# 2008 ENGINE

## Engine - 2.3L - Escape & Mariner

# SPECIFICATIONS

### MATERIALS

### MATERIALS

| Item | Specification | Fill Capacity |
|---|---|---|
| High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A | WSS-M1C267-A1 | - |
| Motorcraft Metal Surface Cleaner ZC-21 | WSE-M5B392-A | - |
| Motorcraft Metal Surface Prep ZC-31 | - | - |
| Motorcraft Premium Gold Engine Coolant with Bittering Agent (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

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| Item | Specification |
|---|---|
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|---|---|
| Displacement | 2.3L |
| No. of cylinders | 4 |
| Bore/stroke | 87.5/94.0 |
| Firing order | 1-3-4-2 |
| Oil pressure (hot @ 2,000 RPM) | 29-39 psi<br>200-268 kPa |
| 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 | 87.5-87.53 mm<br>(3.444-3.446 in) |
| Cylinder bore maximum out-of-round | 0.008 mm<br>(0.0003 in) |
| Main bearing bore diameter | 57.018-57.040 mm<br>(2.244-2.245 in) |
| Head gasket surface flatness | 0.1 mm/general<br>0.05 mm/200 x 200<br>(0.004 in/general)<br>(0.0019 in/7.87 x 7.87) |
| **Piston** | |
| Diameter (1) | 87.465-87.475 mm<br>(3.443-3.444 in) |
| Diameter (2) | 87.4725-87.4875 mm<br>(3.4438-3.4439 in) |
| Diameter (3) | 87.485-87.495 mm<br>(3.4442-3.4447 in) |
| Piston-to-bore clearance | 0.025-0.045 mm<br>(0.0009-0.0017 in) |
| Ring groove width - top | 1.203-1.205 mm<br>(0.0473-0.0474 in) |
| Ring groove width - 2nd | 1.202-1.204 mm<br>(0.0473-0.0474 in) |
| Ring groove width - oil | 2.501-2.503 mm<br>(0.0984-0.0985 in) |
| Piston skirt coating thickness | 0.008-0.016 mm<br>(0.0003-0.0006 in) |
| **Piston Pin** | |
| Diameter | 20.995-21.0 mm<br>(0.8265-0.8267 in) |
| Length | 59.6-60.4 mm<br>(2.346-2.377 in) |

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| | |
|---|---|
| Piston-to-pin clearance | 0.008-0.016 mm (0.0003-0.0006 in) |
| Pin-to-rod clearance | Press fit |
| **Cylinder Head** | |
| 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) | 38.667 lb |
| Intake (valve open) 8.9 mm (0.35 in) of lift | 97.032 lb |
| Exhaust (valve open) 7.4 mm of lift | 93.338 lb |
| 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) |
| | 46.978-47.002 mm |

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|---|---|
| Connecting rod journal diameter | (1.849-1.850 in) |
| Production repair | 49.730-49.750 mm<br>(1.957-1.958 in) |
| End play | 0.220-0.450 mm<br>(0.007-0.018 in) |
| **Rings** | |
| Width - top | 1.17-1.185 mm<br>(0.0460-0.0466 in) |
| Width - 2nd | 1.197-1.199 mm<br>(0.0471-0.0472 in) |
| Width - oil | 2.38-2.45 mm<br>(0.093-0.096 in) |
| Ring gap (in bore) - top | 0.16-0.31 mm<br>(0.006-0.012 in) |
| Ring gap (in bore) - 2nd | 0.33-0.48 mm<br>(0.012-0.018 in) |
| Ring gap (in bore) - oil | 0.2-0.7 mm<br>(0.007-0.027 in) |
| **Valve Tappet** | |
| Diameter | 30.97-30.98 mm<br>(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<br>(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)[a] | 0.03 mm (0.001 in) |
| Thrust clearance | 0.09-0.24 mm<br>(0.003-0.009 in) |
| Journal diameter | 24.96-24.98 mm<br>(0.982-0.983 in) |
| Journal-to-bore clearance | 0.035-0.080 mm<br>(0.001-0.003 in) |
| **Connecting Rod** | |
| Bearing clearance | 0.027-0.052 mm<br>(0.001-0.002 in) |
| Bearing thickness | 1.496-1.520 mm<br>(0.058-0.059 in) |
| Crank bore diameter | 53.023-53.047 mm<br>(2.087-2.088 in) |
| Pin bore diameter | 20.965-20.985 mm |

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| | (0.825-0.826 in) |
| Length (center-to-center) | 154.8 mm (6.094 in) |
| Side clearance | 1.95-3.05 mm<br>(0.076-0.120 in) |
| Axial clearance | 0.14-0.36 mm<br>(0.005-0.014 in) |

[a] No. 3 Journal - Supported by No. 1 and No. 5 journals.

**TORQUE SPECIFICATIONS**

**TORQUE SPECIFICATIONS**

| Description | Nm | lb-ft | lb-in |
|---|---|---|---|
| A/C compressor mounting bolts | 25 | 18 | - |
| Accelerator cable bracket bolts | 10 | - | 89 |
| Accelerator cable bracket nuts | 6 | - | 53 |
| Accelerator cable snow shield retainer | 4 | - | 35 |
| Accessory drive belt idler pulley and bracket assembly bolts[a] | - | - | - |
| Accessory drive belt idler pulley bolt | 25 | 18 | - |
| Automatic transaxle wiring harness bracket nut | 10 | - | 89 |
| Bellhousing-to-engine bolts | 48 | 35 | - |
| Blocker heater | 21 | 15 | - |
| Brake hose retainer and anti-lock brake system (ABS) sensor bolt | 15 | 11 | - |
| Camshaft bearing cap bolts[a] | - | - | - |
| Camshaft sprocket bolts | 72 | 53 | - |
| Catalytic converter bracket bolts | 25 | 18 | - |
| Catalytic converter-to-cylinder head nuts | 47 | 35 | - |
| Clutch hydraulic line | 25 | 18 | - |
| Coil-on-plug retaining stud bolts | 8 | - | 71 |
| Coolant outlet bolts | 10 | - | 89 |
| Coolant pump bolts | 10 | - | 89 |
| Coolant pump pulley bolts | 20 | 15 | - |
| Crankshaft position (CKP) sensor bolts | 7 | - | 62 |
| Crankshaft pulley bolt[a] | - | - | - |
| Crankshaft rear oil seal retainer bolts[a] | - | - | - |
| Cylinder head bolts[a] | - | - | - |
| Cylinder head temperature (CHT) sensor | 12 | 9 | - |
| Damper bolts | 40 | 30 | - |
| Driveshaft bolts | 37 | 27 | - |
| Engine front cover bolts[a] | - | - | - |
| Engine front cover-to-oil pan bolts[a] | - | - | - |


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|---|---|---|---|
| Engine mount bolts | 55 | 41 | - |
| Engine mount bracket bolt | 115 | 85 | - |
| Engine mount bracket nuts | 115 | 85 | - |
| Engine oil pressure (EOP) switch | 15 | 11 | - |
| Engine roll-restrictor bolts | 115 | 85 | - |
| Engine support crossmember bolts | 90 | 66 | - |
| Engine support crossmember nut | 175 | 129 | - |
| Engine timing plug bolt | 20 | 15 | - |
| Engine-to-bellhousing bolts | 48 | 35 | - |
| Exhaust gas recirculation (EGR) tube | 55 | 41 | - |
| EGR valve assembly bolts | 20 | 15 | - |
| Exhaust manifold nut[a] | - | - | - |
| Exhaust manifold stud bolts | 17 | 13 | - |
| Flexplate bolts[a] | - | - | - |
| Flywheel bolts[a] | - | - | - |
| Fuel rail bolts | 23 | 17 | - |
| Generator electrical connection nut | 6 | - | 53 |
| Generator mounting bolts and nut | 47 | 35 | - |
| Generator shield nut | 20 | 15 | - |
| Ground eyelet bolt | 10 | - | 89 |
| Ground wire bolt | 10 | - | 89 |
| Halfshaft support bracket bolts | 40 | 30 | - |
| Heat shield bolts | 10 | - | 89 |
| Hydraulic line bracket bolt | 3 | - | 27 |
| Intake manifold bolts | 18 | 13 | - |
| Intermediate shaft nuts | 27 | 20 | - |
| Knock sensor (KS) bolt | 20 | 15 | - |
| Lateral support crossmember bolts | 115 | 85 | - |
| LH splash shield bolts | 9 | - | 80 |
| LH transaxle mount bolt | 103 | 76 | - |
| Lower ball joint-to-knuckle bolt | 63 | 46 | - |
| Lower front cover timing hole plug | 12 | 9 | - |
| Manual transaxle wiring harness bracket nut | 12 | 9 | - |
| Oil filter adapter bolts | 25 | 18 | - |
| Oil level indicator tube bolt | 10 | - | 89 |
| Oil pan-to-bellhousing bolts[a] | - | - | - |
| Oil pan bolts[a] | - | - | - |
| Oil pan drain plug | 28 | 21 | - |
| Oil pump drive chain tensioner shoulder bolts | 10 | - | 89 |
| Oil pump-to-engine block bolts[a] | - | - | - |

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|---|---|---|---|
| Oil pump screen and pickup tube bolts | 10 | - | 89 |
| Oil pump sprocket bolt | 25 | 18 | - |
| Oil separator bolts | 10 | - | 89 |
| Output shaft speed (OSS) sensor bolt | 13 | 10 | - |
| Power distribution box (PDB) cable nuts | 12 | 9 | - |
| Powertrain control module (PCM) wiring harness nut | 6 | - | 53 |
| Power transfer unit (PTU) bolts | 70 | 52 | - |
| PTU bracket bolts | 45 | 33 | - |
| PTU-to-engine bolts | 40 | 30 | - |
| Pressure plate bolts | 29 | 21 | - |
| Radio capacitor bolt | 20 | 15 | - |
| Radio capacitor nut | 10 | - | 89 |
| Rear transaxle mount bolt | 115 | 85 | - |
| RH splash shield bolts | 9 | - | 80 |
| Shift cable bracket bolts | 22 | 16 | - |
| Spark plug | 12 | 9 | - |
| Stabilizer bar link nut | 63 | 46 | - |
| Starter motor bolts | 35 | 26 | - |
| Starter motor solenoid battery nut | 12 | 9 | - |
| 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 |
| Tie-rod end nut | 55 | 41 | - |
| Torque converter nuts | 35 | 26 | - |
| Transaxle control cable bracket bolt | 19 | 14 | - |
| Transaxle fluid cooler tube | 23 | 17 | - |
| Transaxle-to-engine bolts | 48 | 35 | - |
| Transaxle-to-PTU bolt | 48 | 35 | - |
| Transmission cooler tube bracket bolt | 13 | 10 | - |
| Transmission fluid cooler tube | 23 | 17 | - |
| Upper engine bracket-to-power transfer unit (PTU) bolts | 45 | 33 | - |
| Upper front cover timing hole plug | 10 | - | 89 |
| Valve cover bolts[a] | - | - | - |

[a] Refer to procedure for specification.

# DESCRIPTION AND OPERATION

**ENGINE**

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The 2.3L (140 CID) 4-cylinder engine has the following features:

- Dual overhead camshaft
- Four valves per cylinder
- Sequential multiport fuel injection (SFI)
- Aluminum cylinder head
- Aluminum cylinder block
- Electronic ignition system with coil-on-plug 4 ignition coils

The 2.3L 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.

**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 application.

**Code Information -** The engine code information label, located on the side of the valve cover and the front side of the valve cover, contains the following:

- Engine build date
- Engine plant code
- Engine code

**Exhaust Emission Control System -** Operation and necessary maintenance of the exhaust emission control devices used on this engine are covered in the **Introduction - Gasoline Engines** article.

**Induction System -** The sequential multiport fuel injection (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.

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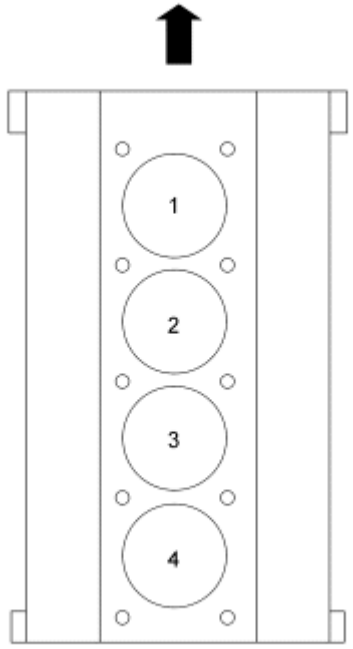
**Positive Crankcase Ventilation System -** All engines are equipped with a closed-type positive crankcase ventilation system recycling the crankcase vapors to the intake manifold.

**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.

**Engine Cylinder Identification**




N0070002

**Fig. 1: Engine Cylinder Identification**
**Courtesy of FORD MOTOR CO.**

## DIAGNOSTIC TESTS

**ENGINE**

Refer to **ENGINE SYSTEM - GENERAL INFORMATION** article for basic mechanical concerns or refer to the **Introduction - Gasoline Engines** article for driveability concerns.

## GENERAL PROCEDURES

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## 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. 2: Right 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.**

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

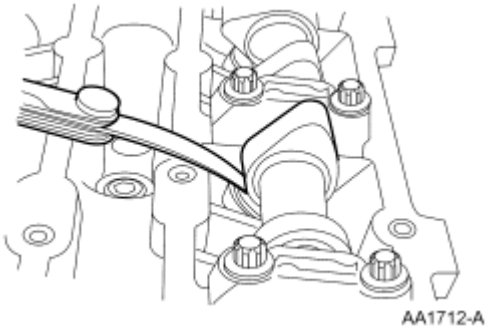


**Fig. 3: Measuring Each Valve's Clearance Using A Feeler Gauge**
**Courtesy of FORD MOTOR CO.**

**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:**

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

**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.**

4. 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**.

# IN-VEHICLE SERVICING

### INTAKE MANIFOLD

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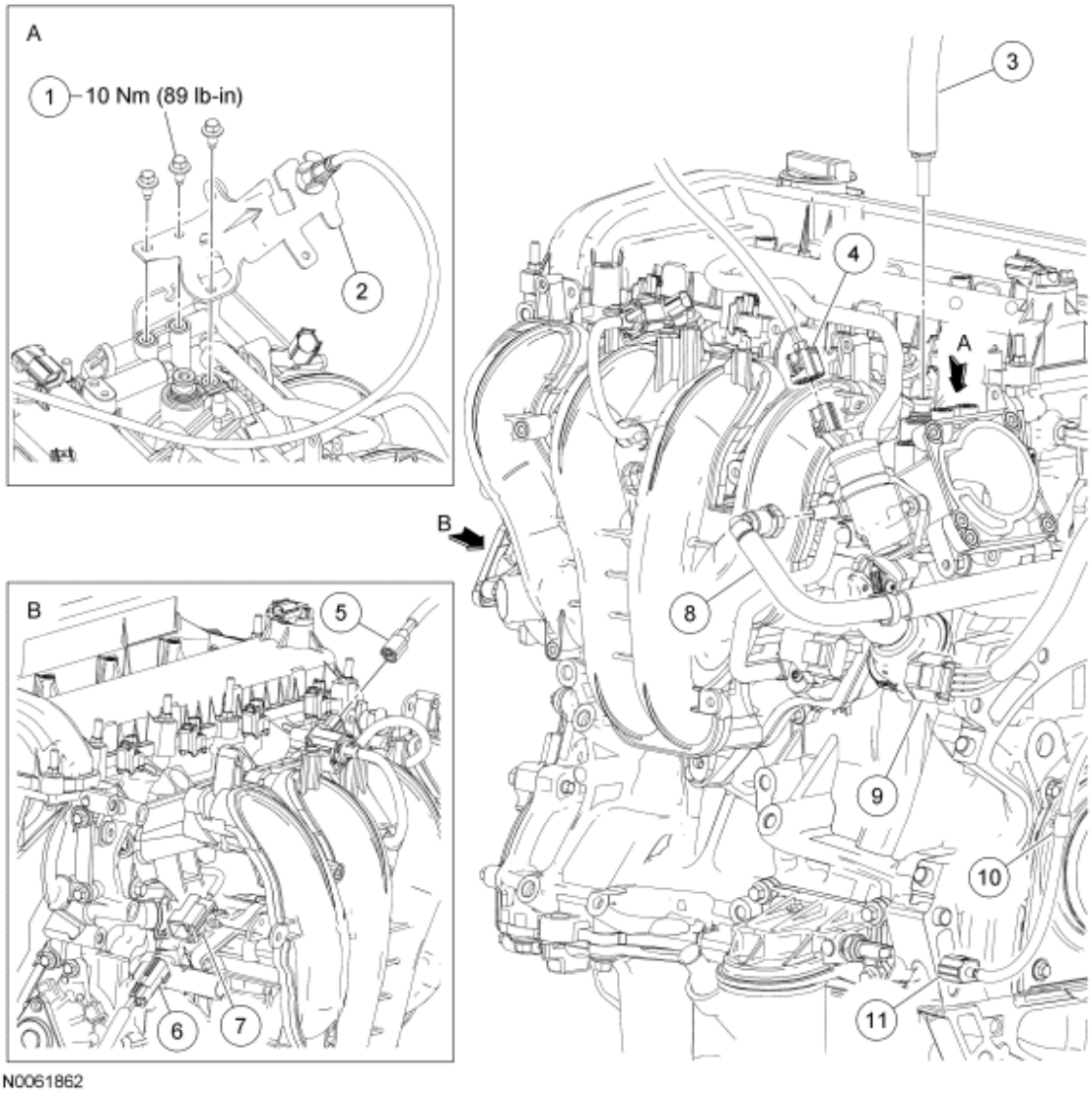


**Fig. 4: Intake Manifold Components With Torque Specification (1 Of 2)**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | W500210 | Accelerator cable bracket bolt (3 required) |
| 2 | 9677 | Accelerator cable bracket |
| 3 | 19D848 | Vacuum supply hose |
| 4 | 14A464 | Idle air control (IAC) motor electrical connector (part of 12B637) |
| 5 | 14A464 | Swirl control valve electrical connector (part of 12B637) |
| 6 | 14A464 | Knock sensor (KS) electrical connector (part of 12B637) |
| 7 | 14A464 | Pin-type retainer (part of 12B637) |

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|---|---|---|
| 8 | 9D289 | Fuel vapor return hose |
| 9 | 14A464 | Manifold absolute pressure (MAP) sensor electrical connector (part of 12B637) |
| 10 | 12B637 | Engine control wiring harness |
| 11 | 14A464 | Engine oil pressure (EOP) switch electrical connector (part of 12B637) |

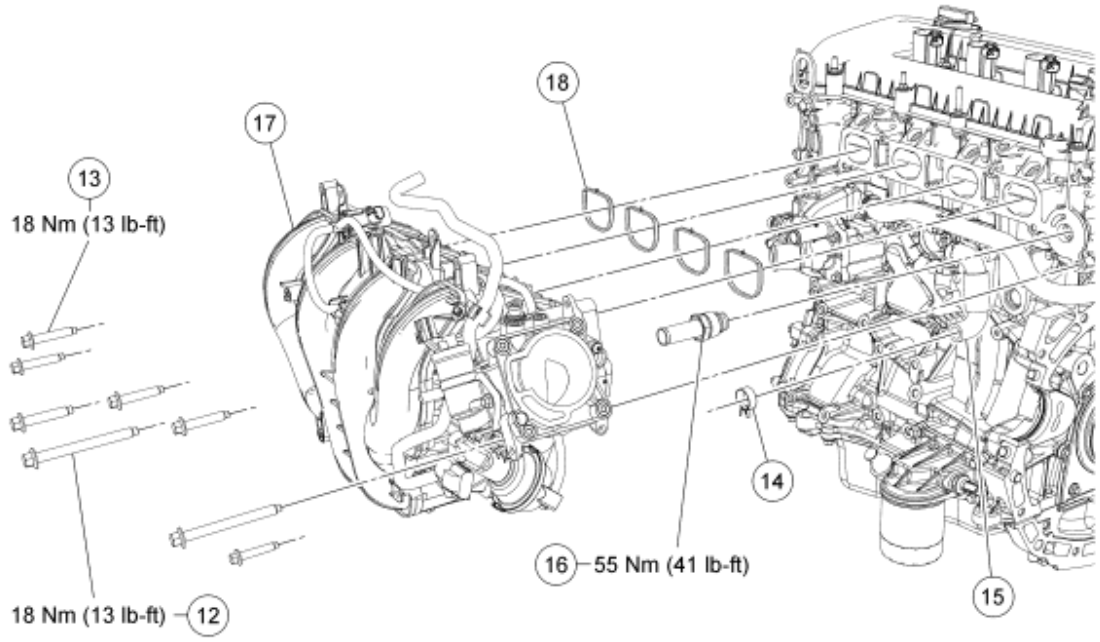


**Fig. 5: Intake Manifold Components With Torque Specifications (2 Of 2)**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 12 | W500319 | Intake manifold bolt (2 required) |
| 13 | W500311 | Intake manifold bolt (6 required) |
| 14 | - | Crankcase vent hose clamp (part of 6758) |
| 15 | 6758 | Crankcase vent hose |
| 16 | 9E470 | EGR tube |
| 17 | 9424 | Intake manifold |
| 18 | 9461 | Intake manifold gasket |

**REMOVAL AND INSTALLATION**

1. With vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the fuel rail. For additional information, refer to **FUEL CHARGING AND CONTROLS -**

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**2.3L** article.

3. Remove the throttle body. For additional information, refer to **FUEL CHARGING AND CONTROLS - 2.3L** article.
4. Remove the oil level indicator and tube. For additional information, refer to **Oil Level Indicator and Tube**.
5. Disconnect the power brake booster vacuum tube.
   - Depress the quick release locking ring.
   - Pull the vacuum tube out of the quick release fitting.

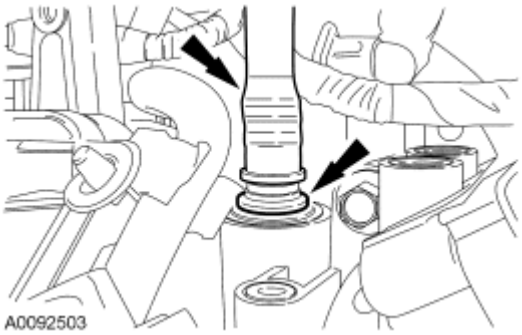


**Fig. 6: Locating Power Brake Booster Vacuum Tube And Quick Release Locking Ring**
**Courtesy of FORD MOTOR CO.**

6. Disconnect the fuel vapor return hose from the intake manifold.
7. Remove the 3 bolts and position the accelerator cable bracket aside.
   - To install, tighten to 10 Nm (89 lb-in).
8. Disconnect the idle air control (IAC) motor electrical connector.
9. Disconnect the swirl control valve electrical connector.
10. Disconnect the knock sensor (KS) electrical connector.
    - Detach the electrical connector pin-type retainer.
11. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.
12. Disconnect the engine oil pressure (EOP) switch electrical connector.
    - Detach the wiring harness pin-type retainer and position the wiring harness aside.

**NOTE: There are 2 different size bolts used. Mark the location of the bolts to make sure they are installed in the correct location.**

13. Remove the 8 bolts and position the intake manifold aside to access the crankcase vent hose clamp and the EGR tube.
    - To install, tighten to 18 Nm (13 lb-ft).
14. Release the clamp and disconnect the crankcase vent hose.
15. Remove the EGR tube.
    - To install, tighten to 55 Nm (41 lb-ft).

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

**VALVE COVER**

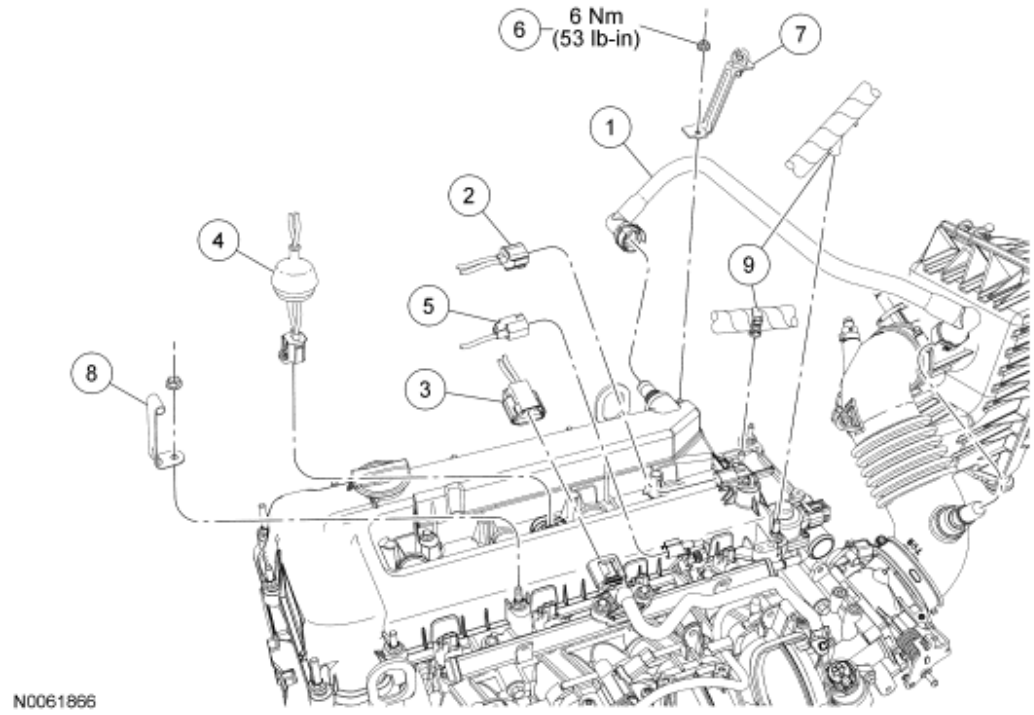


**Fig. 7: Valve Cover Components With Torque Specification (1 Of 2)**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6853 | Crankcase vent hose |
| 2 | 14A464 | Camshaft position (CMP) sensor electrical connector (part of 12B637) |
| 3 | 14A464 | Fuel rail pressure and temperature sensor electrical connector (part of 12B637) |
| 4 | 14A464 | Cylinder head temperature (CHT) sensor electrical connector (part of 12B637) |
| 5 | 14A464 | Radio capacitor electrical connector (part of 12B637) |
| 6 | W520412 | Accelerator cable bracket nut (2 required) |
| 7 | 9E728 | Accelerator cable bracket |
| 8 | - | Accelerator cable bracket (part of 9A758) |
| 9 | 14A163 | Wire harness retainers (part of 12B637) |

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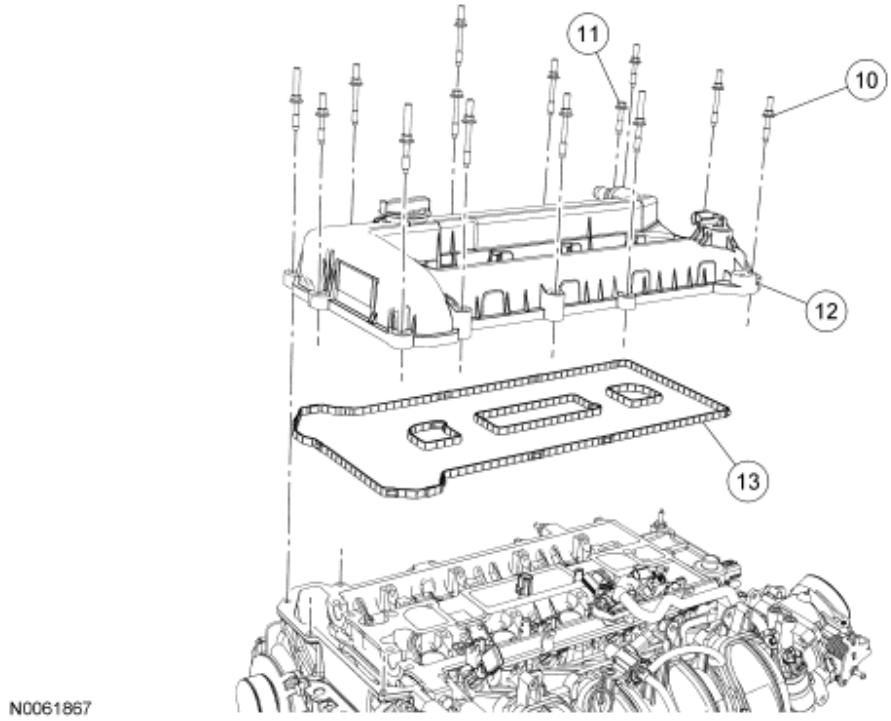


**Fig. 8: Valve Cover Components (2 Of 2)**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 10 | 6C293 | Valve cover retainer (12 required) |
| 11 | 6C295 | Valve cover retainer (2 required) |
| 12 | 6582 | Valve cover |
| 13 | 6584 | Valve cover gasket |

**REMOVAL**

**CAUTION: 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 AND LIFTING** article.
2. Remove the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.3L** article.
3. Disconnect the crankcase vent hose.
4. Disconnect the camshaft position (CMP) sensor electrical connector.
5. Disconnect the fuel rail pressure and temperature sensor electrical connector.
6. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

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7. Disconnect the radio capacitor electrical connector.
8. Remove the 2 accelerator cable bracket nuts.
    - Position the accelerator cable and brackets aside.
9. Detach all of the wiring harness retainers from the valve cover studs and position the harness aside.
10. Remove the 14 valve cover retainers, the valve cover and gasket.

**INSTALLATION**

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

1. Clean and inspect the sealing surfaces.

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

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

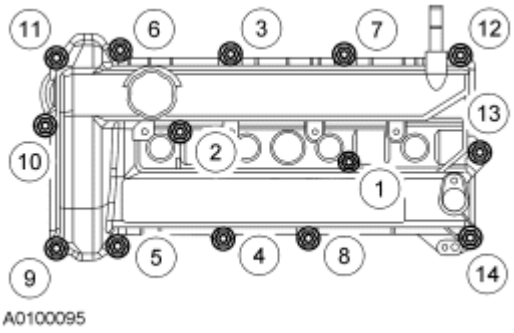


**Fig. 9: Identifying Valve Cover Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

3. Position the wiring harness and attach all of the wiring harness retainers to the valve cover studs.
4. Install the accelerator control cable brackets and nuts.
    - Tighten to 6 Nm (53 lb-in).
5. Connect the radio capacitor electrical connector.
6. Connect the CHT sensor electrical connector.
7. Connect the fuel rail pressure and temperature sensor electrical connector.
8. Connect the CMP sensor electrical connector.
9. Connect the crankcase vent hose.
10. Install the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.3L** article.

**LOWER END COMPONENTS - EXPLODED VIEW**

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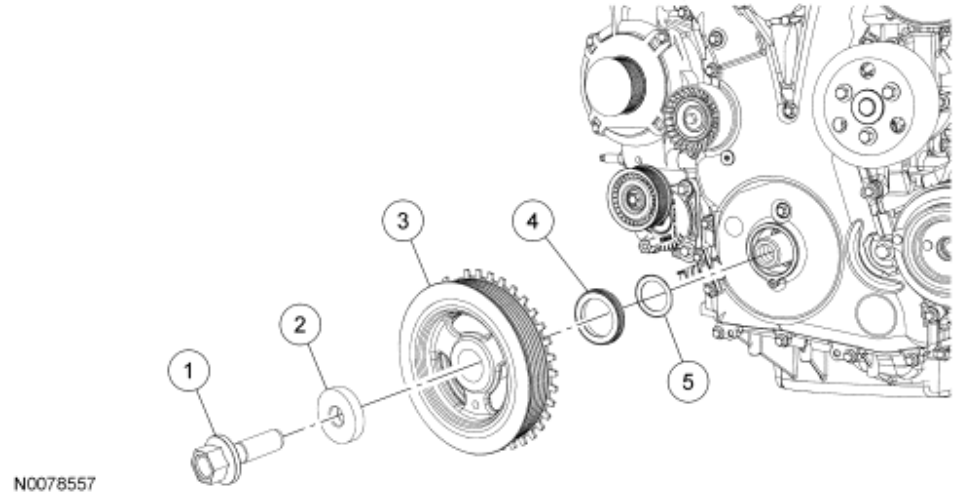


**Fig. 10: Crankshaft Pulley and Crankshaft Front Oil Seal**
**Courtesy of FORD MOTOR CO.**

| 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 |

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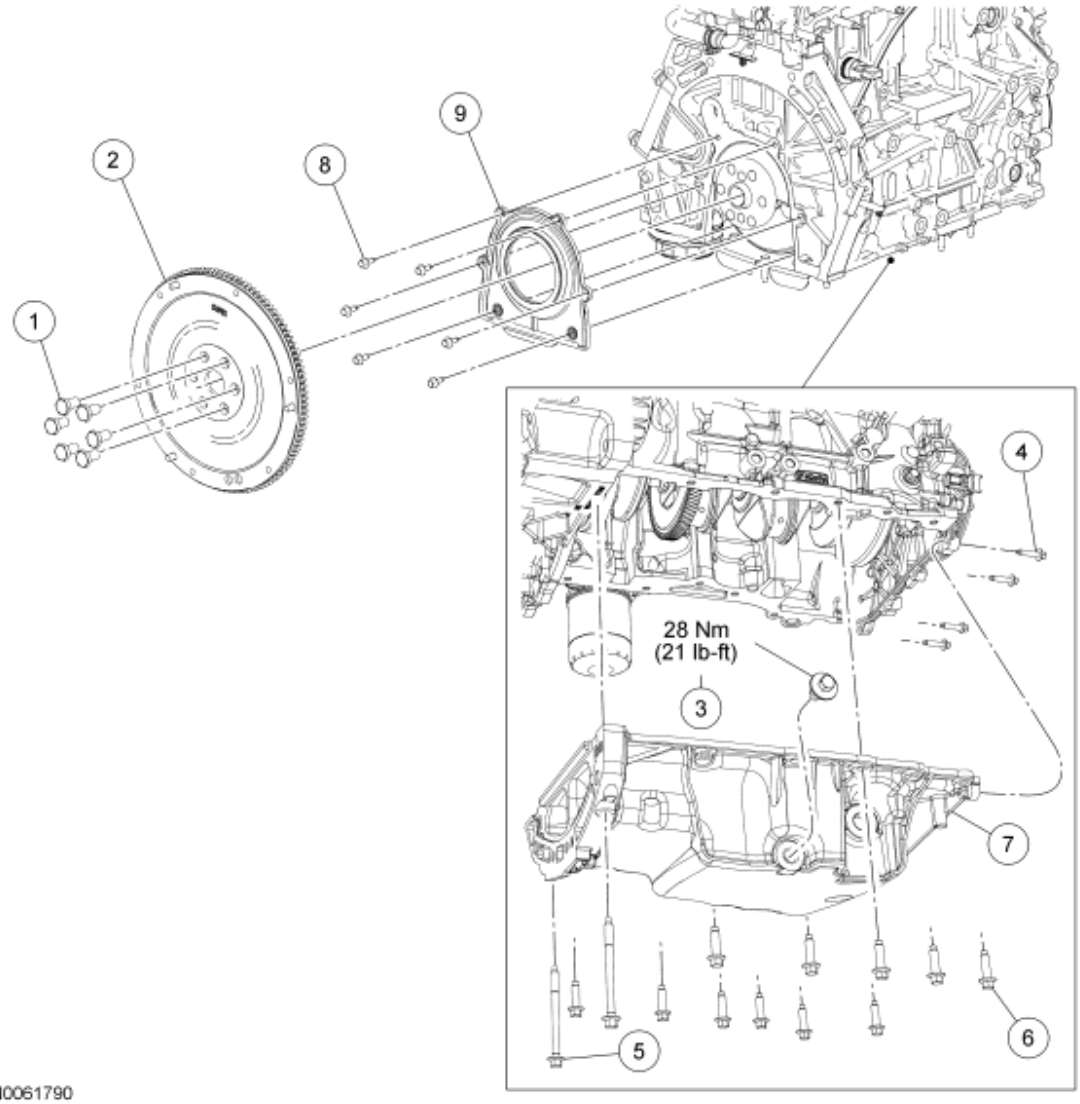


**Fig. 11: Flexplate, Flywheel and Crankshaft Rear Oil Seal With Torque Specification**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6379 | Flexplate or flywheel bolt (6 required) |
| 2 | 6477 | 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 |


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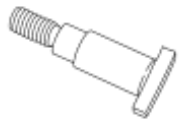
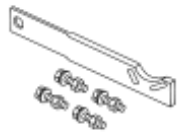
| | | |
|---|---|---|
| | | plate |

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

**CRANKSHAFT PULLEY**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST2639-A | Adapter for 205-126 | (205-072-02) |
|  ST2645-A | Alignment Plate, Camshaft | 303-465 (T94P-6256-CH) |
|  ST2647-A | Holding Fixture, Drive Pinion Flange | 205-126 (T78P-4851-A) |
|  ST2638-A | Timing Peg, Crankshaft | 303-507 |

**Material**

| 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**

**CAUTION: 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**

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**friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if you loosen the pulley bolt. 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.**

**CAUTION: 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 AND LIFTING** article.
2. Remove the front RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
3. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
4. Remove the valve cover. For additional information, refer to **Valve Cover**.

**CAUTION: 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.

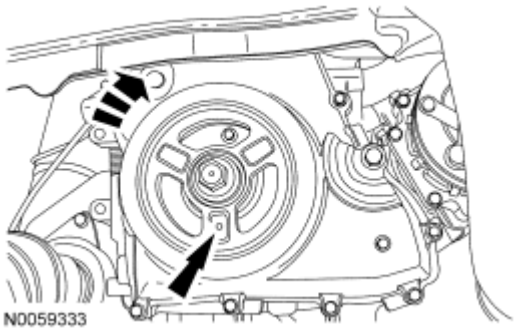


**Fig. 12: Turning Crankshaft Clockwise**
**Courtesy of FORD MOTOR CO.**

**CAUTION: The special tool 303-465 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 special tool cannot be installed,**

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**rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.**

6. Install the special tool in the slots on the rear of both camshafts.

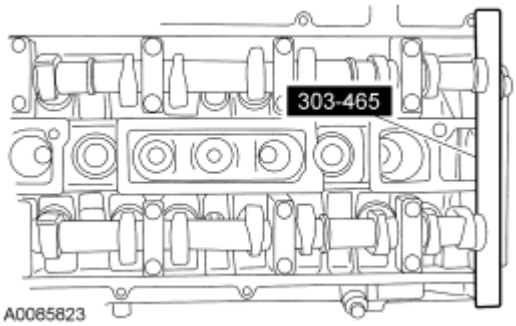


**Fig. 13: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

7. Remove the engine plug bolt.

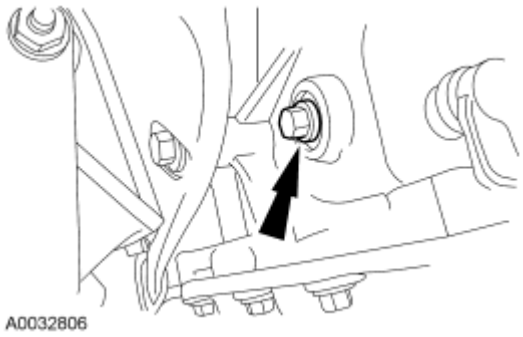


**Fig. 14: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool will contact the crankshaft and prevent it from turning past top dead center (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.**

8. Install the special tool.

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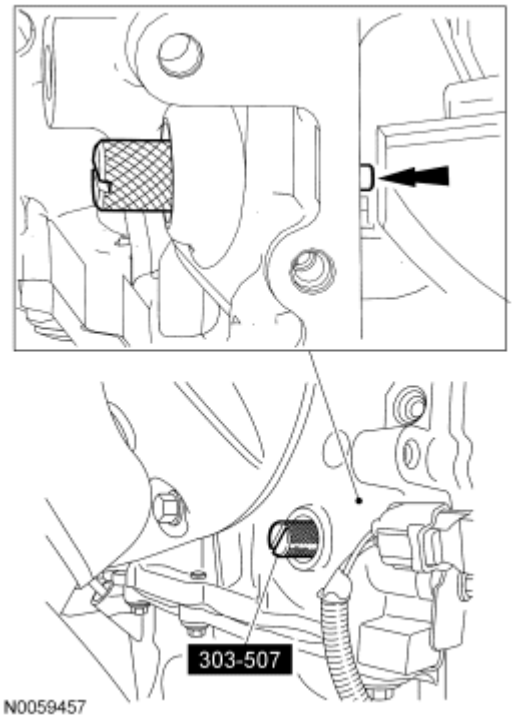


**Fig. 15: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

9. Assemble the special tools using 4 hardened washers in the locations shown.

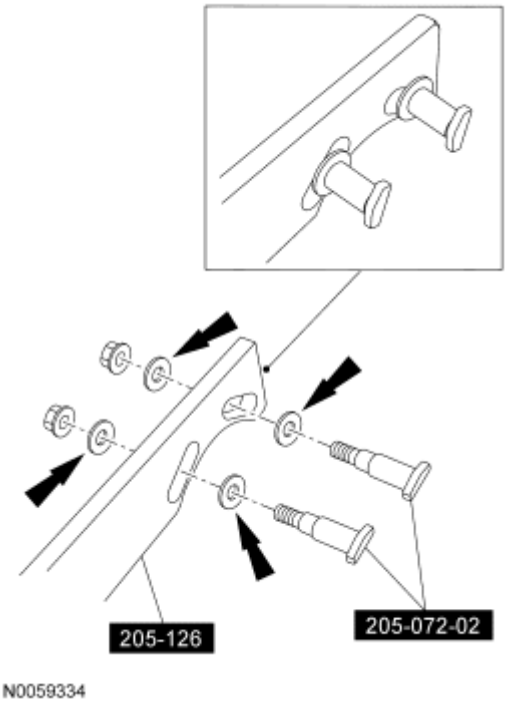


**Fig. 16: Assembling Special Tools (205-126 And 205-072-02) And Hardened Washers**

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**Courtesy of FORD MOTOR CO.**

**CAUTION: 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 special tool and the bolt should be removed using an air impact wrench (1/2-in drive minimum).**

**CAUTION: 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.**

10. Using the special tools and an air impact wrench, remove the crankshaft pulley.
    - Remove and discard the crankshaft pulley bolt and washer.
    - Remove the crankshaft pulley.
    - Remove the diamond washer and discard.

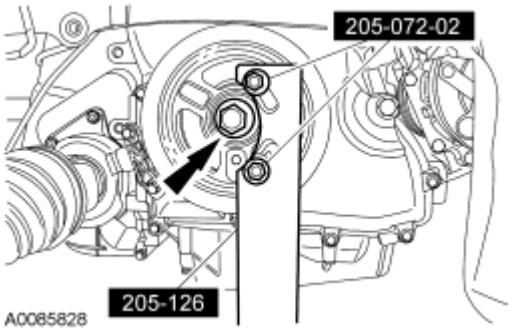


**Fig. 17: Using Special Tools (205-126 And 205-072-02)**
**Courtesy of FORD MOTOR CO.**

**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.**

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

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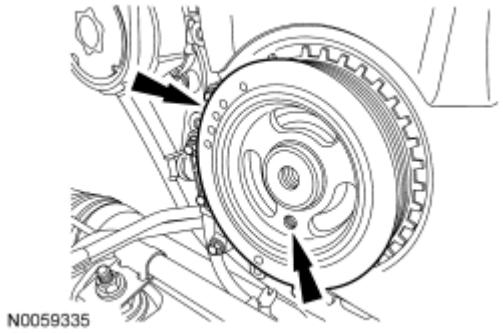


**Fig. 18: Locating Crankshaft Pulley & Hole**
**Courtesy of FORD MOTOR CO.**

**CAUTION: Only hand-tighten the 6 mm (0.23 in) bolt or damage to the front cover can occur.**

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

3. Install a standard 6 mm (0.23 in) x 18 mm (0.7 in) bolt through the crankshaft pulley and thread it into the front cover.

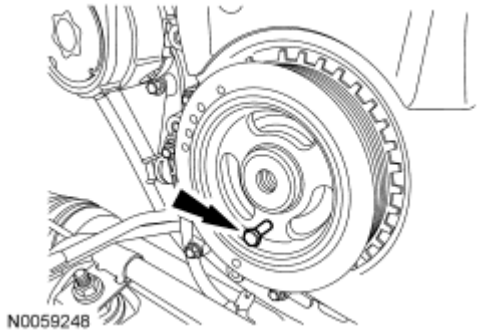


**Fig. 19: Locating Crankshaft Pulley Bolt**
**Courtesy of FORD MOTOR CO.**

4. Assemble the special tools using 4 hardened washers in the locations shown.

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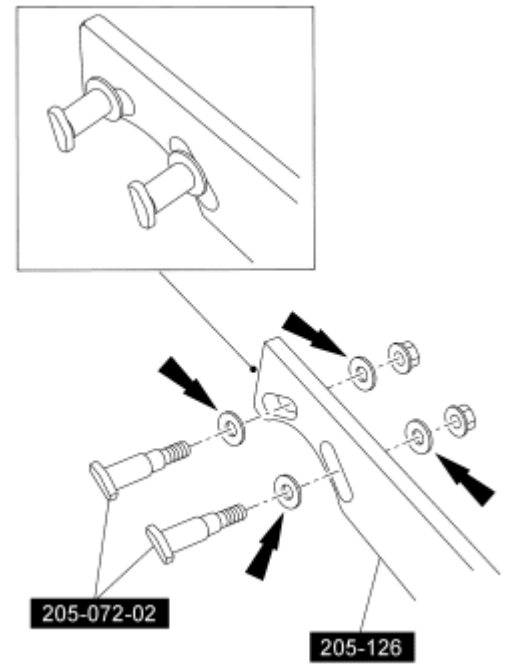


**Fig. 20: Assembling Special Tools (205-126 And 205-072-02)**
**Courtesy of FORD MOTOR CO.**

**NOTE: The crankshaft must remain in the 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 special tool and the bolt should be installed using hand tools only.**

**NOTE: Do not reuse the crankshaft pulley bolt.**

5. Install a new crankshaft pulley bolt. Using the special tools 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).

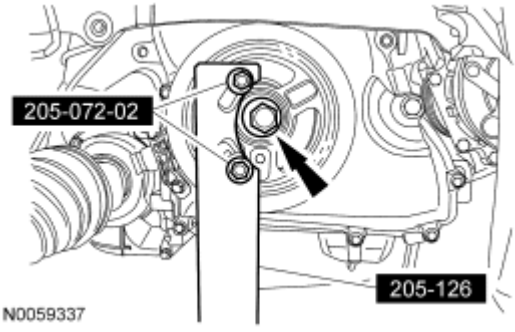


**Fig. 21: Using Special Tools (205-126 And 205-072-02)**

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**Courtesy of FORD MOTOR CO.**

6. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

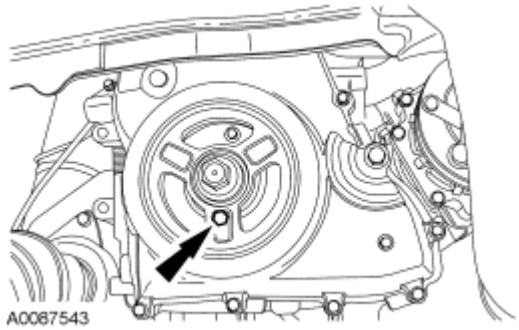


**Fig. 22: Aligning Crankshaft Pulley Bolt Holes**
**Courtesy of FORD MOTOR CO.**

7. Remove the special tool.

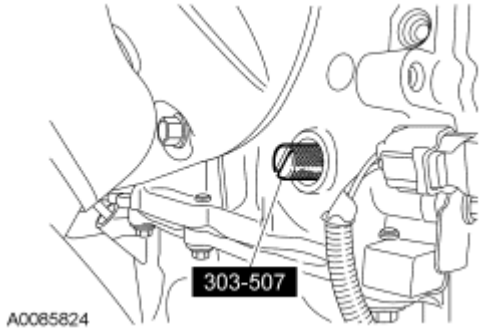


**Fig. 23: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

8. Remove the special tool.

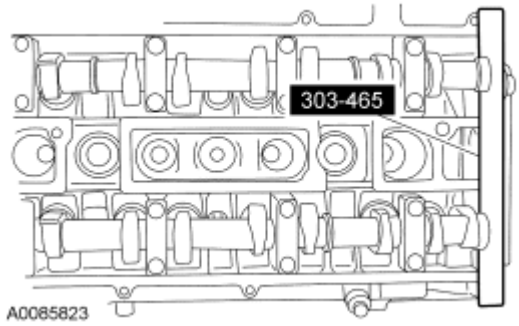


**Fig. 24: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

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

9. Turn the crankshaft clockwise 1 and 3/4 turns.
10. Install the special tool.

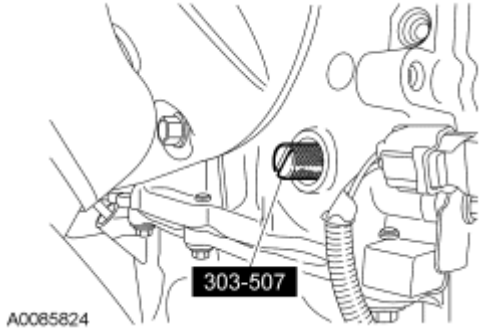


**Fig. 25: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

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

11. Turn the crankshaft clockwise until the crankshaft contacts the special tool.

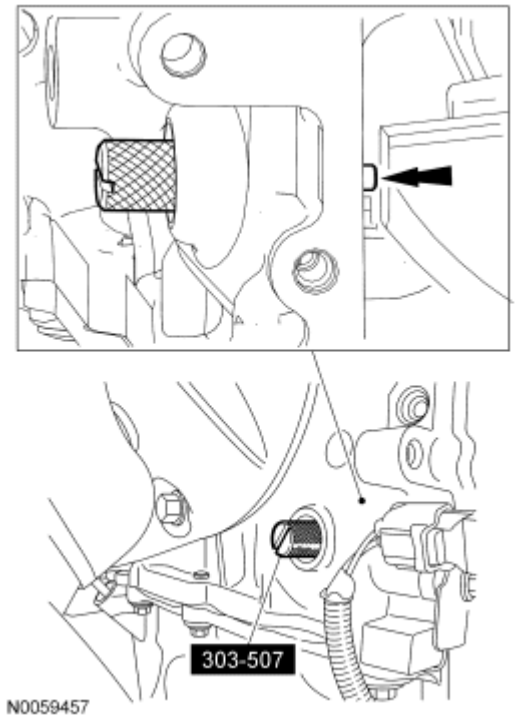


**Fig. 26: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

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

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12. Using the 6 mm (0.23 in) x 18 mm (0.7 in) 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.

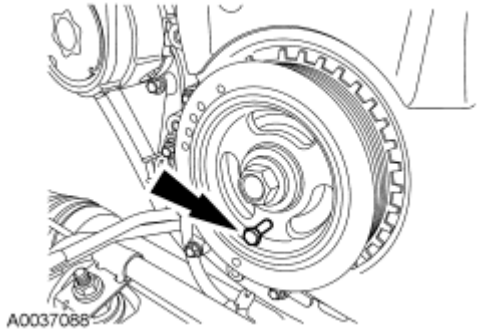


**Fig. 27: Installing Bolt Through Crankshaft Pulley And Thread It Into Front Cover**
**Courtesy of FORD MOTOR CO.**

13. Install the special tool to check the position of the camshafts.
    - If it is not possible to install the special tool, the engine valve timing must be corrected by repeating this procedure.

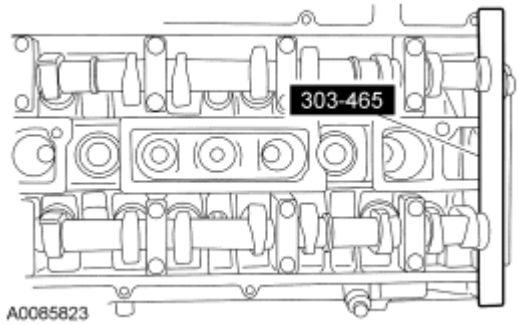


**Fig. 28: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

14. Remove the special tool.

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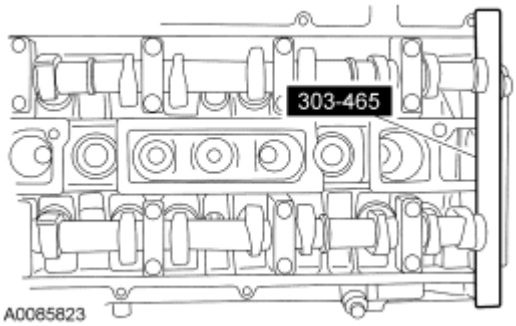


**Fig. 29: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

15. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

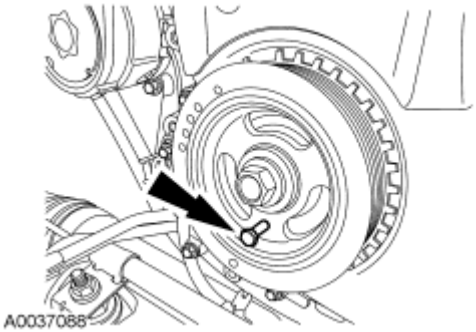


**Fig. 30: Installing Bolt Through Crankshaft Pulley And Thread It Into Front Cover**
**Courtesy of FORD MOTOR CO.**

16. Remove the special tool.

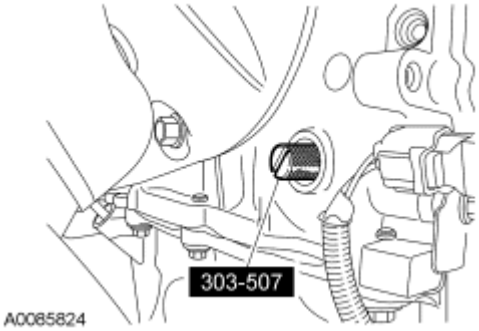


**Fig. 31: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

17. Install the engine plug bolt.
    - Tighten to 20 Nm (15 lb-ft).
18. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
19. Install the front RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.

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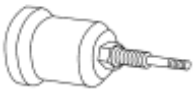
20. Install the valve cover. For additional information, refer to **Valve Cover**.

## CRANKSHAFT FRONT SEAL

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1917-A | Installer, Front Oil Seal | 303-096 (T74P-6150-A) |
|  ST1385-A | Remover, Oil Seal | 303-409 (T92C-6700-CH) |

**Material**

| 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

**CAUTION: 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 you loosen the pulley bolt. 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.**

**CAUTION: 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**

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**View** and **Crankshaft Pulley**.

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

2. Using the special tool, remove the crankshaft front oil seal.

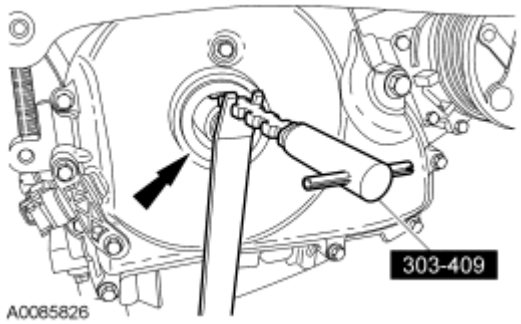


**Fig. 32: Locating Crankshaft Front Oil Seal And Special Tool (303-409)**
**Courtesy of FORD MOTOR CO.**

**INSTALLATION**

**NOTE: Remove the through-bolt from the special tool.**

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

1. Using the special tool, install the crankshaft front oil seal.

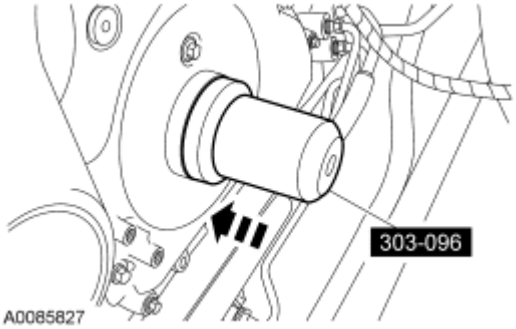


**Fig. 33: Installing Crankshaft Front Oil Seal Using Special Tool**
**Courtesy of FORD MOTOR CO.**

2. Install the crankshaft pulley. For additional information, refer to **Lower End Components - Exploded View** and **Crankshaft Pulley**.

**FLEXPLATE**

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**REMOVAL**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the automatic transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - CD4E** article.
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).

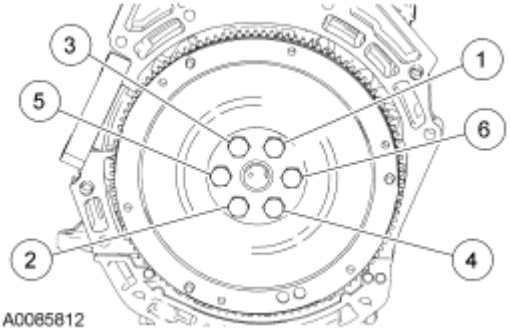


**Fig. 34: Identifying Flexplate Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

2. Install the automatic transaxle. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - CD4E** article.

**FLYWHEEL**

**REMOVAL**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the manual transaxle and clutch. For additional information, refer to **CLUTCH** article and **MANUAL TRANSAXLE/TRANSMISSION** article.
3. Remove the 6 bolts and the flywheel.

**INSTALLATION**

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**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).

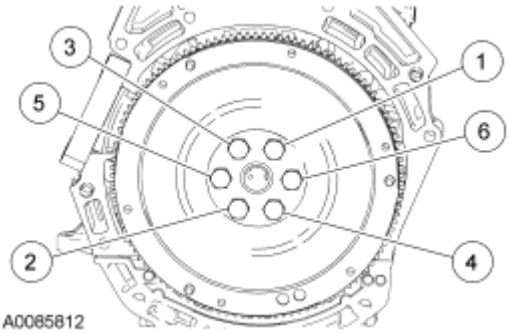


**Fig. 35: Identifying Flexplate Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

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

## CRANKSHAFT REAR SEAL

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1506-A | Installer, Crankshaft Rear Main Oil Seal | 303-328 (T88P-6701-B1) |

**Material**

| Item | Specification |
|---|---|
| Motorcraft Metal Surface Cleaner ZC-21 | WSE-M5B392-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 |

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**REMOVAL**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the flexplate or flywheel. For additional information, refer to **Flexplate** or **Flywheel**.
3. Drain the engine oil.
   - Install the drain plug and tighten to 28 Nm (21 lb-ft).
4. Remove the oil level indicator and tube. For additional information, refer to **Oil Level Indicator and Tube**.

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

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

**INSTALLATION**

1. Using the special tool, position the crankshaft rear oil seal with retainer plate onto the crankshaft.

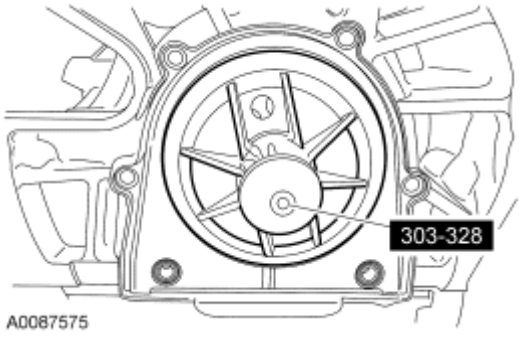


**Fig. 36: Positioning Crankshaft Rear Oil Seal Using Special Tool (303-328)**
**Courtesy of FORD MOTOR CO.**

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).

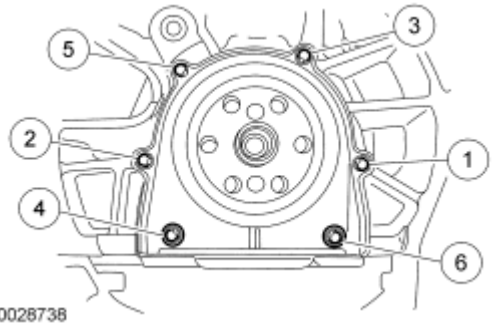


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**Fig. 37: Identifying Tightening Sequence Of Crankshaft Rear Oil Seal Bolts**
**Courtesy of FORD MOTOR CO.**

**CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, 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 cleaner. 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.**

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.

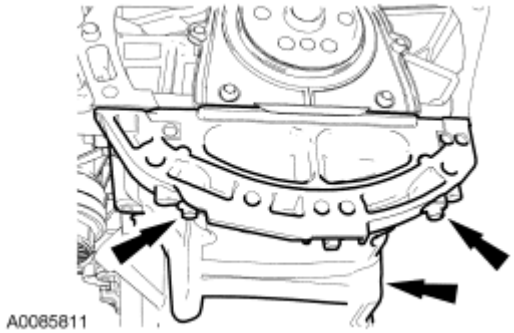


**Fig. 38: Identifying Rear Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

5. Install the 4 bolts.
   - To install, tighten to 10 Nm (89 lb-in).

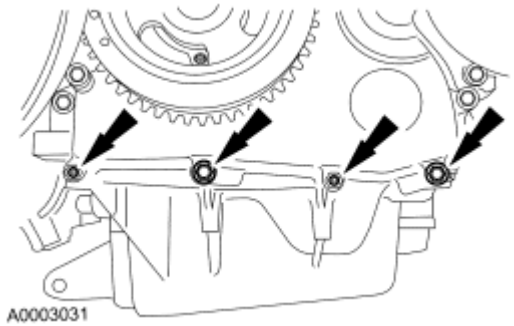


**Fig. 39: Locating Engine Front Cover-To-Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

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

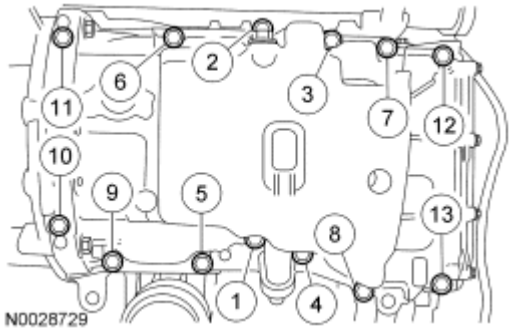
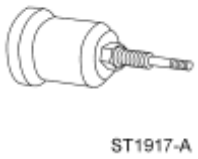



**Fig. 40: Identifying Tightening Sequence Of Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

7. Install the oil level indicator and tube. For additional information, refer to **Oil Level Indicator and Tube**.
8. Install the flexplate or flywheel. For additional information, refer to **Flexplate** or **Flywheel**.
9. Fill the engine with clean engine oil.

## ENGINE FRONT COVER

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1917-A | Installer, Front Oil Seal | 303-096 (T74P-6150-A) |
|  ST1385-A | Remover, Oil Seal | 303-409 (T92C-6700-CH) |

**Material**

| 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 |

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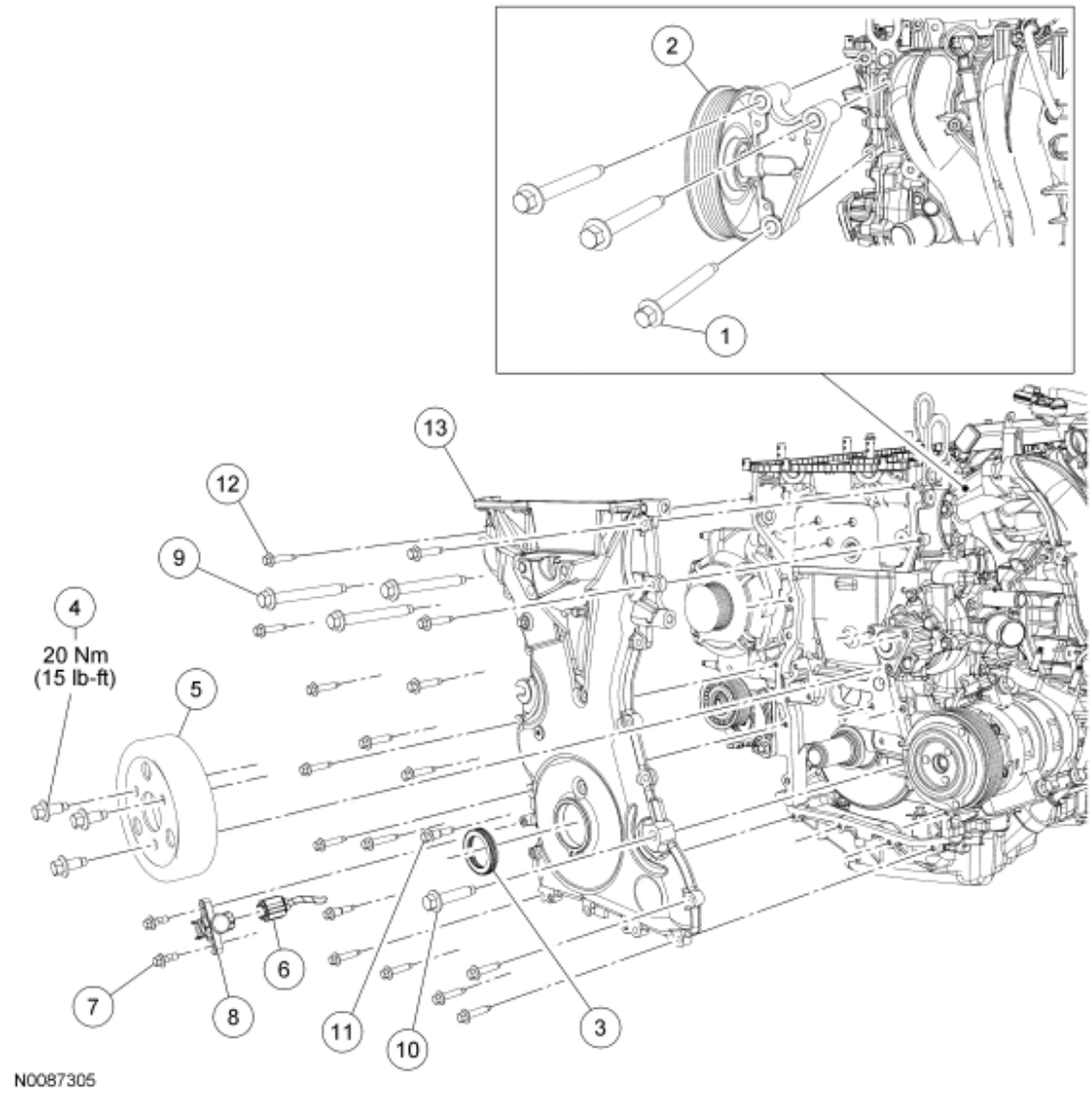


**Fig. 41: Engine Front Cover Components With Torque Specification**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | W500315 | Accessory drive belt idler pulley bolt (3 required) |
| 2 | 3F671 | 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 12B637) |
| 7 | W701219 | CKP sensor bolt (2 required) |
| | | |

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| | | |
|---|---|---|
| 8 | 6C315 | CKP sensor |
| 9 | W500328 | Engine front cover bolt (3 required) |
| 10 | W500320 | Engine front cover bolt |
| 11 | W500300 | Engine front cover bolt |
| 12 | W500215 | Engine front cover bolt (17 required) |
| 13 | 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 you loosen the pulley bolt. 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 AND LIFTING** article.
2. Remove the accessory drive belt and idler pulleys. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
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.**

5. Using the special tool, remove the crankshaft front oil seal.


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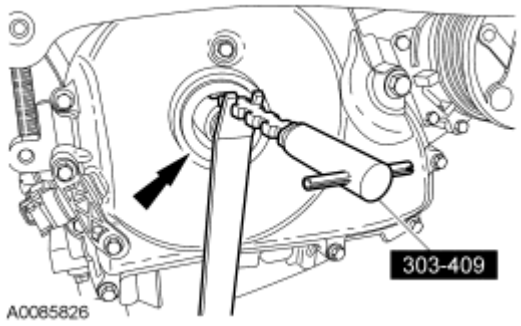


**Fig. 42: Locating Crankshaft Front Oil Seal And Special Tool (303-409)**
**Courtesy of FORD MOTOR CO.**

6. Remove the 3 bolts and the coolant pump pulley.
7. Remove the 3 bolts and the accessory drive belt idler pulley and bracket.

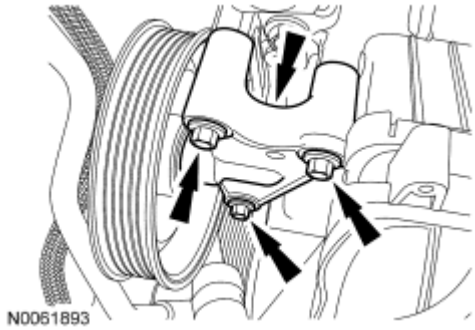


**Fig. 43: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

8. Disconnect the crankshaft position (CKP) sensor electrical connector.

**NOTE: Whenever the crankshaft position (CKP) sensor is removed, a new one must be installed, using the alignment tool supplied with the new part.**

9. Remove and discard the CKP sensor.
10. Remove the bolts and the engine front cover.

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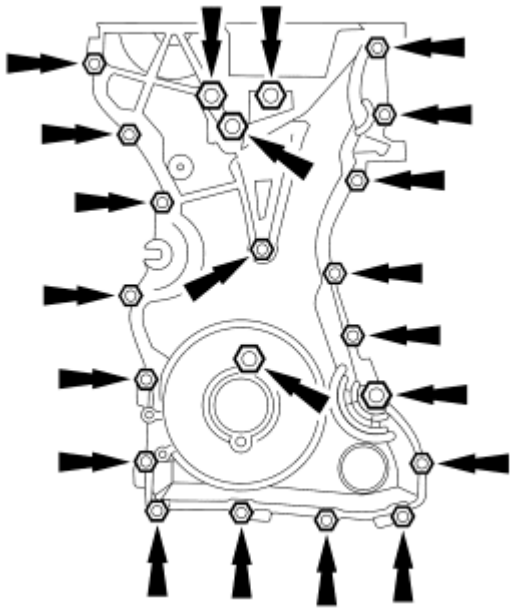


**Fig. 44: Locating Engine Front Cover Bolts**
**Courtesy of FORD MOTOR CO.**

**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.**

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.

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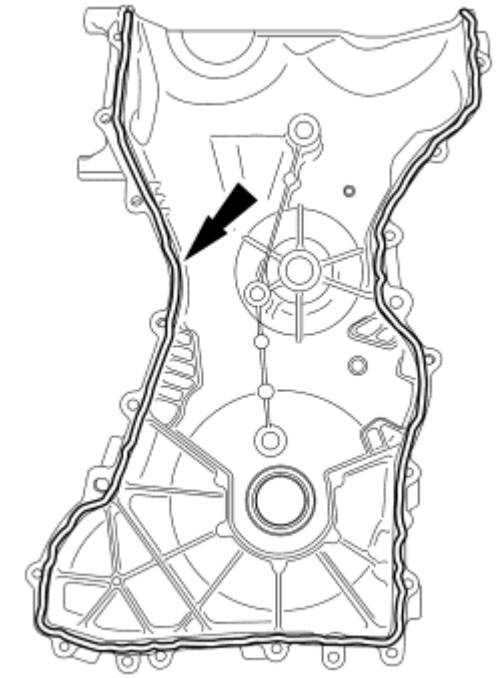


**Fig. 45: Locating Silicone Gasket**
**Courtesy of FORD MOTOR CO.**

3. 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).

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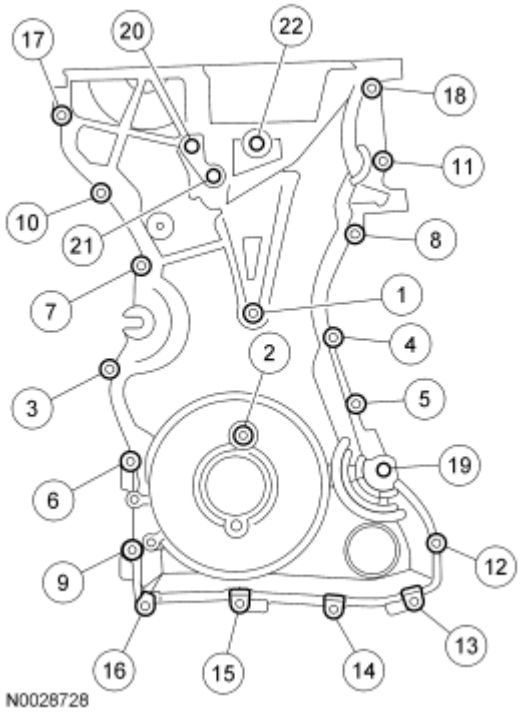


**Fig. 46: Identifying Engine Front Cover Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

4. Install the accessory drive belt idler pulley and bracket and the 3 bolts.
    - Tighten in the sequence shown to 25 Nm (18 lb-ft).

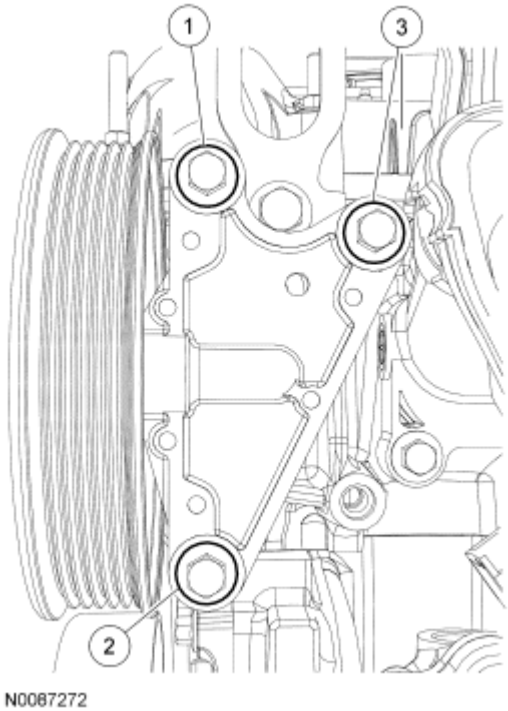


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**Fig. 47: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

5. Install the coolant pump pulley and bolts.
   - Tighten to 20 Nm (15 lb-ft).

**NOTE: Remove the through bolt from the special tool.**

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

6. Using the special tool, install the crankshaft front oil seal.

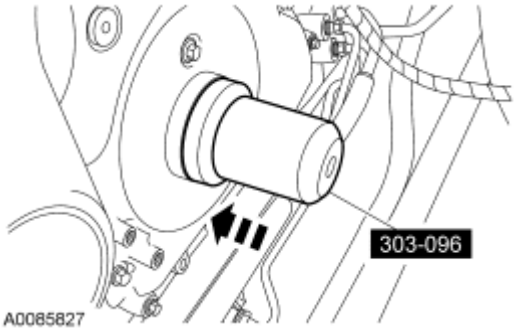


**Fig. 48: Installing Crankshaft Front Oil Seal Using Special Tool**
**Courtesy of FORD MOTOR CO.**

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.**

9. Install a standard 6 mm (0.23 in) x 18 mm (0.7 in) bolt through the crankshaft pulley and thread it into the front cover.

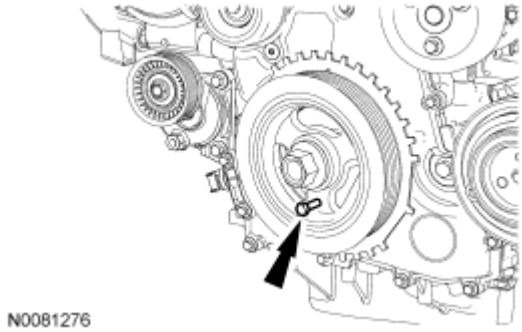


**Fig. 49: Identifying 6 mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

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**NOTE: Whenever the crankshaft position (CKP) sensor is removed, a new one must be installed using the alignment tool supplied with the new part.**

10. Install a new CKP sensor and the 2 bolts.
    - Do not tighten the bolts at this time.

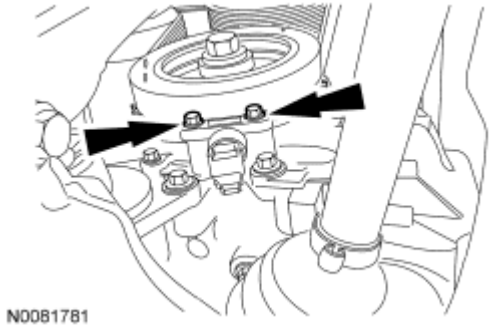


**Fig. 50: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

**NOTE: The crankshaft position (CKP) sensor alignment tool is supplied with the new sensor and is not available separately.**

11. Adjust the CKP sensor with the alignment tool.
    - Tighten the 2 CKP bolts to 7 Nm (62 lb-in).

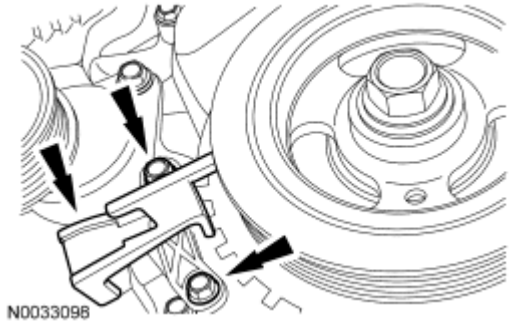


**Fig. 51: Locating CKP Sensor Bolts**
**Courtesy of FORD MOTOR CO.**

12. Connect the CKP sensor electrical connector.

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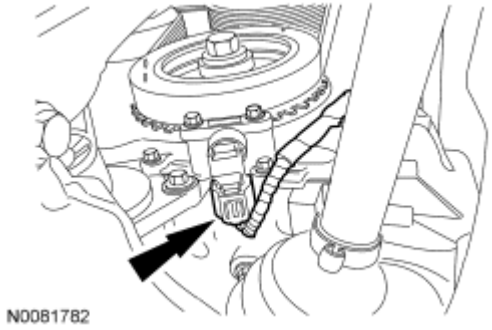


**Fig. 52: Locating CKP Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

13. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

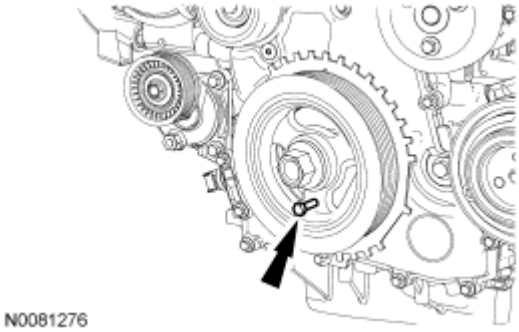


**Fig. 53: Identifying 6 mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

14. Install the accessory drive belt and idler pulleys. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.

## TIMING DRIVE COMPONENTS

### Material

| 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

**CAUTION: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and**

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**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 you loosen the pulley bolt. 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.**

**CAUTION: 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 AND LIFTING** article.
2. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
3. Remove the timing chain tensioner.
    1. Compress the timing chain tensioner, and insert a paper clip into the hole to retain the tensioner.
    2. Remove the bolts and timing chain tensioner.

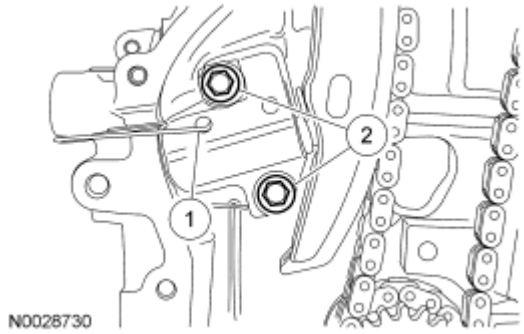


**Fig. 54: Locating Timing Chain Tensioner Bolt**
**Courtesy of FORD MOTOR CO.**

4. Remove the RH timing chain guide.

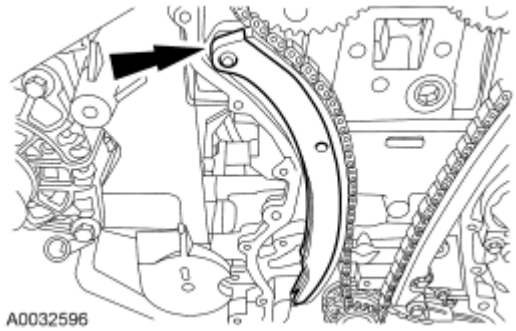


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**Fig. 55: Locating RH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

5. Remove the timing chain.

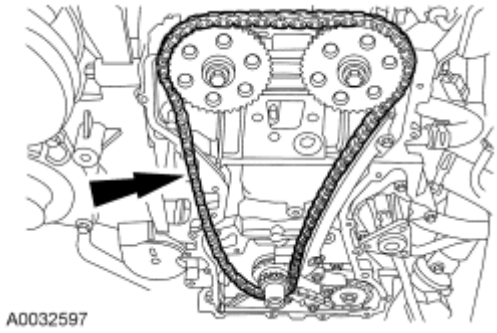


**Fig. 56: View Of Timing Chain**
**Courtesy of FORD MOTOR CO.**

6. Remove the bolts and the LH timing chain guide.

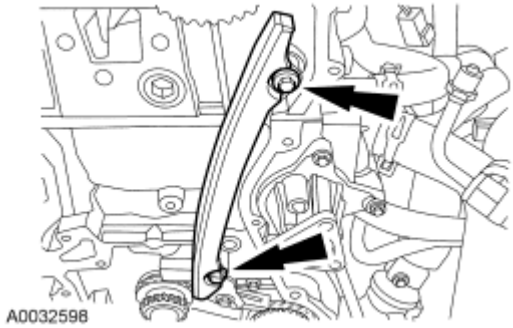


**Fig. 57: Identifying Bolts And LH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

**CAUTION: Do not rely on the Camshaft Alignment Plate to prevent camshaft rotation. Damage to the tool or the camshaft can occur.**

7. Remove the bolts and the camshaft sprockets.
   - Use the flats on the camshaft to prevent camshaft rotation.

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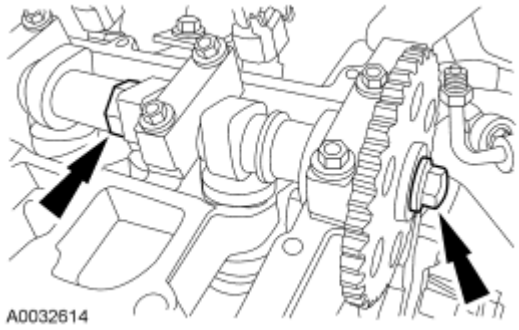


**Fig. 58: Locating Cam Holding Area And Sprocket Bolt**
**Courtesy of FORD MOTOR CO.**

**INSTALLATION**

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

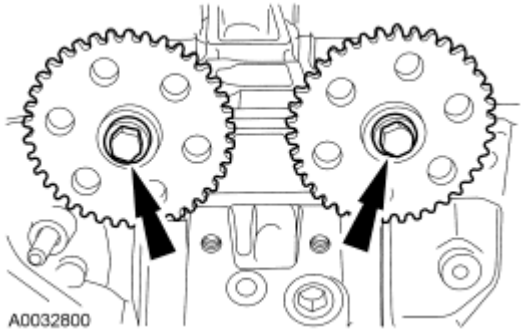


**Fig. 59: Locating Camshaft Sprocket Bolts**
**Courtesy of FORD MOTOR CO.**

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

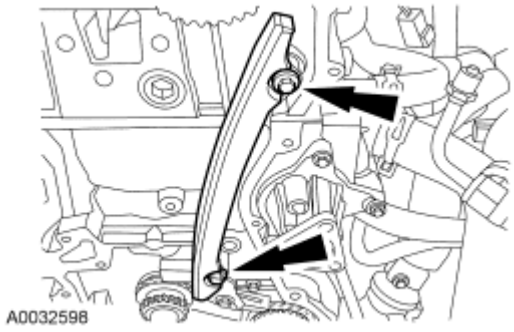


**Fig. 60: Identifying Bolts And LH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

3. Install the timing chain.

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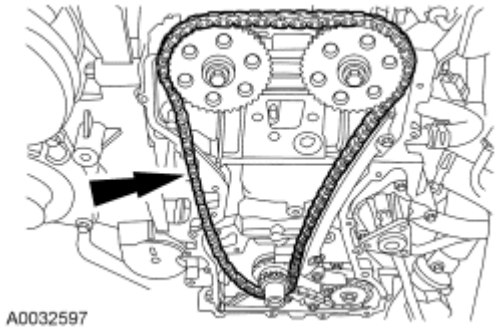


**Fig. 61: View Of Timing Chain**
**Courtesy of FORD MOTOR CO.**

4. Install the RH timing chain guide.

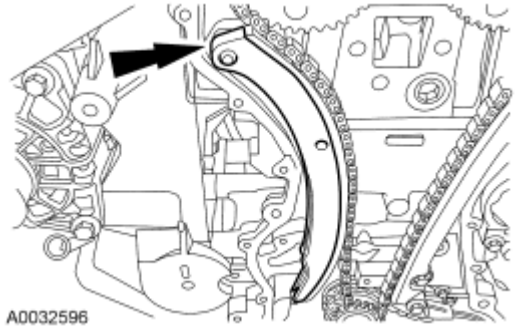


**Fig. 62: Locating RH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

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

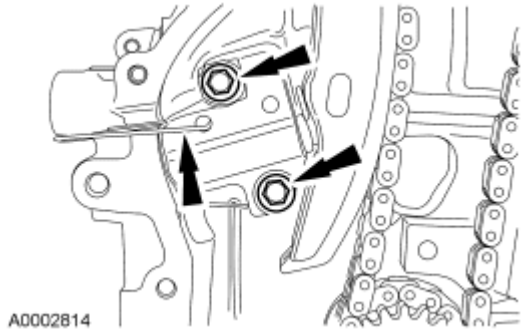


**Fig. 63: Locating Timing Chain Tensioner Bolts And Paper Clip**
**Courtesy of FORD MOTOR CO.**

**CAUTION: The special tool 303-465 is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.**

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

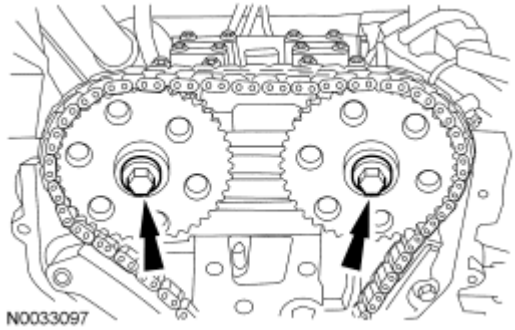


**Fig. 64: Locating Camshaft Sprocket Bolts**
**Courtesy of FORD MOTOR CO.**

7. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

**CAMSHAFTS**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST2638-A | Timing Peg, Crankshaft | 303-507 |
|  ST2645-A | Alignment Plate, Camshaft | 303-465 (T94P-6256-CH) |

**Material**

| 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**

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**CAUTION: 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.**

**CAUTION: 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 AND LIFTING** article.
2. Check the valve clearance. For additional information, refer to **Valve Clearance Check**.
3. Remove the front RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
4. Remove the accessory drivebelt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.

**CAUTION: 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.

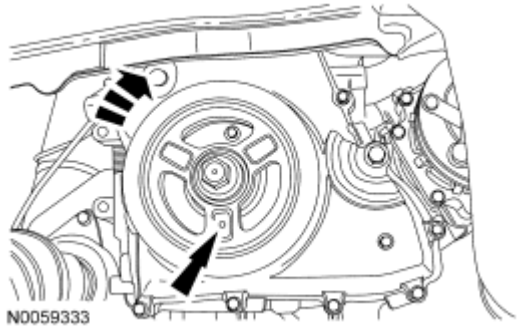


**Fig. 65: Turning Crankshaft Clockwise**
**Courtesy of FORD MOTOR CO.**

**CAUTION: The special tool 303-465 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 special tool cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.**

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6. Install the special tool in the slots on the rear of both camshafts.

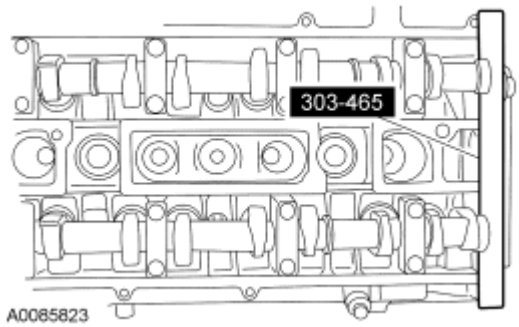


**Fig. 66: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

7. Remove the engine plug bolt.

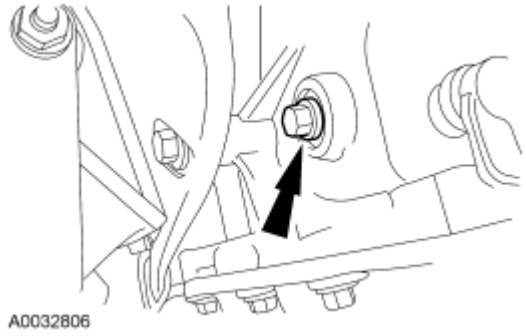


**Fig. 67: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool will contact the crankshaft and prevent it from turning past top dead center (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.**

8. Install the special tool.

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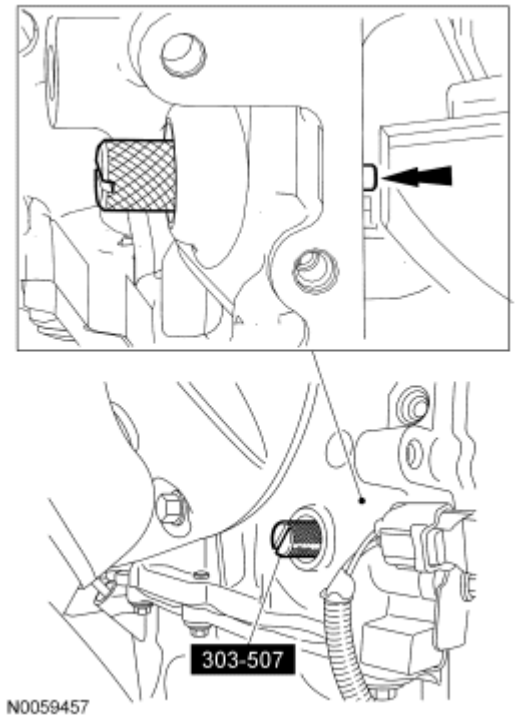


**Fig. 68: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

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

9. Install a standard 6 mm (0.23 in) x 18 mm (0.7 in.) bolt through the crankshaft pulley and thread it into the front cover.

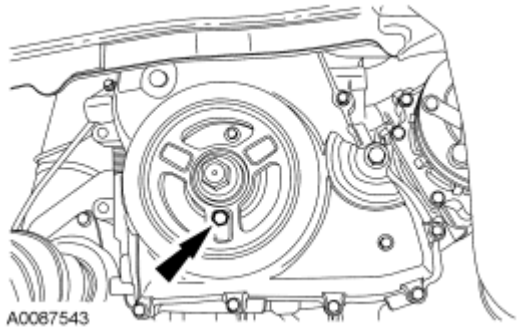


**Fig. 69: Aligning Crankshaft Pulley Bolt Holes**
**Courtesy of FORD MOTOR CO.**

10. Remove the lower front cover timing hole plug from the engine front cover.

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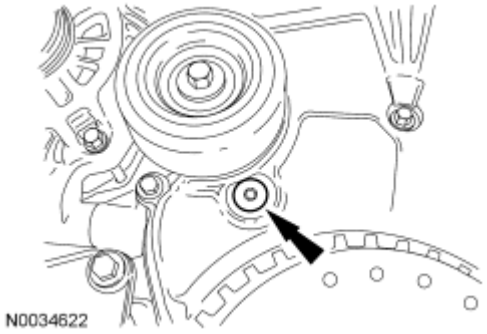


**Fig. 70: Locating Lower Front Cover Timing Hole Plug**
**Courtesy of FORD MOTOR CO.**

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

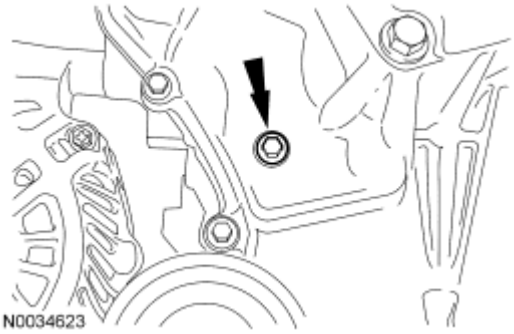


**Fig. 71: Locating Upper Front Cover Timing Hole Plug**
**Courtesy of FORD MOTOR CO.**

12. Reposition the special tool to the slot on the rear of the intake camshaft only.

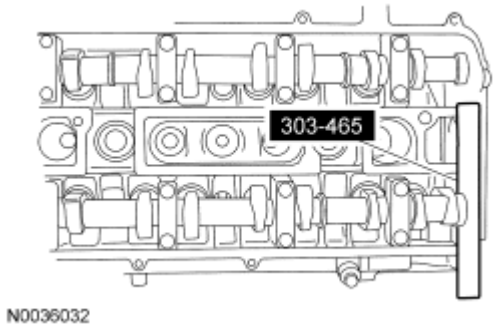


**Fig. 72: Identifying Special Tool (303-465) In Slots On Rear Of Camshafts**
**Courtesy of FORD MOTOR CO.**

**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 (1.18 in) bolt into the upper front cover timing hole will hold the tensioner arm in a retracted position and allow enough slack in the**

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**timing chain for removal of the exhaust camshaft gear.**

13. 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 (1.18 in) bolt into the upper front cover timing hole to hold the tensioner arm in the retracted position.

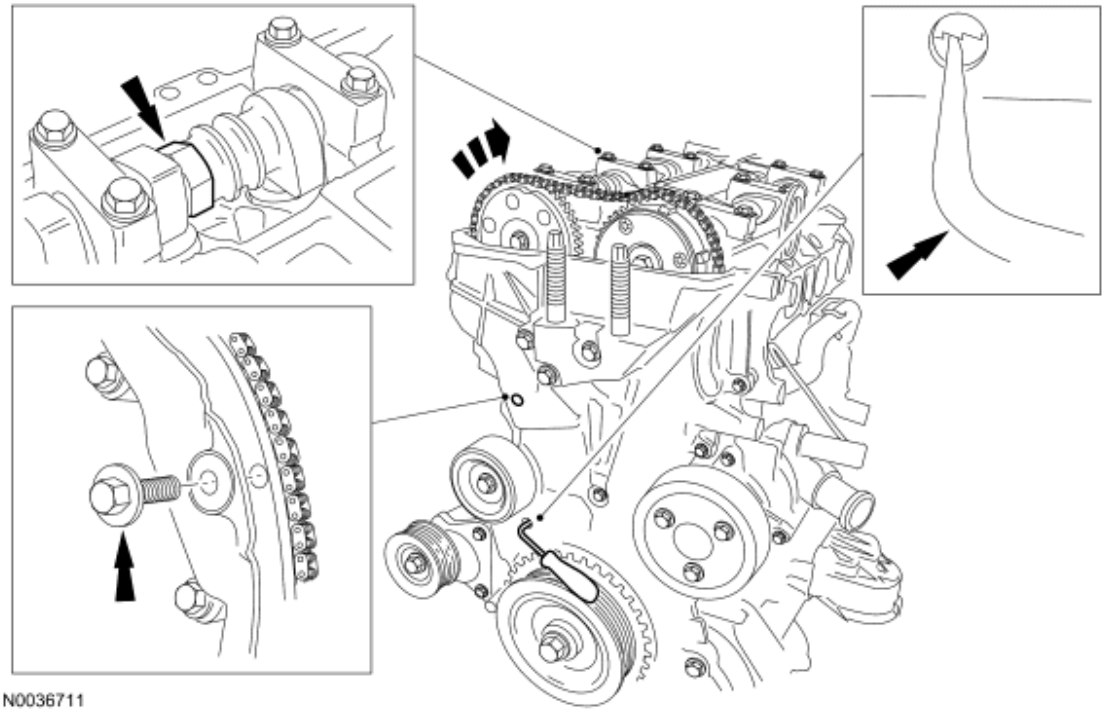


**Fig. 73: Unlocking Chain Tensioner Ratchet Through Lower Front Cover Timing Hole**
**Courtesy of FORD MOTOR CO.**

14. Remove the special tool.

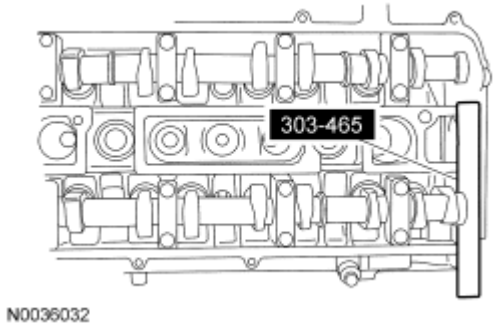


**Fig. 74: Identifying Special Tool (303-465) In Slots On Rear Of Camshafts**
**Courtesy of FORD MOTOR CO.**

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

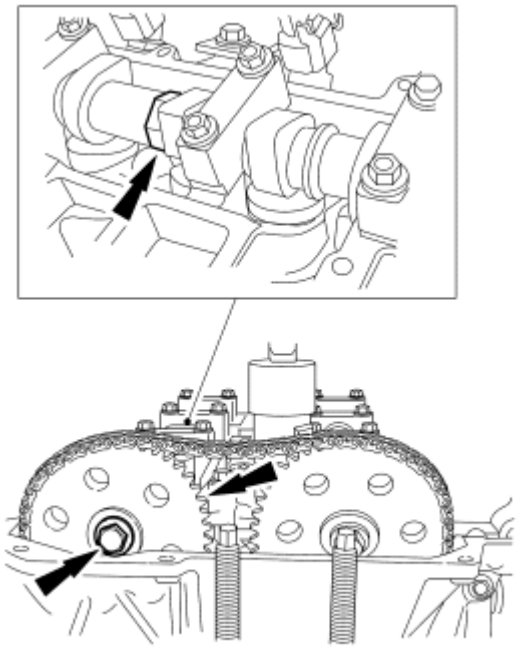


**Fig. 75: Locating Camshaft Bolt, Bolt And Exhaust Camshaft Drive Gear**
**Courtesy of FORD MOTOR CO.**

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

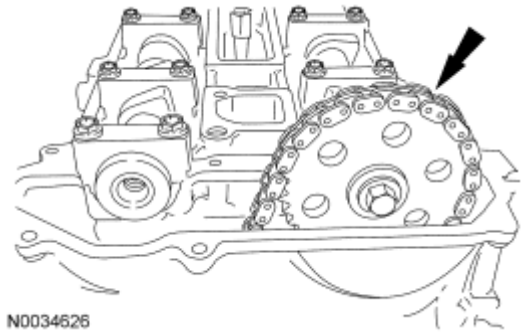


**Fig. 76: Locating Timing Chain**
**Courtesy of FORD MOTOR CO.**

17. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and intake camshaft drive gear.

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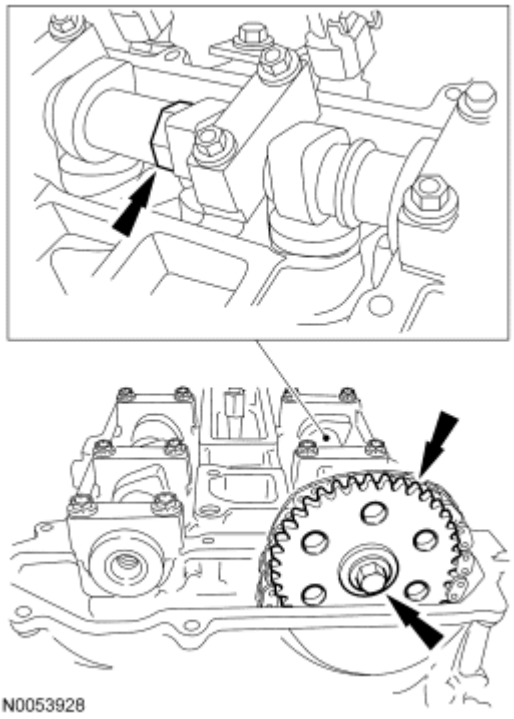


**Fig. 77: Locating Camshaft Bolt And Intake Camshaft Drive Gear**
**Courtesy of FORD MOTOR CO.**

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

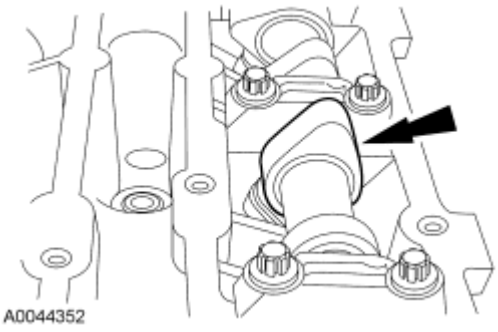


**Fig. 78: Locating Camshaft Lobe**
**Courtesy of FORD MOTOR CO.**

**CAUTION: 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.

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- Remove the bolts and the camshaft bearing caps.
- Remove the camshafts.

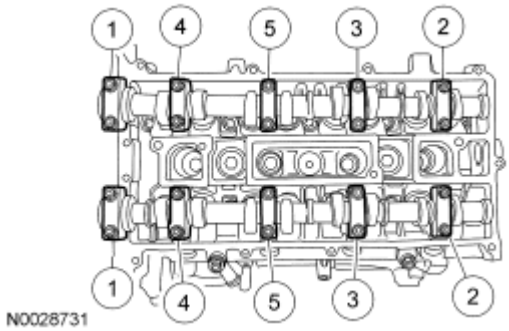


**Fig. 79: Identifying Loosening/Tightening Sequence Of Camshaft Bearing Bolts**
**Courtesy of FORD MOTOR CO.**

**INSTALLATION**

**CAUTION: 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.**

1. 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 (12 lb-ft).

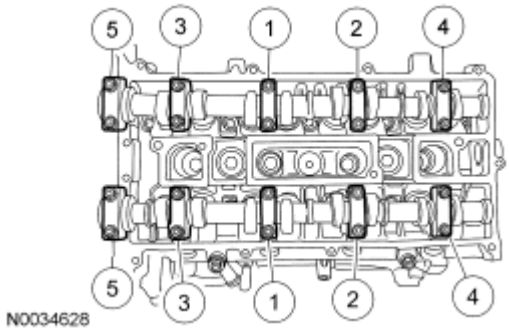


**Fig. 80: Identifying Camshaft Bearing Cap Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

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2. Install the special tool.

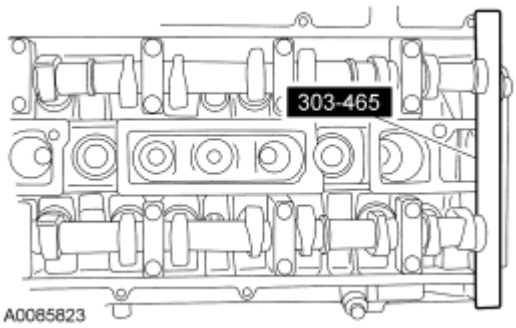


**Fig. 81: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

3. Install the intake camshaft drive gear and hand-tighten the bolt.

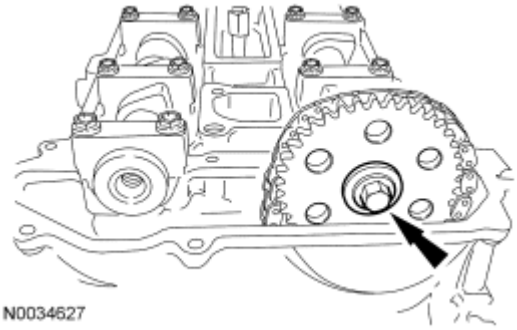


**Fig. 82: Locating Intake Camshaft Drive Gear Bolt**
**Courtesy of FORD MOTOR CO.**

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

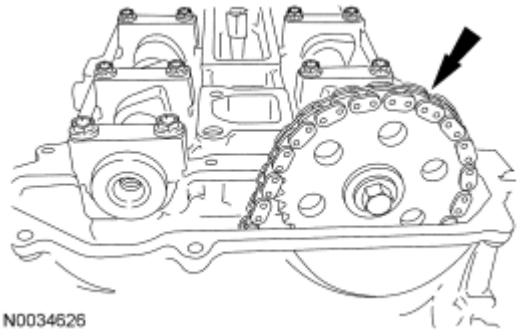


**Fig. 83: Locating Timing Chain**
**Courtesy of FORD MOTOR CO.**

**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**

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**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.

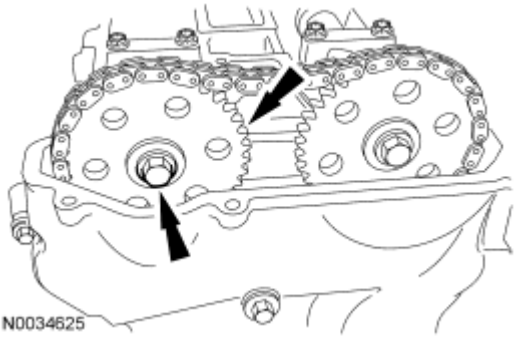


**Fig. 84: Locating Exhaust Camshaft Drive Gear Bolt**
**Courtesy of FORD MOTOR CO.**

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

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

**CAUTION: The special tool 303-465 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).

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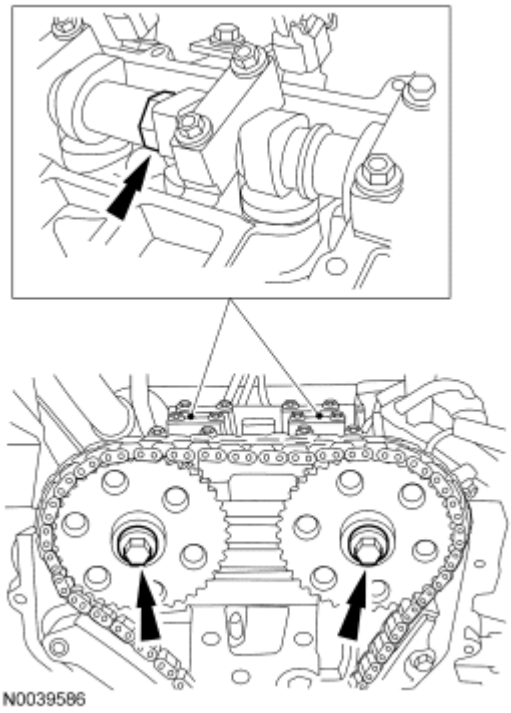


**Fig. 85: Locating Camshaft Bolts**
**Courtesy of FORD MOTOR CO.**

8. Remove the special tool.

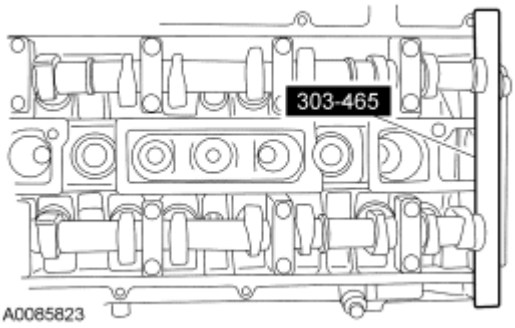


**Fig. 86: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

9. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

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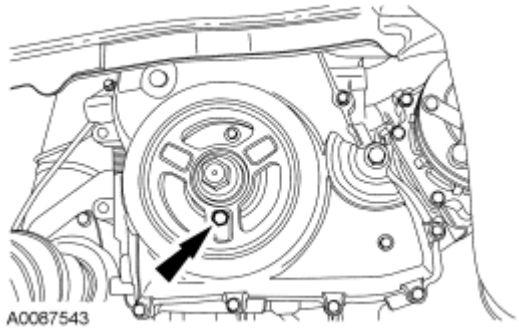


**Fig. 87: Aligning Crankshaft Pulley Bolt Holes**
**Courtesy of FORD MOTOR CO.**

10. Remove the special tool.

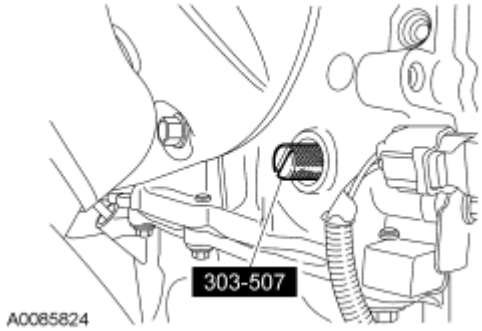


**Fig. 88: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

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

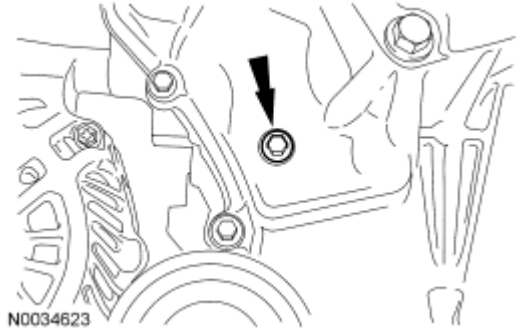


**Fig. 89: Locating Upper Front Cover Timing Hole Plug**
**Courtesy of FORD MOTOR CO.**

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 (9 lb-ft).

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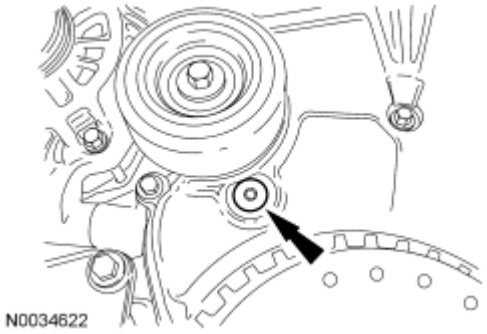


**Fig. 90: Locating Lower Front Cover Timing Hole Plug**
**Courtesy of FORD MOTOR CO.**

13. Install the engine plug bolt.
    - Tighten to 20 Nm (15 lb-ft).

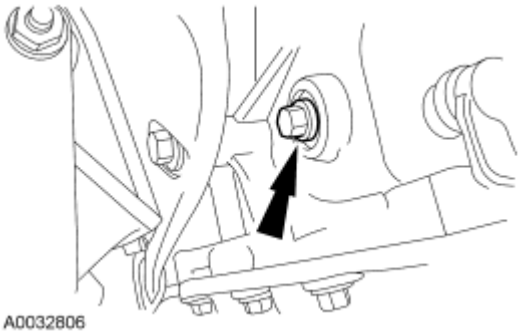


**Fig. 91: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

14. Install the accessory drivebelt. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
15. Install the front RH wheel and tire. For additional information, refer to **WHEELS AND TIRES** article.
16. Install the valve cover. For additional information, refer to **Valve Cover**.

## VALVE TRAIN COMPONENTS - EXPLODED VIEW

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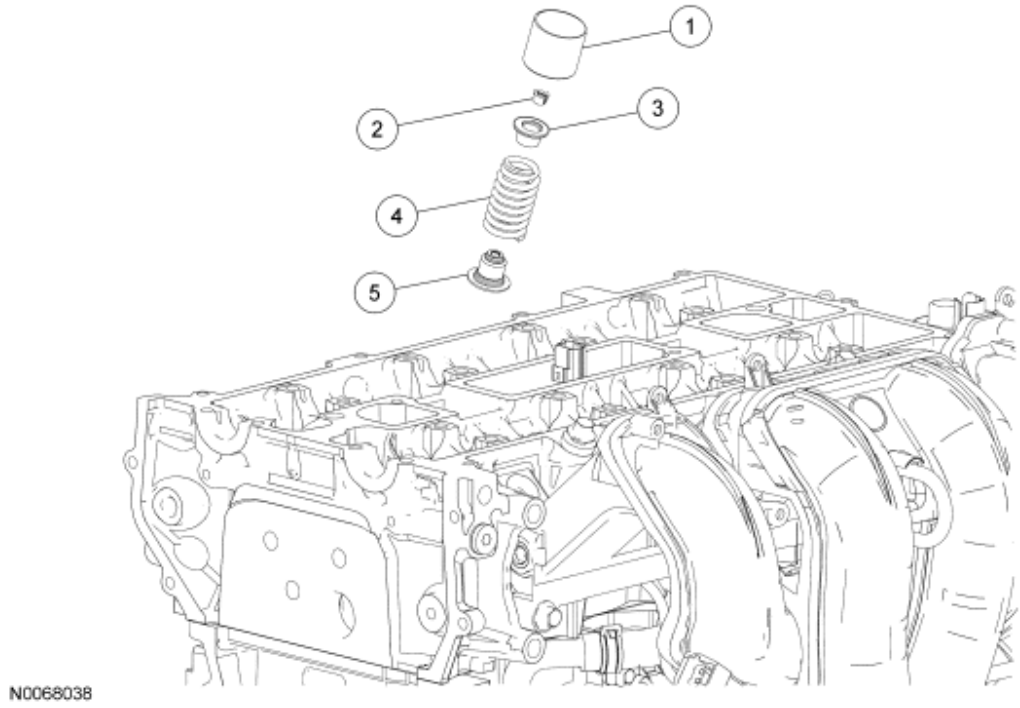


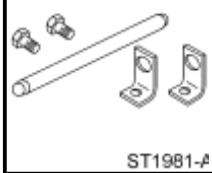

**Fig. 92: Valve Train Components - Exploded View**
**Courtesy of FORD MOTOR CO.**

| 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) |

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

**VALVE SPRINGS**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1981-A | Compressor, Valve Spring | 303-300 (T87C-6565-A) |
| | Compressor, Valve Spring | 303-350 (T89P-6565-A) |

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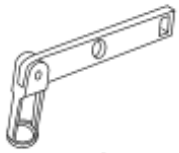
| | | |
|---|---|---|
|  ST1907-A | | |
|  ST1902-A | Compressor, Valve Spring | 303-472 (T94P-6565-AH) |

**Material**

| 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**

**CAUTION: 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 AND LIFTING** article.
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** article.
4. Remove the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.3L** article.

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**CAUTION: 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 special tools, 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.

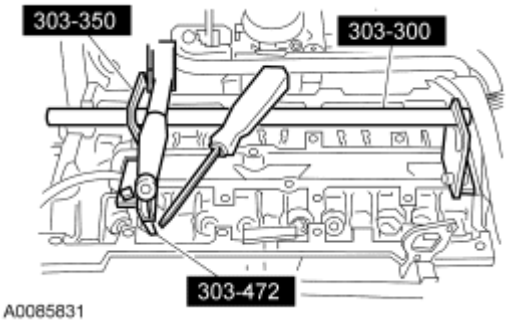


**Fig. 93: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

**INSTALLATION**

**NOTE: Check the seating of the valve collet.**

1. Using the special tools, 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.

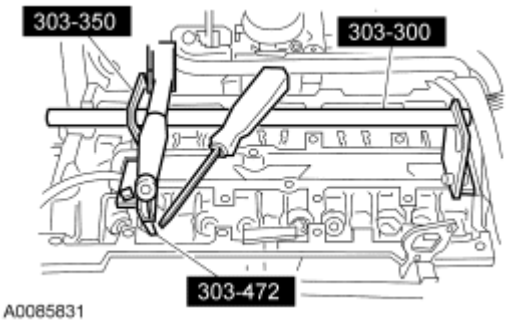


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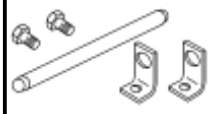
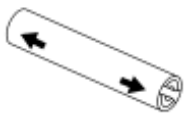
**Fig. 94: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

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 - 2.3L** article.
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 Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1981-A | Compressor, Valve Spring | 303-300 (T87C-6565-A) |
|  ST1907-A | Compressor, Valve Spring | 303-350 (T89P-6565-A) |
|  ST1902-A | Compressor, Valve Spring | 303-472 (T94P-6565-AH) |
|  ST1906-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) |

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| | | |
|---|---|---|
|  ST1187-A | | |

**Material**

| 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**

**CAUTION: 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 AND LIFTING** article.
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** article.
4. Remove the spark plugs. For additional information, refer to **ENGINE IGNITION - 2.3L** article.

**CAUTION: 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.**

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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 special tools, 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.

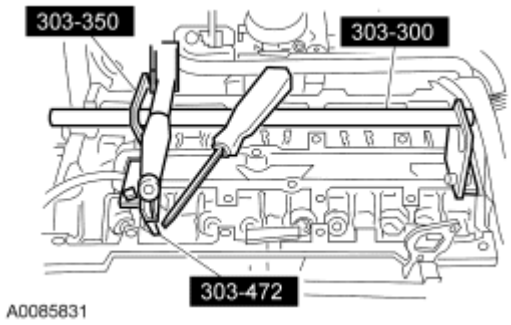


**Fig. 95: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

7. Using the special tools, remove and discard the valve seal.

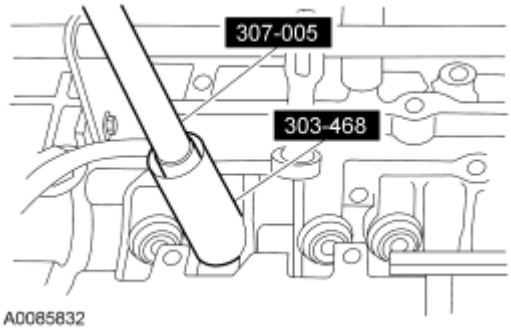


**Fig. 96: Removing Valve Seal Using Special Tools (307-005, 303-468)**
**Courtesy of FORD MOTOR CO.**

**INSTALLATION**

1. Install the valve stem seal installation sleeve.

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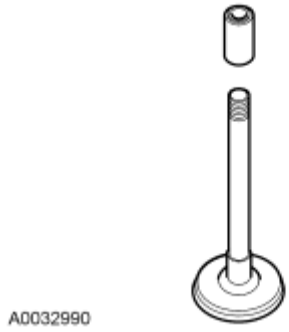


**Fig. 97: Identifying Valve Stem Seal Installation Sleeve**
**Courtesy of FORD MOTOR CO.**

2. Using the special tool, install the valve seal.

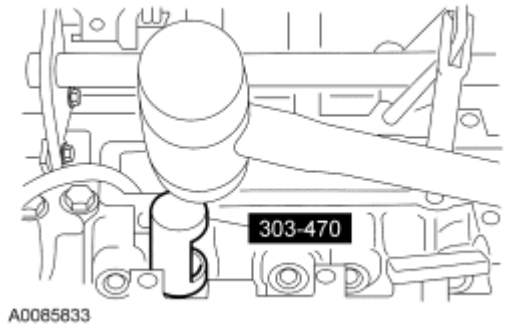


**Fig. 98: Installing Valve Seal Using Special Tool (303-470)**
**Courtesy of FORD MOTOR CO.**

**NOTE: Check the seating of the valve collet.**

3. Using the special tools, 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.

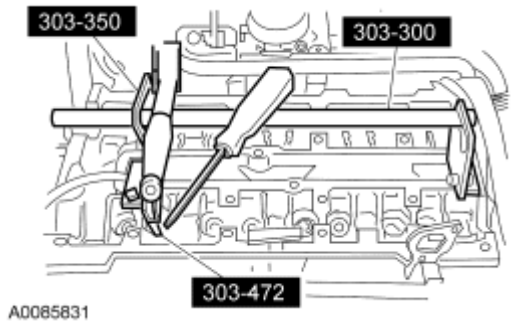


**Fig. 99: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

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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 - 2.3L** article.
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 |
|---|---|
| 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 AND LIFTING** article.
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** article.
4. To install, reverse the removal procedure.
   - Coat the valve tappets with clean engine oil prior to installation.

## CYLINDER HEAD

### Special Tools

| Illustration | Tool Name | Tool Number |
|---|---|---|


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| | | |
|---|---|---|
|  ST2645-A | Alignment Plate, Camshaft | 303-465 (T94P-6256-CH) |

**Material**

| Item | Specification |
|---|---|
| Motorcraft Metal Surface Prep ZC-31 | - |
| 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 | - |

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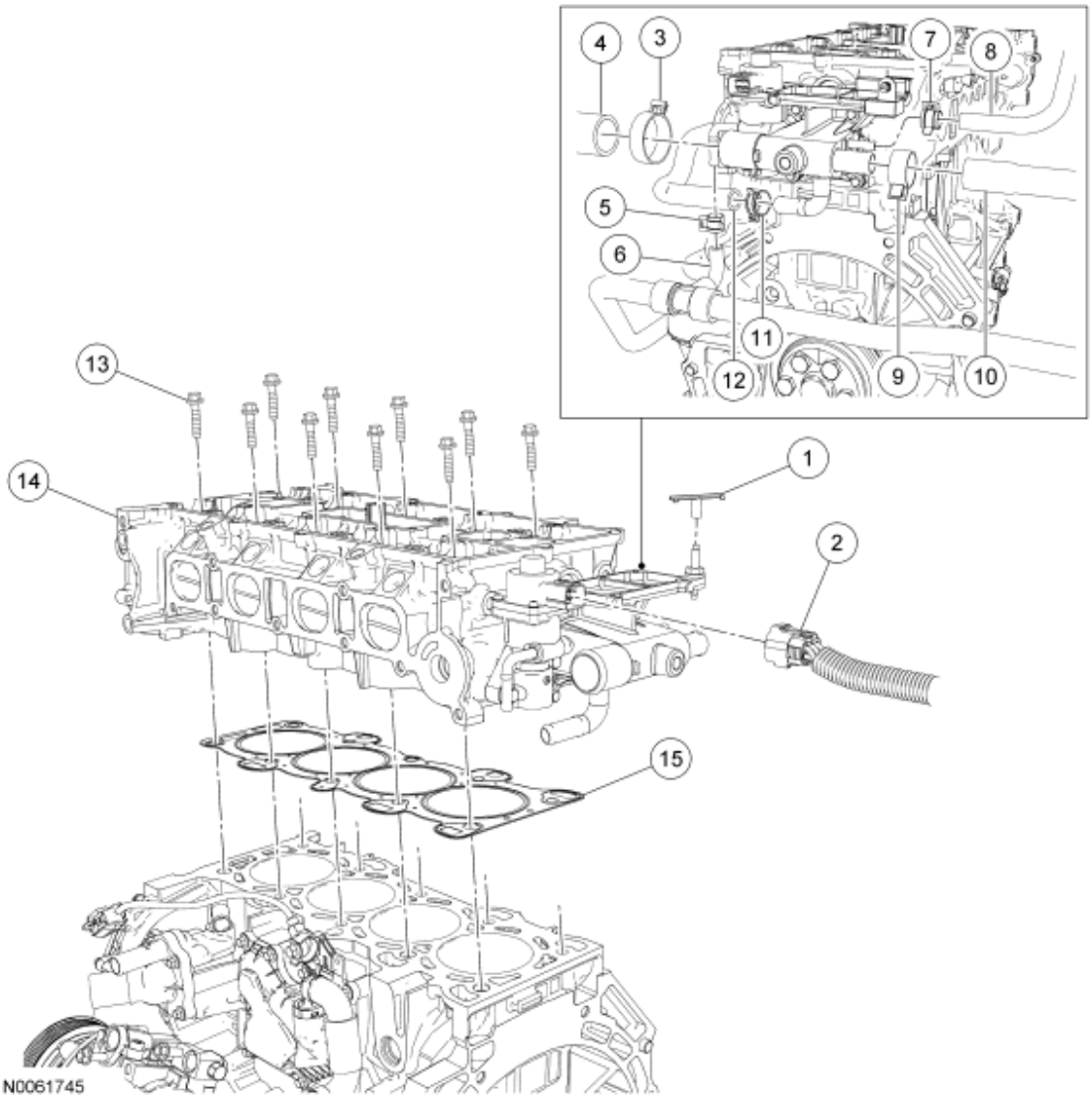


**Fig. 100: Cylinder Head Components**
**Courtesy of FORD MOTOR CO.**

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


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| | | |
|---|---|---|
| 9 | - | Heater hose clamp (part of 18K580) |
| 10 | 18K580 | Heater hose |
| 11 | W525958 | Bypass hose clamp |
| 12 | 8A582 | Bypass hose |
| 13 | 6065 | Cylinder head bolt (10 required) (F7AZ-19554-EA) |
| 14 | 6049 | Cylinder head |
| 15 | 6051 | Cylinder head gasket |

**REMOVAL**

**CAUTION: 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 you loosen the pulley bolt. 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.**

**CAUTION: 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 AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING** article.
4. Remove the timing drive components. For additional information, refer to **Timing Drive Components**.
5. Remove the special tool.

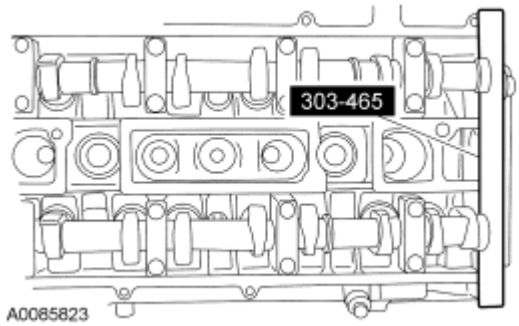


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**Fig. 101: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

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

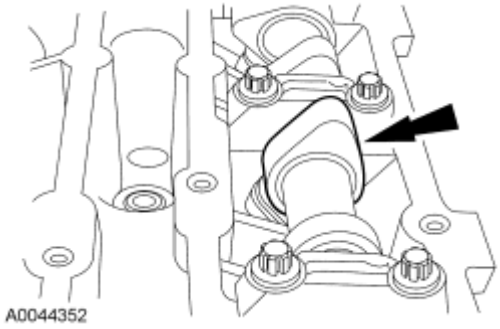


**Fig. 102: Locating Camshaft Lobe**
**Courtesy of FORD MOTOR CO.**

**CAUTION: 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.**

7. 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.

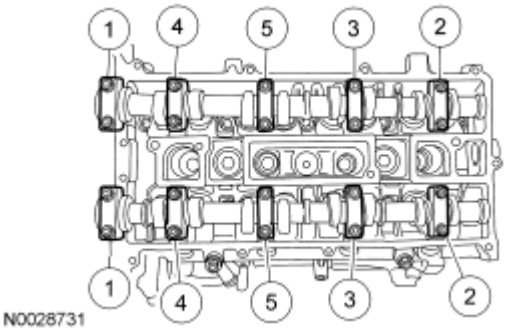


**Fig. 103: Identifying Loosening/Tightening Sequence Of Camshaft Bearing Bolts**
**Courtesy of FORD MOTOR CO.**

**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.**

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8. 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.**

9. Inspect the valve tappets. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
10. Remove the intake manifold. For additional information, refer to **Intake Manifold**.
11. Remove the generator. For additional information, refer to **GENERATOR AND REGULATOR** article.
12. Remove the catalytic converter exhaust manifold. For additional information, refer to **EXHAUST SYSTEM** article.
13. Disconnect the EGR valve electrical connector.
14. Disconnect the EGR coolant hose from the EGR valve.
15. Detach the wire harness retainer from the coolant outlet stud bolt.
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**

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

**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.
    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.

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2. Inspect the cylinder head for distortion. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
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.

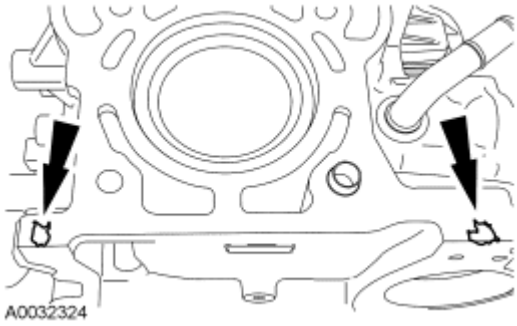


**Fig. 104: Identifying Silicone Gasket And Sealant Location**
**Courtesy of FORD MOTOR CO.**

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 (11 lb-ft).
   - Stage 3: Tighten to 45 Nm (33 lb-ft).
   - Stage 4: Turn 90 degrees.
   - Stage 5: Turn an additional 90 degrees.

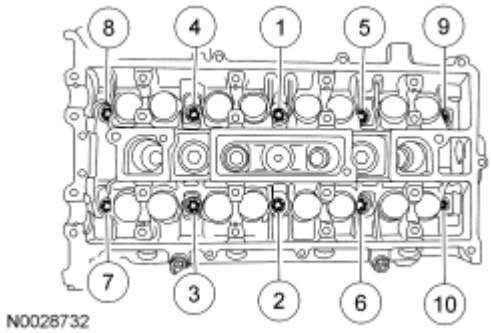


**Fig. 105: Identifying Tightening Sequence Of Cylinder Head Bolts**
**Courtesy of FORD MOTOR CO.**

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7. Connect the upper radiator hose, coolant bypass hose, heater hose and coolant vent hose to the engine coolant outlet.
8. Attach the wire harness retainer to the coolant outlet stud bolt.
9. Connect the EGR coolant hose to the EGR valve.
10. Connect the EGR valve electrical connector.
11. Install the exhaust manifold. For additional information, refer to **EXHAUST SYSTEM** article.
12. Install the generator. For additional information, refer to **GENERATOR AND REGULATOR** article.
13. Install the intake manifold. For additional information, refer to **Intake Manifold**.

**NOTE: Lubricate the valve tappets with clean engine oil.**

14. Install the valve tappets in their original positions.

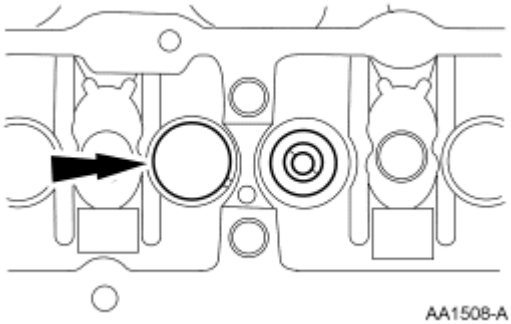


**Fig. 106: Locating Valve Tappet**
**Courtesy of FORD MOTOR CO.**

**CAUTION: 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.**

15. 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 (12 lb-ft).

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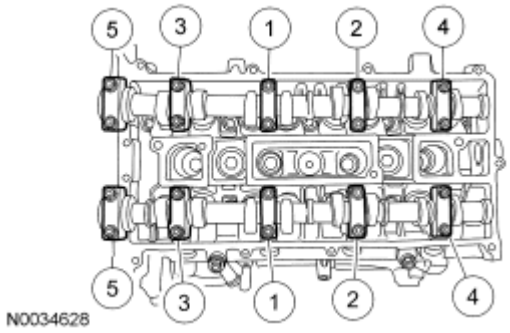


**Fig. 107: Identifying Camshaft Bearing Cap Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

16. Install the special tool.

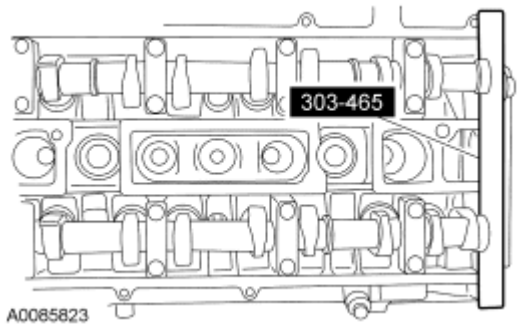


**Fig. 108: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

17. Install the timing drive components. For additional information, refer to **Timing Drive Components**.
18. Fill and bleed the engine cooling system. For additional information, refer to **ENGINE COOLING** article.

## ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

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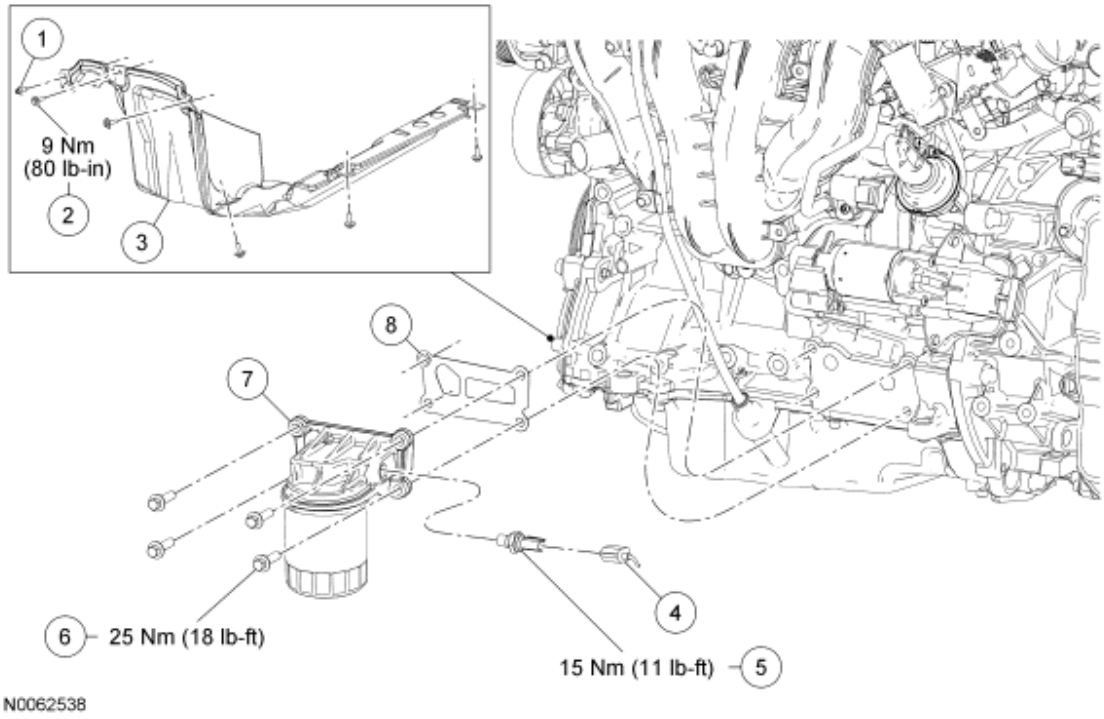


**Fig. 109: Oil Filter Adapter and Oil Pressure Sender With Torque Specifications**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | W706713 | RH splash shield pin-type retainer |
| 2 | W707257 | RH splash shield bolt (5 required) |
| 3 | 16A573 | RH splash shield |
| 4 | 14A464 | Engine oil pressure (EOP) switch electrical connector (part of 12B637) |
| 5 | 9278 | EOP switch |
| 6 | W500225 | Oil filter adapter bolt (4 required) |
| 7 | 6884 | Oil filter adapter |
| 8 | 6A636 | Oil filter adapter gasket |

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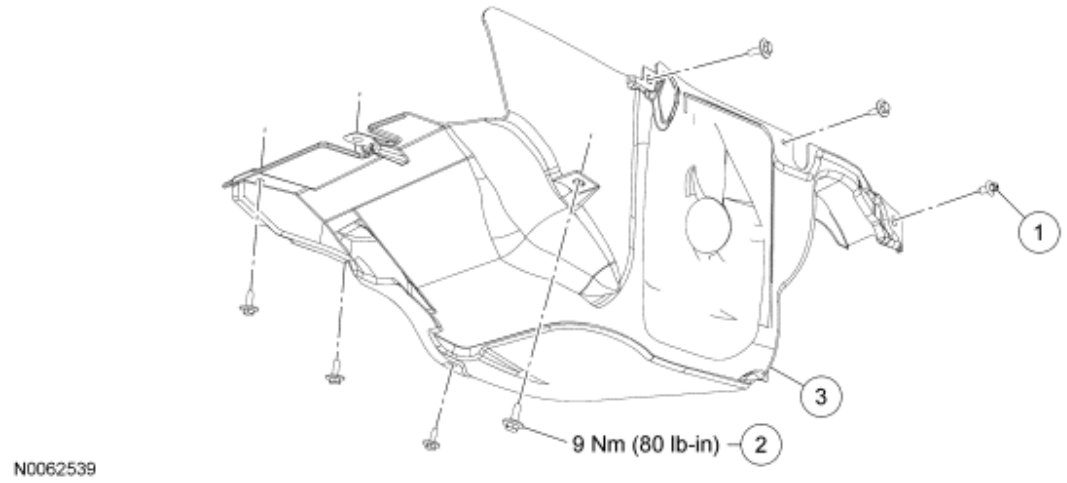


**Fig. 110: Oil Pan, Oil Pump Screen and Pickup Tube, All Vehicles With Torque Specification**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | W706713 | LH splash shield pin-type retainer |
| 2 | W707257 | LH splash shield bolt (6 required) |
| 3 | 16A574 | LH splash shield |

**NOTE: Automatic transmission shown, manual transmission similar.**

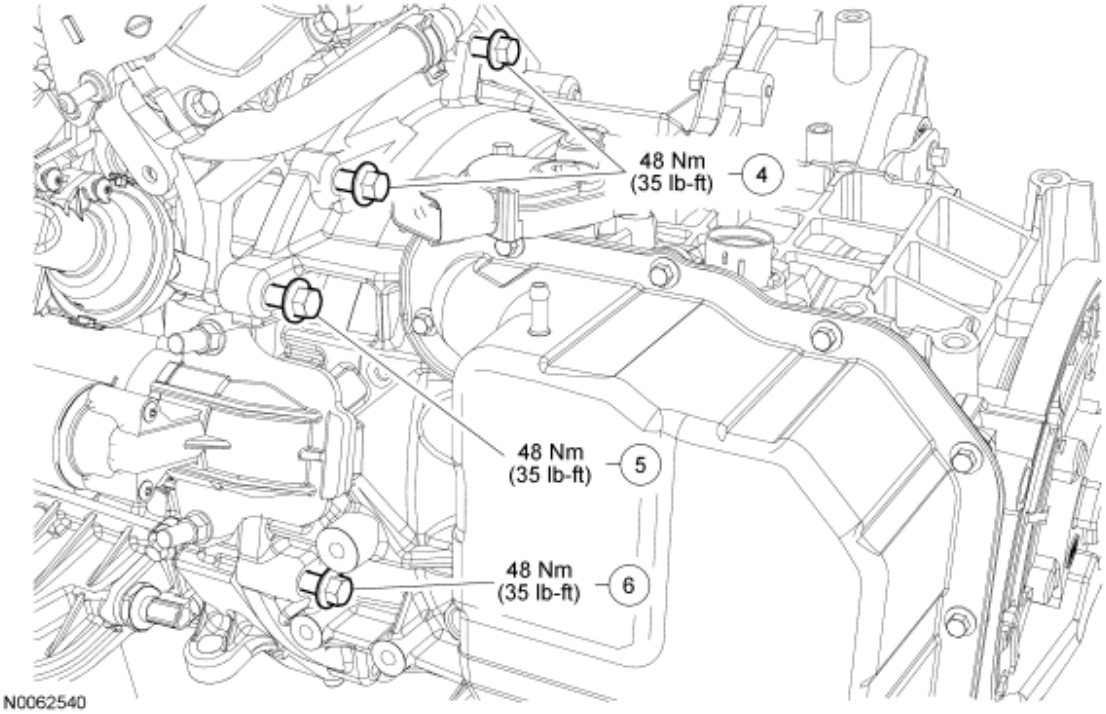


**Fig. 111: Oil Pan, Oil Pump Screen and Pickup Tube, Front Wheel Drive (FWD) Vehicles With Torque**

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**Specifications**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 4 | W500121 | Upper bellhousing-to-engine bolts |
| 5 | W500121 | Front lower bellhousing-to-engine bolt |
| 6 | W500125 | Front lower bellhousing-to-engine bolt |

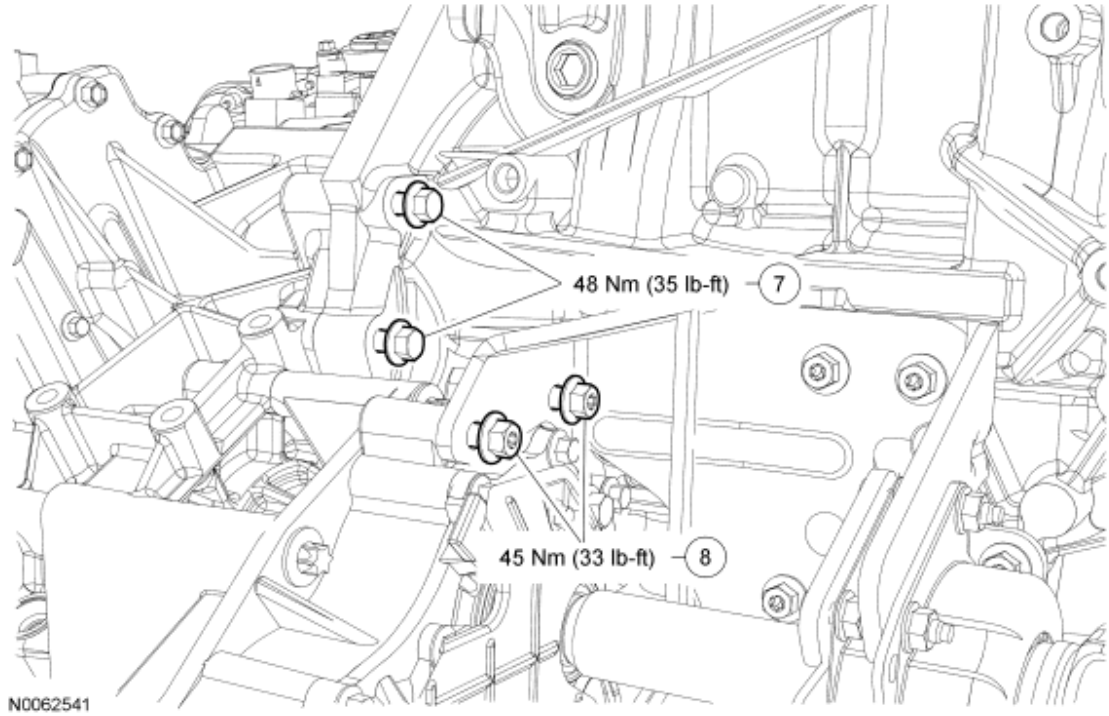


**Fig. 112: Oil Pan, Oil Pump Screen and Pickup Tube, All Wheel Drive (AWD) Vehicles With Torque Specifications**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 7 | W500125 | Rear lower engine-to-bellhousing bolts |
| 8 | W707386 | Upper engine bracket-to-power transfer unit (PTU) bolts |

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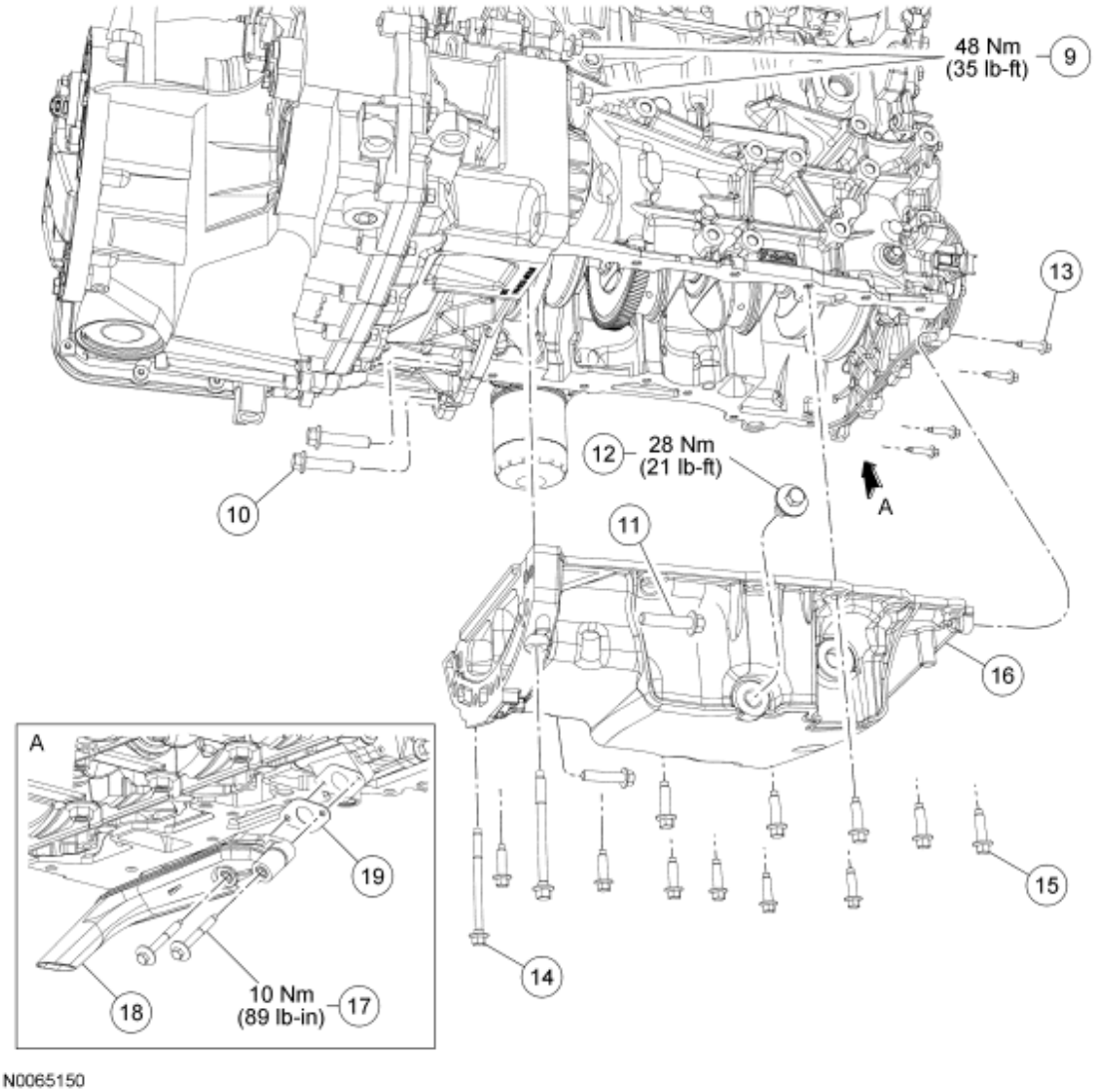


**Fig. 113: Oil Pan, Oil Pump Screen and Pickup Tube, Front Wheel Drive (FWD) Vehicles With Torque Specifications**

**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 9 | W500120 | Rear lower engine-to-bellhousing bolts |
| 10 | W500121 | Bellhousing-to-oil pan bolt (2 required) |
| 11 | W500121 | Oil pan-to-bellhousing bolt (2 required) |
| 12 | 6730 | Oil pan drain plug |
| 13 | W500215 | Engine front cover-to-oil pan bolt (4 required) |
| 14 | W706284 | Oil pan bolt (2 required) |
| 15 | W500224 | Oil pan bolt (11 required) |
| 16 | 6675 | Oil pan |
| | | |

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| | | |
|---|---|---|
| 17 | W706282 | Oil pump screen and pickup tube bolt (2 required) |
| 18 | 6622 | Oil pump screen and pickup tube |
| 19 | 6625 | Oil pump screen and pickup tube gasket |

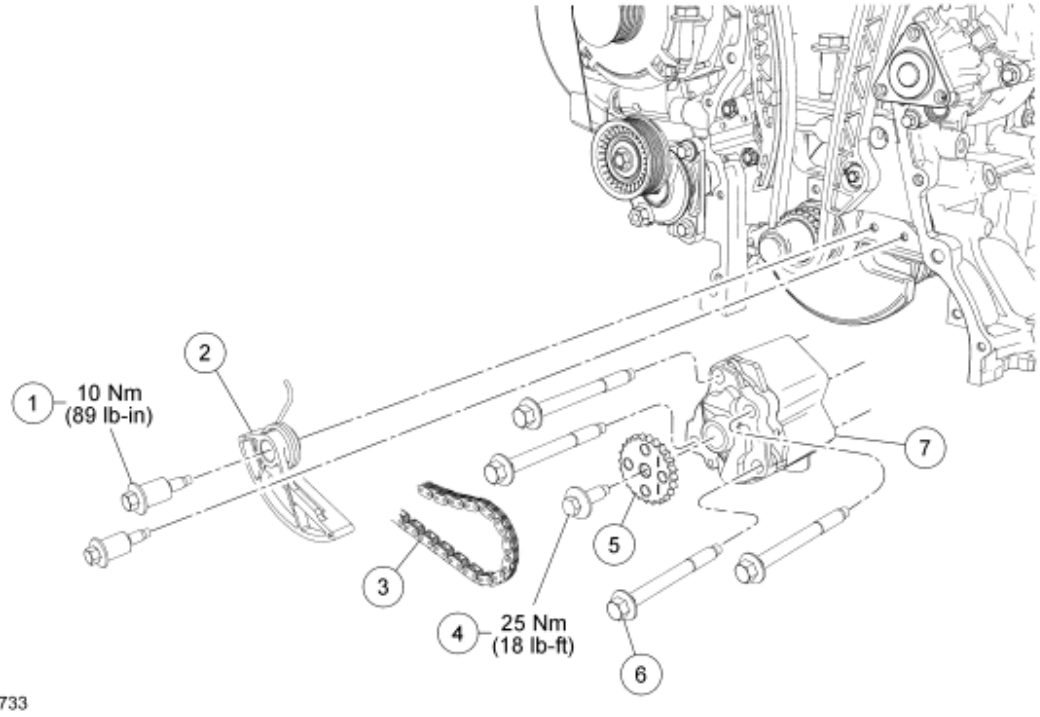


**Fig. 114: Oil Pump Components With Torque Specifications**
**Courtesy of FORD MOTOR CO.**

| 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 |

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

## OIL FILTER ADAPTER

### REMOVAL AND INSTALLATION

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

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**AND LIFTING** article.

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. 115: Right Splash Shield Bolts**
**Courtesy of FORD MOTOR CO.**

3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. Remove the spin on oil filter.
   - To install, tighten the spin on oil filter 3/4 turn after the oil filter gasket makes contact with the oil filter adapter.

**NOTE: Discard the gasket.**

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

## ENGINE OIL PRESSURE (EOP) SWITCH

**Material**

| Item | Specification |
|---|---|
| Thread Sealant with PTFE<br>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 AND LIFTING** article.
2. Remove the pin-type retainer, 5 bolts and the RH splash shield.
   - To install, tighten to 9 Nm (80 lb-in).
3. Disconnect the engine oil pressure (EOP) switch electrical connector.
4. Remove the EOP switch.
   - To install, tighten to 15 Nm (11 lb-ft).

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5. To install, reverse the removal procedure.
    - Apply thread sealant to the EOP switch threads.

**OIL PAN**

**Material**

| Item | Specification |
|---|---|
| Motorcraft Metal Surface Cleaner ZC-21 | WSE-M5B392-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 AND LIFTING** article.
2. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.

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

3. Loosen the 2 top 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 rear lower engine-to-bellhousing bolts 5 mm (0.19 in).
5. Working from under the vehicle, loosen the 2 upper engine bracket-to-power transfer unit (PTU) bolts 5 mm (0.19 in).

**All vehicles**

6. Remove the pin-type retainer, 6 bolts and the LH splash shield.
7. Remove the oil level indicator and tube. For additional information, refer to **Oil Level Indicator and Tube**.
8. Loosen the 2 front lower bellhousing-to-engine bolts 5 mm (0.19 in).

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**Front wheel drive (FWD) vehicles**

9. Loosen the 1 (manual transaxle) and 2 (automatic transaxle) rear lower engine-to-bellhousing bolt 5 mm (0.19 in).

**All vehicles**

10. Remove the 2 oil pan-to-bellhousing bolts.
11. Remove the 2 bellhousing-to-oil pan bolt.
12. Slide the transaxle rearward 5 mm (0.19 in).
13. Drain the engine oil.
    - Install the drain plug.
    - Tighten to 28 Nm (21 lb-ft).
14. Remove the 4 engine front cover-to-oil pan bolts.
15. Remove the 13 bolts and the oil pan.

**INSTALLATION**

**All vehicles**

**CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove 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 cleaner. 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.**

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.

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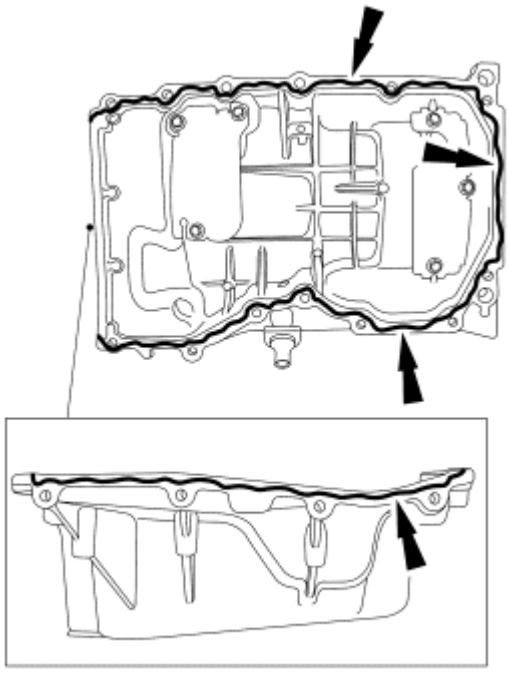


**Fig. 116: Applying Bead Of Silicone Gasket And Sealant**
**Courtesy of FORD MOTOR CO.**

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).

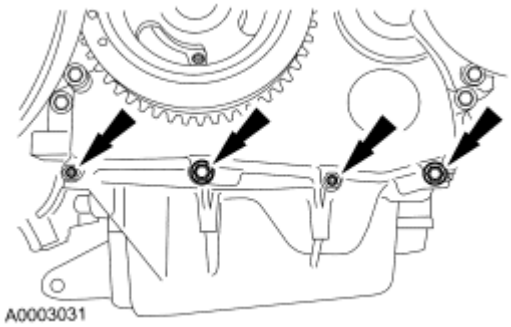


**Fig. 117: Locating Engine Front Cover-To-Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

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

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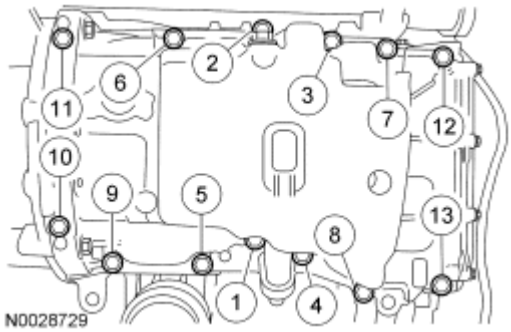


**Fig. 118: Identifying Tightening Sequence Of Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

**FWD vehicles**

6. Alternate tightening the 1 front and 1 rear lower bolts to slide the transaxle and engine together.
   - Tighten to 48 Nm (35 lb-ft).
7. Tighten the remaining front lower bolt and rear lower bolt (automatic transaxle).
   - Tighten to 48 Nm (35 lb-ft).

**AWD vehicles**

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

**All vehicles**

11. Install the 2 bellhousing-to-oil pan bolts.
    - Tighten to 48 Nm (35 lb-ft).
12. Install the 2 oil pan-to-bellhousing bolts.
    - Tighten to 48 Nm (35 lb-ft).
13. Install the oil level indicator and tube. For additional information, refer to **Oil Level Indicator and Tube**.
14. Install the LH splash shield and the pin-type retainers and 6 bolts.
    - Tighten to 9 Nm (80 lb-in).

**AWD vehicles**

15. Working from the top of vehicle, tighten the 2 rear lower engine-to-bellhousing bolts.

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- Tighten to 48 Nm (35 lb-ft).

**All vehicles**

16. Tighten the 2 top bellhousing-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).
17. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.
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 AND LIFTING** article.
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 |
|---|---|
| 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 AND LIFTING** article.
2. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.

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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.
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.

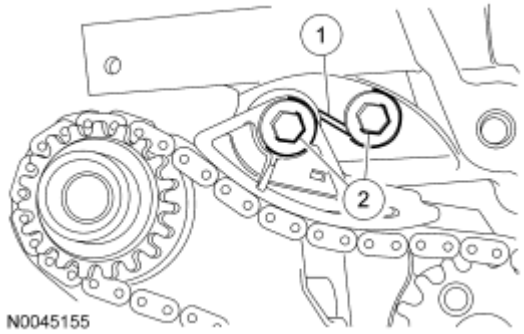


**Fig. 119: Locating Shoulder Bolts & Tensioner**
**Courtesy of FORD MOTOR CO.**

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).

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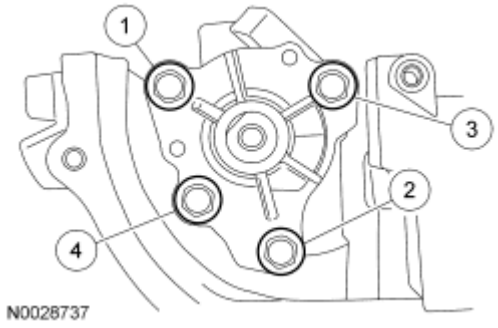


**Fig. 120: Identifying Tightening Sequence Of Oil Pump Assembly Bolts**
**Courtesy of FORD MOTOR CO.**

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).

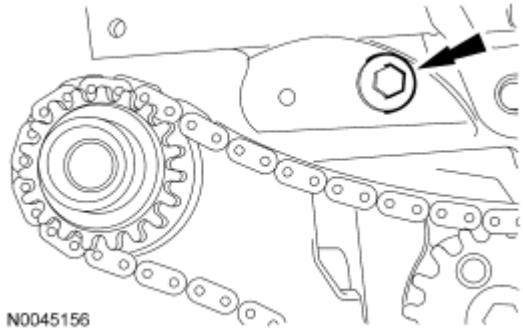


**Fig. 121: Locating Oil Pump Chain Drive Tensioner Shoulder Bolt**
**Courtesy of FORD MOTOR CO.**

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).

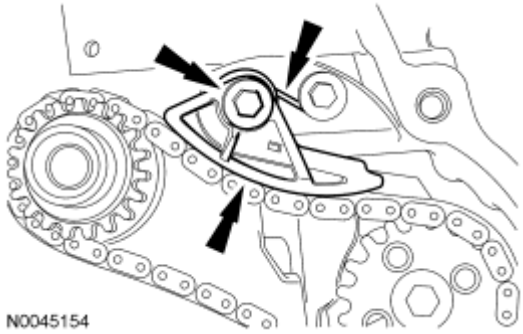


**Fig. 122: Locating Oil Pump Chain Tensioner And Bolt**
**Courtesy of FORD MOTOR CO.**

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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 to 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.

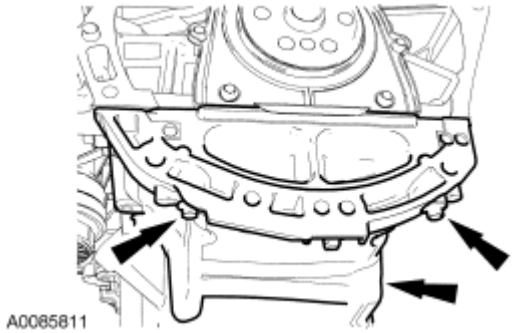


**Fig. 123: Identifying Rear Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

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

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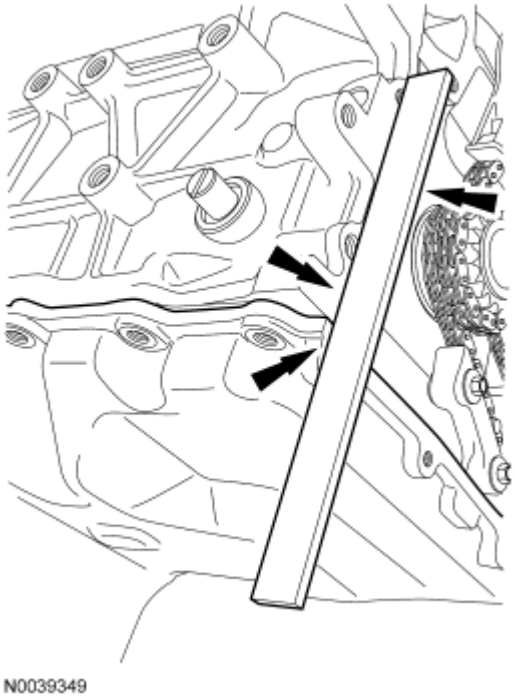


**Fig. 124: Aligning Front Surface Of The Oil Pan**
**Courtesy of FORD MOTOR CO.**

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

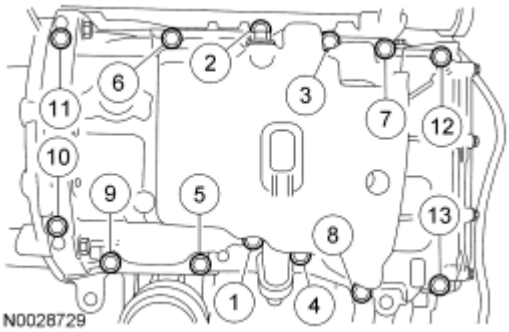


**Fig. 125: Identifying Tightening Sequence Of Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

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.

**OIL LEVEL INDICATOR AND TUBE**

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**Material**

| Item | Specification |
|---|---|
| Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent | WSS-M2C930-A |

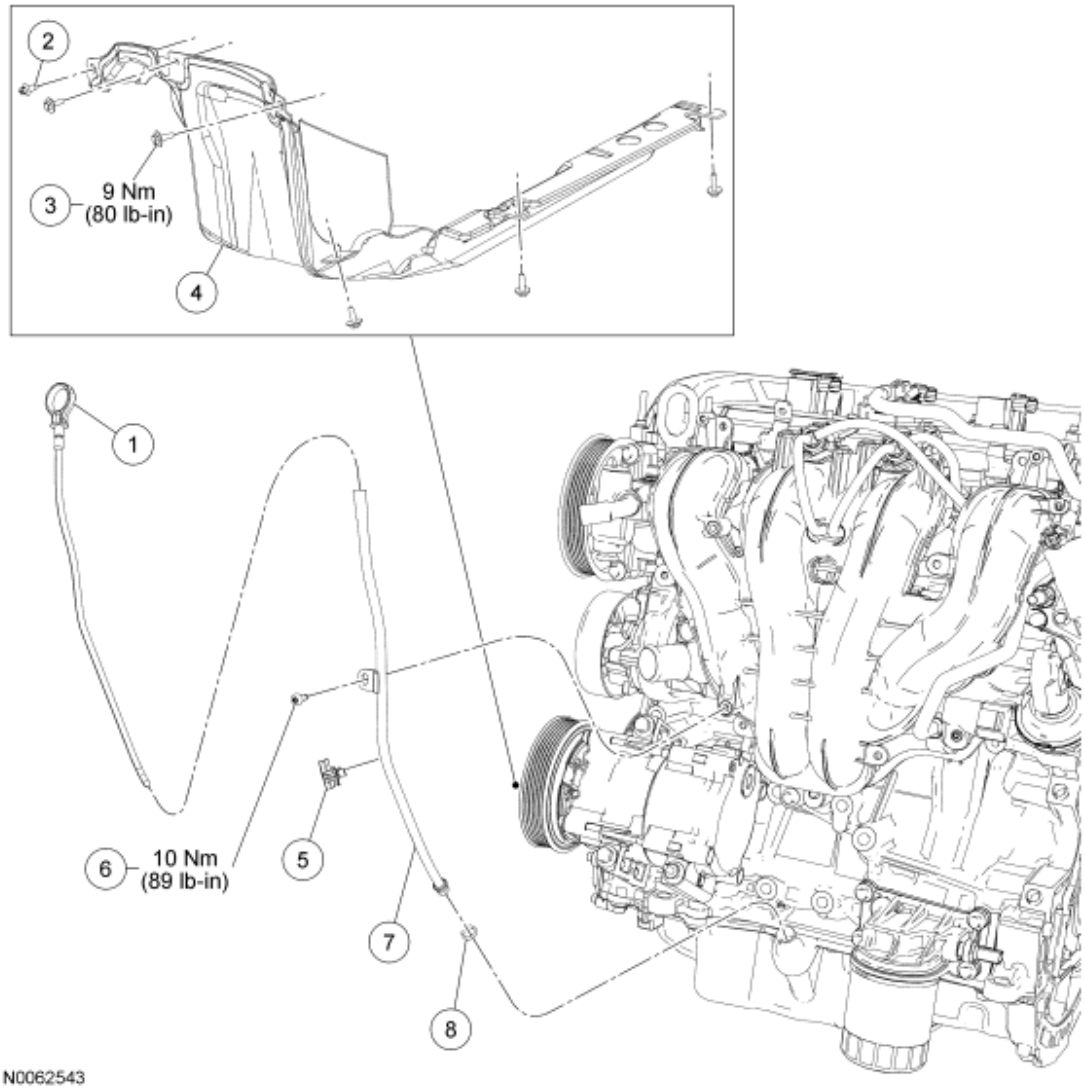


**Fig. 126: Oil Level Indicator and Tube Components With Torque Specifications**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6750 | Oil level indicator |
| 2 | W706713 | RH splash shield pin-type retainer |
| 3 | W707257 | RH splash shield bolt (5 required) |

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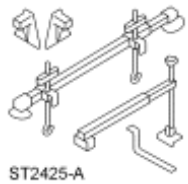
| | | |
|---|---|---|
| 4 | 16A573 | RH splash shield |
| 5 | 14A163 | Wire harness retainer (part of 14290) |
| 6 | W505581 | Oil level indicator tube bolt |
| 7 | 6754 | Oil level indicator tube |
| 8 | 6754-B | Oil level indicator tube O-ring seal |

**REMOVAL AND INSTALLATION**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the oil level indictor.
3. Remove the pin-type retainer, the 5 bolts and the RH splash shield.
   - To install, tighten to 9 Nm (80 lb-in).
4. Detach the wire harness retainer from the oil indicator tube.
5. Remove the bolt and the oil level indicator tube.
   - To install, tighten to 10 Nm (89 lb-in).
6. Remove and discard the oil level indicator tube O-ring seal.
7. To install, reverse the removal procedure.
   - Lubricate a new O-ring seal with clean engine oil.

**ENGINE MOUNT**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST2425-A | Support Bar, Engine | 303-F072 |

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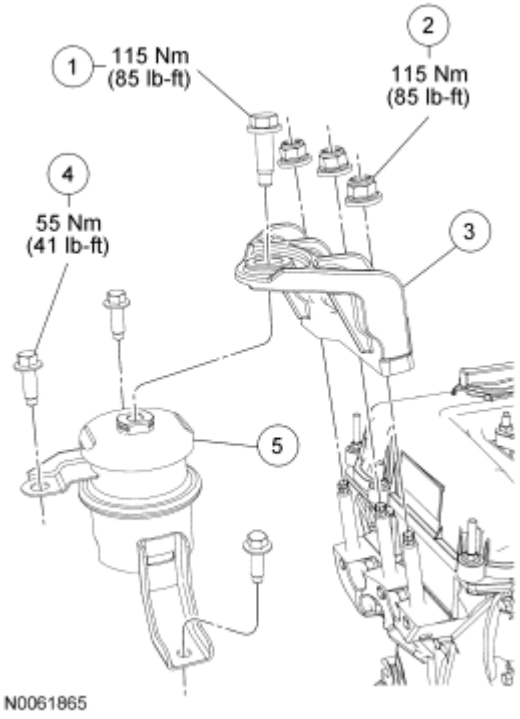


**Fig. 127: Engine Mount Components With Torque Specifications**
**Courtesy of FORD MOTOR CO.**

| 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 AND LIFTING** article.
2. Install the Engine Support Bar.

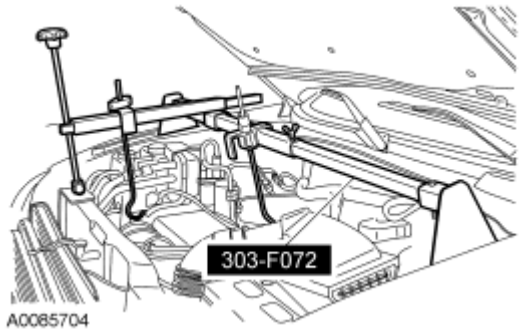


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**Fig. 128: Supporting Engine With Special Tool**
**Courtesy of FORD MOTOR CO.**

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).

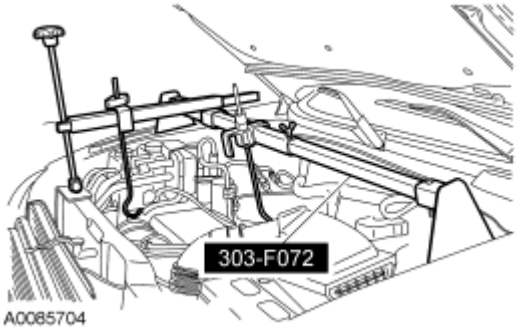


**Fig. 129: Supporting Engine With Special Tool**
**Courtesy of FORD MOTOR CO.**

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

### ENGINE - AUTOMATIC TRANSAXLE

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1582-A | Front Drive Halfshaft Remover | 205-241 (T86P-3514-A) |
|  ST1341-A | Heavy Duty Floor Crane | 014-00071 or equivalent |
| | | |

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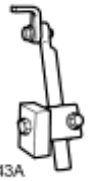
| | | |
|---|---|---|
|  ST1293-A | Powertrain Lift | 014-00765 |
|  ST1185-A | Slide Hammer | 100-001 (T50T-100-A) |
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST1408-A | Tie-Rod End Remover | 211-105 (T85M-3395-A) |
|  ST2743A | Universal Adapter Brackets | 014-0001 |

**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 AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.
4. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
5. Drain the engine oil.

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- Install the drain plug.
- Tighten to 28 Nm (21 lb-ft).

6. Remove the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
8. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
9. Disconnect the heated oxygen sensor (HO2S) and the catalyst monitor sensor electrical connectors.

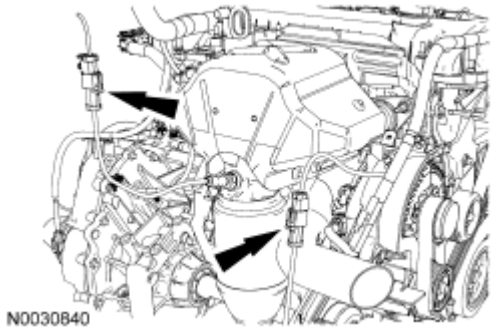


**Fig. 130: Heated Oxygen Sensor (HO2S) And Catalyst Monitor Sensor Electrical Connectors**
**Courtesy of FORD MOTOR CO.**

10. Remove the accessory drive belt and tensioner. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
11. Press the 2 locking tabs (1 shown) to release the lower air duct from the upper air duct.

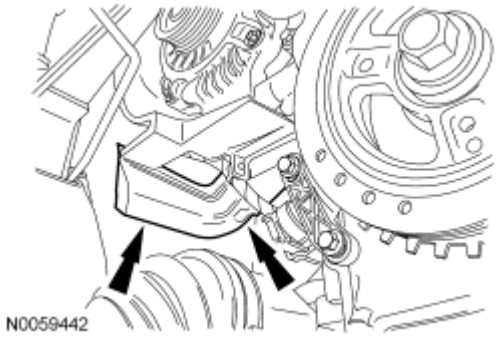


**Fig. 131: Identifying Locking Tab**
**Courtesy of FORD MOTOR CO.**

12. Detach the wire retainers from the generator shield and remove the nut and pin-type retainer.
    - Remove the generator shield.

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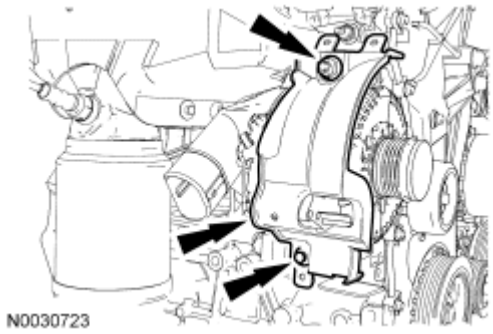


**Fig. 132: Generator Shield**
**Courtesy of FORD MOTOR CO.**

13. Remove the bolts and the lateral support crossmember.

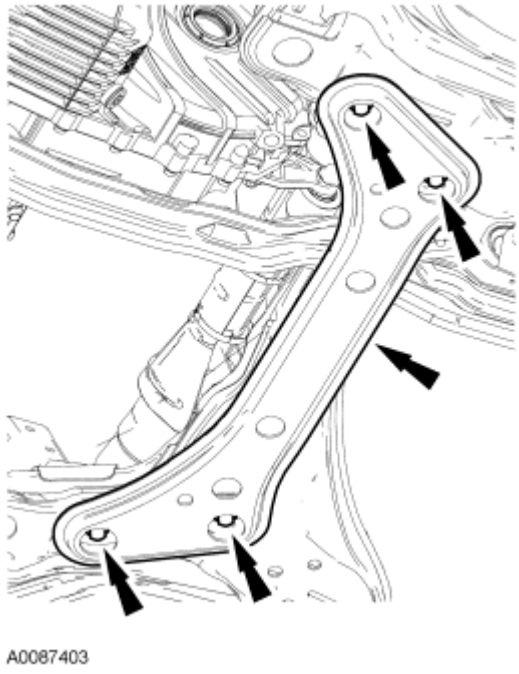


**Fig. 133: Identifying Lateral Support Crossmember And Bolts**
**Courtesy of FORD MOTOR CO.**

14. Remove the brake hose retainer and the ABS sensor retaining bolt from the LH strut.

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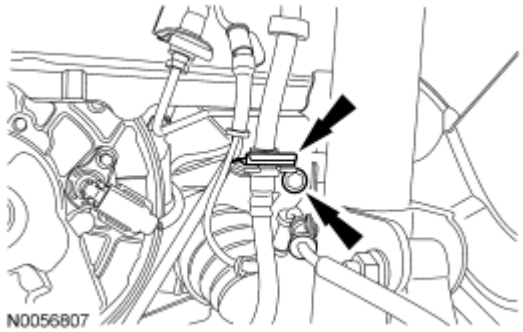


**Fig. 134: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

15. Disconnect the LH suspension.
    1. Disconnect the stabilizer bar link.
    2. Remove the tie rod end retaining nut.
    3. Remove the lower control arm knuckle bolt.

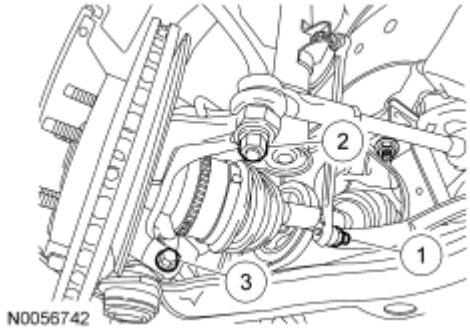


**Fig. 135: Identifying Stabilizer Bar Link, Retaining Nut, And Knuckle Bolt**
**Courtesy of FORD MOTOR CO.**

16. Remove the brake hose retainer and the ABS sensor retaining bolt from the RH strut.

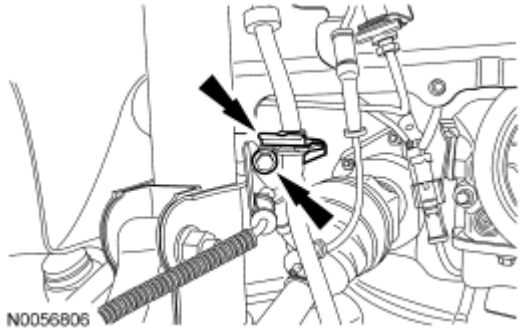


**Fig. 136: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

17. Disconnect the RH suspension.

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1. Disconnect the stabilizer bar link.
2. Remove the tie rod end retaining nut.
3. Remove the lower control arm knuckle bolt.

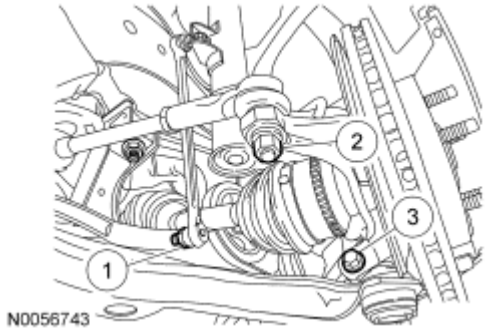


**Fig. 137: Identifying Stabilizer Bar Link, Retaining Nut, And Knuckle Bolt**
**Courtesy of FORD MOTOR CO.**

18. Using the special tool, disconnect the LH and RH tie rod end from the steering knuckle.

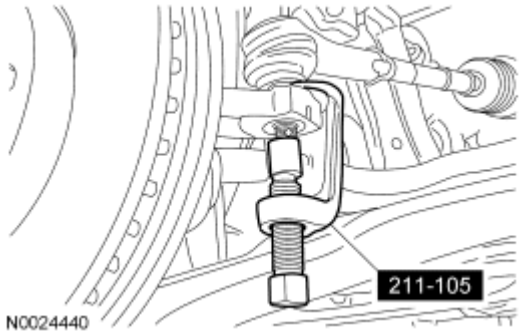


**Fig. 138: Disconnecting LH And RH Tie Rod End From Steering Knuckle**
**Courtesy of FORD MOTOR CO.**

19. Separate the LH and RH lower control arms from the lower ball joints and position the steering knuckles aside.
20. Using a suitable tool, separate the LH halfshaft from the transaxle and secure the halfshaft aside.
21. Using the special tools, remove the RH halfshaft from the intermediate shaft and secure the halfshaft aside.

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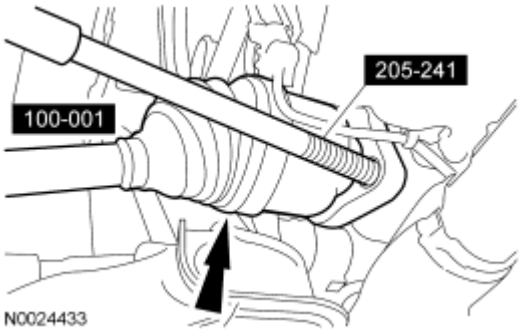


**Fig. 139: Removing RH Outer Halfshaft Using Special Tools**
**Courtesy of FORD MOTOR CO.**

22. Remove the 2 intermediate shaft retaining nuts.

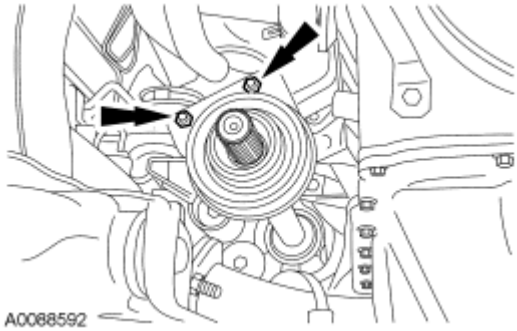


**Fig. 140: Locating Intermediate Shaft Retaining Nuts**
**Courtesy of FORD MOTOR CO.**

23. Remove the intermediate shaft.

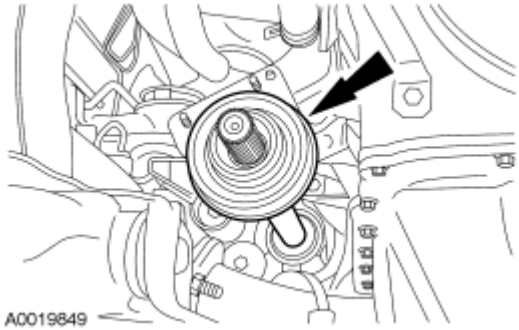


**Fig. 141: Locating Intermediate Shaft**
**Courtesy of FORD MOTOR CO.**

**All wheel drive (AWD) vehicles**

**NOTE: Index-mark the driveshaft to the yoke for installation.**

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24. Remove the 6 bolts holding the driveshaft to the PTU and position aside with mechanic's wire.

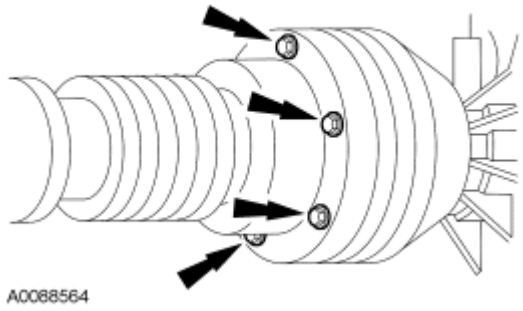


**Fig. 142: Locating Driveshaft & Bolts**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

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

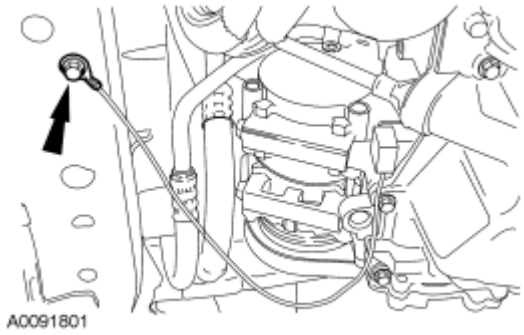


**Fig. 143: Ground Eyelet & Bolt**
**Courtesy of FORD MOTOR CO.**

26. Remove the power distribution box (PDB) cover.

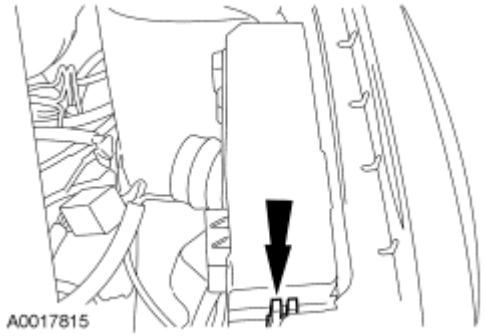


**Fig. 144: Locating Power Distribution Box Cover**
**Courtesy of FORD MOTOR CO.**

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

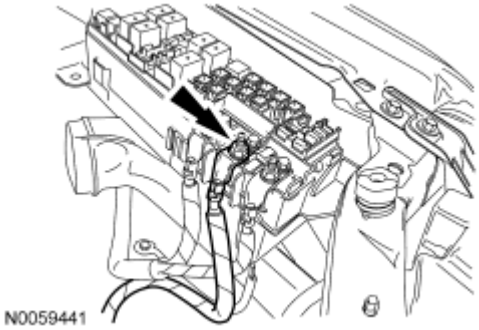


**Fig. 145: Identifying Nut**
**Courtesy of FORD MOTOR CO.**

28. Disconnect the electrical connector from the PDB.

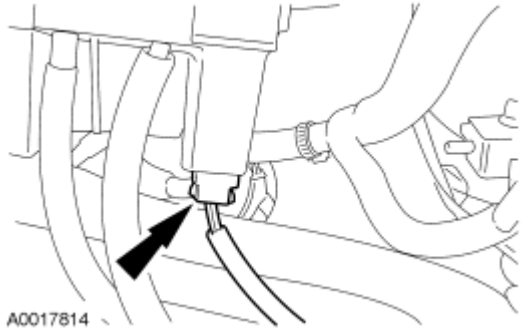


**Fig. 146: Power Distribution Box Electrical Connector**
**Courtesy of FORD MOTOR CO.**

29. Remove the bolt and the ground strap.

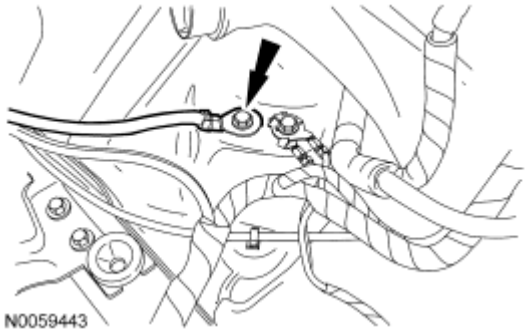


**Fig. 147: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

30. Disconnect the 34-pin electrical connector.

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**Fig. 148: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

31. Detach the wiring harness retainers from the battery tray bracket.

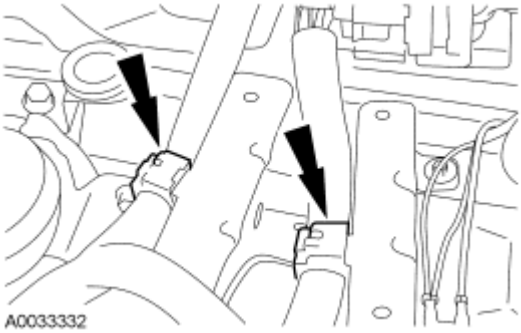


**Fig. 149: Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

32. Detach the transaxle vent tube retaining clip from the engine wiring harness.

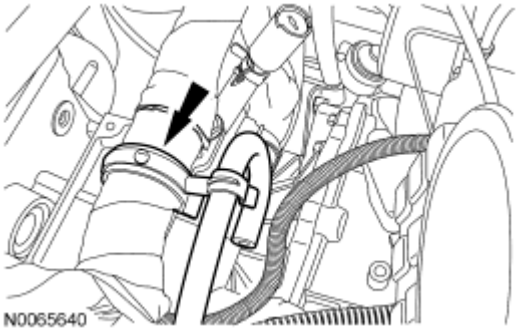


**Fig. 150: Identifying Retaining Clip**
**Courtesy of FORD MOTOR CO.**

33. Remove the nut holding the wiring harness bracket and unplug the transaxle electrical connector.

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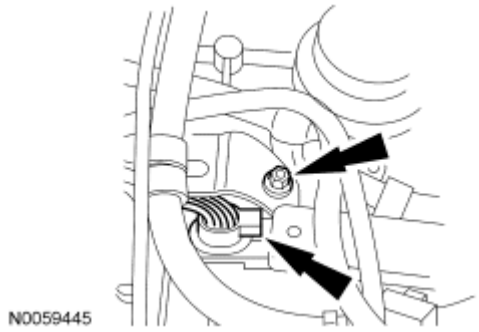


**Fig. 151: Identifying Nut And Connector**
**Courtesy of FORD MOTOR CO.**

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

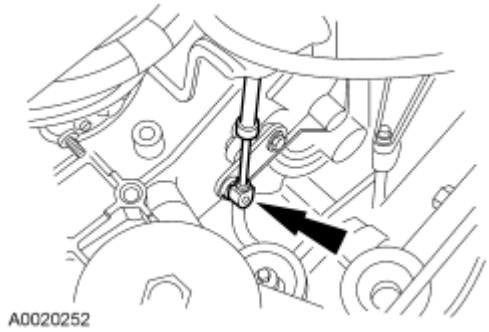


**Fig. 152: Locating Shift Cable End At Manual Lever**
**Courtesy of FORD MOTOR CO.**

35. Detach the wiring harness pin-type retainer and remove the 2 bolts.
    - Position the transaxle cable and bracket aside.

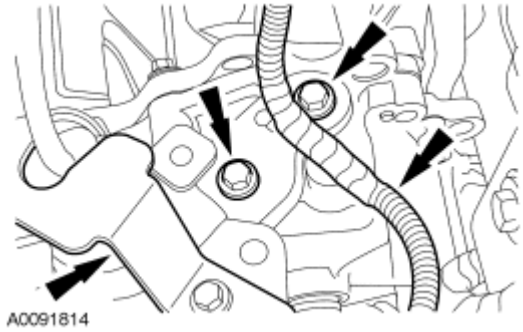


**Fig. 153: Transaxle Control Cable & Bracket**
**Courtesy of FORD MOTOR CO.**

36. Disconnect the transaxle range sensor electrical connector.

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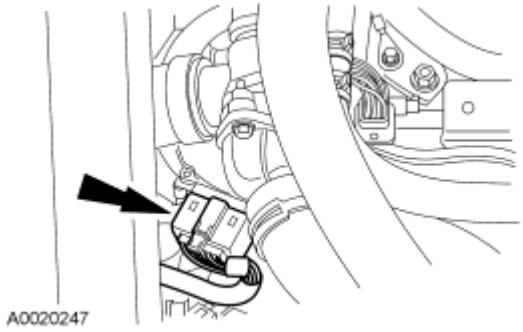


**Fig. 154: Locating Transmission Range (TR) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

37. Disconnect the front transaxle fluid cooler tube.

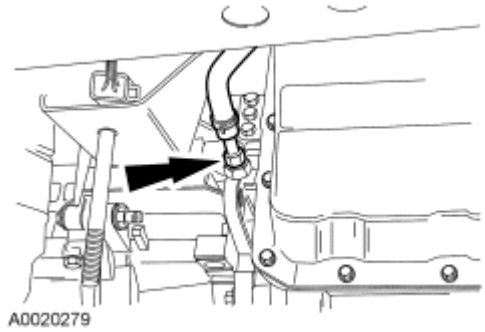


**Fig. 155: Locating Transmission Fluid Cooler Tube**
**Courtesy of FORD MOTOR CO.**

38. Disconnect the rear transaxle fluid cooler tube.

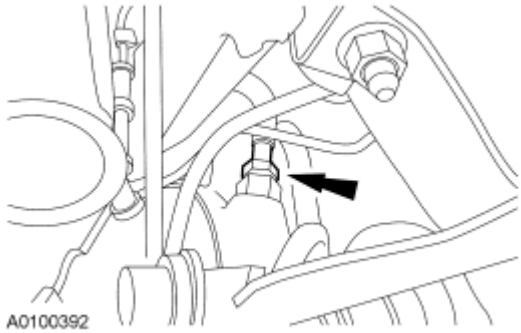


**Fig. 156: Rear Cooler Tube At Transaxle Case**
**Courtesy of FORD MOTOR CO.**

39. Disconnect the transaxle fluid cooler tube.
    1. Disconnect the output shaft speed (OSS) sensor electrical connector (black).
    2. Disconnect the turbine shaft speed (TSS) sensor electrical connector (white).
        - Disconnect the wiring harness retainer from the transaxle case and position the harness aside.

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3. Remove the transaxle fluid cooler retaining bracket bolt.
4. Position the fluid cooler tube aside.

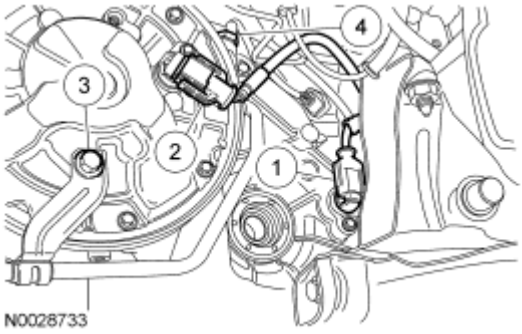


**Fig. 157: Fluid Cooler Tube, Electrical Connectors & Bracket**
**Courtesy of FORD MOTOR CO.**

40. Remove the bolt and the OSS sensor.

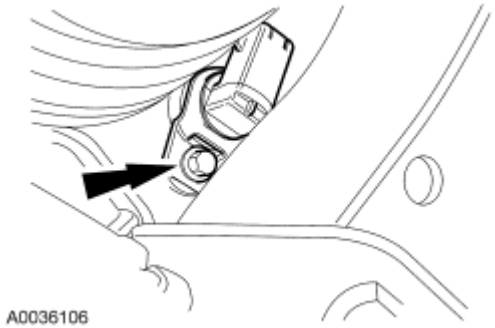


**Fig. 158: Locating OSS Sensor Bolt**
**Courtesy of FORD MOTOR CO.**

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

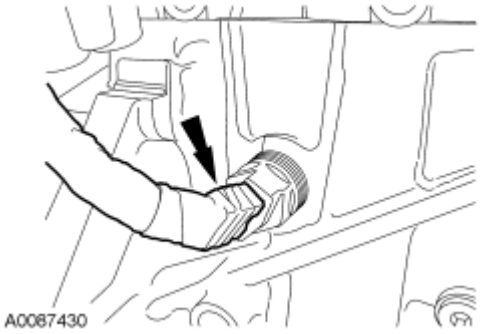


**Fig. 159: Block Heater Electrical Connector**
**Courtesy of FORD MOTOR CO.**

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42. Disconnect the upper radiator hose.

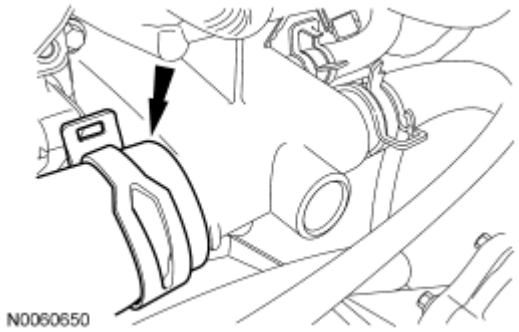


**Fig. 160: Identifying Upper Radiator Hose**
**Courtesy of FORD MOTOR CO.**

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

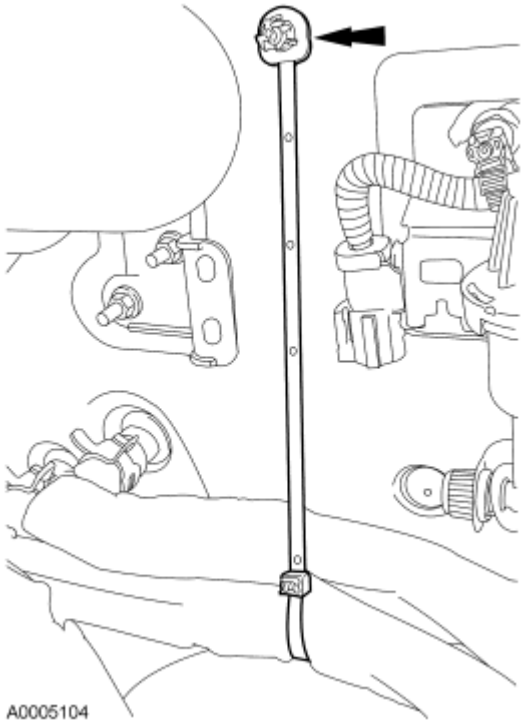


**Fig. 161: Heater Hose Support Strap & Stud**
**Courtesy of FORD MOTOR CO.**

44. Disconnect the heater hoses from the heater core.

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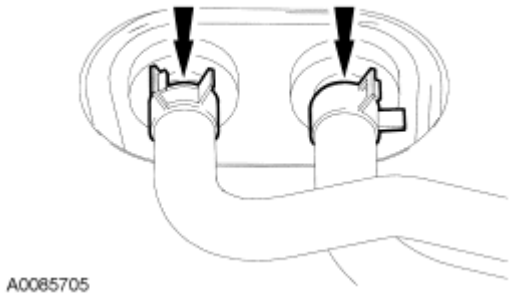


**Fig. 162: Locating Heater Hoses**
**Courtesy of FORD MOTOR CO.**

45. Remove the retainers and the accelerator cable snow shield.

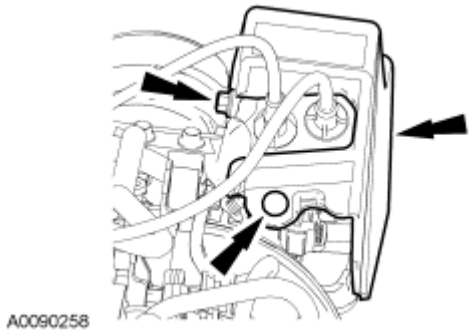


**Fig. 163: Accelerator Cable Snow Shield Retainers**
**Courtesy of FORD MOTOR CO.**

46. Disconnect the accelerator cable and speed control cable (if equipped).
    1. Disconnect the accelerator and speed control cable (if equipped) from the throttle body.
    2. Remove the bolts from the accelerator cable bracket.

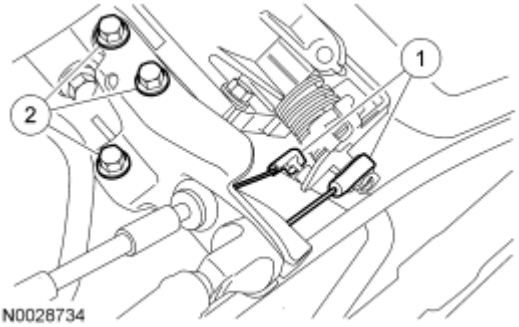


**Fig. 164: Accelerator Cable, Speed Control Cable & Bracket Bolts**
**Courtesy of FORD MOTOR CO.**

47. Remove the nut from the accelerator control cable bracket.

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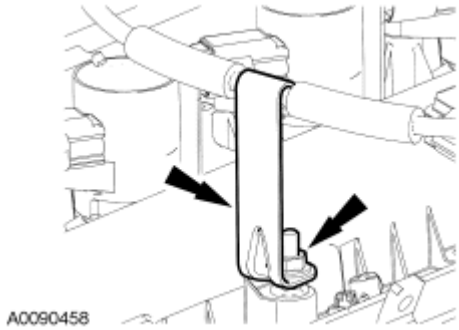


**Fig. 165: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

48. Remove the nut from the accelerator control cable bracket.
    - Position the accelerator control cable and bracket assembly aside.

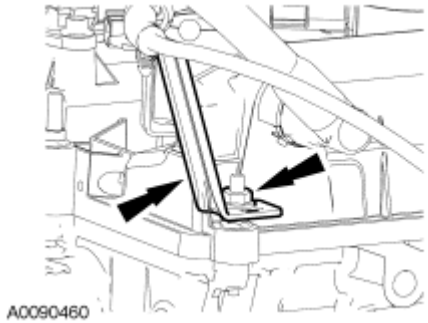


**Fig. 166: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

49. Disconnect the vacuum supply tube and position aside.

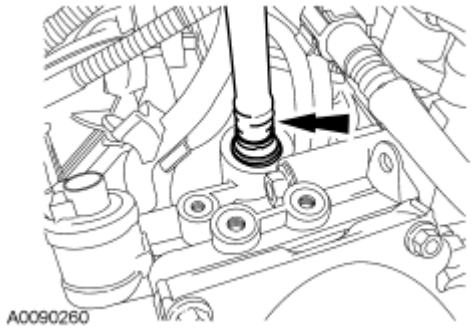


**Fig. 167: Vacuum Supply Tube**
**Courtesy of FORD MOTOR CO.**

50. Disconnect the fuel vapor return tube and retainer and position aside.

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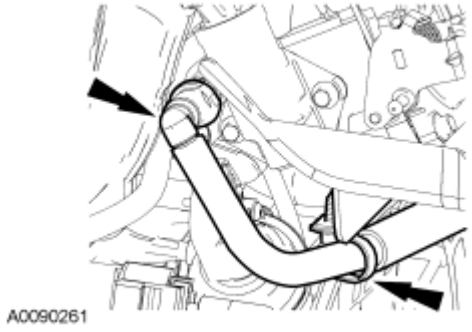


**Fig. 168: Fuel Vapor Return Tube**
**Courtesy of FORD MOTOR CO.**

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

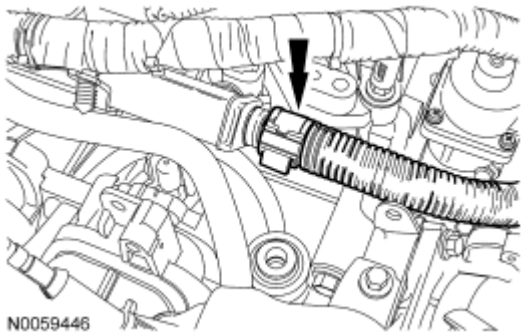


**Fig. 169: Identifying Fuel Supply Tube Quick Connect Coupling**
**Courtesy of FORD MOTOR CO.**

52. Detach the electrical connector retainers.

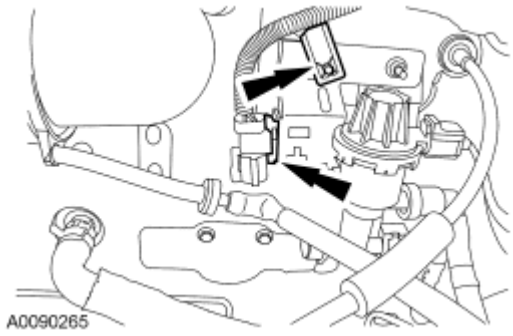


**Fig. 170: Electrical Connector Retainers**
**Courtesy of FORD MOTOR CO.**

53. Remove the bolt and detach the ground wire.

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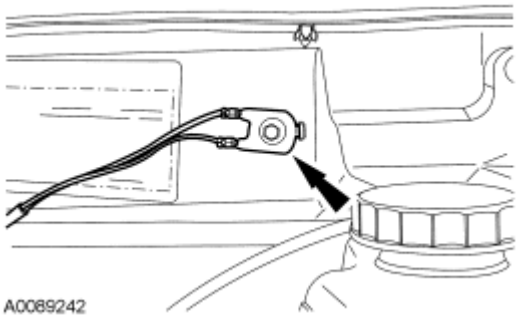


**Fig. 171: Locating Ground Wire & Bolt**
**Courtesy of FORD MOTOR CO.**

54. Disconnect the PCM electrical connectors.
    - Remove the wiring harness retainer nut.

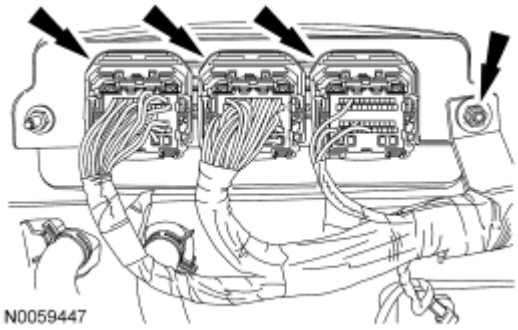


**Fig. 172: Identifying Connectors**
**Courtesy of FORD MOTOR CO.**

55. Disconnect the lower radiator hose from the radiator.

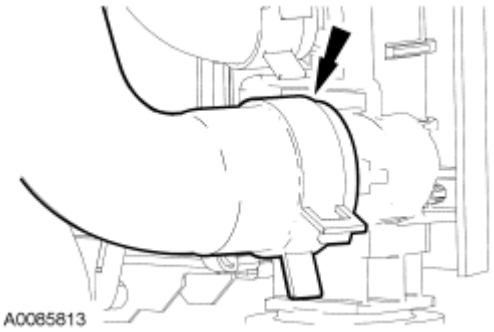


**Fig. 173: Locating Lower Radiator Hose**
**Courtesy of FORD MOTOR CO.**

56. Disconnect the A/C compressor electrical connector and remove the 4 bolts.
    - Position the A/C compressor aside and support the compressor with a length of mechanic's wire.

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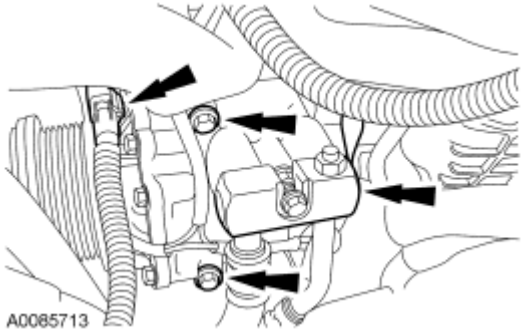


**Fig. 174: A/C Compressor Electrical Connector & Bolts**
**Courtesy of FORD MOTOR CO.**

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

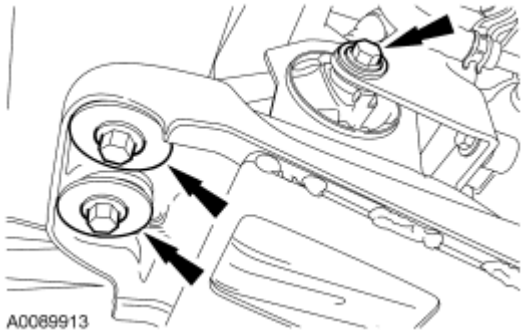


**Fig. 175: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember**
**Courtesy of FORD MOTOR CO.**

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

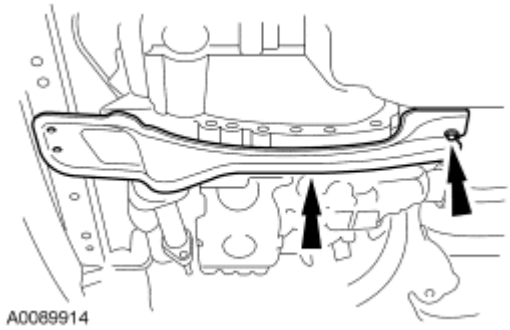


**Fig. 176: Identifying Cross Brace And Rear Nut**
**Courtesy of FORD MOTOR CO.**

**Front wheel drive (FWD) vehicles**

59. Remove the 3 bolts and the damper.

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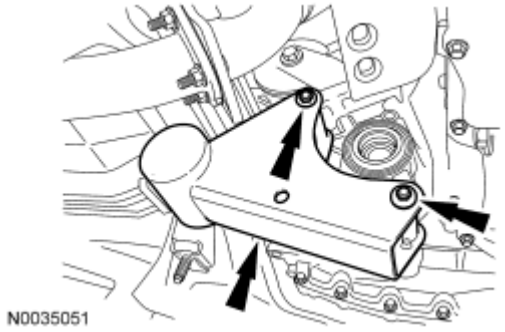


**Fig. 177: Locating Bolts & Dampener**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

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

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


**Fig. 178: Locating Lower Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

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

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

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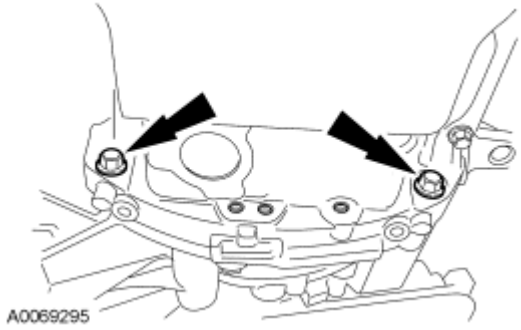


**Fig. 179: Locating Engine-To-Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

62. Using the special tools, secure the engine to the lift table.

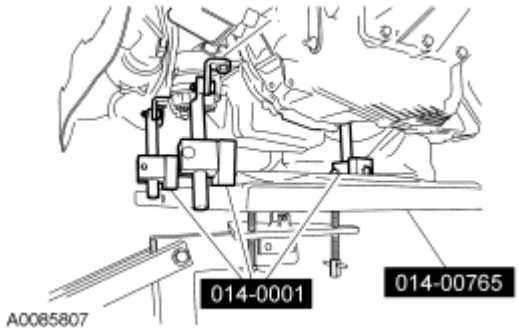


**Fig. 180: Securing Engine To Lift Table Using Special Tool (014-0001, 014-00765)**
**Courtesy of FORD MOTOR CO.**

63. Remove the engine mount bracket bolt.

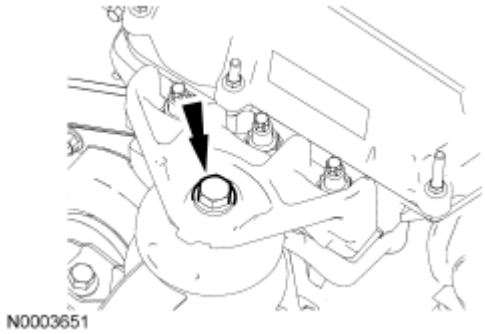


**Fig. 181: Engine Mount Bracket Bolt**
**Courtesy of FORD MOTOR CO.**

64. Remove the nuts and the engine mount bracket.

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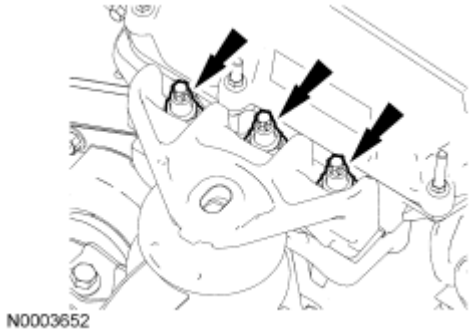


**Fig. 182: Engine Mount Bracket Nuts**
**Courtesy of FORD MOTOR CO.**

65. Remove the bolt from the transaxle rear mount.

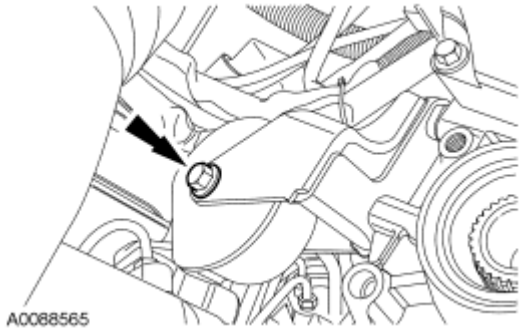


**Fig. 183: Transaxle Rear Mount Bolt**
**Courtesy of FORD MOTOR CO.**

66. Remove the bolt from the LH transaxle mount.

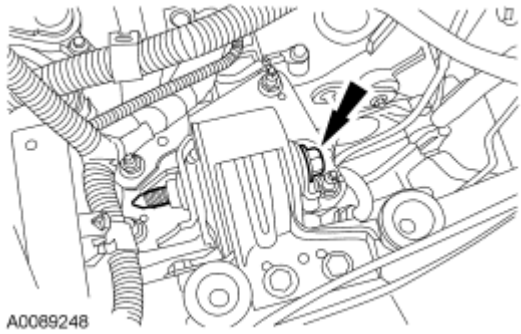


**Fig. 184: Locating Transaxle Mount Bolt**
**Courtesy of FORD MOTOR CO.**

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

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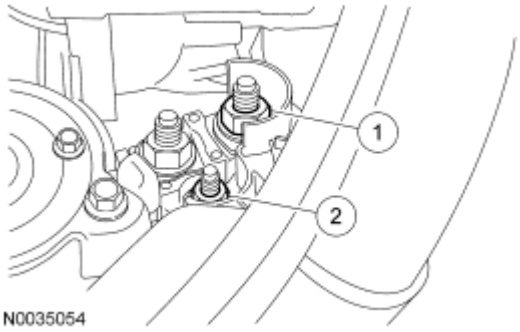


**Fig. 185: Identifying Battery Cable & Starter Solenoid Terminal Nut**
**Courtesy of FORD MOTOR CO.**

69. Remove the wire harness clip retainer and the ground wire from the starter bolts.

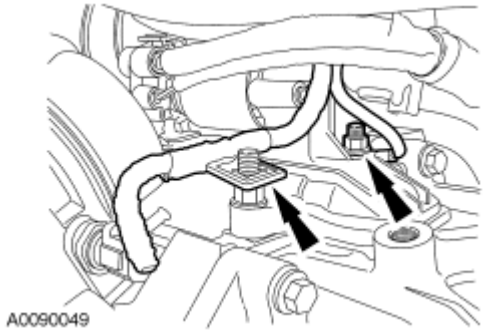


**Fig. 186: Locating Wire Harness Clip Retainer & Starter Bolts**
**Courtesy of FORD MOTOR CO.**

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

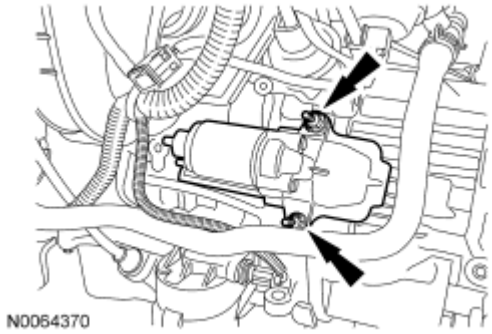


**Fig. 187: Identifying Stud Bolts**
**Courtesy of FORD MOTOR CO.**

71. Remove the starter motor isolator.

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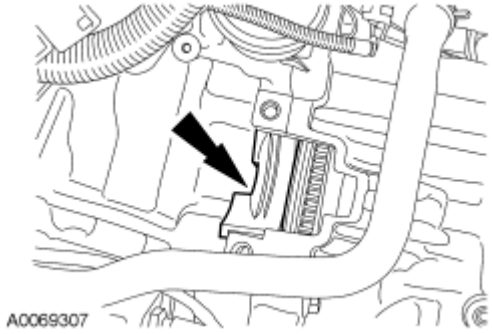


**Fig. 188: Identifying Starter Motor Isolator**
**Courtesy of FORD MOTOR CO.**

**AWD vehicles**

72. Remove the 2 lower catalytic converter bolts.

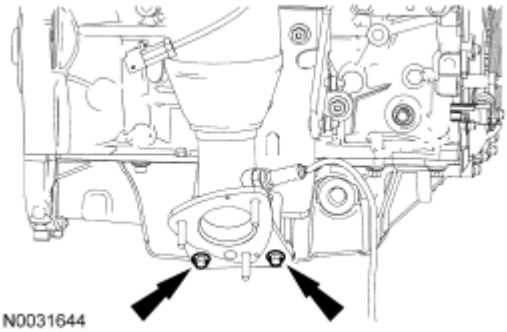


**Fig. 189: Locating Lower Catalytic Converter Bolts**
**Courtesy of FORD MOTOR CO.**

73. Remove the 6 bolts and the catalytic converter heat shield.

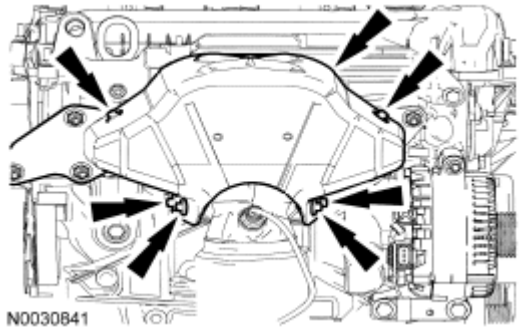


**Fig. 190: Locating Heat Shield & Bolts**
**Courtesy of FORD MOTOR CO.**

74. Remove and discard the 7 exhaust manifold nuts.

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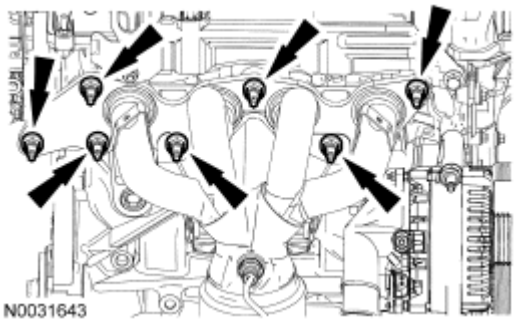


**Fig. 191: Locating Exhaust Manifold Nuts**
**Courtesy of FORD MOTOR CO.**

75. Remove the catalytic converter and discard the exhaust manifold gasket.
76. Remove and discard the 7 exhaust manifold studs.
77. Remove the 3 PTU bracket-to-engine bolts.

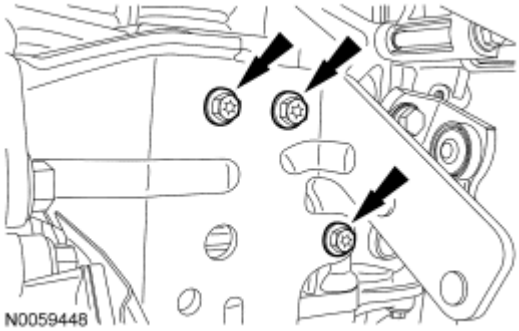


**Fig. 192: Identifying Bracket-To-Engine Bolts**
**Courtesy of FORD MOTOR CO.**

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

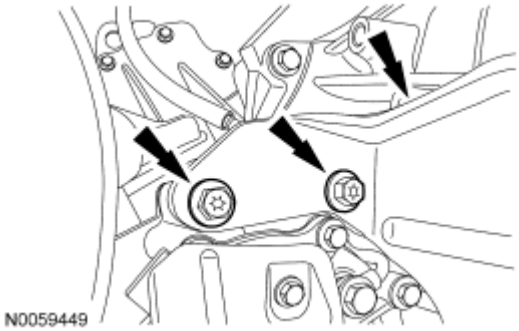


**Fig. 193: Identifying Bracket-To-PTU Bolts And Bracket**
**Courtesy of FORD MOTOR CO.**

79. Detach the PTU vent hose retainer.

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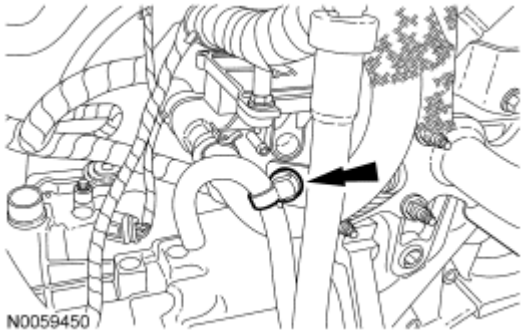


**Fig. 194: Identifying PTU Vent Hose Retainer**
**Courtesy of FORD MOTOR CO.**

80. Remove the transaxle-to-PTU bolt.

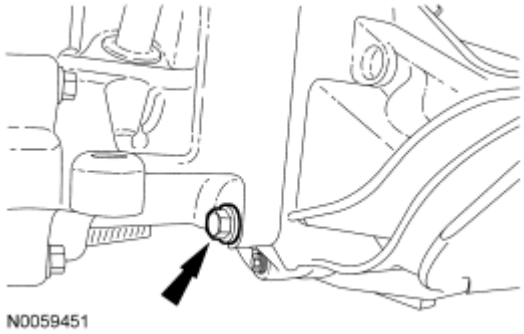


**Fig. 195: Identifying Transaxle-To-PTU Bolt**
**Courtesy of FORD MOTOR CO.**

81. Remove the 3 PTU-to-transaxle bolts and the PTU.

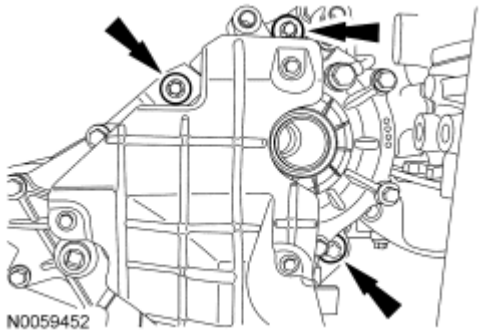


**Fig. 196: Identifying PTU-To-Transaxle Bolts And PTU**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

82. Remove and discard the 4 torque converter nuts.

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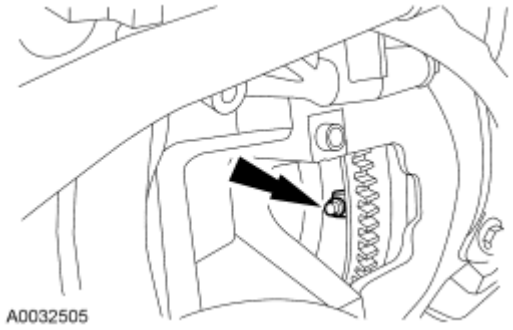


**Fig. 197: Locating Torque Converter Nut**
**Courtesy of FORD MOTOR CO.**

83. Using the engine 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.**

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

**ENGINE - MANUAL TRANSAXLE**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1582-A | Front Drive Halfshaft Remover | 205-241 (T86P-3514-A) |
|  ST1341-A | Heavy Duty Floor Crane | 014-00071 or equivalent |
|  ST1293-A | Powertrain Lift | 014-00765 |
|  ST1185-A | Slide Hammer | 100-001 (T50T-100-A) |

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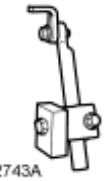
| | | |
|---|---|---|
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST1408-A | Tie-Rod End Remover | 211-105 (T85M-3395-A) |
|  ST2743A | Universal Adapter Brackets | 014-0001 |

**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 AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.
4. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
5. Drain the engine oil.
   - Install the drain plug.
   - Tighten to 28 Nm (21 lb-ft).
6. Remove the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
8. Remove the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
9. Disconnect the heated oxygen sensor (HO2S) and the catalyst monitor sensor electrical connectors.

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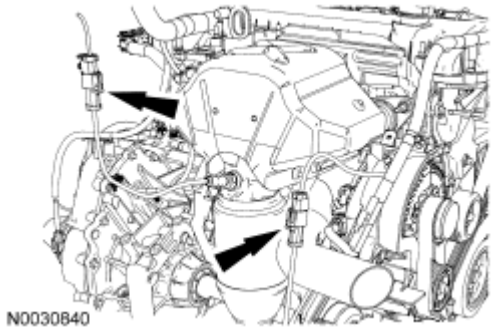


**Fig. 198: Heated Oxygen Sensor (HO2S) And Catalyst Monitor Sensor Electrical Connectors**
**Courtesy of FORD MOTOR CO.**

10. Remove the accessory drive belt and tensioner. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
11. Press the 2 locking tabs (1 shown) to release the lower air duct from the upper air duct.

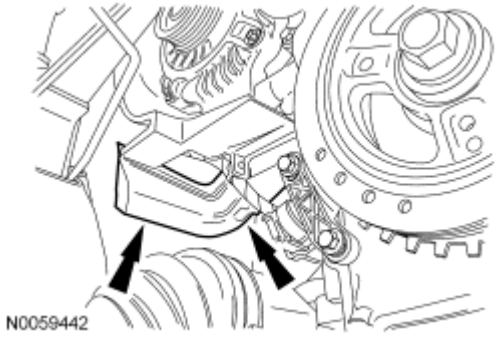


**Fig. 199: Identifying Locking Tab**
**Courtesy of FORD MOTOR CO.**

12. Detach the wire retainers from the generator shield and remove the nut and pin-type retainer.
    - Remove the generator shield.

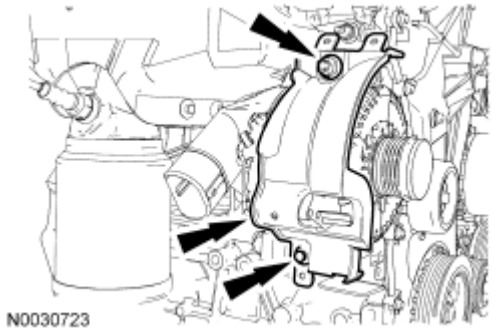


**Fig. 200: Generator Shield**
**Courtesy of FORD MOTOR CO.**

13. Remove the 4 bolts and the lateral support crossmember.

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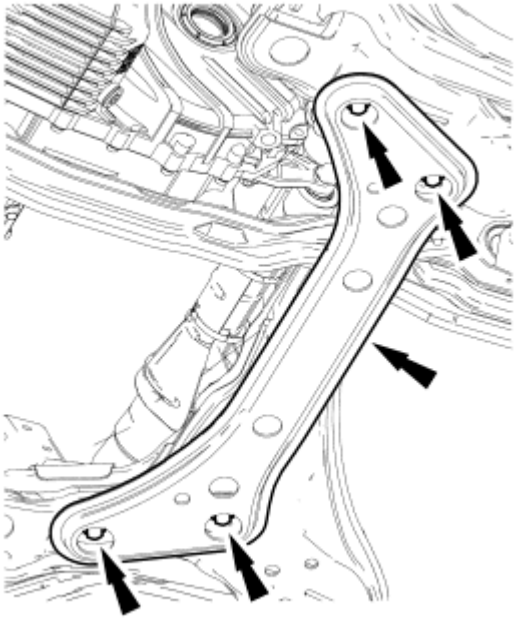


**Fig. 201: Identifying Lateral Support Crossmember And Bolts**
**Courtesy of FORD MOTOR CO.**

14. Remove the brake hose retainer and the ABS sensor retaining bolt from the LH strut.

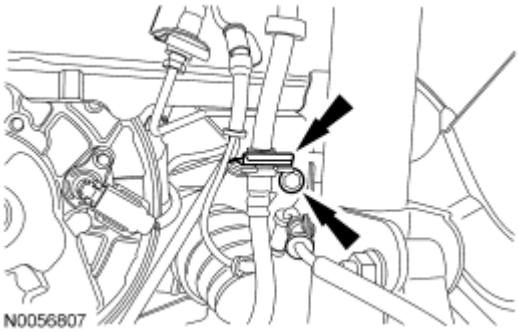


**Fig. 202: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

15. Disconnect the LH suspension.
    1. Disconnect the stabilizer bar link.
    2. Remove the tie rod end retaining nut.
    3. Remove the lower control arm knuckle bolt.

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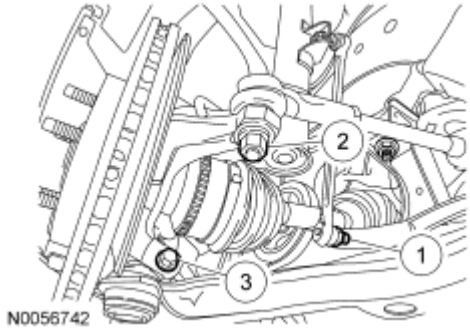


**Fig. 203: Identifying Stabilizer Bar Link, Retaining Nut And Knuckle Bolt**
**Courtesy of FORD MOTOR CO.**

16. Remove the brake hose retainer and the ABS sensor retaining bolt from the RH strut.

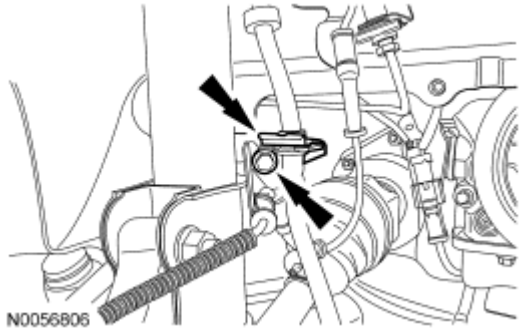


**Fig. 204: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

17. Disconnect the RH suspension.
    1. Disconnect the stabilizer bar link.
    2. Remove the tie rod end retaining nut.
    3. Remove the lower control arm knuckle bolt.

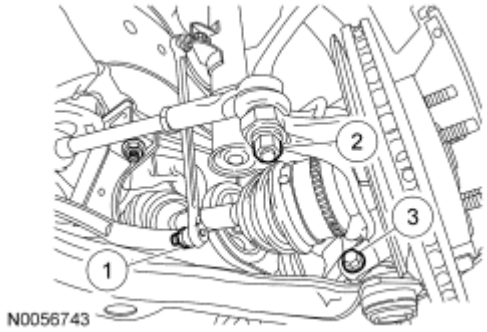


**Fig. 205: Identifying Stabilizer Bar Link, Retaining Nut And Knuckle Bolt**
**Courtesy of FORD MOTOR CO.**

18. Using the special tool, disconnect the LH and RH tie rod end from the steering knuckle.

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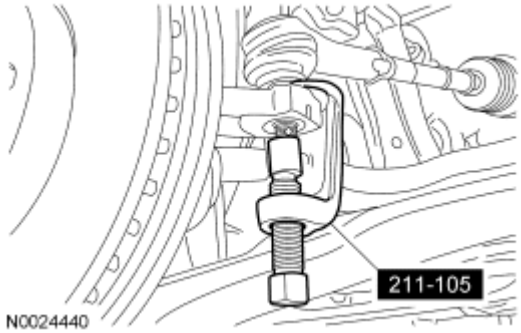


**Fig. 206: Disconnecting LH And RH Tie Rod End From Steering Knuckle**
**Courtesy of FORD MOTOR CO.**

19. Separate the LH and RH lower control arms and disconnect the steering knuckle from the lower ball joint and position the steering knuckle aside.
20. Using a suitable tool, separate the LH halfshaft from the transaxle and secure the halfshaft aside.
21. Using the special tools, remove the RH halfshaft from the intermediate shaft and secure the halfshaft aside.

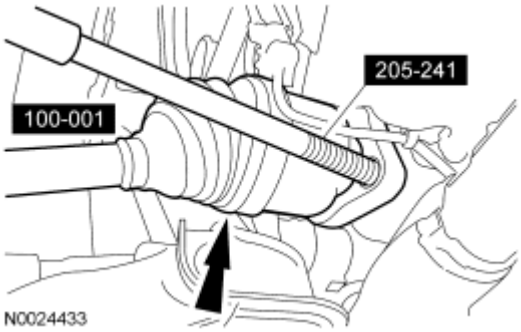


**Fig. 207: Removing RH Outer Halfshaft Using Special Tools**
**Courtesy of FORD MOTOR CO.**

22. Remove the 2 intermediate shaft retaining nuts.

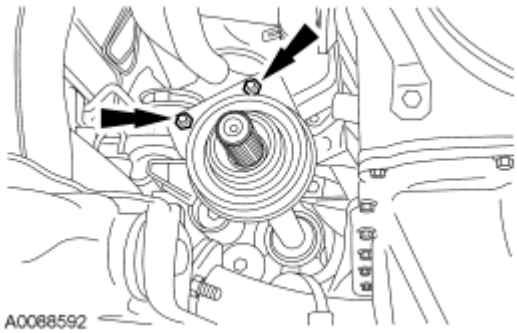


**Fig. 208: Locating Intermediate Shaft Retaining Nuts**
**Courtesy of FORD MOTOR CO.**

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23. Remove the intermediate shaft.

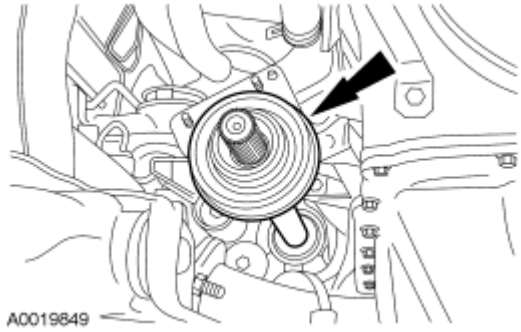


**Fig. 209: Locating Intermediate Shaft**
**Courtesy of FORD MOTOR CO.**

24. Remove the power distribution box (PDB) cover.

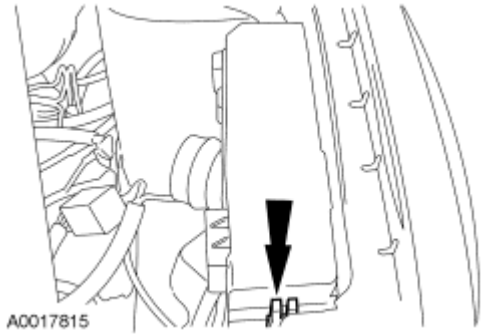


**Fig. 210: Locating Power Distribution Box Cover**
**Courtesy of FORD MOTOR CO.**

25. Remove the nut and the cable from the PDB.

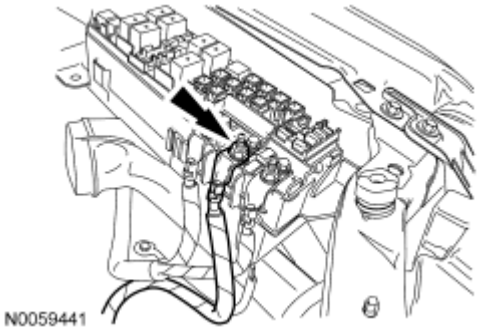


**Fig. 211: Identifying Nut**
**Courtesy of FORD MOTOR CO.**

26. Disconnect the electrical connector from the PDB.

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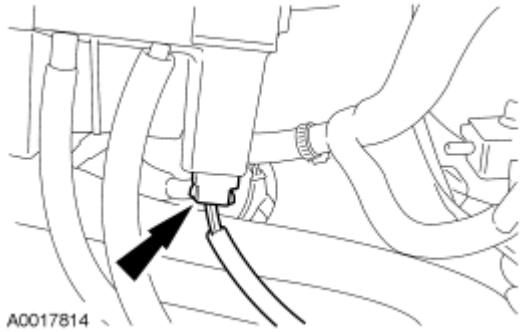


**Fig. 212: Power Distribution Box Electrical Connector**
**Courtesy of FORD MOTOR CO.**

27. Remove the bolt and ground strap.

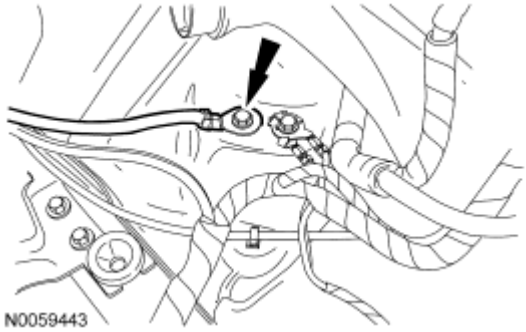


**Fig. 213: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

28. Disconnect the 34-pin electrical connector.


**Fig. 214: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

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

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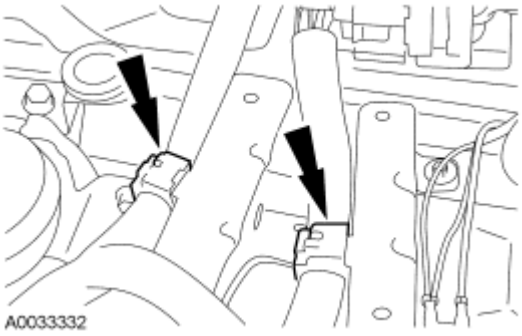


**Fig. 215: Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

30. 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.

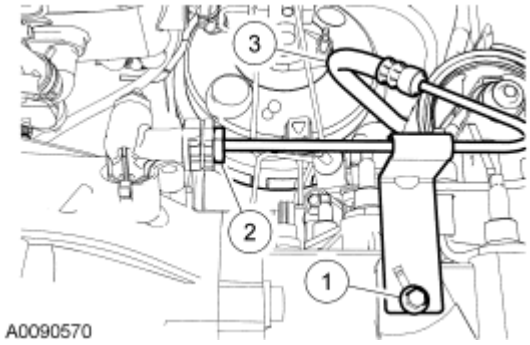


**Fig. 216: Clutch Hydraulic Line & Components**
**Courtesy of FORD MOTOR CO.**

31. Remove the wiring harness bracket nut and position aside

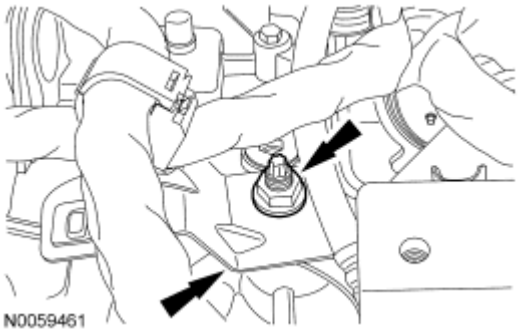


**Fig. 217: Identifying Bracket And Nut**
**Courtesy of FORD MOTOR CO.**

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32. Disconnect the vehicle speed sensor (VSS) electrical connector and pin-type retainers.

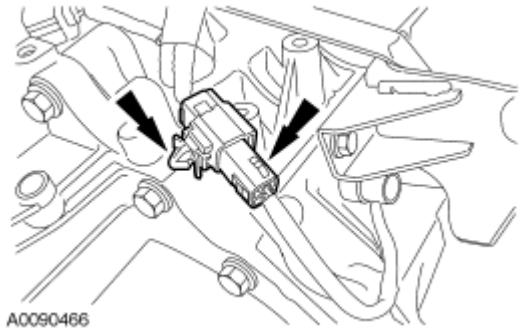


**Fig. 218: Locating Vehicle Speed Sensor (VSS) Electrical Connector**
**Courtesy of FORD MOTOR CO.**

33. Disconnect the reversing lamp indicator switch.

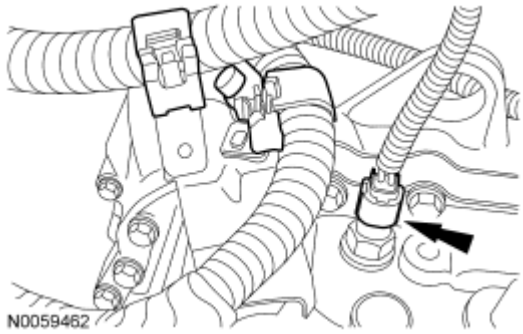


**Fig. 219: Identifying Reversing Lamp Indicator Switch**
**Courtesy of FORD MOTOR CO.**

34. Disconnect the shift cables.

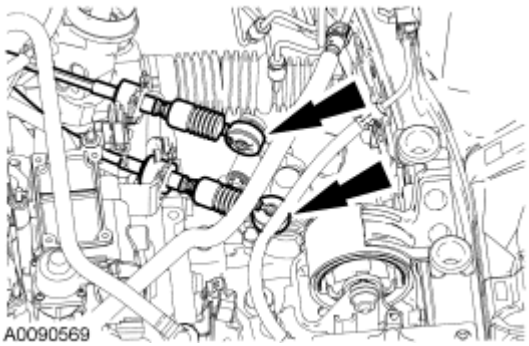


**Fig. 220: Shift Cables**
**Courtesy of FORD MOTOR CO.**

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

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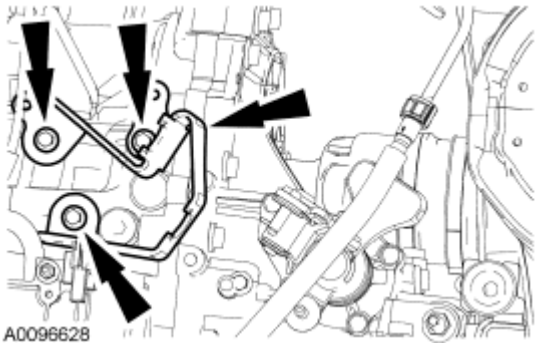


**Fig. 221: Shift Cable Bracket & Bolts**
**Courtesy of FORD MOTOR CO.**

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

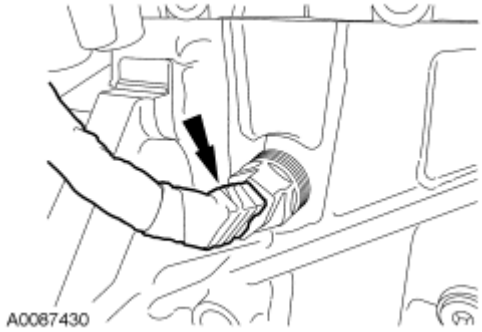


**Fig. 222: Block Heater Electrical Connector**
**Courtesy of FORD MOTOR CO.**

37. Disconnect the upper radiator hose.

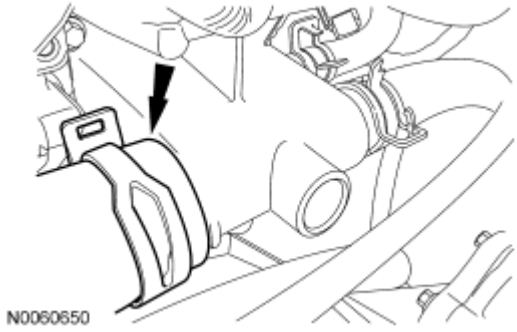


**Fig. 223: Identifying Upper Radiator Hose**
**Courtesy of FORD MOTOR CO.**

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

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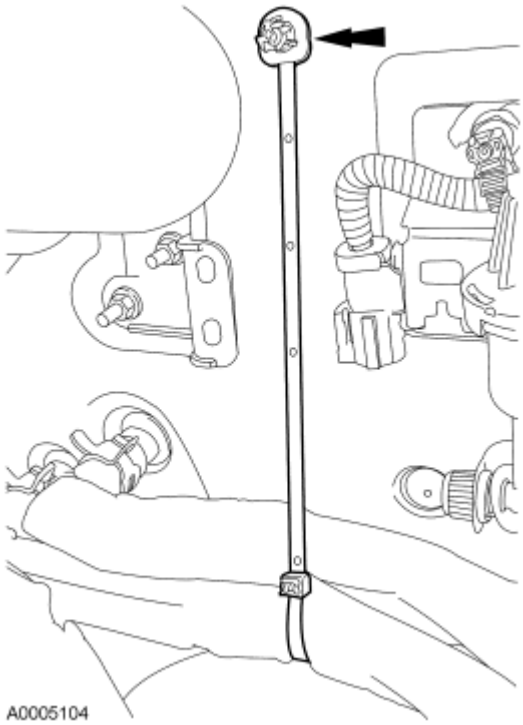


**Fig. 224: Heater Hose Support Strap & Stud**
**Courtesy of FORD MOTOR CO.**

39. Disconnect the heater hoses from the heater core.

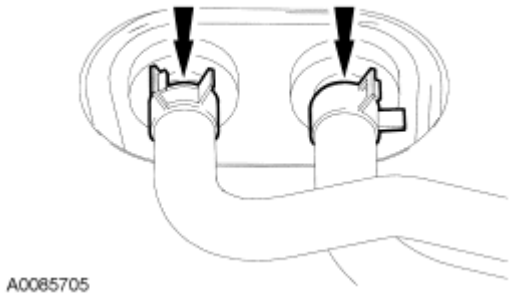


**Fig. 225: Locating Heater Hoses**
**Courtesy of FORD MOTOR CO.**

40. Remove the retainers and the accelerator cable snow shield.

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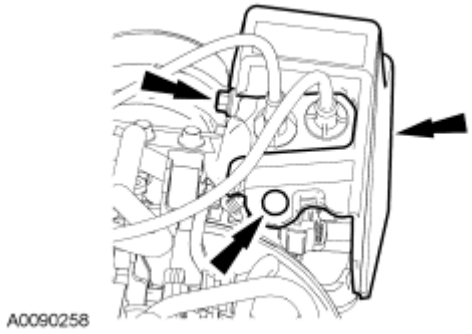


**Fig. 226: Accelerator Cable Snow Shield Retainers**
**Courtesy of FORD MOTOR CO.**

41. Disconnect the accelerator cable and speed control cable (if equipped).
    1. Disconnect the accelerator and speed control cable (if equipped) from the throttle body.
    2. Remove the bolts from the accelerator cable bracket.

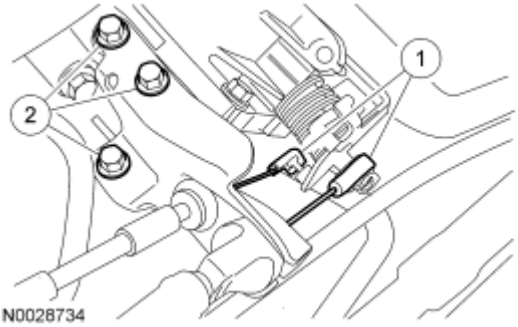


**Fig. 227: Accelerator Cable, Speed Control Cable & Bracket Bolts**
**Courtesy of FORD MOTOR CO.**

42. Remove the nut from the accelerator control cable bracket.
    - Position the accelerator control cable and bracket assembly aside.

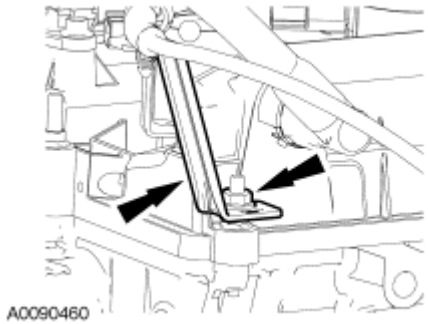


**Fig. 228: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

43. Remove the nut from the accelerator control cable bracket.

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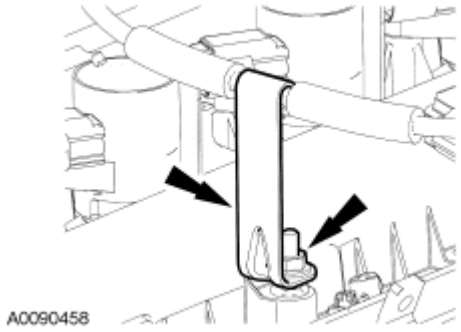


**Fig. 229: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

44. Disconnect the vacuum supply tube and position aside.

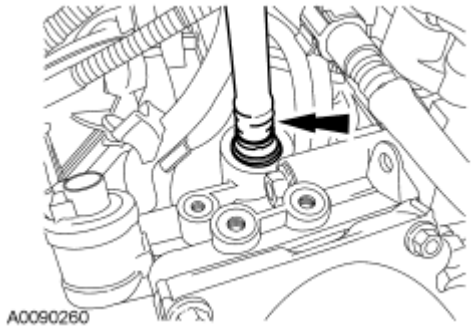


**Fig. 230: Vacuum Supply Tube**
**Courtesy of FORD MOTOR CO.**

45. Disconnect the fuel vapor return tube and position aside.

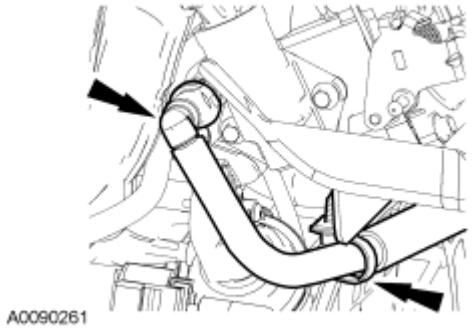


**Fig. 231: Fuel Vapor Return Tube**
**Courtesy of FORD MOTOR CO.**

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

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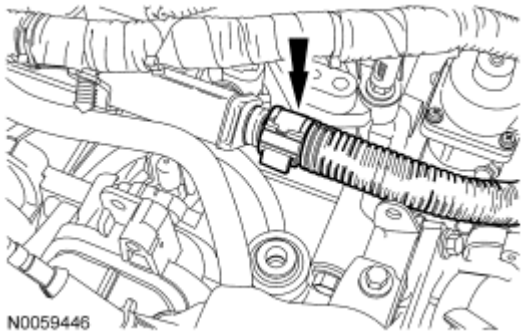


**Fig. 232: Identifying Fuel Supply Tube**
**Courtesy of FORD MOTOR CO.**

47. Detach the electrical connector retainers.

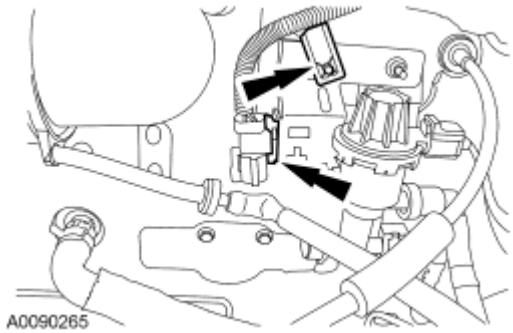


**Fig. 233: Electrical Connector Retainers**
**Courtesy of FORD MOTOR CO.**

48. Remove the bolt and detach the ground wire.

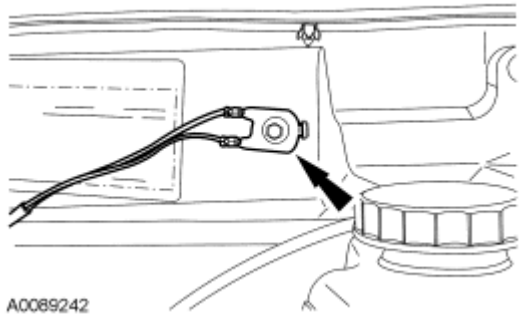


**Fig. 234: Locating Ground Wire & Bolt**
**Courtesy of FORD MOTOR CO.**

49. Disconnect the PCM electrical connectors.
    - Remove the wiring harness retainer nut.

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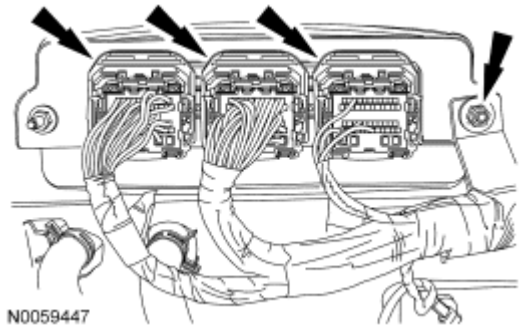


**Fig. 235: Identifying Connectors And Nut**
**Courtesy of FORD MOTOR CO.**

50. Disconnect the lower radiator hose from the radiator.

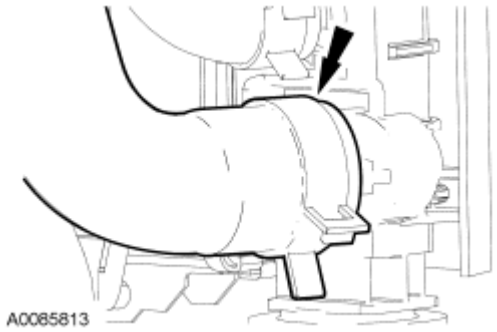


**Fig. 236: Locating Lower Radiator Hose**
**Courtesy of FORD MOTOR CO.**

51. 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.

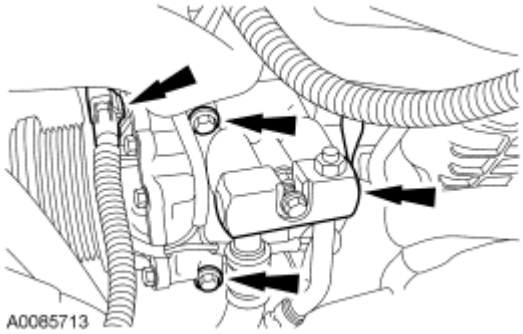


**Fig. 237: A/C Compressor Electrical Connector & Bolts**
**Courtesy of FORD MOTOR CO.**

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

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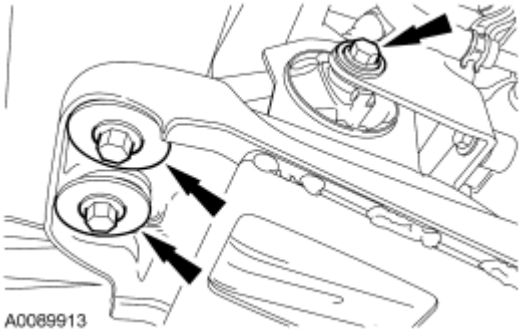


**Fig. 238: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember**
**Courtesy of FORD MOTOR CO.**

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

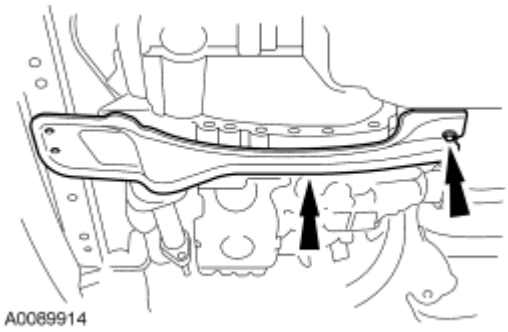


**Fig. 239: Identifying Cross Brace And Rear Nut**
**Courtesy of FORD MOTOR CO.**

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

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


**Fig. 240: Locating Lower Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

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

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

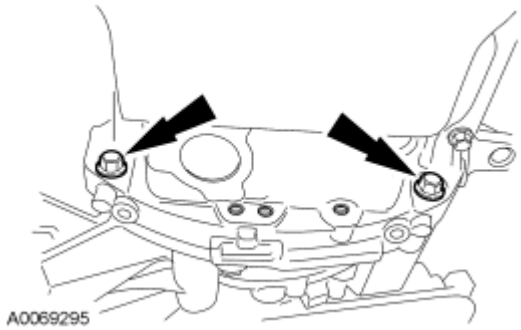


**Fig. 241: Locating Engine-To-Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

56. Using the special tools, secure the engine to the lift table.

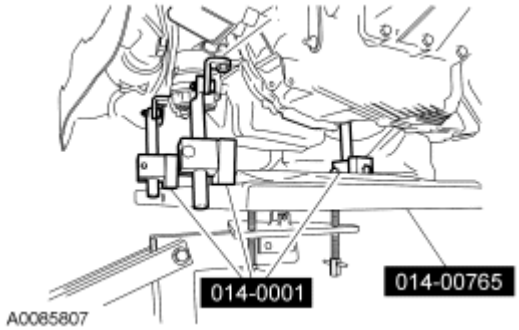


**Fig. 242: Securing Engine To Lift Table Using Special Tool (014-0001, 014-00765)**
**Courtesy of FORD MOTOR CO.**

57. Remove the engine mount bracket bolt.

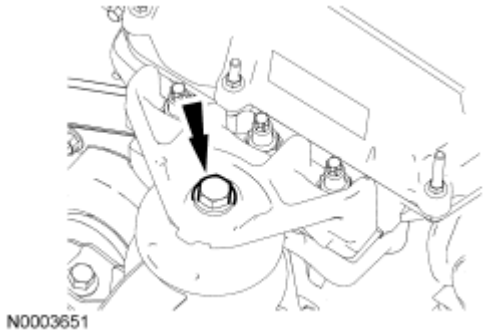


**Fig. 243: Engine Mount Bracket Bolt**
**Courtesy of FORD MOTOR CO.**

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58. Remove the nuts and the engine mount bracket.

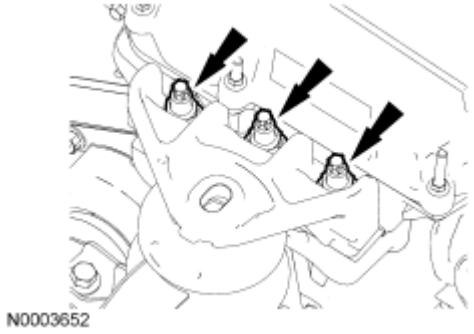


**Fig. 244: Engine Mount Bracket Nuts**
**Courtesy of FORD MOTOR CO.**

59. Remove the bolt from the transaxle rear mount.

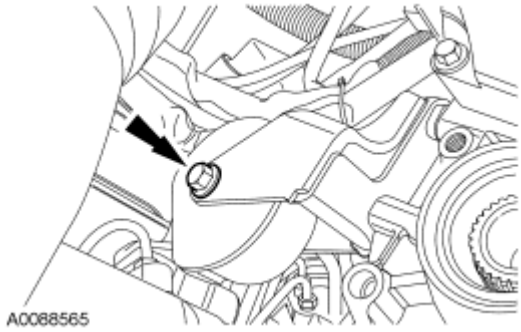


**Fig. 245: Transaxle Rear Mount Bolt**
**Courtesy of FORD MOTOR CO.**

60. Remove bolt from the LH transaxle mount.

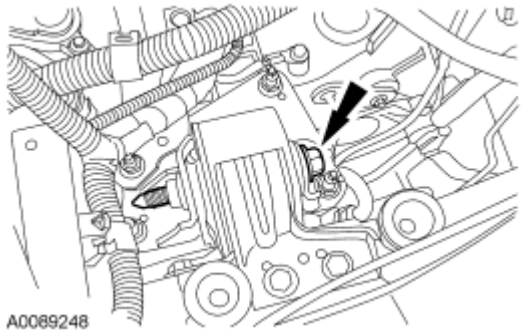


**Fig. 246: Locating Transaxle Mount Bolt**
**Courtesy of FORD MOTOR CO.**

61. Lower the engine and transaxle from the vehicle.
62. Disconnect the starter terminals.

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1. Remove the battery cable nut.
2. Remove the starter solenoid terminal nut.

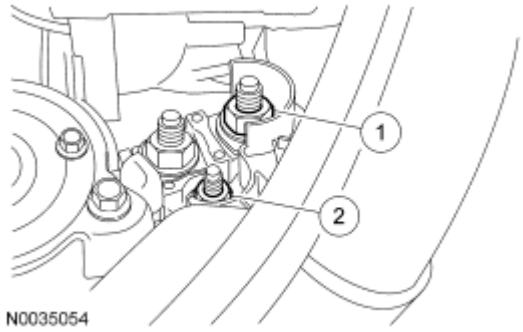


**Fig. 247: Identifying Battery Cable & Starter Solenoid Terminal Nut**
**Courtesy of FORD MOTOR CO.**

63. Remove the wire harness clip retainer and the ground wire from the starter bolts.

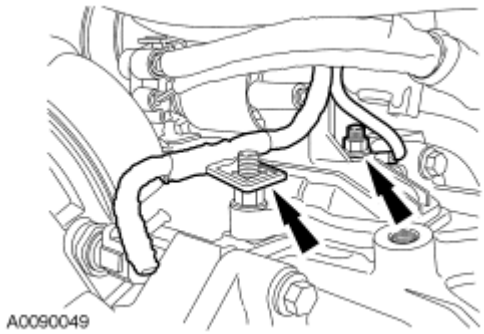


**Fig. 248: Locating Wire Harness Clip Retainer & Starter Bolts**
**Courtesy of FORD MOTOR CO.**

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

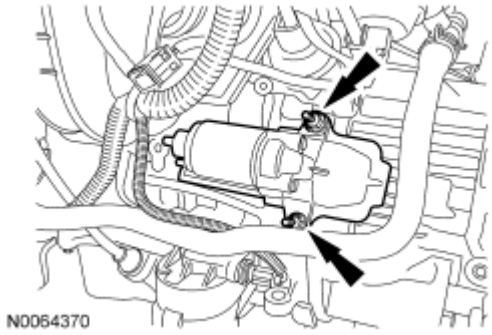


**Fig. 249: Identifying Stud Bolts**
**Courtesy of FORD MOTOR CO.**

65. Using the engine crane and spreader bar, remove the engine and transaxle from the lift table.

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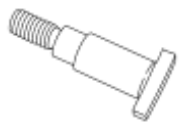
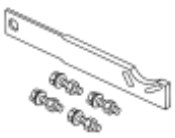
**NOTE: The transaxle-to-engine bolts differ in length. Mark the bolts for correct installation.**

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

# DISASSEMBLY

**ENGINE**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST2639-A | Adapter for 205-126 | (205-072-02) |
|  ST2645-A | Alignment Plate, Camshaft | 303-465 (T94P-6256-CH) |
|  ST1910-A | Engine Stand | 014-00232 or equivalent |
|  ST1341-A | Heavy Duty Floor Crane | 014-00071 or equivalent |
|  ST2647-A | Holding Fixture, Drive Pinion Flange | 205-126 (T78P-4851-A) |
|  ST1385-A | Remover, Oil Seal | 303-409 (T92C-6700-CH) |
| | | |

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| | | |
|---|---|---|
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST2638-A | Timing Peg, Crankshaft | 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 you loosen the pulley bolt. 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 in this article.**

**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.**

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

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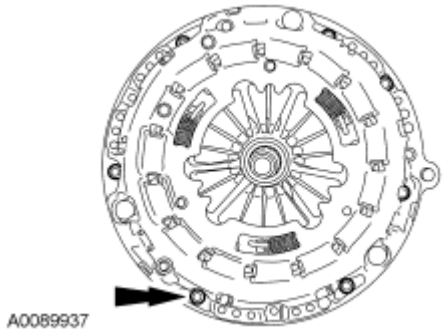


**Fig. 250: Locating Clutch Pressure Plate Bolts**
**Courtesy of FORD MOTOR CO.**

2. Remove the starter motor isolator.

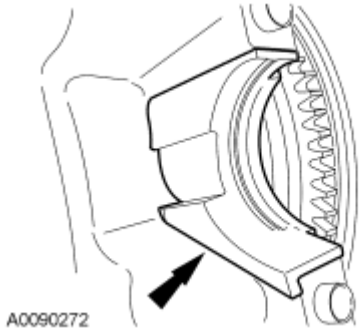


**Fig. 251: Locating Starter Motor Isolator**
**Courtesy of FORD MOTOR CO.**

3. Remove the bolts and the flywheel.

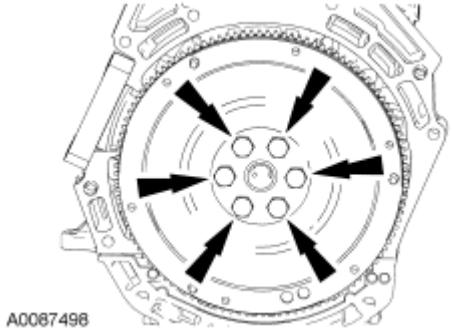


**Fig. 252: Flywheel Bolts**
**Courtesy of FORD MOTOR CO.**

**Vehicles with automatic transaxle**

4. Remove the bolts and the flexplate.

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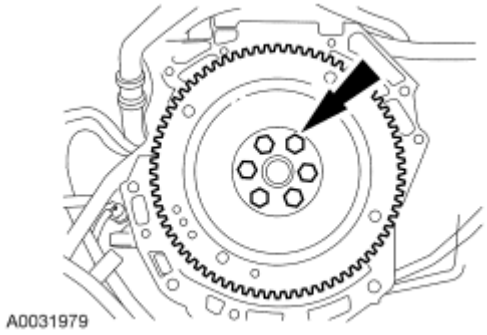


**Fig. 253: Locating Flexplate Bolts**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

5. Mount the engine on a suitable stand.
6. Disconnect the crankshaft position (CKP) sensor electrical connector.

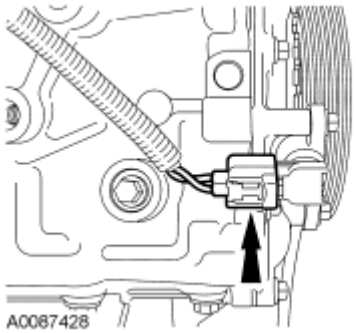


**Fig. 254: Crankshaft Position (CKP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

7. Remove the nut and disconnect the generator electrical connections.

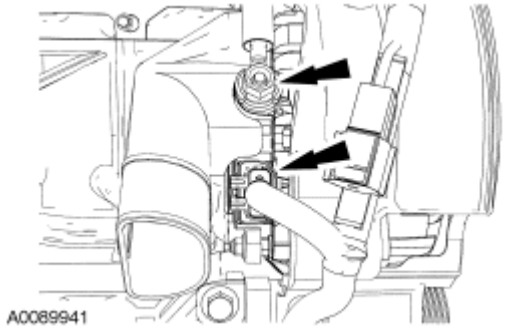


**Fig. 255: Locating Generator Electrical Connections**
**Courtesy of FORD MOTOR CO.**

**Front wheel drive (FWD) vehicles**

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8. Remove the 2 lower catalytic converter bolts.

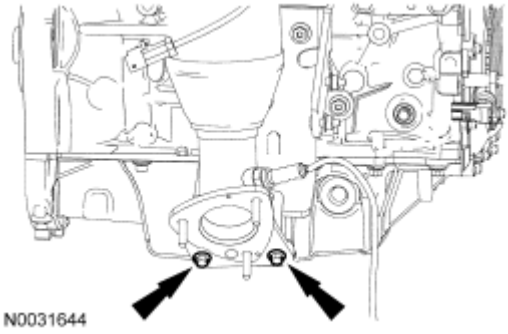


**Fig. 256: Locating Lower Catalytic Converter Bolts**
**Courtesy of FORD MOTOR CO.**

9. Remove the 6 heat shield bolts and the heat shield.

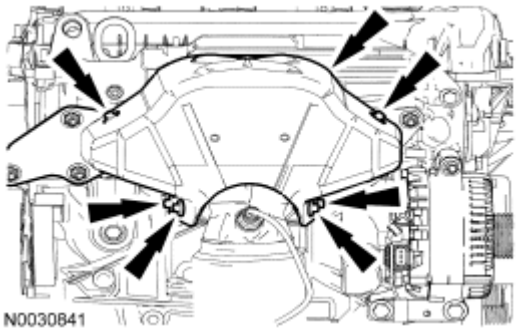


**Fig. 257: Locating Heat Shield & Bolts**
**Courtesy of FORD MOTOR CO.**

10. Remove and discard the 7 exhaust manifold nuts.

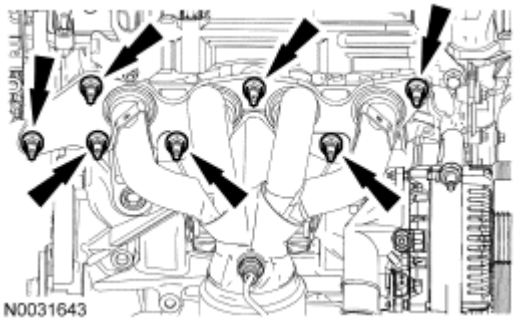


**Fig. 258: Locating Exhaust Manifold Nuts**
**Courtesy of FORD MOTOR CO.**

11. Remove the catalytic converter and discard the exhaust manifold gasket.
12. Remove and discard the 7 exhaust manifold studs.

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**All vehicles**

13. Remove the nut, bolts and the generator.

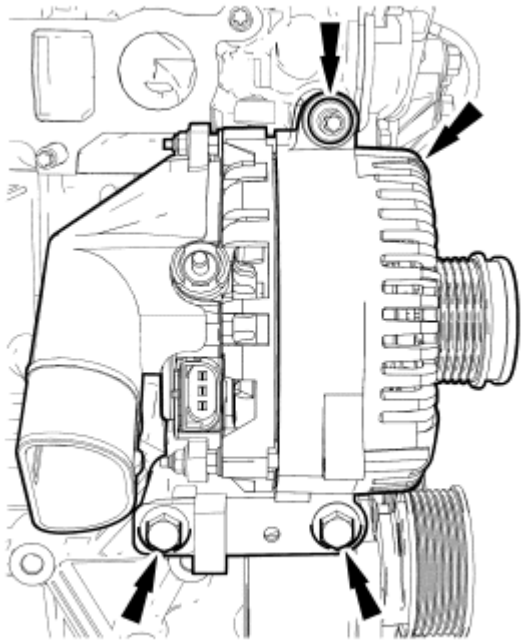


**Fig. 259: Locating Generator & Bolts**
**Courtesy of FORD MOTOR CO.**

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

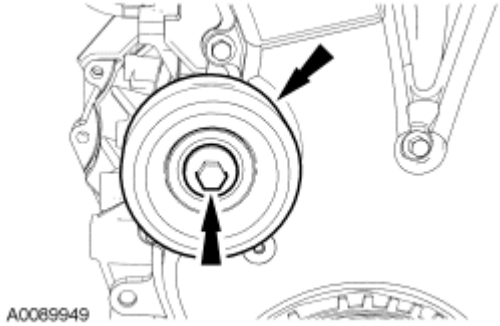


**Fig. 260: Locating Accessory Drivebelt Idler Pulley And Bolt**
**Courtesy of FORD MOTOR CO.**

15. Remove the 3 bolts and the accessory drive belt idler pulley and bracket.

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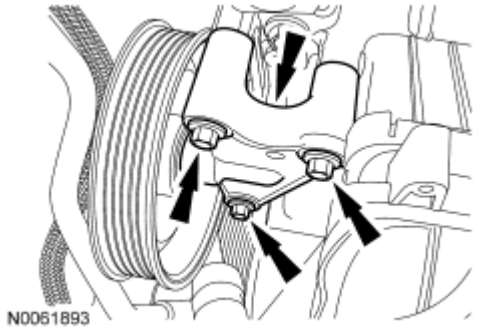


**Fig. 261: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

16. Remove the bolts and the coolant pump pulley.

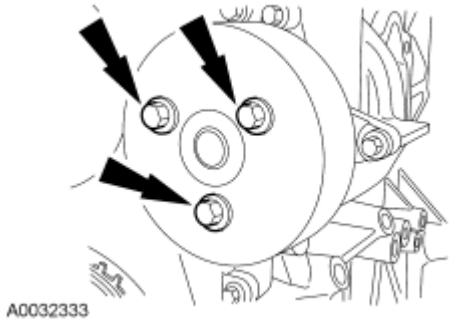


**Fig. 262: Locating Coolant Pump Pulley Bolts**
**Courtesy of FORD MOTOR CO.**

17. Remove the bolts and the coolant pump.

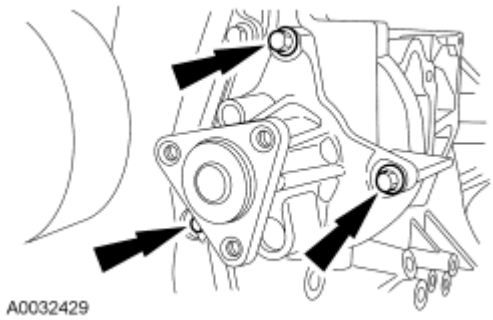


**Fig. 263: Locating Coolant Pump Bolts**
**Courtesy of FORD MOTOR CO.**

18. Detach the 2 wiring harness retainers.

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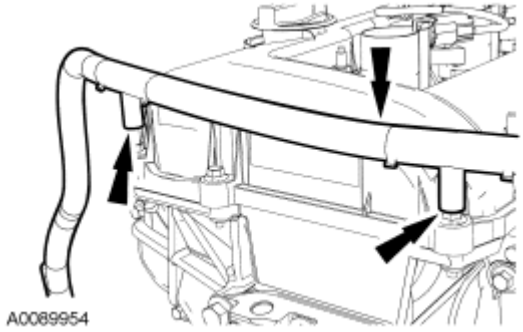


**Fig. 264: Locating Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

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

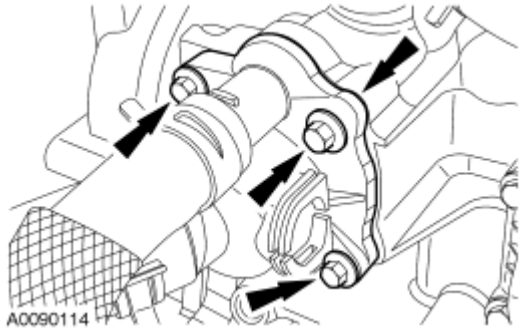


**Fig. 265: Locating Thermostat Housing & Bolts**
**Courtesy of FORD MOTOR CO.**

20. Remove the bolt and the oil level indicator.

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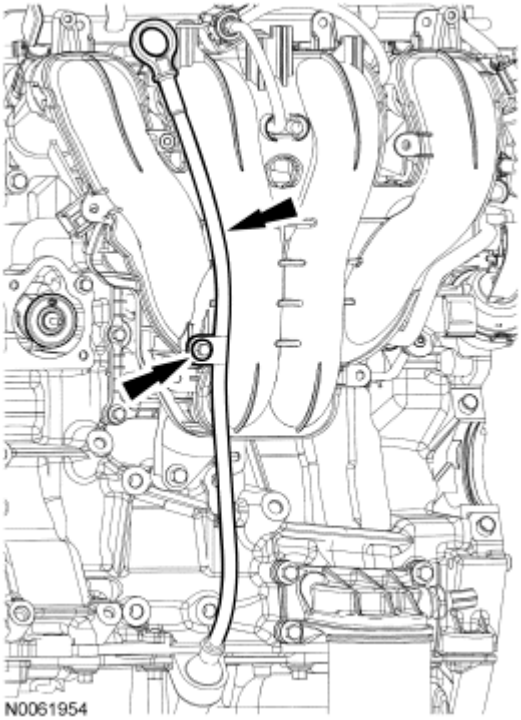


**Fig. 266: Identifying Bolt And Oil Level indicator**
**Courtesy of FORD MOTOR CO.**

21. Disconnect the engine oil pressure (EOP) switch electrical connector.

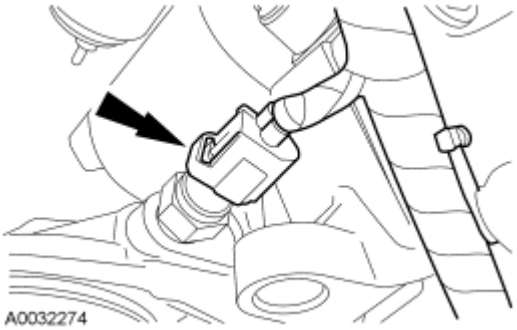


**Fig. 267: Locating Engine Oil Pressure (EOP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

22. Remove the engine oil filter.

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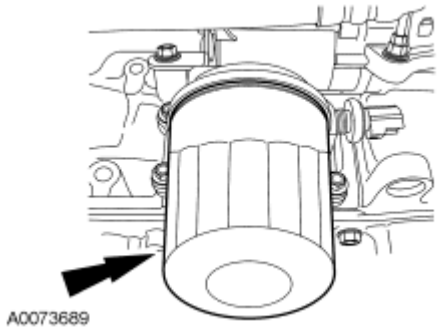


**Fig. 268: Locating Engine Oil Filter**
**Courtesy of FORD MOTOR CO.**

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

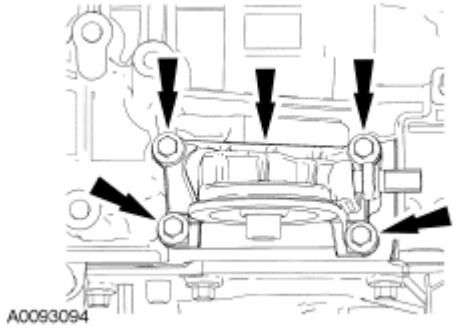


**Fig. 269: Locating Oil Filter Adapter And Bolts**
**Courtesy of FORD MOTOR CO.**

24. If equipped, remove the bolt and capacitor.

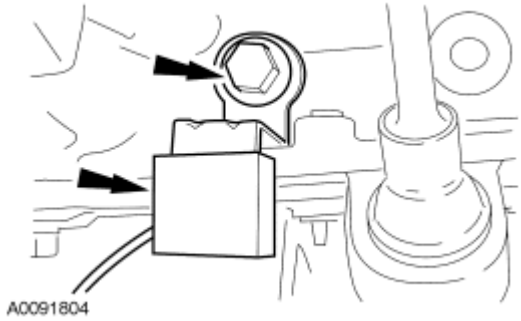


**Fig. 270: Locating Capacitor & Bolt**
**Courtesy of FORD MOTOR CO.**

25. Detach the 2 wiring harness retainers.

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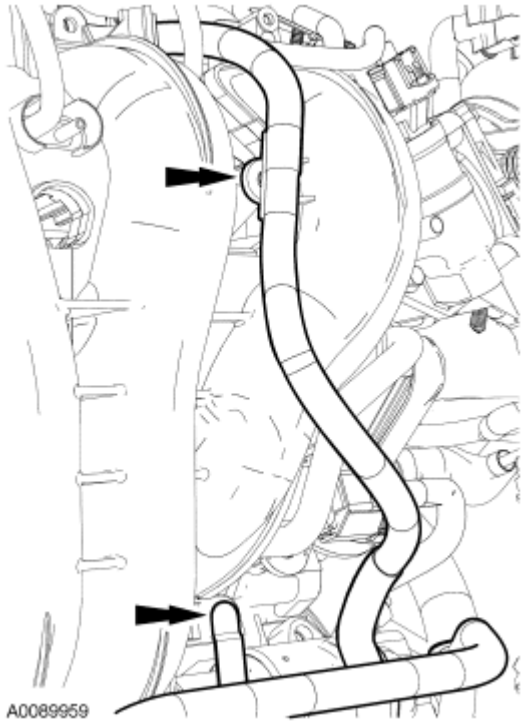


**Fig. 271: Locating Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

26. Disconnect the knock sensor (KS) and detach the 2 wiring harness retainers.

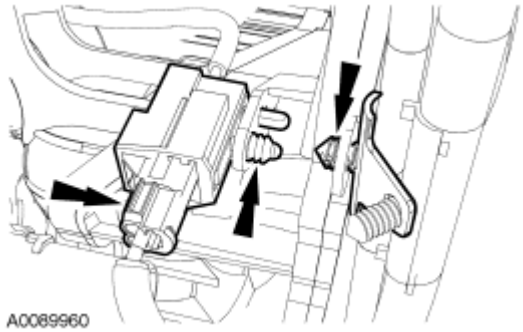


**Fig. 272: Locating Knock Sensor (KS) & Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

27. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

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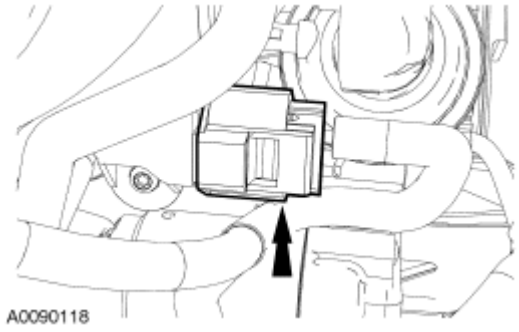


**Fig. 273: Locating Manifold Actual Pressure (MAP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

28. Disconnect the idle air control (IAC) motor electrical connector.

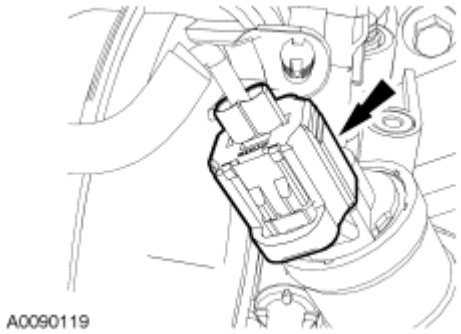


**Fig. 274: Locating Idle Air Control (IAC) Motor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

29. Disconnect the swirl control valve electrical connector.

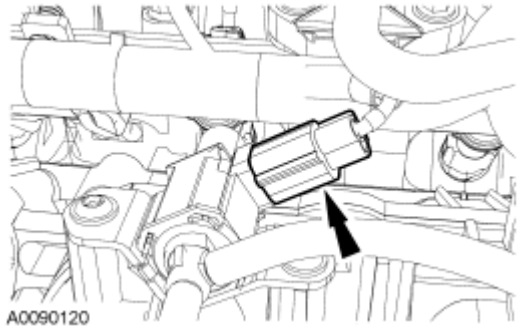


**Fig. 275: Locating Swirl Control Valve Electrical Connector**
**Courtesy of FORD MOTOR CO.**

30. Disconnect the fuel rail pressure and temperature sensor electrical connector and vacuum tube.

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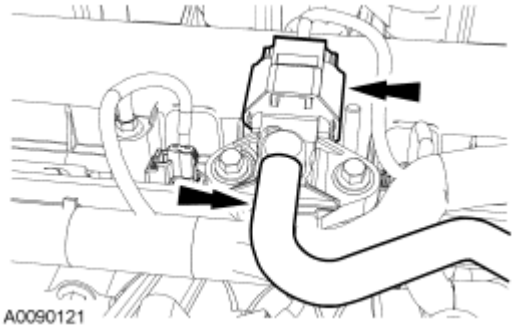


**Fig. 276: Locating Fuel Rail Pressure & Temperature Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

31. Disconnect the radio capacitor electrical connector.

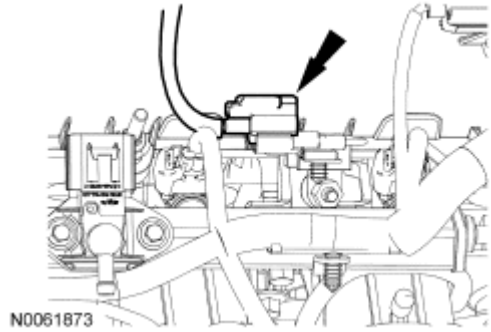


**Fig. 277: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

32. Disconnect the throttle position (TP) sensor electrical connector.

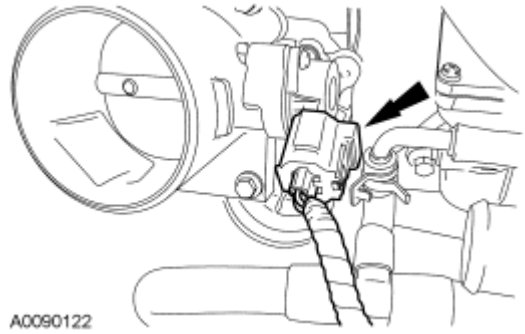


**Fig. 278: Locating Throttle Position (TP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

**NOTE: There are 2 different size bolts used. Mark the location of the bolts to make sure of installation in the correct locations.**

33. Remove the bolts and position the intake manifold aside.

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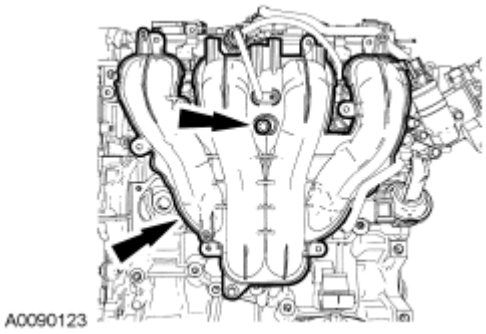


**Fig. 279: Locating Intake Manifold Gaskets & Intake Manifold**
**Courtesy of FORD MOTOR CO.**

34. Disconnect the positive crankcase ventilation (PCV) hose and remove the intake manifold.

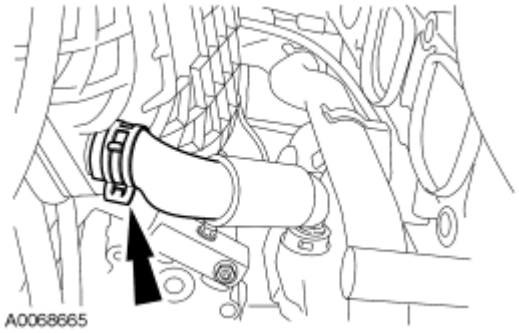


**Fig. 280: Locating Positive Crankcase Ventilation (PCV) Hose**
**Courtesy of FORD MOTOR CO.**

35. Remove the EGR tube.

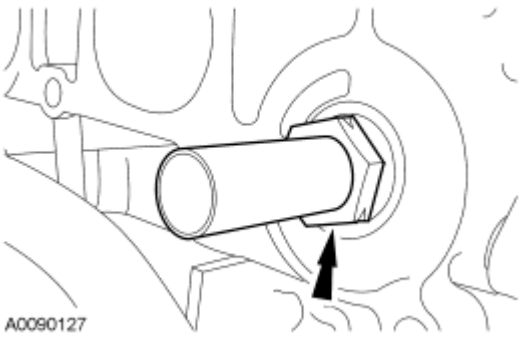


**Fig. 281: Locating Exhaust Gas Recirculation (EGR) Tube**
**Courtesy of FORD MOTOR CO.**

36. Disconnect the 4 fuel injector electrical connectors.
    - Detach the 2 wiring harness retainers.

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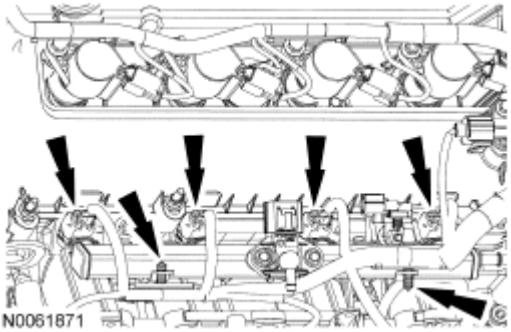


**Fig. 282: Identifying Connectors And Retainers**
**Courtesy of FORD MOTOR CO.**

37. Remove the nut and the radio capacitor.

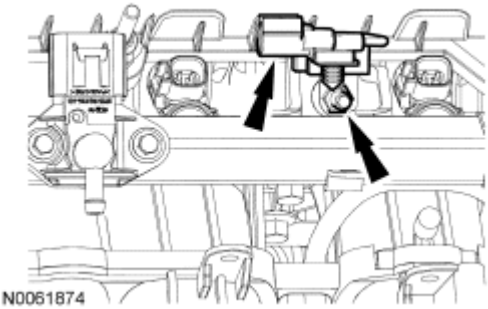


**Fig. 283: Identifying Nut And Radio Capacitor**
**Courtesy of FORD MOTOR CO.**

38. Remove the 2 stud bolts and the fuel rail with the fuel injectors.

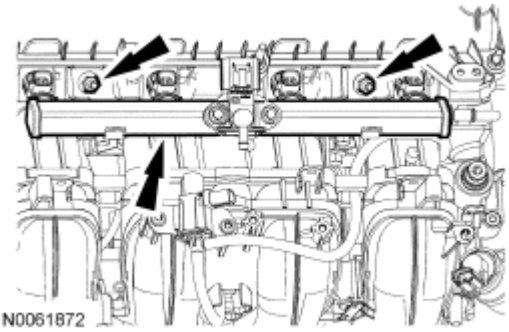


**Fig. 284: Identifying Bolts And Fuel Rail**
**Courtesy of FORD MOTOR CO.**

39. Detach the wiring harness retainer.

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**Fig. 285: Locating Wiring Harness Retainer**
**Courtesy of FORD MOTOR CO.**

40. Disconnect the EGR valve electrical connectors.
    - Detach the wiring harness retainer.

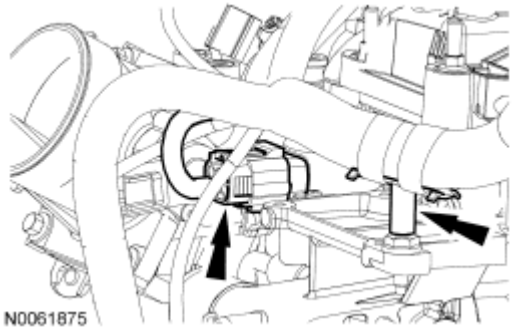


**Fig. 286: Identifying Connector And Retainer**
**Courtesy of FORD MOTOR CO.**

41. Disconnect the coil-on-plug and camshaft position (CMP) sensor electrical connectors.

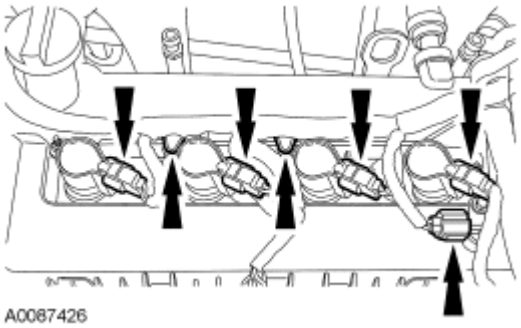


**Fig. 287: Locating Camshaft Position Sensor Electrical Connectors And Coil-On-Plug**
**Courtesy of FORD MOTOR CO.**

42. Detach the wiring harness retainer.

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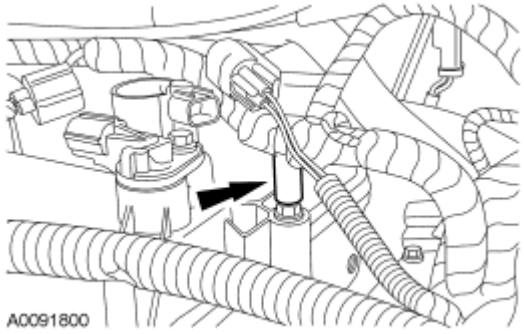


**Fig. 288: Locating Wiring Harness Retainer**
**Courtesy of FORD MOTOR CO.**

43. Position the rubber boot aside and disconnect the cylinder head temperature (CHT) sensor electrical connector.
    - Remove the wiring harness from the engine.

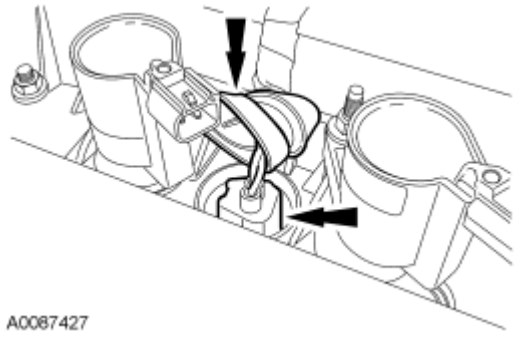


**Fig. 289: Locating Cylinder Head Temperature Sensor Electrical Connector And Rubber Boot**
**Courtesy of FORD MOTOR CO.**

44. Disconnect the coolant hose.

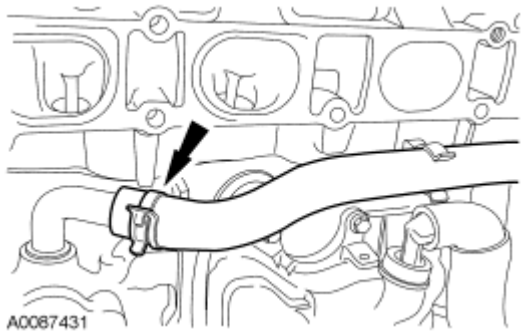


**Fig. 290: Locating Coolant Bypass Hose**
**Courtesy of FORD MOTOR CO.**

45. Disconnect and remove the coolant hose.

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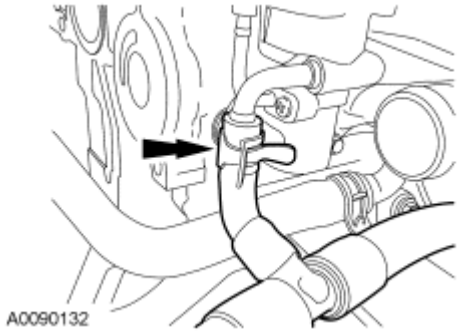


**Fig. 291: Locating Coolant Hose**
**Courtesy of FORD MOTOR CO.**

46. Disconnect and remove the coolant hoses.

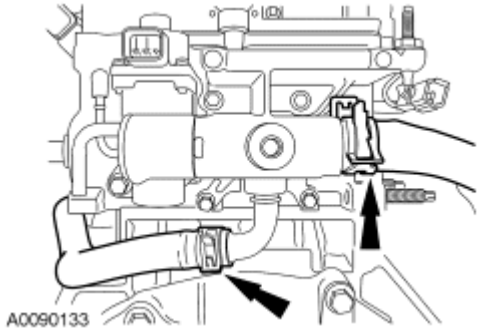


**Fig. 292: Locating Coolant Hoses**
**Courtesy of FORD MOTOR CO.**

47. Remove the bolt and the KS.

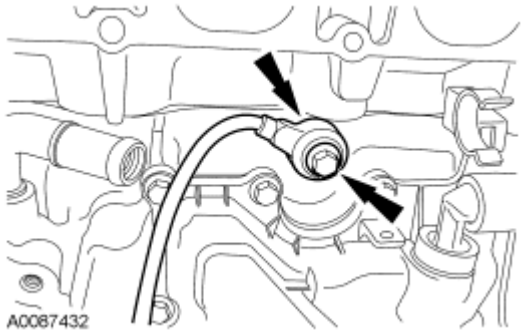


**Fig. 293: Locating Knock Sensor Bolt**
**Courtesy of FORD MOTOR CO.**

48. Remove the bolts and the crankcase vent oil separator.

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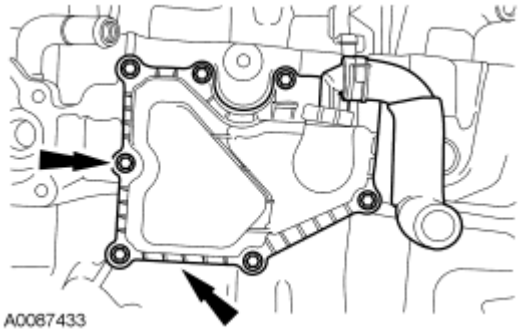


**Fig. 294: Locating Crankcase Vent Oil Separator And Bolts**
**Courtesy of FORD MOTOR CO.**

49. If equipped, remove the block heater.

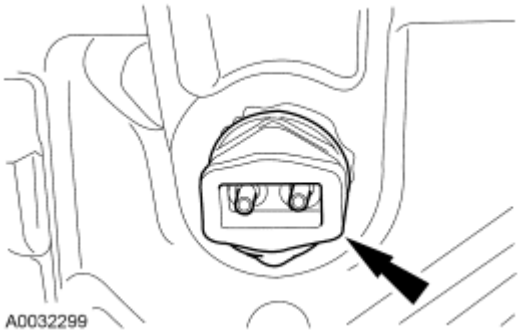


**Fig. 295: Locating Block Heater**
**Courtesy of FORD MOTOR CO.**

50. Remove the crankcase vent tube and the coil-on-plugs.

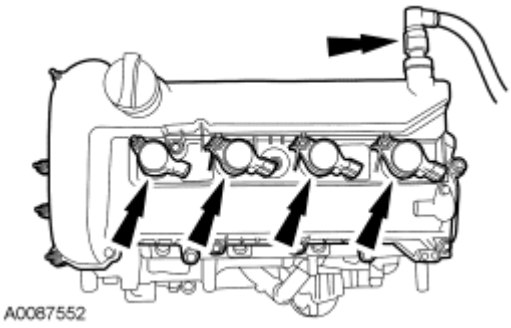


**Fig. 296: Locating Crankcase Vent Tube And Coil-On-Plugs**
**Courtesy of FORD MOTOR CO.**

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

51. Remove the spark plugs and the CHT sensor.

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- Discard the CHT.

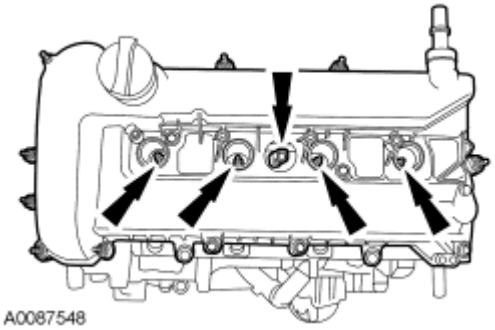


**Fig. 297: Locating Cylinder Head Temperature (CHT) Sensor & Spark Plugs**
**Courtesy of FORD MOTOR CO.**

52. Remove the bolts and the valve cover.

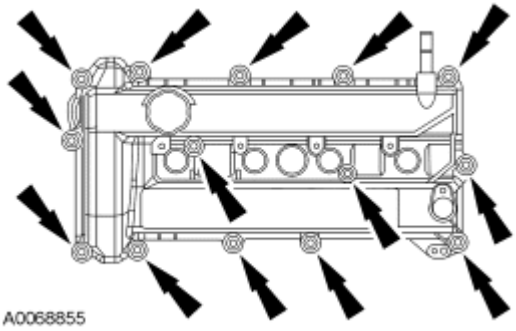


**Fig. 298: Locating Valve Cover Bolts**
**Courtesy of FORD MOTOR CO.**

**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.**

53. 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.

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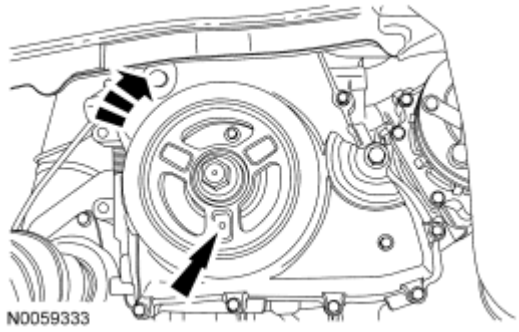


**Fig. 299: Turning Crankshaft Clockwise**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool 303-465 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 special tool cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.**

54. Install the special tool in the slots on the rear of both camshafts.

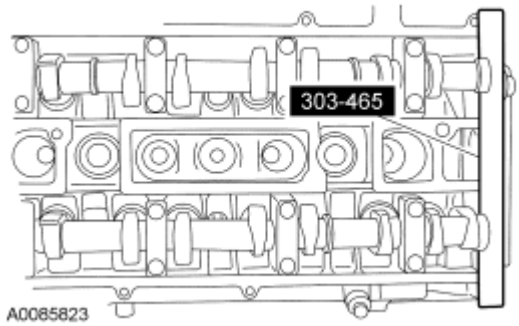


**Fig. 300: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

55. Remove the engine plug bolt.

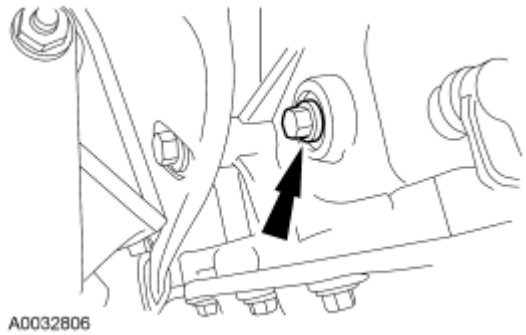


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**Fig. 301: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool 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 top dead center (TDC) position during disassembly.**

56. Install the special tool.

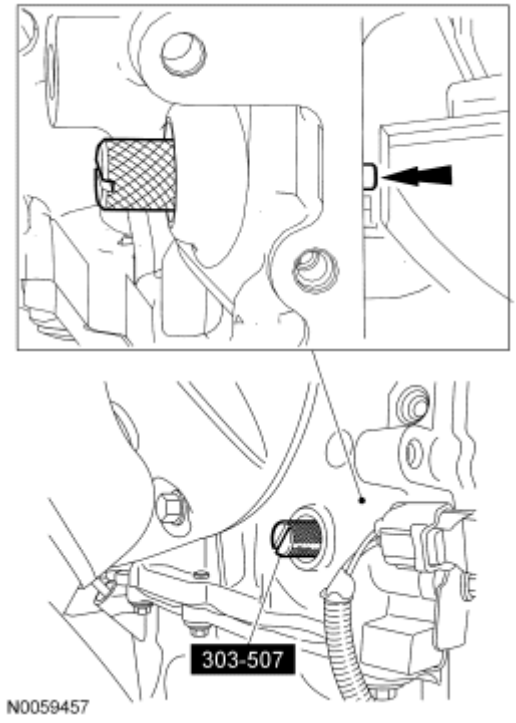


**Fig. 302: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

57. Assemble the special tools using 4 hardened washers in the locations shown.

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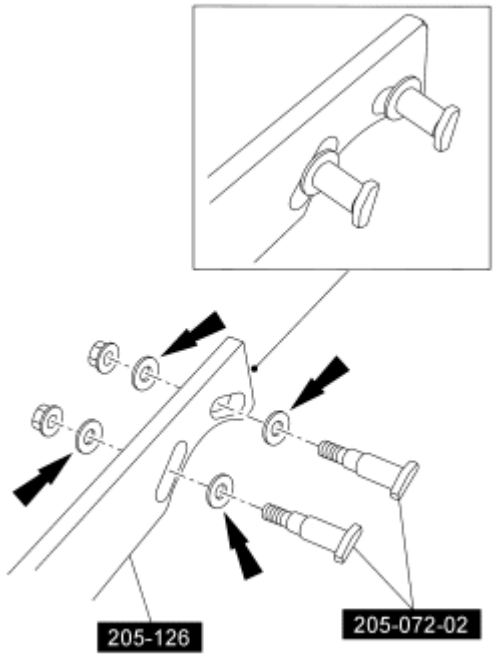


**Fig. 303: Assembling Special Tools (205-126 And 205-072-02) And Hardened Washers**
**Courtesy of FORD MOTOR CO.**

**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 special 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.**

58. Using the special tools and an air impact wrench, remove the crankshaft pulley.
    - Remove and discard the crankshaft pulley bolt and washer.
    - Remove the crankshaft pulley.
    - Remove the diamond washer and discard.

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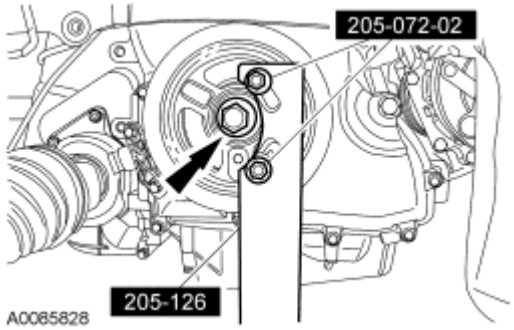


**Fig. 304: Using Special Tools (205-126 And 205-072-02)**
**Courtesy of FORD MOTOR CO.**

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

59. Using the special tool, remove the crankshaft front oil seal.

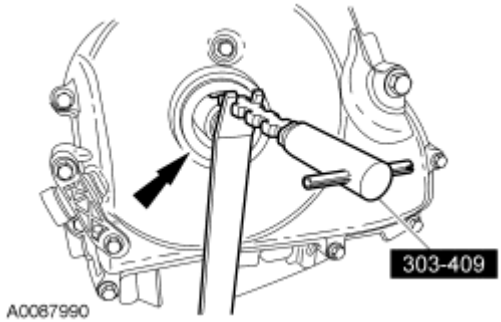


**Fig. 305: Identifying Special Tool (303-409) And Crankshaft Front Oil Seal**
**Courtesy of FORD MOTOR CO.**

**NOTE: Whenever the crankshaft position (CKP) sensor is removed, a new one must be installed using the alignment tool supplied with the new part.**

60. Remove and discard the CKP sensor.

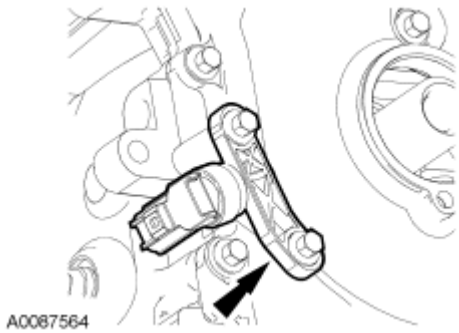


**Fig. 306: Locating CKP Sensor**

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**Courtesy of FORD MOTOR CO.**

61. Remove the bolts and the engine front cover.

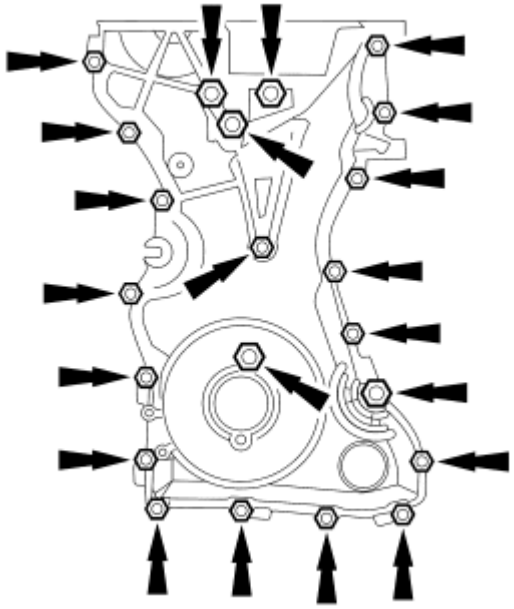


**Fig. 307: Locating Engine Front Cover Bolts**
**Courtesy of FORD MOTOR CO.**

62. Remove the timing chain tensioner.
    1. Compress the timing chain tensioner, and insert a paper clip into the hole to retain the tensioner.
    2. Remove the bolts and timing chain tensioner.

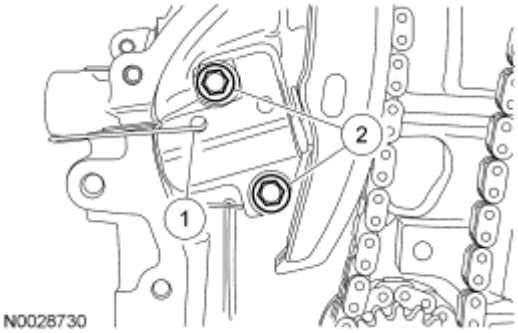


**Fig. 308: Locating Timing Chain Tensioner Bolt**
**Courtesy of FORD MOTOR CO.**

63. Remove the RH timing chain guide.

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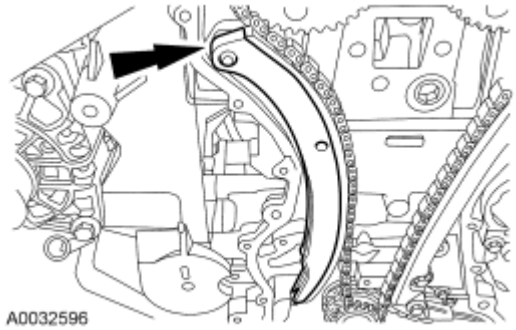


**Fig. 309: Locating RH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

64. Remove the timing chain.

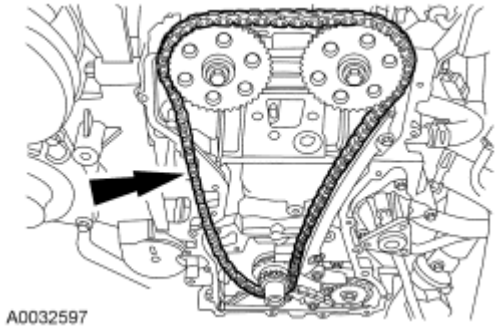


**Fig. 310: View Of Timing Chain**
**Courtesy of FORD MOTOR CO.**

65. Remove the bolts and the LH timing chain guide.

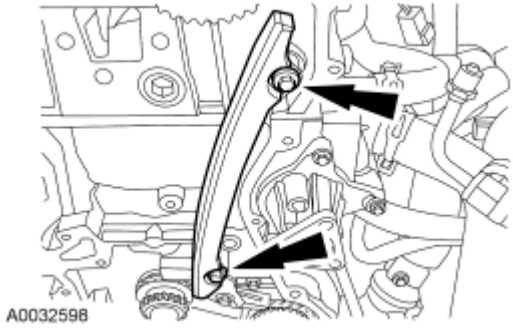


**Fig. 311: Identifying Bolts And LH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

**NOTE: Do not rely on the Camshaft Alignment Plate to prevent camshaft rotation. Damage to the tool or the camshaft can occur.**

66. Using the flats on the camshaft to prevent camshaft rotation, remove the bolts and the camshaft sprockets.

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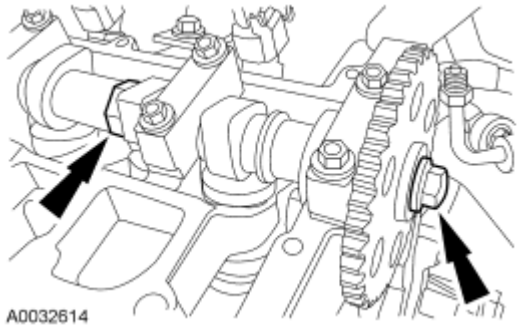


**Fig. 312: Locating Cam Holding Area And Sprocket Bolt**
**Courtesy of FORD MOTOR CO.**

67. Remove the oil pump drive chain tensioner.
    1. Release the tension on the tensioner spring.
    2. Remove the tensioner and the 2 shoulder bolts.

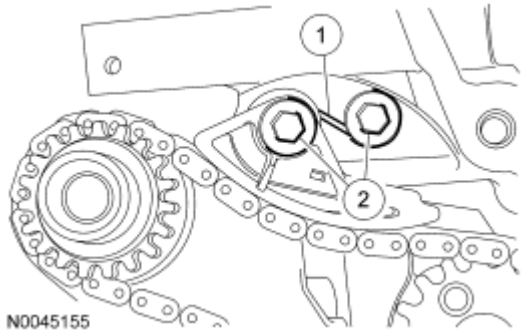


**Fig. 313: Locating Shoulder Bolts & Tensioner**
**Courtesy of FORD MOTOR CO.**

**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.**

68. Remove the oil pump chain and sprockets.
    1. Remove the bolt.
    2. Remove the chain and sprockets.

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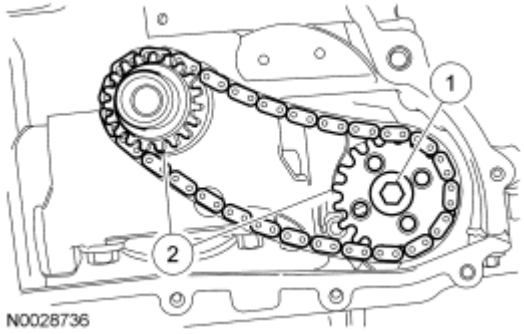


**Fig. 314: Identifying Chain & Sprockets**
**Courtesy of FORD MOTOR CO.**

69. Mark the position of the camshaft lobes on the No. 1 cylinder for assembly reference.

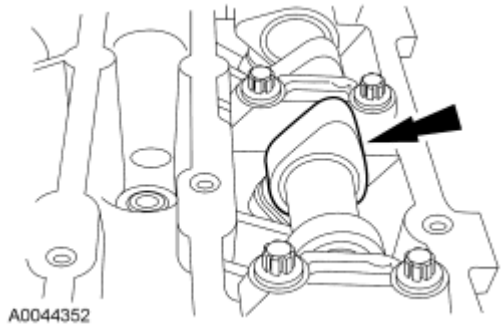


**Fig. 315: Locating Camshaft Lobe**
**Courtesy of FORD MOTOR CO.**

**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.**

70. 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.

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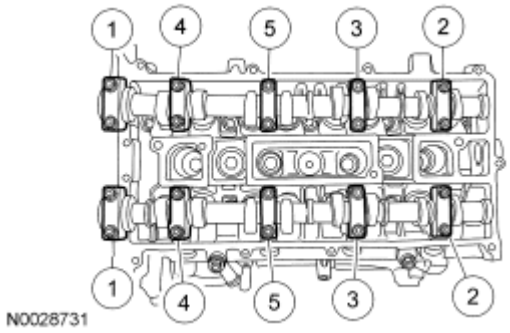


**Fig. 316: Identifying Loosening/Tightening Sequence Of Camshaft Bearing Bolts**
**Courtesy of FORD MOTOR CO.**

71. Remove the cylinder head.
    - Remove and discard the cylinder head bolts.
    - Remove the cylinder head.
    - Remove and discard the cylinder head gasket.

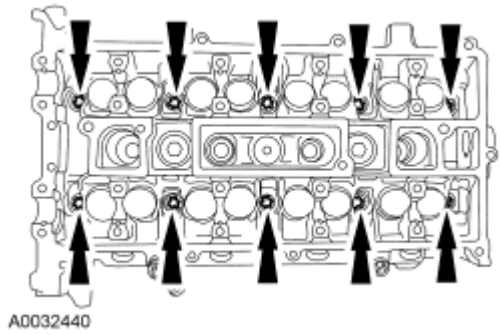


**Fig. 317: Locating Cylinder Head Bolts**
**Courtesy of FORD MOTOR CO.**

72. Remove the cylinder head alignment dowels.

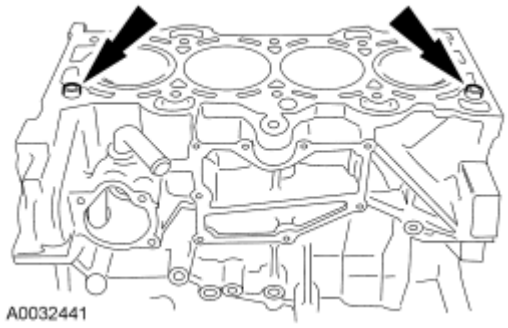


**Fig. 318: Identifying Cylinder Head Alignment Dowels**
**Courtesy of FORD MOTOR CO.**

73. Remove the bolts and the oil pan.

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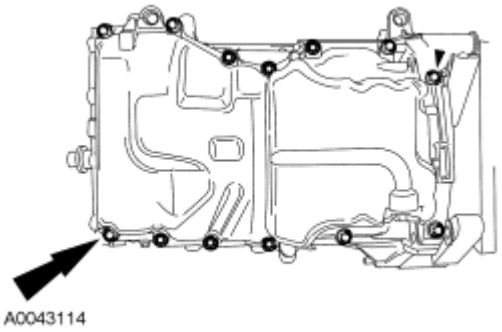


**Fig. 319: Locating Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

74. Remove the bolts and the rear crankshaft seal.

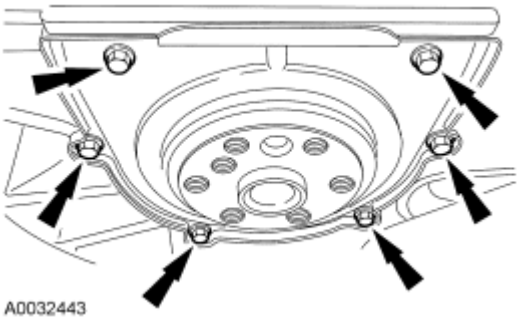


**Fig. 320: Locating Rear Crankshaft Seal Bolts**
**Courtesy of FORD MOTOR CO.**

75. Remove the bolts, oil pump pickup tube and gasket.

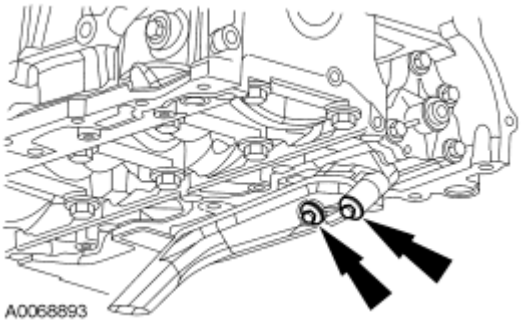


**Fig. 321: Locating Oil Pump Pickup Tube Bolts**
**Courtesy of FORD MOTOR CO.**

76. Remove the bolts and the oil pump.

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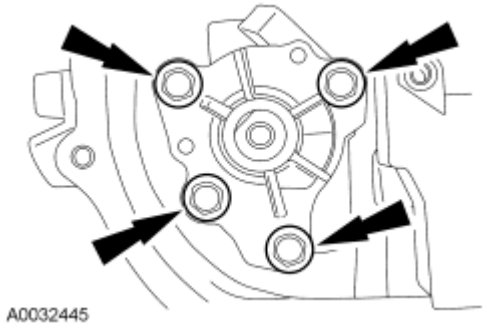
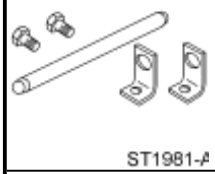
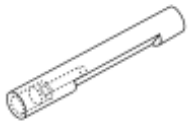



**Fig. 322: Locating Oil Pump Assembly & Bolts**
**Courtesy of FORD MOTOR CO.**

## DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

### CYLINDER HEAD

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST1981-A | Compressor, Valve Spring | 303-300 (T87C-6565-A) |
|  ST1907-A | Compressor, Valve Spring | 303-350 (T89P-6565-A) |
|  ST1902-A | Compressor, Valve Spring | 303-472 (T94P-6565-AH) |
|  ST1906-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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| | | |
|---|---|---|
|  ST1904-A | | |
|  ST1187-A | Slide Hammer | 307-005 (T59L-100-B) |

**Material**

| 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 |

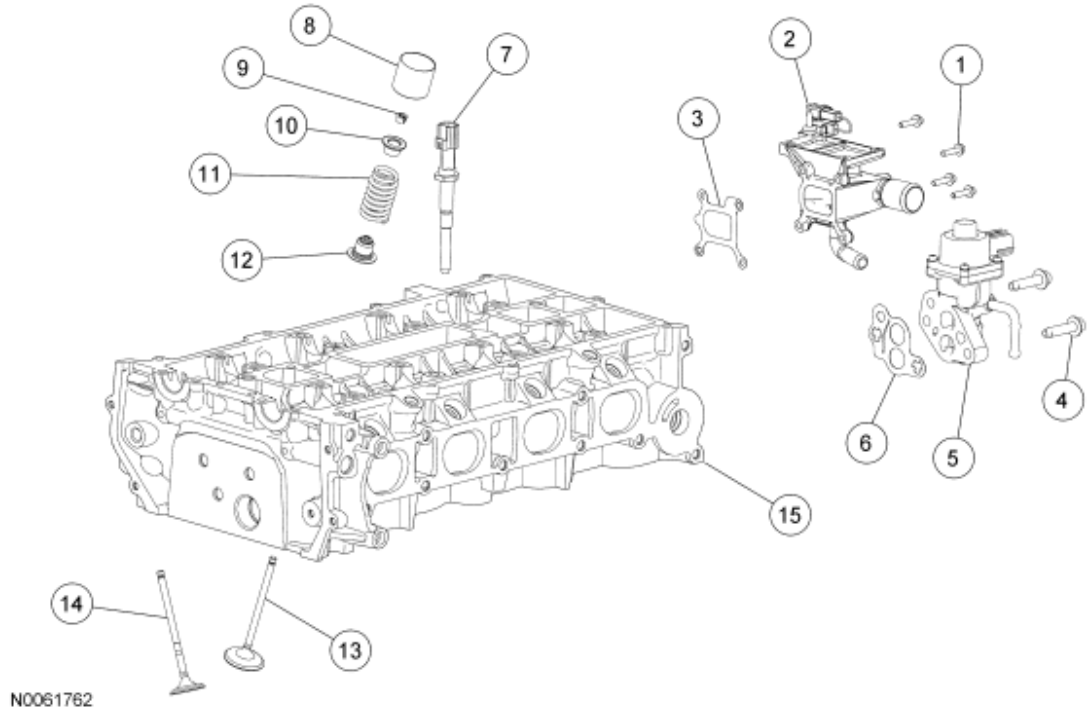


**Fig. 323: Identifying Cylinder head Components**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | W500015 | Coolant outlet bolt (4 required) |
| 2 | 8K556 | Coolant outlet |
| 3 | 8255 | Coolant outlet gasket |
| 4 | W500225 | EGR valve bolts (2 required) |
| 5 | 9D475 | EGR valve |
| 6 | 9D476 | EGR valve gasket |
| 7 | 6G004 | Cylinder head temperature (CHT) sensor |
| 8 | 6500 | Valve tappet (16 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 and discard the cylinder head temperature (CHT) sensor.

**CAUTION: 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.
5. Remove the valve tappets.

**NOTE: Use a small screwdriver and grease to remove the valve collets.**

6. Using the special tools, compress the valve springs and remove the valve collets, valve spring retainers and the valve springs.

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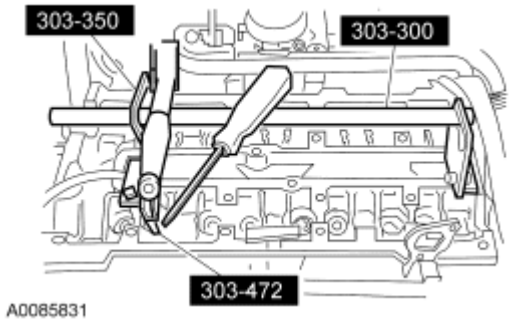


**Fig. 324: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

7. Inspect the components, if necessary. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
8. Remove the valves.
9. Using the special tools, remove and discard the valve seals.

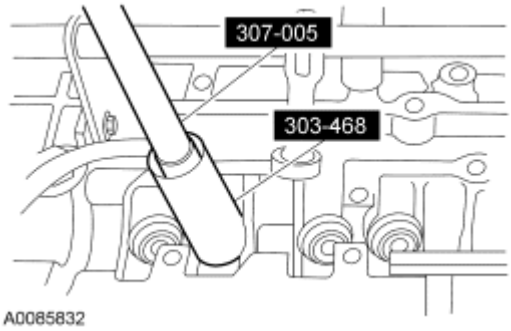


**Fig. 325: Removing Valve Seal Using Special Tools (307-005, 303-468)**
**Courtesy of FORD MOTOR CO.**

10. Inspect the valves. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article. 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.**

2. Using the special tool, install the valve seals.

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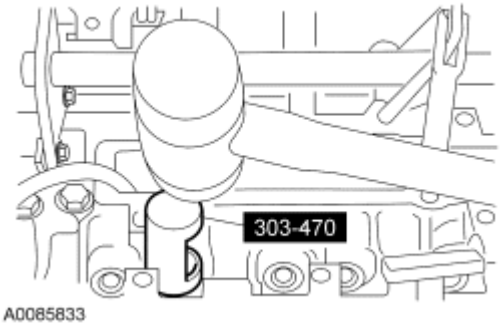


**Fig. 326: Installing Valve Seal Using Special Tool (303-470)**
**Courtesy of FORD MOTOR CO.**

**NOTE: Check the seating of the valve collets.**

3. Using the special tools, install the valve springs.
   - Insert the valve springs and the valve spring retainers.
   - Compress the valve springs and install the valve collets, using grease and a small screwdriver.

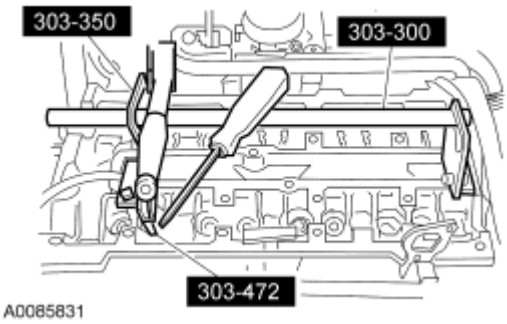


**Fig. 327: Identifying Special Tools (303-300, 303-350, 303-472)**
**Courtesy of FORD MOTOR CO.**

**NOTE: Coat the valve tappets with clean engine oil.**

4. Install the valve tappets.

**CAUTION: Only use hand tools when removing or installing the spark plugs or damage can occur to the cylinder head or spark plug.**

5. Install the spark plugs.
   - Tighten to 12 Nm (9 lb-ft).
6. Install a new CHT sensor.
   - Tighten to 12 Nm (9 lb-ft).
7. Install the EGR valve, using a new gasket.

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- Tighten to 20 Nm (15 lb-ft).

8. Using a new gasket, install the coolant outlet and bolts.
   - Tighten to 10 Nm (89 lb-in).

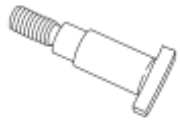
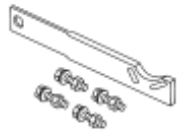
# ASSEMBLY

### ENGINE BLOCK

For engine block, crankshaft and piston assembly installation procedures, refer to **ENGINE BLOCK - 2.3L** .

### ENGINE (EXCEPT BLOCK)

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
|  ST2639-A | Adapter for 205-126 | (205-072-02) |
|  ST1751-A | Aligner, Clutch Disc | 308-006 (T71P-7137-H) |
|  ST2645-A | Alignment Plate, Camshaft | 303-465 (T94P-6256-CH) |
|  ST1341-A | Heavy Duty Floor Crane | 014-00071 or equivalent |
|  ST2647-A | Holding Fixture, Drive Pinion Flange | 205-126 (T78P-4851-A) |
| | Installer, Crankshaft Rear Main Oil Seal | 303-328 (T88P-6701-B1) |

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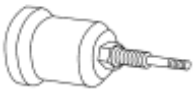
| | | |
|---|---|---|
|  ST1506-A | | |
|  ST1917-A | Installer, Front Oil Seal | 303-096 (T74P-6150-A) |
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST2638-A | Timing Peg, Crankshaft | 303-507 |

**Material**

| Item | Specification |
|---|---|
| High Temperature 4x4 Front Axle and Wheel Bearing Grease<br>E8TZ-19590-A | WSS-M1C267-A1 |
| Motorcraft Metal Surface Cleaner<br>ZC-21 | WSE-M5B392-A |
| Motorcraft Metal Surface Prep ZC-31 | - |
| Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only)<br>VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color) | WSS-M97B51-A1 |
| Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil<br>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 | WSE-M4G323-A4 |

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| | |
|---|---|
| TA-30 | |
| Silicone Gasket Remover ZC-30 | - |

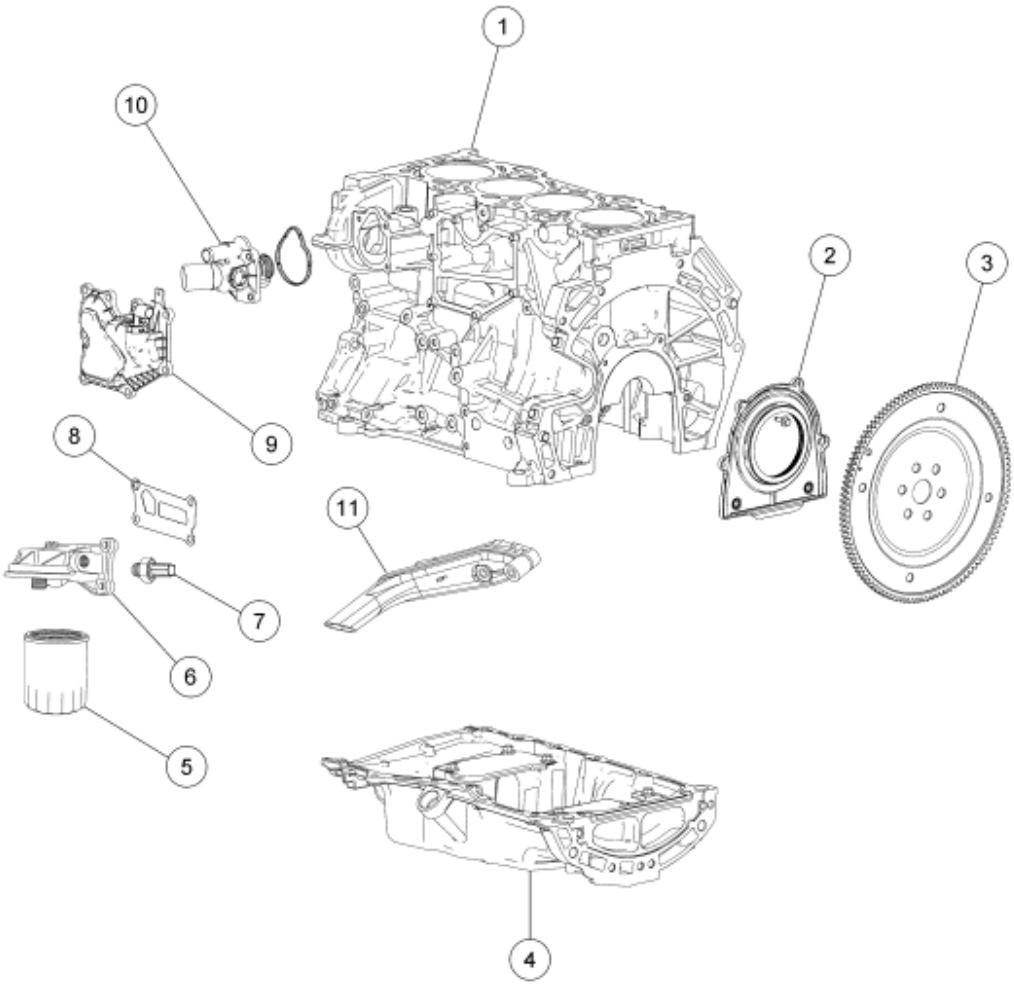


**Fig. 328: Lower Engine Block**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 6010 | Cylinder block |
| 2 | 6K318 | Crankshaft rear oil seal and retainer |
| 3 | 6477 | Flywheel |
| 4 | 6675 | Oil pan |
| 5 | 6714 | Oil filter |
| 6 | 6884 | Oil filter adapter |
| | | |

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| | | |
|---|---|---|
| 7 | 9278 | Engine oil pressure (EOP) switch |
| 8 | 6A636 | Oil filter adapter gasket |
| 9 | 6A785 | Crankcase vent oil separator |
| 10 | 8575 | Thermostat assembly |
| 11 | 6622 | Oil pump screen and pickup tube |

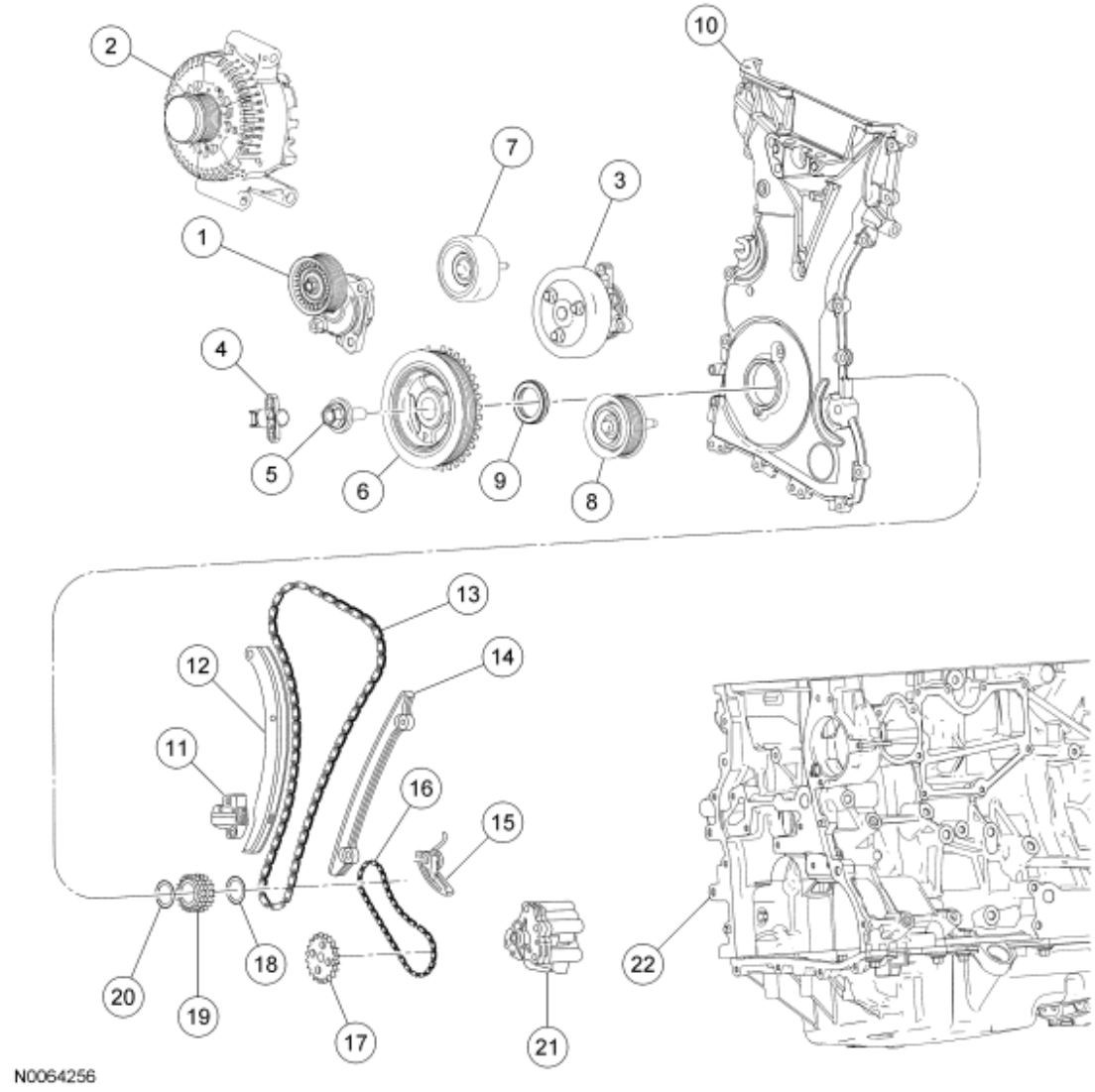


**Fig. 329: Front Engine Block**
**Courtesy of FORD MOTOR CO.**

| 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 |
| | | |

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| | | |
|---|---|---|
| 5 | 6K340 | Crankshaft pulley bolt |
| 6 | 6316 | Crankshaft pulley |
| 7 | 6C348 | Idler pulley |
| 8 | 6C348 | Idler pulley (without A/C only) |
| 9 | 6700 | Crankshaft front seal |
| 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 |
| 29 | 6306 | Crankshaft sprocket |
| 20 | 6378 | Diamond washer |
| 21 | 6600 | Oil pump |
| 22 | 6010 | Cylinder block |

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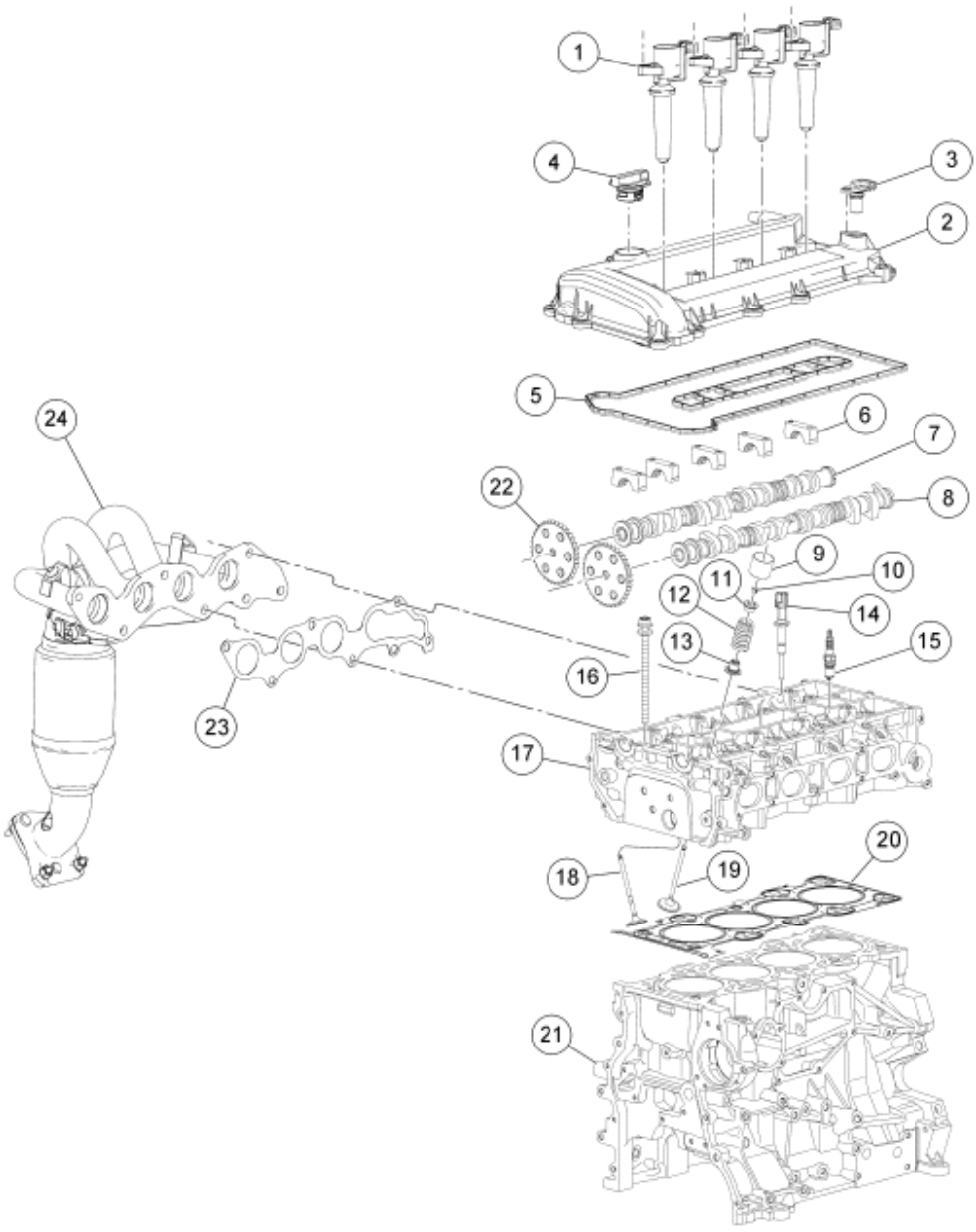


N0061765

**Fig. 330: Cylinder Head**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 12A366 | Coil-on-plug assembly (4 required) |
| 2 | 6M293 | Valve cover |
| 3 | 12K073 | Camshaft position (CMP) sensor |


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| | | |
|---|---|---|
| 4 | 6766 | Oil filler cap |
| 5 | 6M293 | Valve cover gasket |
| 6 | 6A284 | Camshaft bearing caps |
| 7 | 6A272 | Camshaft (exhaust) |
| 8 | 6A271 | Camshaft (intake) |
| 9 | 6500 | Valve tappet (16 required) |
| 10 | 6518 | Valve collet (16 required) |
| 11 | 6514 | Valve spring retainer (16 required) |
| 12 | 6513 | Valve spring (16 required) |
| 13 | 6A517 | Valve stem seal (16 required) |
| 14 | 6G004 | Cylinder head temperature (CHT) sensor |
| 15 | 12405 | Spark plug (4 required) |
| 16 | 6065 | Cylinder head bolt (10 required) |
| 17 | 6049 | Cylinder head |
| 18 | 6505 | Exhaust valve (8 required) |
| 19 | 6507 | Intake valve (8 required) |
| 20 | 6051 | Head gasket |
| 21 | 6010 | Cylinder block |
| 22 | 6C251 | Camshaft sprocket (2 required) |
| 23 | 9448 | Catalytic converter gasket |
| 24 | 5E211 | Catalytic converter |

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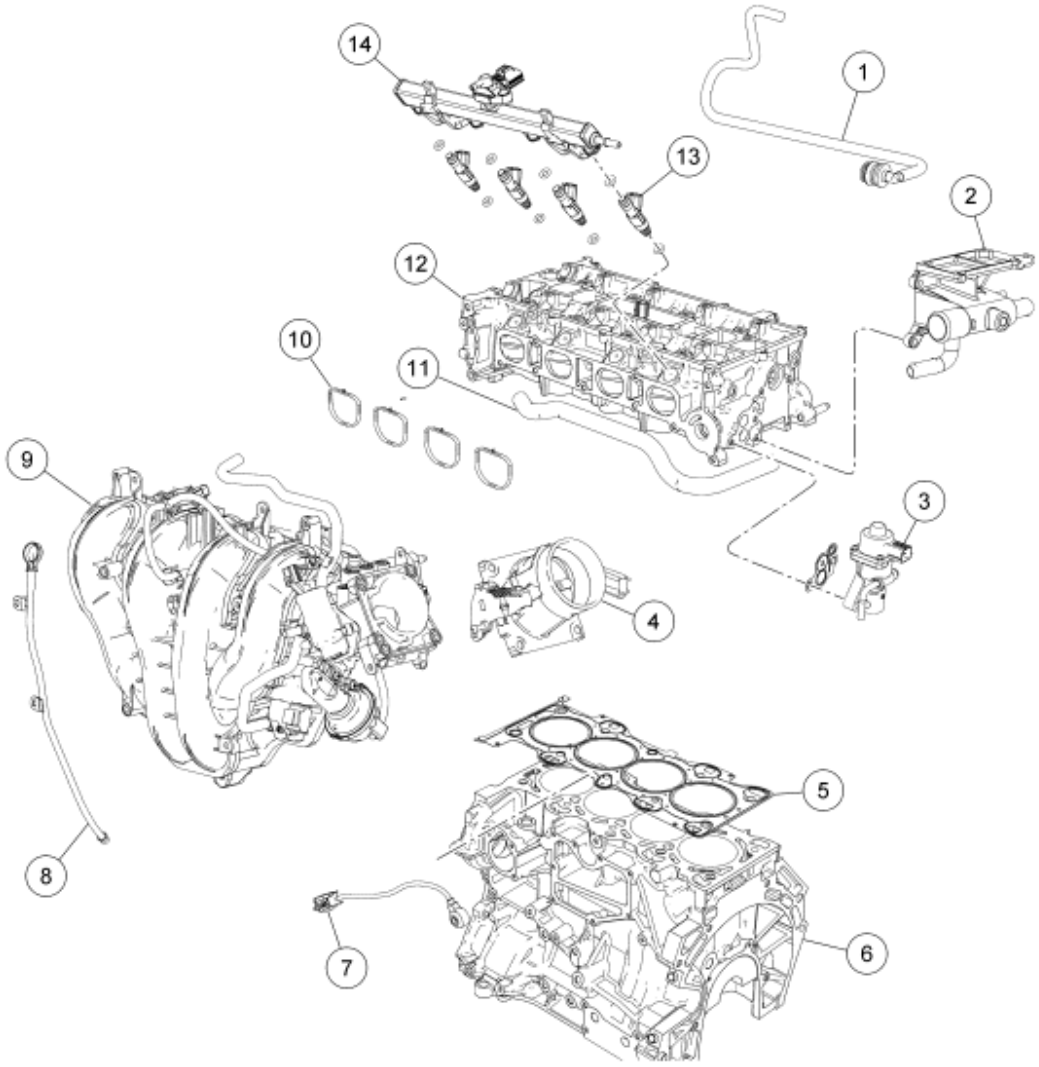


**Fig. 331: Intake Manifold**
**Courtesy of FORD MOTOR CO.**

| Item | Part Number | Description |
|---|---|---|
| 1 | 9288 | Fuel supply tube |
| 2 | 8K556 | Coolant outlet |
| 3 | 9D475 | EGR valve |
| 4 | 9E926 | Throttle body |
| 5 | 6051 | Cylinder head gasket |
| 6 | 6010 | Cylinder block |
| 7 | 12A699 | Knock sensor (KS) |
| 8 | 6754 | Oil level indicator and tube assembly |
| 9 | 9424 | Intake manifold |
| 10 | 9439 | Intake manifold gasket |
| | | |

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| | | |
|---|---|---|
| 11 | 8A582 | Coolant hose |
| 12 | 6049 | Cylinder head |
| 13 | 9F593 | Fuel injector (4 required) |
| 14 | 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 you loosen the pulley bolt. 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. 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.**

**All vehicles**

**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.**

1. Turn the crankshaft clockwise to position the No. 1 piston at top dead center (TDC).
2. Remove the engine plug bolt.

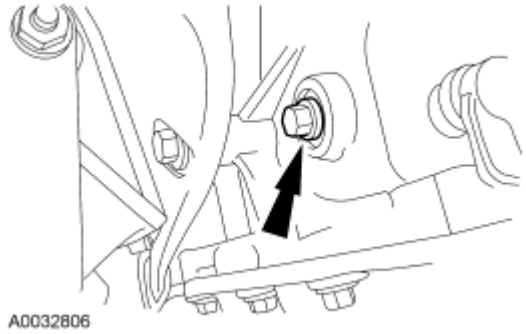


**Fig. 332: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool will contact the crankshaft and prevent it from turning past top dead center (TDC). However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC**

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**position until the timing drive components and crankshaft pulley are installed.**

3. Install the special tool.

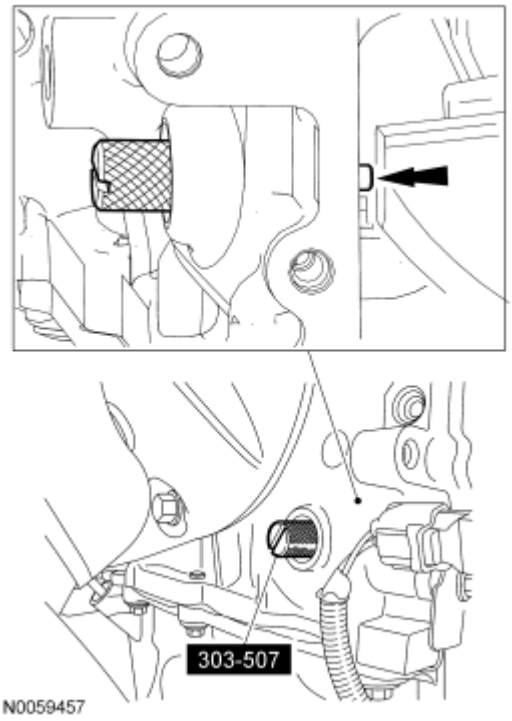


**Fig. 333: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

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

4. 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 (15 lb-ft).

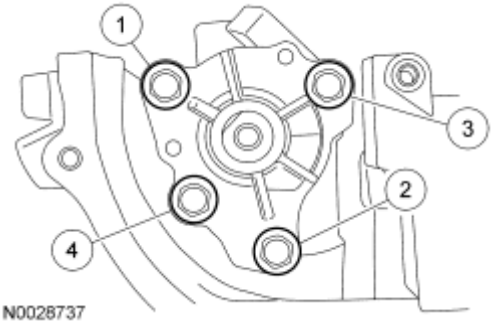


**Fig. 334: Identifying Tightening Sequence Of Oil Pump Assembly Bolts**

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**Courtesy of FORD MOTOR CO.**

5. Install a new oil pump pickup tube gasket and the pickup tube.
   - Tighten to 10 Nm (89 lb-in).

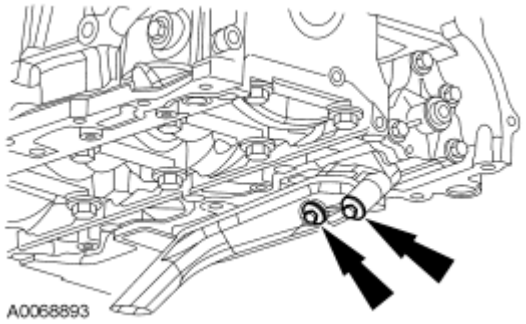


**Fig. 335: Locating Oil Pump Pickup Tube Bolts**
**Courtesy of FORD MOTOR CO.**

6. Using the special tool, install the crankshaft rear main oil seal.

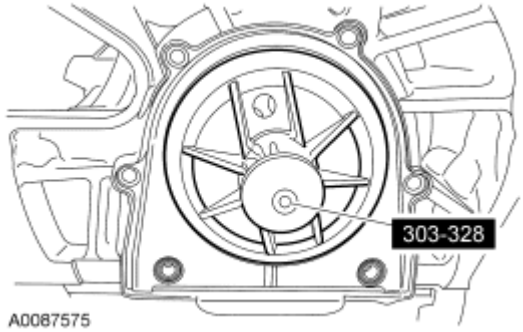


**Fig. 336: Positioning Crankshaft Rear Oil Seal Using Special Tool (303-328)**
**Courtesy of FORD MOTOR CO.**

7. Tighten the crankshaft rear oil seal retainer bolts in the sequence shown.
   - To install, tighten to 10 Nm (89 lb-in).

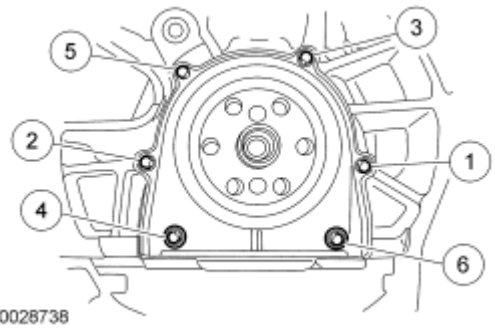


**Fig. 337: Identifying Tightening Sequence Of Crankshaft Rear Oil Seal Bolts**

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**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.**

8. 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 cleaner. 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.**

9. 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.

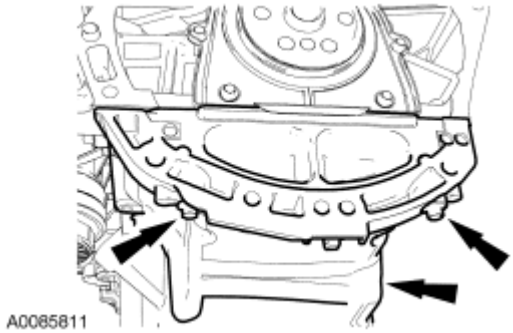


**Fig. 338: Identifying Rear Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

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

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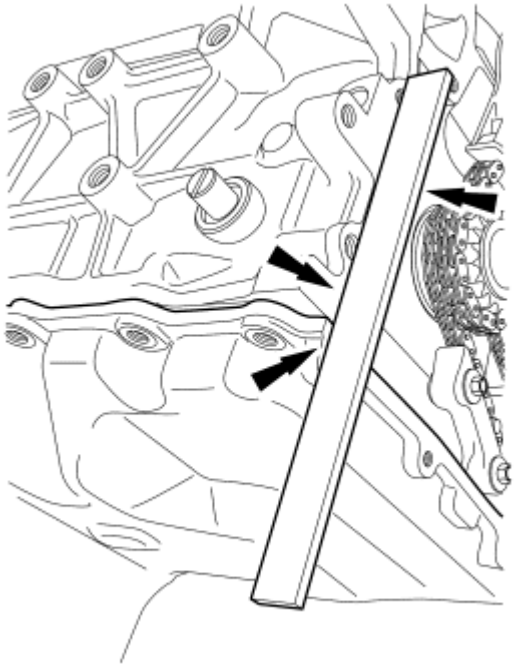


**Fig. 339: Aligning Front Surface Of The Oil Pan**
**Courtesy of FORD MOTOR CO.**

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

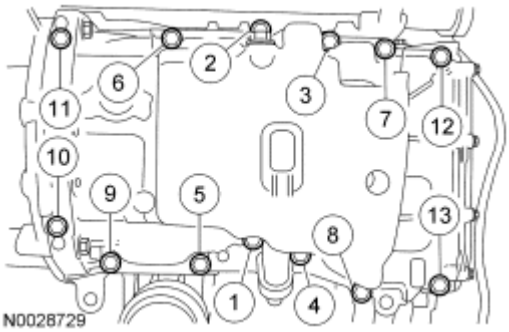


**Fig. 340: Identifying Tightening Sequence Of Oil Pan Bolts**
**Courtesy of FORD MOTOR CO.**

12. Install the cylinder head alignment dowels.
    - Dowels must be fully seated in the cylinder block.

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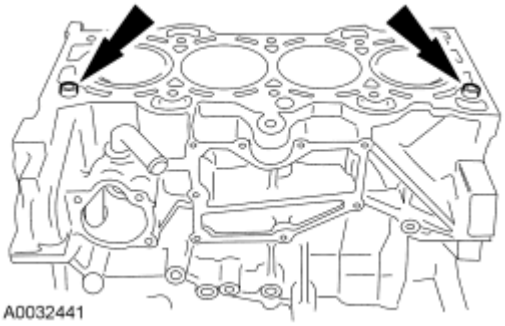


**Fig. 341: Identifying Cylinder Head Alignment Dowels**
**Courtesy of FORD MOTOR CO.**

**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.**

13. Clean the cylinder head-to-cylinder block mating surface of both the cylinder head and the cylinder block.
    1. Remove any large deposits of silicone or gasket material with a plastic scraper.
    2. Apply silicone gasket remover, following package directions, and allow to set for several minutes.
    3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
    4. Apply metal surface prep, following package directions, to remove any 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.
14. Apply silicone gasket and sealant to the locations shown.

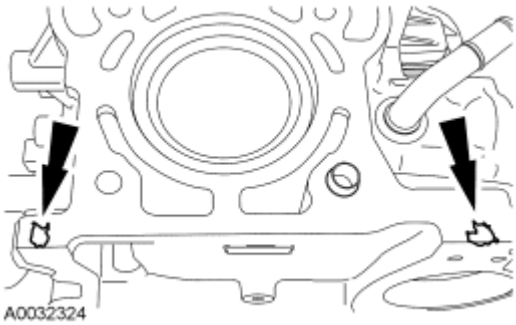


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**Fig. 342: Identifying Silicone Gasket And Sealant Location**
**Courtesy of FORD MOTOR CO.**

15. Install a new head gasket.

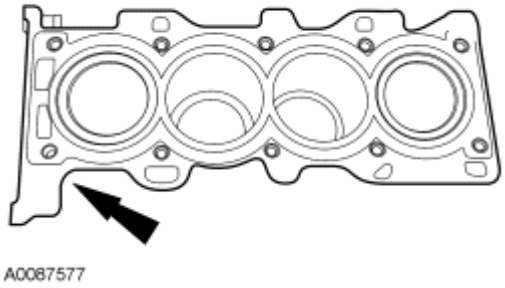


**Fig. 343: Identifying Head Gasket**
**Courtesy of FORD MOTOR CO.**

**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.**

16. 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 (11 lb-ft).
    - Stage 3: Tighten to 45 Nm (33 lb-ft).
    - Stage 4: Turn 90 degrees.
    - Stage 5: Turn an additional 90 degrees.

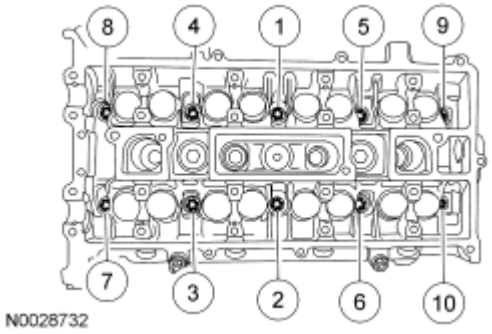


**Fig. 344: Identifying Tightening Sequence Of Cylinder Head Bolts**
**Courtesy of FORD MOTOR CO.**

**NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the**

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**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.**

17. 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 (12 lb-ft).

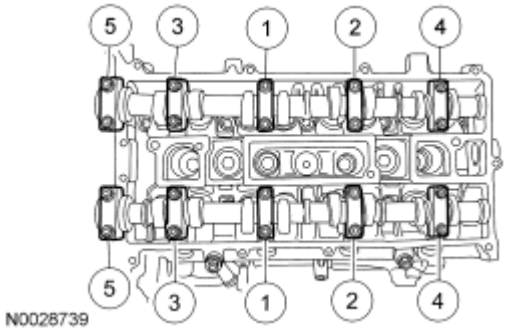


**Fig. 345: Identifying Camshaft Bearing Caps Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

**NOTE: Install a new crankshaft sprocket diamond washer on both sides of the crankshaft sprocket.**

18. 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.

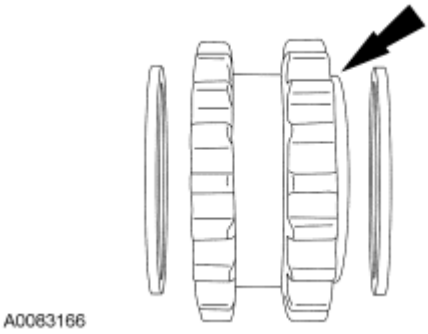


**Fig. 346: Locating Washers, Oil Pump Chain & Sprockets**
**Courtesy of FORD MOTOR CO.**

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19. Install the oil pump chain, sprocket and bolt.
    - Tighten to 25 Nm (18 lb-ft).

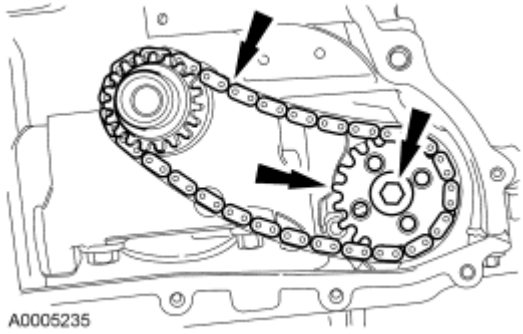


**Fig. 347: Locating Oil Pump Chain, Sprocket & Bolt**
**Courtesy of FORD MOTOR CO.**

20. Install the oil pump chain tensioner shoulder bolt.
    - Tighten to 10 Nm (89 lb-in).

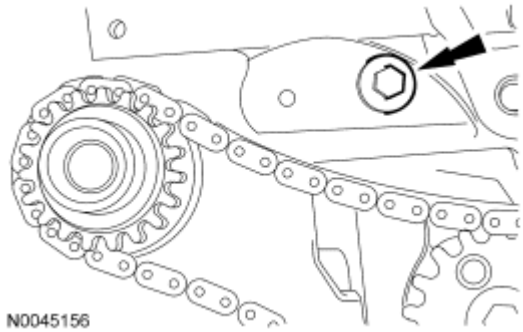


**Fig. 348: Locating Oil Pump Chain Drive Tensioner Shoulder Bolt**
**Courtesy of FORD MOTOR CO.**

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

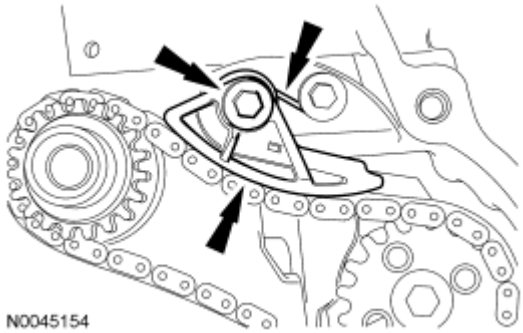


**Fig. 349: Locating Oil Pump Chain Tensioner And Bolt**
**Courtesy of FORD MOTOR CO.**

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**NOTE: The special tool 303-465 is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.**

22. Install the special tool in the slots on the rear of both camshafts.

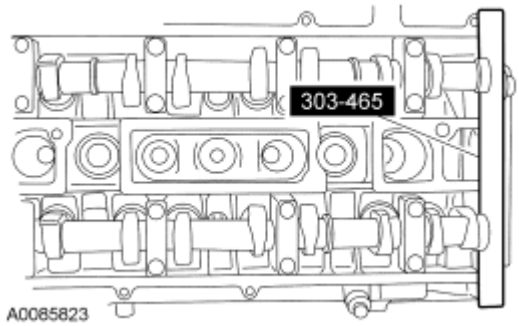


**Fig. 350: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

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

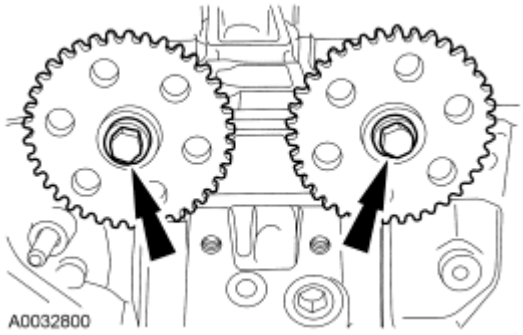


**Fig. 351: Locating Camshaft Sprocket Bolts**
**Courtesy of FORD MOTOR CO.**

24. Install the LH timing chain guide and the bolts.
    - Tighten to 10 Nm (89 lb-in).

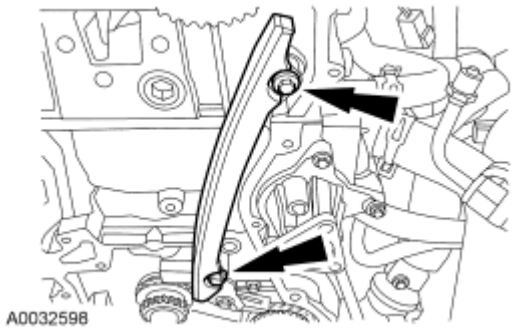


**Fig. 352: Identifying Bolts And LH Timing Chain Guide**

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**Courtesy of FORD MOTOR CO.**

25. Install the timing chain.

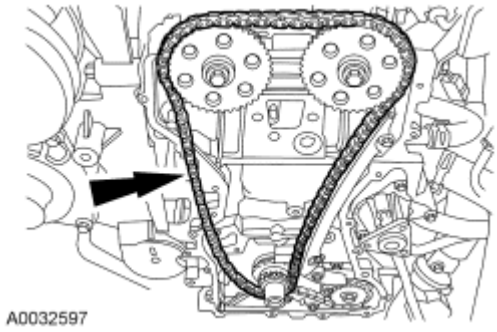


**Fig. 353: View Of Timing Chain**
**Courtesy of FORD MOTOR CO.**

26. Install the RH timing chain guide.

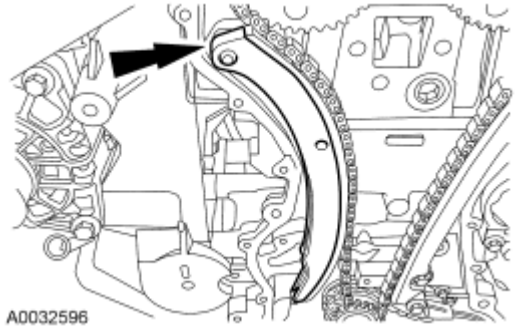


**Fig. 354: Locating RH Timing Chain Guide**
**Courtesy of FORD MOTOR CO.**

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

27. Using the edge of a vise, compress the timing chain tensioner plunger.

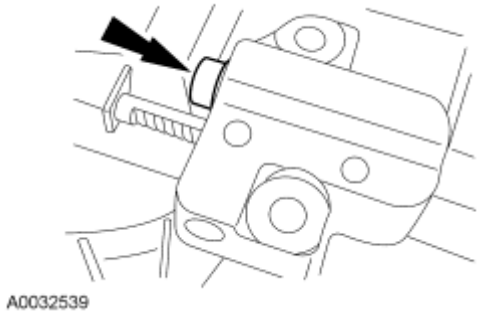


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**Fig. 355: Locating Timing Chain Tensioner Plunger**
**Courtesy of FORD MOTOR CO.**

28. Using a small pick, push back and hold the ratchet mechanism.

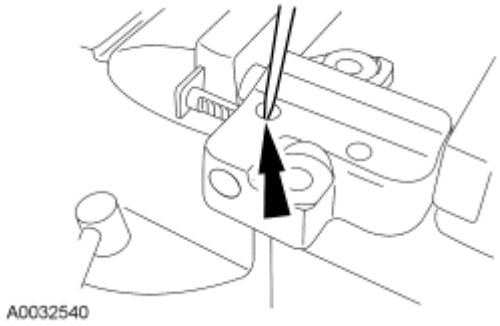


**Fig. 356: Using A Small Pick To Push Back And Hold Ratchet Mechanism**
**Courtesy of FORD MOTOR CO.**

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

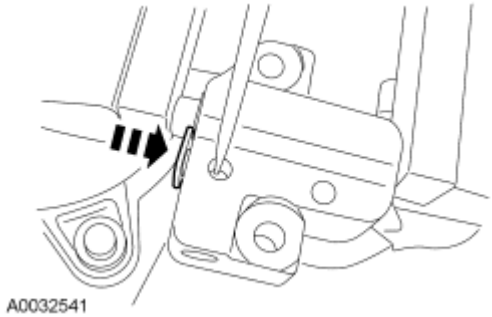


**Fig. 357: Pushing Ratchet Arm Back Into Tensioner Housing**
**Courtesy of FORD MOTOR CO.**

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

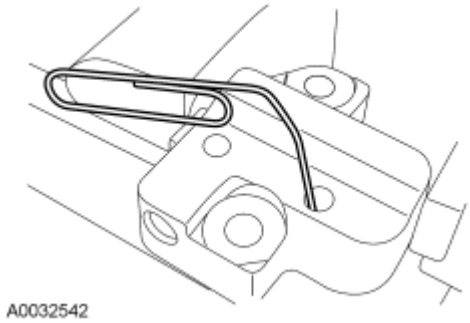


**Fig. 358: Installing Paper Clip Into Hole In Tensioner Housing To Hold Ratchet Assembly And Plunger**

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**Courtesy of FORD MOTOR CO.**

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

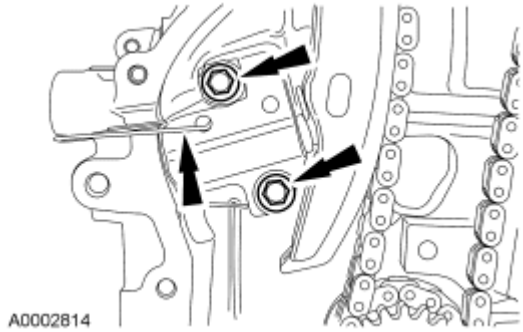


**Fig. 359: Locating Timing Chain Tensioner Bolts And Paper Clip**
**Courtesy of FORD MOTOR CO.**

**NOTE: The special tool 303-465 is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.**

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

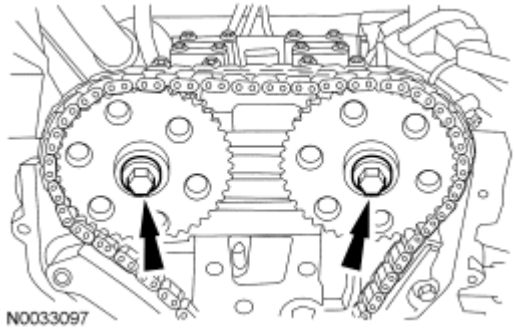


**Fig. 360: Locating Camshaft Sprocket Bolts**
**Courtesy of FORD MOTOR CO.**

**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.**

33. 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.**

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34. 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.

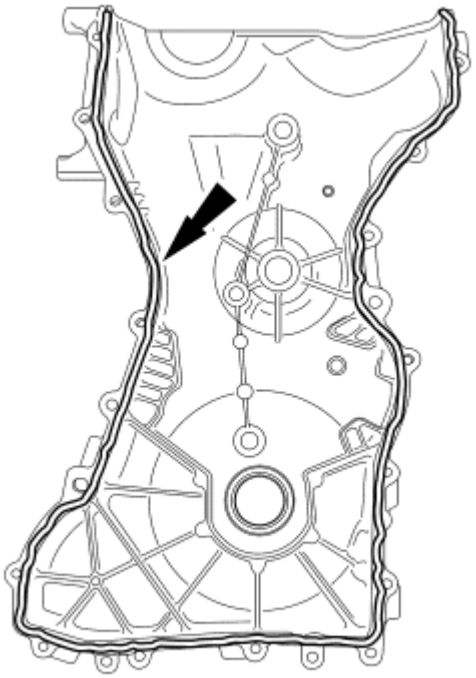


**Fig. 361: Locating Silicone Gasket**
**Courtesy of FORD MOTOR CO.**

35. 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).

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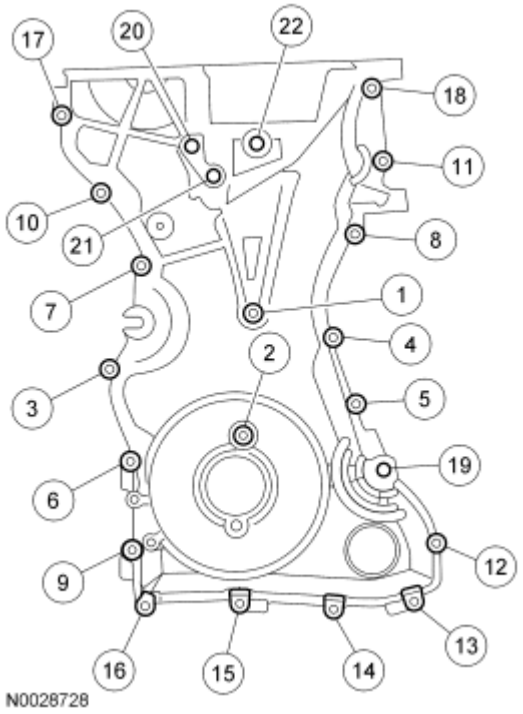


**Fig. 362: Identifying Engine Front Cover Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

**NOTE: Remove the through-bolt from the special tool.**

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

36. Using the special tool, install a new crankshaft front oil seal.

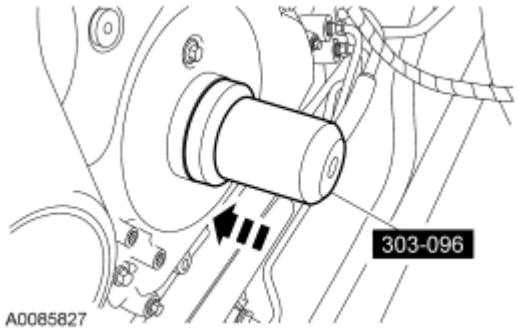


**Fig. 363: Installing Crankshaft Front Oil Seal Using Special Tool**
**Courtesy of FORD MOTOR CO.**

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

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

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

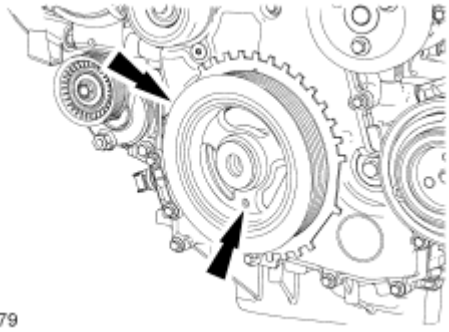


**Fig. 364: Identifying Hole In Crankshaft Pulley At 6 O'Clock Position**
**Courtesy of FORD MOTOR CO.**

**NOTE: Only hand-tighten the 6 mm (0.23 in) bolt or damage to the front cover can occur.**

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

38. Install a standard 6 mm (0.23 in) x 18 mm (0.7 in) bolt through the crankshaft pulley and thread it into the front cover.

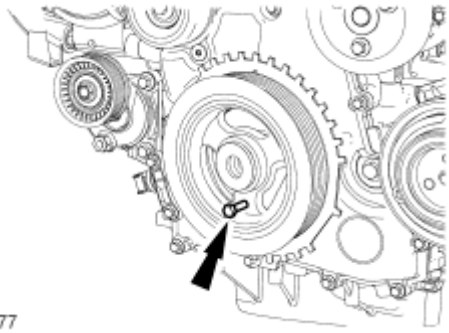


**Fig. 365: Identifying Standard 6mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

39. Assemble the special tools using 4 hardened washers in the locations shown.

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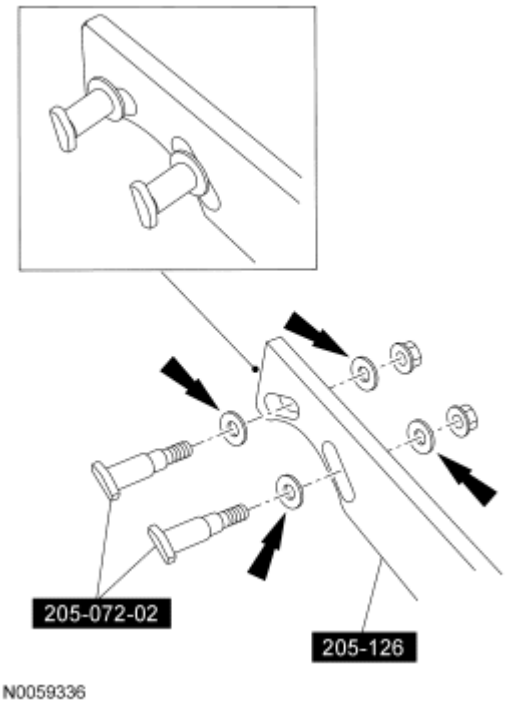


**Fig. 366: Assembling Special Tools (205-126 And 205-072-02)**
**Courtesy of FORD MOTOR CO.**

**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 special tool and the bolt should be installed using hand tools only.**

**NOTE: Do not reuse the crankshaft pulley bolt.**

40. Install a new crankshaft pulley bolt. Using the special tools 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).

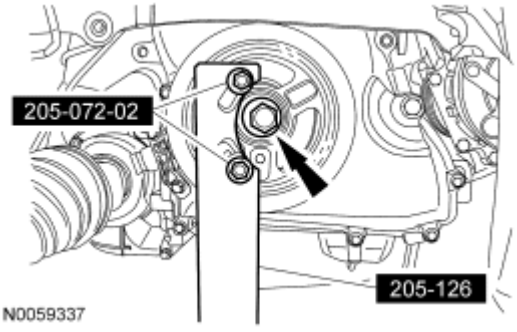


**Fig. 367: Using Special Tools (205-126 And 205-072-02)**

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**Courtesy of FORD MOTOR CO.**

41. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

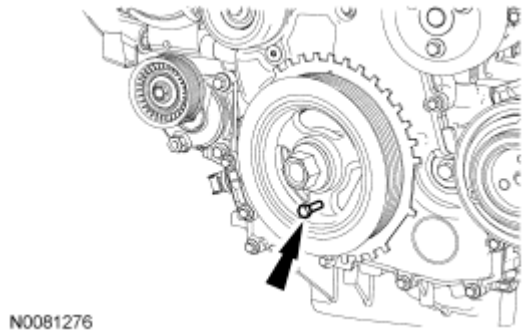


**Fig. 368: Identifying 6 mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

42. Remove the special tool.

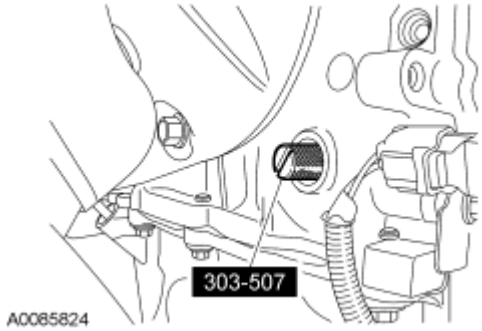


**Fig. 369: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

43. Remove the special tool.

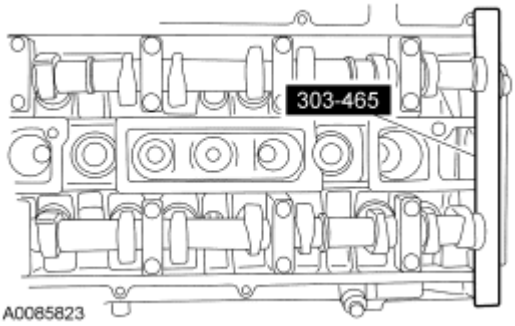


**Fig. 370: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

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

44. Turn the crankshaft clockwise 1 and 3/4 turns.
45. Install the special tool.

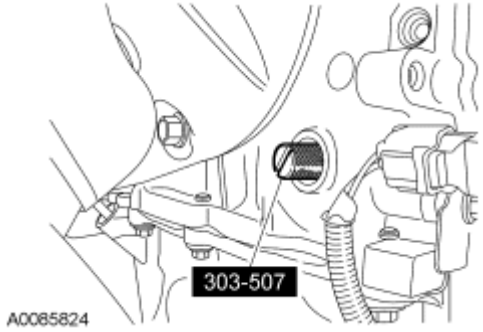


**Fig. 371: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

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

46. Turn the crankshaft clockwise until the crankshaft contacts the special tool.

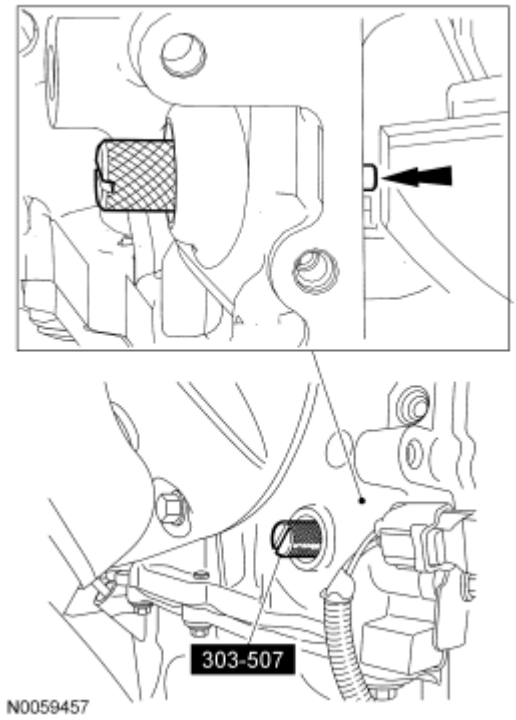


**Fig. 372: Identifying Special Tool (303-507)**
**Courtesy of FORD MOTOR CO.**

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

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47. Using the 6 mm (0.23 in) x 18 mm (0.7 in) bolt, check the position of the crankshaft pulley.
    - If it is not possible to install the bolt, the engine valve timing must be corrected.

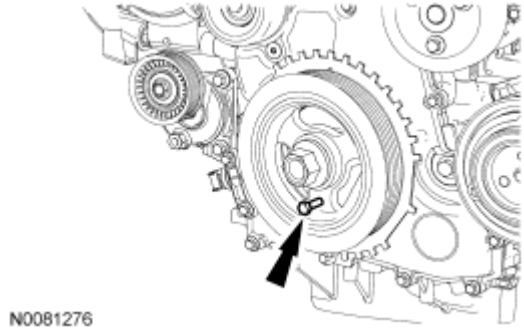


**Fig. 373: Identifying 6 mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

48. Install the special tool to check the position of the camshafts.
    - If it is not possible to install the special tool, the engine valve timing must be corrected.

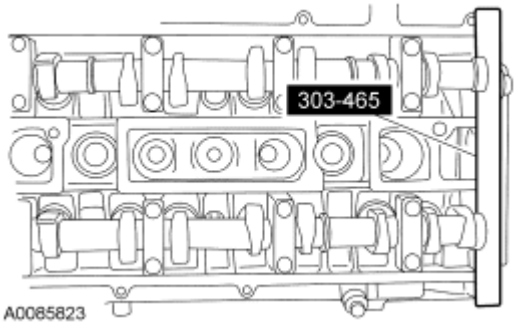


**Fig. 374: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

49. Remove the special tool.

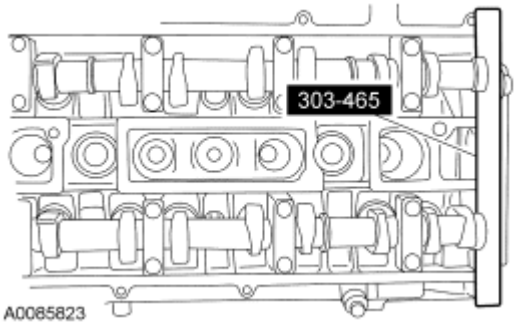


**Fig. 375: Identifying Special Camshaft Tool (303-465)**
**Courtesy of FORD MOTOR CO.**

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**NOTE: Whenever the crankshaft position (CKP) sensor is removed, a new one must be installed using the alignment tool supplied with the new part.**

50. Install a new CKP sensor and the 2 bolts.
    - Do not tighten the bolts at this time.

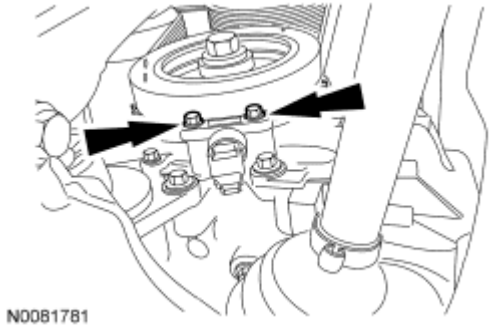


**Fig. 376: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

**NOTE: The CKP sensor alignment tool is supplied with the new sensor and is not available separately.**

51. Adjust the CKP sensor with the alignment tool.
    - Tighten the 2 CKP bolts to 7 Nm (62 lb-in).

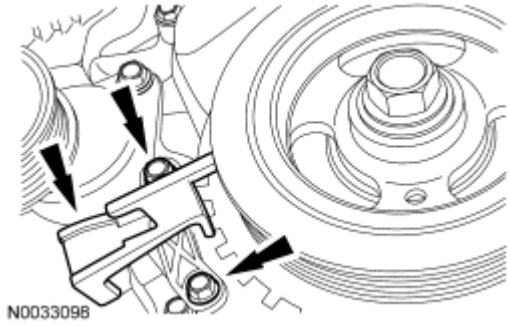


**Fig. 377: Locating CKP Sensor Bolts**
**Courtesy of FORD MOTOR CO.**

52. Remove the 6 mm (0.23 in) x 18 mm (0.7 in) bolt.

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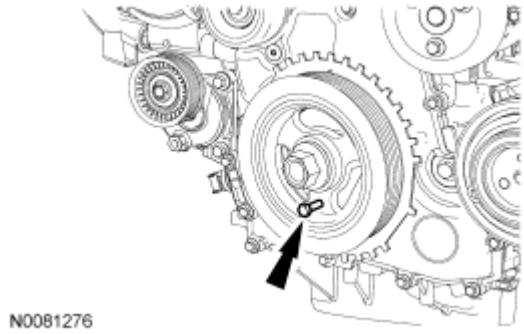


**Fig. 378: Identifying 6 mm x 18 mm Bolt**
**Courtesy of FORD MOTOR CO.**

53. Remove the special tool.

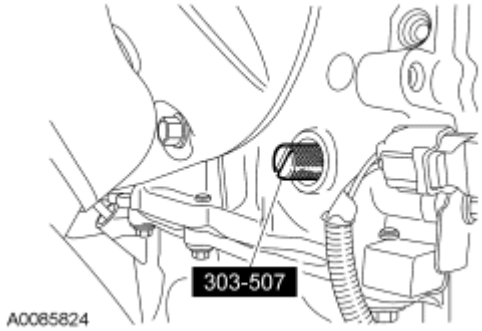


**Fig. 379: Identifying Special Tool**
**Courtesy of FORD MOTOR CO.**

54. Install the engine plug bolt.
    - Tighten to 20 Nm (15 lb-ft).

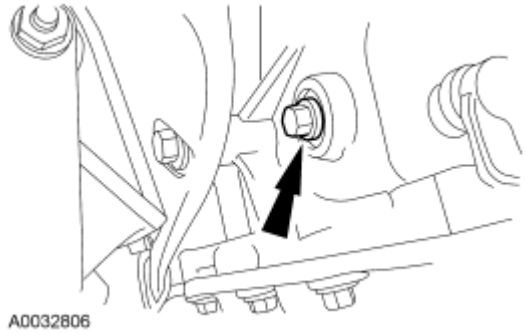


**Fig. 380: Locating Engine Plug Bolt**
**Courtesy of FORD MOTOR CO.**

**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.**

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55. Clean the valve cover gasket surface with metal surface cleaner.
56. Apply silicone gasket and sealant to the locations shown.

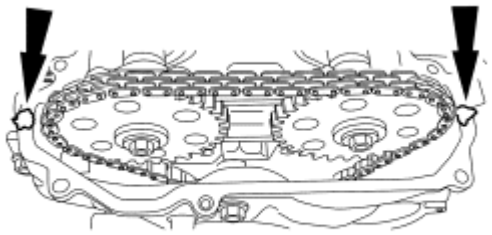

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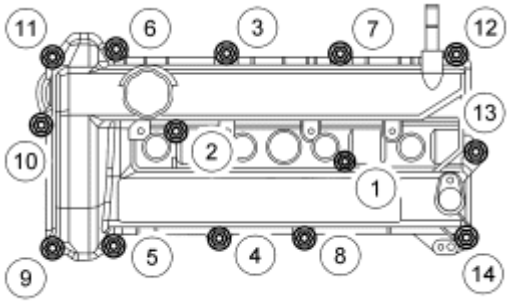
**Fig. 381: Applying Silicone Gasket And Sealant**
**Courtesy of FORD MOTOR CO.**

**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.**

57. Install the valve cover.
    - Tighten the bolts in the sequence shown to 10 Nm (89 lb-in).




A0100095

**Fig. 382: 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.**

58. Install a new cylinder head temperature (CHT) sensor and the spark plugs.
    - Tighten the CHT sensor to 12 Nm (9 lb-ft).
    - Tighten the spark plugs to 12 Nm (9 lb-ft).

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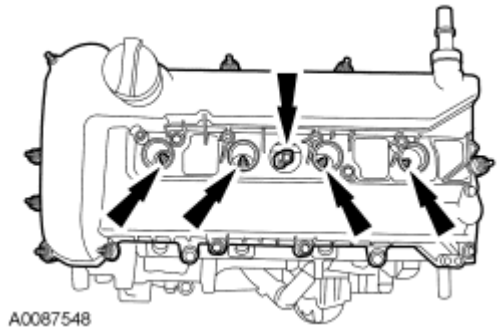


**Fig. 383: Locating Cylinder Head Temperature (CHT) Sensor & Spark Plugs**
**Courtesy of FORD MOTOR CO.**

**NOTE: Apply dielectric compound to the inside of the coil-on-plug boots.**

59. Install the coil-on-plugs, stud bolts and the crankcase vent tube.
    - Tighten to 8 Nm (71 lb-in).

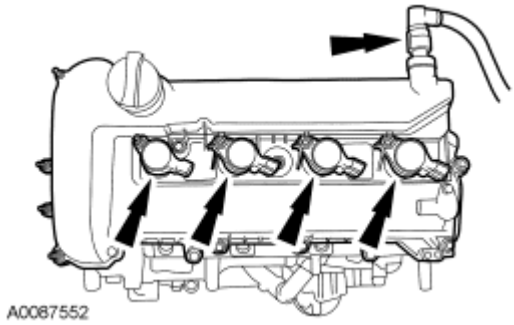


**Fig. 384: Locating Crankcase Vent Tube And Coil-On-Plugs**
**Courtesy of FORD MOTOR CO.**

60. If equipped, install the block heater.
    - Tighten to 21 Nm (15 lb-ft).

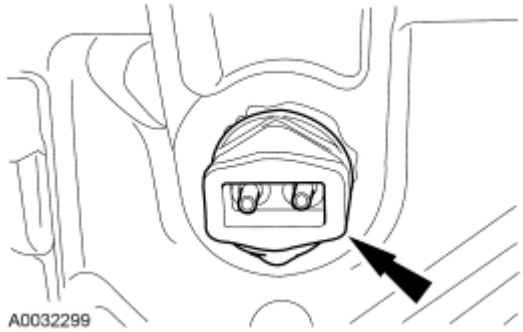


**Fig. 385: Locating Block Heater**
**Courtesy of FORD MOTOR CO.**

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**NOTE: The knock sensor (KS) must not touch the crankcase vent oil separator.**

61. Install the crankcase vent oil separator and the KS.
    - Tighten the oil separator bolts to 10 Nm (89 lb-in).
    - Tighten the KS to 20 Nm (15 lb-ft).

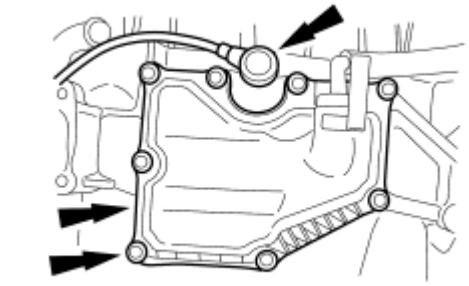


**Fig. 386: Locating Crankcase Vent Oil Separator, KS And Bolts**
**Courtesy of FORD MOTOR CO.**

62. Install the coolant hoses.

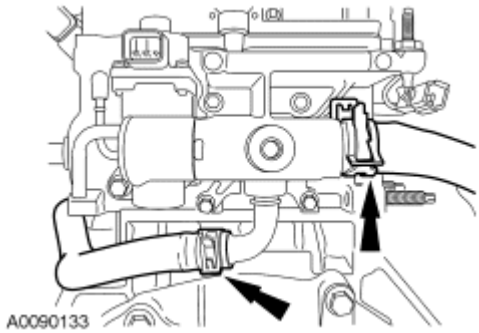


**Fig. 387: Locating Coolant Hoses**
**Courtesy of FORD MOTOR CO.**

63. Install the coolant hose.

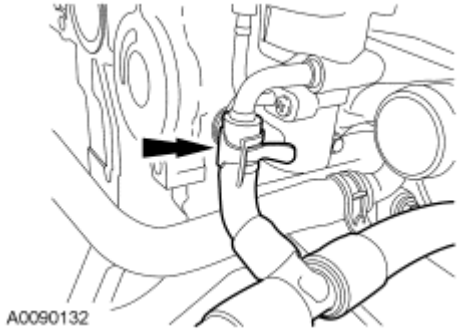


**Fig. 388: Locating Coolant Hose**

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**Courtesy of FORD MOTOR CO.**

64. Install the coolant hose.

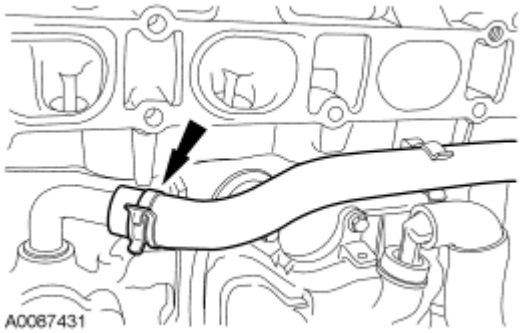


**Fig. 389: Locating Coolant Bypass Hose**
**Courtesy of FORD MOTOR CO.**

65. Position the engine control wiring harness on the engine and connect the CHT sensor and install the rubber boot.

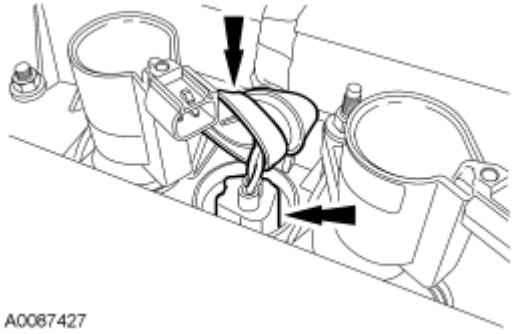


**Fig. 390: Locating Cylinder Head Temperature Sensor Electrical Connector And Rubber Boot**
**Courtesy of FORD MOTOR CO.**

66. Attach the wiring harness retainer.

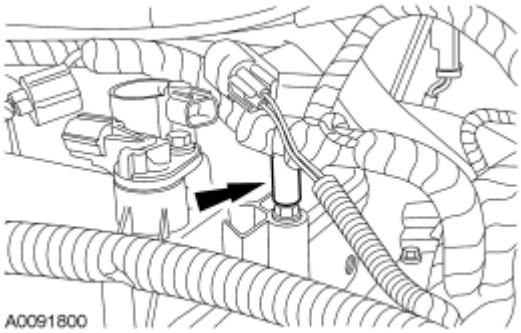


**Fig. 391: Locating Wiring Harness Retainer**
**Courtesy of FORD MOTOR CO.**

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67. Connect the coil-on-plug and camshaft position (CMP) sensor electrical connectors.

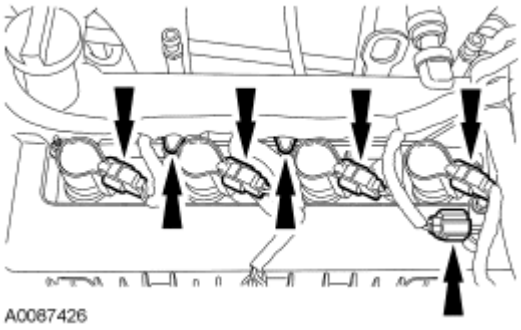


**Fig. 392: Locating Camshaft Position Sensor Electrical Connectors And Coil-On-Plug**
**Courtesy of FORD MOTOR CO.**

68. Connect the exhaust gas recirculation (EGR) valve electrical connectors. Attach the wiring harness retainer.

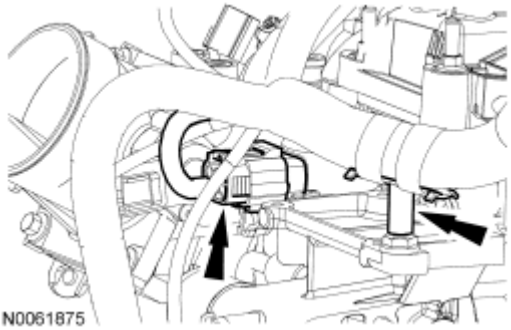


**Fig. 393: Identifying Connector And Retainer**
**Courtesy of FORD MOTOR CO.**

69. Attach the wiring harness retainer.


**Fig. 394: Locating Wiring Harness Retainer**
**Courtesy of FORD MOTOR CO.**

**NOTE: Use O-ring seals that are made of special fuel-resistant material. Use of**

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**ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.**

70. 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.

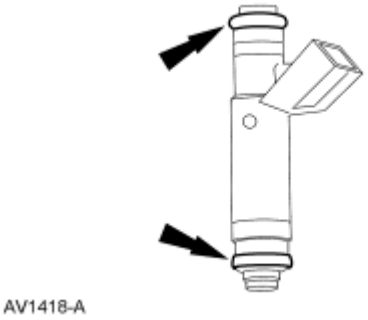


**Fig. 395: Identifying Fuel Injector O-Ring Seals**
**Courtesy of FORD MOTOR CO.**

71. Install the fuel rail with the fuel injectors and stud bolts.
    - Tighten to 23 Nm (17 lb-ft).

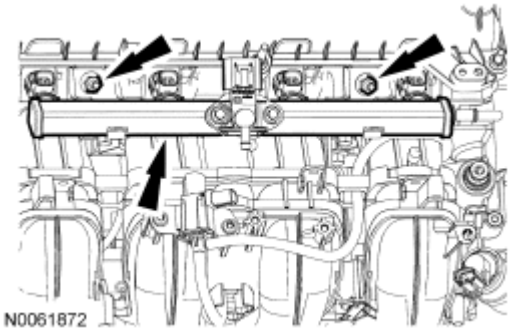


**Fig. 396: Identifying Fuel Rail And Bolts**
**Courtesy of FORD MOTOR CO.**

72. Install the radio capacitor and nut.
    - Tighten to 10 Nm (89 lb-in).

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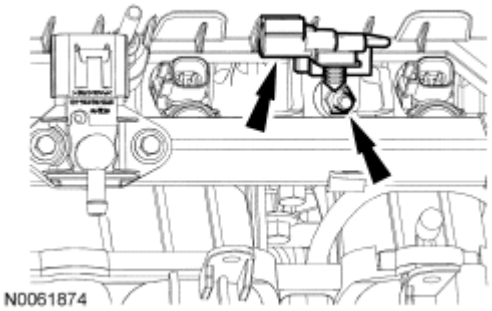


**Fig. 397: Identifying Radio Capacitor And Nut**
**Courtesy of FORD MOTOR CO.**

73. Connect the 4 fuel injector electrical connectors. Attach the 2 wiring harness retainers.

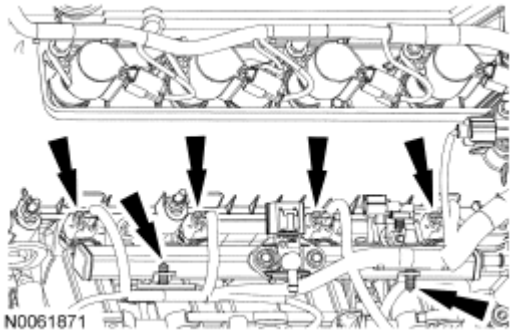


**Fig. 398: Identifying Connectors And Retainers**
**Courtesy of FORD MOTOR CO.**

74. Install the EGR tube.
    - Tighten to 55 Nm (41 lb-ft).

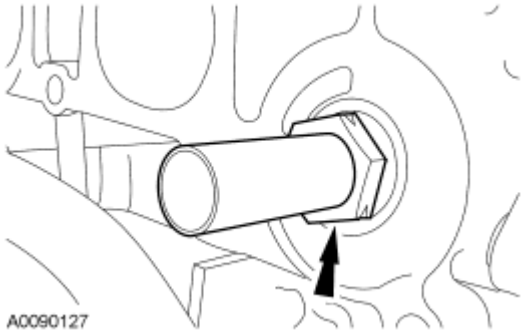


**Fig. 399: Locating Exhaust Gas Recirculation (EGR) Tube**
**Courtesy of FORD MOTOR CO.**

75. Position the intake manifold and connect the positive crankcase ventilation hose.

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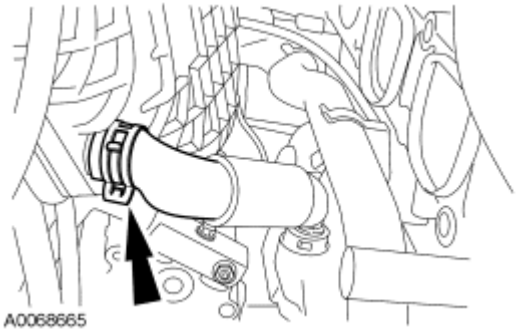


**Fig. 400: Locating Positive Crankcase Ventilation (PCV) Hose**
**Courtesy of FORD MOTOR CO.**

**NOTE: Inspect and install new intake manifold gaskets, if necessary.**

76. Install the intake manifold gaskets and intake manifold.
    - Tighten the bolts to 18 Nm (13 lb-ft).

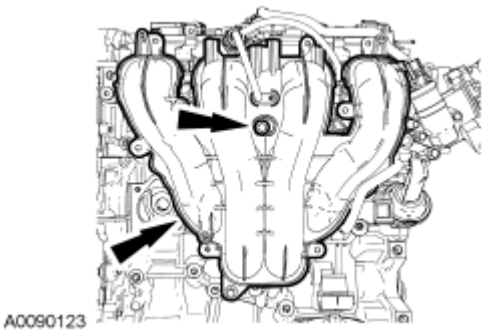


**Fig. 401: Locating Intake Manifold Gaskets & Intake Manifold**
**Courtesy of FORD MOTOR CO.**

77. Connect the throttle position (TP) sensor electrical connector.

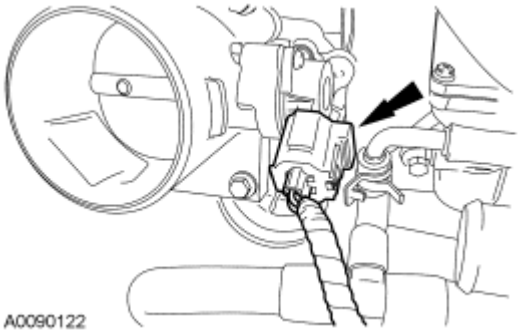


**Fig. 402: Locating Throttle Position (TP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

78. Connect the radio capacitor electrical connector.

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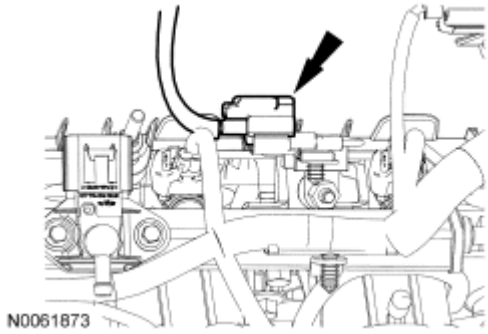


**Fig. 403: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

79. Connect the fuel rail pressure and temperature sensor electrical connector and vacuum tube.

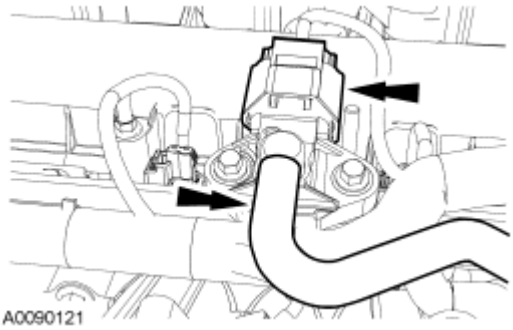


**Fig. 404: Locating Fuel Rail Pressure & Temperature Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

80. Connect the swirl control valve electrical connector.

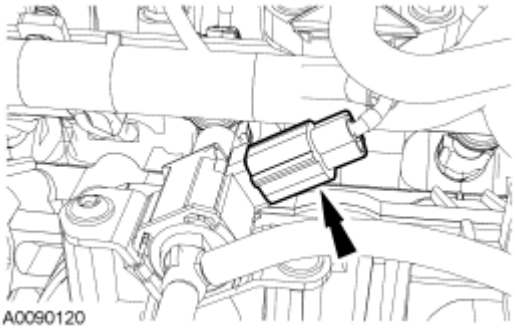


**Fig. 405: Locating Swirl Control Valve Electrical Connector**
**Courtesy of FORD MOTOR CO.**

81. Connect the idle air control (IAC) motor electrical connector.

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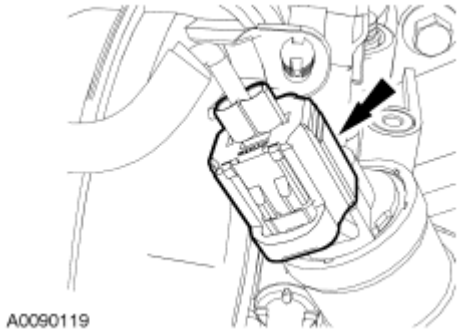


**Fig. 406: Locating Idle Air Control (IAC) Motor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

82. Connect the manifold absolute pressure (MAP) electrical connector.

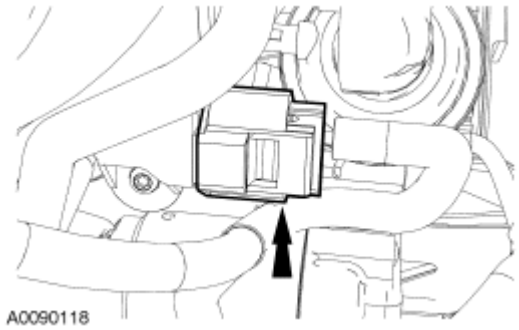


**Fig. 407: Locating Manifold Actual Pressure (MAP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

83. Connect the KS and attach the 2 wiring harness retainers.

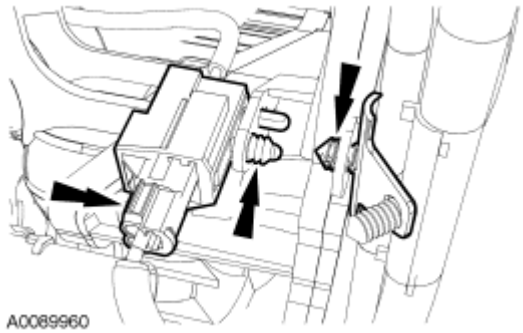


**Fig. 408: Locating Knock Sensor (KS) & Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

84. Attach the 2 wiring harness retainers.

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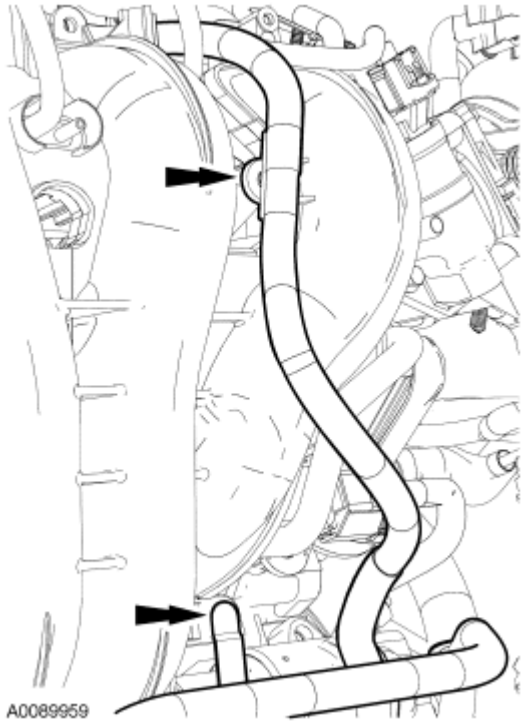


**Fig. 409: Locating Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

85. If removed, install the capacitor and bolt.
    - Tighten to 20 Nm (15 lb-ft).

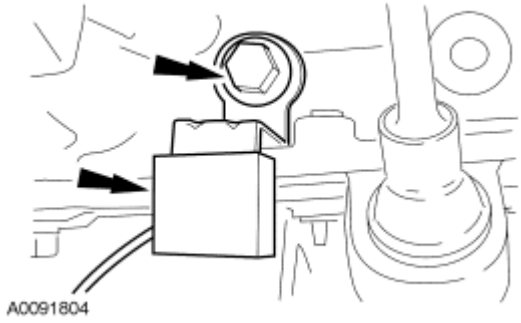


**Fig. 410: Locating Capacitor & Bolt**
**Courtesy of FORD MOTOR CO.**

**NOTE: Clean the gasket mating surfaces with metal surface cleaner.**

86. Install the oil filter adapter with a new gasket.
    - Tighten to 25 Nm (18 lb-ft).

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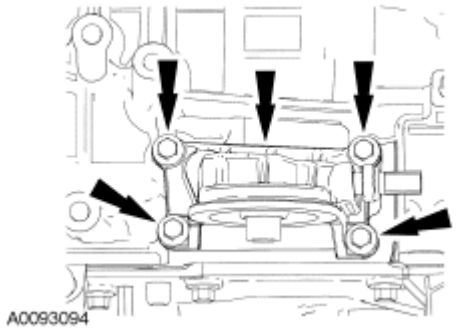


**Fig. 411: Locating Oil Filter Adapter And Bolts**
**Courtesy of FORD MOTOR CO.**

87. Install a new oil filter.
    - Tighten the oil filter 3/4 turn after the oil filter gasket makes contact with the oil filter adapter.

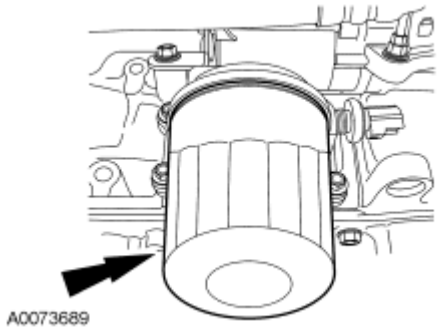


**Fig. 412: Locating Engine Oil Filter**
**Courtesy of FORD MOTOR CO.**

88. Connect the engine oil pressure (EOP) switch electrical connector.

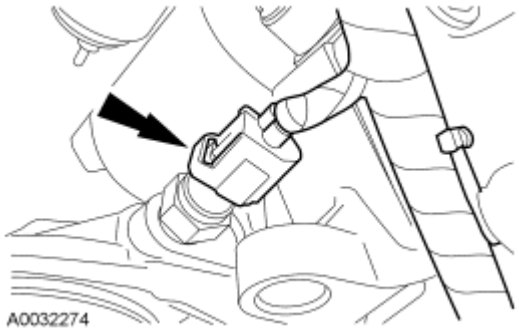


**Fig. 413: Locating Engine Oil Pressure (EOP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

**NOTE: Install a new O-ring seal on the oil level indicator tube and lubricate with clean engine oil prior to installing.**

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89. Install the oil level indicator and bolt.
    - Tighten to 10 Nm (89 lb-in).

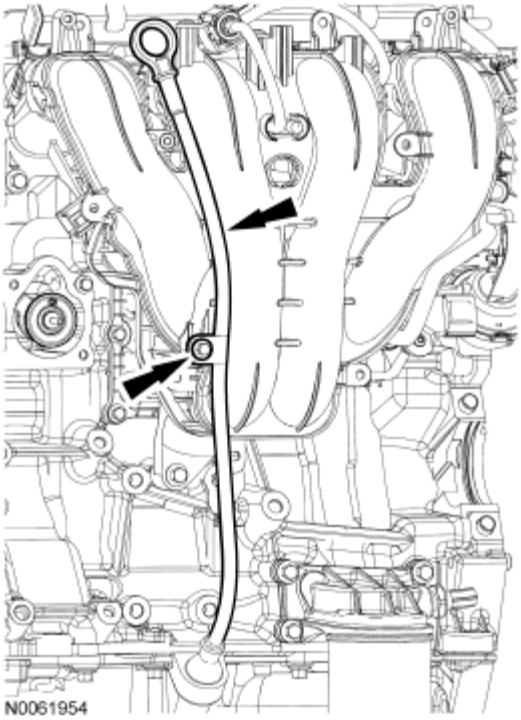


**Fig. 414: Identifying oil Level Indicator And Bolt**
**Courtesy of FORD MOTOR CO.**

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

90. Install the thermostat housing and bolts.
    - Tighten to 10 Nm (89 lb-in).

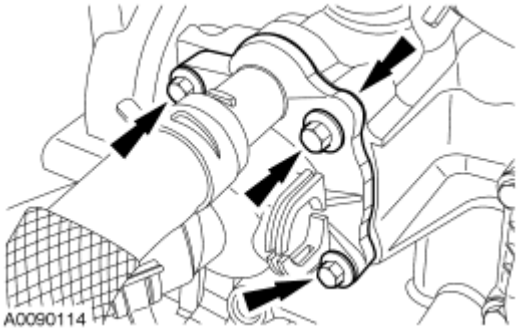


**Fig. 415: Locating Thermostat Housing & Bolts**
**Courtesy of FORD MOTOR CO.**

91. Attach the 2 wiring harness retainers.

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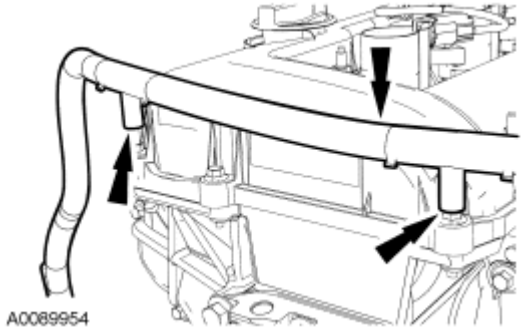


**Fig. 416: Locating Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

**NOTE: Clean the coolant pump mating surface with metal surface cleaner.**

**NOTE: Lubricate the coolant pump O-ring with clean engine coolant.**

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

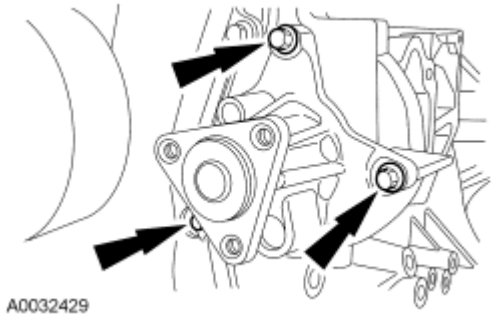


**Fig. 417: Locating Coolant Pump Bolts**
**Courtesy of FORD MOTOR CO.**

93. Install the 3 coolant pump pulley and bolts.
    - Tighten to 20 Nm (15 lb-ft).

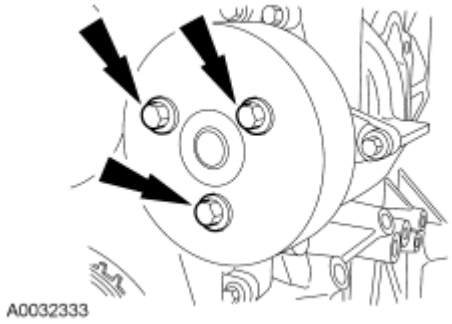


**Fig. 418: Locating Coolant Pump Pulley Bolts**

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**Courtesy of FORD MOTOR CO.**

94. Install the accessory drive belt idler pulley and bracket and the 3 bolts.
    - Tighten in the sequence shown to 25 Nm (18 lb-ft).

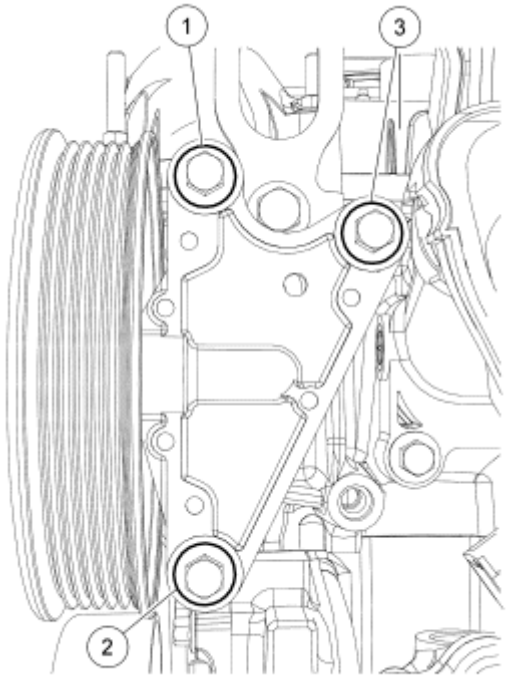


**Fig. 419: Identifying Bolts**
**Courtesy of FORD MOTOR CO.**

95. Install the accessory drive belt idler pulley.
    - Tighten to 25 Nm (18 lb-ft).

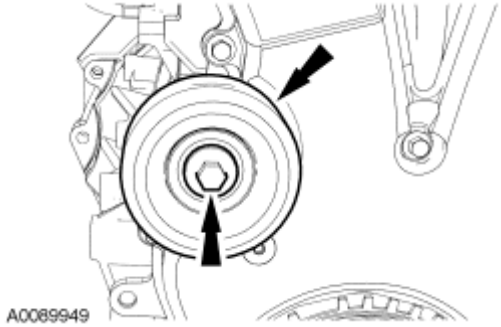


**Fig. 420: Locating Accessory Drivebelt Idler Pulley And Bolt**
**Courtesy of FORD MOTOR CO.**

96. Install the generator, nut and bolts.
    - Tighten to 47 Nm (35 lb-ft).

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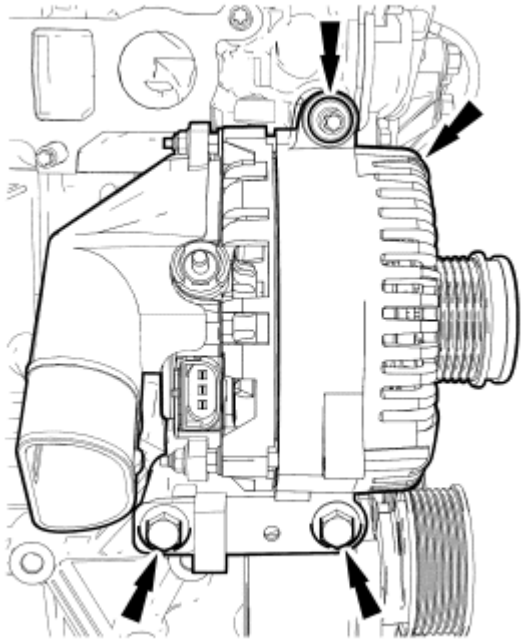

A0089945

**Fig. 421: Locating Generator & Bolts**
**Courtesy of FORD MOTOR CO.**

**Front wheel drive (FWD) vehicles**

97. Install 7 new exhaust manifold studs in the cylinder head.
    - Tighten to 17 Nm (13 lb-ft).
98. Install the new exhaust manifold gasket on the engine.

**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.**

**NOTE: Make sure to tighten the nuts in the sequence in 2 stages.**

99. Position the catalytic converter and tighten the 7 new exhaust manifold nuts in the sequence shown in 2 stages:
    - Stage 1: Tighten to 47 Nm (35 lb-ft).
    - Stage 2: Tighten to 47 Nm (35 lb-ft).

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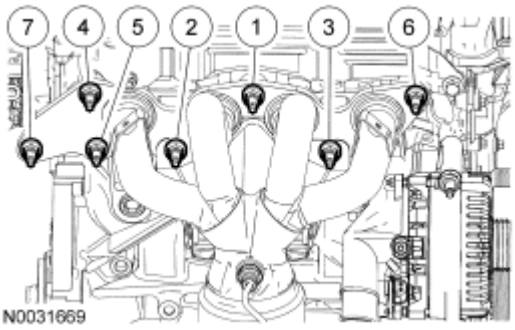


**Fig. 422: Identifying Tightening Sequence Of Exhaust Manifold Nuts**
**Courtesy of FORD MOTOR CO.**

100. Install the heat shield and the 6 bolts.
    - Tighten to 10 Nm (89 lb-in).

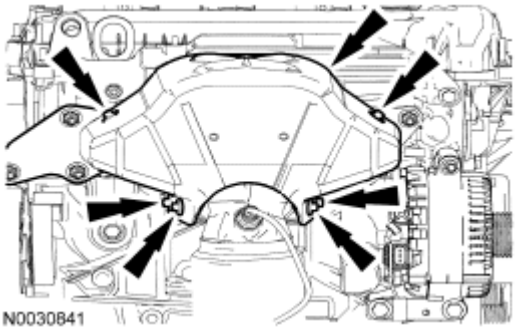


**Fig. 423: Locating Heat Shield & Bolts**
**Courtesy of FORD MOTOR CO.**

101. Install the 2 catalytic converter bracket bolts.
    - Tighten to 25 Nm (18 lb-ft).

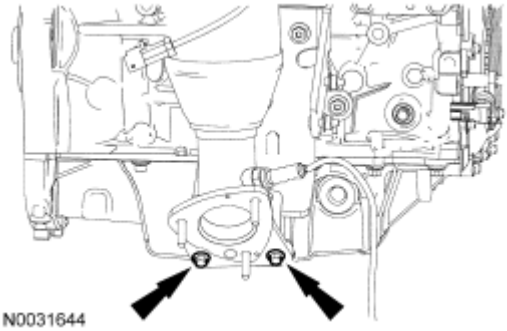


**Fig. 424: Locating Lower Catalytic Converter Bolts**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

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102. Connect the generator electrical connections and install the nut.
    - Tighten to 6 Nm (53 lb-in).

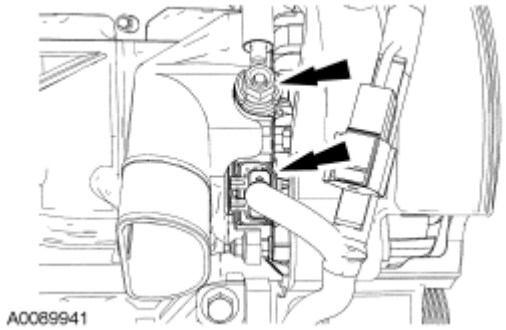


**Fig. 425: Locating Generator Electrical Connections**
**Courtesy of FORD MOTOR CO.**

103. Connect the CKP sensor electrical connector.

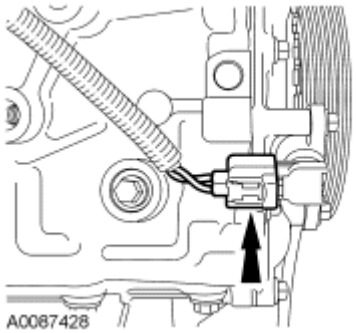


**Fig. 426: Crankshaft Position (CKP) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

104. Using the heavy duty floor crane and spreader bar, remove the engine from the engine stand.

**Vehicles with automatic transaxle**

105. 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).

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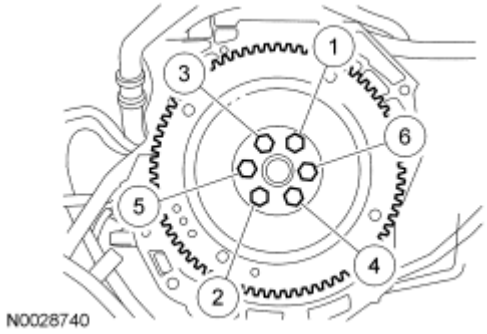


**Fig. 427: Identifying Flexplate Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

**Vehicles with manual transaxle**

106. 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).

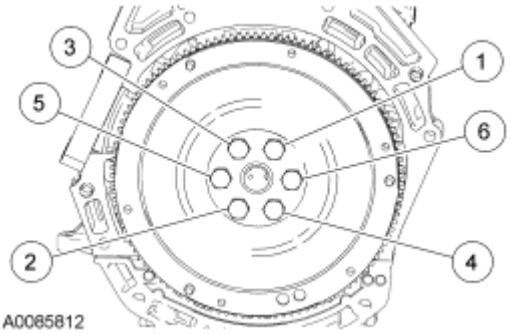


**Fig. 428: Identifying Flexplate Bolts Tightening Sequence**
**Courtesy of FORD MOTOR CO.**

107. Install the starter motor isolator.

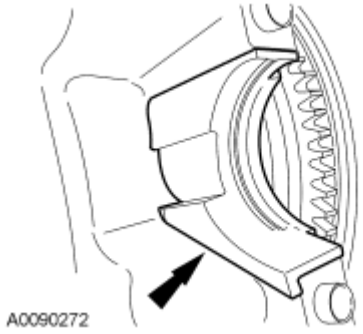


**Fig. 429: Locating Starter Motor Isolator**
**Courtesy of FORD MOTOR CO.**

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108. Lubricate the transaxle input shaft pilot bearing with front axle grease.

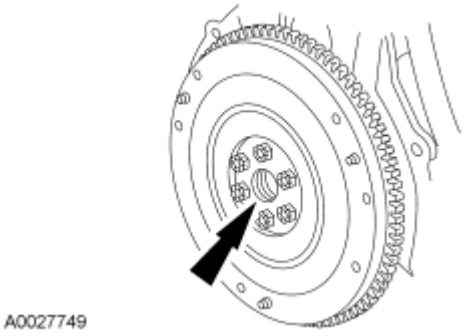


**Fig. 430: Locating Transmission Input Shaft Pilot Bearing**
**Courtesy of FORD MOTOR CO.**

109. Using the special tool, position the clutch disc on the flywheel.

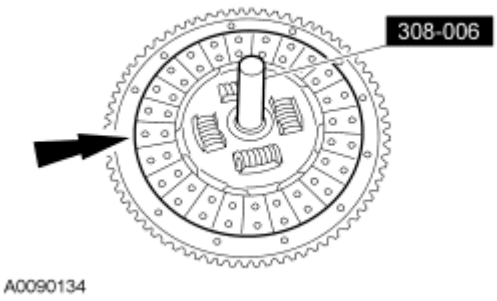


**Fig. 431: Positioning Clutch Disc On Flywheel Using Special Tool (308-006)**
**Courtesy of FORD MOTOR CO.**

**NOTE: If reusing the clutch pressure plate and flywheel, align the marks made during removal.**

110. Position the clutch pressure plate and install the bolts.
    - Tighten to 29 Nm (21 lb-ft) in a star pattern sequence.

# INSTALLATION

**ENGINE - AUTOMATIC TRANSAXLE**

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
| | Heavy Duty Floor Crane | 014-00071 or equivalent |

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| | | |
|---|---|---|
|  ST1341-A | | |
|  ST1293-A | Powertrain Lift | 014-00765 |
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST2743A | Universal Adapter Brackets | 014-0001 |

**Material**

| 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 engine 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. Using the engine crane and spreader bar, position the engine and transaxle onto the lift table.
3. Using the special tools, secure the engine to the lift table.

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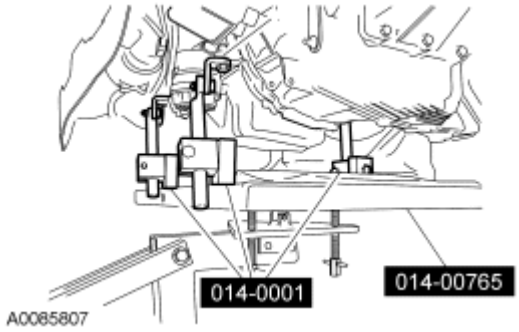


**Fig. 432: Securing Engine To Lift Table Using Special Tool (014-0001, 014-00765)**
**Courtesy of FORD MOTOR CO.**

4. Install new torque converter nuts.
    - Tighten to 35 Nm (26 lb-ft).

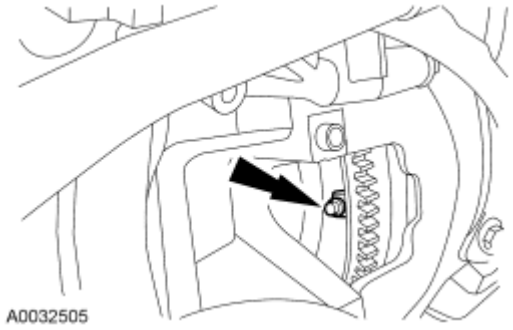


**Fig. 433: Locating Torque Converter Nut**
**Courtesy of FORD MOTOR CO.**

**All wheel drive (AWD) vehicles**

5. Install the power transfer unit (PTU) and the 3 PTU-to-transaxle bolts.
    - Tighten to 70 Nm (52 lb-ft).

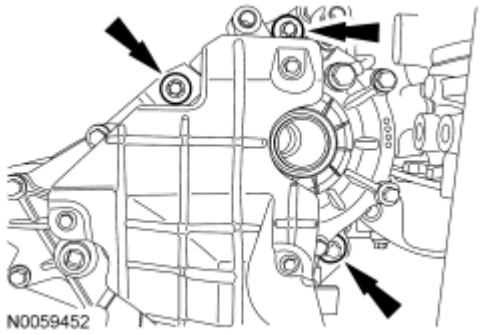


**Fig. 434: Identifying PTU-To-Transaxle Bolts**
**Courtesy of FORD MOTOR CO.**

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6. Install the 1 transaxle-to-PTU bolt.
    - Tighten to 48 Nm (35 lb-ft).

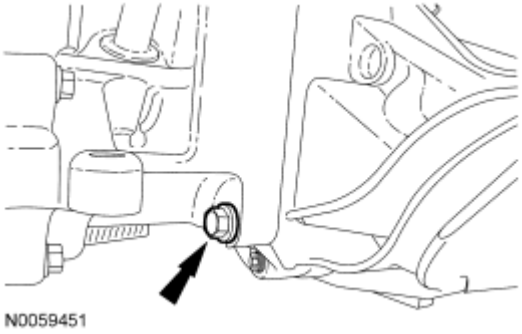


**Fig. 435: Identifying Transaxle-To-PTU Bolt**
**Courtesy of FORD MOTOR CO.**

7. Attach the PTU vent hose.

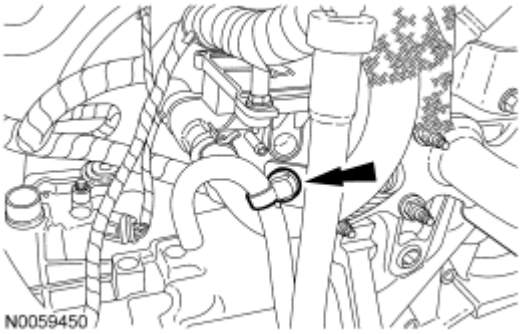


**Fig. 436: Identifying PTU Vent Hose**
**Courtesy of FORD MOTOR CO.**

8. Install the PTU bracket and the 2 bolts.
    - Tighten to 45 Nm (33 lb-ft).

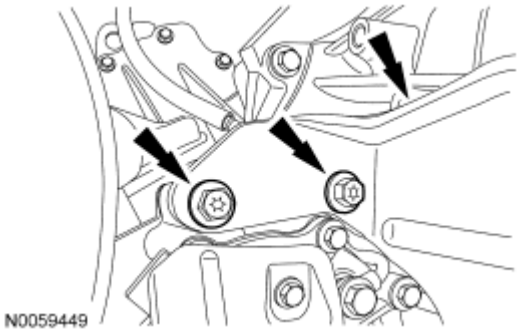


**Fig. 437: Identifying PTU Bracket And Bolts**
**Courtesy of FORD MOTOR CO.**

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9. Install the 3 PTU bracket-to-engine bolts.
    - Tighten to 40 Nm (30 lb-ft).

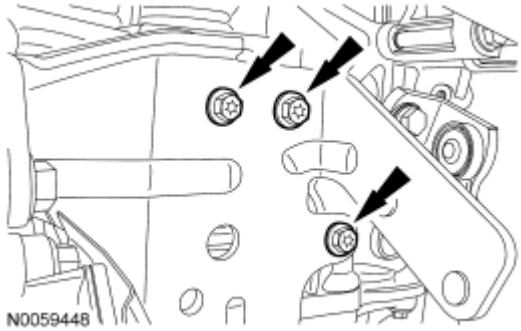


**Fig. 438: Identifying Bracket-To-Engine Bolts**
**Courtesy of FORD MOTOR CO.**

10. Install 7 new exhaust manifold studs in the cylinder head.
    - Tighten to 17 Nm (13 lb-ft).
11. Install the new exhaust manifold gasket on the engine.
12. Position the catalytic converter and tighten the 7 new exhaust manifold nuts in the sequence shown in 2 stages:
    - Stage 1: Tighten to 47 Nm (35 lb-ft).
    - Stage 1: Tighten to 47 Nm (35 lb-ft).

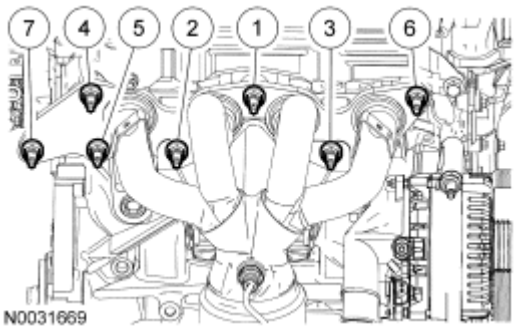


**Fig. 439: Identifying Tightening Sequence Of Exhaust Manifold Nuts**
**Courtesy of FORD MOTOR CO.**

13. Install the heat shield and the 6 bolts.
    - Tighten to 10 Nm (89 lb-in).

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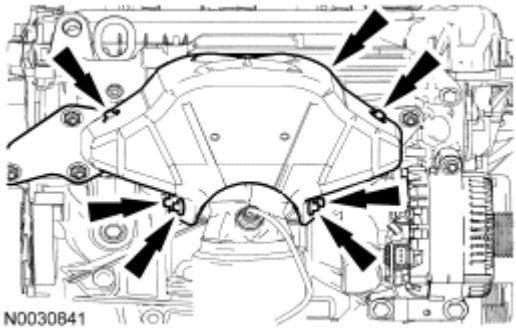


**Fig. 440: Locating Heat Shield & Bolts**
**Courtesy of FORD MOTOR CO.**

14. Install the 2 lower catalytic converter bolts.
    - Tighten to 25 Nm (18 lb-ft).

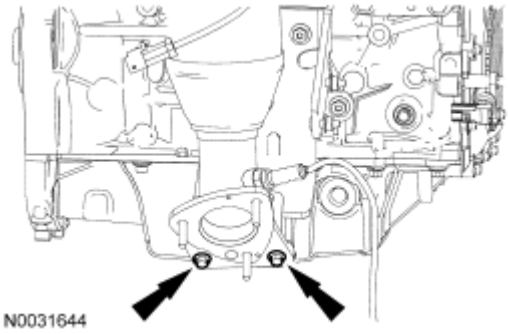


**Fig. 441: Locating Lower Catalytic Converter Bolts**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

15. Install the starter motor isolator.

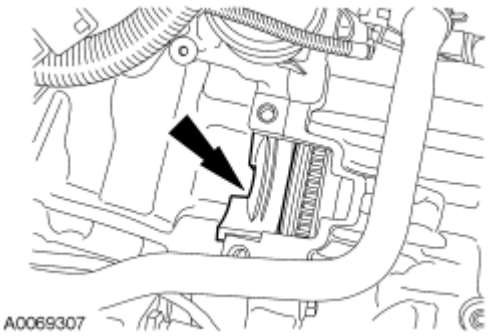


**Fig. 442: Identifying Starter Motor Isolator**
**Courtesy of FORD MOTOR CO.**

16. Install the starter motor.

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- Tighten to 35 Nm (26 lb-ft).

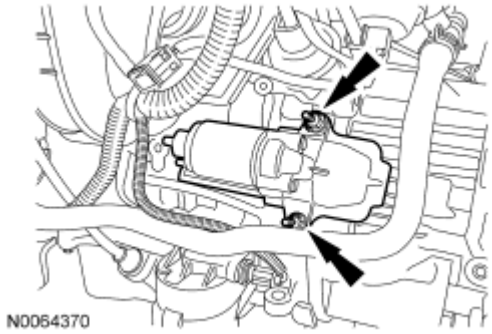


**Fig. 443: Identifying Starter Motor Bolts**
**Courtesy of FORD MOTOR CO.**

17. Install the starter motor harness connector.
    1. Install the starter motor solenoid battery nut.
        - Tighten to 12 Nm (9 lb-ft).
    2. Install the starter motor solenoid nut.
        - Tighten to 5 Nm (44 lb-in).

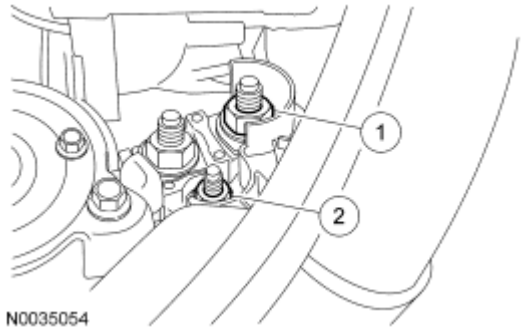


**Fig. 444: Identifying Battery Cable & Starter Solenoid Terminal Nut**
**Courtesy of FORD MOTOR CO.**

18. Install the wire harness clip retainer and the ground wire and nut to the starter bolts.
    - Tighten to 25 Nm (18 lb-ft).

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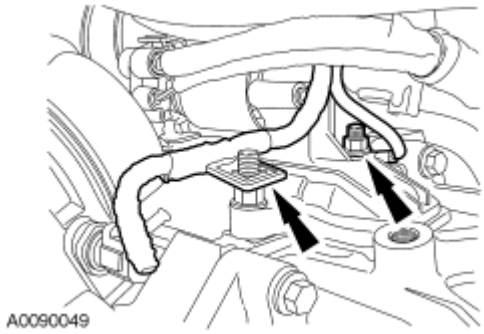


**Fig. 445: Locating Wire Harness Clip Retainer & Starter Bolts**
**Courtesy of FORD MOTOR CO.**

19. Raise the engine and transaxle into the vehicle.
20. Install the bolt in the LH transaxle mount.
    - Tighten to 103 Nm (76 lb-ft).

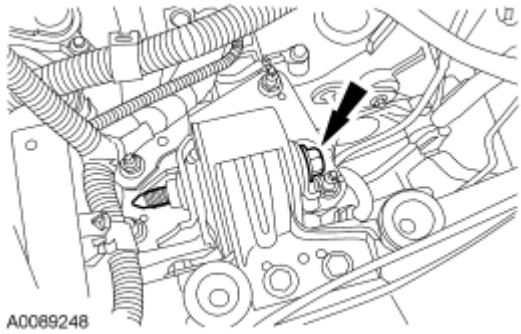


**Fig. 446: Locating Transaxle Mount Bolt**
**Courtesy of FORD MOTOR CO.**

21. Install the bolt in the rear transaxle mount.
    - Tighten to 115 Nm (85 lb-ft).

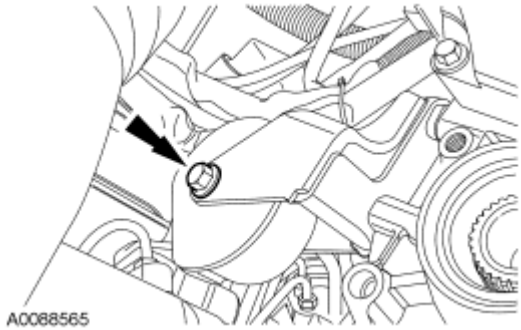


**Fig. 447: Transaxle Rear Mount Bolt**
**Courtesy of FORD MOTOR CO.**

22. Install the engine mount bracket and nuts.

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- Tighten to 115 Nm (85 lb-ft).

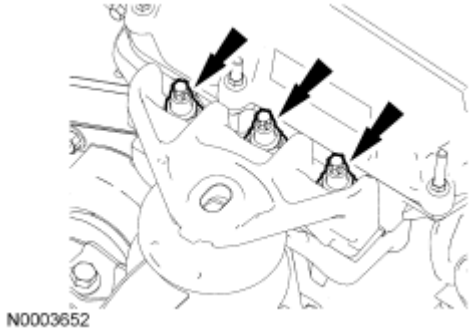


**Fig. 448: Engine Mount Bracket Nuts**
**Courtesy of FORD MOTOR CO.**

23. Install the engine mount bracket bolt.
    - Tighten to 115 Nm (85 lb-ft).

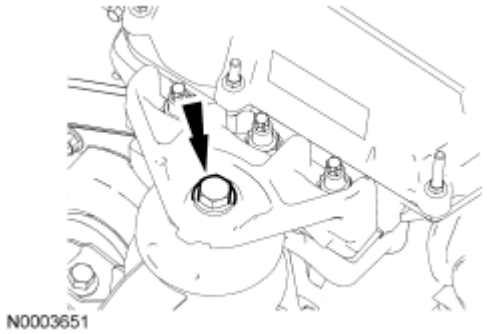


**Fig. 449: Engine Mount Bracket Bolt**
**Courtesy of FORD MOTOR CO.**

24. Install the 2 transaxle-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).

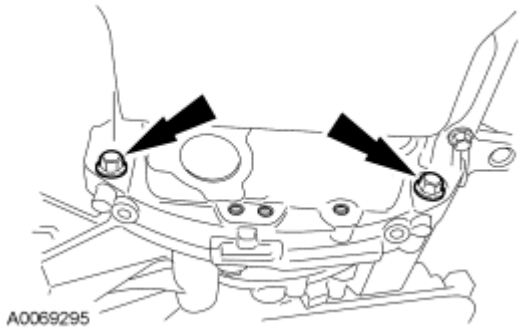


**Fig. 450: Locating Engine-To-Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

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25. Install the 2 transaxle-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).


**Fig. 451: Locating Lower Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

**Front wheel drive (FWD) vehicles**

26. Install the damper and the 3 bolts.
    - Tighten to 40 Nm (30 lb-ft).

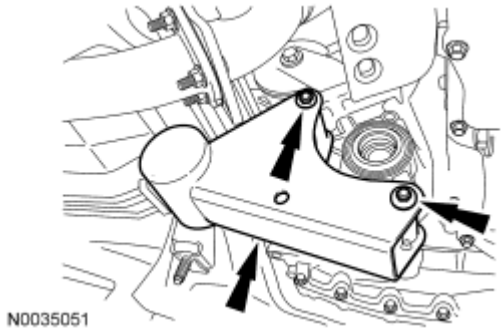


**Fig. 452: Locating Bolts & Dampener**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

27. Install the engine support crossmember and new nut.
    - Tighten to 175 Nm (129 lb-ft).

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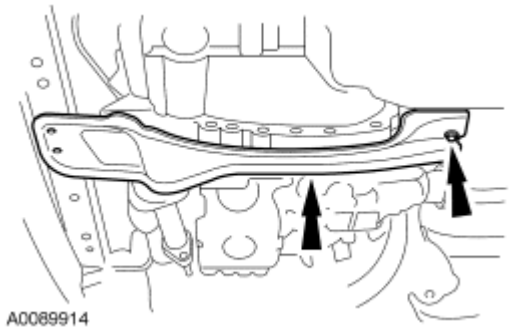


**Fig. 453: Identifying Cross Brace And Rear Nut**
**Courtesy of FORD MOTOR CO.**

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).

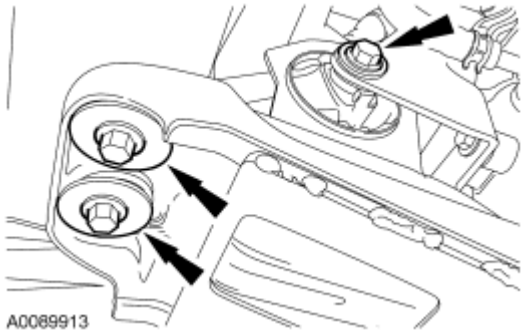


**Fig. 454: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember**
**Courtesy of FORD MOTOR CO.**

29. Install the A/C compressor and connect the A/C compressor electrical connector.
    - Tighten the bolts to 25 Nm (18 lb-ft).

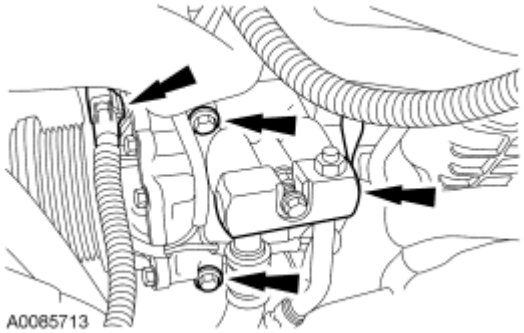


**Fig. 455: A/C Compressor Electrical Connector & Bolts**
**Courtesy of FORD MOTOR CO.**

30. Connect the lower radiator hose to the radiator.

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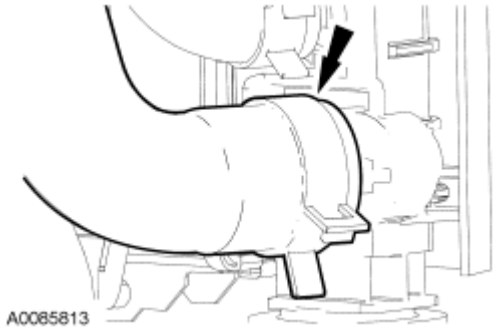


**Fig. 456: Locating Lower Radiator Hose**
**Courtesy of FORD MOTOR CO.**

31. Connect the PCM electrical connectors.
    - Position the harness and install the nut.
        - Tighten to 6 Nm (53 lb-in).

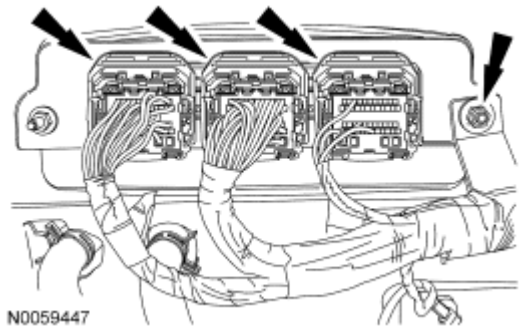


**Fig. 457: Identifying Connectors And nut**
**Courtesy of FORD MOTOR CO.**

32. Install the ground wire and bolt.
    - Tighten to 10 Nm (89 lb-in).

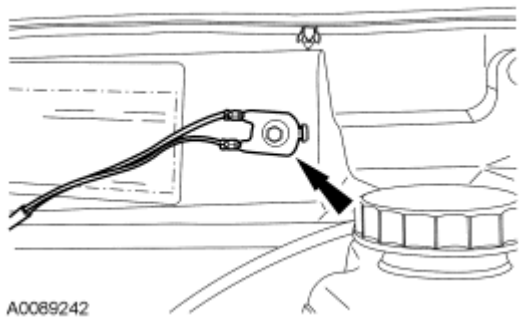


**Fig. 458: Locating Ground Wire & Bolt**
**Courtesy of FORD MOTOR CO.**

33. Attach the electrical connector retainers.

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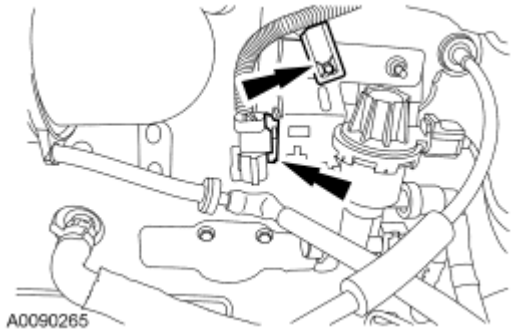


**Fig. 459: Electrical Connector Retainers**
**Courtesy of FORD MOTOR CO.**

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

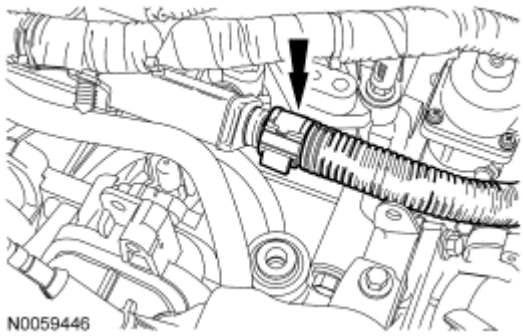


**Fig. 460: Identifying Fuel Supply Tube**
**Courtesy of FORD MOTOR CO.**

35. Connect the fuel vapor return tube and retainer.

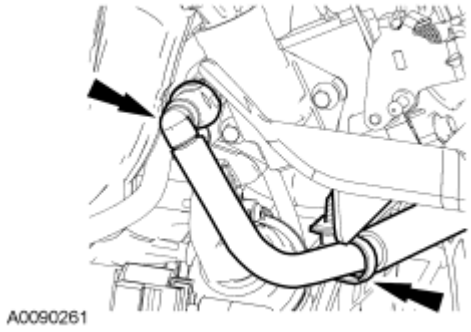


**Fig. 461: Fuel Vapor Return Tube**
**Courtesy of FORD MOTOR CO.**

36. Connect the vacuum supply tube.

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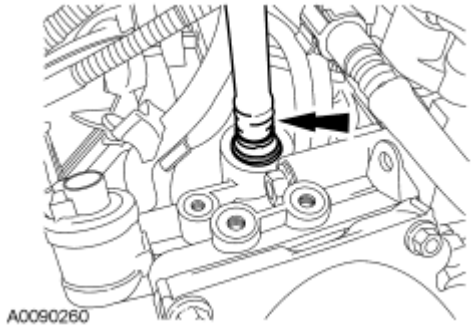


**Fig. 462: Vacuum Supply Tube**
**Courtesy of FORD MOTOR CO.**

37. Position the accelerator control cable and bracket and install the nut.
    - Tighten to 6 Nm (53 lb-in).

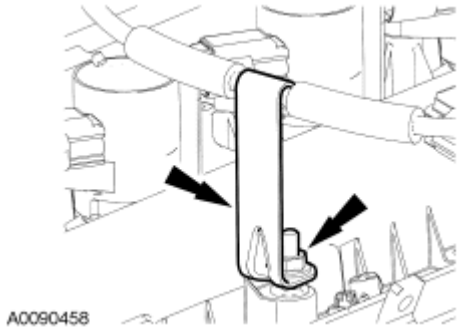


**Fig. 463: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

38. Install the accelerator control cable and bracket and nut.
    - Tighten to 6 Nm (53 lb-in).

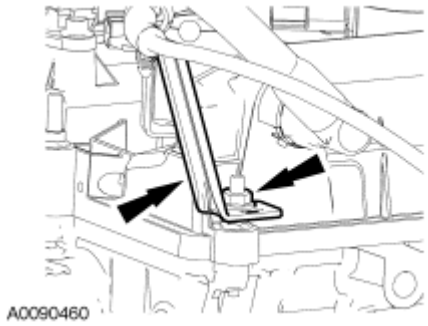


**Fig. 464: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

39. Install the accelerator cable and speed control cable (if equipped).
    1. Connect the accelerator and speed control cable (if equipped) to the throttle body.

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2. Install the accelerator cable bracket and bolts.
    - Tighten to 10 Nm (89 lb-in).

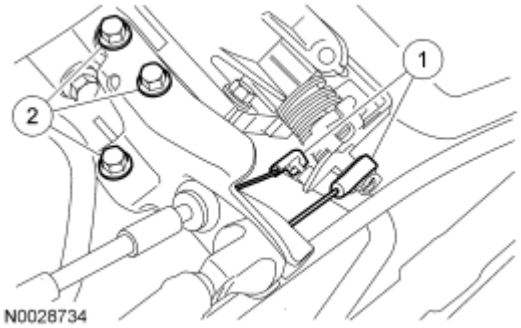


**Fig. 465: Accelerator Cable, Speed Control Cable & Bracket Bolts**
**Courtesy of FORD MOTOR CO.**

40. Install the accelerator cable snow shield and retainers.
    - Tighten to 4 Nm (35 lb-in).

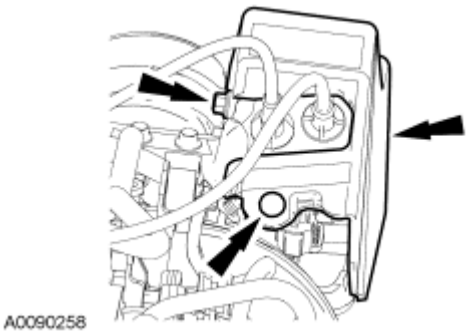


**Fig. 466: Accelerator Cable Snow Shield Retainers**
**Courtesy of FORD MOTOR CO.**

41. Connect the heater hoses to the heater core.

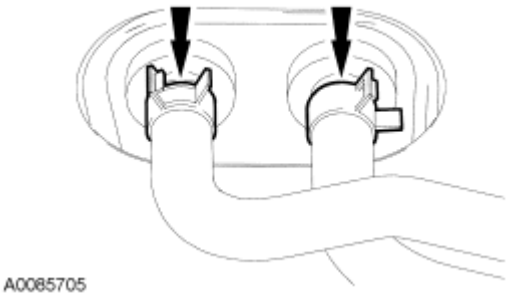


**Fig. 467: Locating Heater Hoses**
**Courtesy of FORD MOTOR CO.**

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42. Attach the heater hose support strap to the stud.

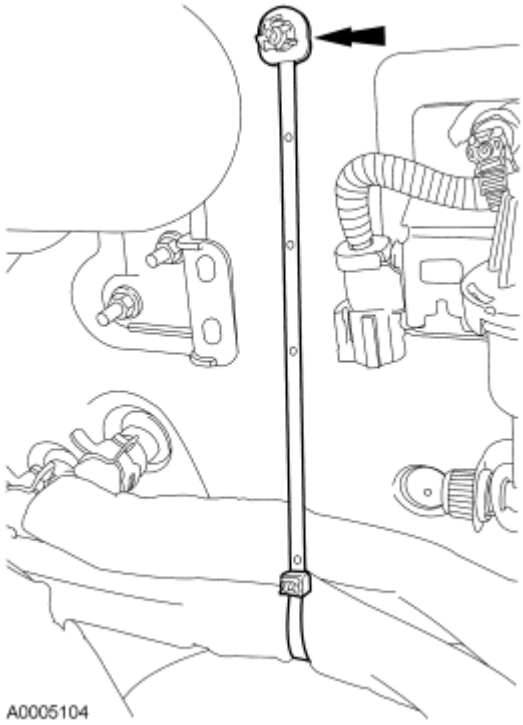


**Fig. 468: Heater Hose Support Strap & Stud**
**Courtesy of FORD MOTOR CO.**

43. Connect the upper radiator hose.

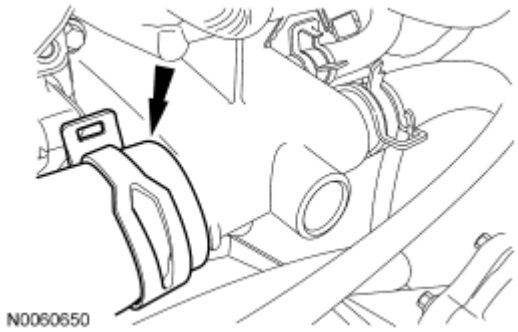


**Fig. 469: Identifying Upper Radiator Hose**
**Courtesy of FORD MOTOR CO.**

44. If equipped, route the block heater wiring harness and attach all retainers.
    - Connect the block heater electrical connector.

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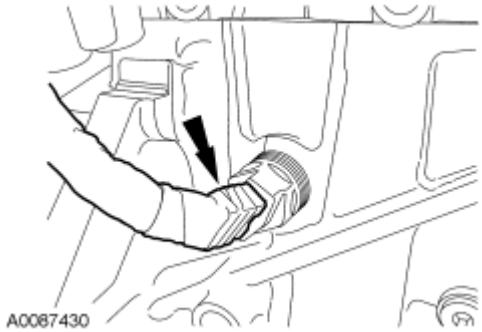


**Fig. 470: Block Heater Electrical Connector**
**Courtesy of FORD MOTOR CO.**

45. Install the output shaft speed (OSS) sensor and bolt.
    - Tighten to 13 Nm (10 lb-ft).

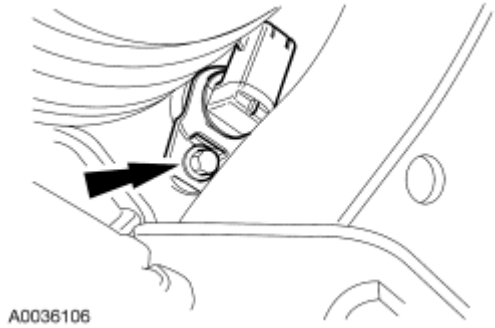


**Fig. 471: Locating OSS Sensor Bolt**
**Courtesy of FORD MOTOR CO.**

46. Install the fluid cooler tube.
    1. Connect the OSS sensor.
    2. Connect the turbine shaft speed (TSS) sensor (white connector).
        - Connect the wiring harness retainer to the transaxle case.
    3. Position the bracket and install the bolt.
        - Tighten 13 Nm (10 lb-ft).
    4. Install the fluid cooler tube fitting.
        - Tighten to 23 Nm (17 lb-ft).

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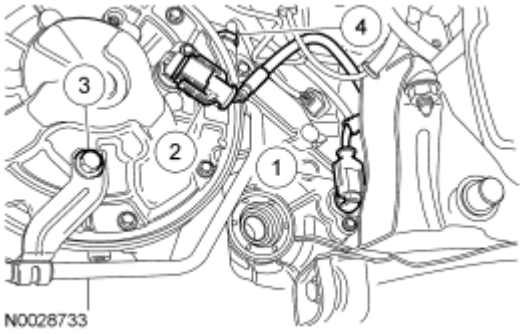


**Fig. 472: Fluid Cooler Tube, Electrical Connectors & Bracket**
**Courtesy of FORD MOTOR CO.**

47. Connect the rear transaxle fluid cooler tube.
    - Tighten to 23 Nm (17 lb-ft).

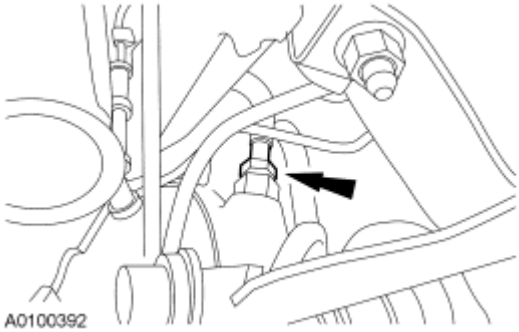


**Fig. 473: Rear Cooler Tube At Transaxle Case**
**Courtesy of FORD MOTOR CO.**

48. Connect the front transaxle fluid cooler tube.
    - Tighten to 23 Nm (17 lb-ft).

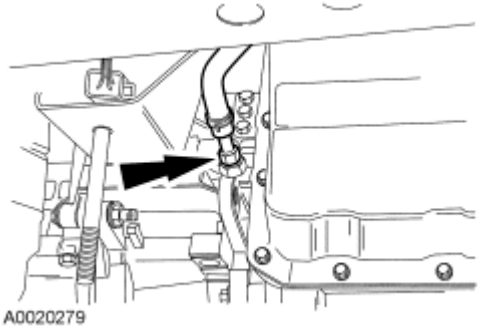


**Fig. 474: Locating Transmission Fluid Cooler Tube**
**Courtesy of FORD MOTOR CO.**

49. Connect the transaxle range sensor electrical connector.

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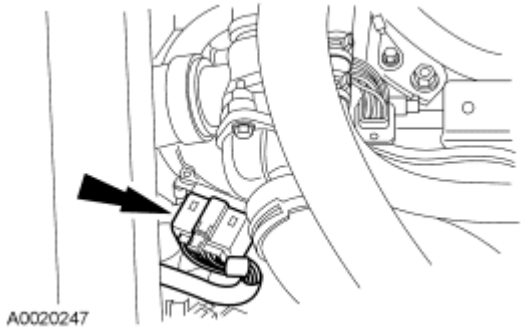


**Fig. 475: Locating Transmission Range (TR) Sensor Electrical Connector**
**Courtesy of FORD MOTOR CO.**

50. Install the transaxle control cable, bracket and bolts.
    - Tighten to 19 Nm (14 lb-ft).
    - Attach the wiring harness pin-type retainers.

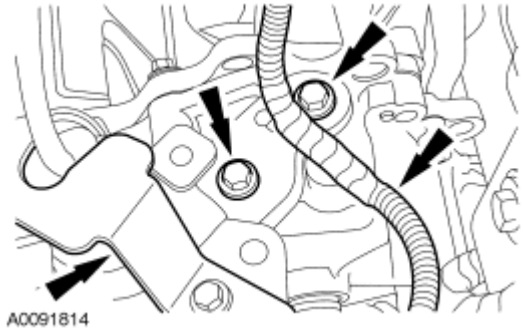


**Fig. 476: Transaxle Control Cable & Bracket**
**Courtesy of FORD MOTOR CO.**

51. Connect the shift cable to the transaxle manual lever.

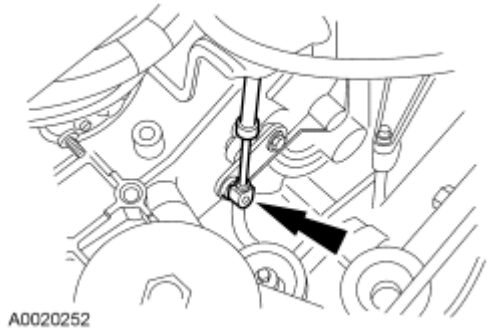


**Fig. 477: Locating Shift Cable End At Manual Lever**
**Courtesy of FORD MOTOR CO.**

52. Install the transaxle wiring harness bracket and nut and connect the transaxle electrical connector.
    - Tighten to 10 Nm (89 lb-in).

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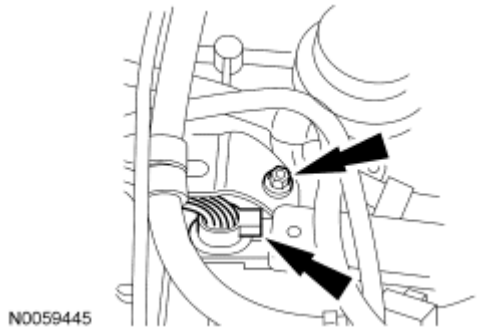


**Fig. 478: Identifying Bracket And Nut**
**Courtesy of FORD MOTOR CO.**

53. Attach the transaxle vent tube retaining clip to the engine wiring harness.

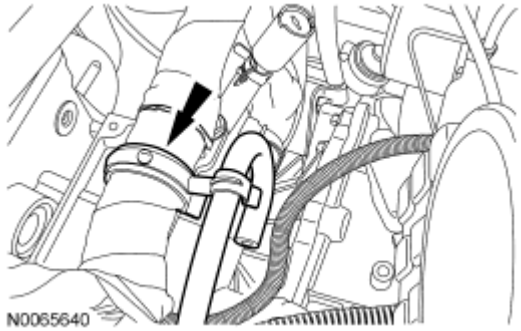


**Fig. 479: Identifying Retaining Clip**
**Courtesy of FORD MOTOR CO.**

54. Attach the wiring harness retainers to the battery tray bracket.

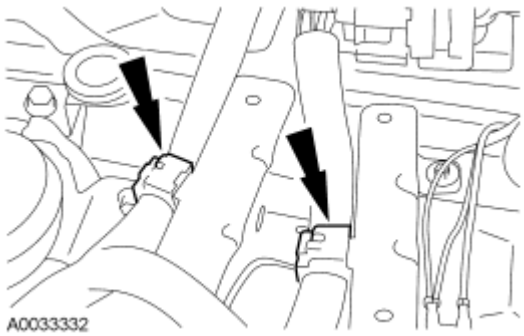


**Fig. 480: Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

55. Connect the 34-pin electrical connector.

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**Fig. 481: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

56. Install the ground strap and bolt.
    - Tighten to 10 Nm (89 lb-in).

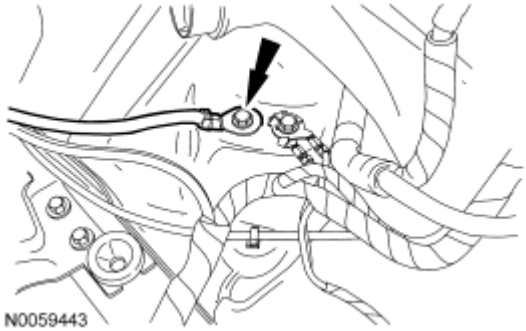


**Fig. 482: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

57. Connect the electrical connector to the power distribution box (PDB).

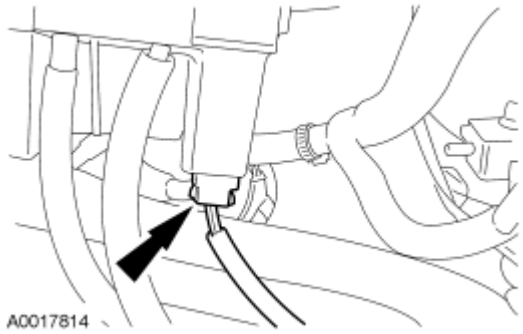


**Fig. 483: Power Distribution Box Electrical Connector**
**Courtesy of FORD MOTOR CO.**

58. Connect the cable to the PDB and install the nut.
    - Tighten to 12 Nm (9 lb-ft).

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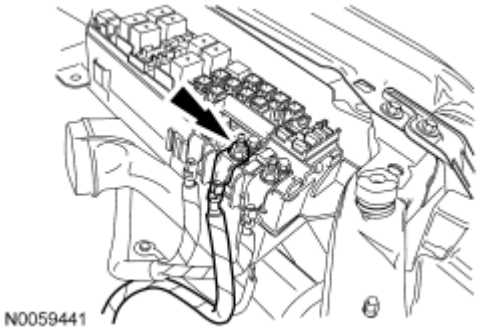


**Fig. 484: Identifying Nut**
**Courtesy of FORD MOTOR CO.**

59. Install the PDB cover.

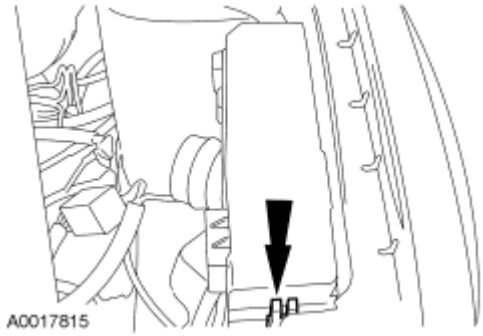


**Fig. 485: Locating Power Distribution Box Cover**
**Courtesy of FORD MOTOR CO.**

60. If equipped, install the ground eyelet and bolt.
    - Tighten to 10 Nm (89 lb-in).

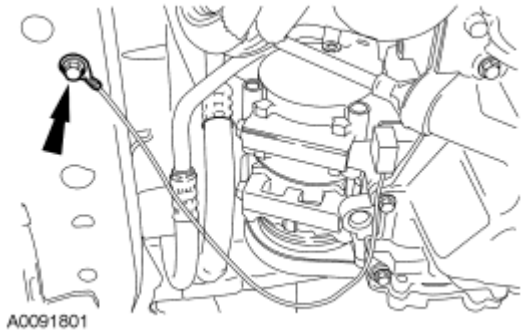


**Fig. 486: Ground Eyelet & Bolt**
**Courtesy of FORD MOTOR CO.**

**All wheel drive (AWD) vehicles**

61. Align index mark and position the driveshaft to the PTU and install the 6 bolts.

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- Tighten to 37 Nm (27 lb-ft).

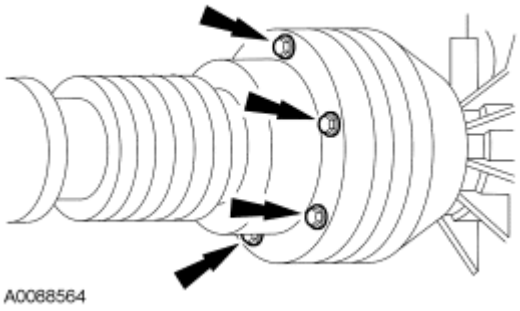


**Fig. 487: Locating Driveshaft & Bolts**
**Courtesy of FORD MOTOR CO.**

**All vehicles**

62. Install the intermediate shaft.

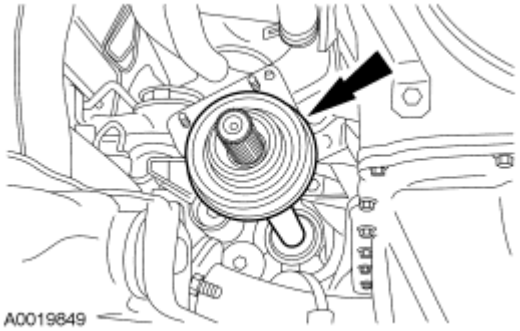


**Fig. 488: Locating Intermediate Shaft**
**Courtesy of FORD MOTOR CO.**

63. Install the intermediate shaft retaining nuts.
    - Tighten to 27 Nm (20 lb-ft).

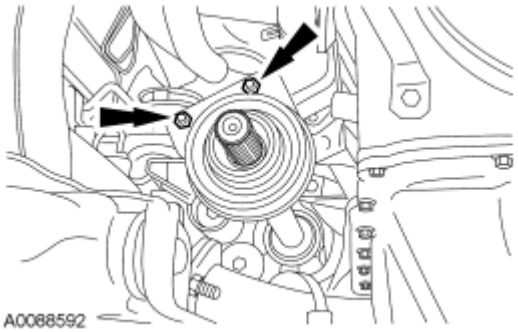


**Fig. 489: Locating Intermediate Shaft Retaining Nuts**
**Courtesy of FORD MOTOR CO.**

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64. Install the LH halfshaft in the transaxle and the RH halfshaft to the intermediate shaft.
    - Install the ball joints in the knuckles.
65. Connect the RH suspension.
    1. Install the lower ball joint-to-knuckle bolt.
        - Tighten to 63 Nm (46 lb-ft).
    2. Position the tie-rod end and install the retaining nut.
        - Tighten to 55 Nm (41 lb-ft).
    3. Connect the stabilizer bar link.
        - Tighten to 63 Nm (46 lb-ft).

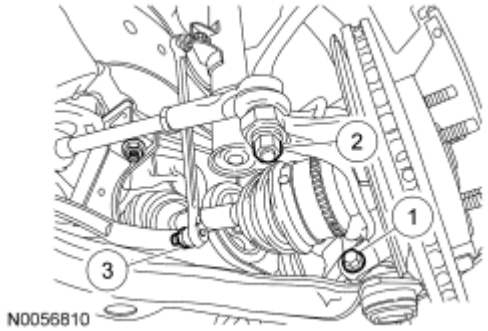


**Fig. 490: Identifying Lower Ball Joint-To-Knuckle Bolt, Retaining Nut And Stabilizer Bar Link**
**Courtesy of FORD MOTOR CO.**

66. Install the RH brake hose retainer and the ABS sensor bolt.
    - Tighten to 15 Nm (11 lb-ft).

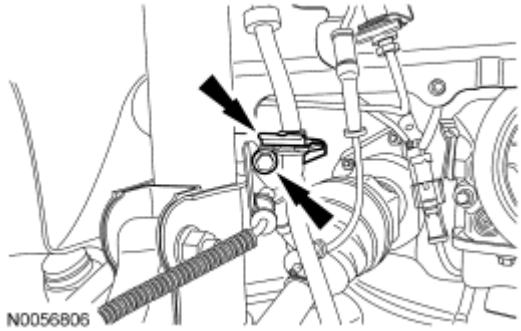


**Fig. 491: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

67. Connect the LH suspension.
    1. Install the lower ball joint-to-knuckle bolt.
        - Tighten to 63 Nm (46 lb-ft).
    2. Position the tie-rod end and install the retaining nut.
        - Tighten to 55 Nm (41 lb-ft).

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3. Connect the stabilizer bar link.
    - Tighten to 63 Nm (46 lb-ft).

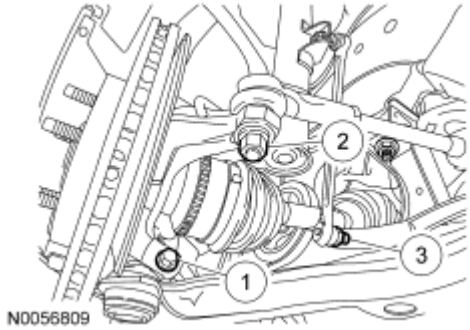


**Fig. 492: Identifying Lower Ball Joint-To-Knuckle Bolt, Retaining Nut And Stabilizer Bar Link**
**Courtesy of FORD MOTOR CO.**

68. Install the LH brake hose retainer and the ABS sensor bolt.
    - Tighten to 15 Nm (11 lb-ft).

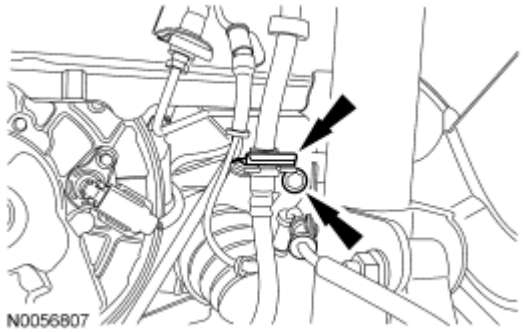


**Fig. 493: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

69. Install the lateral support crossmember and bolts.
    - Tighten to 115 Nm (85 lb-ft).

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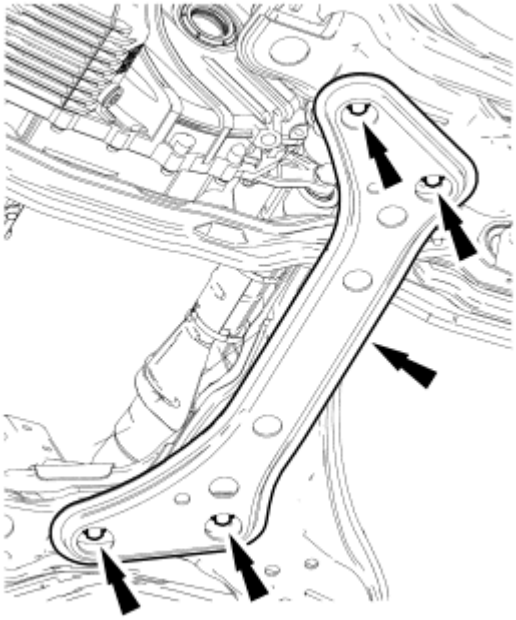


**Fig. 494: Identifying Lateral Support Crossmember And Bolts**
**Courtesy of FORD MOTOR CO.**

70. Install the generator shield, the nut and the pin-type retainer.
    - Tighten to 20 Nm (15 lb-ft).
    - Attach the wire retainers.

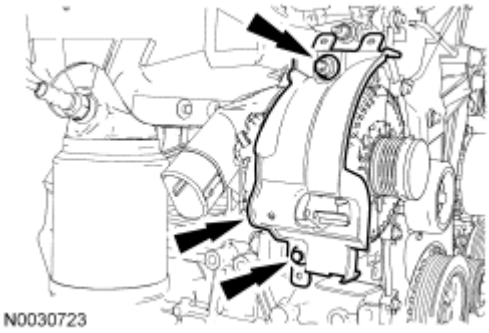


**Fig. 495: Generator Shield**
**Courtesy of FORD MOTOR CO.**

71. Install the lower air duct.

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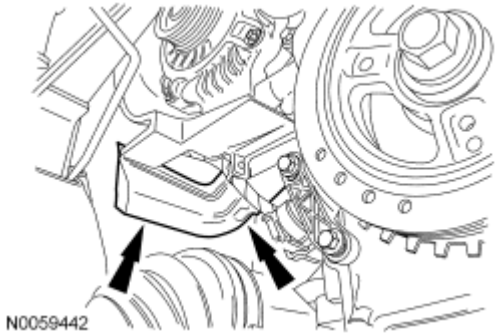


**Fig. 496: Identifying lower Air Duct**
**Courtesy of FORD MOTOR CO.**

72. Install the accessory drive belt and tensioner. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
73. Connect the heated oxygen sensor (HO2S) and the catalyst monitor sensor electrical connectors.

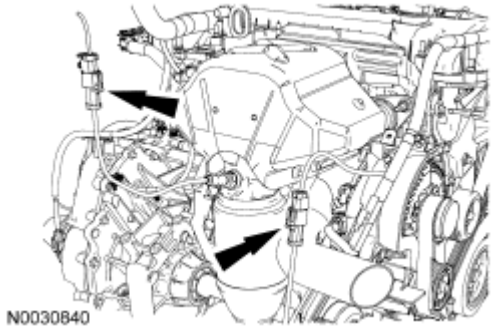


**Fig. 497: Heated Oxygen Sensor (HO2S) And Catalyst Monitor Sensor Electrical Connectors**
**Courtesy of FORD MOTOR CO.**

74. Install the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
75. Install the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
76. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
77. Install the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.
78. Fill the engine with clean engine oil.
79. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.

## ENGINE - MANUAL TRANSAXLE

**Special Tools**

| Illustration | Tool Name | Tool Number |
|---|---|---|
| | | |

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| | | |
|---|---|---|
|  ST1341-A | Heavy Duty Floor Crane | 014-00071 or equivalent |
|  ST1293-A | Powertrain Lift | 014-00765 |
|  ST1602-A | Spreader Bar | 303-D089 (D93P-6001-A3) or equivalent |
|  ST2743A | Universal Adapter Brackets | 014-0001 |

**Material**

| 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.**

1. Using the engine crane and spreader bar, position the engine and transaxle together. Install the 5 transaxle-to-engine bolts.
2. Using the engine crane and spreader bar, position the engine and transaxle onto the lift table.
3. Using the special tools, secure the engine to the lift table.

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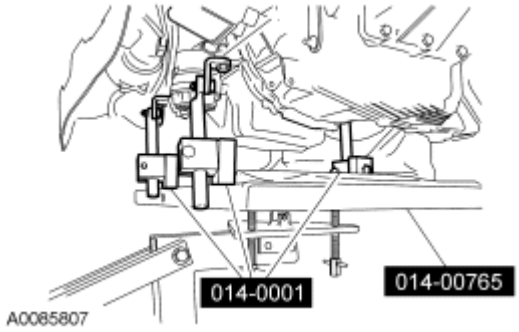


**Fig. 498: Securing Engine To Lift Table Using Special Tool (014-0001, 014-00765)**
**Courtesy of FORD MOTOR CO.**

4. Install the starter motor.
   - Tighten to 35 Nm (26 lb-ft).

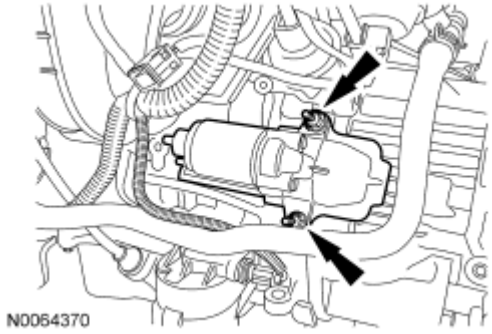


**Fig. 499: Identifying Starter Motor Bolts**
**Courtesy of FORD MOTOR CO.**

5. Install the starter motor harness connector.
   1. Install the starter motor solenoid battery nut.
      - Tighten to 12 Nm (9 lb-ft).
   2. Install the starter motor solenoid nut.
      - Tighten to 5 Nm (44 lb-in).

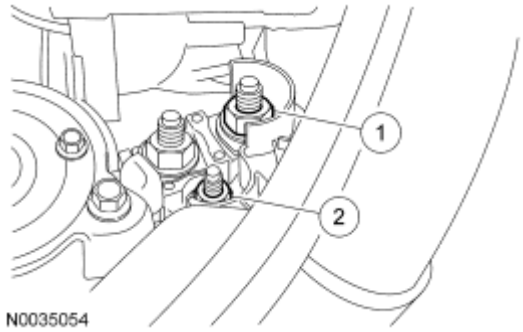


**Fig. 500: Identifying Battery Cable & Starter Solenoid Terminal Nut**
**Courtesy of FORD MOTOR CO.**

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6. Install the wire harness clip retainer and the ground wire and nut to the starter bolts.
    - Tighten to 25 Nm (18 lb-ft).

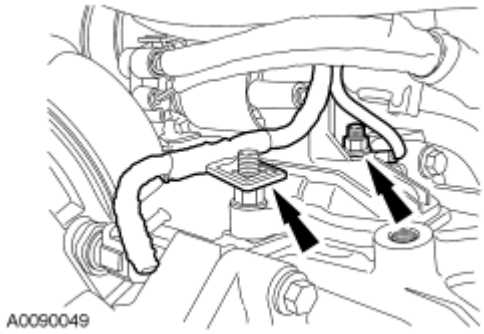


**Fig. 501: Locating Wire Harness Clip Retainer & Starter Bolts**
**Courtesy of FORD MOTOR CO.**

7. Raise the engine and transaxle into the vehicle.
8. Install the bolt in the LH transaxle mount.
    - Tighten to 103 Nm (76 lb-ft).

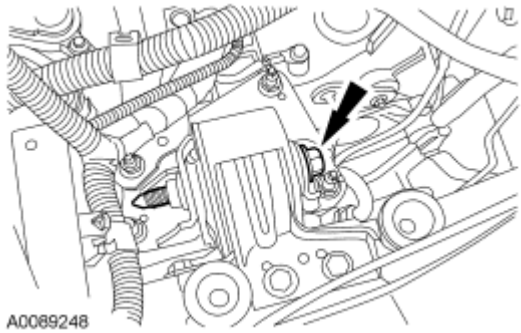


**Fig. 502: Locating Transaxle Mount Bolt**
**Courtesy of FORD MOTOR CO.**

9. Install the bolt in the rear transaxle mount.
    - Tighten 115 Nm (85 lb-ft).

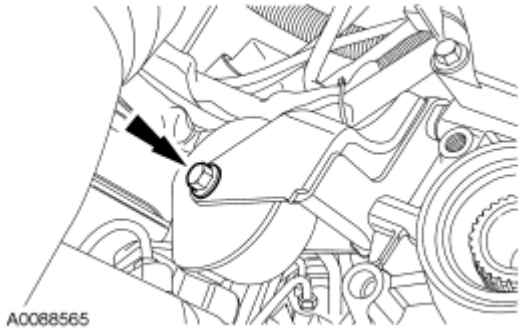


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**Fig. 503: Transaxle Rear Mount Bolt**
**Courtesy of FORD MOTOR CO.**

10. Install the engine mount bracket and nuts.
    - Tighten 115 Nm (85 lb-ft).

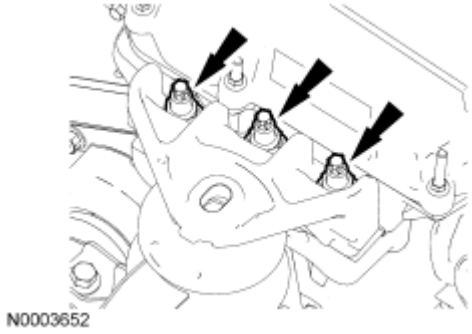


**Fig. 504: Engine Mount Bracket Nuts**
**Courtesy of FORD MOTOR CO.**

11. Install the engine mount bracket bolt.
    - Tighten to 115 Nm (85 lb-ft).

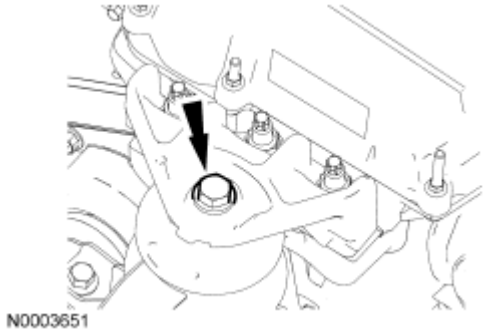


**Fig. 505: Engine Mount Bracket Bolt**
**Courtesy of FORD MOTOR CO.**

12. Install the 2 engine-to-transaxle bolts.
    - Tighten to 48 Nm (35 lb-ft).

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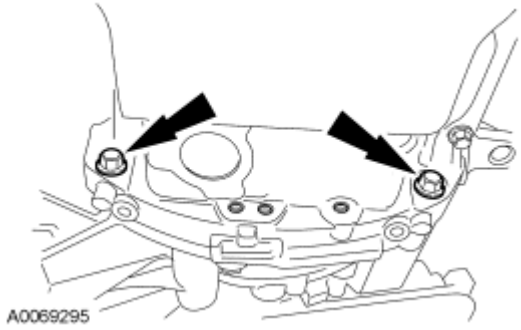


**Fig. 506: Locating Engine-To-Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

13. Install the 2 transaxle-to-engine bolts.
    - Tighten to 48 Nm (35 lb-ft).


**Fig. 507: Locating Lower Bellhousing Bolts**
**Courtesy of FORD MOTOR CO.**

14. Install the engine support crossmember and new nut.
    - Tighten to 175 Nm (129 lb-ft).

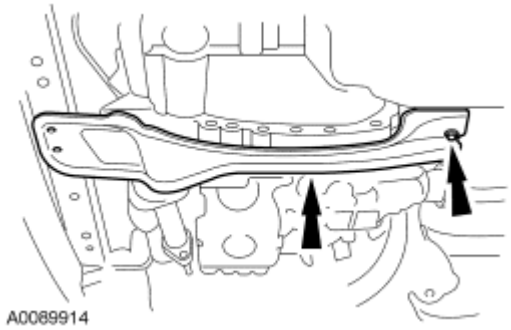


**Fig. 508: Identifying Cross Brace And Rear Nut**
**Courtesy of FORD MOTOR CO.**

15. 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).

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- Tighten the front roll restrictor bolt to 115 Nm (85 lb-ft).

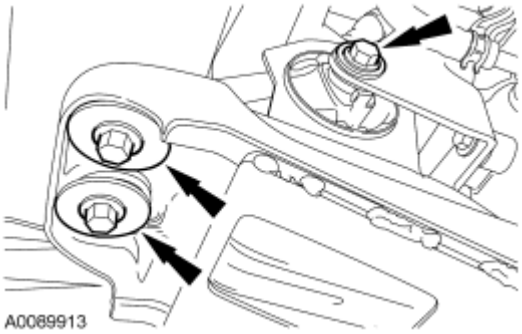


**Fig. 509: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember**
**Courtesy of FORD MOTOR CO.**

16. Position the A/C compressor and install the bolts.
    - Tighten the bolts to 25 Nm (18 lb-ft).
    - Connect the A/C compressor electrical connector.

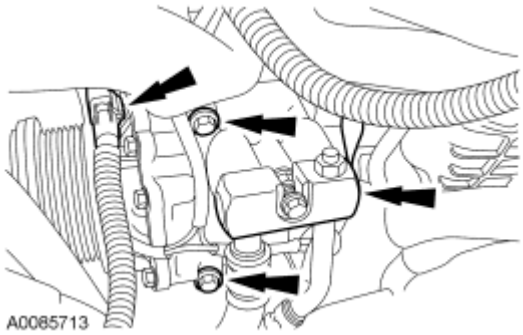


**Fig. 510: A/C Compressor Electrical Connector & Bolts**
**Courtesy of FORD MOTOR CO.**

17. Connect the lower radiator hose to the radiator.

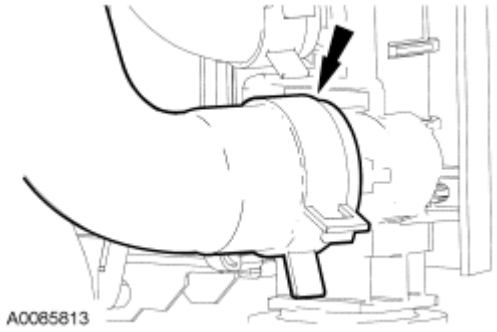


**Fig. 511: Locating Lower Radiator Hose**
**Courtesy of FORD MOTOR CO.**

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18. Connect the PCM electrical connectors.
    - Position the harness and install the nut.
        - Tighten to 6 Nm (53 lb-in).

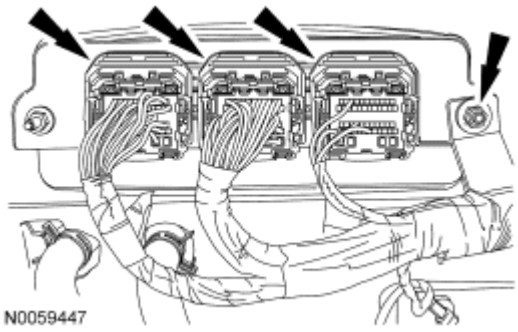


**Fig. 512: Identifying Connectors And Nut**
**Courtesy of FORD MOTOR CO.**

19. Install the ground wire and bolt.
    - Tighten to 10 Nm (89 lb-in).

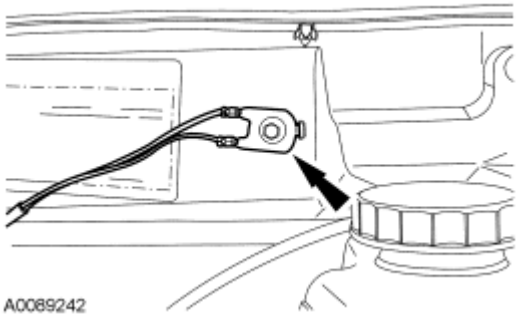


**Fig. 513: Locating Ground Wire & Bolt**
**Courtesy of FORD MOTOR CO.**

20. Attach the electrical connector retainers.

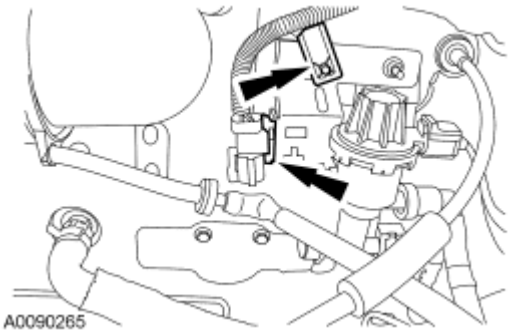


**Fig. 514: Electrical Connector Retainers**
**Courtesy of FORD MOTOR CO.**

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

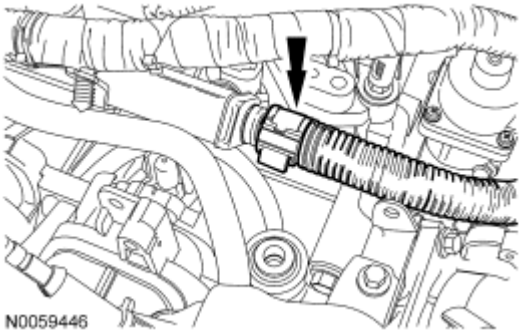


**Fig. 515: Identifying Fuel Supply Tube**
**Courtesy of FORD MOTOR CO.**

22. Connect the fuel vapor return tube and retainer.

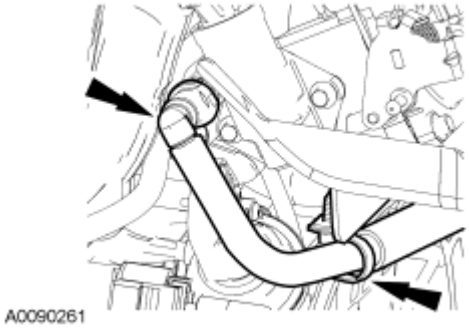


**Fig. 516: Fuel Vapor Return Tube**
**Courtesy of FORD MOTOR CO.**

23. Connect the vacuum supply tube.

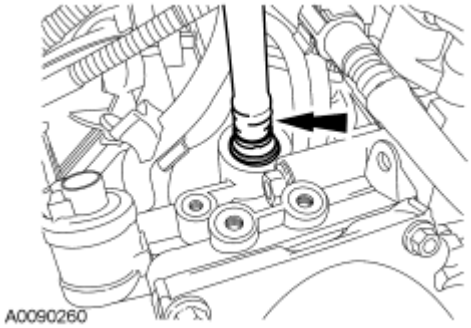


**Fig. 517: Vacuum Supply Tube**
**Courtesy of FORD MOTOR CO.**

24. Position the accelerator control cable and bracket and install the nut.

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- Tighten to 6 Nm (53 lb-in).

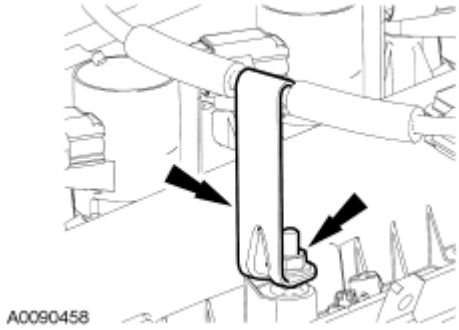


**Fig. 518: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

25. Install the accelerator control cable and bracket and nut.
    - Tighten to 6 Nm (53 lb-in).

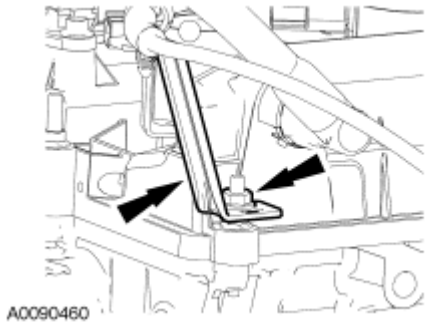


**Fig. 519: Accelerator Control Cable Bracket & Nut**
**Courtesy of FORD MOTOR CO.**

26. Install the accelerator cable and speed control cable (if equipped).
    1. Connect the accelerator and speed control cable (if equipped) to the throttle body.
    2. Install the accelerator cable bracket and bolts.
        - Tighten to 10 Nm (89 lb-in).

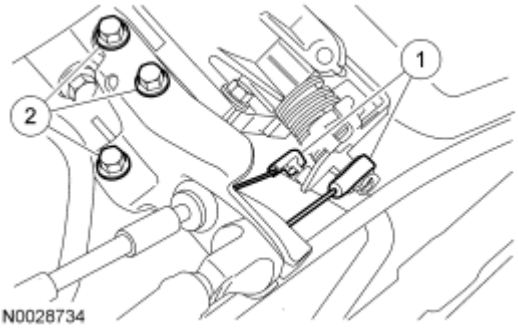


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**Fig. 520: Accelerator Cable, Speed Control Cable & Bracket Bolts**
**Courtesy of FORD MOTOR CO.**

27. Install the accelerator cable snow shield and retainers.
    - Tighten to 4 Nm (35 lb-in).

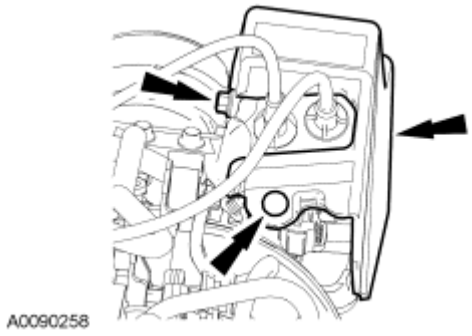


**Fig. 521: Accelerator Cable Snow Shield Retainers**
**Courtesy of FORD MOTOR CO.**

28. Connect the heater hoses to the heater core.

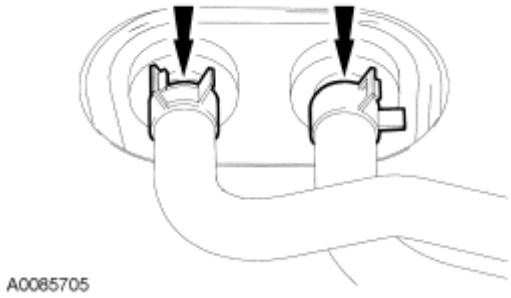


**Fig. 522: Locating Heater Hoses**
**Courtesy of FORD MOTOR CO.**

29. Attach the heater hose support strap to the stud.

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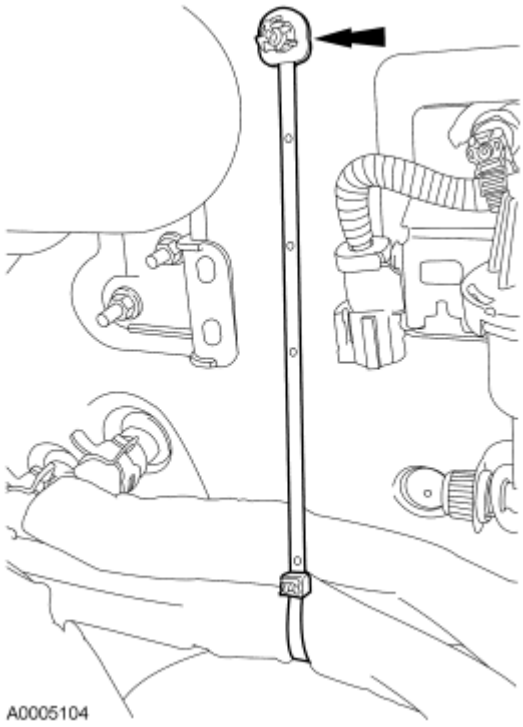


**Fig. 523: Heater Hose Support Strap & Stud**
**Courtesy of FORD MOTOR CO.**

30. Connect the upper radiator hose.

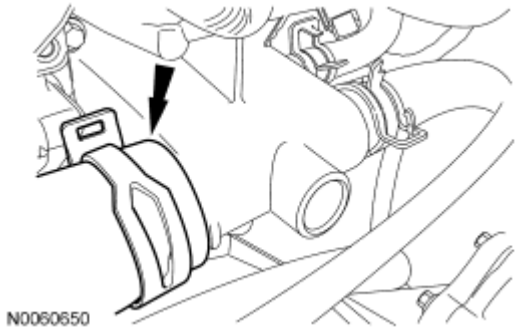


**Fig. 524: Identifying Upper Radiator Hose**
**Courtesy of FORD MOTOR CO.**

31. If equipped, route the block heater wiring harness and attach all retainers.
    - Connect the block heater electrical connector.

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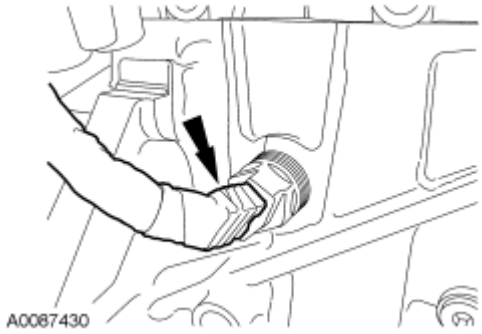


**Fig. 525: Block Heater Electrical Connector**
**Courtesy of FORD MOTOR CO.**

32. Install the shift cable bracket.
    1. Position the shift cable bracket.
    2. Install the 3 bolts.
        - Tighten to 22 Nm (16 lb-ft).

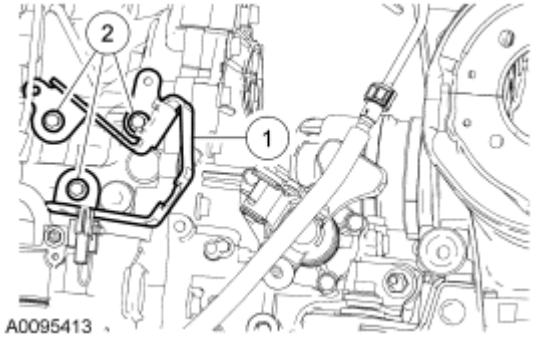


**Fig. 526: Shift Cable Bracket & Bolts**
**Courtesy of FORD MOTOR CO.**

33. Connect the shift cables.

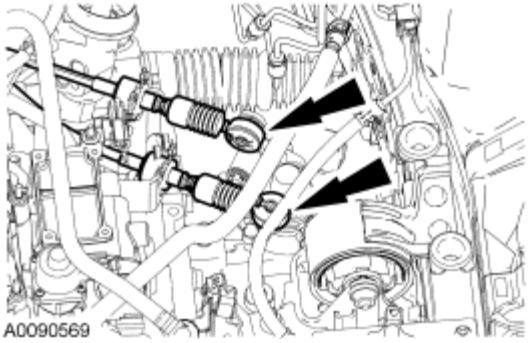


**Fig. 527: Shift Cables**
**Courtesy of FORD MOTOR CO.**

34. Connect the reversing lamp indicator switch.

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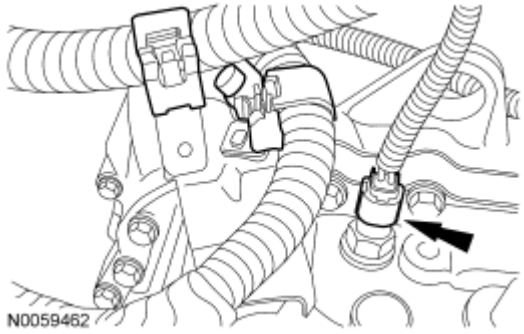


**Fig. 528: Identifying Reversing Lamp Indicator Switch**
**Courtesy of FORD MOTOR CO.**

35. Connect the vehicle speed sensor (VSS) electrical connector and pin-type retainer.

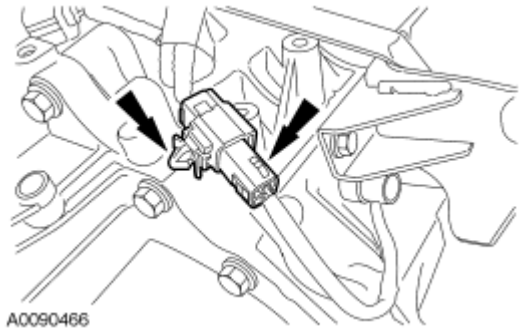


**Fig. 529: Locating Vehicle Speed Sensor (VSS) Electrical Connector**
**Courtesy of FORD MOTOR CO.**

36. Install the wiring harness bracket nut.
    - Tighten to 12 Nm (9 lb-ft).

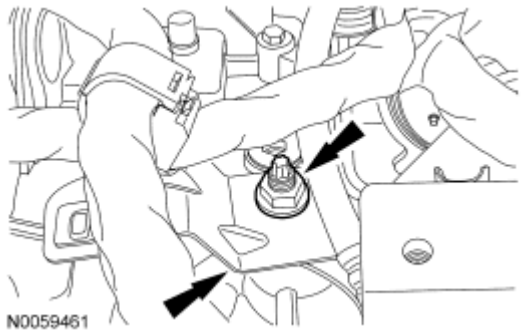


**Fig. 530: Identifying Bracket And Nut**
**Courtesy of FORD MOTOR CO.**

37. Connect the clutch hydraulic line.
    1. Position the clutch hydraulic line.
    2. Connect the clutch hydraulic line to the clutch slave cylinder.

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- Tighten to 25 Nm (18 lb-ft).

3. Install the clutch hydraulic line bracket-to-transaxle bolt.
   - Tighten to 3 Nm (27 lb-in).

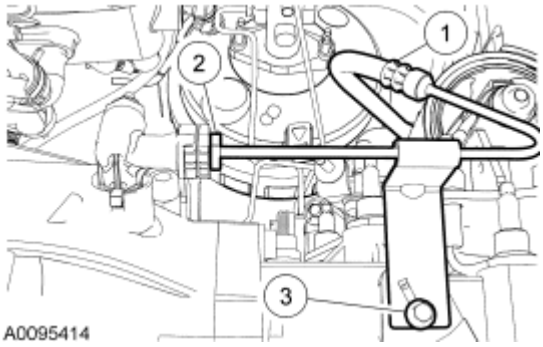


**Fig. 531: Clutch Hydraulic Line & Components**
**Courtesy of FORD MOTOR CO.**

38. Attach the wiring harness retainers to the battery tray bracket.

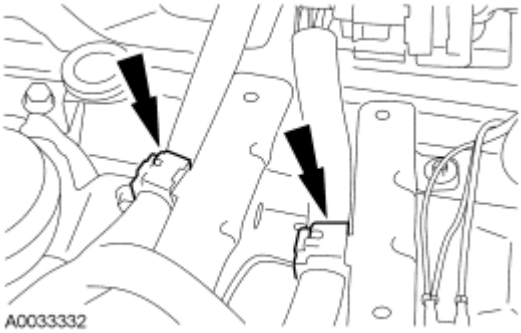


**Fig. 532: Wiring Harness Retainers**
**Courtesy of FORD MOTOR CO.**

39. Connect the 34-pin electrical connector.


**Fig. 533: Identifying Connector**
**Courtesy of FORD MOTOR CO.**

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40. Install the ground strap and bolt.
    - Tighten to 10 Nm (89 lb-in).

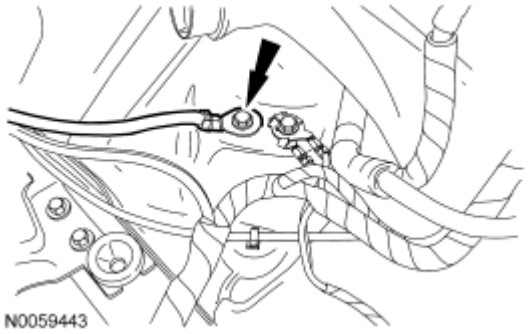


**Fig. 534: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

41. Connect the electrical connector to the power distribution box (PDB).

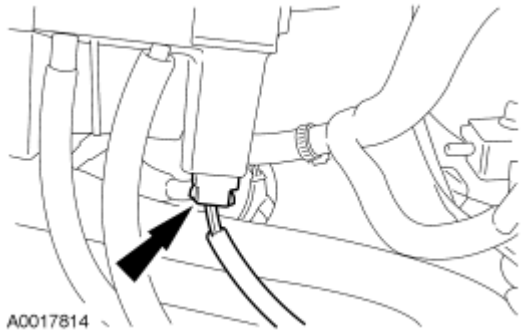


**Fig. 535: Power Distribution Box Electrical Connector**
**Courtesy of FORD MOTOR CO.**

42. Connect the cable to the PDB and install the nut.
    - Tighten to 12 Nm (9 lb-ft).

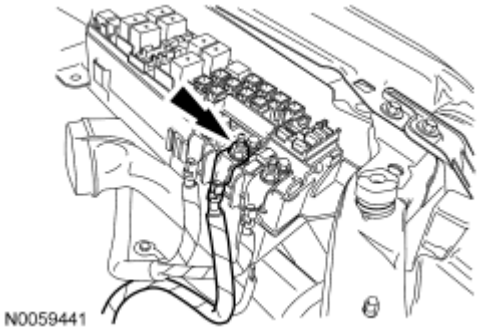


**Fig. 536: Identifying Nut**
**Courtesy of FORD MOTOR CO.**

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43. Install the PDB cover.

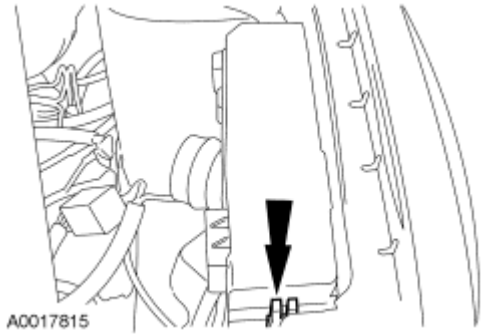


**Fig. 537: Locating Power Distribution Box Cover**
**Courtesy of FORD MOTOR CO.**

44. Install the intermediate shaft.

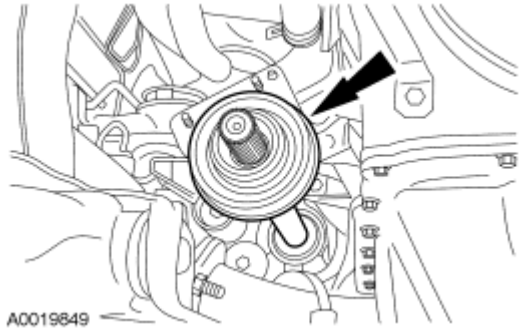


**Fig. 538: Locating Intermediate Shaft**
**Courtesy of FORD MOTOR CO.**

45. Install the intermediate shaft retaining nuts.
    - Tighten to 27 Nm (20 lb-ft).

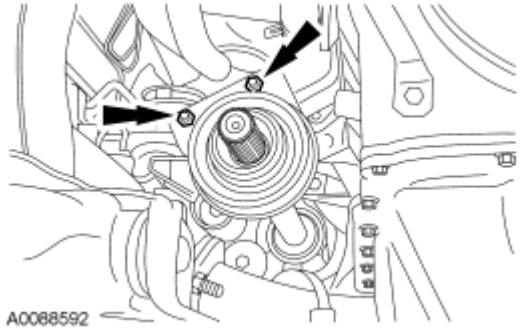


**Fig. 539: Locating Intermediate Shaft Retaining Nuts**
**Courtesy of FORD MOTOR CO.**

46. Install the LH halfshaft in the transaxle and the RH halfshaft to the intermediate shaft.

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- Install the ball joints in the knuckles.

47. Connect the RH suspension.
    1. Install the lower ball joint-to-knuckle bolt.
        - Tighten to 63 Nm (46 lb-ft).
    2. Position the tie-rod end and install the retaining nut.
        - Tighten to 55 Nm (41 lb-ft).
    3. Connect the stabilizer bar link.
        - Tighten to 63 Nm (46 lb-ft).

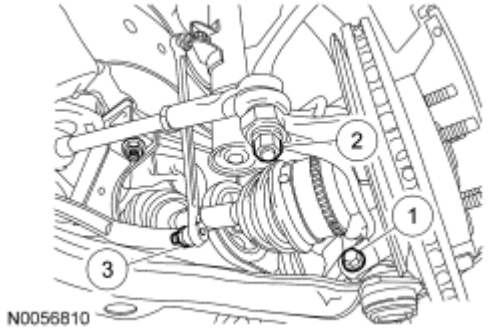


**Fig. 540: Identifying Lower Ball Joint-To-Knuckle Bolt, Retaining Nut And Stabilizer Bar Link**
**Courtesy of FORD MOTOR CO.**

48. Install the RH brake hose retainer and the anti-lock brake system (ABS) sensor bolt.
    - Tighten to 15 Nm (11 lb-ft).

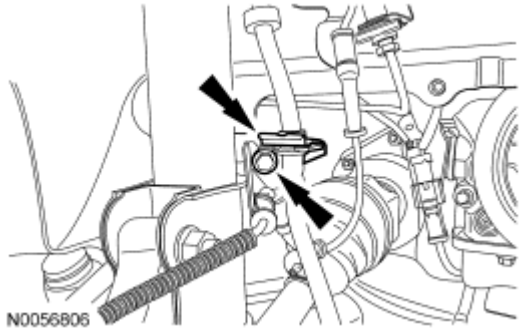


**Fig. 541: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

49. Connect the LH suspension.
    1. Install the lower ball joint-to-knuckle bolt.
        - Tighten to 63 Nm (46 lb-ft).
    2. Position the tie-rod end and install the retaining nut.
        - Tighten to 55 Nm (41 lb-ft).
    3. Connect the stabilizer bar link.

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- Tighten to 63 Nm (46 lb-ft).

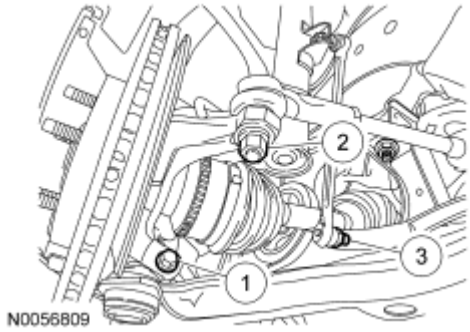


**Fig. 542: Identifying Lower Ball Joint-To-Knuckle Bolt, Retaining Nut And Stabilizer Bar Link**
**Courtesy of FORD MOTOR CO.**

50. Install the LH brake hose retainer and the ABS sensor bolt.
    - Tighten to 15 Nm (11 lb-ft).

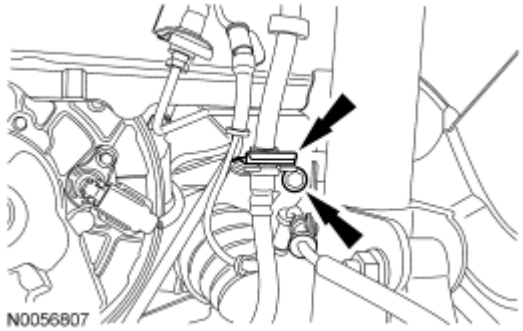


**Fig. 543: Identifying Bolt**
**Courtesy of FORD MOTOR CO.**

51. Install the lateral support crossmember and bolts.
    - Tighten to 115 Nm (85 lb-ft).

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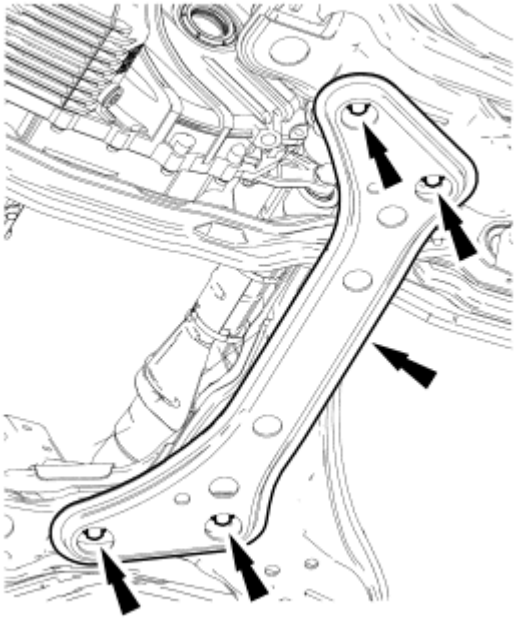


**Fig. 544: Identifying Lateral Support Crossmember And Bolts**
**Courtesy of FORD MOTOR CO.**

52. Install the generator shield, the nut and the pin-type retainer.
    - Tighten to 20 Nm (15 lb-ft).
    - Attach the wire retainers.

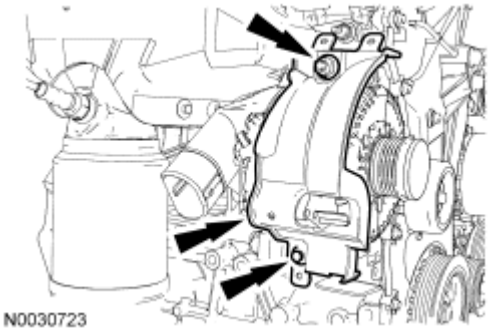


**Fig. 545: Generator Shield**
**Courtesy of FORD MOTOR CO.**

53. Install the lower air duct.

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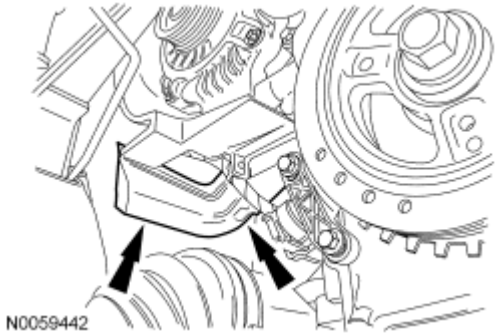


**Fig. 546: Identifying Lower Air Duct**
**Courtesy of FORD MOTOR CO.**

54. Install the accessory drive belt tensioner. For additional information, refer to **ACCESSORY DRIVE - 2.3L** article.
55. Connect the heated oxygen sensor (HO2S) and the catalyst monitor sensor electrical connectors.

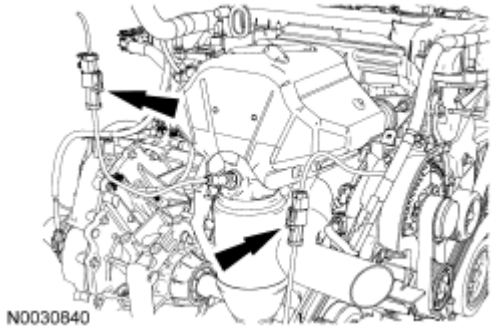


**Fig. 547: Heated Oxygen Sensor (HO2S) And Catalyst Monitor Sensor Electrical Connectors**
**Courtesy of FORD MOTOR CO.**

56. Install the exhaust flexible pipe. For additional information, refer to **EXHAUST SYSTEM** article.
57. Install the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
58. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
59. Install the engine air cleaner and air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 2.3L** article.
60. Fill the engine with clean engine oil.
61. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
62. Bleed the clutch system. For additional information, refer to **MANUAL TRANSAXLE/TRANSMISSION AND CLUTCH - GENERAL INFORMATION** article.

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