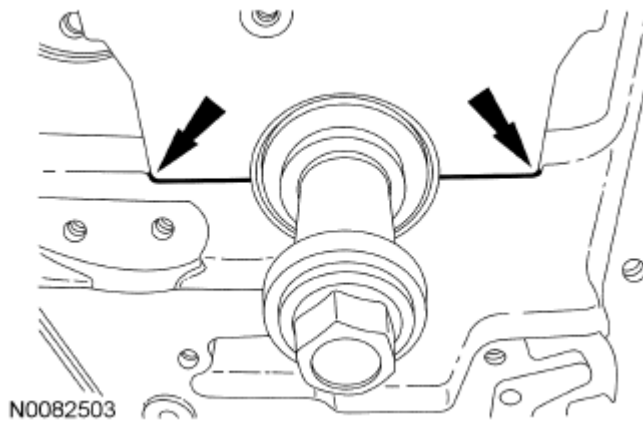


Fig. 387: Locating Main Bearing Beam Side Fit Surfaces
Courtesy of FORD MOTOR CO.

16. Lubricate the crankshaft bearing journals on the main bearing beam with clean engine oil. Then position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear face of the engine block.

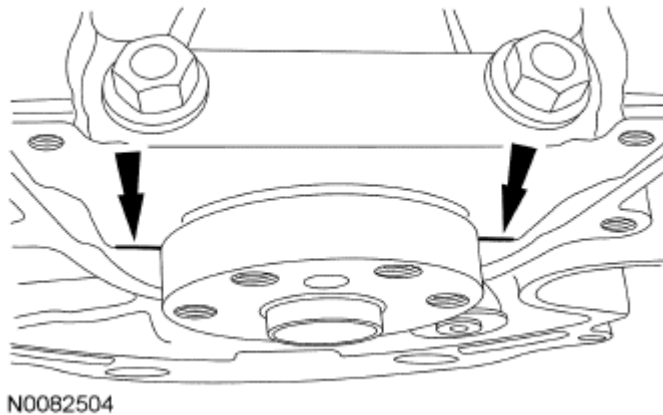


Fig. 388: Locating Main Bearing Beam In Engine Block
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the main bearing beam bolts threads and under the bolt heads with clean engine oil.

NOTE: Position the crankshaft to the rear of the cylinder block, then position the crankshaft to the front of the cylinder block before tightening the main bearing beam bolts.

17. Install and tighten the 10 new main bearing beam bolts.
 - Tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

- Stage 3: Tighten an additional 90 degrees.

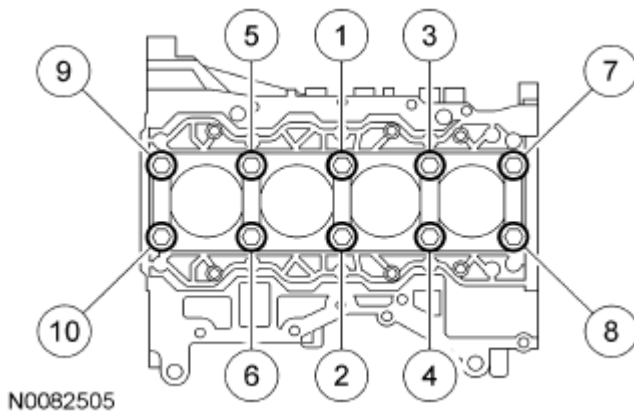


Fig. 389: Identifying Main Bearing Beam Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

- Using the Dial Indicator Gauge with Holding Fixture, measure crankshaft end play.
 - Position the crankshaft to the rear of the cylinder block.
 - Zero the Dial Indicator Gauge with Holding Fixture.
 - Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
 - Acceptable crankshaft end play is 0.22-0.43 mm (0.008-0.016 in). If the crankshaft end play exceeds the specified range, install new parts as necessary.

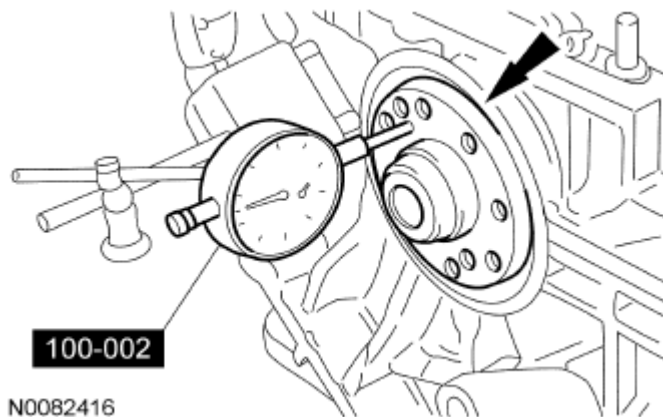


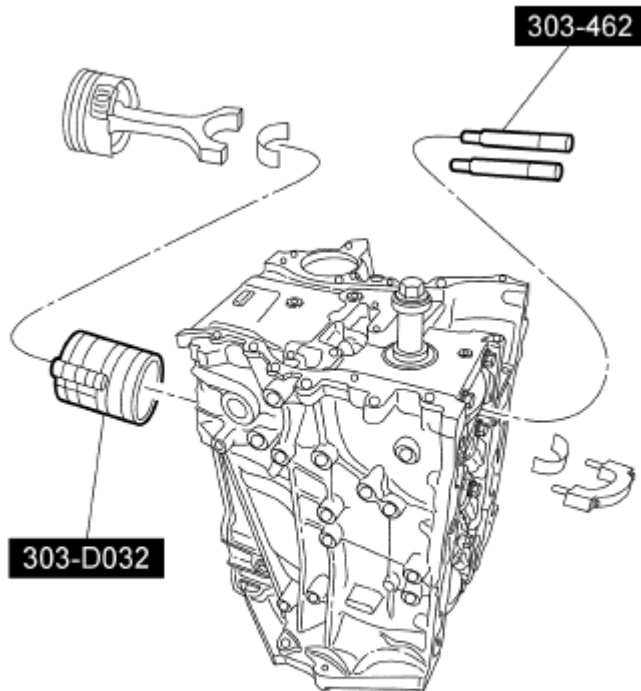
Fig. 390: Measuring Crankshaft End Play
Courtesy of FORD MOTOR CO.

NOTE: Be sure not to scratch the cylinder wall or crankshaft journal with the connecting rod. Push the piston down until the connecting rod bearing seats on the crankshaft journal.

NOTE: Lubricate the pistons, piston rings, connecting rod bearings and the entire cylinder bores with clean engine oil.

NOTE: Make sure the piston arrow on top is facing toward the front of the engine.

19. Using the Piston Ring Compressor and the Connecting Rod Installer, install the piston and connecting rod assemblies.
- When installing the pistons and connecting rod assemblies, the oil ring gaps must be positioned 60 degrees apart from each other and a minimum of 90 degrees from the expander gap.
 - The position of the upper and lower compression ring gaps are not controlled for installation.



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Fig. 391: Identifying Piston Ring Compressor And Connecting Rod Installer
Courtesy of FORD MOTOR CO.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

NOTE: Install connecting rod caps and bolts on the connecting rods for cylinders 1 and 4 first and tighten. Then rotate crankshaft 180 degrees and install connecting rod caps and bolts on connecting rods for cylinders 2 and 3 and tighten.

NOTE: After installation of each connecting rod cap, rotate the crankshaft to verify smooth operation.

20. Install the connecting rod caps and the new bolts.

- Tighten the bolts in 2 stages.
- Stage 1: Tighten to 29 Nm (21 lb-ft).
- Stage 2: Tighten an additional 90 degrees.

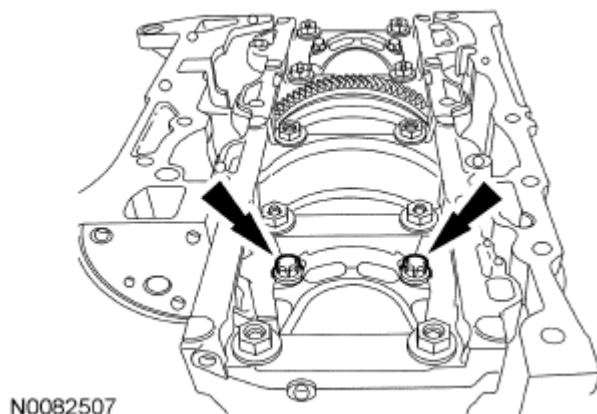


Fig. 392: Locating Connecting Rod Caps Bolts
Courtesy of FORD MOTOR CO.

21. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg. The engine is now at Top Dead Center (TDC).

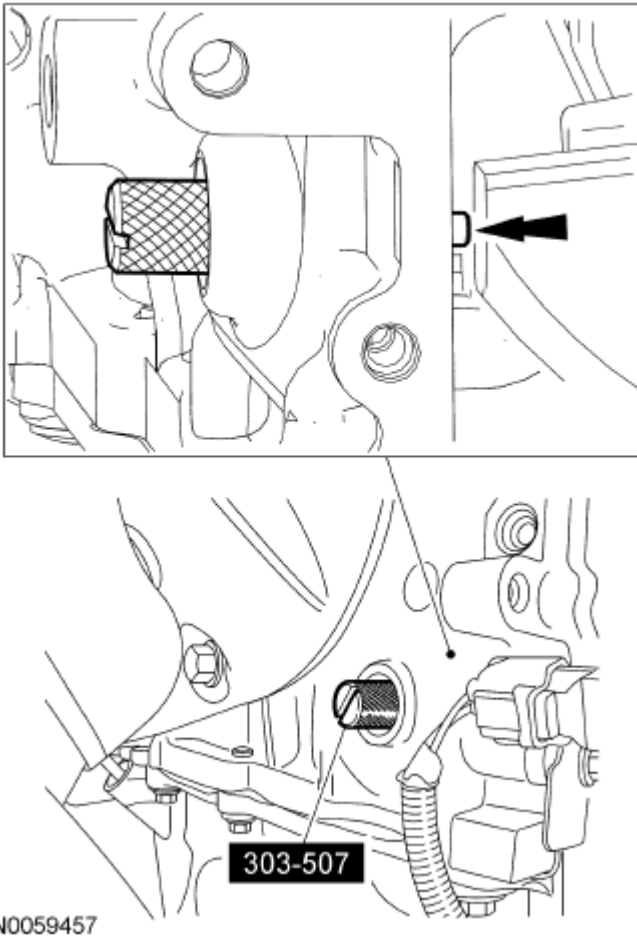


Fig. 393: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

- NOTE:** Due to the precision interior construction of the balancer unit, it should not be disassembled.
- NOTE:** The original adjustment shims must be installed in their original position.
- NOTE:** Confirm by visual inspection that there is no damage to the balancer unit gear and verify that the shaft turns smoothly. If there is any damage or malfunction, replace the balancer unit.

22. Install the adjustment shims in their original position on the seat faces of the balancer unit.
23. With the balancer unit shaft marks in the TDC position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

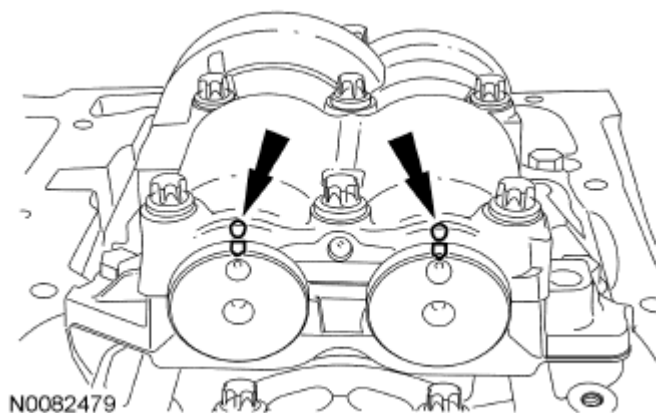


Fig. 394: Locating Balancer Unit Shaft Marks At TDC Position
Courtesy of FORD MOTOR CO.

24. Install the balancer unit bolts.
- Tighten in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

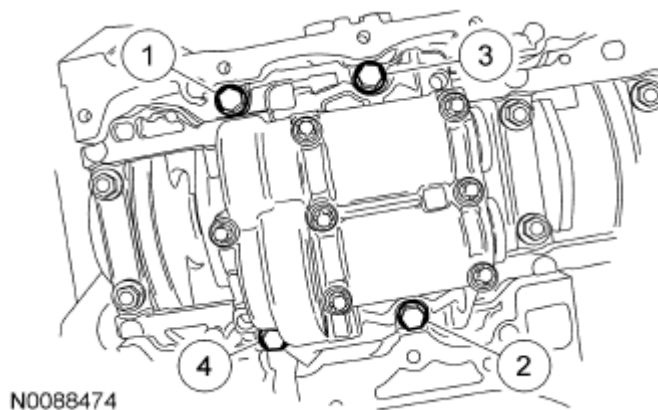


Fig. 395: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

25. Remove the Crankshaft TDC Timing Peg.

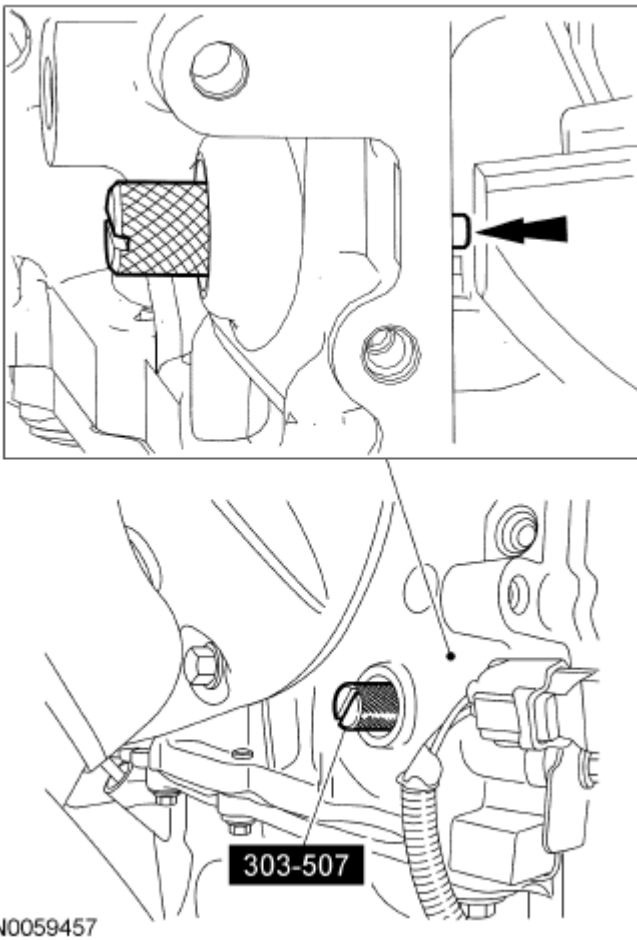


Fig. 396: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

26. Rotate the crankshaft to confirm that there are no meshing problems between the balancer unit gear and the crankshaft gear.
27. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg.
 - Remove the Crankshaft TDC Timing Peg.

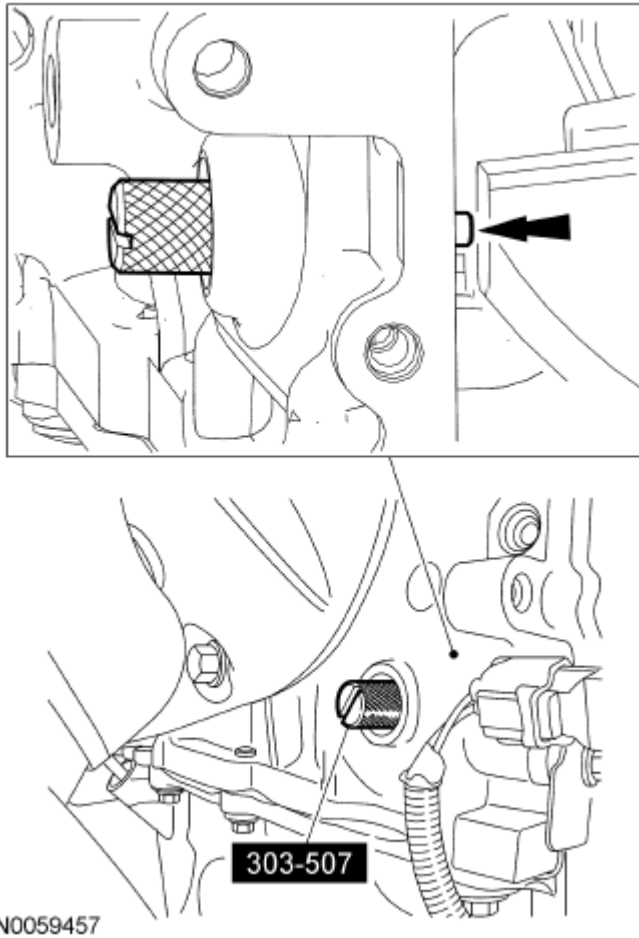


Fig. 397: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

- NOTE:** Measure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.
- NOTE:** The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.
- NOTE:** For an accurate measurement while measuring the gear backlash, insert a screwdriver as shown into the crankshaft No. 1 crank weight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.

28. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.

- Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
- Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.
- Backlash specifications are 0.005 to 0.101 mm (0.00019 to 0.0039 in).
- If the backlash exceeds the specified range, carry out the Balance Shaft Backlash procedure. For additional information, refer to **BALANCE SHAFT BACKLASH** procedure.

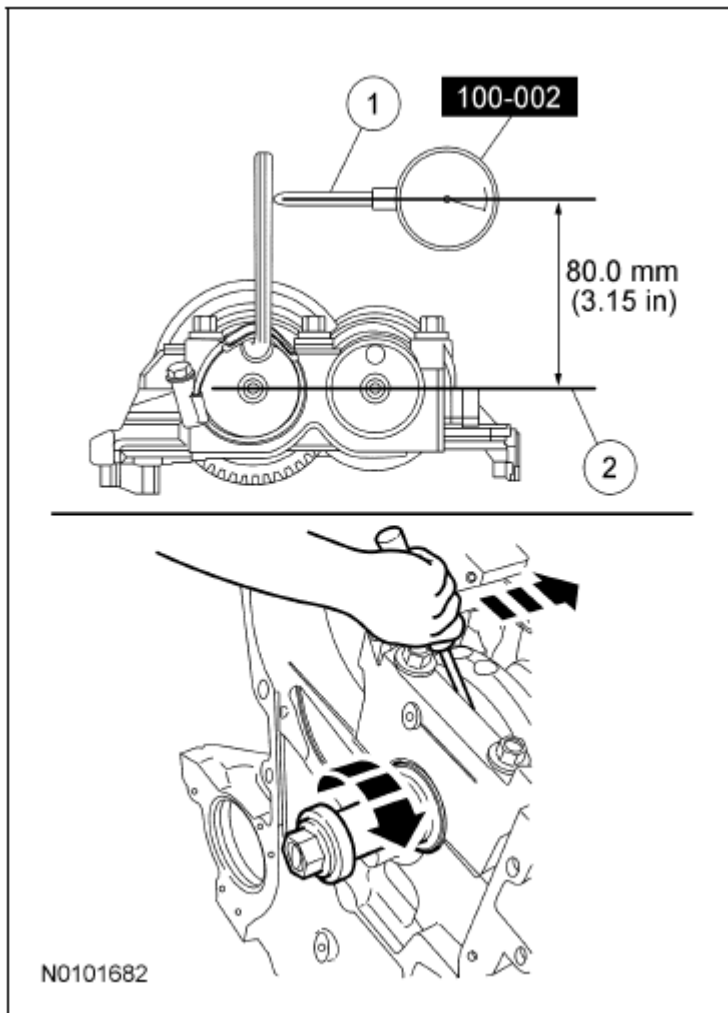


Fig. 398: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

29. Turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).

30. Remove the engine plug bolt.

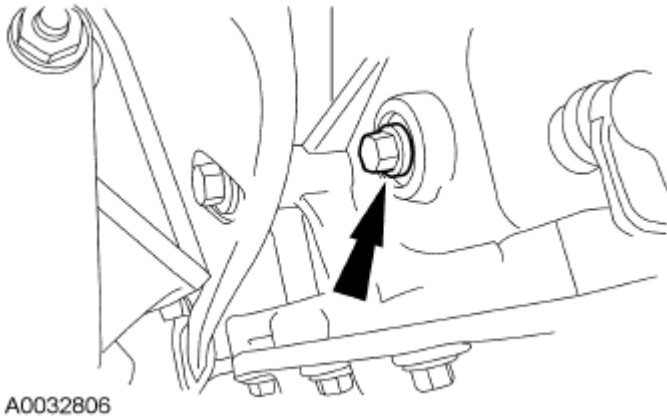


Fig. 399: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position until the timing drive components and crankshaft pulley are installed.

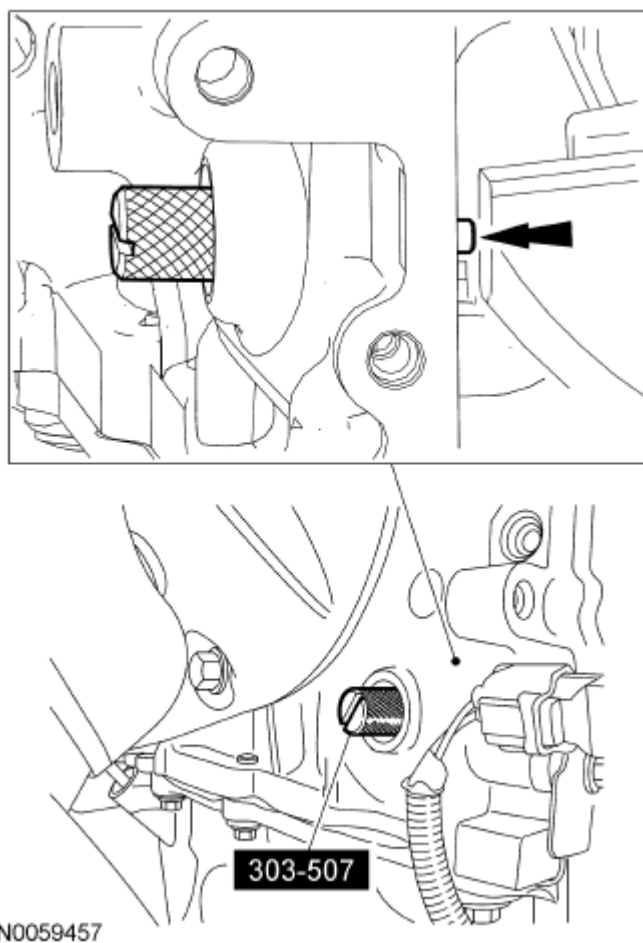


Fig. 400: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

31. Install the Crankshaft TDC Timing Peg.

NOTE: Clean the oil pump and cylinder block mating surfaces with metal surface prep.

32. Install the oil pump assembly. Tighten the bolts in the sequence shown in 2 stages:

- Stage 1: Tighten to 10 Nm (89 lb-in).
- Stage 2: Tighten to 20 Nm (177 lb-in).

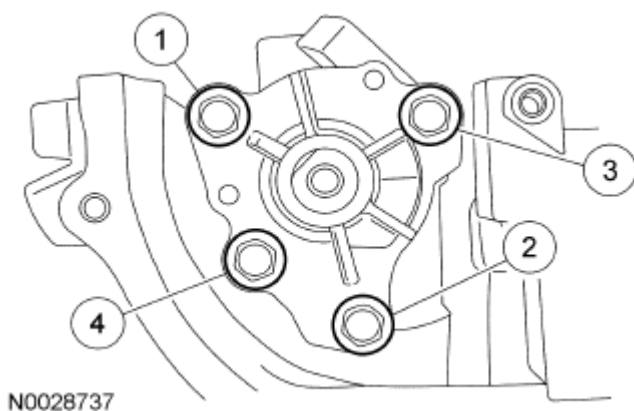


Fig. 401: Identifying Oil Pump Assembly Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

33. Install a new oil pump pickup tube gasket and the pickup tube.
 - Tighten to 10 Nm (89 lb-in).

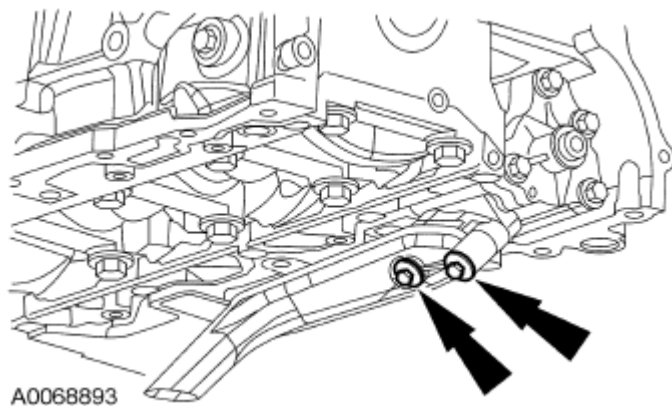


Fig. 402: Locating Oil Pump Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

34. Using the Crankshaft Rear Main Oil Seal Installer, install the crankshaft rear main oil seal.

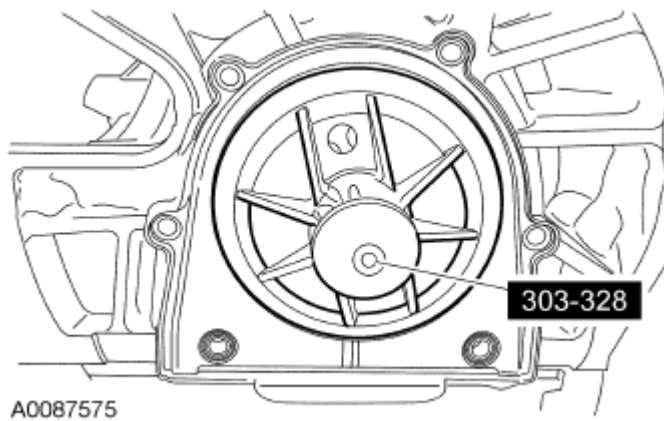


Fig. 403: Identifying Crankshaft Rear Main Oil Seal Installer
Courtesy of FORD MOTOR CO.

35. Tighten the crankshaft rear oil seal retainer bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

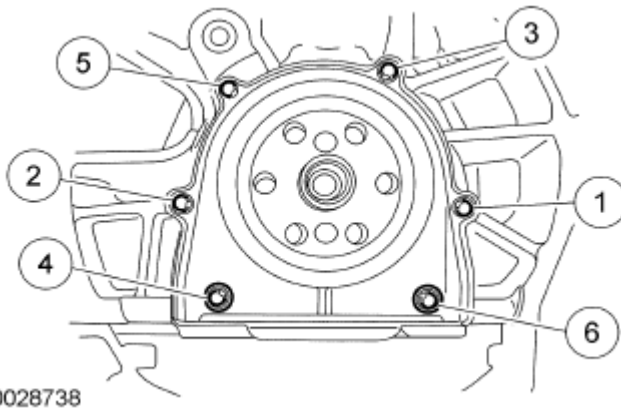


Fig. 404: Identifying Crankshaft Rear Oil Seal With Retainer Plate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

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 traces of sealant.

36. Clean and inspect all mating surfaces.

NOTE: If the oil pan is not secured within 4 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

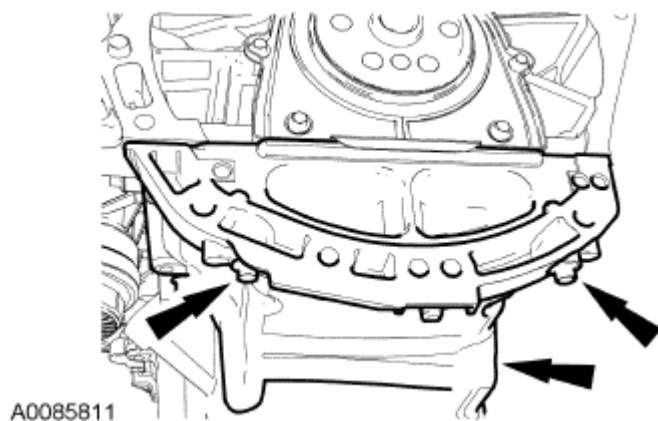


Fig. 405: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

37. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan. Install the oil pan. Install the 2 oil pan bolts finger-tight.
38. Using a suitable straight edge, align the front surface of the oil pan flush with the front surface of the engine block.

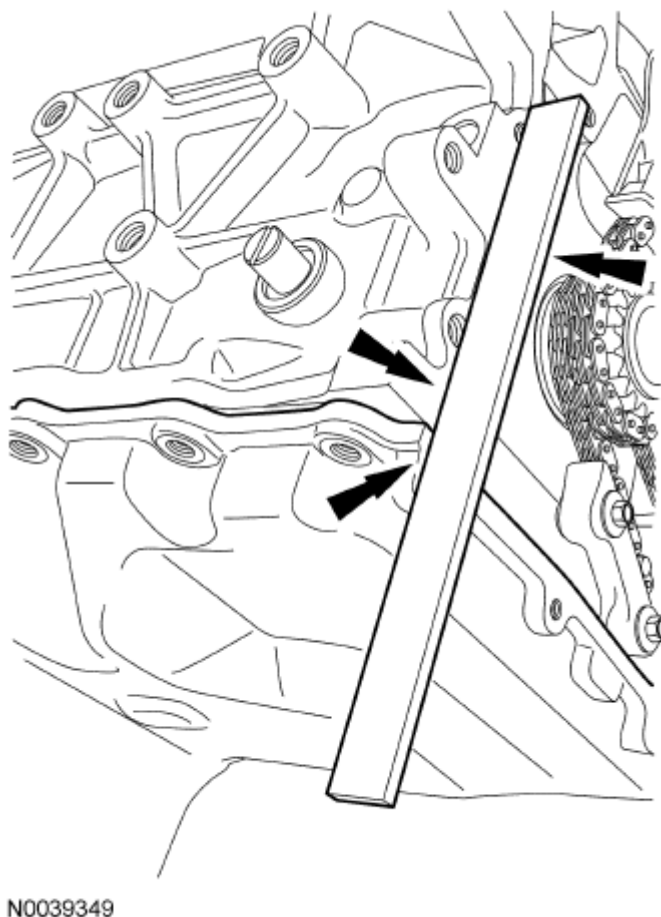


Fig. 406: Aligning Front Surface Of Oil Pan Flush With Front Surface Of Engine Block
Courtesy of FORD MOTOR CO.

39. Install the remaining oil pan bolts and tighten the oil pan bolts in the sequence shown.
- Tighten to 25 Nm (18 lb-ft).

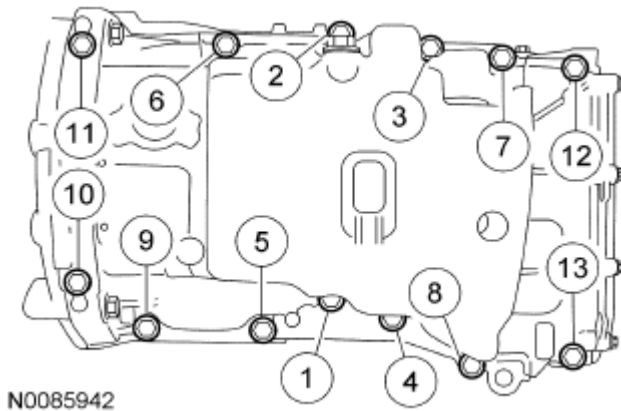


Fig. 407: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

40. Install the cylinder head alignment dowels.
- Dowels must be fully seated in the cylinder block.

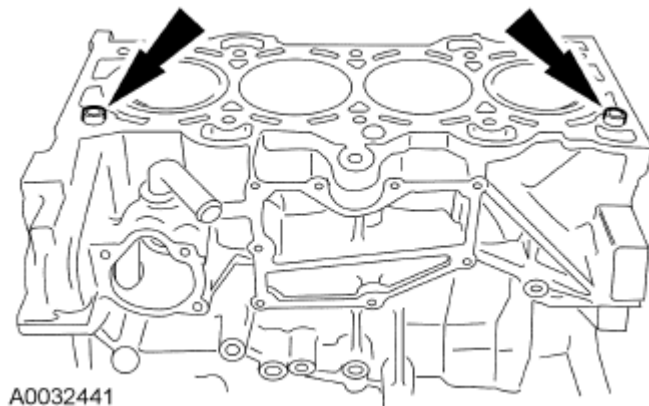


Fig. 408: Locating Cylinder Head Alignment Dowels
Courtesy of FORD MOTOR CO.

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

NOTE: Observe all warnings and 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.

41. Clean the cylinder head-to-cylinder block mating surface 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 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.
42. Apply silicone gasket and sealant to the locations shown.

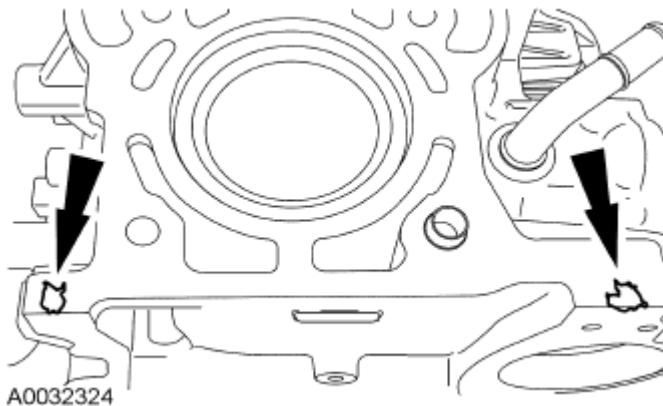


Fig. 409: Locating Silicone Gasket And Sealant Apply Locations
 Courtesy of FORD MOTOR CO.

43. Install a new head gasket.

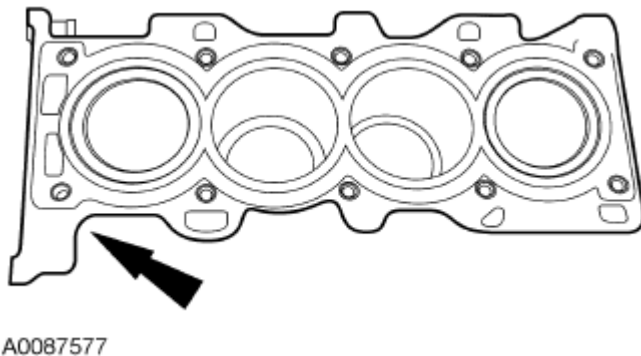


Fig. 410: Locating Head Gasket

Courtesy of FORD MOTOR CO.

NOTE: The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

NOTE: Lubricate the bolts with clean engine oil prior to installation.

44. Install the cylinder head and 10 new bolts.

Tighten the bolts in the sequence shown in 5 stages:

- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten to 15 Nm (133 lb-in).
- Stage 3: Tighten to 45 Nm (33 lb-ft).
- Stage 4: Turn 90 degrees.
- Stage 5: Turn an additional 90 degrees.

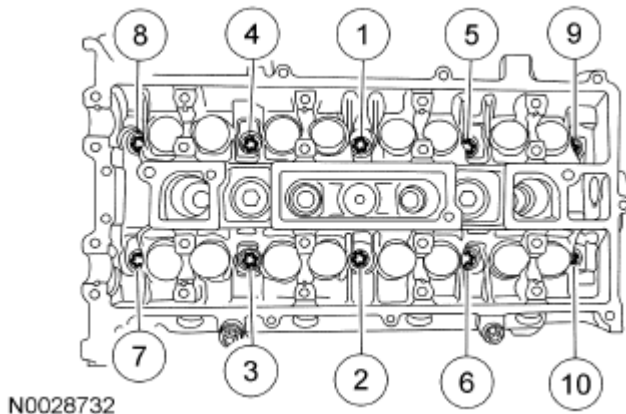


Fig. 411: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the disassembly procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position, can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

45. Install the camshafts and bearing caps in their original location and orientation. Tighten the bearing caps in the sequence shown in 3 stages:

- Stage 1: Tighten the camshaft bearing cap bolts one at a time until finger tight.

- Stage 2: Tighten to 7 Nm (62 lb-in).
- Stage 3: Tighten to 16 Nm (142 lb-in).

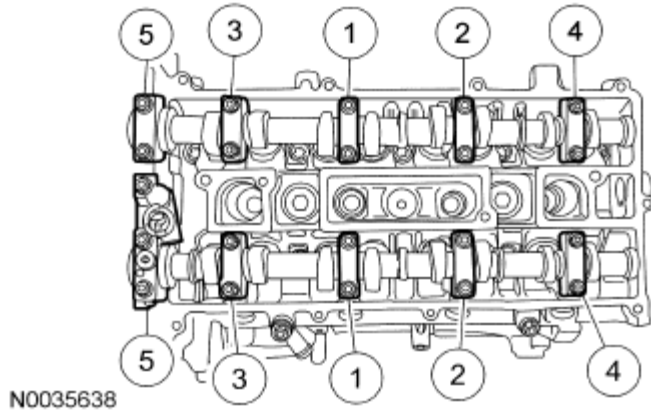


Fig. 412: Identifying Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

46. Install the VCT system oil filter and the plug in the intake camshaft thrust cap.
- Tighten to 17 Nm (150 lb-in).

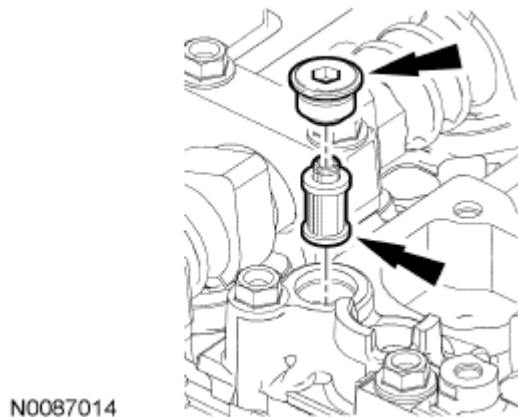


Fig. 413: Locating Plug And VCT System Oil Filter
Courtesy of FORD MOTOR CO.

47. Install the Variable Camshaft Timing (VCT) solenoid and the bolt.
- Tighten to 10 Nm (89 lb-in).

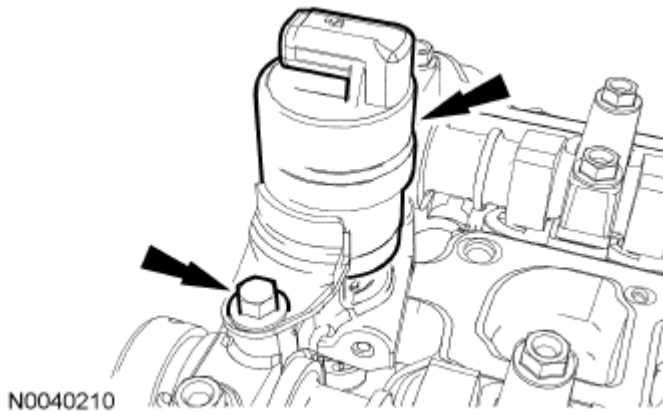


Fig. 414: Locating Bolt And VCT Solenoid
Courtesy of FORD MOTOR CO.

NOTE: Install a new crankshaft sprocket diamond washer on both sides of the crankshaft sprocket.

48. Install the crankshaft sprocket, new crankshaft sprocket diamond washers, oil pump chain and oil pump sprocket.
- The crankshaft sprocket flange must be facing away from the engine block.

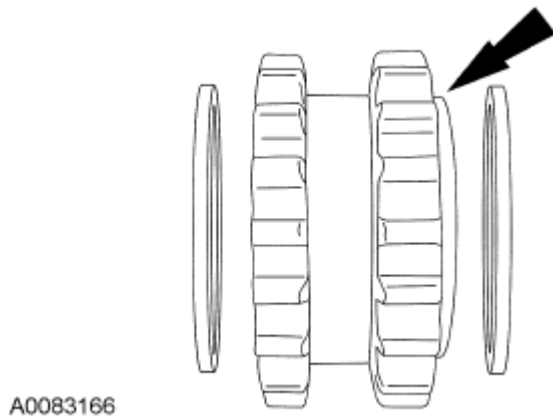


Fig. 415: Locating Crankshaft Sprocket Diamond Washer
Courtesy of FORD MOTOR CO.

49. Install the oil pump chain, sprocket and bolt.
- Tighten to 25 Nm (18 lb-ft).

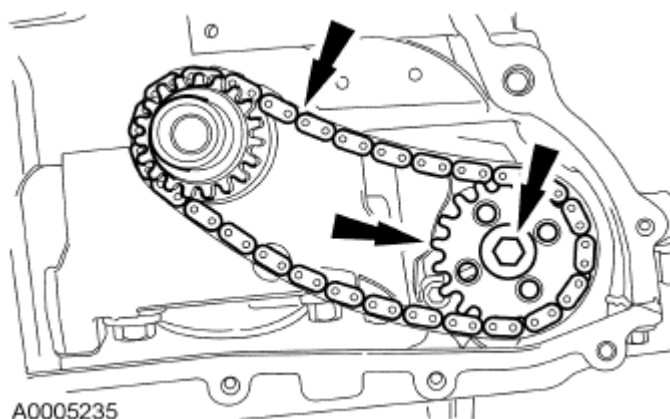


Fig. 416: Locating Oil Pump Chain, Sprocket And Bolt
Courtesy of FORD MOTOR CO.

50. Install the oil pump chain tensioner shoulder bolt.
- Tighten to 10 Nm (89 lb-in).

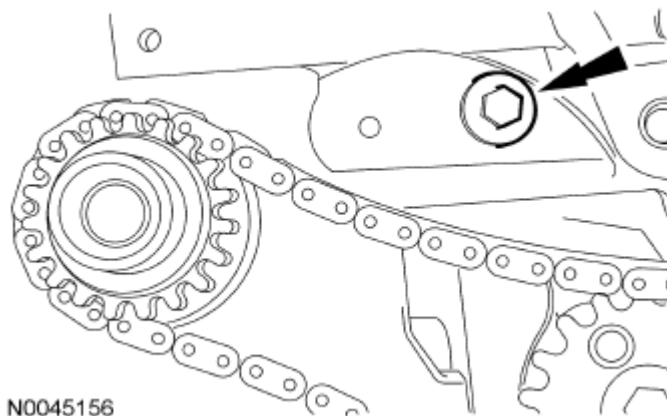


Fig. 417: Locating Oil Pump Drive Chain Tensioner Shoulder Bolt
Courtesy of FORD MOTOR CO.

51. Install the oil pump chain tensioner. Hook the tensioner spring around the shoulder bolt.
- Tighten to 10 Nm (89 lb-in).

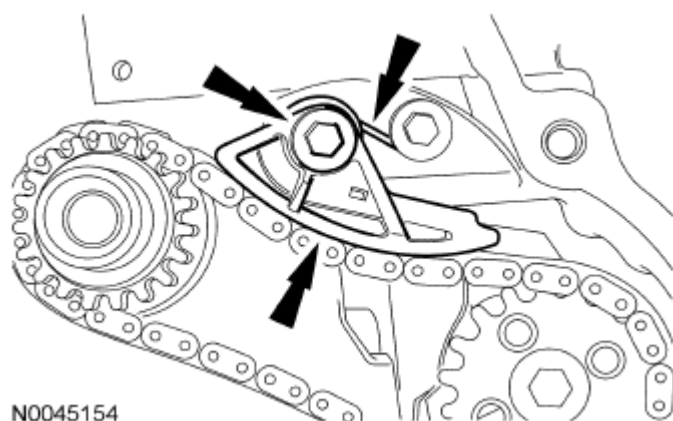


Fig. 418: Locating Oil Pump Drive Chain Tensioner, Bolt And Tensioner Spring
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

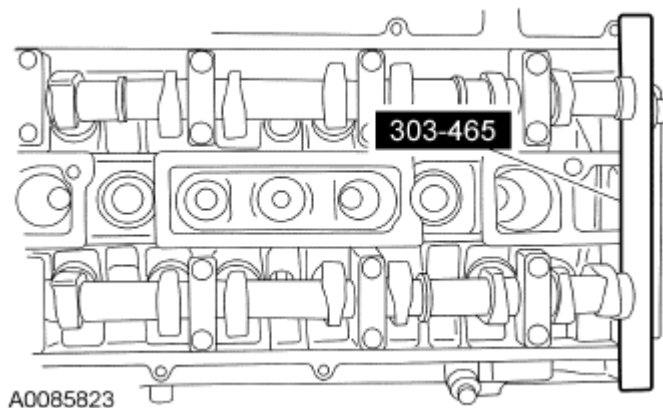


Fig. 419: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

52. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.
53. Install the camshaft sprockets and the bolts. Do not tighten the bolts at this time.

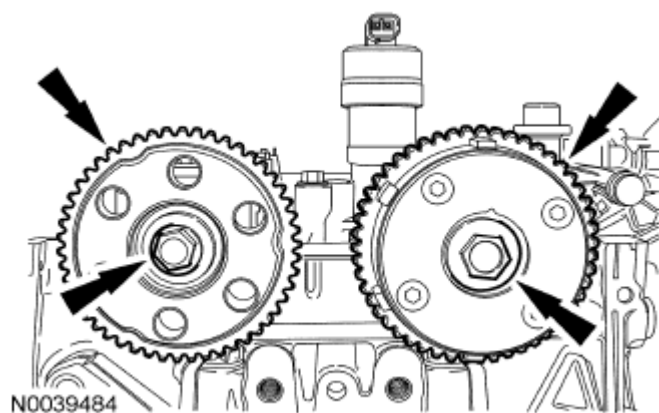


Fig. 420: Locating Camshaft Sprockets And Bolts
Courtesy of FORD MOTOR CO.

54. Install the LH timing chain guide and the bolts.
- Tighten to 10 Nm (89 lb-in).

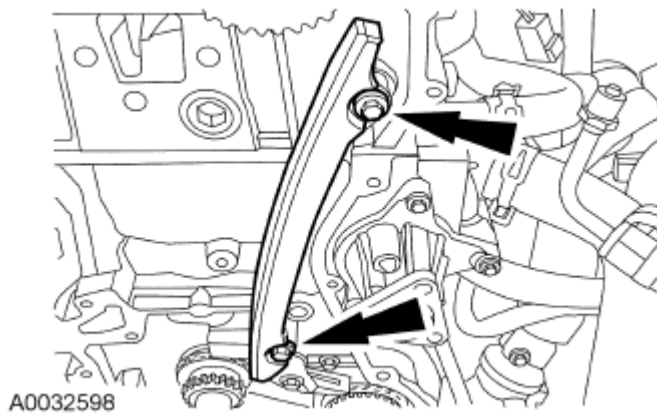


Fig. 421: Locating Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

55. Install the timing chain.

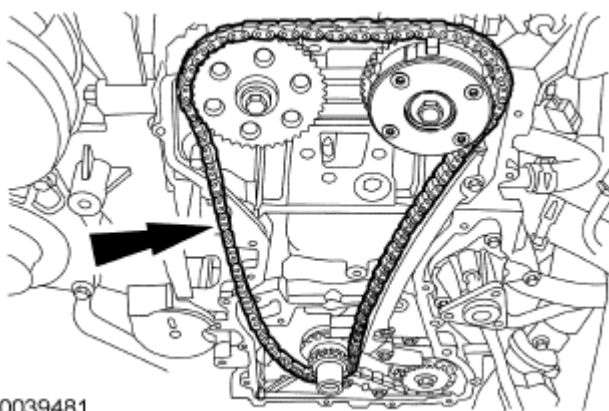


Fig. 422: Locating Timing Chain
Courtesy of FORD MOTOR CO.

56. Install the RH timing chain guide.

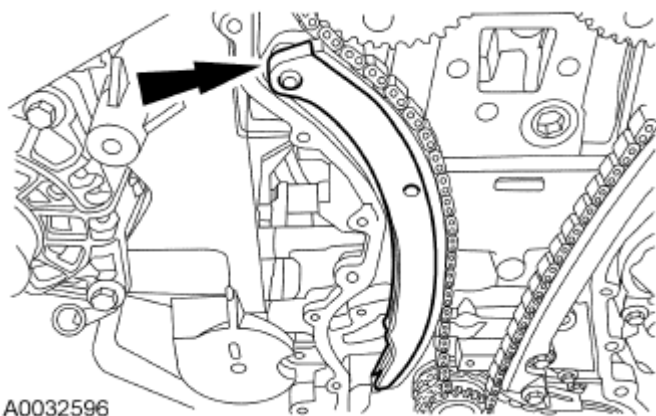
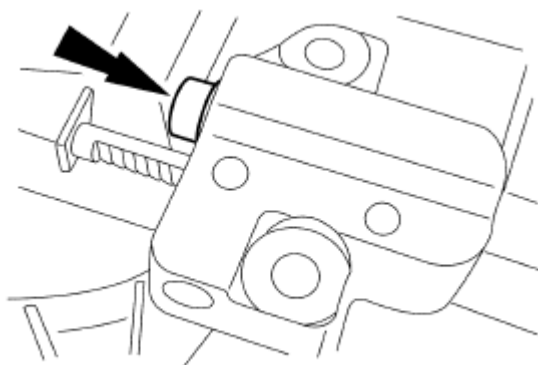


Fig. 423: Locating RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

NOTE: If the timing chain plunger and ratchet assembly are not pinned in the compressed position, follow the next 4 steps.

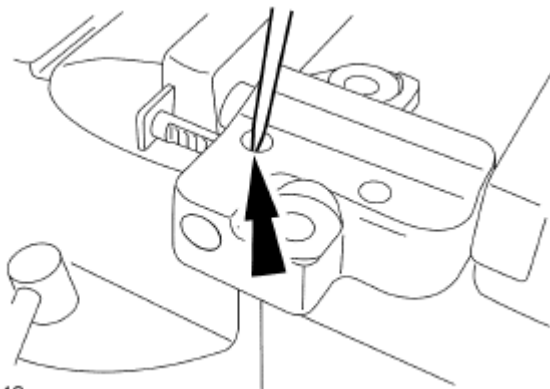
NOTE: Do not compress the ratchet assembly. This will damage the ratchet assembly.



A0032539

Fig. 424: Locating Timing Chain Tensioner Plunger
Courtesy of FORD MOTOR CO.

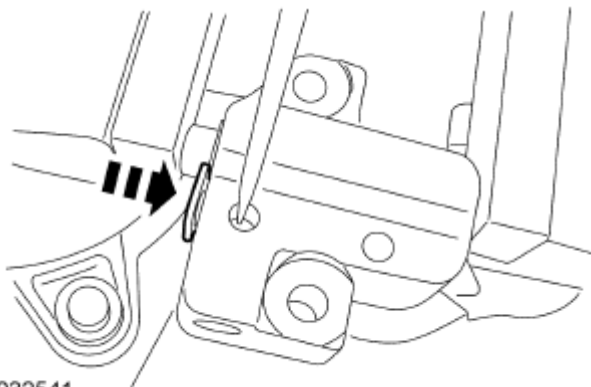
57. Using the edge of a vise, compress the timing chain tensioner plunger.
58. Using a small pick, push back and hold the ratchet mechanism.



A0032540

Fig. 425: Pushing Back And Hold Ratchet Mechanism
Courtesy of FORD MOTOR CO.

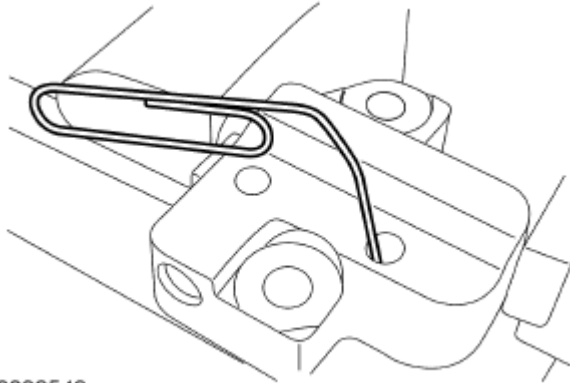
59. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.



A0032541

Fig. 426: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

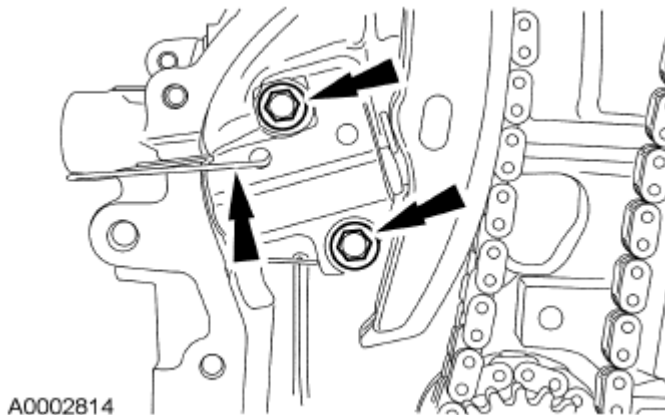
60. Install a paper clip into the hole in the tensioner housing to hold the ratchet assembly and the plunger in during installation.



A0032542

Fig. 427: Installing Paper Clip Into Hole In Tensioner Housing To Hold Ratchet Assembly And Plunger
Courtesy of FORD MOTOR CO.

61. Install the timing chain tensioner and the bolts. Remove the paper clip to release the piston.
- Tighten to 10 Nm (89 lb-in).



A0002814

Fig. 428: Locating Timing Chain Tensioner And Bolts
Courtesy of FORD MOTOR CO.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

62. Using the flats on the camshafts to prevent camshaft rotation, tighten the bolts.
- Tighten to 72 Nm (53 lb-ft).

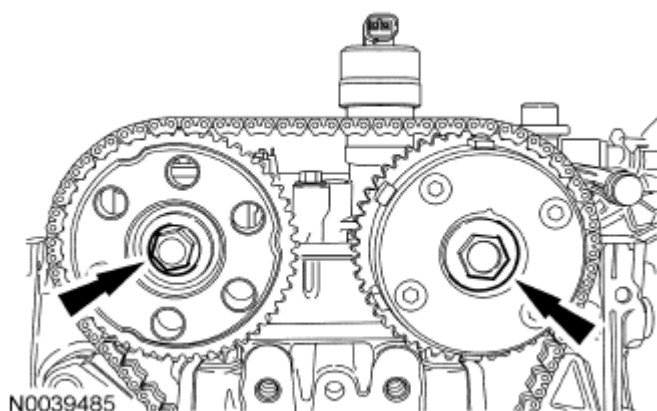
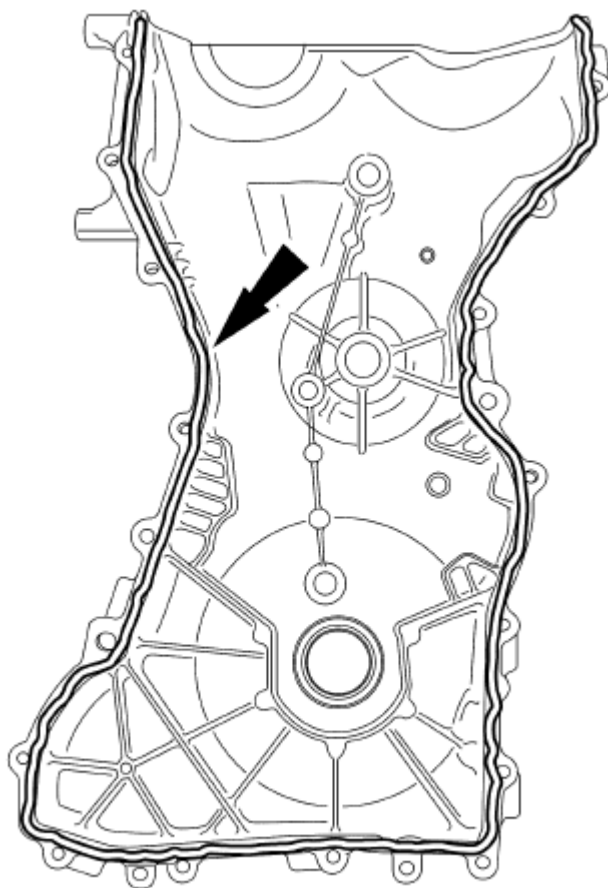


Fig. 429: Locating Camshafts Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not use metal scrapers, wire brushes, power abrasive disks or other abrasive means to clean sealing surfaces. These tools cause scratches and gouges which make leak paths.

63. Clean and inspect the mounting surfaces of the engine and the front cover.

NOTE: The engine front cover must be installed and the bolts tightened within 4 minutes of applying the silicone gasket and sealant.



A0032803

Fig. 430: Locating Front Cover Silicone Gasket And Sealant Bead
Courtesy of FORD MOTOR CO.

64. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the cylinder head and oil pan joint areas. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the front cover.
65. Install the engine front cover. Tighten the bolts in the sequence shown, to the following specifications:
 - Tighten the 8-mm bolts to 10 Nm (89 lb-in).
 - Tighten the 13-mm bolts to 48 Nm (35 lb-ft).

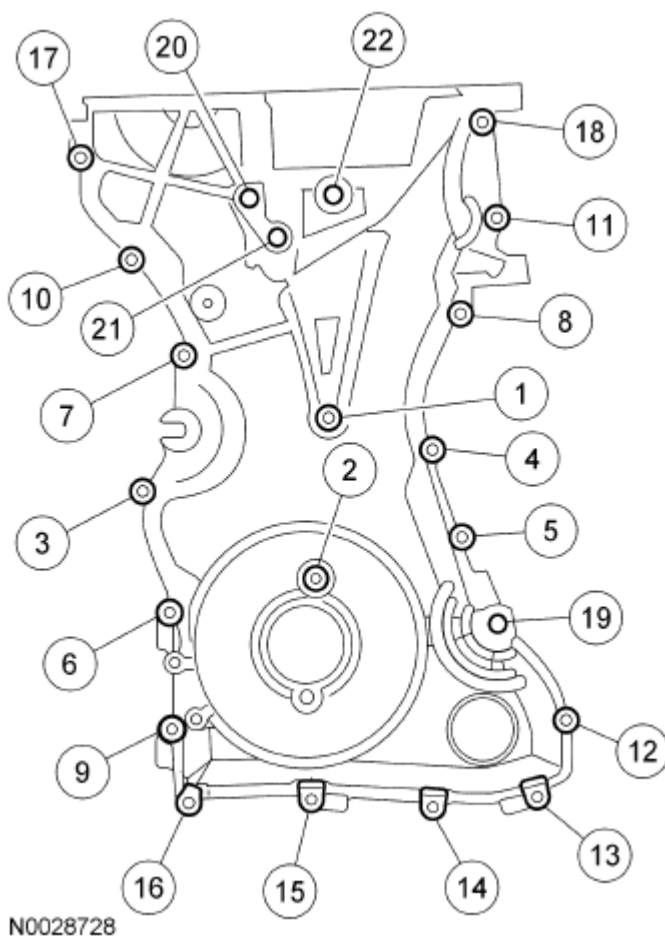


Fig. 431: Identifying Engine Front Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Remove the through-bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

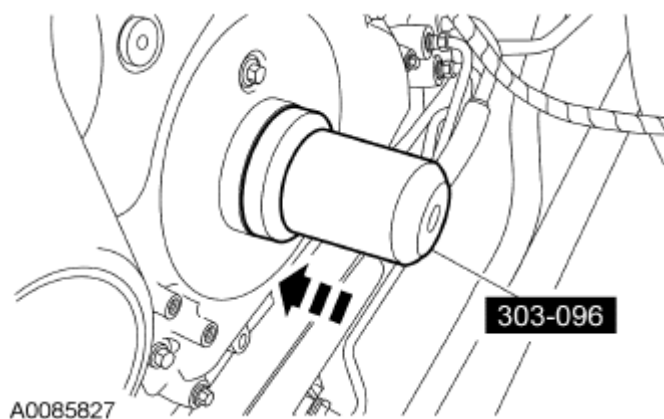


Fig. 432: Installing Crankshaft Front Oil Seal

Courtesy of FORD MOTOR CO.

66. Using the Camshaft Front Oil Seal Installer, install a new crankshaft front oil seal.

NOTE: Do not install the crankshaft pulley bolt at this time.

NOTE: Apply clean engine oil on the seal area before installing.

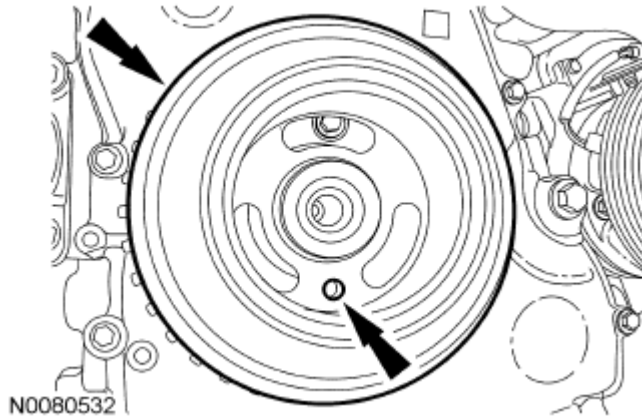


Fig. 433: Positioning Crankshaft Pulley Onto Crankshaft With Hole In Pulley At 6 O'Clock Position

Courtesy of FORD MOTOR CO.

67. Position the crankshaft pulley onto the crankshaft with the hole in the pulley at the 6 o'clock position.

NOTE: Only hand-tighten the 6 mm x 18 mm bolt or damage to the front cover can occur.

NOTE: This step will correctly align the crankshaft pulley to the crankshaft.

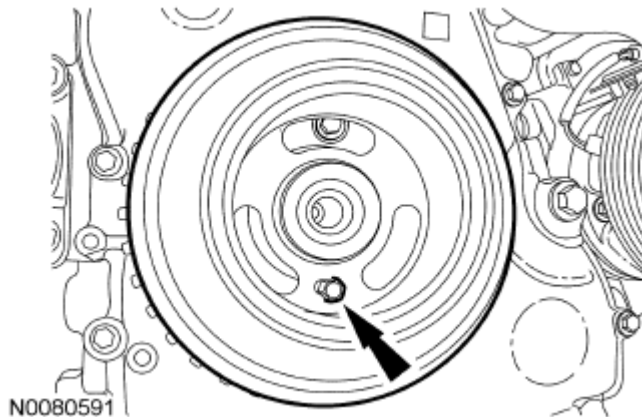


Fig. 434: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)

Courtesy of FORD MOTOR CO.

68. Install a 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during installation of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be installed using hand tools only.

NOTE: Do not reuse the crankshaft pulley bolt.

69. Install a new crankshaft pulley bolt. Using the Crankshaft Damper Holding Tool to hold the crankshaft pulley in place, tighten the crankshaft pulley bolt in 2 stages:

- Stage 1: Tighten to 100 Nm (74 lb-ft).
- Stage 2: Tighten an additional 90 degrees (1/4 turn).

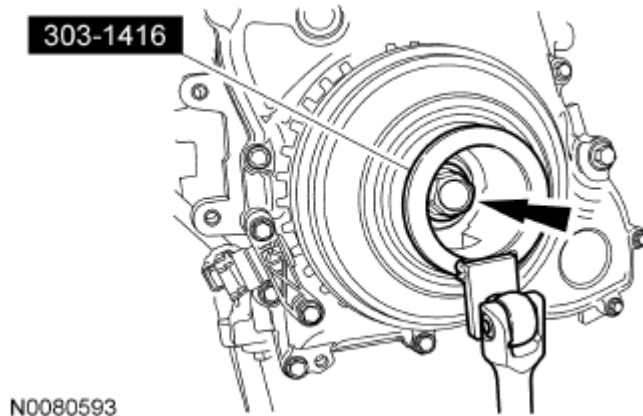


Fig. 435: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

70. Remove the 6 mm x 18 mm bolt.

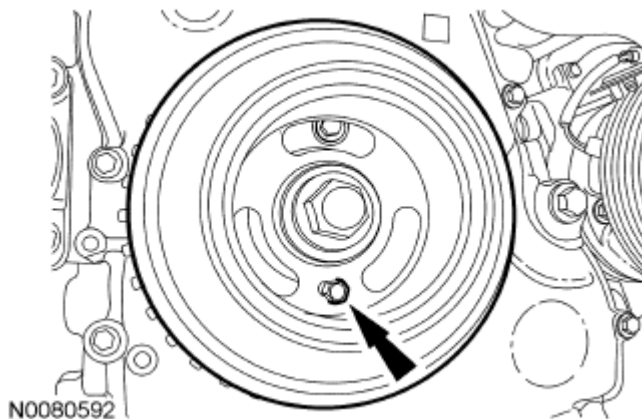


Fig. 436: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)

Courtesy of FORD MOTOR CO.

71. Remove the Crankshaft TDC Timing Peg.

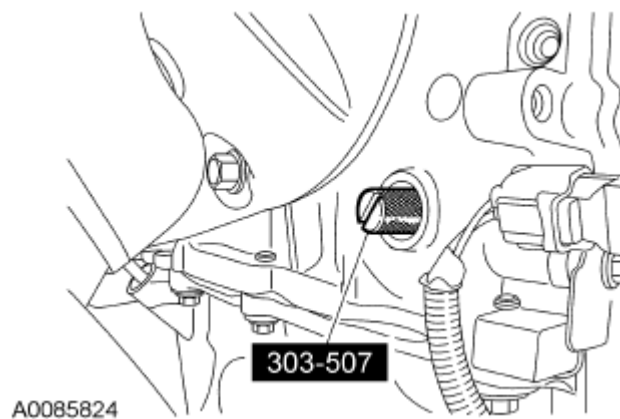


Fig. 437: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

72. Remove the Camshaft Alignment Plate.

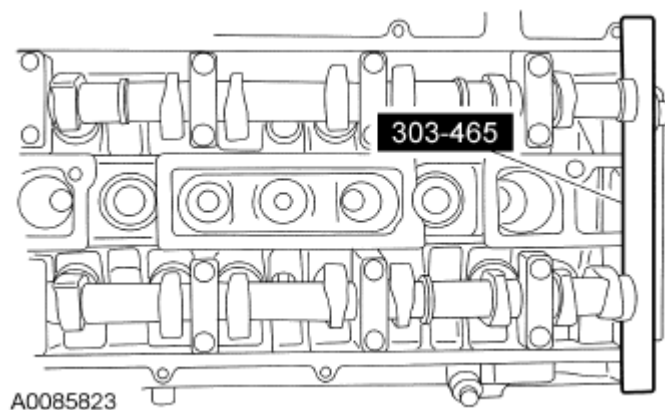


Fig. 438: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

NOTE: Only turn the engine in the normal direction of rotation.

73. Turn the crankshaft clockwise one and three-fourths turns.
74. Install the Crankshaft TDC Timing Peg.

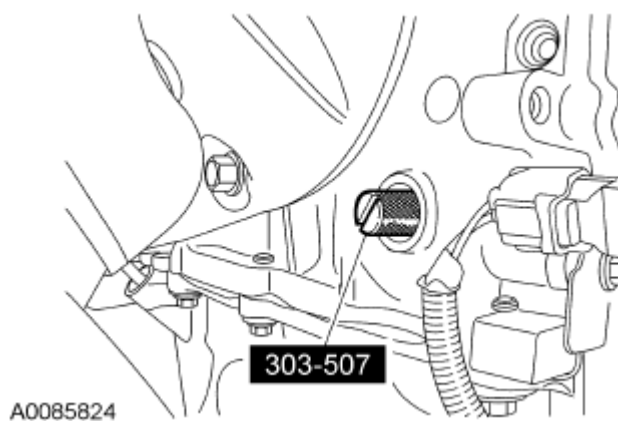


Fig. 439: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

NOTE: Only turn the engine in the normal direction of rotation.

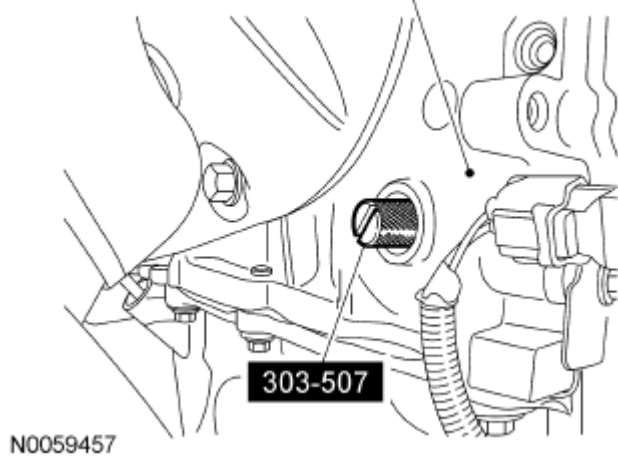
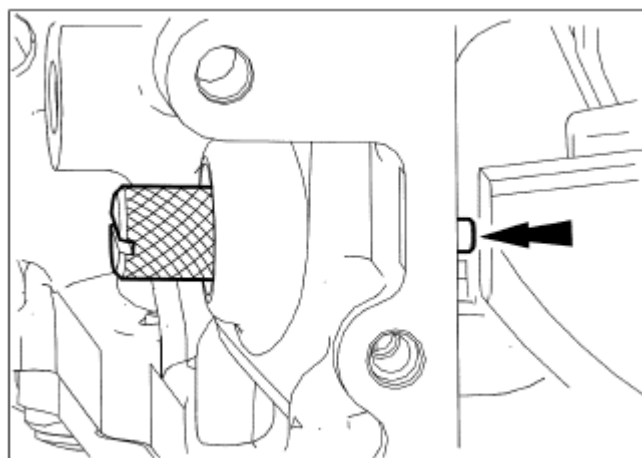


Fig. 440: Locating Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

75. Turn the crankshaft clockwise until the crankshaft contacts the Crankshaft TDC Timing Peg.

NOTE: Only hand-tighten the bolt or damage to the front cover can occur.

76. Using the 6 mm x 18 mm bolt, check the position of the crankshaft pulley.
- If it is not possible to install the bolt, the engine valve timing must be corrected.

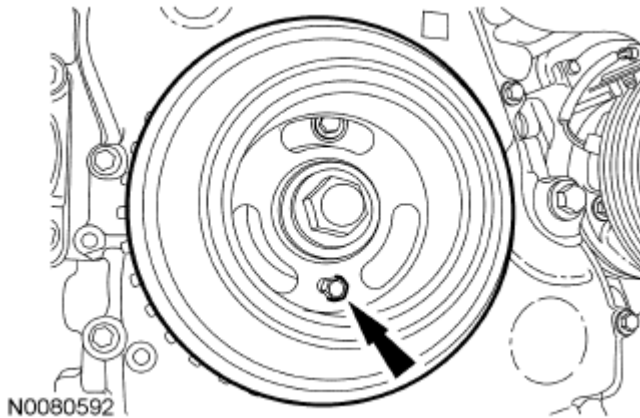


Fig. 441: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

77. Install the Camshaft Alignment Plate to check the position of the camshafts.
- If it is not possible to install the Camshaft Alignment Plate, the engine valve timing must be corrected.

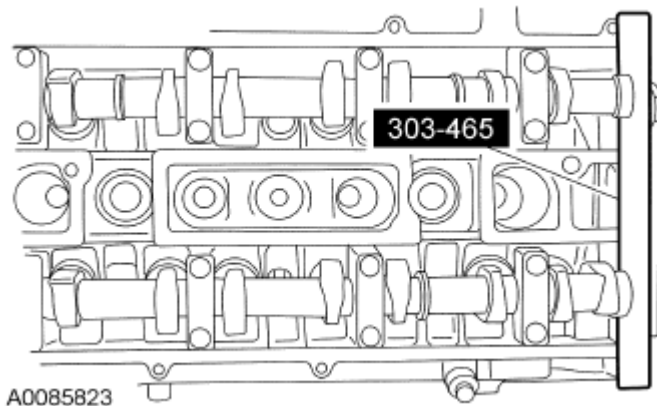


Fig. 442: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

78. Remove the Camshaft Alignment Plate.

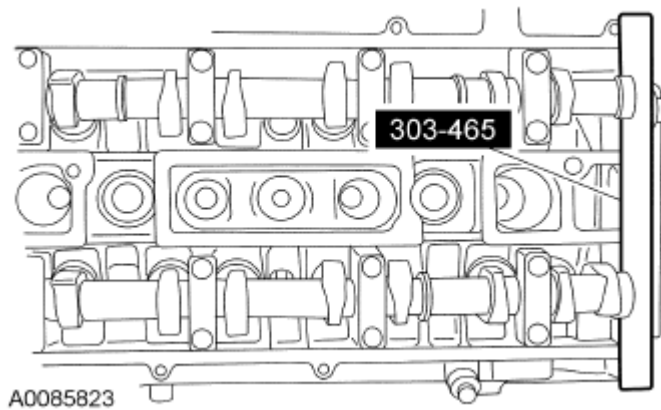


Fig. 443: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

79. Install the Crankshaft Position (CKP) sensor and the 2 bolts.
- Do not tighten the bolts at this time.

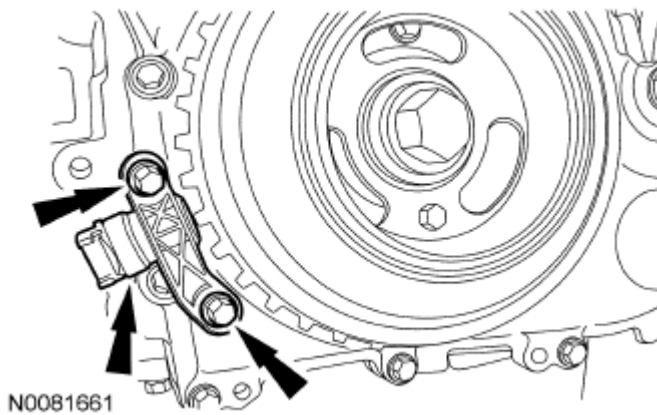


Fig. 444: Locating CKP Sensor And Bolts
Courtesy of FORD MOTOR CO.

80. Using the Crankshaft Sensor Aligner, adjust the CKP sensor.
- Tighten the 2 CKP bolts to 7 Nm (62 lb-in).

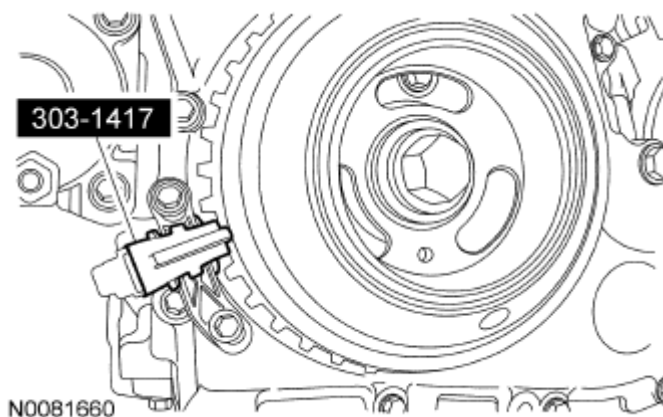


Fig. 445: Identifying Crankshaft Sensor Aligner
Courtesy of FORD MOTOR CO.

81. Remove the 6 mm x 18 mm bolt.

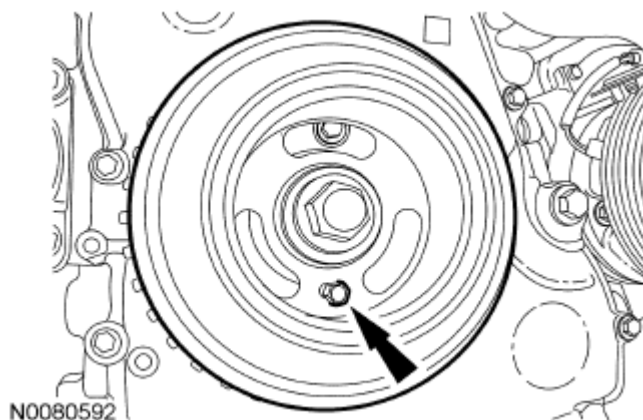


Fig. 446: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

82. Remove the Crankshaft TDC Timing Peg.

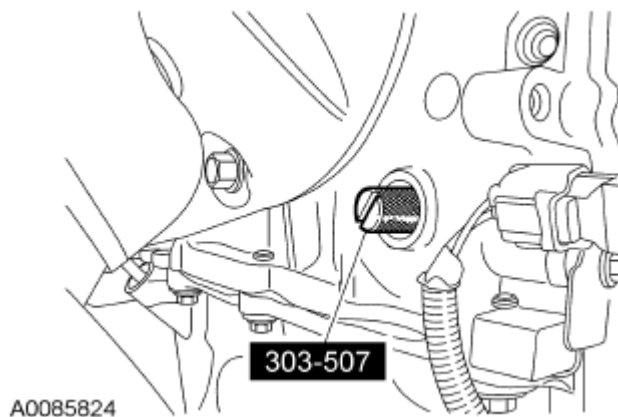


Fig. 447: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

83. Install the engine plug bolt.
 - Tighten to 20 Nm (177 lb-in).

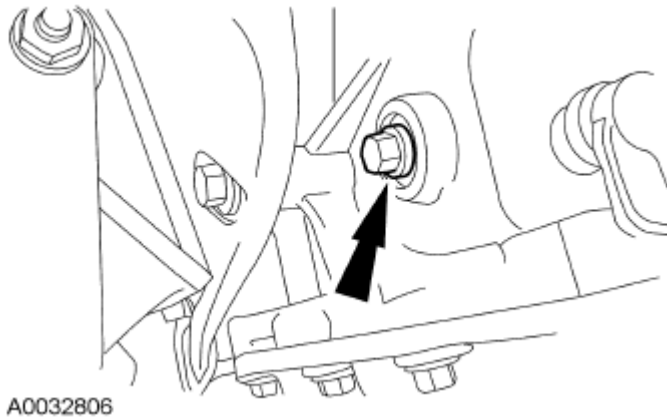


Fig. 448: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

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.

84. Clean the valve cover gasket surface with metal surface cleaner.
85. Apply silicone gasket and sealant to the locations shown.

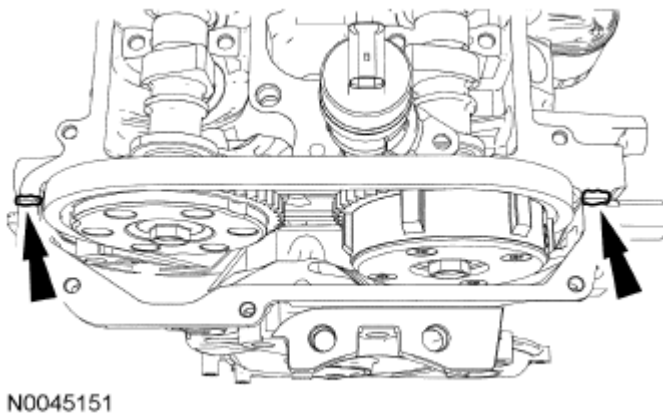


Fig. 449: Locating Silicone Gasket And Sealant Applying Locations
Courtesy of FORD MOTOR CO.

NOTE: The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant

must be removed and the sealing area cleaned with metal surface cleaner.

86. Install the valve cover.

- Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).

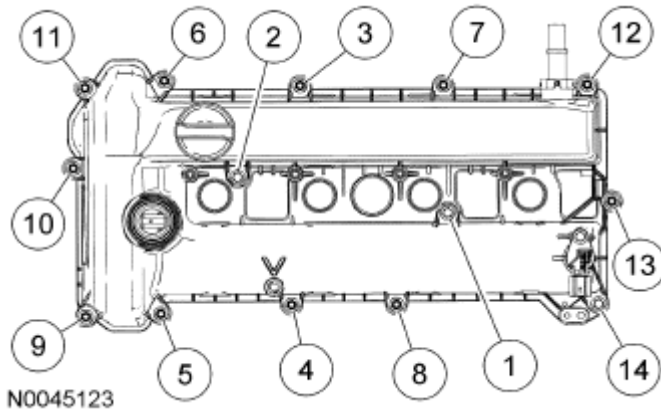


Fig. 450: Identifying Valve Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

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

87. Install the Cylinder Head Temperature (CHT) sensor and the spark plugs.

- Tighten the CHT sensor to 12 Nm (106 lb-in).
- Tighten the spark plugs to 12 Nm (106 lb-in).

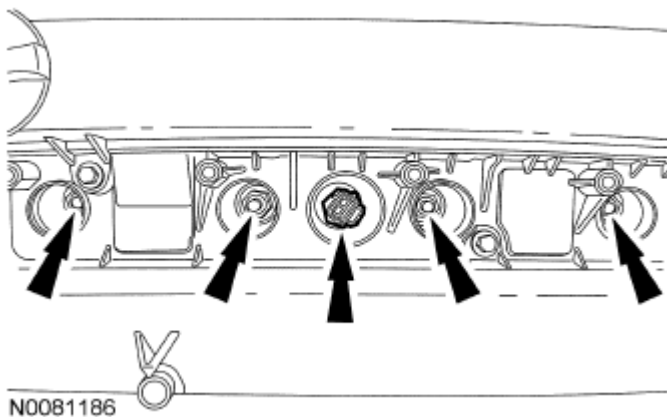
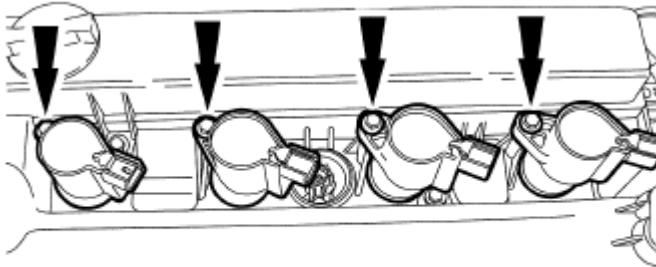


Fig. 451: Locating Spark Plugs And CHT Sensor
Courtesy of FORD MOTOR CO.

NOTE: Apply dielectric compound to the inside of the coil-on-plug boots.

88. Install the 4 coil-on-plugs and the 4 bolts.

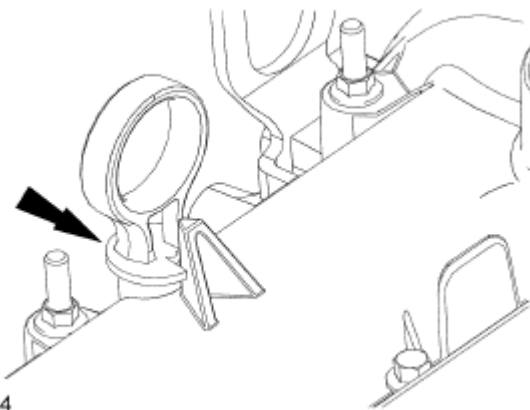
- Tighten to 8 Nm (71 lb-in).



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Fig. 452: Locating Bolts And Coil-On-Plugs
Courtesy of FORD MOTOR CO.

NOTE: Make sure the notch on the oil level indicator is aligned with the V-shaped boss on the valve cover and fully engaged into the valve cover.



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Fig. 453: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

89. Install the oil level indicator.
90. If equipped, install the block heater.
 - Tighten to 40 Nm (30 lb-ft).

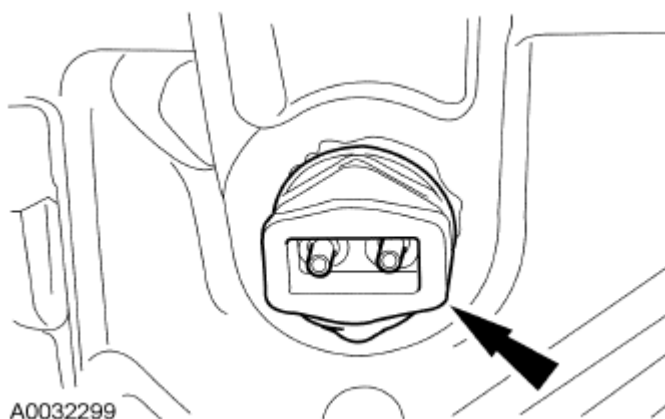


Fig. 454: Locating Block Heater
Courtesy of FORD MOTOR CO.

91. Install the crankcase vent oil separator and the 8 bolts.
 - Tighten to 10 Nm (89 lb-in).

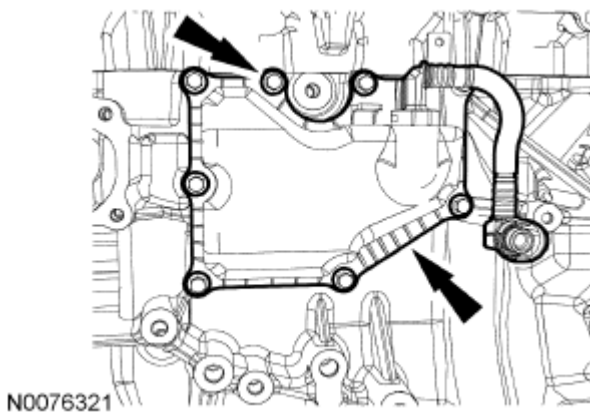


Fig. 455: Locating Bolts And Crankcase Vent Oil Separator
Courtesy of FORD MOTOR CO.

NOTE: The Knock Sensor (KS) must not touch the crankcase vent oil separator.

92. Install the KS and the bolt.
 - Tighten to 20 Nm (177 lb-in).

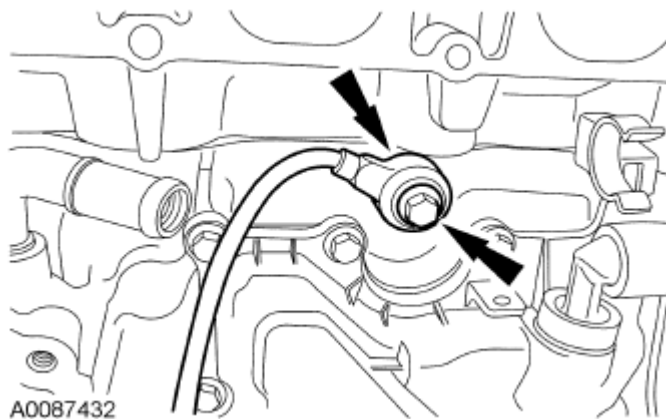


Fig. 456: Locating Bolt And KS
Courtesy of FORD MOTOR CO.

93. Install the 2 coolant hoses.

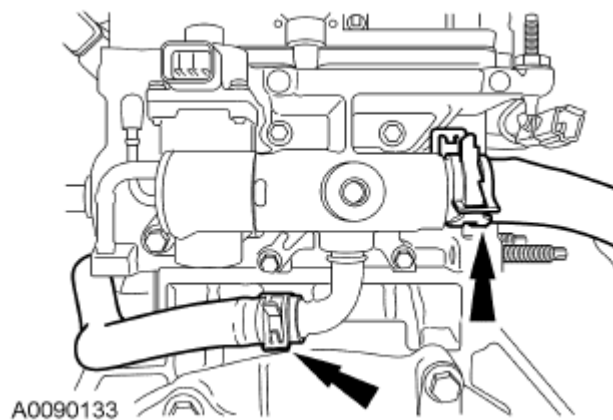


Fig. 457: Locating Coolant Hoses
Courtesy of FORD MOTOR CO.

94. Install the coolant hose.

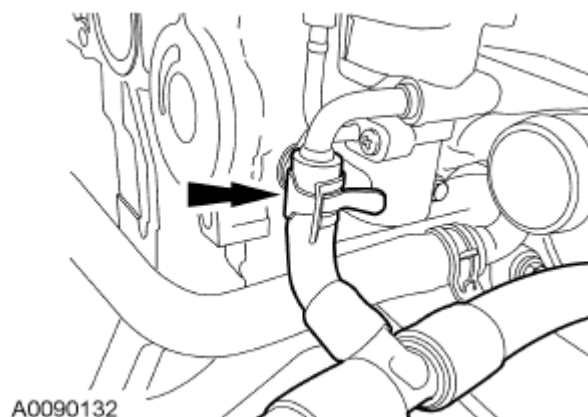


Fig. 458: Locating Coolant Hose
Courtesy of FORD MOTOR CO.

95. Install the coolant hose.

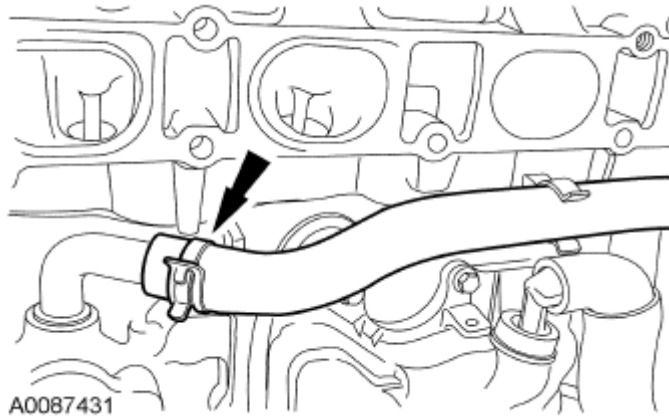


Fig. 459: Locating Coolant Hose
Courtesy of FORD MOTOR CO.

96. Install the EGR tube.
- Tighten to 55 Nm (41 lb-ft).

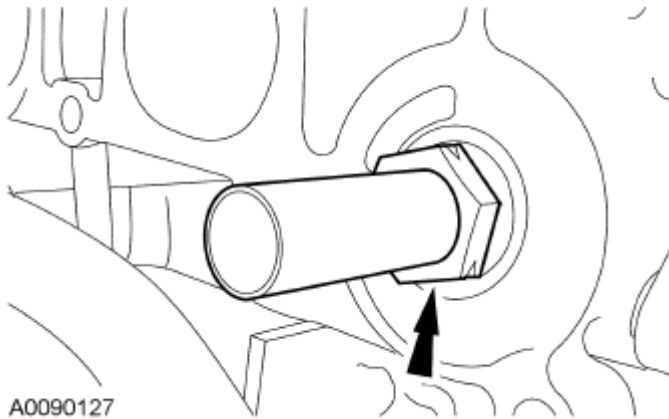


Fig. 460: Identifying EGR Tube
Courtesy of FORD MOTOR CO.

NOTE: If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.

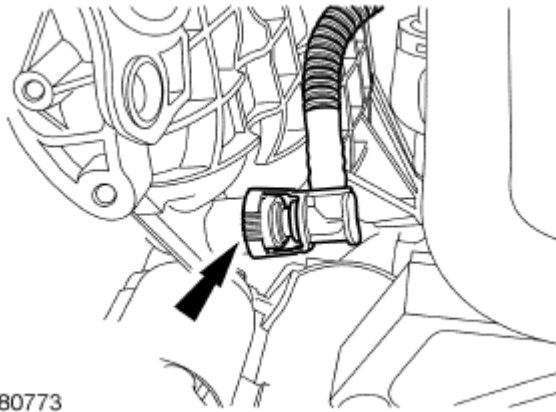


Fig. 461: Locating Crankcase Vent Oil Separator Tube
Courtesy of FORD MOTOR CO.

97. Position the intake manifold and connect the crankcase vent oil separator tube.

NOTE: **Inspect and install new intake manifold gaskets, if necessary.**

98. Install the intake manifold gaskets, intake manifold and the 8 bolts.

- Tighten to 18 Nm (159 lb-in).

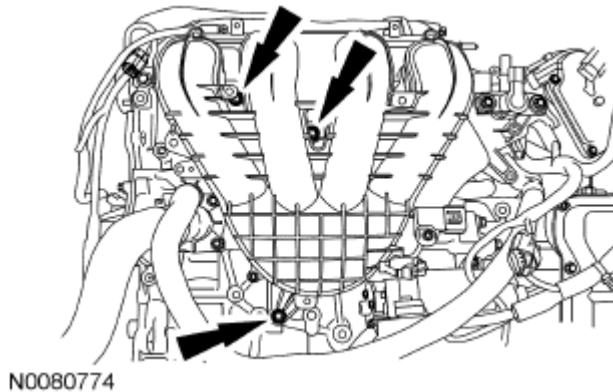


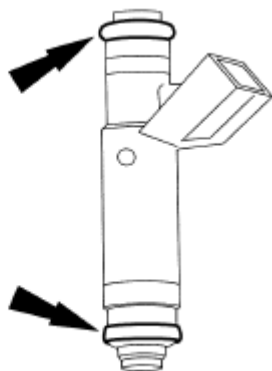
Fig. 462: Locating Bolts And Intake Manifold
Courtesy of FORD MOTOR CO.

NOTE: **Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.**

99. Install new fuel injector O-rings.

- Separate the fuel injectors from the fuel rail.
- Remove and discard the fuel injector O-rings.
- Install new O-rings and lubricate with clean engine oil.

- Install the fuel injectors onto the fuel rail.



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Fig. 463: Locating Fuel Injector O-Rings
Courtesy of FORD MOTOR CO.

100. Install the fuel rail with the fuel injectors as an assembly and the 2 stud bolts.

- Tighten to 23 Nm (17 lb-ft).

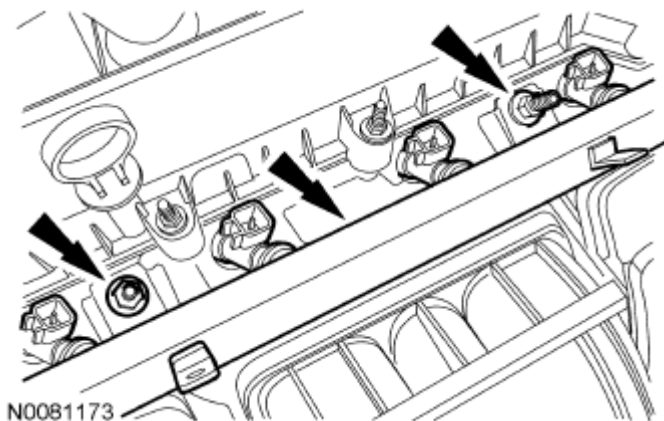


Fig. 464: Locating Stud Bolts, Fuel Rail And Fuel Injectors
Courtesy of FORD MOTOR CO.

101. Install the radio capacitor and nut.

- Tighten to 10 Nm (89 lb-in).

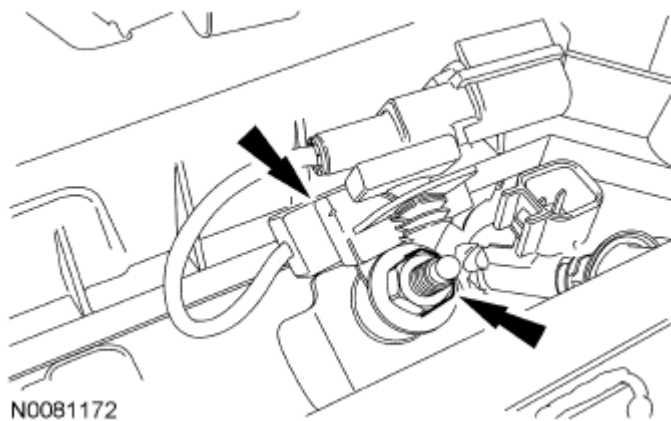


Fig. 465: Locating Nut And Radio Capacitor
Courtesy of FORD MOTOR CO.

102. Install the fuel rail insulator.

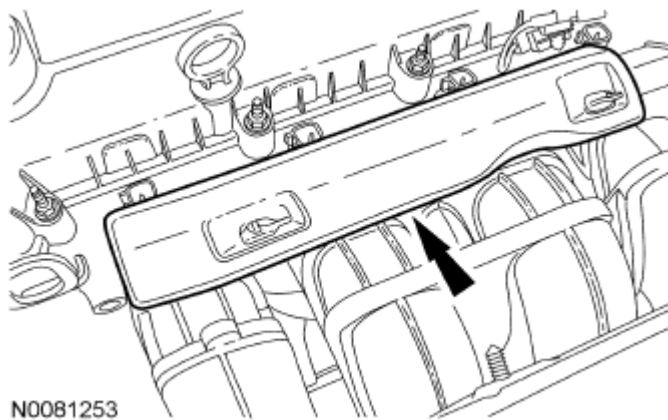


Fig. 466: Locating Fuel Rail Insulator
Courtesy of FORD MOTOR CO.

103. Connect the 4 fuel injector electrical connectors. Attach the 2 wiring harness retainers.

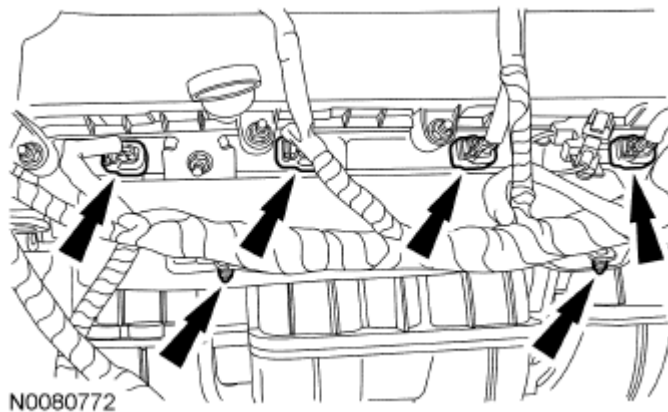


Fig. 467: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

104. Connect the radio capacitor electrical connector.

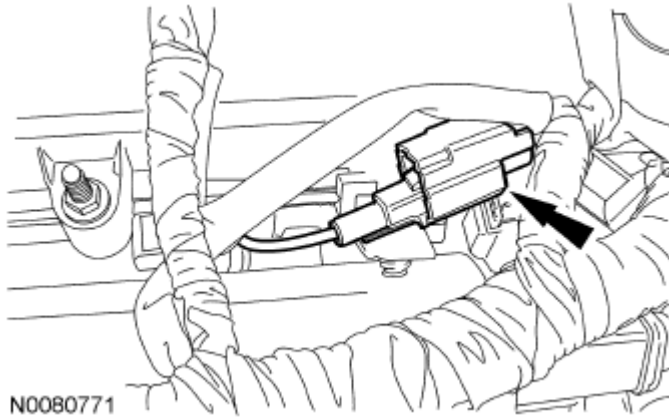


Fig. 468: Locating Radio Capacitor Electrical Connector
Courtesy of FORD MOTOR CO.

105. Position the engine control wiring harness on the engine and connect the CHT sensor and install the rubber boot.

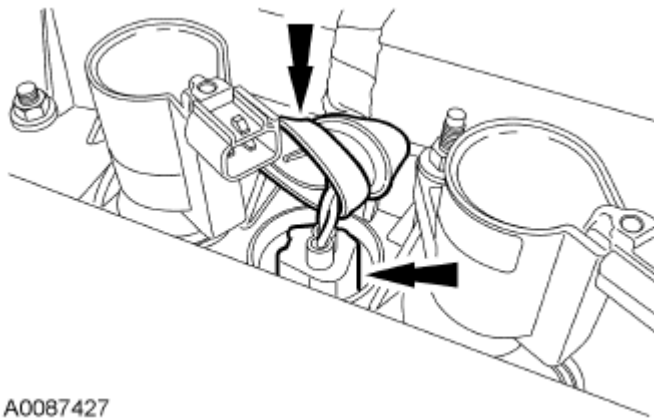


Fig. 469: Locating Rubber Boot Aside And Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

106. Connect the 4 coil-on-plugs and Camshaft Position (CMP) sensor electrical connectors.

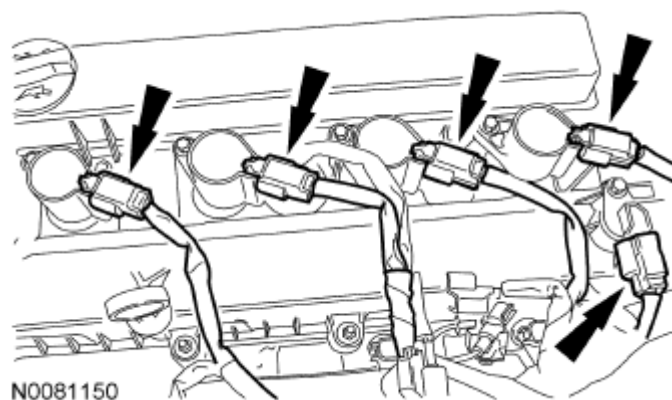


Fig. 470: Locating Coil-On-Plugs And Camshaft Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

107. Attach all the wiring harness retainer to the intake manifold.
108. Connect the KS and attach the 2 wiring harness retainers.

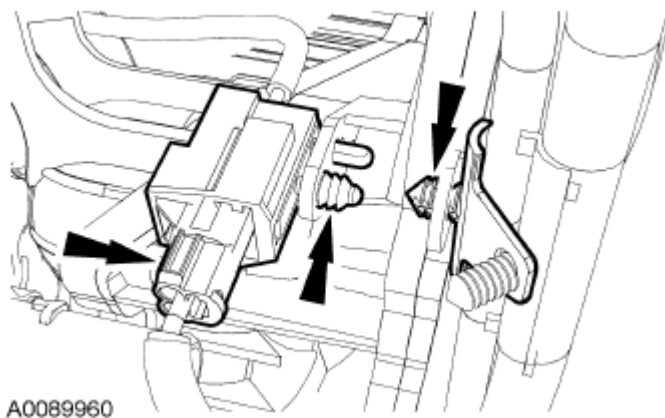


Fig. 471: Locating Knock Sensor And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

109. Connect the EGR valve electrical connector.

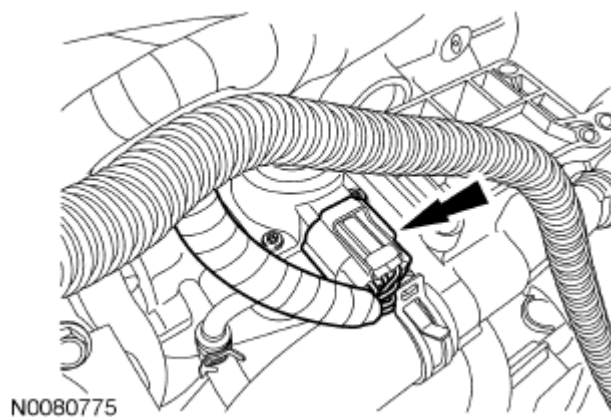


Fig. 472: Locating EGR Valve Electrical Connector
Courtesy of FORD MOTOR CO.

110. Connect the electronic throttle control and Evaporative Emission (EVAP) canister purge valve electrical connectors.

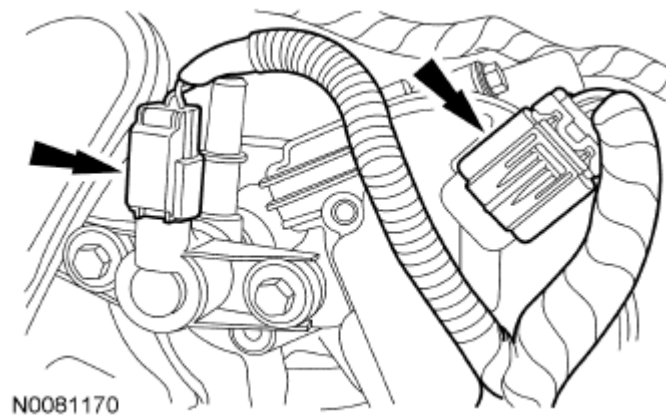


Fig. 473: Locating Electronic Throttle Control And Evaporative Emission Canister Purge Valve Electrical Connectors
Courtesy of FORD MOTOR CO.

111. Connect the Manifold Absolute Pressure (MAP) sensor electrical connector.

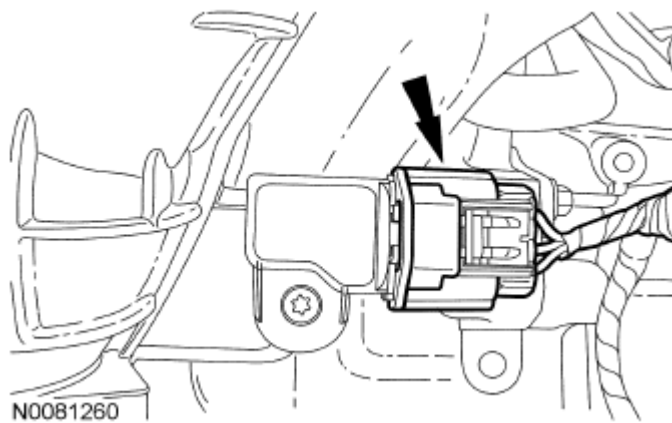


Fig. 474: Locating Manifold Absolute Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

112. Attach the wiring harness retainers to the LH side valve cover stud bolts.

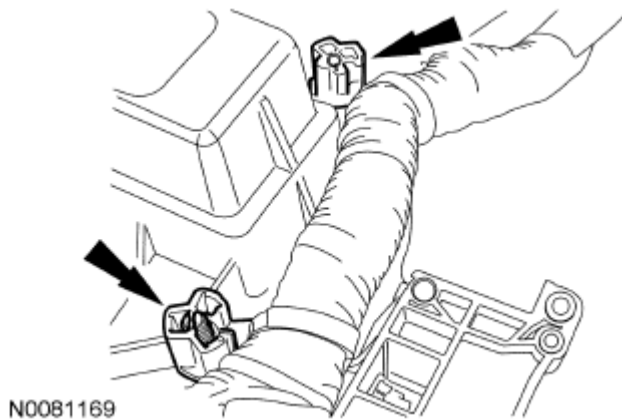


Fig. 475: Locating Wiring Harness Retainers And LH Side Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

113. Connect the crankcase vent hose to the valve cover.

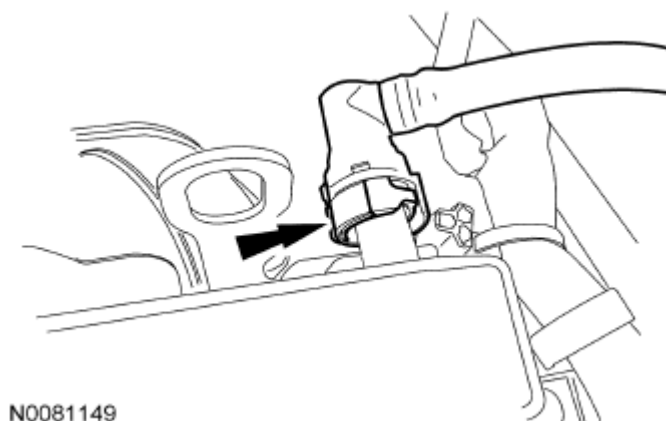


Fig. 476: Locating Crankcase Vent Hose
Courtesy of FORD MOTOR CO.

114. Attach the wiring harness retainers to the RH side valve cover stud bolts.

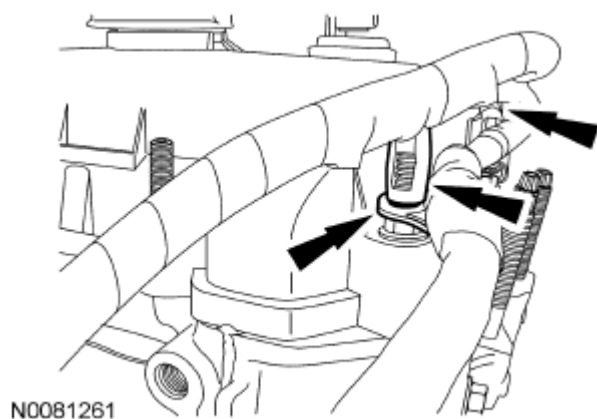


Fig. 477: Locating Wiring Harness Retainers And RH Side Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

115. Connect the VCT electrical connector.

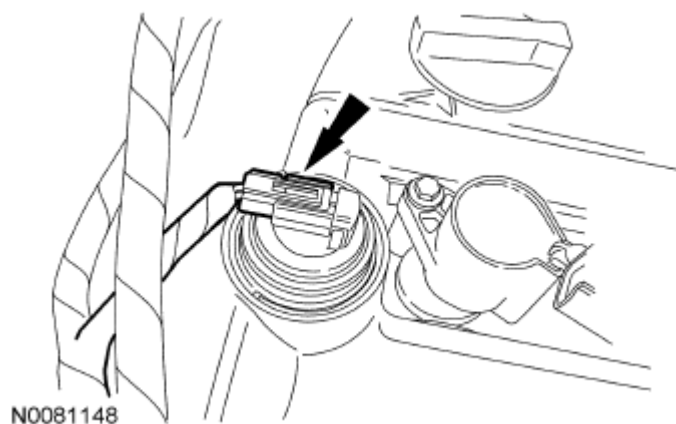


Fig. 478: Locating Variable Camshaft Timing Electrical Connector
Courtesy of FORD MOTOR CO.

116. If removed, install the capacitor and bolt.
- Tighten to 20 Nm (177 lb-in).

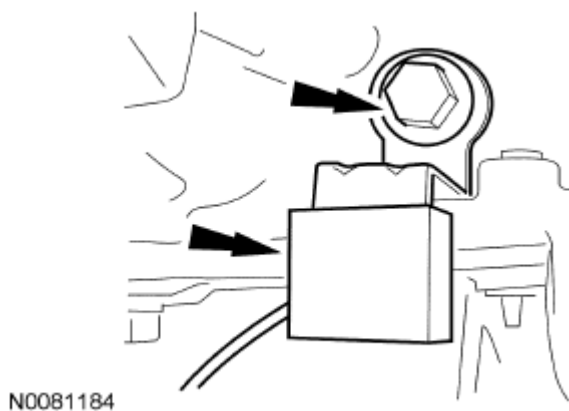


Fig. 479: Locating Bolt And Capacitor
Courtesy of FORD MOTOR CO.

NOTE: Clean the gasket mating surfaces with metal surface prep.

NOTE: Spin on oil filter adapter shown, element oil filter adapter similar.

117. Install the oil filter adapter with a new gasket.

- Tighten to 25 Nm (18 lb-ft).

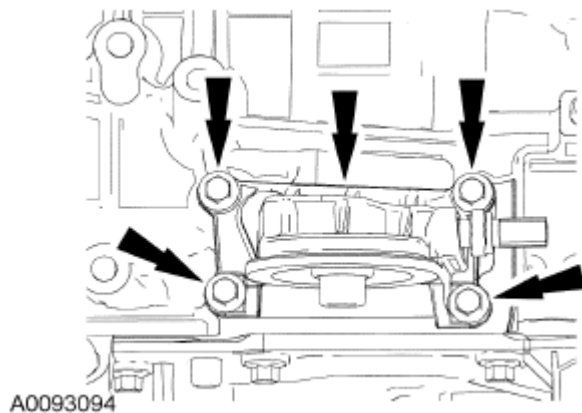


Fig. 480: Locating Bolts And Oil Filter Adapter
Courtesy of FORD MOTOR CO.

118. Connect the Engine Oil Pressure (EOP) switch electrical connector.

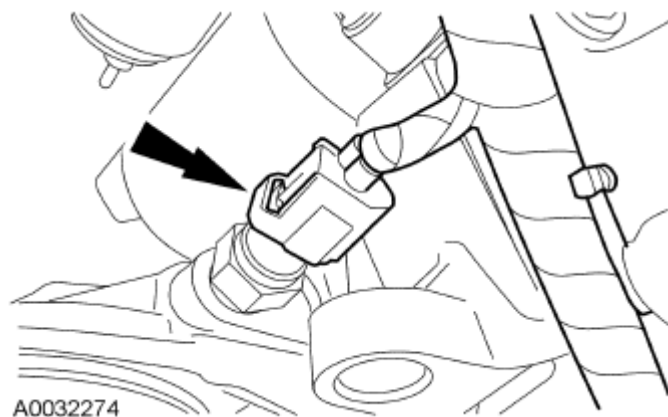


Fig. 481: Locating Engine Oil Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

119. Install the coolant tube retainer to the intake manifold.

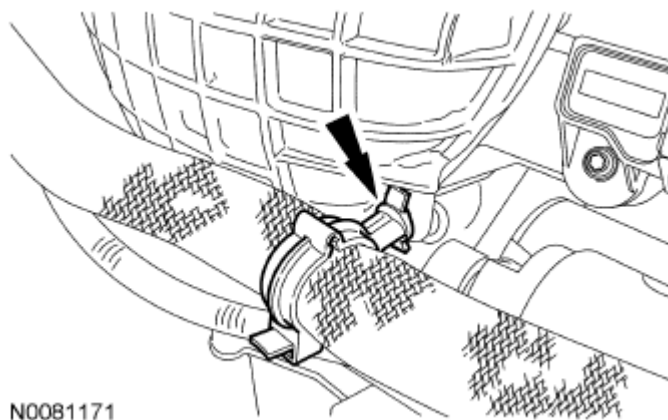


Fig. 482: Locating Coolant Tube Retainer
Courtesy of FORD MOTOR CO.

NOTE: Clean and inspect the thermostat housing gasket. Install a new gasket, if necessary.

120. Install the thermostat housing and bolts.
- Tighten to 10 Nm (89 lb-in).

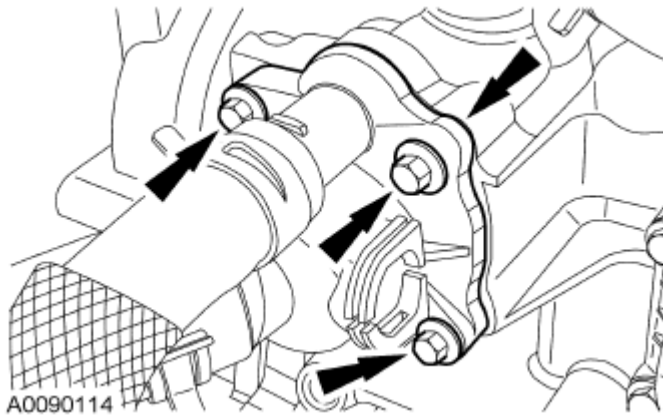


Fig. 483: Locating Bolts And Thermostat Housing Assembly
Courtesy of FORD MOTOR CO.

NOTE: Clean the coolant pump mating surface with metal surface prep.

NOTE: Lubricate the coolant pump O-ring with clean engine coolant.

121. Install the coolant pump and bolts.

- Tighten to 10 Nm (89 lb-in).

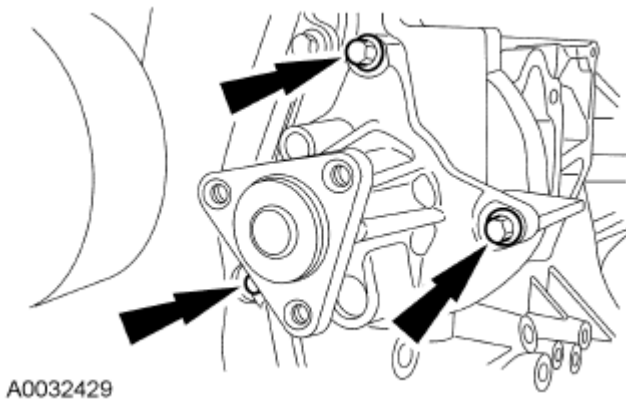


Fig. 484: Locating Bolts And Coolant Pump
Courtesy of FORD MOTOR CO.

122. Install the 3 coolant pump pulley and bolts.

- Tighten to 20 Nm (177 lb-in).

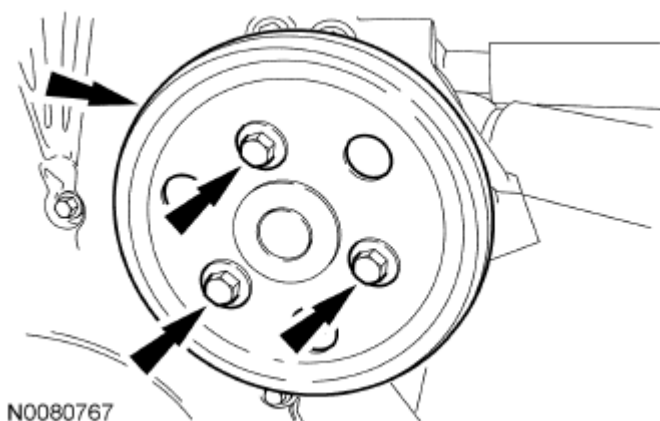


Fig. 485: Locating Bolts And Coolant Pump Pulley
Courtesy of FORD MOTOR CO.

123. Install the accessory drive belt idler pulley and bracket and the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

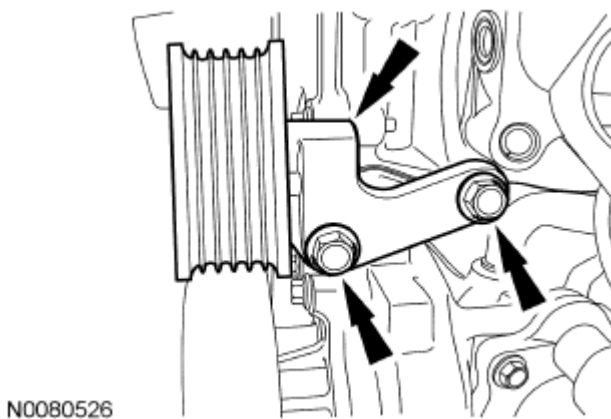


Fig. 486: Locating Bolts And Accessory Drive Belt Idler Pulley Bracket
Courtesy of FORD MOTOR CO.

124. Install the accessory drive belt idler pulley.
 - Tighten to 25 Nm (18 lb-ft).

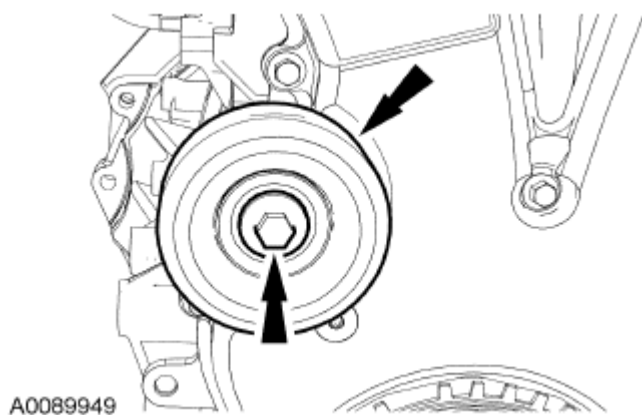


Fig. 487: Locating Bolt And Accessory Drive Belt Idler Pulley
Courtesy of FORD MOTOR CO.

125. Install the accessory drive belt tensioner and the 2 bolts.

- Tighten to 25 Nm (18 lb-ft).

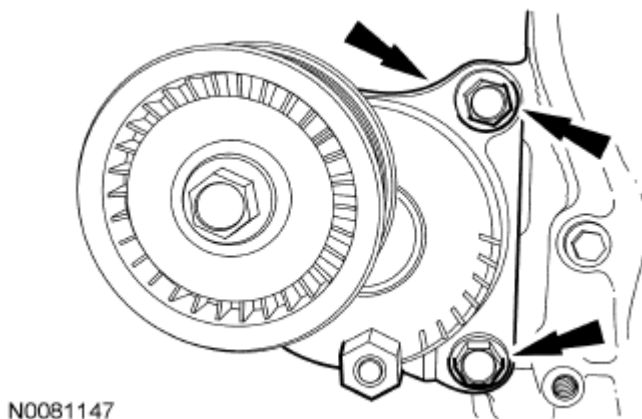


Fig. 488: Locating Bolts And Accessory Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

126. Install 7 new exhaust manifold studs in the cylinder head.

- Tighten to 17 Nm (150 lb-in).

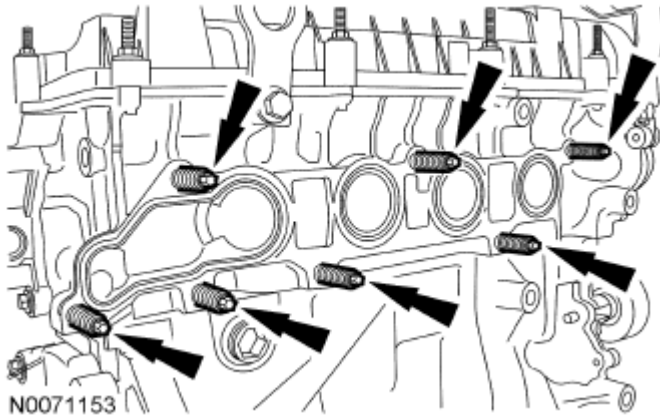


Fig. 489: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

127. Install the new exhaust manifold gasket on the engine.

NOTE: Failure to tighten the exhaust manifold nuts to specification a second time will cause the exhaust manifold to develop an exhaust leak.

NOTE: Make sure to tighten the nuts in the sequence in 2 stages.

128. Position the exhaust manifold and tighten the 7 new exhaust manifold nuts in the sequence shown in 2 stages:

- Stage 1: Tighten to 48 Nm (35 lb-ft).
- Stage 2: Tighten to 48 Nm (35 lb-ft).

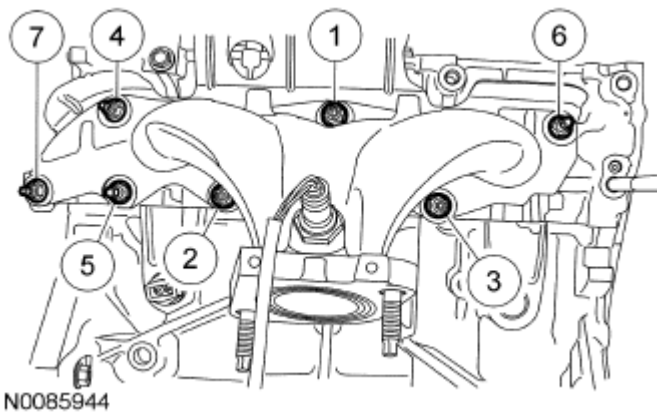
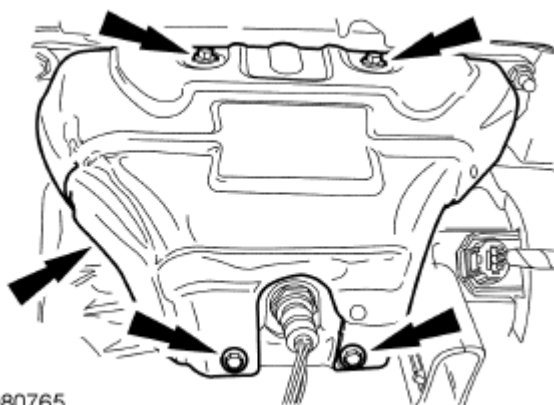


Fig. 490: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

129. Install the exhaust manifold heat shield and the 4 bolts.

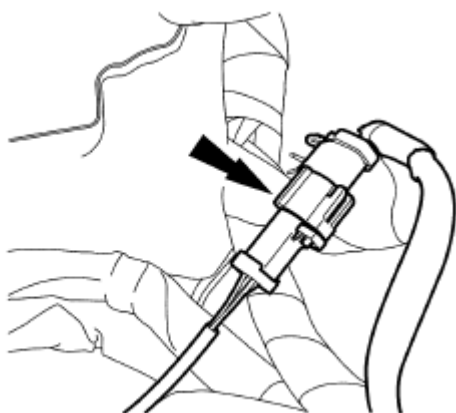
- Tighten to 10 Nm (89 lb-in).



N0080765

Fig. 491: Locating Exhaust Manifold Heat Shield Bolts And Heat Shield
Courtesy of FORD MOTOR CO.

130. Connect the Heated Oxygen Sensor (HO2S) electrical connector.



N0081190

Fig. 492: Locating Heated Oxygen Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

131. Install the generator, 2 nuts and 1 bolt.
- Tighten to 47 Nm (35 lb-ft).

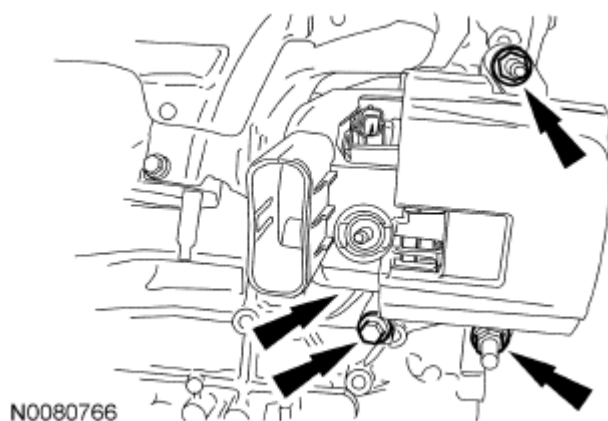


Fig. 493: Locating Nuts, Bolt And Generator
Courtesy of FORD MOTOR CO.

132. Connect the generator electrical connection and install the nut.
- Tighten to 6 Nm (53 lb-in).

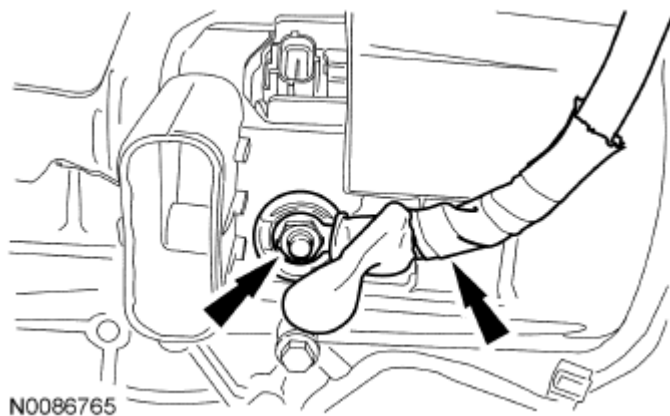


Fig. 494: Locating Nut And Generator Wiring Harness
Courtesy of FORD MOTOR CO.

133. Connect the generator electrical connection and attach the 2 wiring harness retainers.

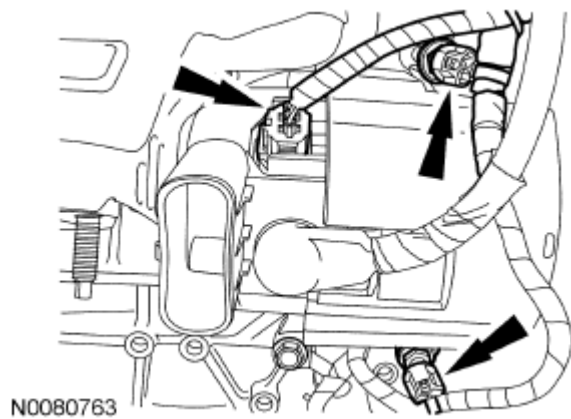


Fig. 495: Locating Generator Electrical Connection And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

134. Connect the CKP sensor electrical connector.
- Attach the wiring harness-to-engine retainer.

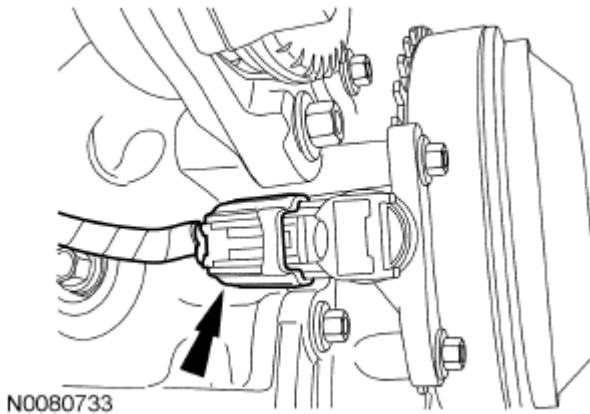


Fig. 496: Locating Crankshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

135. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the engine stand.

Vehicles with automatic transaxle

136. Install the flexplate and the bolts. Tighten the bolts in the sequence shown in 3 stages:
- Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

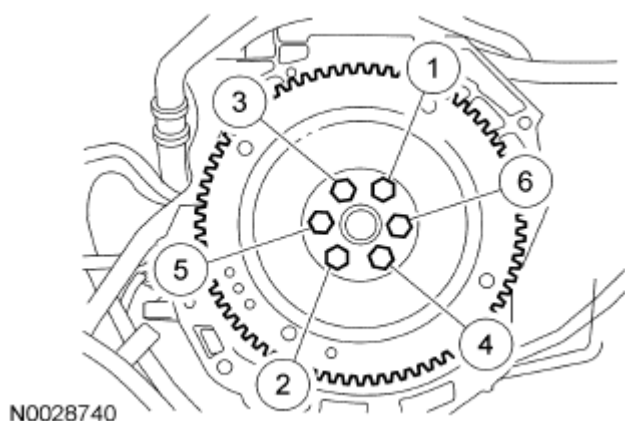


Fig. 497: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

Vehicles with manual transaxle

137. Install the flywheel and the bolts. Tighten the bolts in the sequence shown in 3 stages:
- Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

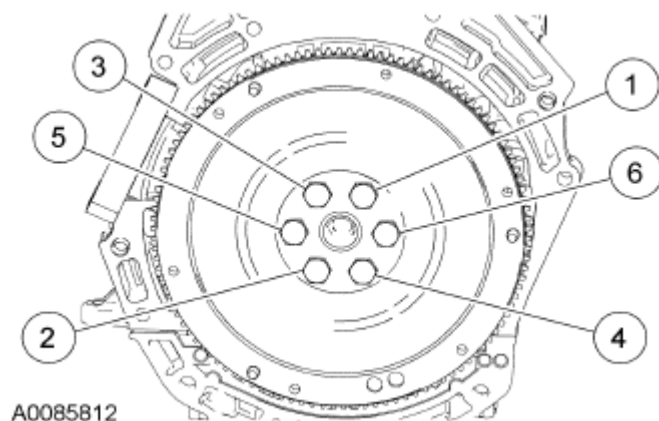
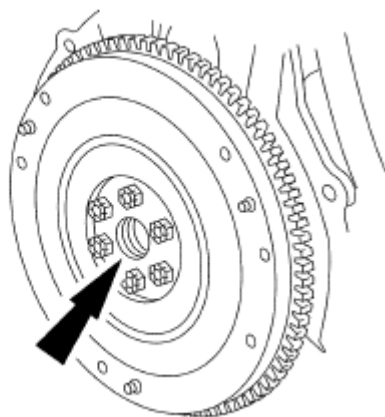


Fig. 498: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

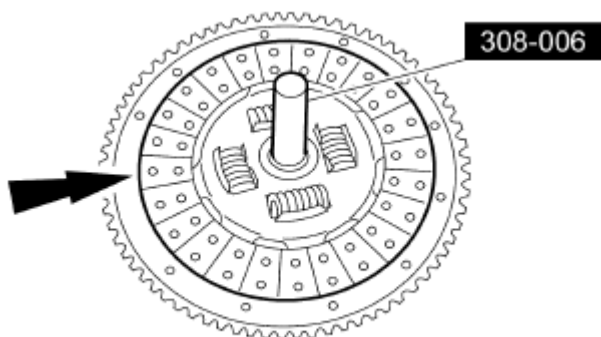
138. Lubricate the transaxle input shaft pilot bearing with front axle grease.



A0027749

Fig. 499: Locating Transaxle Input Shaft Pilot Bearing
Courtesy of FORD MOTOR CO.

139. Using the Clutch Disk Aligner, position the clutch disc on the flywheel.



A0090134

Fig. 500: Locating Clutch Disk Aligner And Clutch Disc
Courtesy of FORD MOTOR CO.

NOTE: If reusing the clutch pressure plate and flywheel, align the marks made during removal.

140. Position the clutch pressure plate and install the bolts.
- Tighten to 29 Nm (21 lb-ft) in a star pattern sequence.

REMOVAL AND INSTALLATION

ENGINE - AUTOMATIC TRANSAXLE

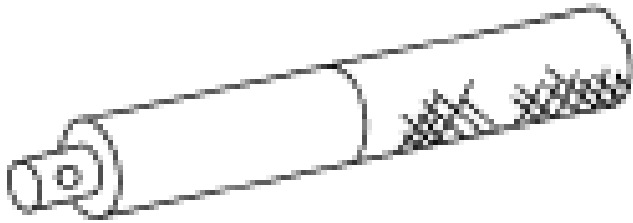
Special Tool(s)

SPECIAL TOOL REFERENCE CHART

| | |
|--|--|
| | |
|--|--|

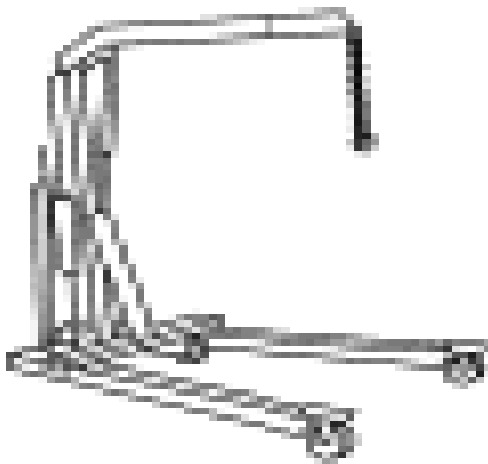
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



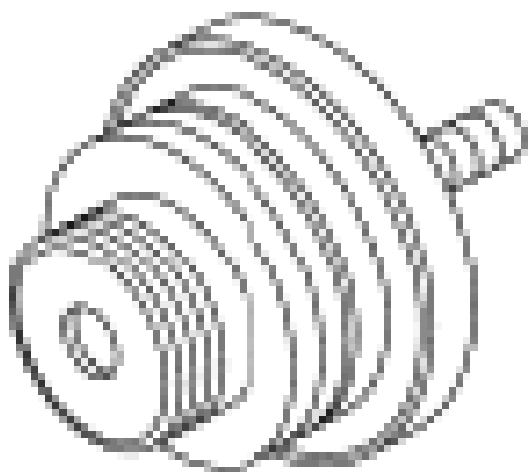
Handle
205-153 (T80T-4000-W)

QT1652_A

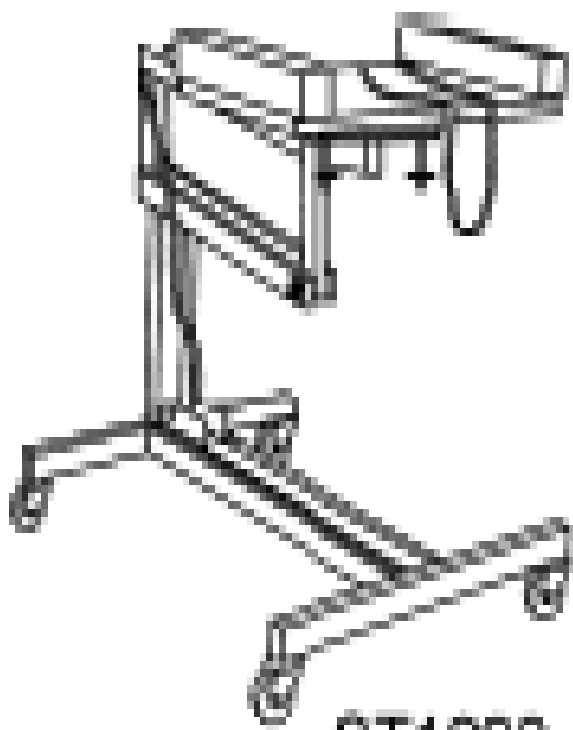


Heavy Duty Floor Crane
014-00071 or equivalent

Installer, PTO Driven Gear Oil Seal
308-429



ST2670-A



ST1293-A

Powertrain Lift
014-00765 or equivalent

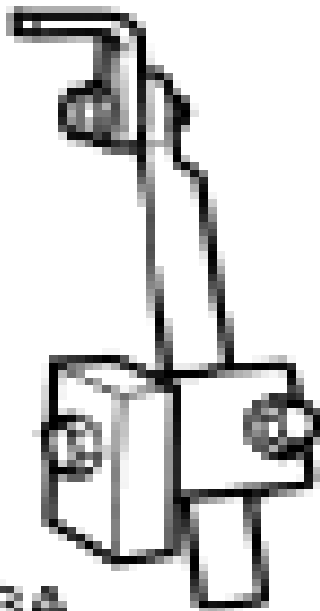
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



3T1A072-A

Spreader Bar
303-D089 (D93P-6001-A3) or equivalent

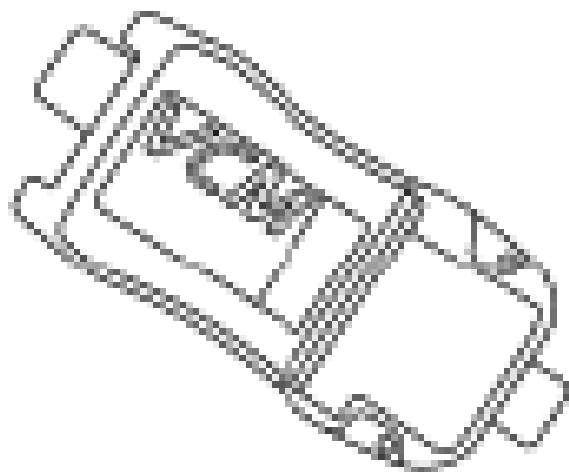


ST2743A

Universal Adapter Brackets
014-0001 or equivalent

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2834-A

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

ITEM SPECIFICATION

| 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 |

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

All vehicles

1. Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle together. Install the 6 transaxle-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).
2. Install the 4 new torque converter nuts.
 - Tighten to 35 Nm (26 lb-ft).

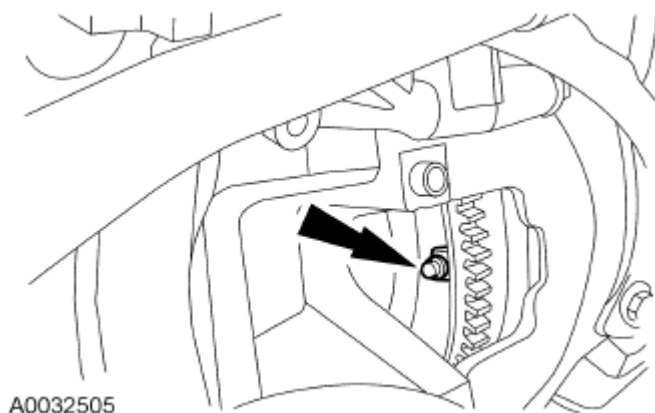


Fig. 501: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

3. Using the Powertrain Lift and Universal Adapter Brackets, position the engine and transaxle onto the Powertrain Lift.

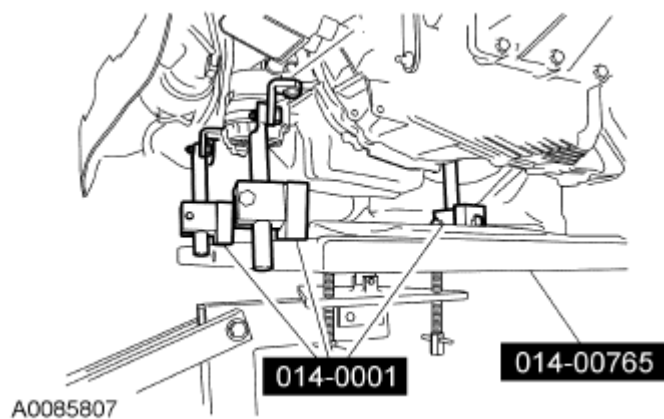


Fig. 502: Identifying Powertrain Lift And Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

4. Using the Handle and PTO Driven Gear Oil Seal Installer, install the intermediate shaft seal.

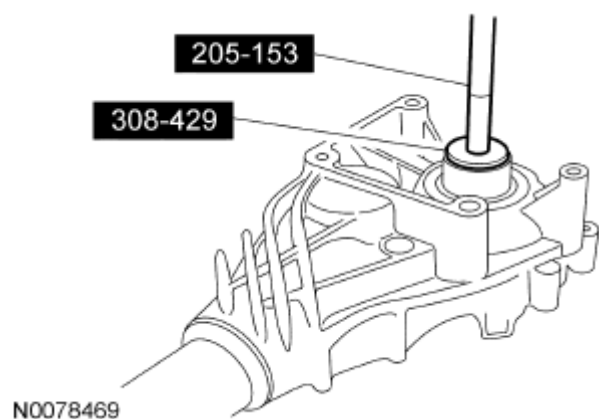


Fig. 503: Installing Intermediate Shaft Seal
Courtesy of FORD MOTOR CO.

5. Install the PTU heat shield and the 3 bolts.
 - Tighten to 11 Nm (97 lb-in).

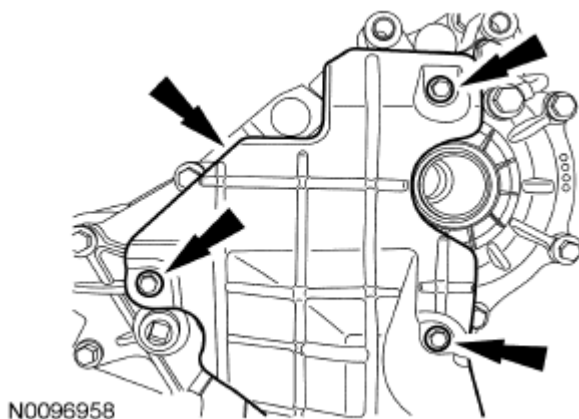


Fig. 504: Locating PTU Heat Shield And Bolts
Courtesy of FORD MOTOR CO.

6. Install the Power Transfer Unit (PTU) and the 3 RH PTU bolts.
 - Tighten to 70 Nm (52 lb-ft).

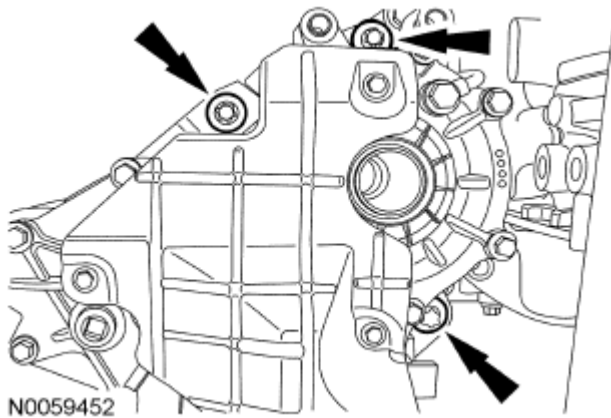


Fig. 505: Locating RH PTU Bolts And PTU
Courtesy of FORD MOTOR CO.

7. Install the LH lower PTU bolt.
 - Tighten to 48 Nm (35 lb-ft).

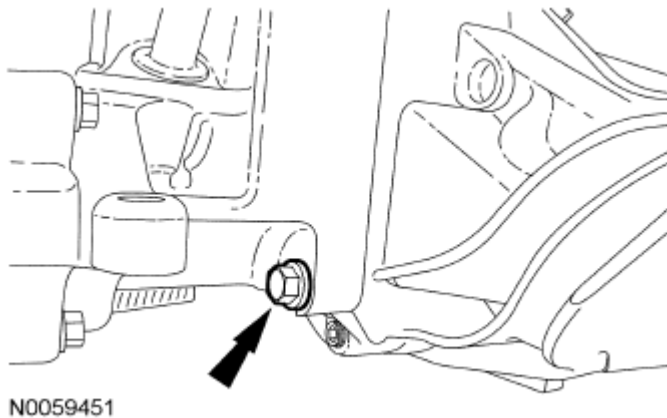


Fig. 506: Locating LH Lower PTU Bolt
Courtesy of FORD MOTOR CO.

8. Attach the PTU vent hose.

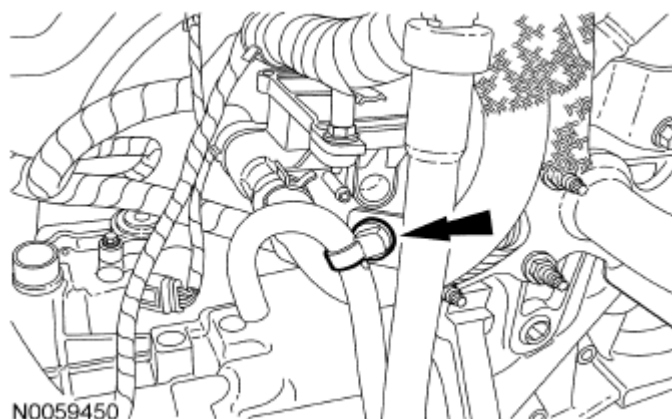


Fig. 507: Locating PTU Vent Hose Retainer
Courtesy of FORD MOTOR CO.

All vehicles

9. Install the starter motor isolator.

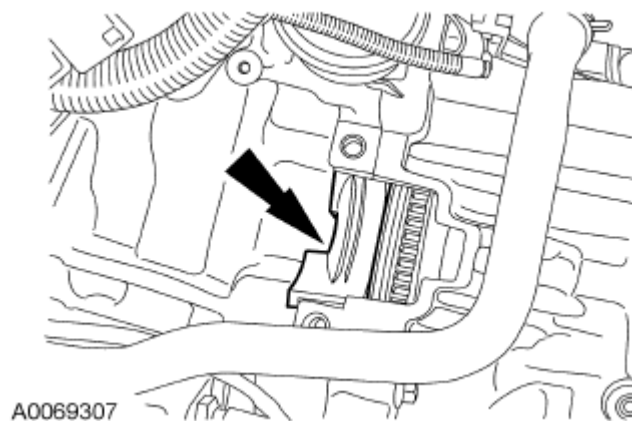


Fig. 508: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

10. Install the starter motor and the 2 stud bolts.
 - Tighten to 35 Nm (26 lb-ft).

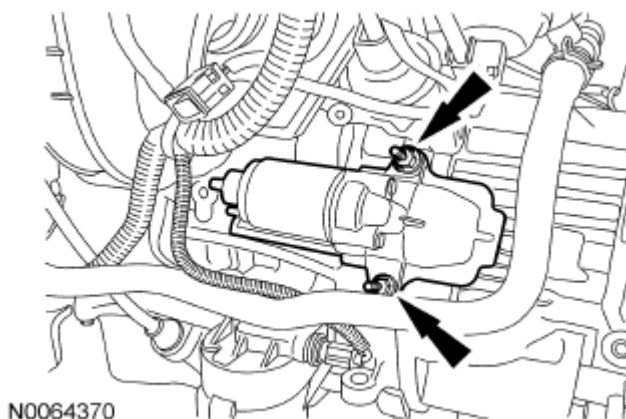


Fig. 509: Locating Starter Stud Bolts
Courtesy of FORD MOTOR CO.

11. Install the ground wire and the nut.
 - Tighten to 25 Nm (18 lb-ft).

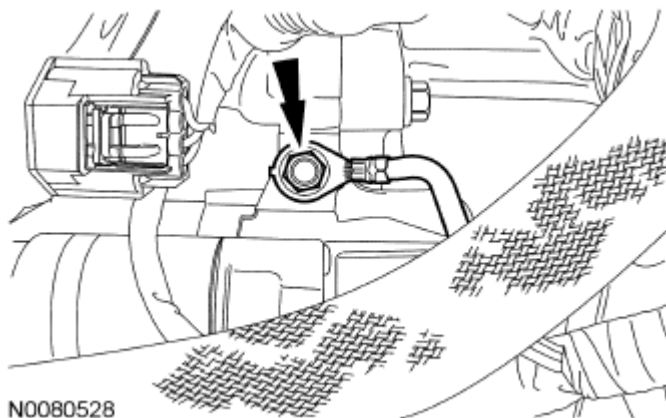


Fig. 510: Locating Ground Wire Nut
Courtesy of FORD MOTOR CO.

12. Install the starter motor harness connectors.
 1. Install the starter motor solenoid battery nut.
 - Tighten to 12 Nm (106 lb-in).
 2. Install the starter motor solenoid nut.
 - Tighten to 5 Nm (44 lb-in).

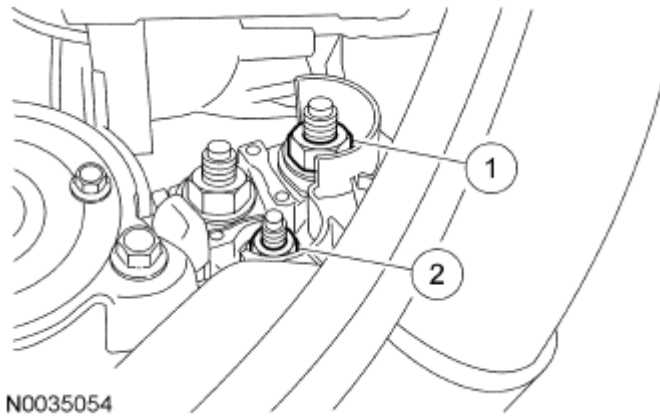


Fig. 511: Identifying Battery Cable Nut And Starter Solenoid Terminal Nut
Courtesy of FORD MOTOR CO.

13. Raise the engine and transaxle into the vehicle.
14. Install the bolt in the LH transaxle mount.
 - Tighten to 103 Nm (76 lb-ft).

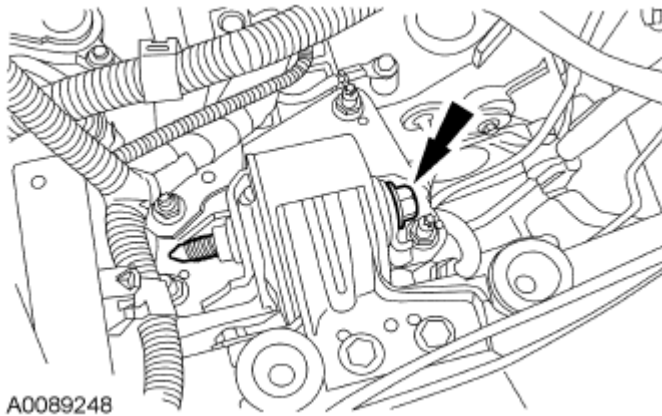


Fig. 512: Locating LH Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

15. Install the bolt in the rear transaxle mount.
 - Tighten to 115 Nm (85 lb-ft).

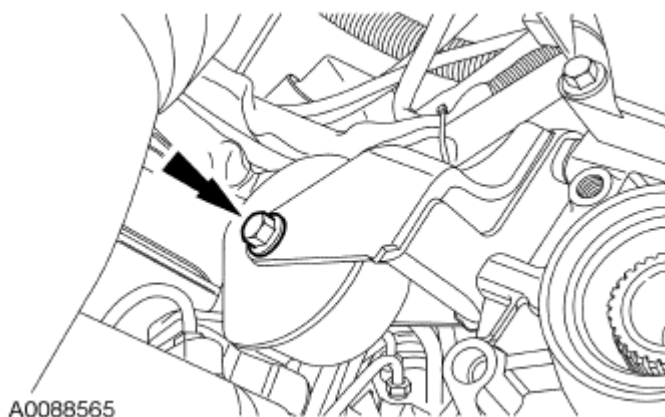


Fig. 513: Locating Transaxle Rear Mount Bolt
Courtesy of FORD MOTOR CO.

16. Install the engine mount bracket and nuts.
 - Tighten to 115 Nm (85 lb-ft).

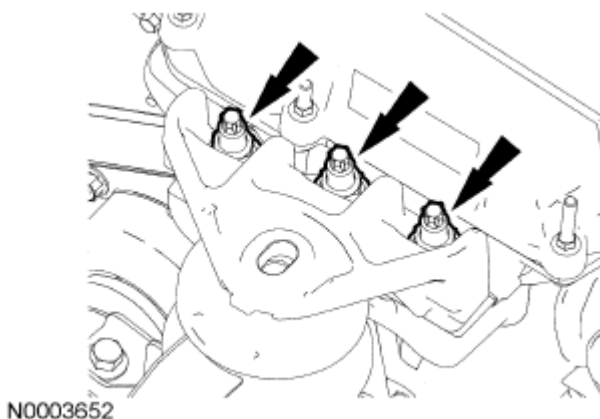


Fig. 514: Locating Engine Mount Bracket Nuts
Courtesy of FORD MOTOR CO.

17. Install the engine mount bracket bolt.
 - Tighten to 115 Nm (85 lb-ft).

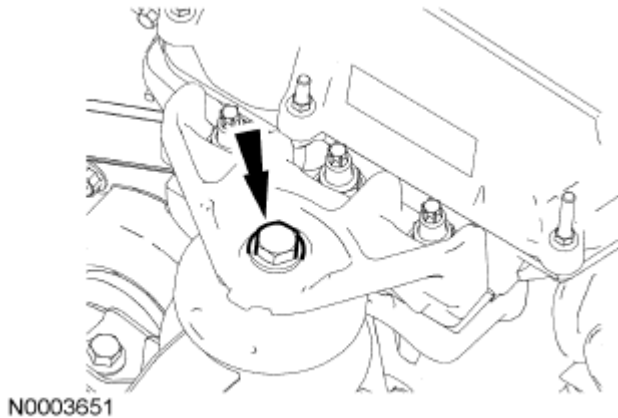


Fig. 515: Locating Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

18. If equipped, install a new oil filter element. For additional information, refer to **OIL FILTER ELEMENT**.
19. If equipped, install a new spin on engine oil filter.
 - Lubricate the spin on oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.

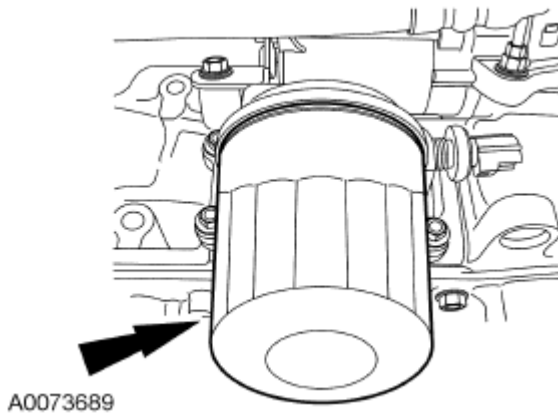


Fig. 516: Locating Engine Oil Filter
Courtesy of FORD MOTOR CO.

AWD vehicles

20. Install the PTU bracket and the 2 PTU bracket-to-PTU bolts.
 - Tighten to 45 Nm (33 lb-ft).

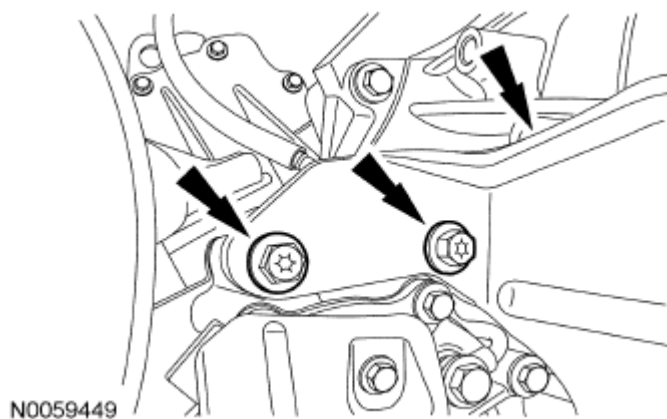


Fig. 517: Locating PTU Bracket-To-PTU Bolts And Bracket
Courtesy of FORD MOTOR CO.

21. Install the PTU bracket-to-engine bolt.
- Tighten to 40 Nm (30 lb-ft).

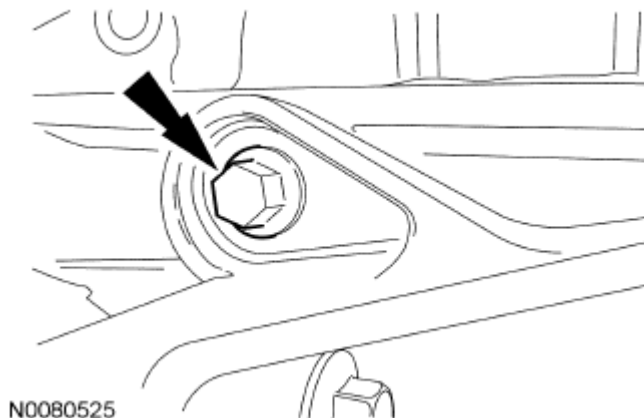


Fig. 518: Locating PTU Bracket-To-Engine Bolt
Courtesy of FORD MOTOR CO.

22. Install the 4 PTU bracket-to-engine bolts.
- Tighten to 40 Nm (30 lb-ft).

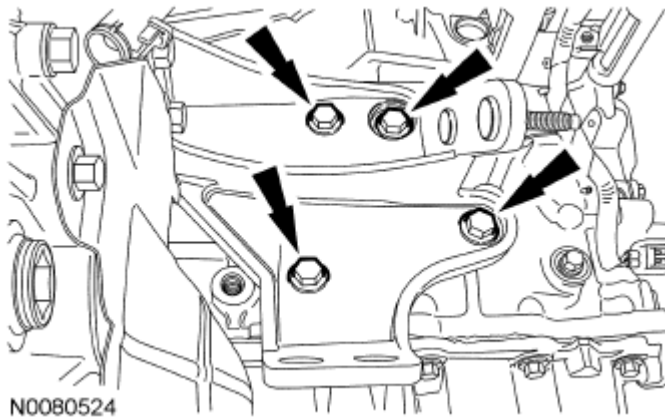


Fig. 519: Locating PTU Bracket-To-Engine Bolts
Courtesy of FORD MOTOR CO.

NOTE: A new Power Transfer Unit (PTU) intermediate shaft seal must be installed whenever the intermediate shaft or PTU is removed from the vehicle.

23. Install a new intermediate shaft seal and deflector. For additional information, refer to **TRANSFER CASE-POWER TRANSFER UNIT (PTU)**.
24. If equipped, install the dampener and the 3 bolts.
 - Tighten to 40 Nm (30 lb-ft).

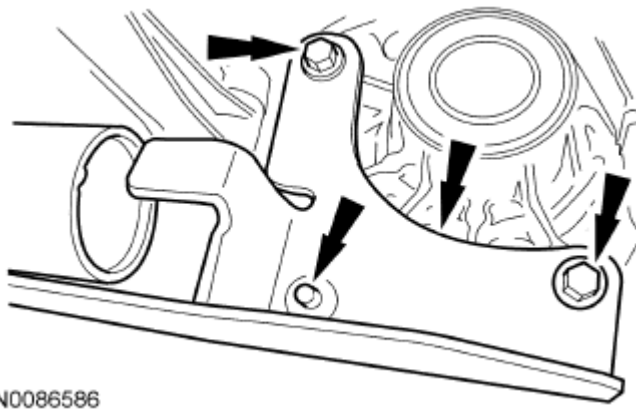


Fig. 520: Locating Dampener Bolts
Courtesy of FORD MOTOR CO.

25. Install the 2 transaxle-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).

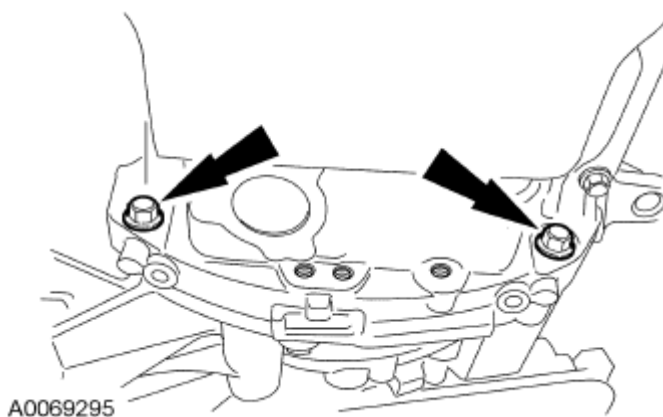


Fig. 521: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

26. Install the 2 transaxle-to-engine bolts.
- Tighten to 48 Nm (35 lb-ft).

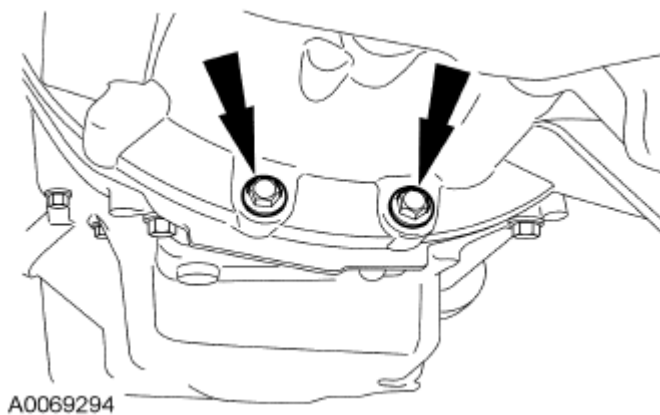


Fig. 522: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

27. Install the engine support crossmember and new nut.
- Tighten to 175 Nm (129 lb-ft).

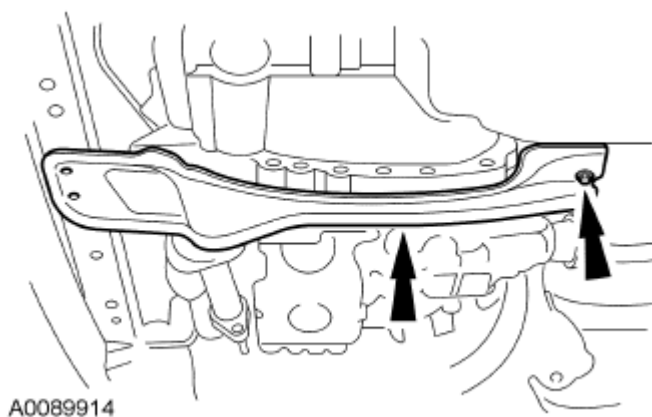


Fig. 523: Locating Rear Nut And Engine Support Crossmember
 Courtesy of FORD MOTOR CO.

28. Install the 2 bolts for the engine support crossmember and the front roll restrictor bolt.
- Tighten the engine support crossmember bolts to 90 Nm (66 lb-ft).
 - Tighten the front roll restrictor bolt to 115 Nm (85 lb-ft).

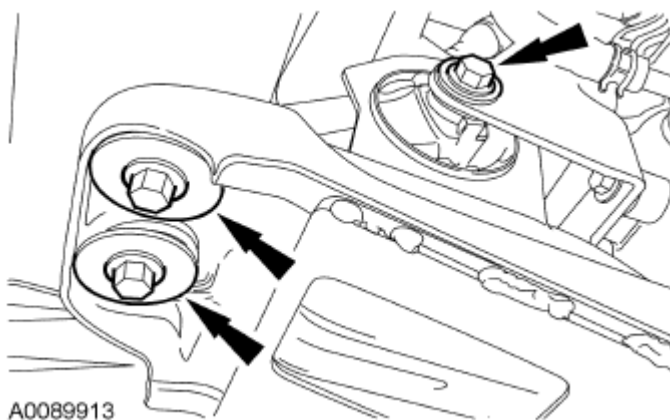


Fig. 524: Locating Front Roll Restrictor Bolt And Engine Support Crossmember Bolts
 Courtesy of FORD MOTOR CO.

29. Connect the lower radiator hose to the radiator.

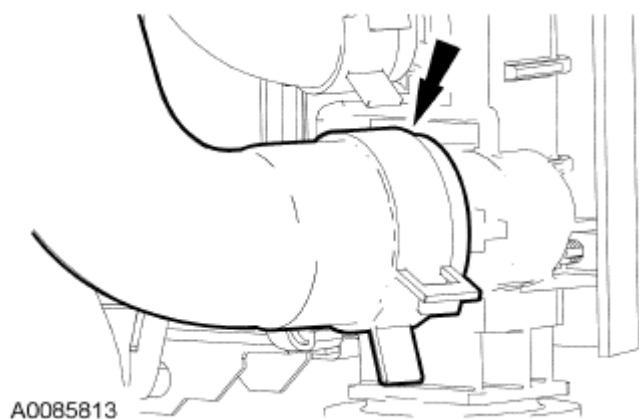


Fig. 525: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

30. Install the A/C compressor and connect the A/C compressor electrical connector.
- Attach the wire harness retainer.
 - Tighten the bolts to 25 Nm (18 lb-ft).

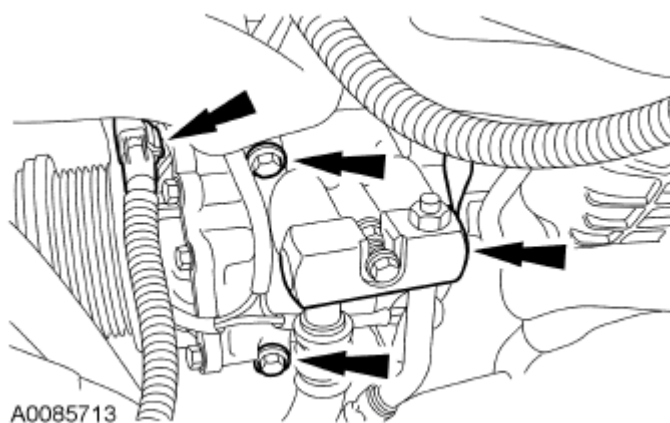


Fig. 526: Locating A/C Compressor Electrical Connector And Bolts
Courtesy of FORD MOTOR CO.

31. Attach the 2 retainers and connect the generator electrical connector.

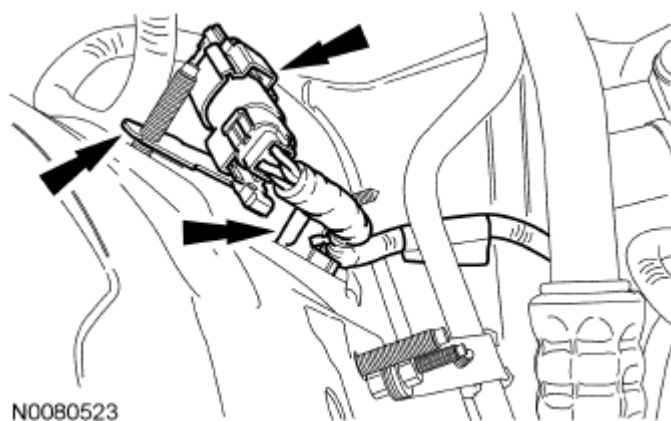


Fig. 527: Locating Generator Electrical Connector And Retainers
Courtesy of FORD MOTOR CO.

32. Connect the engine control harness electrical connector.

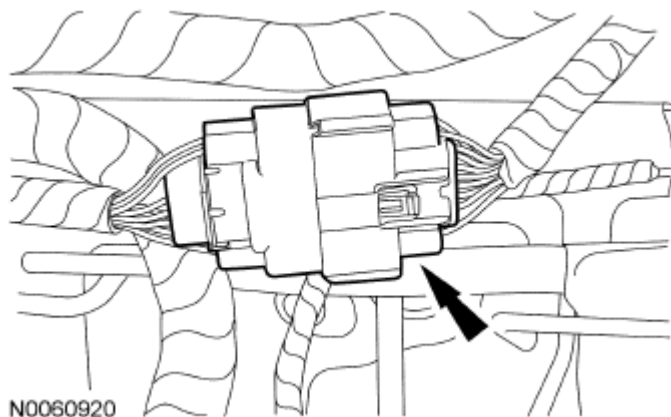


Fig. 528: Locating Engine Control Harness Electrical Connector
Courtesy of FORD MOTOR CO.

33. Connect the PCM electrical connector and attach the wire harness retainer.

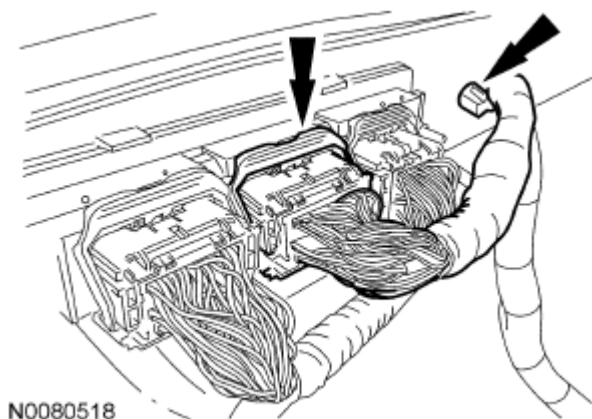


Fig. 529: Locating PCM Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

34. Connect the fuel supply tube quick connect coupling. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .

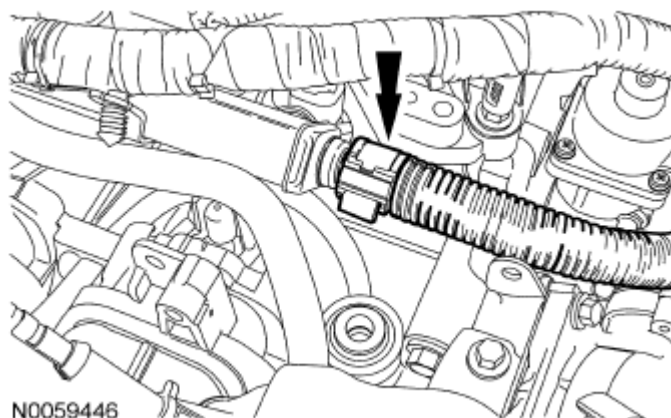


Fig. 530: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

35. Connect the fuel vapor return tube.
- Attach the fuel vapor tube retainer to the wire harness.

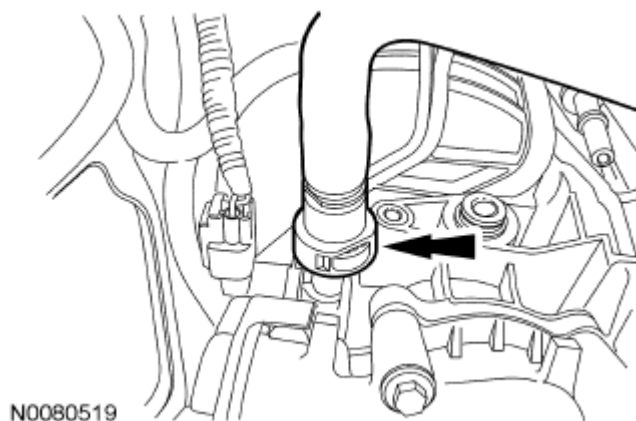


Fig. 531: Locating Fuel Vapor Tube Retainer
Courtesy of FORD MOTOR CO.

36. Connect the vacuum supply tube.

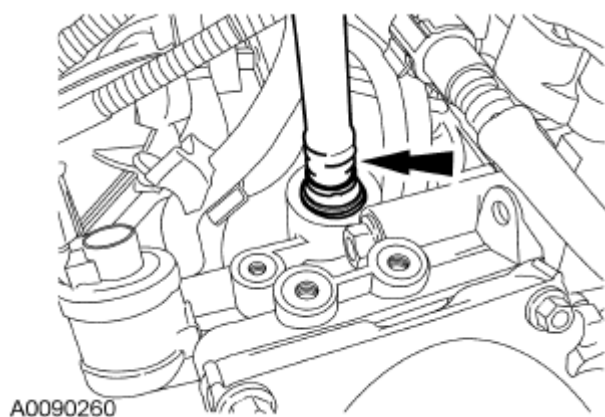


Fig. 532: Locating Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

37. Connect the heater hoses to the heater core.

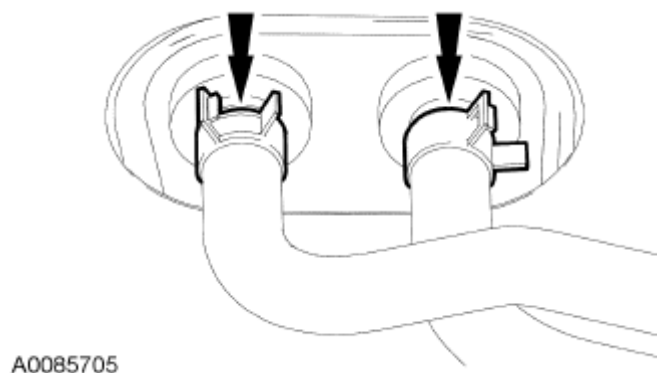


Fig. 533: Locating Heater Core Hoses
Courtesy of FORD MOTOR CO.

38. Attach the heater hose support strap to the stud.

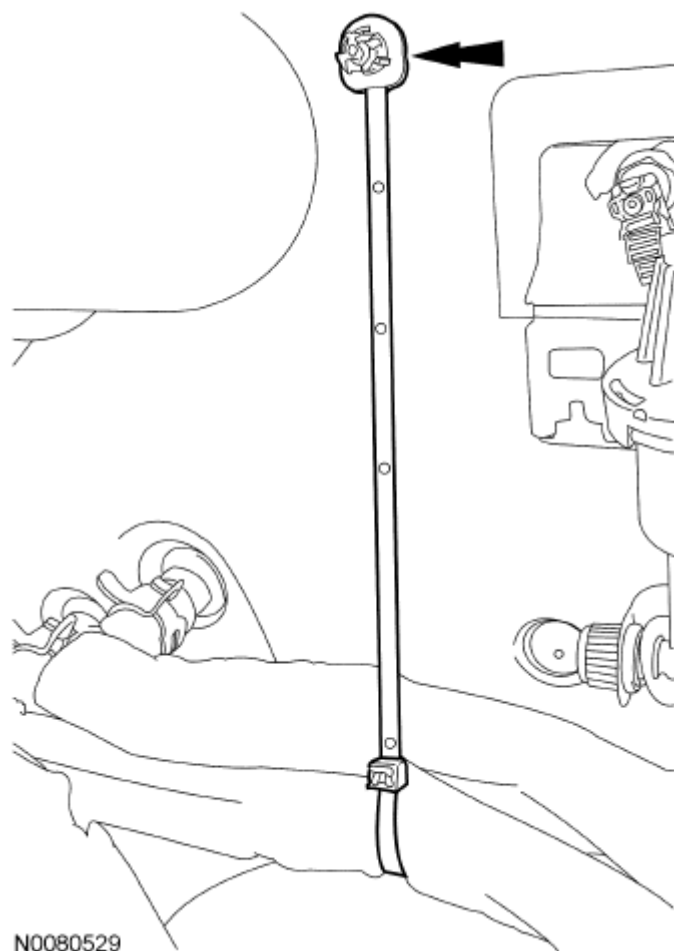


Fig. 534: Locating Heater Hose Support Strap Stud
Courtesy of FORD MOTOR CO.

39. Connect the upper radiator hose.

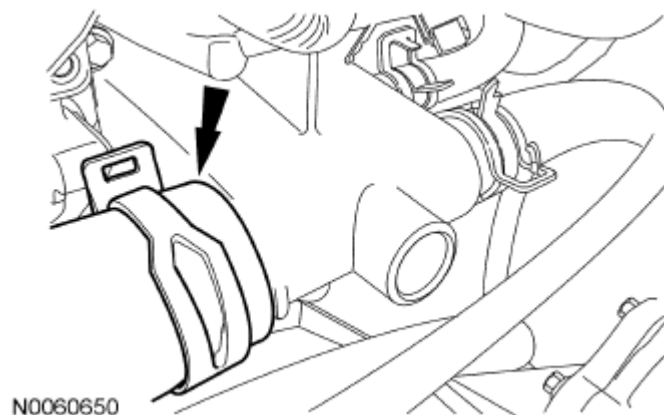


Fig. 535: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

40. If equipped, route the block heater wiring harness and attach all retainers. Connect the block heater electrical connector.

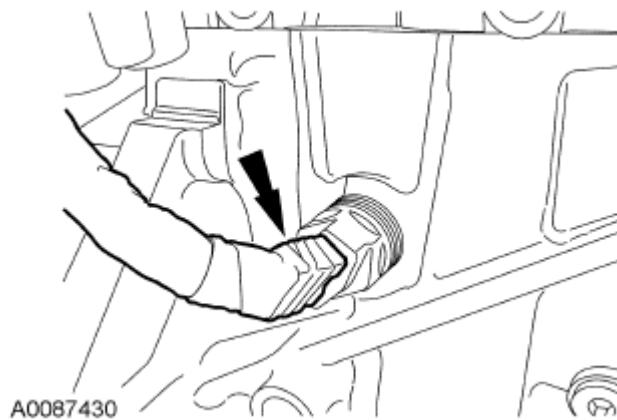


Fig. 536: Locating Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

41. Attach the shift cable pin-type retainer.

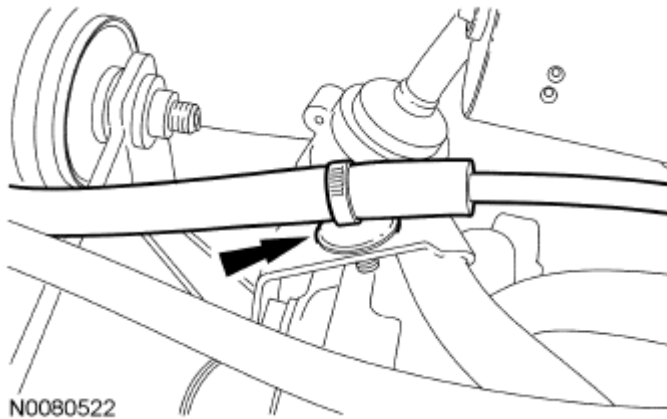


Fig. 537: Locating Shift Cable Pin-Type Retainer
Courtesy of FORD MOTOR CO.

42. Attach the shift cable to the shift cable bracket.

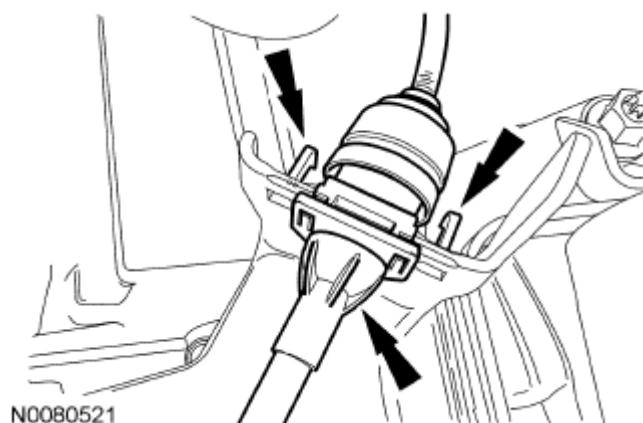


Fig. 538: Locating Transmission Shift Cable Tabs And Bracket
Courtesy of FORD MOTOR CO.

43. Connect the shift cable to the transaxle manual lever.

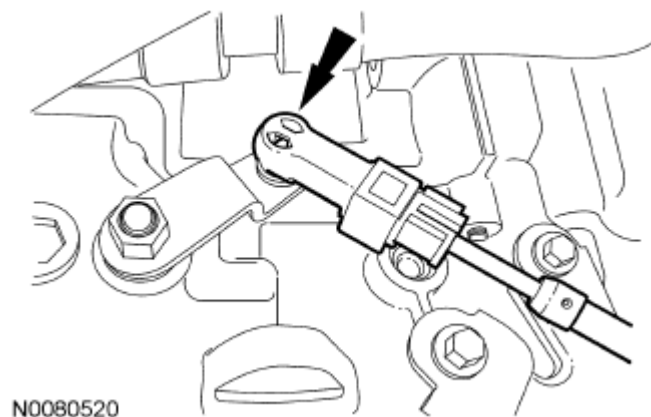


Fig. 539: Locating Transaxle Manual Lever Shift Cable
Courtesy of FORD MOTOR CO.

44. Attach the 2 wiring harness retainers to the battery tray bracket.

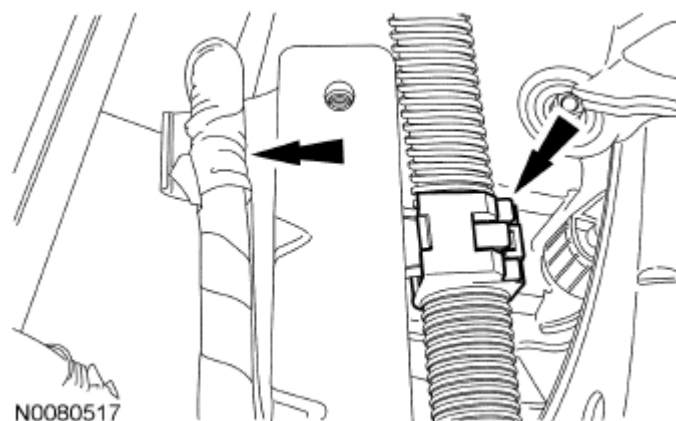


Fig. 540: Locating Wiring Harness Retainers On Battery Tray Bracket
Courtesy of FORD MOTOR CO.

45. Install the ground strap and bolt.
- Tighten to 10 Nm (89 lb-in).

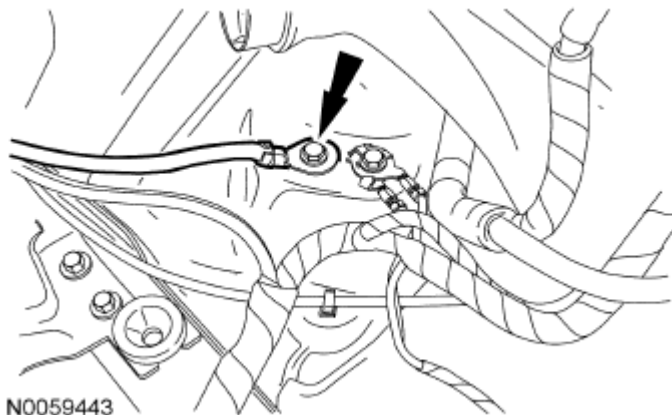


Fig. 541: Locating Ground Strap Bolt
Courtesy of FORD MOTOR CO.

46. Connect the electrical connector to the Power Distribution Box (PDB).

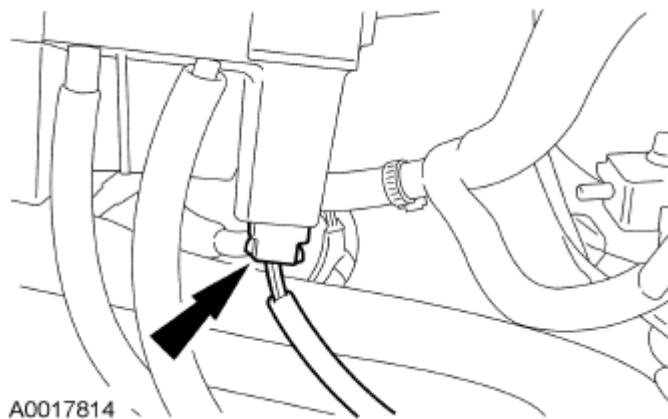


Fig. 542: Locating PDB Electrical Connector
Courtesy of FORD MOTOR CO.

47. Connect the cable to the PDB and install the nut.
- Tighten to 12 Nm (106 lb-in).

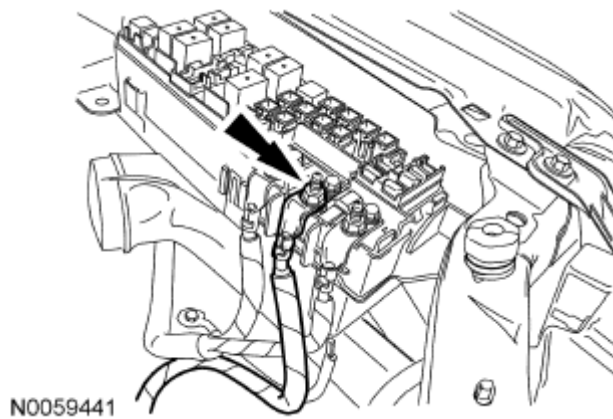


Fig. 543: Locating PDB Cable Nut
Courtesy of FORD MOTOR CO.

48. Install the PDB cover.

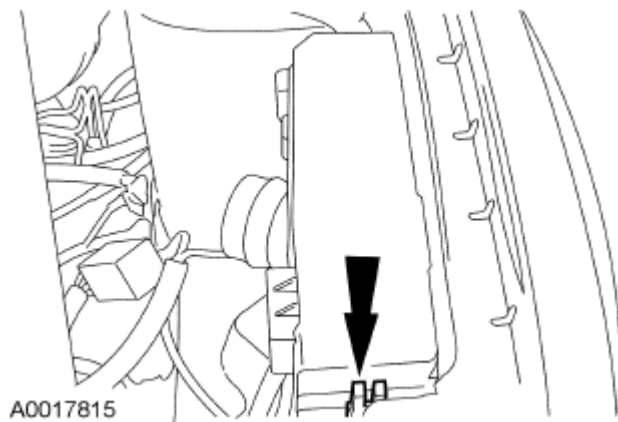


Fig. 544: Locating Power Distribution Box Cover
Courtesy of FORD MOTOR CO.

49. Connect the 2 transaxle fluid cooler tubes.

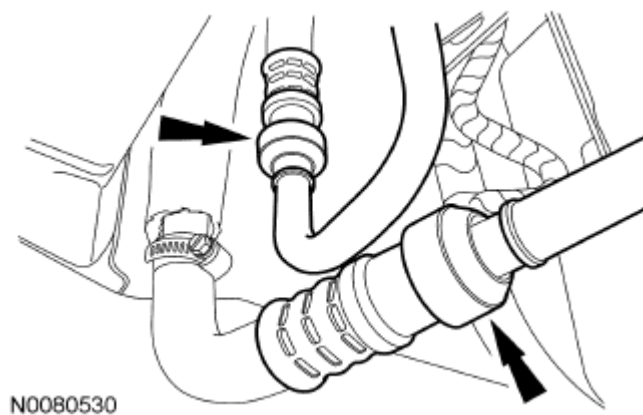


Fig. 545: Locating Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

50. Install the 2 secondary latches to the transaxle fluid cooler tubes.

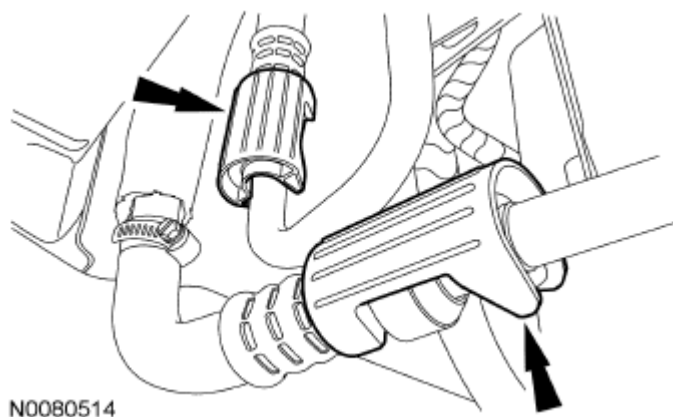


Fig. 546: Locating Secondary Latches On Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

51. Connect the Turbine Shaft Speed (TSS) sensor electrical connector.

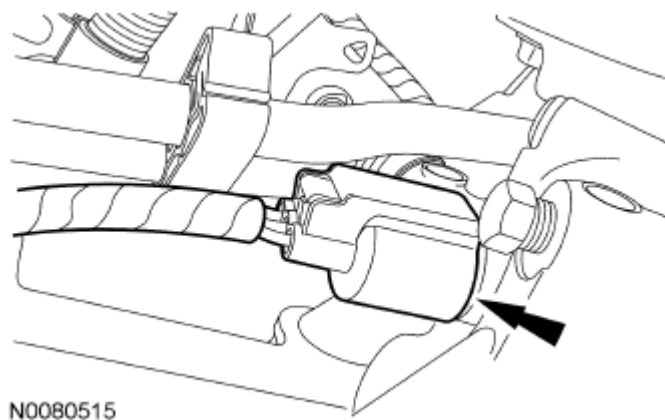


Fig. 547: Locating Turbine Shaft Speed Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

52. Attach the wiring harness retainer to the transaxle stud bolt.

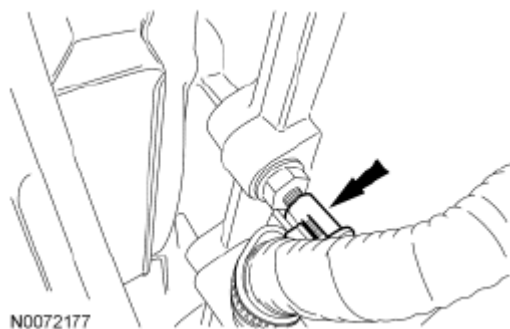


Fig. 548: Locating Wiring Harness Retainer On Transaxle Stud Bolt
Courtesy of FORD MOTOR CO.

53. Connect the transaxle electrical connector.

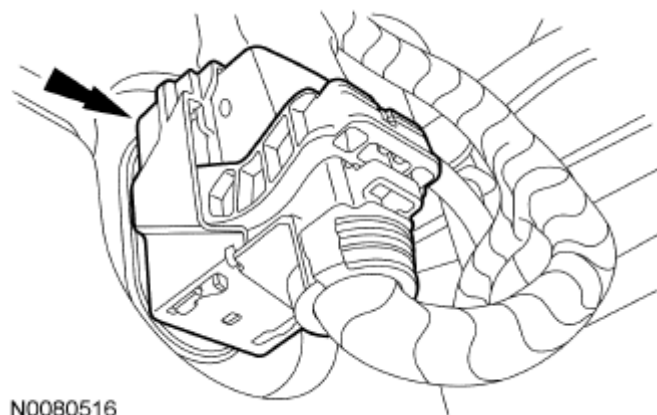


Fig. 549: Locating Transaxle Electrical Connector
Courtesy of FORD MOTOR CO.

54. If equipped, install the ground eyelet and bolt.
- Tighten to 10 Nm (89 lb-in).

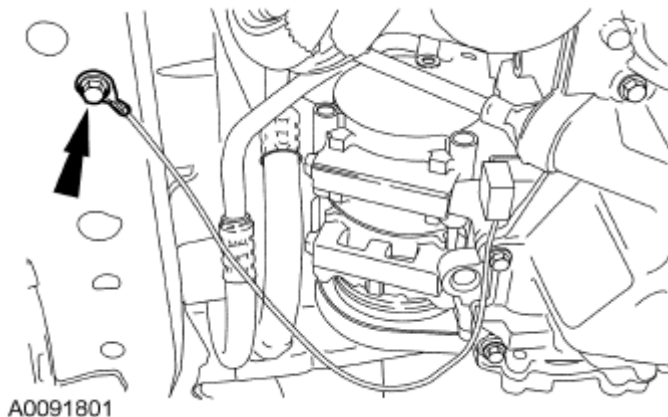


Fig. 550: Locating Ground Eyelet Bolt

Courtesy of FORD MOTOR CO.

AWD vehicles

55. Position the driveshaft to the PTU and install the 6 bolts.
 - Tighten to 37 Nm (27 lb-ft).

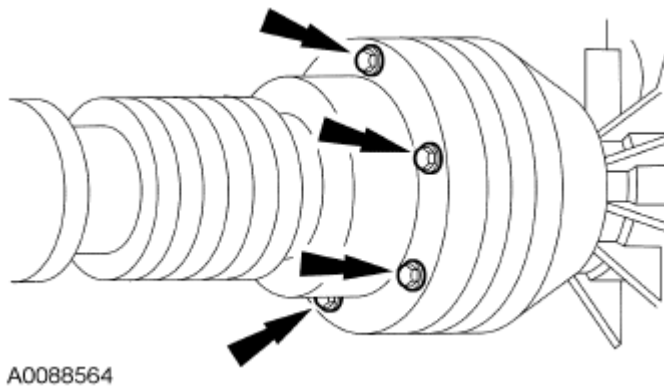


Fig. 551: Locating Bolts Holding Driveshaft To PTU
Courtesy of FORD MOTOR CO.

All vehicles

56. Install the generator air duct and make sure the tab is latched.

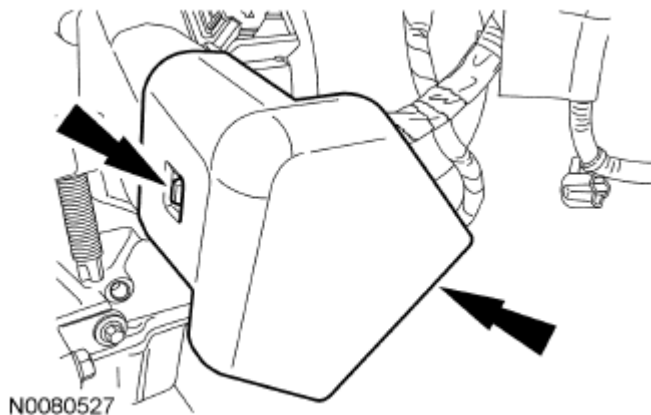


Fig. 552: Locating Locking Tabs And Generator Air Duct
Courtesy of FORD MOTOR CO.

57. Install the accessory drive belt. For additional information, refer to ACCESSORY DRIVE - 2.5L.
58. Install the intermediate shaft.

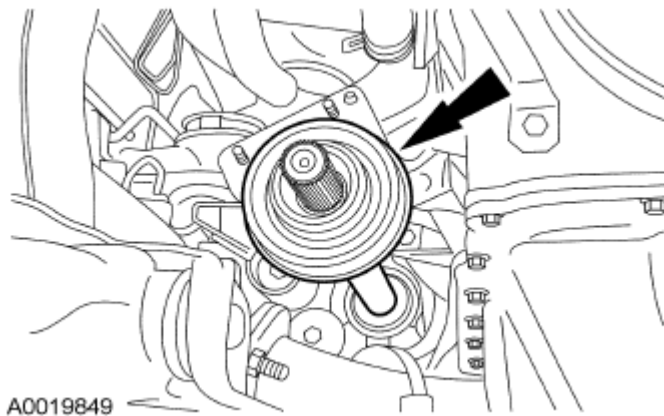


Fig. 553: Locating Intermediate Shaft
Courtesy of FORD MOTOR CO.

59. Install the 2 intermediate shaft bearing retainer nuts.
- Tighten to 27 Nm (20 lb-ft).

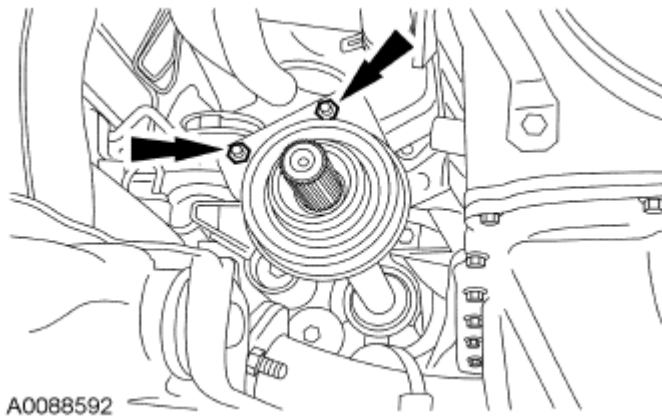
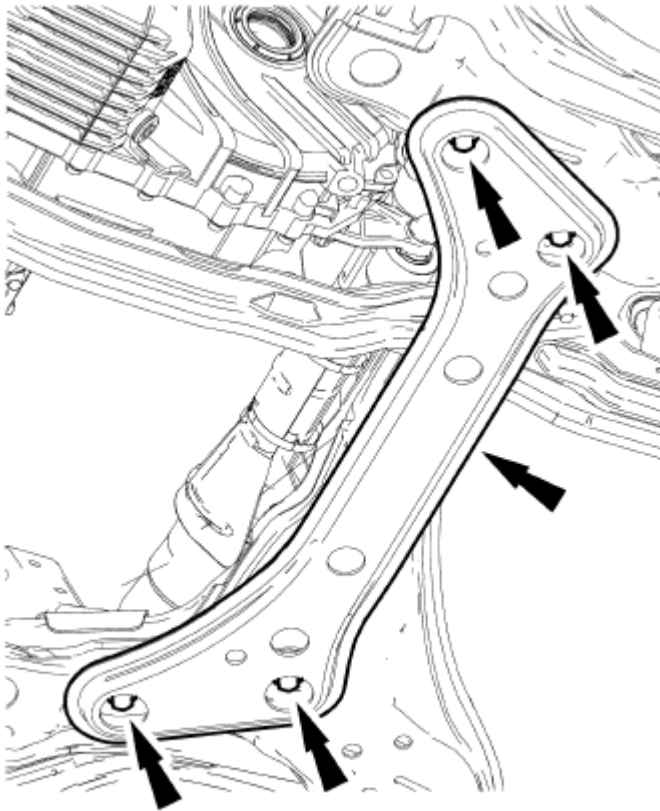


Fig. 554: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of FORD MOTOR CO.

60. Install the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM**.
61. Install the lateral support crossmember and bolts.
- Tighten to 115 Nm (85 lb-ft).



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Fig. 555: Locating Lateral Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

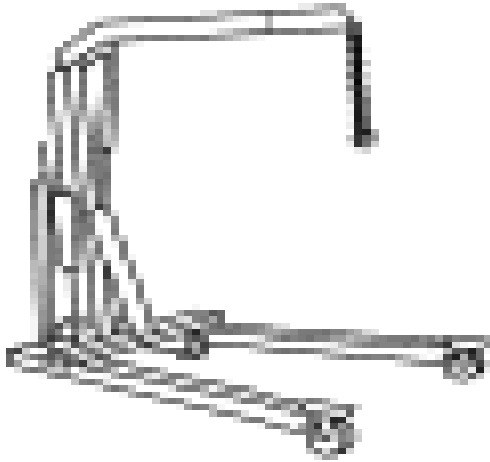
62. Install the RH and LH half shafts. For additional information, refer to **FRONT DRIVE HALFSHAFTS** .
63. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .
64. Install the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L** .
65. Fill the engine with clean engine oil.
66. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** .
67. Check and fill the transmission fluid as necessary. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6F35** .

AWD vehicles

68. Check and fill the PTU fluid as necessary. For additional information, refer to **TRANSFER CASE-POWER TRANSFER UNIT (PTU)** .

All vehicles

69. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure following the on-screen instructions.

ENGINE - MANUAL TRANSAXLE**Special Tool(s)****SPECIAL TOOL REFERENCE CHART**

Heavy Duty Floor Crane
014-00071 or equivalent

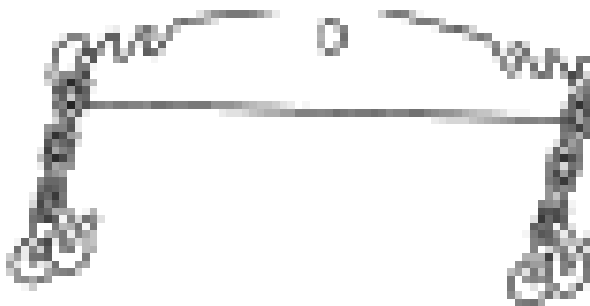
Powertrain Lift
014-00765 or equivalent

2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST1293-A



Spreader Bar
303-D089 (D93P-6001-A3) or equivalent

303-D089-A

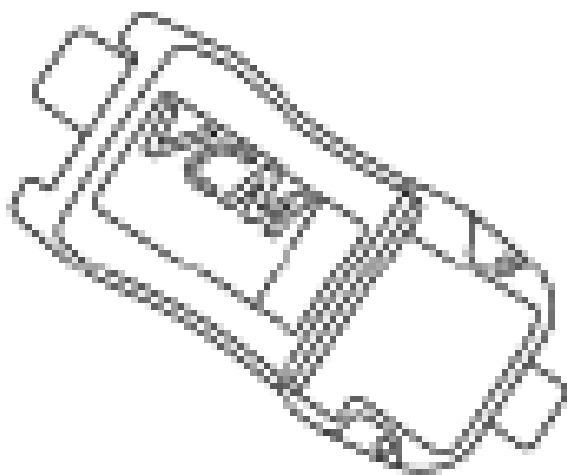
2009 Mercury Mariner

2009 ENGINE Engine - 2.5L - Escape & Mariner



ST2743A

Universal Adapter Brackets
014-0001 or equivalent



ST2834-A

Vehicle Communication Module (VCM) and
Integrated Diagnostic System (IDS) software
with appropriate hardware, or equivalent scan
tool

Material

ITEM SPECIFICATION

| Item | Specification |
|---|---------------|
| Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); | WSS- |

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

M2C930-A

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle together. Install the 5 transaxle-to-engine bolts.
2. Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle onto the lift table.
3. Using the Powertrain Lift and Universal Adapter Brackets, secure the engine to the lift table.

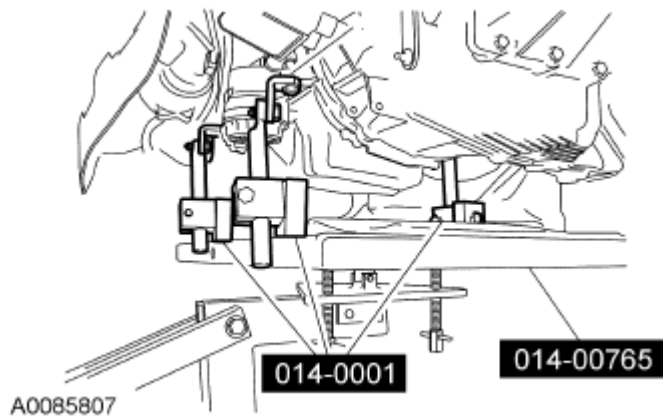


Fig. 556: Identifying Powertrain Lift And Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

4. Install the starter motor isolator.

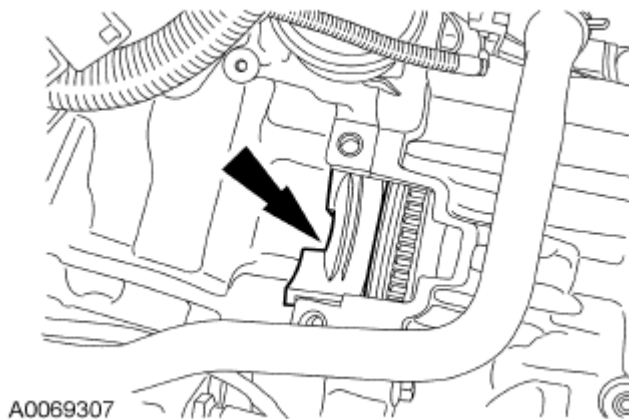


Fig. 557: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

5. Install the starter motor and the 2 stud bolts.
 - Tighten to 35 Nm (26 lb-ft).

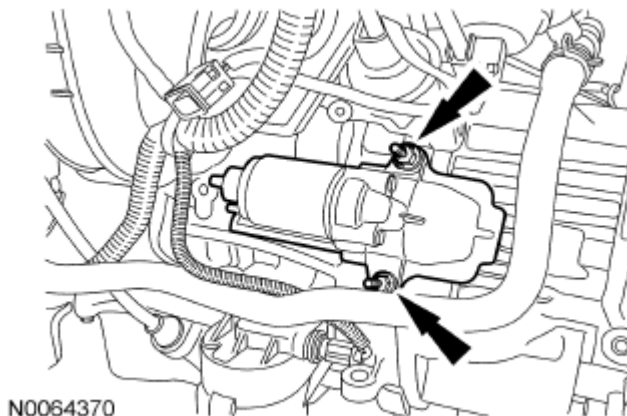


Fig. 558: Locating Starter Stud Bolts
Courtesy of FORD MOTOR CO.

6. Install the ground wire and the nut.
 - Tighten to 25 Nm (18 lb-ft).

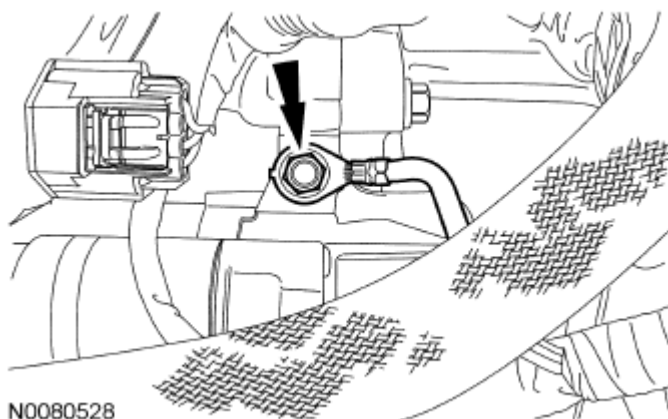


Fig. 559: Locating Ground Wire Nut
Courtesy of FORD MOTOR CO.

7. Install the starter motor harness connector.
 1. Install the starter motor solenoid battery nut.
 - Tighten to 12 Nm (106 lb-in).
 2. Install the starter motor solenoid nut.
 - Tighten to 5 Nm (44 lb-in).

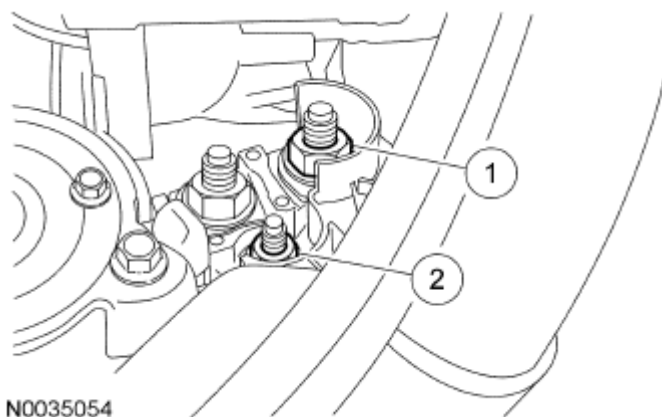


Fig. 560: Identifying Battery Cable Nut And Starter Solenoid Terminal Nut
Courtesy of FORD MOTOR CO.

8. Raise the engine and transaxle into the vehicle.
9. Install the bolt in the LH transaxle mount.
 - Tighten to 103 Nm (76 lb-ft).

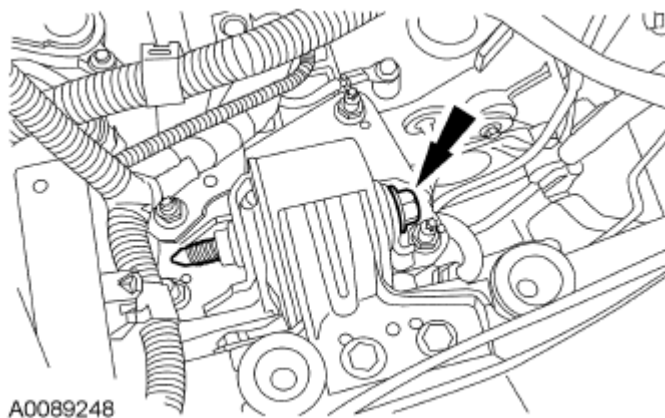


Fig. 561: Locating LH Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

10. Install the bolt in the rear transaxle mount.
 - Tighten 115 Nm (85 lb-ft).

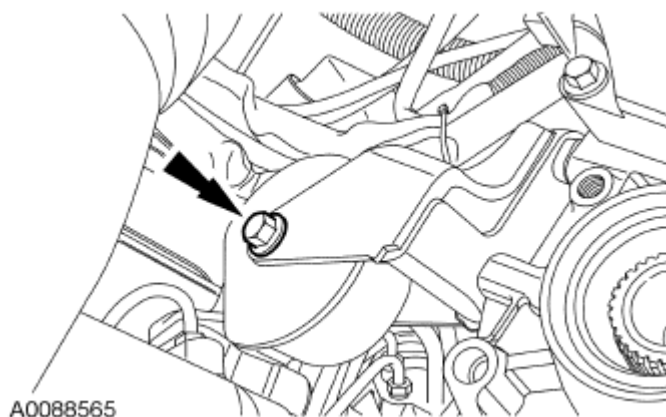


Fig. 562: Locating Transaxle Rear Mount Bolt
Courtesy of FORD MOTOR CO.

11. Install the engine mount bracket and nuts.
 - Tighten 115 Nm (85 lb-ft).

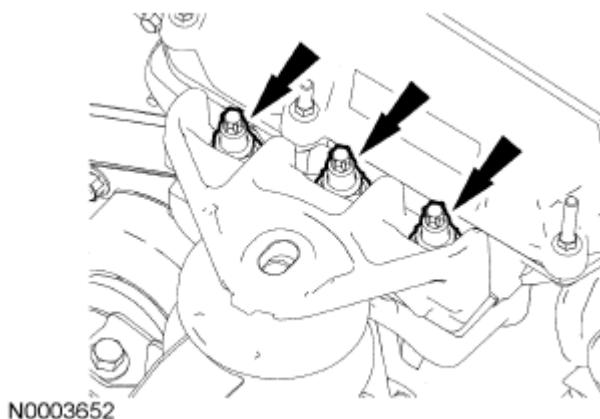


Fig. 563: Locating Engine Mount Bracket Nuts
Courtesy of FORD MOTOR CO.

12. Install the engine mount bracket bolt.
 - Tighten to 115 Nm (85 lb-ft).

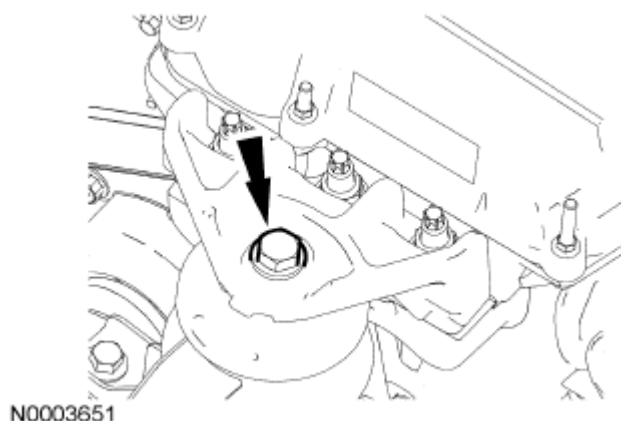


Fig. 564: Locating Engine Mount Bracket Bolt
Courtesy of FORD MOTOR CO.

13. If equipped, install a new oil filter element. For additional information, refer to **OIL FILTER ELEMENT**.
14. If equipped, install a new spin on engine oil filter.
 - Lubricate the spin on oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.

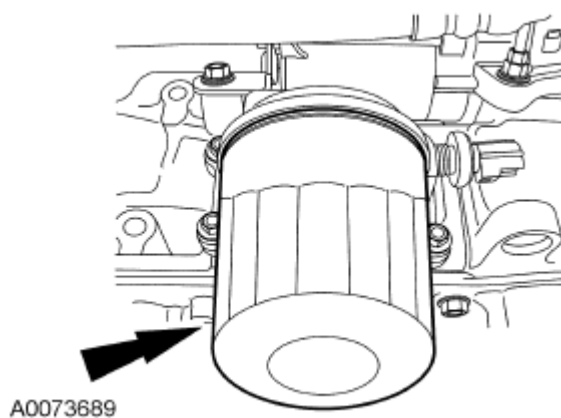


Fig. 565: Locating Engine Oil Filter
Courtesy of FORD MOTOR CO.

15. Install the 2 engine-to-transaxle bolts.
 - Tighten to 48 Nm (35 lb-ft).

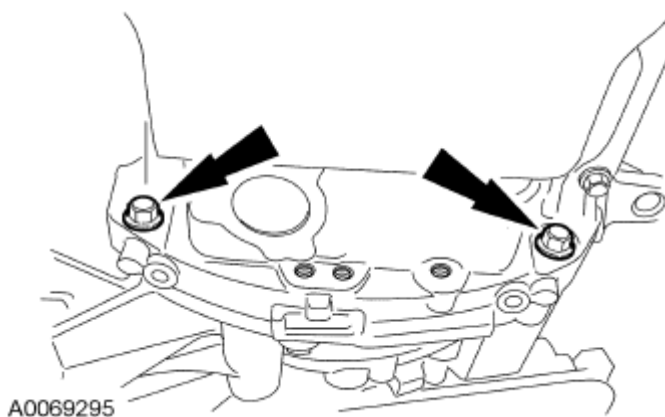


Fig. 566: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

16. Install the 2 transaxle-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).

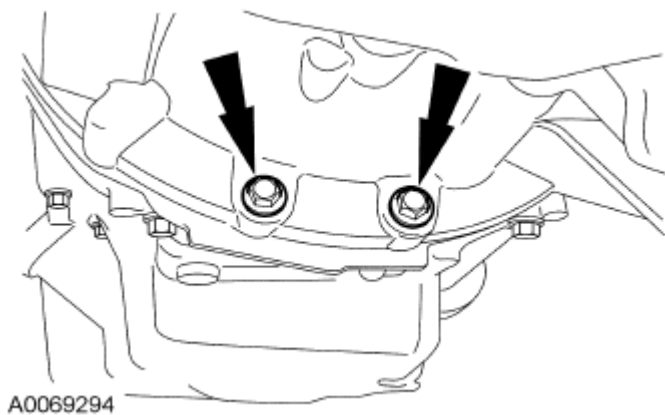


Fig. 567: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

17. Install the engine support crossmember and new nut.
 - Tighten to 175 Nm (129 lb-ft).

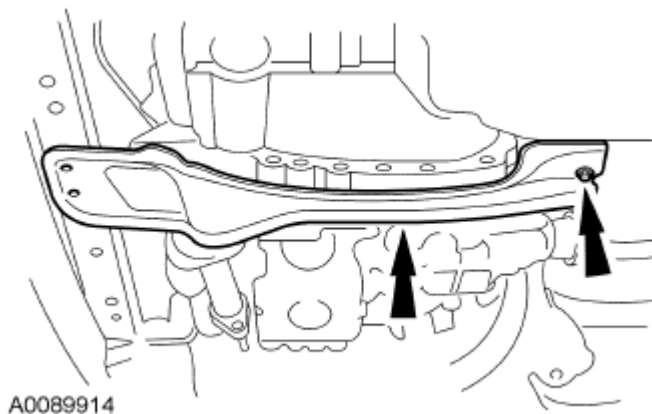


Fig. 568: Locating Rear Nut And Engine Support Crossmember
 Courtesy of FORD MOTOR CO.

18. Install the 2 bolts for the engine support crossmember and the front roll restrictor bolt.
 - Tighten the engine support crossmember bolts to 90 Nm (66 lb-ft).
 - Tighten the front roll restrictor bolt to 115 Nm (85 lb-ft).

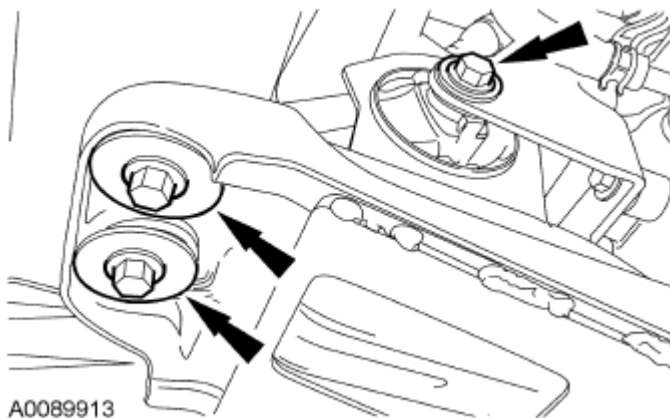


Fig. 569: Locating Front Roll Restrictor Bolt And Engine Support Crossmember Bolts
 Courtesy of FORD MOTOR CO.

19. Connect the lower radiator hose to the radiator.

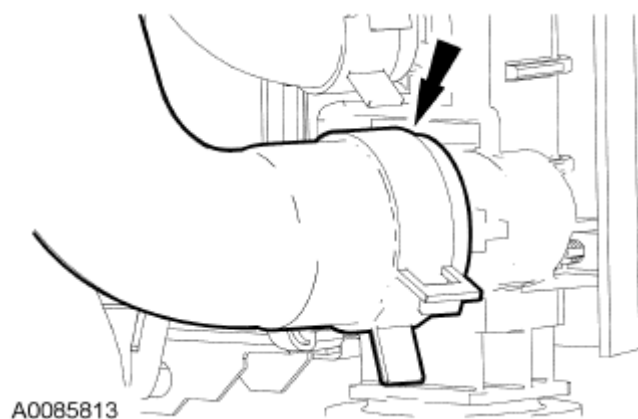


Fig. 570: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

20. Position the A/C compressor and install the 3 bolts.
- Tighten the bolts to 25 Nm (18 lb-ft).
 - Connect the A/C compressor electrical connector. Attach the wire harness retainer.

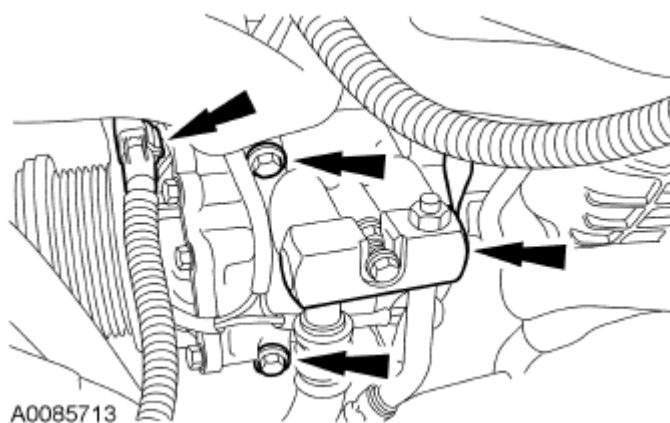


Fig. 571: Locating A/C Compressor Electrical Connector And Bolts
Courtesy of FORD MOTOR CO.

21. Connect the generator electrical connector and attach the 2 retainers.

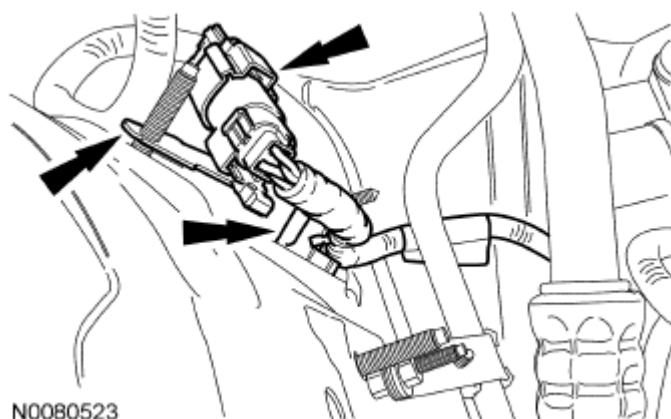


Fig. 572: Locating Generator Electrical Connector And Retainers
Courtesy of FORD MOTOR CO.

22. Connect the engine control harness electrical connector.

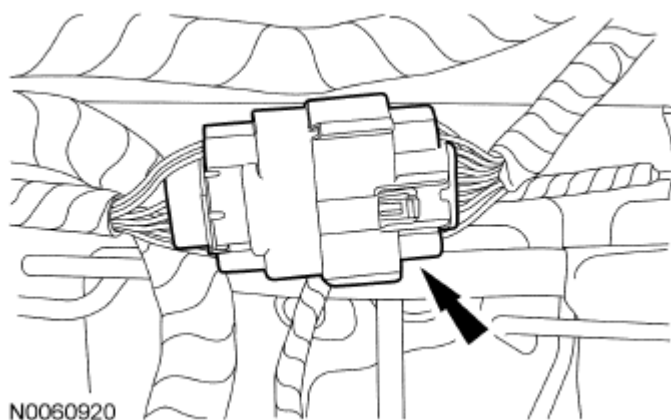


Fig. 573: Locating Engine Control Harness Electrical Connector
Courtesy of FORD MOTOR CO.

23. Connect the PCM electrical connector and attach the wire harness retainer.

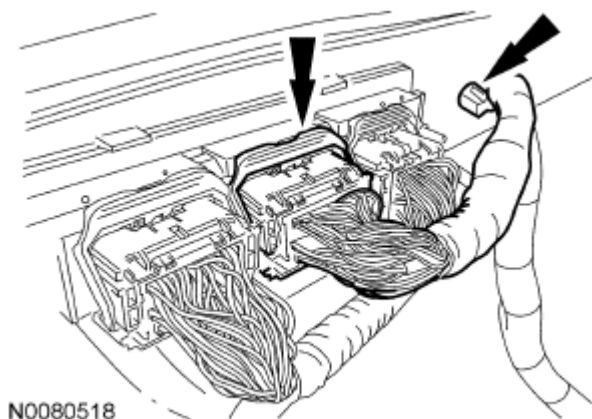


Fig. 574: Locating PCM Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

24. Connect the fuel supply tube quick connect coupling. For additional information, refer to **FUEL SYSTEM-GENERAL INFORMATION** .

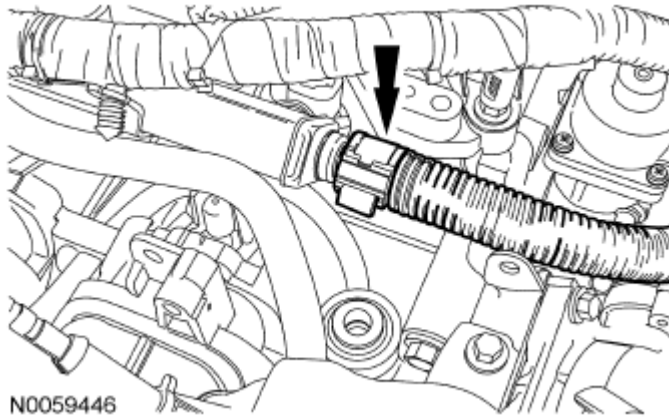


Fig. 575: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

25. Connect the fuel vapor return tube and retainer.
- Attach the fuel vapor tube retainer to the wire harness.

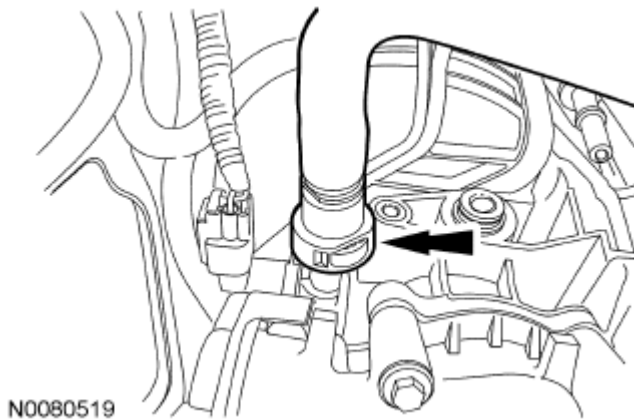


Fig. 576: Locating Fuel Vapor Tube Retainer
Courtesy of FORD MOTOR CO.

26. Connect the vacuum supply tube.

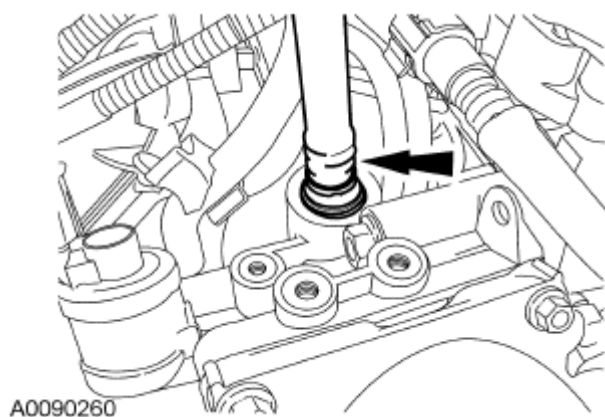


Fig. 577: Locating Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

27. Connect the heater hoses to the heater core.

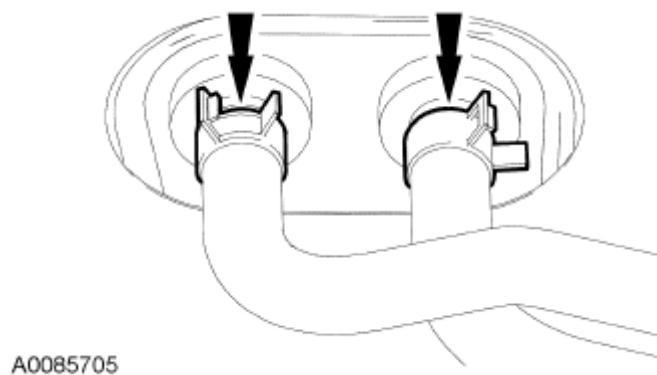


Fig. 578: Locating Heater Core Hoses
Courtesy of FORD MOTOR CO.

28. Attach the heater hose support strap to the stud.

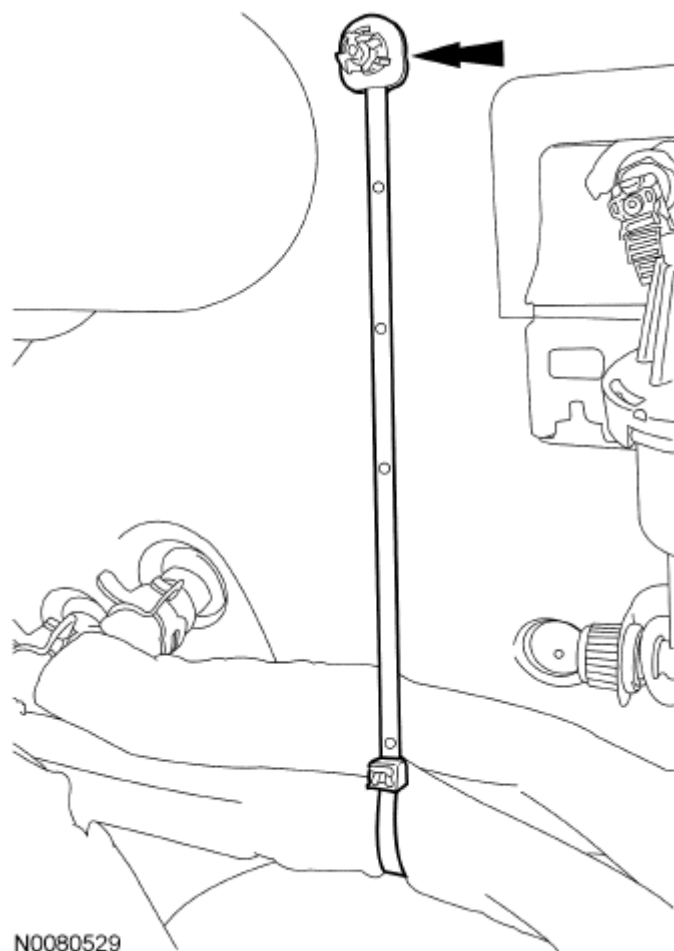


Fig. 579: Locating Heater Hose Support Strap Stud
Courtesy of FORD MOTOR CO.

29. Connect the upper radiator hose.

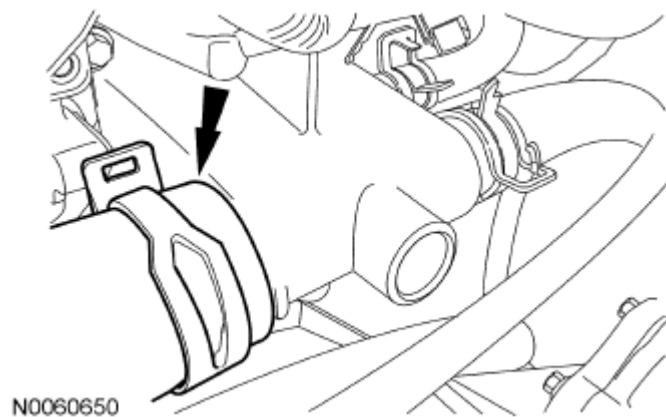


Fig. 580: Locating Upper Radiator Hose
Courtesy of FORD MOTOR CO.

30. If equipped, route the block heater wiring harness and attach all retainers.
- Connect the block heater electrical connector.

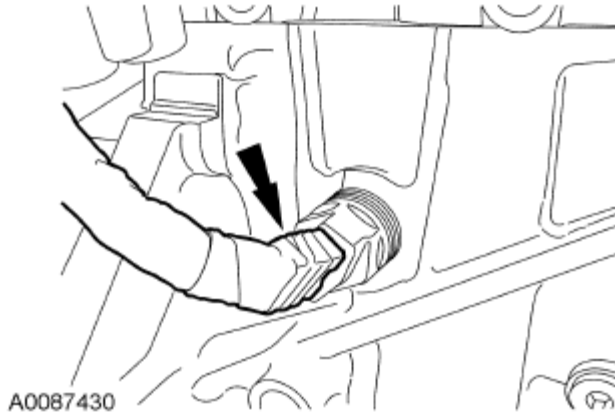


Fig. 581: Locating Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

31. Install the shift cable bracket.
1. Position the shift cable bracket.
 2. Install the 3 bolts.
 - Tighten to 22 Nm (16 lb-ft).

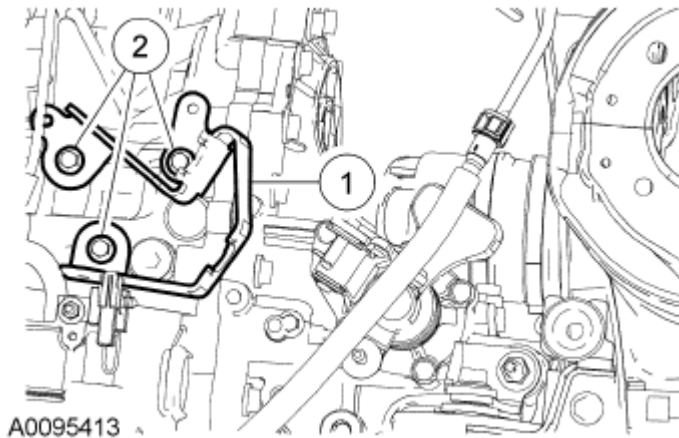


Fig. 582: Identifying Shift Cable Bracket And Bolts
Courtesy of FORD MOTOR CO.

32. Connect the shift cables.

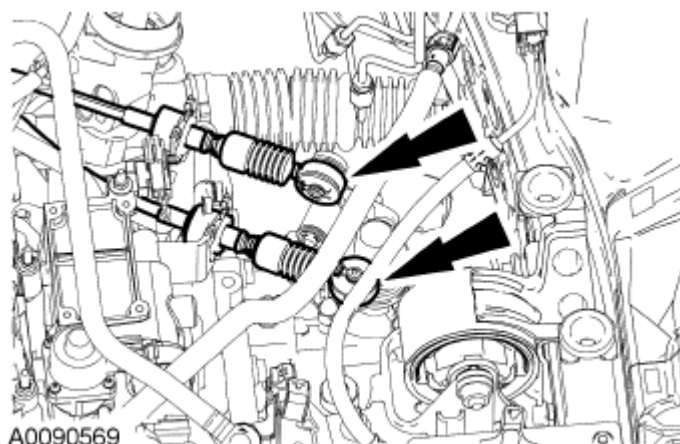


Fig. 583: Locating Shift Cables
Courtesy of FORD MOTOR CO.

33. Connect the reversing lamp indicator switch electrical connector and attach the 2 wiring harness retainers.

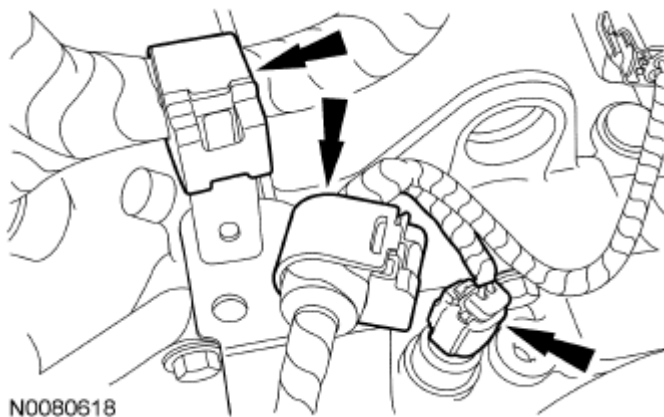


Fig. 584: Locating Wiring Harness Retainers And Reversing Lamp Indicator Switch Electrical Connector
Courtesy of FORD MOTOR CO.

34. Connect the Vehicle Speed Sensor (VSS) electrical connector and attach the 2 pin-type retainers.

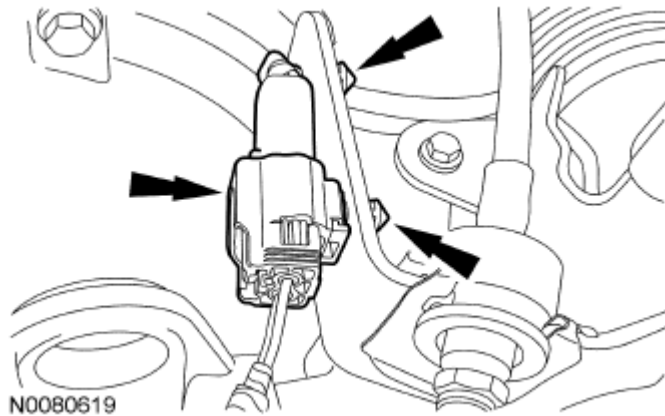


Fig. 585: Locating Vehicle Speed Sensor Electrical Connector And Pin-Type Retainers
Courtesy of FORD MOTOR CO.

35. Connect the clutch hydraulic line.
 1. Position the clutch hydraulic line.
 2. Connect the clutch hydraulic line to the clutch slave cylinder.
 - Tighten to 25 Nm (18 lb-ft).
 3. Install the clutch hydraulic line bracket-to-transaxle bolt.
 - Tighten to 3 Nm (27 lb-in).

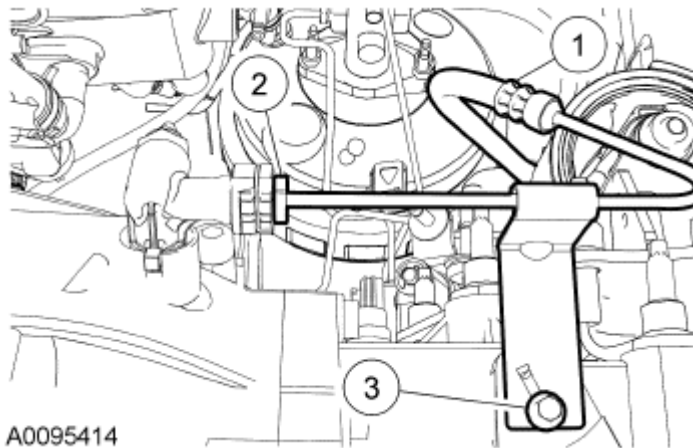


Fig. 586: Identifying Clutch Hydraulic Line And Clutch Hydraulic Line Bracket-To-Transaxle Bolt
Courtesy of FORD MOTOR CO.

36. Position the wiring harness and attach the 2 wiring harness retainers to the battery tray bracket.

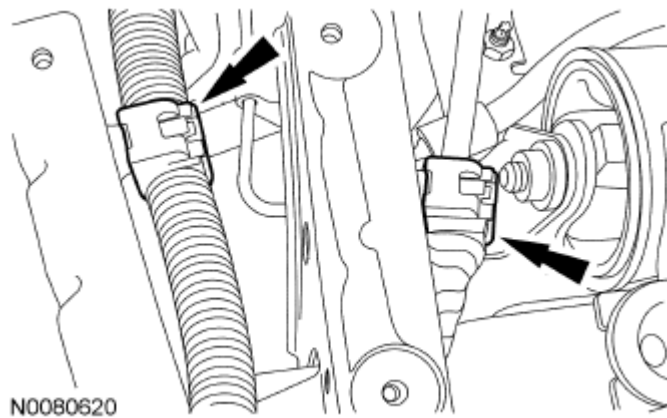


Fig. 587: Locating Wiring Harness Retainers On Battery Tray Bracket
Courtesy of FORD MOTOR CO.

37. Install the ground strap and bolt.
- Tighten to 10 Nm (89 lb-in).

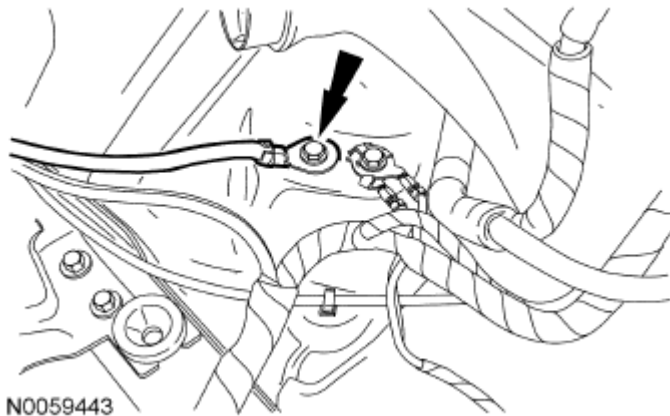


Fig. 588: Locating Ground Strap Bolt
Courtesy of FORD MOTOR CO.

38. Connect the electrical connector to the Power Distribution Box (PDB).

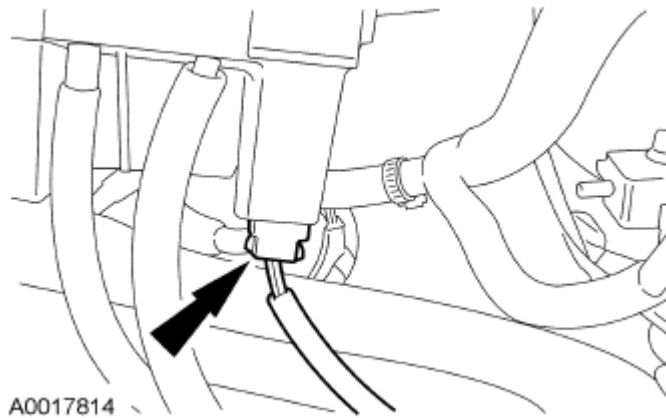


Fig. 589: Locating PDB Electrical Connector
Courtesy of FORD MOTOR CO.

39. Connect the cable to the PDB and install the nut.
 - Tighten to 12 Nm (106 lb-in).

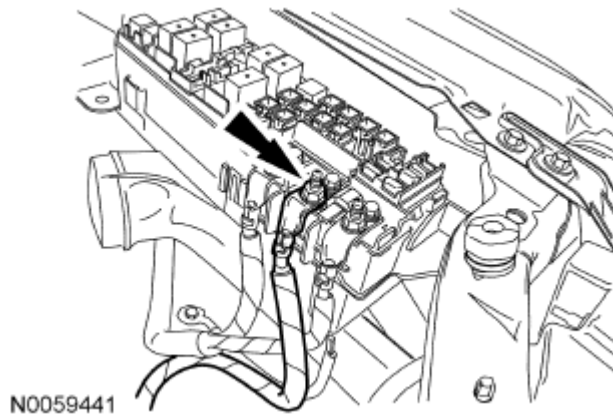


Fig. 590: Locating PDB Cable Nut
Courtesy of FORD MOTOR CO.

40. Install the PDB cover.

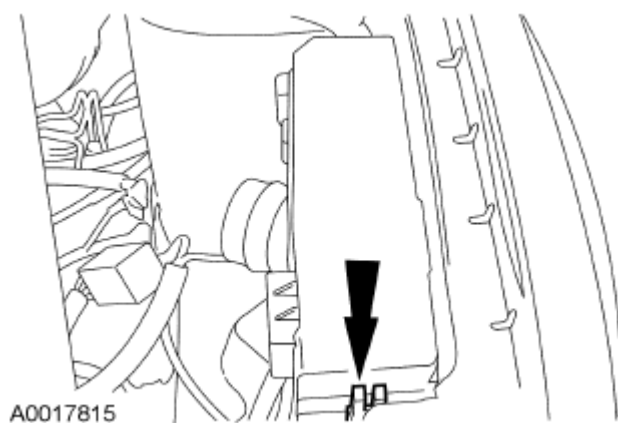


Fig. 591: Locating Power Distribution Box Cover
Courtesy of FORD MOTOR CO.

41. If equipped, install the ground eyelet and bolt.
- Tighten to 10 Nm (89 lb-in).

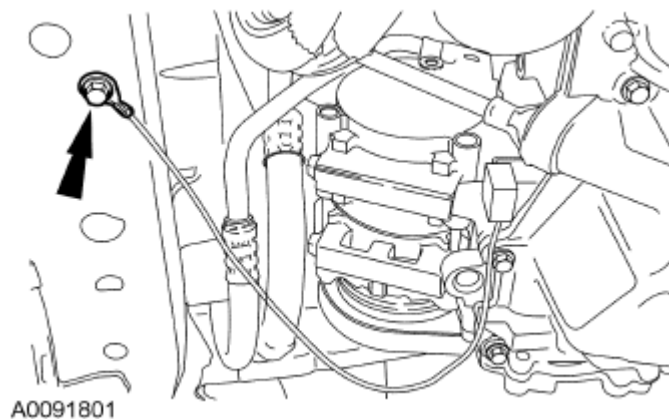


Fig. 592: Locating Ground Eyelet Bolt
Courtesy of FORD MOTOR CO.

42. Install the generator air duct and make sure the tab is latched.

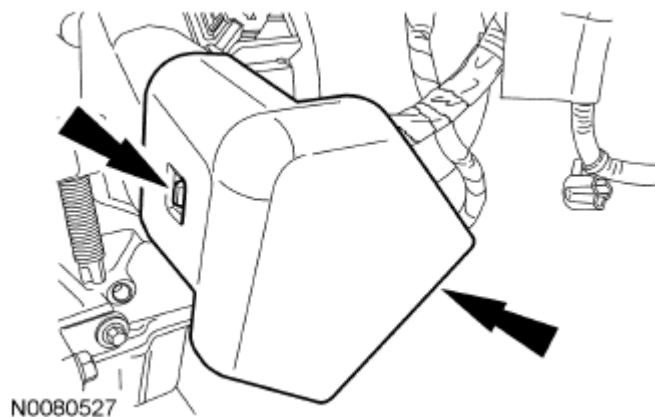
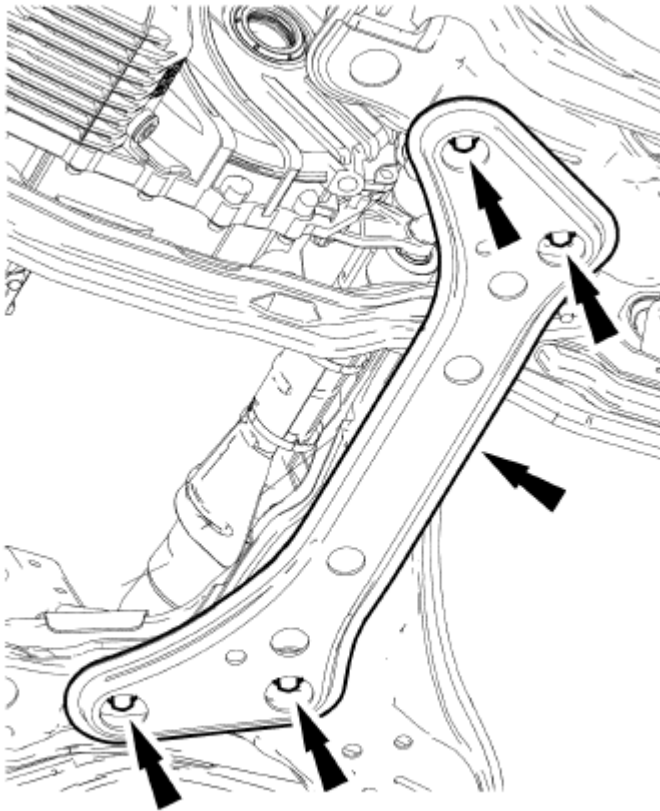


Fig. 593: Locating Locking Tabs And Generator Air Duct
Courtesy of FORD MOTOR CO.

43. Install the accessory drive belt tensioner. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
44. Install the exhaust downpipe and exhaust intermediate pipe. For additional information, refer to **EXHAUST SYSTEM**.
45. Install the lateral support crossmember and bolts.
 - Tighten to 115 Nm (85 lb-ft).



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Fig. 594: Locating Lateral Support Crossmember Bolts
Courtesy of FORD MOTOR CO.

46. Install the LH halfshaft and the intermediate shaft. For additional information, refer to **FRONT DRIVE HALFSHAFTS** .
47. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .
48. Install the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L** .
49. Fill the engine with clean engine oil.
50. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** .
51. Bleed the clutch system. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** .
52. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure following the on-screen instructions.