2010 ENGINE

Engine - 3.0L (4V) - Escape, Escape Hybrid & Mariner, Mariner Hybrid

SPECIFICATIONS

MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATIONS

Item	Specification	Fill Capacity
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	5.7L (6.0 qt) includes filter change
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Item	Specification
Engine	
Bore/stroke	89.0 x 79.5 mm (3.12 in)
Compression ratio	10.3:1
Displacement	3.0L (4V) (182 CID)
Engine and transaxle assembly weight (without accessory drive components)	234 kg (516 lb)
Engine weight (without accessory drive components and flexplate)	146 kg (322 lb)
Fire order	1-4-2-5-3-6
No. cylinders	6
Oil pressure (Minimum at 1,500 RPM with engine warmed up after 10 minutes of idling)	172 kPa (25 psi)
Spark plug	CGSF-22F Gap = 1.15-1.25 mm (0.045-0.049 in)
Cylinder Head and Valve Train	
Combustion chamber volume	51.2 cc +/- 1.5 cc
Cylinder head gasket surface flatness	0.025 mm (0.001 in) in any 25 mm (1 in) x 25 mm (1 in) area, 0.05 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area;

 © 2011 Mitchell Repair Information Company, LLC.

	0.15 mm (0.005 in) overall
Roller follower ratio @ max. lift	2.0:1
Valve arrangement (front to rear)	LH intake I-I-I-I-I-I LH exhaust E-E-E-E-E-E RH intake I-I-I-I-I-I RH exhaust E-E-E-E-E-E
Valve face angle	45.5 degrees
Valve face runout	0.04 mm (0.001 in)
Valve guide bore diameter	6.015-6.044 mm (0.236-0.237 in)
Valve head diameter - exhaust	30 mm (1.18 in)
Valve head diameter - intake	35 mm (1.38 in)
Valve head diameter (exhaust) - gauge diameter	28.0 mm (1.10236 in)
Valve head diameter (intake) - gauge diameter	33.5 mm (1.3189 in)
Valve seat angle	44.75 degrees
Valve seat runout	0.04 mm (0.001 in)
Valve seat width - exhaust	1.4-1.7 mm (0.055-0.066 in)
Valve seat width - intake	1.1-1.4 mm (0.043-0.055 in)
Valve spring compression pressure (Nm @ spec. length)	780 Nm @ 32.29 mm (575 lb @ 1.27 in)
Valve spring free length (approx.)	50.52 mm (1.988 in)
Valve spring installed height (Nm @ spec. length)	42.61 mm (1.677 in)
Valve spring installed pressure	280 Nm @ 42.61 mm (206 lb @ 1.677 in)
Valve spring installed pressure - service limit	5% force loss @ specified height
Valve spring squareness	1.2 mm (0.047 in) from ID
Valve stem diameter - exhaust	5.950-5.970 mm (0.2343-0.2350 in)
Valve stem diameter - intake	5.975-5.995 mm (0.2350-0.2358 in)
Valve stem-to-guide clearance - exhaust	0.045-0.094 mm (0.0017-0.037 in)
Valve stem-to-guide clearance - intake	0.019-0.069 mm (0.0007-0.0027 in)
Hydraulic Lash Adjuster	
Clearance to bore	0.018-0.069 mm (0.0007-0.0027 in)
Collapsed lash adjuster gap	0.50-1.11 mm (0.019-0.043 in)
Diameter (standard)	16-15.988 mm (0.6290-0.6294 in)
Hydraulic leakdown rate	5-25 seconds
Camshaft	
Camshaft journal bore inside diameter	27.012-26.987 mm (1.063-1.062 in)
Camshaft journal-to-bearing clearance - service limit	0.121 mm (0.0047 in)

 © 2011 Mitchell Repair Information Company, LLC.

Camshaft journal-to-bearing clearance - standard	0.025-0.076 mm (0.001-0.0029 in)
End play - service limit	0.241 mm (0.009 in)
Journal diameter (all)	26.962-26.936 mm (1.061-1.060 in)
Lobe lift (intake)	5.084 mm (0.2 in)
Lobe lift (exhaust)	5.084 mm (0.2 in)
Runout	-
Theoretical valve lift @ 0 lash	10.38 mm (0.408 in)
Cylinder Block	
Cylinder bore diameter - grade 1	89.000-89.010 mm (3.50393-3.504323 in)
Cylinder bore diameter - grade 2	89.011-89.020 mm (3.50437-3.50472 in)
Cylinder bore diameter - grade 3	89.021-82.030 mm (3.50476-3.50511 in)
Cylinder bore maximum out-of-round	0.015 mm (0.0005 in)
Cylinder bore maximum out-of-round - service limit	0.020 mm (0.0007 in)
Cylinder bore maximum taper	0.020 mm (0.0008 in)
Head gasket surface flatness	0.025 mm (0.001 in) in any 25 mm (1 in) x 25 mm (1 in) area, 0.05 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.15 mm (0.005 in) overall
Main bearing bore inside diameter	67.998-68.022 mm (2.677-2.6780 in)
Crankshaft	
Connecting rod journal diameter	49.969-49.991 mm (1.967-1.968 in)
Connecting rod journal maximum out-of-round	0.006 mm (0.0002 in)
Connecting rod journal maximum taper	0.008 mm (0.0003 in)
Crankshaft maximum end play	0.100-0.255 mm (0.003-0.100 in)
Main bearing journal diameter	62.968-62.992 mm (2.467-2.479 in)
Main bearing journal maximum out-of-round	0.006 mm (0.0002 in)
Main bearing journal maximum taper	0.008 mm (0.0003 in)
Main bearing journal-to-cylinder block clearance	0.024-0.046 mm (0.0009-0.0018 in) (select fit bearings)
Piston and Connecting Rod	
Connecting rod bearing bore diameter	53.015-53.035 mm (2.0872-2.0879 in)
Connecting rod bearing-to-crankshaft clearance	0.028-0.066 mm (0.001-0.0025 in)
Connecting rod length (center-to-center)	138.06-138.14 mm (5.435-5.38 in)
Connecting rod maximum allowed bend	0.038 per 25 mm (0.0014 per 0.984 in)
Connecting rod maximum allowed twist	0.050 per 25 mm (0.0019 per 0.984 in)
Connecting rod pin bore diameter	21.017-21.031 mm (0.827-0.828 in)
Connecting rod side clearance	0.100-0.30 mm (0.0039-0.0118 in)

 © 2011 Mitchell Repair Information Company, LLC.

Connecting rod-to-pin clearance - service limit	0.035 mm (0.0013 in)
Connecting rod-to-pin clearance - standard	0.004-0.02 mm (0.0001-0.0007 in)
Piston diameter - coated, grade 1	88.980-88.995 mm (3.5031-3.5037 in)
Piston diameter - coated, grade 2	88.78-89.007 mm (3.4952-3.5042 in)
Piston diameter - coated, grade 3	89.00-89.015 mm (3.5039-3.5045 in)
Piston diameter - uncoated, grade 1	88.970-88.980 mm (3.50275-3.50314 in)
Piston diameter - uncoated, grade 2	88.978-88.992 mm (3.50306-3.50362 in)
Piston diameter - uncoated, grade 3	88.990-89.000 mm (3.5035-3.5039 in)
Piston pin bore diameter	21.015-21.020 mm (0.8273-0.8275 in)
Piston pin diameter	21.011-21.013 mm (0.8271-0.8273 in)
Piston pin length	60.08-60.51 mm (2.365-2.382 in)
Piston ring end gap - compression (bottom, gauge diameter)	0.27-0.42 mm (0.0106-0.0165 in)
Piston ring end gap - compression (bottom, service limit)	0.65 mm (0.0255 in) max
Piston ring end gap - compression (top, gauge diameter)(1)	0.100-0.250 mm (0.0039-0.0098 in)
Piston ring end gap - compression (top, service limit)	0.50 mm (0.0196 in) max
Piston ring end gap - oil ring (steel rail, gauge diameter)	0.15-0.65 mm (0.0059-0.0255 in)
Piston ring end gap - oil ring (steel rail, service limit)	0.90 mm (0.0354 in) max
Piston ring groove width - compression (bottom)	1.530-1.555 mm (0.0602-0.0612 in)
Piston ring groove width - compression (top)	1.230-1.255 mm (0.0484-0.0494 in)
Piston ring groove width - oil ring	2.53-2.555 mm (0.0996-0.1005 in)
Piston ring-to-groove clearance	-
Piston ring width	-
Piston pin-to-piston fit	0.002 to 0.009 mm (0.00007-0.0003 in)
Piston-to-connecting rod clearance	-
Piston-to-cylinder bore clearance (coated)	0.003 to 0.032 mm (0.0001-0.0012 in)
Piston-to-cylinder bore clearance (uncoated)	0.012 to 0.022 mm (0.0005-0.0009 in)
(1) Specification 82.4 mm (3.2441 in) diameter gauge	

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

 © 2011 Mitchell Repair Information Company, LLC.

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner bolts	25	18	-
A/C compressor bracket bolts	25	18	-
A/C compressor bolts	25	18	-
Block heater	21	15	-
Camshaft journal and thrust cap bolts(1)	-	-	-
Camshaft oil seal retainer bolts	10	-	89
Camshaft phaser and sprocket bolts	18	-	159
Coil-on-plug bolts	6	-	53
Connecting rod cap bolts(1)	-	-	-
Coolant pump housing	10	-	89
Coolant pump housing hose clamps	7	-	62
Crankcase cover bolts	10	-	89
Crankshaft pulley bolt(1)	-	-	-
Cross brace bolts	90	66	-
Cross brace nut	175	129	-
Cylinder head bolts(1)	-	-	-
Driveshaft-to-Power Transfer Unit (PTU) bolts and washers	37	27	-
Engine front cover bolts and studs(1)	-	-	-
Engine oil filter(1)	-	-	-
Engine Oil Pressure (EOP) switch	14	-	124
Engine support insulator bolts	48	35	-
Engine support insulator bracket bolt	115	85	-
Engine support insulator bracket nuts	55	41	-
EGR tube fitting nut	40	30	-
Flexplate bolts	80	59	-
Front roll restrictor bolt	115	85	-
Fuel rail bolts	10	-	89
Gearshift cable bracket bolts	23	17	-
Generator B+ wire nut	8	-	71
Generator bolt	47	35	-
Generator studs	8	-	71
Generator stud nuts	47	35	-
Ground wire bolt	10	-	89
Ground wire eyelet nut	25	18	-
Halfshaft support bracket bolts	48	35	-
Heat shield bolts	10	-	89
Ignition coil-on-plug bolts	6	-	53
Intermediate shaft bearing retainer nuts	27	20	-
Lateral support crossmember bolts	115	85	-

 © 2011 Mitchell Repair Information Company, LLC.

LH catalytic converter nuts(1)	-	-	-
LH catalytic converter studs	12	-	106
LH transaxle support insulator through bolt	115	85	-
Lower cylinder block bolts(1)	-	-	-
Lower intake manifold bolts(1)	-	-	-
Oil level indicator tube stud bolt	10	-	89
Oil pan baffle nuts(1)	-	-	-
Oil pan bolts and studs	25	18	-
Oil pan drain plug	26	19	-
Oil pan-to-engine bolts(1)	-	-	-
Oil pan-to-transaxle bolts	40	30	-
Oil pump bolts(1)	-	-	-
Oil pump screen and pickup tube bolts	10	-	89
Power Distribution Box (PDB) cable nuts	12	-	106
PTU bolts	45	33	-
PTU heat shield bolts	11	-	97
PTU support bracket bolts	55	41	-
PTU vent tube bolt	14	-	124
Rear transaxle support through bolt	103	76	-
RH catalytic converter nuts	40	30	-
RH exhaust manifold nuts(1)	-	-	-
RH exhaust manifold studs	12	-	106
RH and LH lower splash shield bolts	9	-	80
RH radio ignition interference capacitor nut	6	-	53
RH transaxle support insulator bracket nuts and bolt	80	59	-
RH transaxle support insulator through bolt	115	85	-
Spark plugs	15	-	133
Starter stud bolts	27	20	-
Starter wiring ground nut	18	-	159
Starter wiring large nut	12	-	106
Starter wiring small nut	5	-	44
Timing chain guide bolts	25	18	-
Timing chain tensioner bolts	25	18	-
Torque converter-to-flexplate nuts	40	30	-
Transaxle-to-engine bolts	48	35	-
Transaxle-to-engine stud and nuts	48	35	-
Upper intake manifold bolts(1)	-	-	-
Upper intake manifold support bracket bolts	10	-	89
Upper radiator support bracket bolts	10	-	89
	-	-	-

 © 2011 Mitchell Repair Information Company, LLC.

Valve cover bolts and stud bolts(1)			
Variable Camshaft Timing (VCT) solenoid bolts	10	-	89
(1) Refer to the procedure in this article.			

DESCRIPTION AND OPERATION

ENGINE

The 3.0L (4V) is a V-6 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- A composite lower intake manifold and a composite upper intake manifold
- Aluminum cylinder heads
- Two-piece design aluminum cylinder block
- Variable Camshaft Timing (VCT) system
- Electronic ignition system with 6 ignition coils

Engine Identification

For quick identification, refer to **IDENTIFICATION CODES** for safety certification decal.

- The decal is located on the LH front door lock face panel.

Engine Code Information Label

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

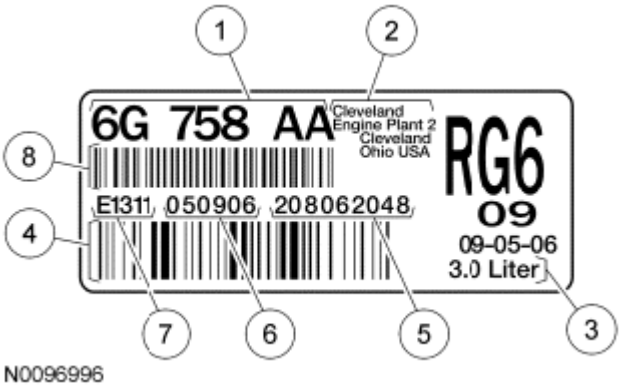


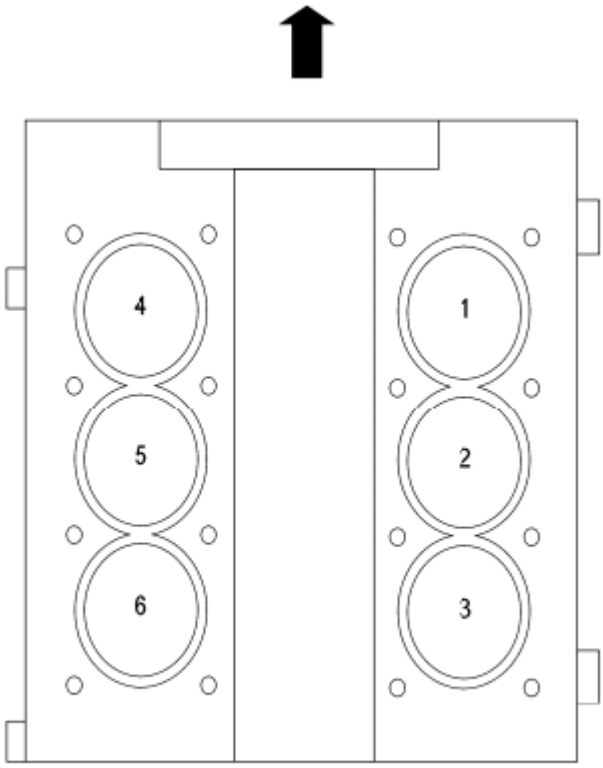
Fig. 1: Identifying Engine Code Information Label
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

ITEM DESCRIPTION

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

Engine Cylinder Identification



N0069904

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

Exhaust Emission Control System

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

Induction System

 © 2011 Mitchell Repair Information Company, LLC.

The **SFI** provides the fuel/air mixture needed for combustion in the cylinders. The 6 solenoid-operated fuel injectors:

- are mounted between the fuel rail and 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.

Valve Train

The camshafts are mounted in the cylinder heads and act against a roller follower to open and close the valves. A hydraulic lash adjuster is located on one side of the roller follower and the valve tip on the opposite end. The camshafts are driven off the front of each cylinder head by 2 chains (one each side). Both of the chains are driven by sprockets that are located on the crankshaft, just in front of the oil pump.

Variable Camshaft Timing (VCT) System

The **VCT** system changes intake camshaft timing dependent on engine speed, load and oil temperature. Oil pressure advances and retards camshaft timing to improve low-speed and high-speed engine performance, engine idle quality and exhaust emissions.

PCV System

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

Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft, connecting rod bearings and timing chain tensioners. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the head gaskets.

Oil Pump

The lubrication system is designed to provide optimum oil flow to critical components of the engine through its entire operating range.

The heart of the system is a positive displacement internal gear oil pump.

Generically this design is known as a gerotor pump, which operates as follows:

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

 © 2011 Mitchell Repair Information Company, LLC.

- The relief valve is designed to provide adequate connecting rod bearing lubrication under high-temperature and high-speed conditions.

Cooling System

The engine cooling system includes the following components:

- Radiator
- Electric cooling fan motor
- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses
- Coolant pump housing

DIAGNOSIS AND TESTING

ENGINE

For basic engine mechanical concerns, refer to **ENGINE SYSTEM - GENERAL INFORMATION** . For driveability concerns, refer to the **INTRODUCTION - GASOLINE MODELS** .

IN-VEHICLE REPAIR

UPPER INTAKE MANIFOLD

Upper Intake Manifold (View 1 of 2)

 © 2011 Mitchell Repair Information Company, LLC.

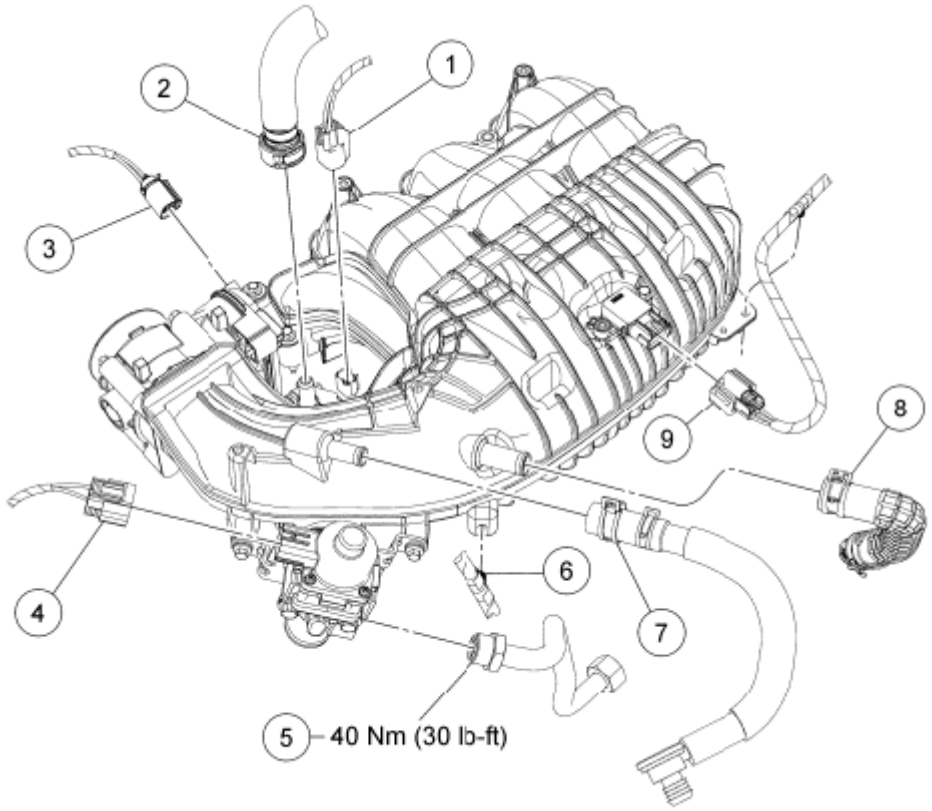


Fig. 3: Identifying Upper Intake Manifold Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	Evaporative Emission (EVAP) canister purge valve electrical connector (part of 12C508)
2	9D289	**EVAP** tube-to- **EVAP** canister purge valve quick connect coupling
3	14A464	Electronic throttle control electrical connector (part of 12C508)
4	14A464	EGR regulator electrical connector (part of 12C508)
5	-	EGR tube fitting (part of 9D477)
6	W700497	Engine control wiring harness retainer (part of 12C508) (2 required)
7	-	Brake booster vacuum tube
8	6K817	PCV tube
9	14A464	Manifold Absolute Pressure (MAP) electrical connector (part of 12C508)

Upper Intake Manifold (View 2 of 2)

 © 2011 Mitchell Repair Information Company, LLC.

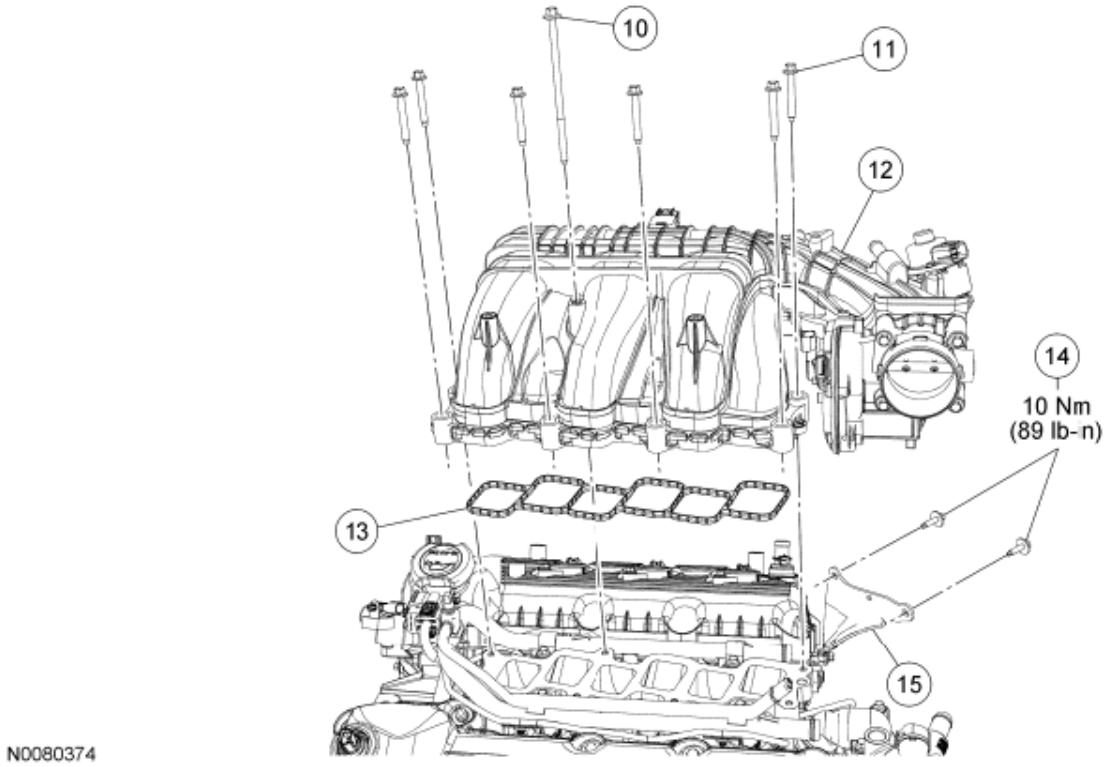


Fig. 4: Identifying Upper Intake Manifold Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
10	W713391	Upper intake manifold bolt
11	9Y450	Upper intake manifold bolt (6 required)
12	9424	Upper intake manifold
13	-	Upper intake manifold gasket
14	W701775	Upper intake manifold support bracket bolts (2 required)
15	9J444	Upper intake manifold support bracket

Removal

1. Remove the Air Cleaner (ACL) outlet pipe and the **ACL** . For additional information, refer to **AIR CLEANER OUTLET PIPE** .
2. Remove the EGR tube fitting from the EGR valve.
3. Disconnect the electronic throttle control electrical connector.
4. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.
5. Disconnect the EGR regulator electrical connector and detach the wiring retainer.
6. Disconnect the **EVAP** tube-to- **EVAP** canister purge valve quick connect coupling and the brake booster vacuum tube from the upper intake manifold.
7. Detach the engine control wiring harness retainer from the upper intake manifold.

 © 2011 Mitchell Repair Information Company, LLC.

8. Disconnect the PCV tube from the upper intake manifold.
9. Disconnect the Manifold Absolute Pressure (MAP) electrical connector and detach the wiring retainer.
10. Remove the 2 upper intake manifold support bracket bolts from the upper intake manifold.
11. Remove the 7 bolts and the upper intake manifold.
    - Remove and discard the gaskets.

Installation

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

NOTE: Clean and inspect all sealing surfaces. Install new gaskets.

1. Position the upper intake manifold and install the 7 bolts.
    - Tighten the bolts in 2 stages in the sequence shown.
        - Stage 1: Tighten to 10 Nm (89 lb-in).
        - Stage 2: Tighten an additional 45 degrees.

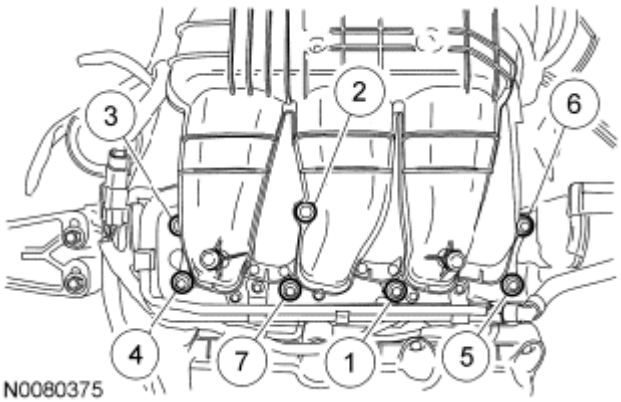


Fig. 5: Identifying Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the 2 upper intake manifold support bracket bolts.
    - Tighten to 10 Nm (89 lb-in).
3. Connect the **MAP** electrical connector and attach the wiring retainer.
4. Connect the PCV tube to the upper intake manifold.
5. Attach the engine control wiring harness retainer to the upper intake manifold.
6. Connect the **EVAP** tube-to- **EVAP** canister purge valve quick connect coupling and the brake booster vacuum tube to the upper intake manifold.
7. Connect the EGR regulator electrical connector and attach the wiring retainer.

 © 2011 Mitchell Repair Information Company, LLC.

8. Connect the **EVAP** canister purge valve electrical connector.
9. Connect the electronic throttle control electrical connector.
10. Install the EGR tube fitting to the EGR valve.
    - Tighten to 40 Nm (30 lb-ft).
11. Install the **ACL** outlet pipe and the **ACL** . For additional information, refer to **AIR CLEANER OUTLET PIPE** .

LOWER INTAKE MANIFOLD

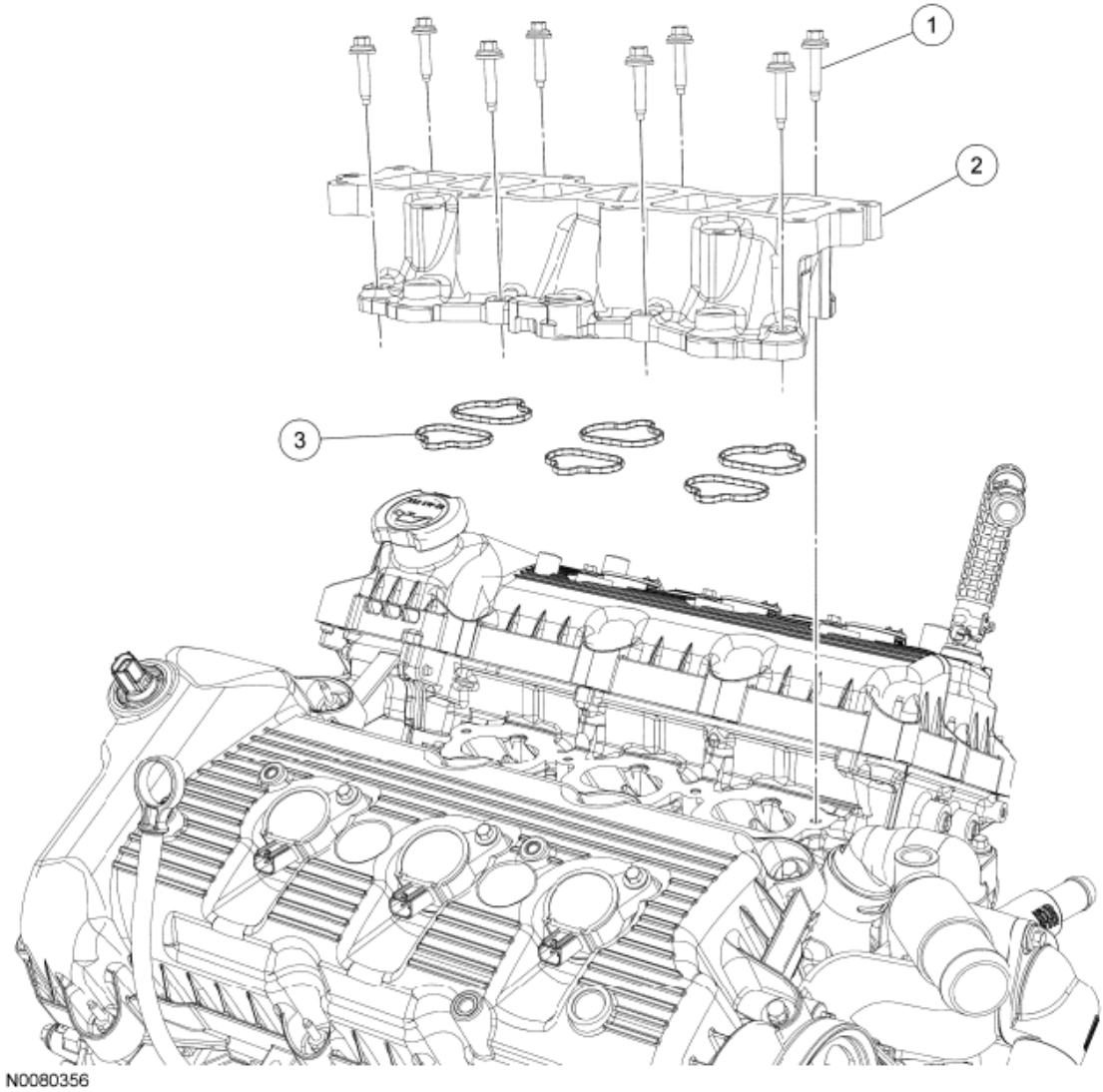


Fig. 6: Identifying Lower Intake Manifold Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description

 © 2011 Mitchell Repair Information Company, LLC.

1	W503279	Lower intake manifold bolt (8 required)
2	9K461	Lower intake manifold
3	9439	Lower intake manifold gasket (6 required)

Removal

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.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
2. Disconnect the battery ground cable. For additional information, refer to **BATTERY DISCONNECT** .
3. Remove the fuel rail. For additional information, refer to **FUEL RAIL** .
4. Remove the 8 lower intake manifold bolts and the lower intake manifold.
   - Remove and discard the gaskets.

Installation

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

NOTE: Clean and inspect all sealing surfaces. Install new gaskets.

1. Position the lower intake manifold and install the 8 bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

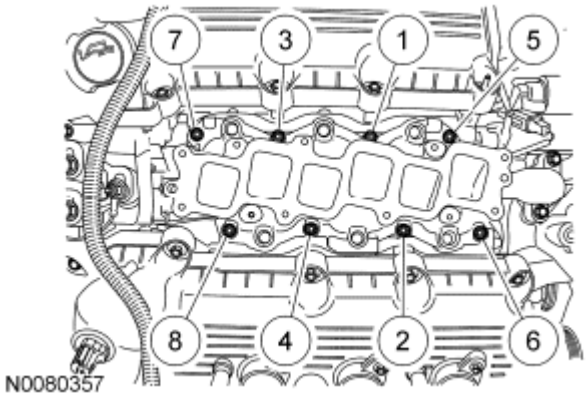


Fig. 7: Identifying Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the fuel rail. For additional information, refer to **FUEL RAIL** .
3. Connect the battery ground cable. For additional information, refer to **BATTERY DISCONNECT** .

VALVE COVER - LH

Material

MATERIAL SPECIFICATIONS

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

LH Valve Cover (View 1 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

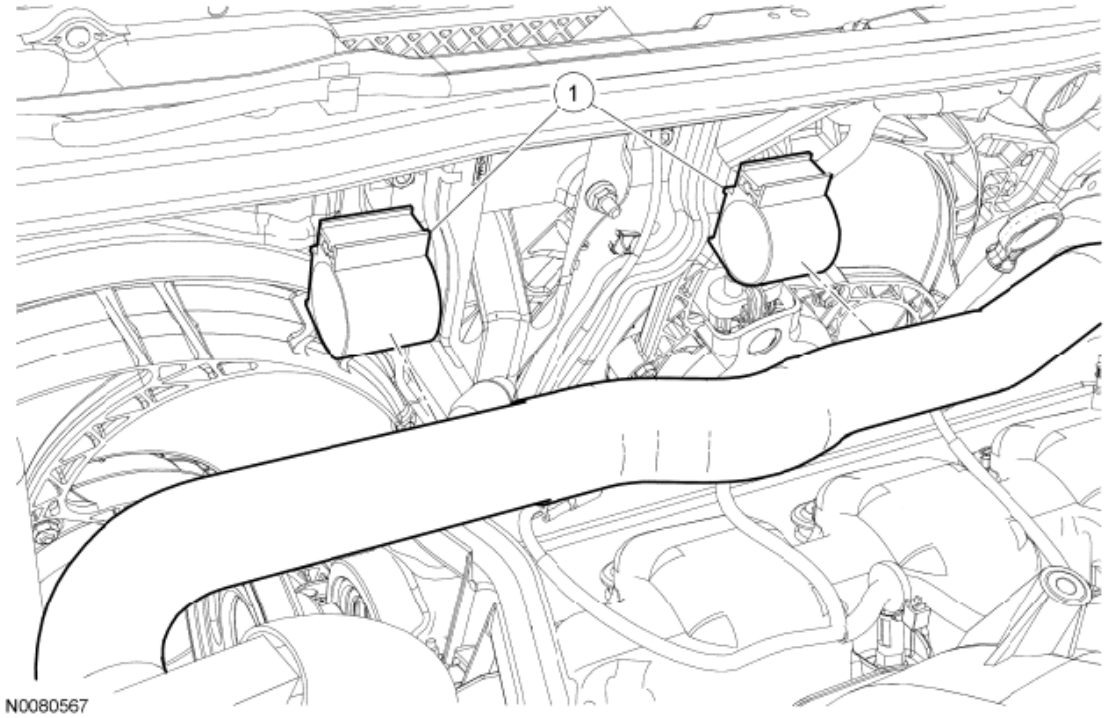


Fig. 8: Identifying LH Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	8260	Upper radiator hose retainers

LH Valve Cover (View 2 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

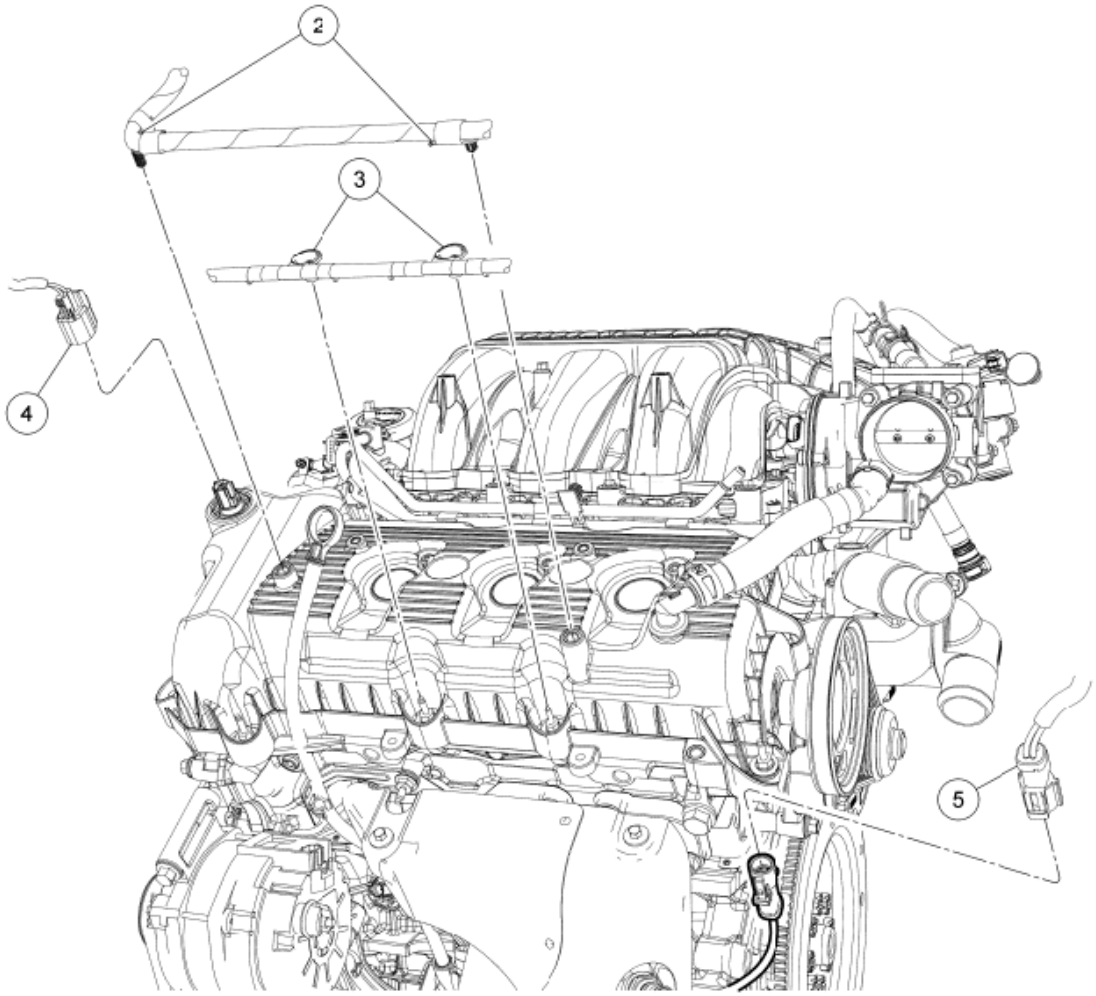


Fig. 9: Identifying LH Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
2	-	Valve cover wiring retainers (part of 12A581)
3	-	B+ cable valve cover stud bolt wiring retainers (part of 14A280)
4	14A464	Variable Camshaft Timing (VCT) electrical connector (part of 12A581)
5	14A464	LH Heated Oxygen Sensor (HO2S) electrical connector (part of 12A581)

LH Valve Cover (View 3 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

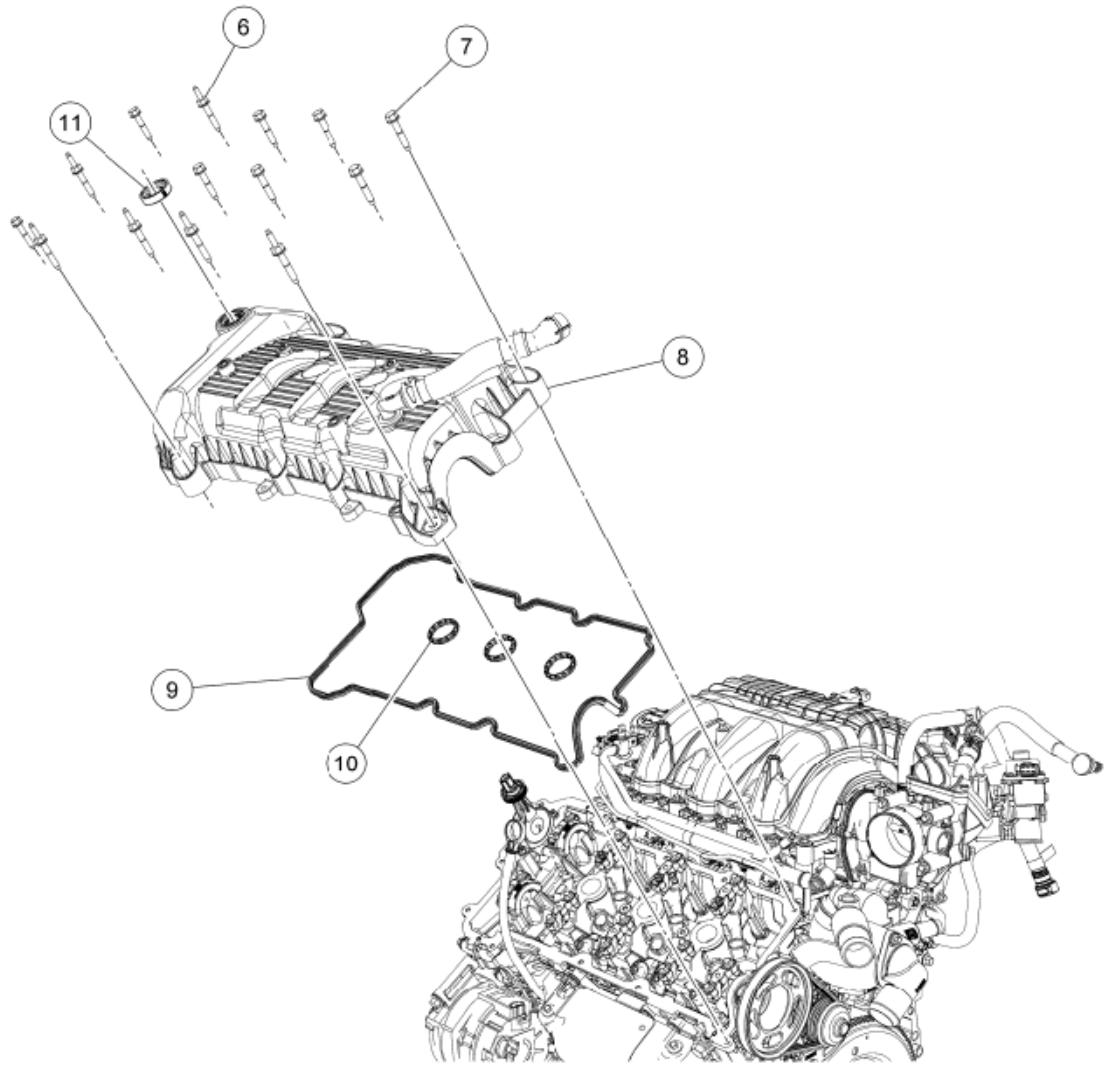


Fig. 10: Identifying LH Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
6	6C519	Valve cover stud bolt (6 required)
7	6C519	Valve cover bolt (8 required)
8	6A505	Valve cover
9	6A559	Valve cover gasket
10	6C527	Valve cover spark plug gasket (3 required)
11	6C535	**VCT** valve cover seal

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any

 © 2011 Mitchell Repair Information Company, LLC.

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. Remove the LH ignition coil-on-plugs. For additional information, refer to **IGNITION COIL-ON-PLUG** .
2. Detach the upper radiator hose from the 2 retainers on the cooling fan shroud and position the hose aside.
3. Detach the 2 wiring retainers from the valve cover.
4. Detach the 2 wiring retainers from the valve cover stud bolts.
5. Disconnect the Variable Camshaft Timing (VCT) electrical connector.
6. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.

NOTE: Inspect the crankcase ventilation tube and valve cover sealing area. If either a new valve cover or crankcase ventilation tube is required, both components must be installed new.

7. Remove the 8 bolts, 6 stud bolts and the valve cover.
   - Remove and discard the gasket.

Installation

NOTE: If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep. Failure to follow this procedure can cause future oil leakage.

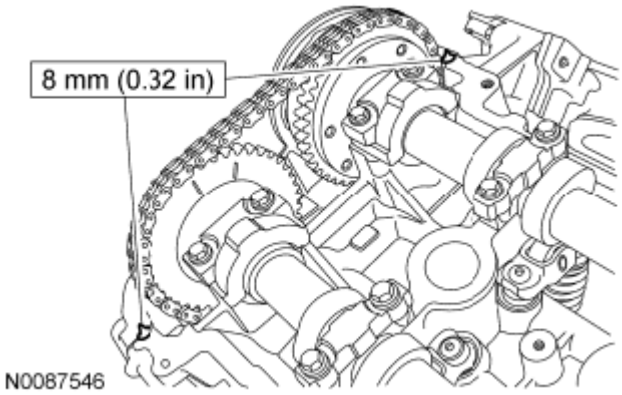


Fig. 11: Identifying Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

1. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.
2. Position the valve cover and install the bolts and stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

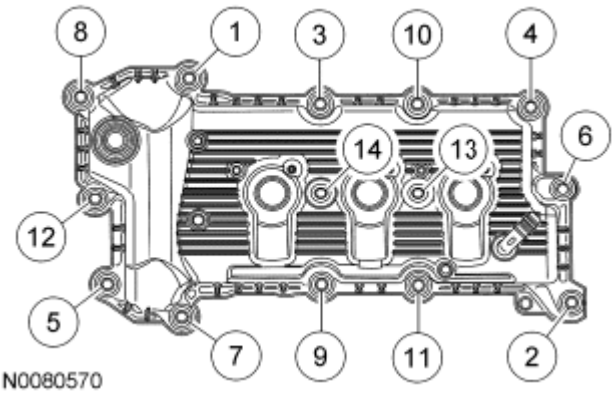


Fig. 12: Identifying Valve Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Connect the **HO2S** electrical connector.
4. Connect the **VCT** electrical connector.
5. Attach the 2 wiring retainers to the valve cover stud bolts.
6. Attach the 2 wiring retainers to the valve cover.
7. Attach the upper radiator hose to the 2 retainers on the cooling fan shroud.
8. Install the LH ignition coil-on-plugs. For additional information, refer to **IGNITION COIL-ON-PLUG** .

VALVE COVER - RH

Material

MATERIAL SPECIFICATIONS

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

RH Valve Cover (View 1 of 2)

 © 2011 Mitchell Repair Information Company, LLC.

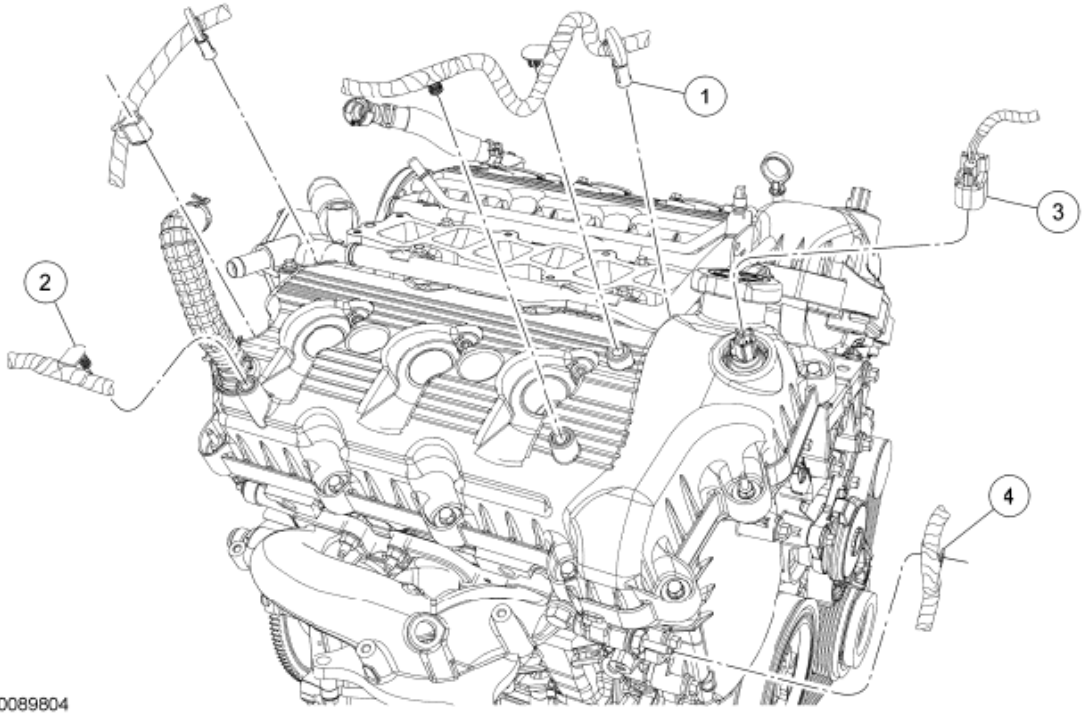


Fig. 13: Identifying RH Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	-	Main engine control wiring harness valve cover stud bolt retainer (part of 12A581) (3 required)
2	-	Main engine control wiring harness valve cover retainer (part of 12A581) (3 required)
3	14A464	Variable Camshaft Timing (VCT) electrical connector (part of 12A581)
4	-	Crankshaft Position (CKP) wiring harness retainer (part of 12A581)

RH Valve Cover (View 2 of 2)

 © 2011 Mitchell Repair Information Company, LLC.

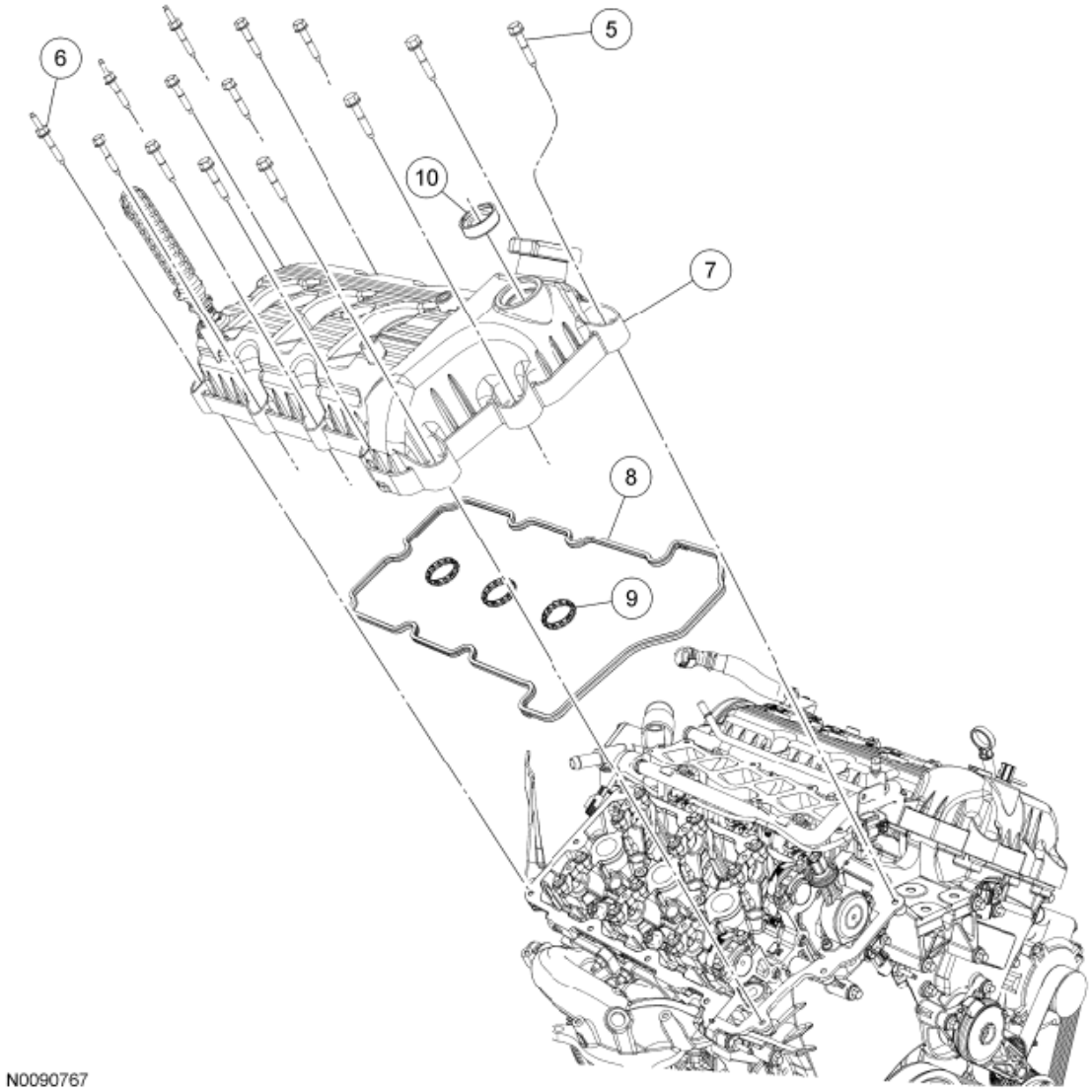


Fig. 14: Identifying RH Valve Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
5	6C519	Valve cover stud bolt (11 required)
6	6C519	Valve cover bolt (3 required)
7	6582	Valve cover
8	6584	Valve cover gasket
9	6C527	Valve cover spark plug gasket (3 required)
10	6C535	**VCT** valve cover seal

Removal

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. Remove the RH ignition coil-on-plugs. For additional information, refer to **IGNITION COIL-ON-PLUG** .
2. Detach the 3 main engine control wiring harness retainers from the valve cover stud bolts.
3. Detach the 3 main engine control wiring harness retainers from the valve cover.
4. Disconnect the Variable Camshaft Timing (VCT) electrical connector.
5. Detach the Crankshaft Position (CKP) wiring harness retainer from the stud.
6. Remove the 11 bolts, 3 stud bolts and the valve cover.
   - Remove and discard the gasket.

Installation

NOTE: If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep. Failure to follow this procedure can cause future oil leakage.

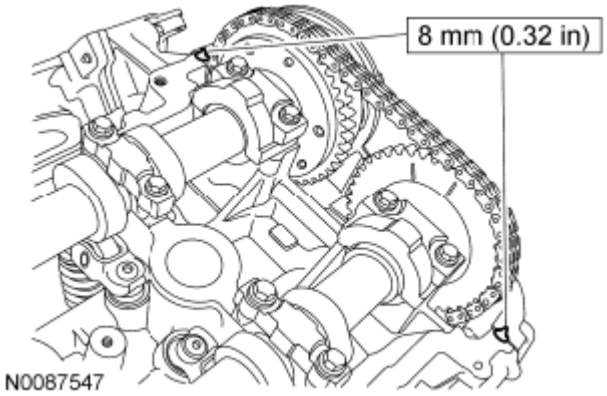


Fig. 15: Identifying Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

1. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.
2. Position the valve cover and install the 11 bolts and 3 stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

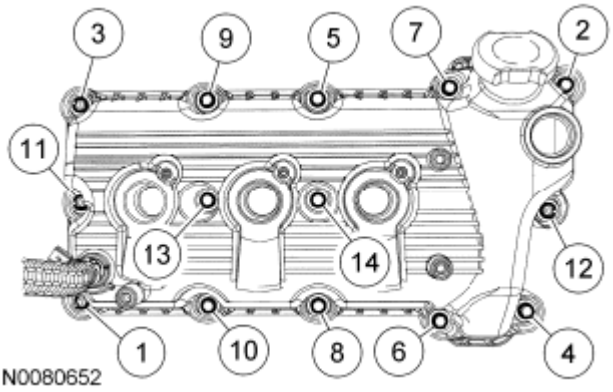


Fig. 16: Identifying Valve Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Attach the **CKP** wiring harness retainer on the stud.
4. Connect the **VCT** electrical connector.
5. Attach the 3 main engine control wiring harness retainers to the valve cover.
6. Attach the 3 main engine control wiring harness retainers to the valve cover stud bolts.
7. Install the RH ignition coil-on-plugs. For additional information, refer to **IGNITION COIL-ON-PLUG** .

LOWER END COMPONENTS - EXPLODED VIEW

Crankshaft Pulley and Front Seal

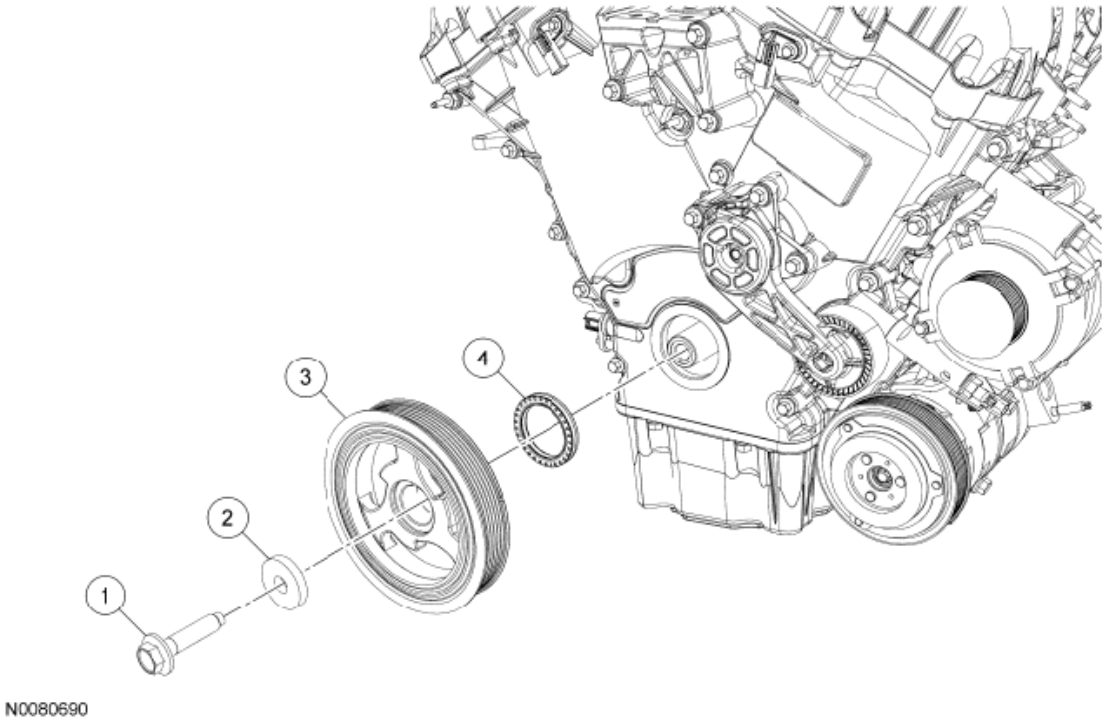


Fig. 17: Identifying Crankshaft Pulley And Front Seal

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	N806165	Washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal

Flexplate and Rear Seal

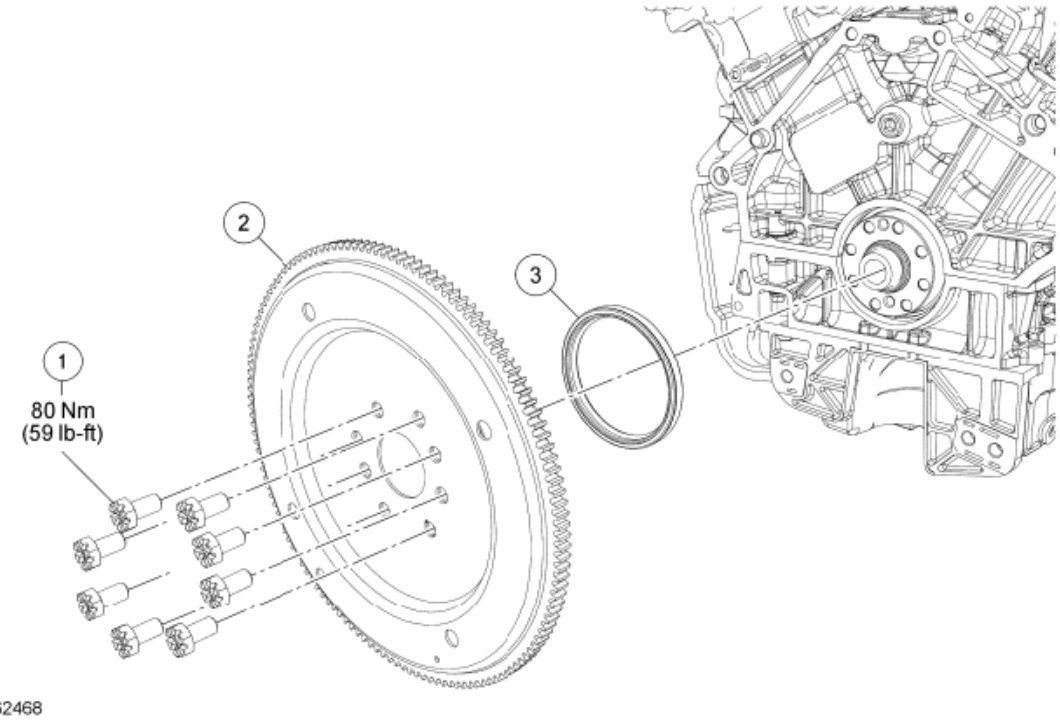


Fig. 18: Identifying Flexplate And Rear Seal With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W701559	Flexplate bolt (8 required)
2	6375	Flexplate
3	6701	Crankshaft rear oil seal

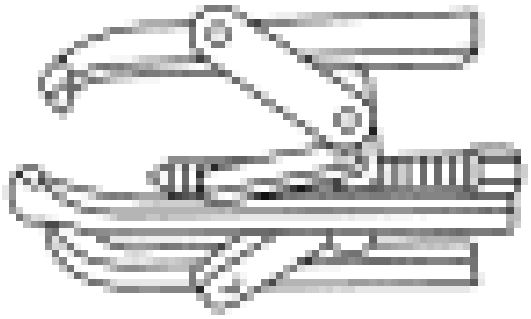
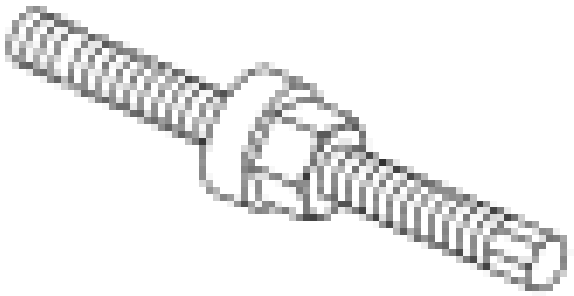
1. For additional information, refer to the procedures.

CRANKSHAFT PULLEY

Special Tool(s)

 © 2011 Mitchell Repair Information Company, LLC.

SPECIAL TOOL CHART

 ST1184-A	3 Jaw Puller 303-D121 (or equivalent)
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

Material

MATERIAL SPECIFICATIONS

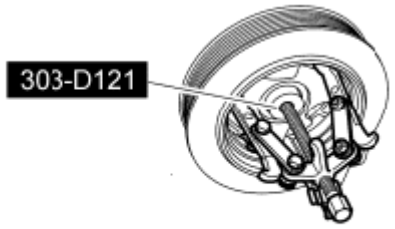
Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

 © 2011 Mitchell Repair Information Company, LLC.

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

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE BELT** .
3. Remove the crankshaft pulley bolt and washer.
   - Discard the crankshaft pulley bolt.
4. Using the 3 Jaw Puller, remove the crankshaft pulley.



N0010528

Fig. 19: Removing Crankshaft Pulley Using 3 Jaw Puller
Courtesy of FORD MOTOR CO.

Installation

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

NOTE: Clean the keyway and slot using metal surface prep before applying silicone gasket and sealant.

NOTE: The crankshaft pulley must be installed and the bolt tightened within 4 minutes of applying the silicone gasket and sealant.

 © 2011 Mitchell Repair Information Company, LLC.

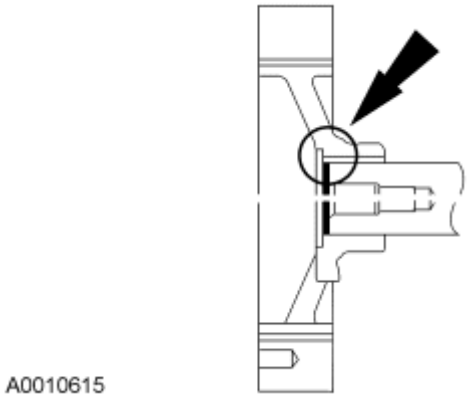


Fig. 20: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

2. Apply silicone gasket and sealant to the end of the keyway slot.

NOTE: Lubricate the outside diameter sealing surface with clean engine oil.

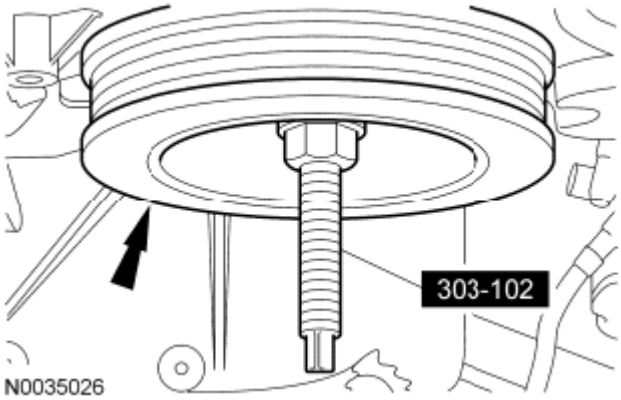


Fig. 21: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

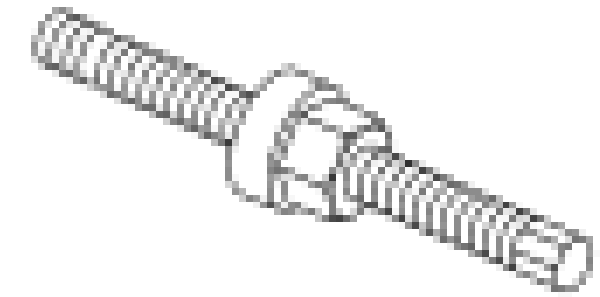
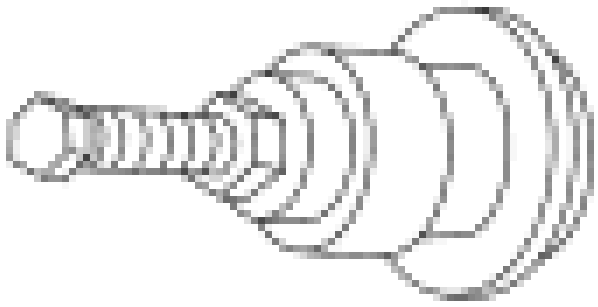
3. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.
4. Install the bolt and washer. Tighten the bolt in 4 stages:
   - Stage 1: Tighten to 120 Nm (89 lb-ft).
   - Stage 2: Loosen one full turn.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.
5. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE BELT** .

CRANKSHAFT FRONT SEAL

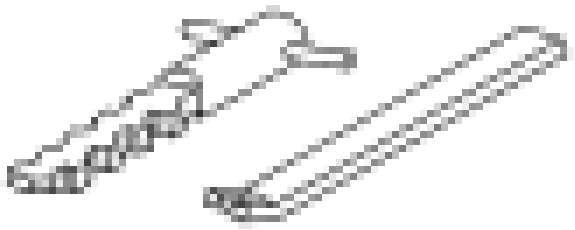
Special Tool(s)

 © 2011 Mitchell Repair Information Company, LLC.

SPECIAL TOOL CHART

 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST1328-A	Installer, Front Cover Oil Seal 303-335 (T88T-6701-A)
	Remover, Oil Seal 303-409 (T92C-6700CH)

 © 2011 Mitchell Repair Information Company, LLC.



ST1385-A

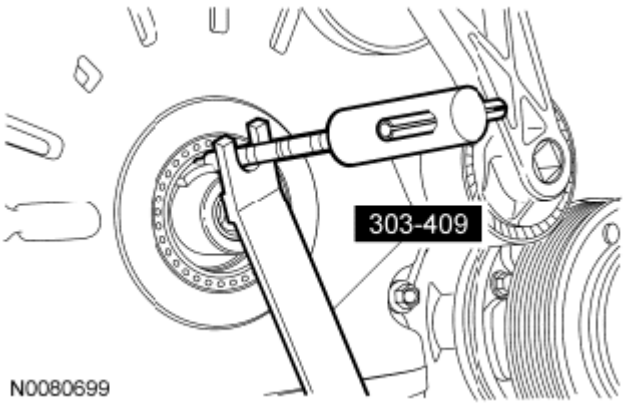
Material

MATERIAL SPECIFICATIONS

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.
3. Using the Oil Seal Remover, remove and discard the crankshaft front seal.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 22: Removing Crankshaft Front Seal Using Oil Seal Remover
Courtesy of FORD MOTOR CO.

Installation

NOTE: Clean all sealing surfaces with metal surface prep.

1. Apply clean engine oil to the seal lip and seal bore before installing the seal.
2. Using the Front Cover Oil Seal Installer and the Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

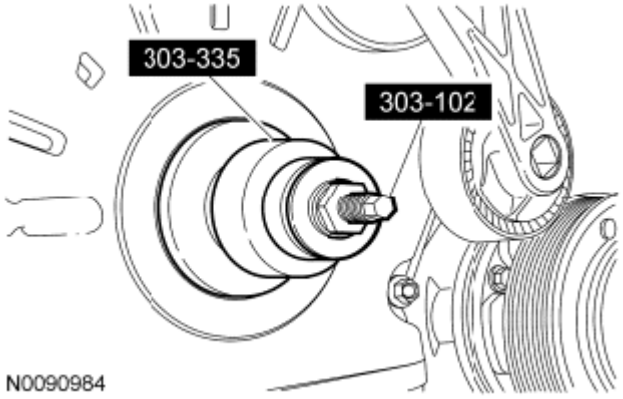


Fig. 23: Installing Crankshaft Front Seal Using Front Cover Oil Seal Installer And Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

3. Install the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.

FLEXPLATE

Removal and Installation

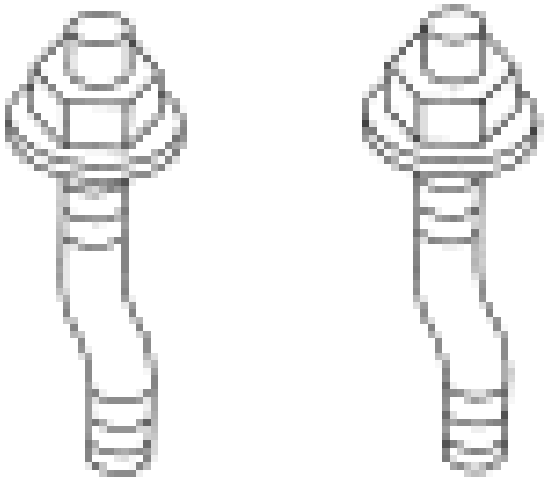
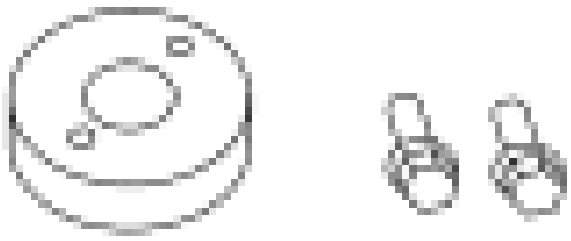
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the transaxle. For additional information, refer to **TRANSAXLE -- 3.0L** .
3. Remove the bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft).
4. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL

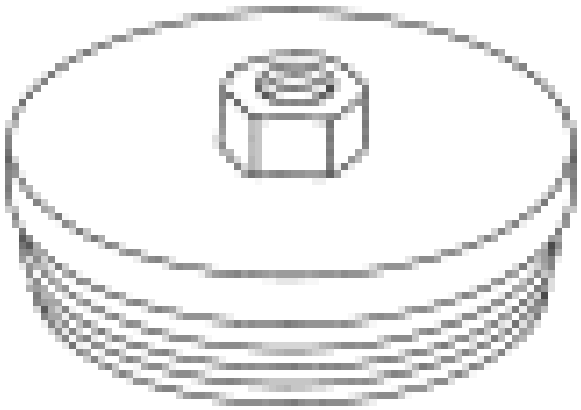
Special Tool(s)

SPECIAL TOOL CHART

 © 2011 Mitchell Repair Information Company, LLC.

 ST1333-A	Installer Bolts, Crankshaft Rear Main Oil Seal 303-384 (T91P-6701-A)
 ST1327-A	Installer, Crankshaft Rear Main Oil Seal 303-178 (T82L-6701-A)
	Remover, Crankshaft Rear Oil Seal 303-519 (T95P-6701-EH)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1382-A	
 ST1187-A	Slide Hammer 307-005 (T59L-100-B)

Material

MATERIAL SPECIFICATIONS

Item	Specification
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Removal

 © 2011 Mitchell Repair Information Company, LLC.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the flexplate. For additional information, refer to **FLEXPLATE**.
3. Using the Slide Hammer and the Crankshaft Rear Oil Seal Remover, remove and discard the crankshaft rear oil seal.

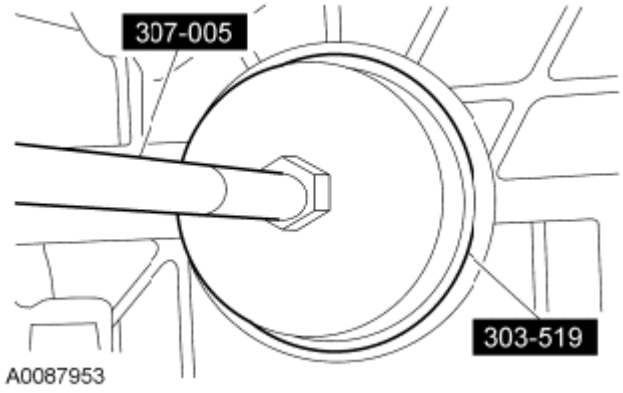


Fig. 24: Removing Crankshaft Rear Oil Seal
Courtesy of FORD MOTOR CO.

Installation

NOTE: Clean all sealing surfaces with metal surface prep.

NOTE: Apply clean engine oil to the seal lip and seal bore before installing the seal.

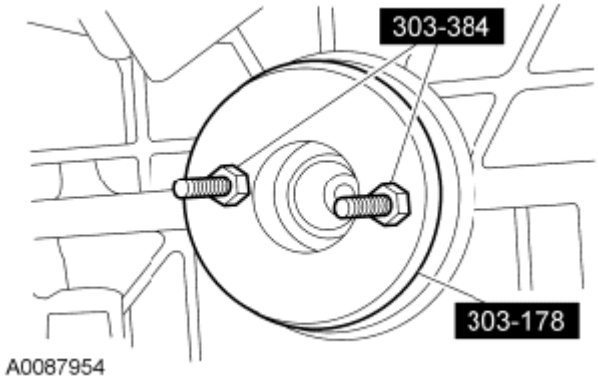


Fig. 25: Installing Crankshaft Rear Oil Seal
Courtesy of FORD MOTOR CO.

1. Using the Crankshaft Rear Main Oil Seal Installer Bolts and the Crankshaft Rear Main Oil Seal Installer, install the crankshaft rear oil seal.
2. Install the flexplate. For additional information, refer to **FLEXPLATE**.

 © 2011 Mitchell Repair Information Company, LLC.

ENGINE FRONT COVER

Special Tool(s)

SPECIAL TOOL CHART

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

Material

MATERIAL SPECIFICATIONS

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

Engine Front Cover (View 1 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

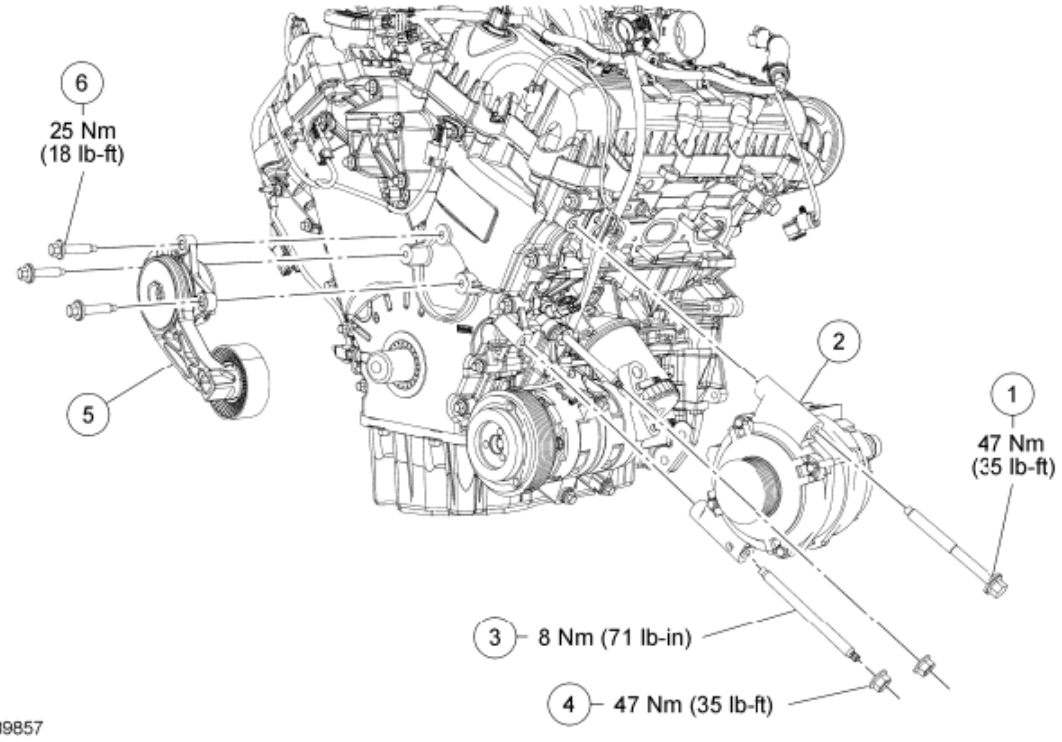


Fig. 26: Identifying Engine Front Cover Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W709986	Generator bolt
2	10300	Generator
3	W710416	Generator stud
4	W520414	Generator stud nut (2 required)
5	6B209	Accessory drive belt tensioner
6	W503297	Accessory drive belt tensioner bolt (3 required)

Engine Front Cover (View 2 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

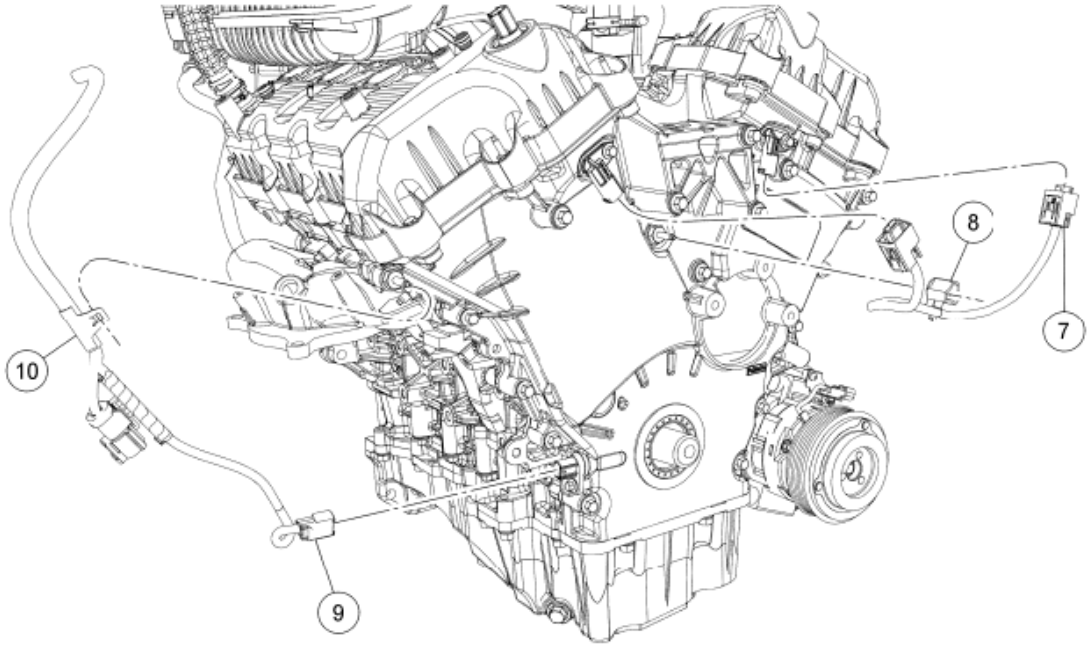


Fig. 27: Identifying Engine Front Cover Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
7	14A464	Camshaft Position (CMP) sensor electrical connector (part of 12A581) (2 required)
8	-	**CMP** sensor wiring harness retainer (part of 12A581)
9	14A464	Crankshaft Position (CKP) electrical connector (part of 12A581)
10	-	**CKP** wiring harness retainer (part of 12A581)

Engine Front Cover (View 3 of 3)

 © 2011 Mitchell Repair Information Company, LLC.

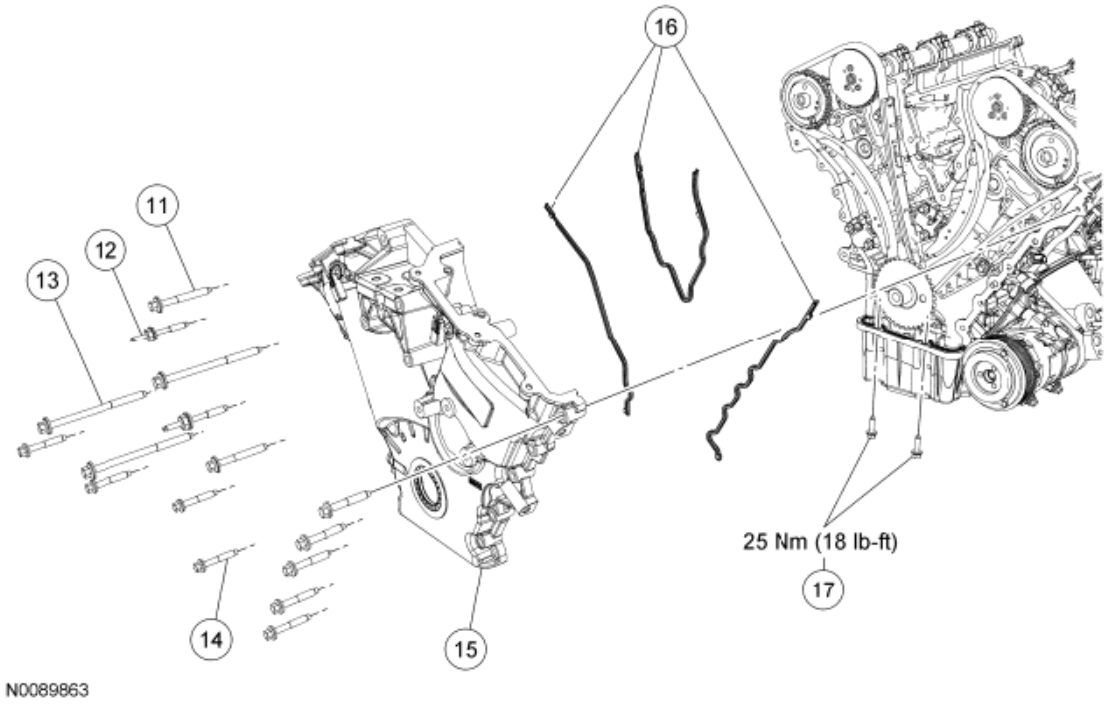


Fig. 28: Identifying Engine Front Cover Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
11	W708222	Engine front cover bolt (2 required)
12	W710030	Engine front cover stud bolt (2 required)
13	W708221	Engine front cover bolt (2 required)
14	W701525	Engine front cover bolt (10 required)
15	6019	Engine front cover
16	6D081	Engine front cover gaskets
17	W709678	Oil pan-to-front cover bolts

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY DISCONNECT** .

 © 2011 Mitchell Repair Information Company, LLC.

4. Remove the crankshaft front seal. For additional information, refer to **LOWER END COMPONENTS - EXPLODED VIEW** and **CRANKSHAFT FRONT SEAL**.
5. Remove the generator bolt and the 2 nuts.

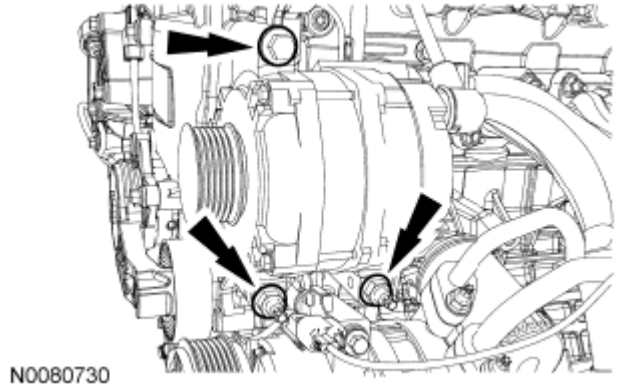


Fig. 29: Locating Generator Bolt And Nuts
Courtesy of FORD MOTOR CO.

6. Remove the stud and position the generator away from the engine.

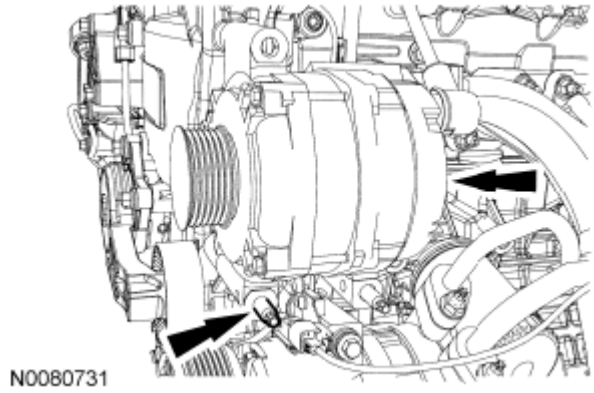


Fig. 30: Locating Stud And Generator
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the accessory drive belt tensioner.
8. Detach the wiring harness retainer from the engine front cover stud bolt.
9. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
10. Disconnect the 2 Camshaft Position (CMP) sensor electrical connectors and detach the wiring harness retainer from the engine front cover stud bolt.
11. Remove the LH and RH Variable Camshaft Timing (VCT) oil control solenoids. For additional information, refer to **VARIABLE CAMSHAFT TIMING (VCT) OIL CONTROL SOLENOID** .
12. Remove the engine support insulator. For additional information, refer to **ENGINE SUPPORT INSULATORS**.
13. Remove the 2 oil pan-to-front cover bolts.

 © 2011 Mitchell Repair Information Company, LLC.

14. Remove the 14 bolts, 2 stud bolts and the engine front cover.
    - Remove and discard the gaskets.

Installation

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

NOTE: Do not damage the oil pan gasket while cleaning the sealant from the lower cylinder block-to-oil pan joint.

1. Use a plastic scraping tool to remove all traces of sealant.
    - Clean all sealing surfaces with metal surface prep and install new gaskets.

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

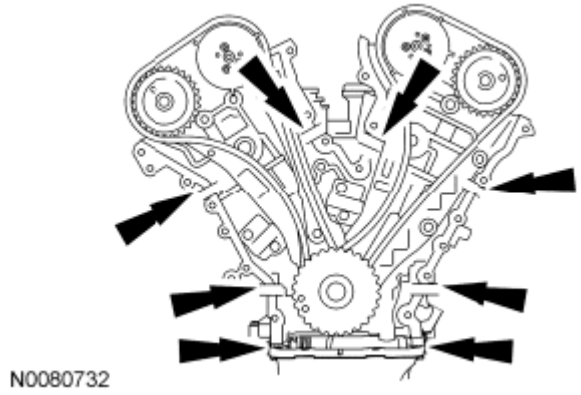


Fig. 31: Locating Silicone Gasket And Sealer Area
Courtesy of FORD MOTOR CO.

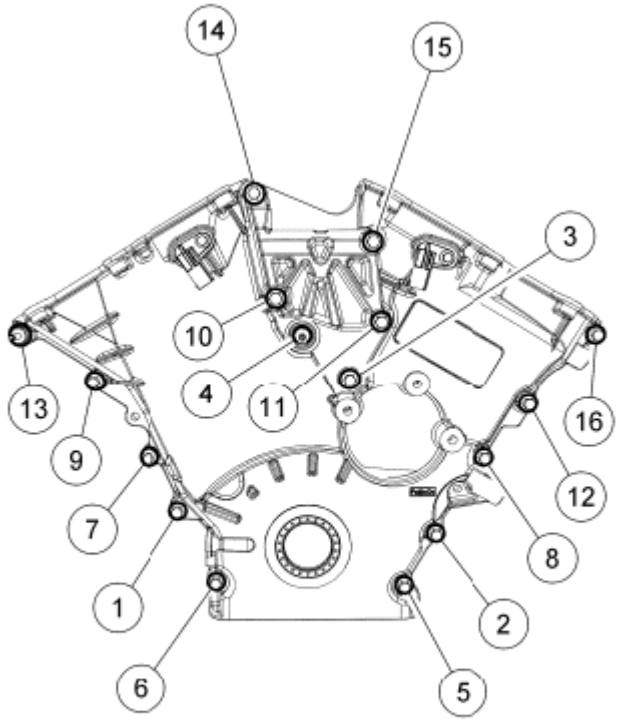
2. Apply a 6 mm (0.23 in) diameter dot of silicone gasket and sealer to the cylinder block, lower cylinder block, cylinder head and oil pan mating surfaces.
3. Position the engine front cover and install the bolts. Tighten in the sequence shown to 25 Nm (18 lb-ft).

ITEM DESCRIPTION

Item	Part Number	Description
1	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
2	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
3	W708222	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 64
4	W710030	Stud, Hex Flange Head Pilot, M6 x 1 x 20/M8 x 1.25 x 47.5
5	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5

 © 2011 Mitchell Repair Information Company, LLC.

6	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
7	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
8	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
9	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
10	W708221	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 118
11	W708221	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 118
12	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
13	W710030	Stud, Hex Flange Head Pilot, M6 x 1 x 20/M8 x 1.25 x 47.5
14	W708222	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 64
15	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 118
16	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5



N0089880

Fig. 32: Identifying Engine Front Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Install the 2 oil pan-to-front cover bolts.
   - Tighten to 25 Nm (18 lb-ft).
5. Remove the oil pan drain plug and drain the engine oil.
   - Install the plug and tighten to 26 Nm (19 lb-ft).
6. Install the engine support insulator. For additional information, refer to **ENGINE SUPPORT INSULATORS**.

 © 2011 Mitchell Repair Information Company, LLC.

7. Install the LH and RH **VCT** oil control solenoids. For additional information, refer to **VARIABLE CAMSHAFT TIMING (VCT) OIL CONTROL SOLENOID** .
8. Connect the 2 **CMP** sensor electrical connectors and attach the wiring harness retainer to the engine front cover stud bolt.
9. Connect the **CKP** electrical connector.
10. Attach the wiring harness retainer to the engine front cover stud bolt.
11. Install the accessory drive belt tensioner and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).
12. Position the generator and install the stud.
    - Tighten to 8 Nm (71 lb-in).
13. Install the generator bolt and 2 nuts.
    - Tighten to 47 Nm (35 lb-ft).
14. Install the crankshaft front seal. For additional information, refer to **LOWER END COMPONENTS - EXPLODED VIEW** and **CRANKSHAFT FRONT SEAL**.
15. Fill the engine with clean engine oil.
16. Connect the battery ground cable. For additional information, refer to **BATTERY DISCONNECT** .
17. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

TIMING DRIVE COMPONENTS

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

NOTE: Failure to verify correct timing drive component alignment will result in severe engine damage.

1. Remove the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.
2. Remove the LH and RH spark plugs. For additional information, refer to **SPARK PLUGS** .

NOTE: This pulse wheel is used in several different engines. Install the pulse wheel with the keyway in the slot stamped "30RFF" (orange in color).

 © 2011 Mitchell Repair Information Company, LLC.

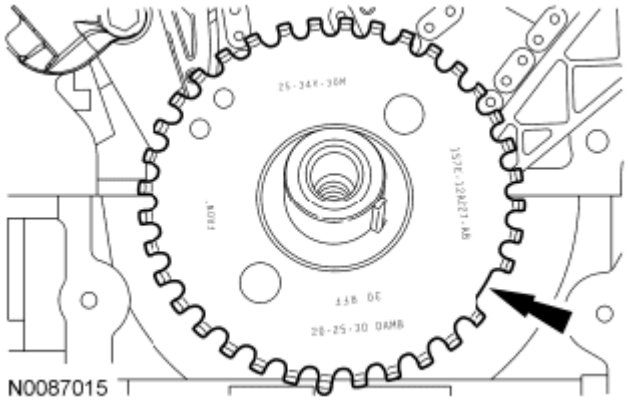


Fig. 33: Locating Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

3. Remove the ignition pulse wheel.
4. Install the crankshaft pulley bolt and washer.

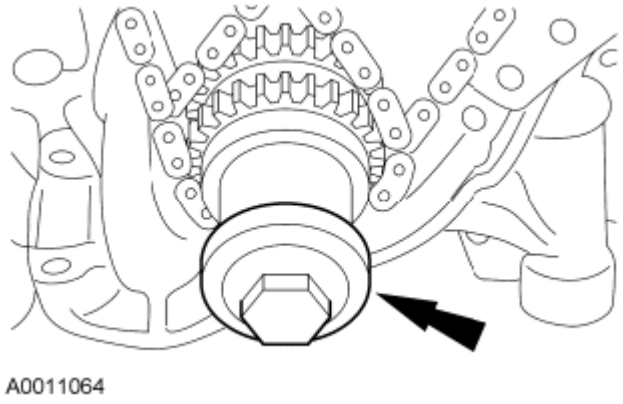


Fig. 34: Locating Crankshaft Pulley Bolt And Washer
Courtesy of FORD MOTOR CO.

5. Rotate the crankshaft clockwise to position the crankshaft keyway in the 11 o'clock position and position the camshafts in the correct position. This will position the No. 1 cylinder at Top Dead Center (TDC).
    - Verify that the camshafts are correctly located. If not, rotate the crankshaft one additional turn and recheck.

 © 2011 Mitchell Repair Information Company, LLC.

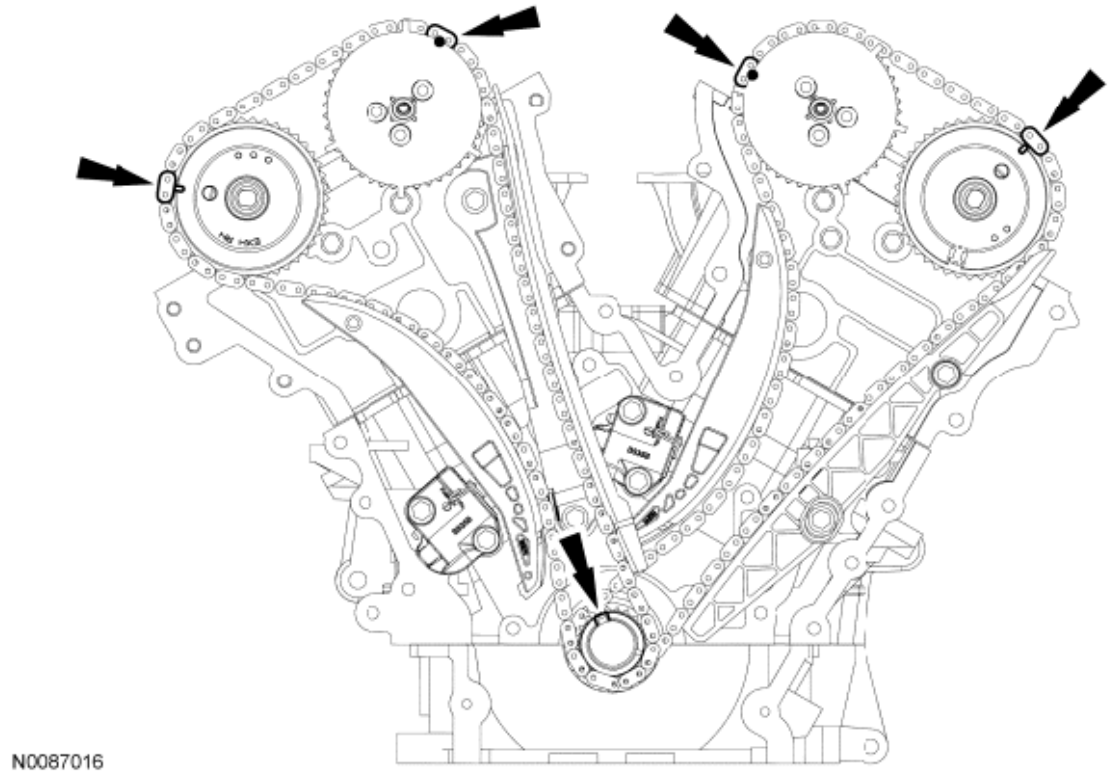


Fig. 35: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

6. Rotate the crankshaft clockwise 120 degrees to the 3 o'clock position to position the RH camshafts in the neutral position.

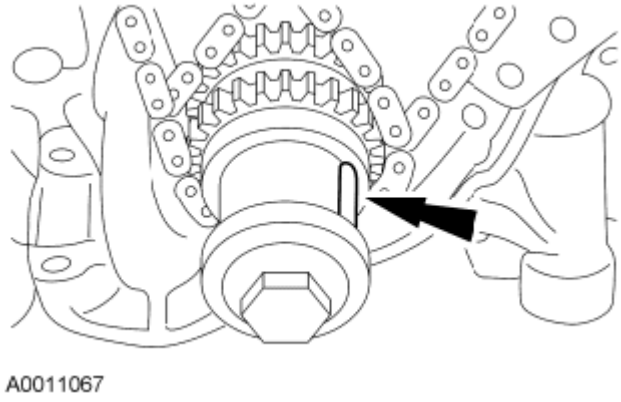


Fig. 36: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

7. Verify that the RH camshafts are in the neutral position.

 © 2011 Mitchell Repair Information Company, LLC.

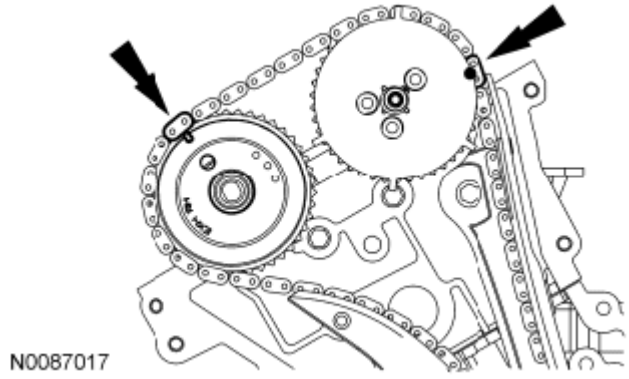


Fig. 37: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

8. Remove the RH timing chain tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

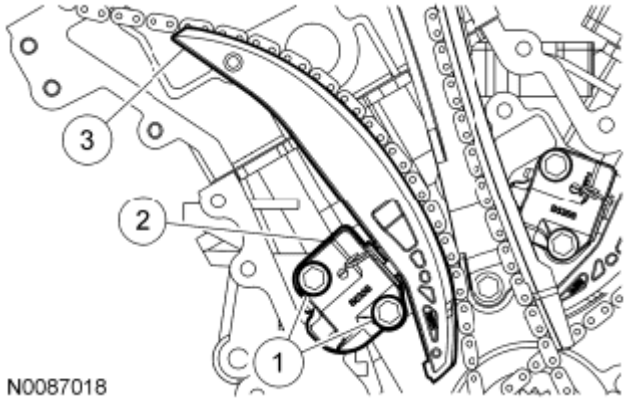


Fig. 38: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

9. Remove the 2 bolts and the RH timing chain guide.
    - Remove the RH timing chain from the engine.

 © 2011 Mitchell Repair Information Company, LLC.

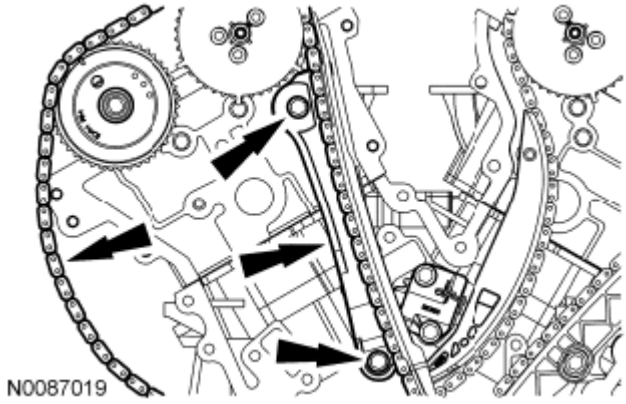


Fig. 39: Locating Bolts And RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

10. Rotate the crankcase clockwise 600 degrees (one and two-third turns) to position the crankcase keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

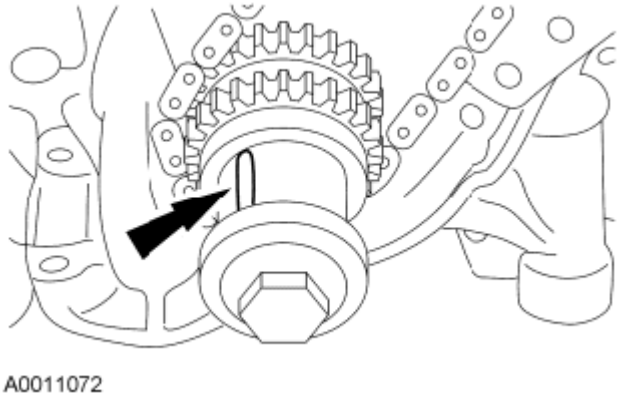
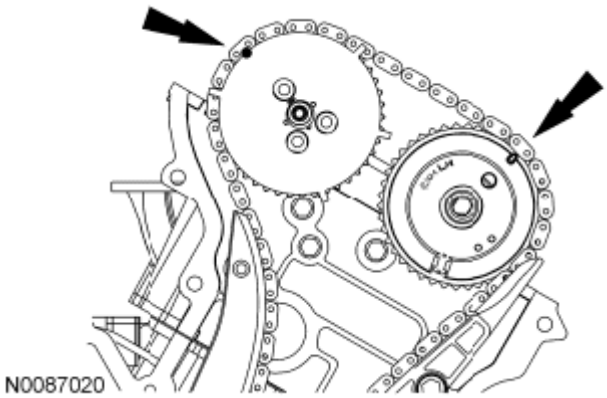


Fig. 40: Locating LH Camshafts Keywey
Courtesy of FORD MOTOR CO.

11. Verify the LH camshafts are in the neutral position.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 41: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

12. Remove the LH timing chain and tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

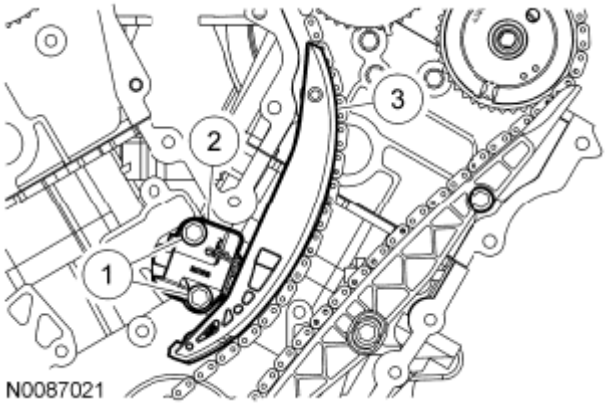


Fig. 42: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the LH timing chain guide.
    - Remove the LH timing chain from the engine.

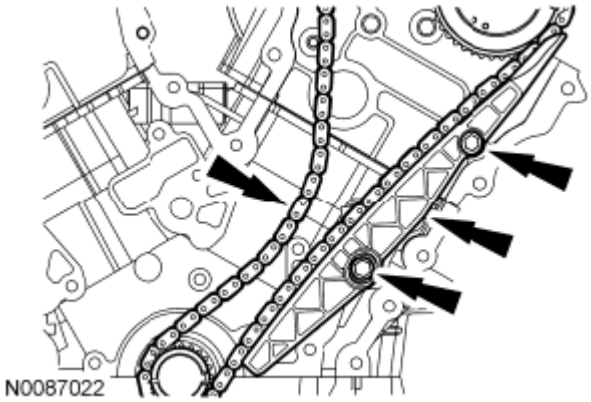


Fig. 43: Locating Bolts And LH Timing Chain Guide
Courtesy of FORD MOTOR CO.

14. Remove the crankshaft pulley bolt and the crankshaft sprocket.

 © 2011 Mitchell Repair Information Company, LLC.

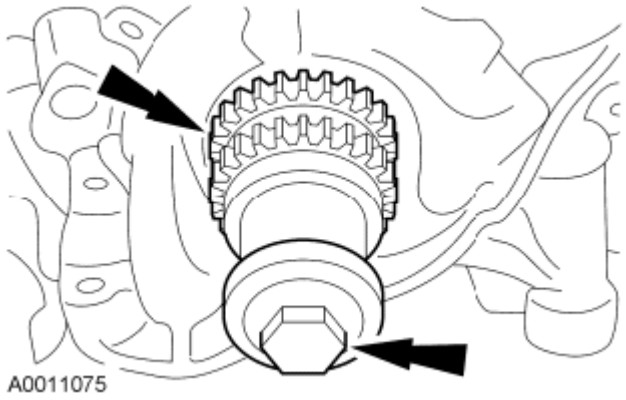


Fig. 44: Locating Crankshaft Pulley Bolt And Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

Installation

NOTE: Failure to verify correct timing drive component alignment will result in severe engine damage.

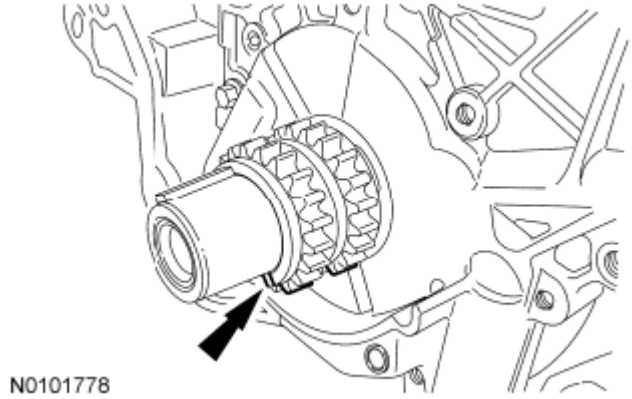


Fig. 45: Locating Crankshaft Sprocket With Timing Mark
Courtesy of FORD MOTOR CO.

1. Install the crankshaft sprocket with the timing mark facing out. The timing mark on the LH and RH timing chains will be aligned to this mark during assembly.

NOTE: LH shown, RH similar.

 © 2011 Mitchell Repair Information Company, LLC.

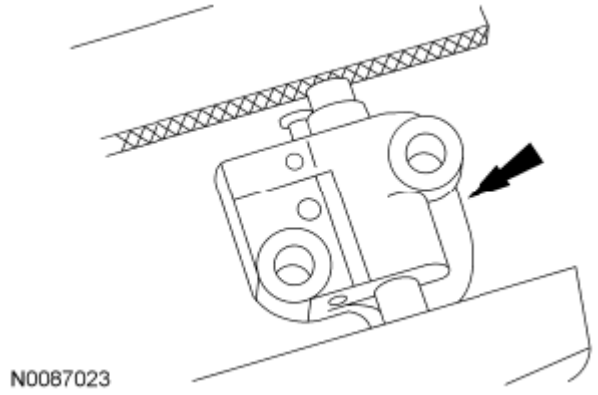


Fig. 46: Locating Chain Tensioner
Courtesy of FORD MOTOR CO.

2. Position the chain tensioner in a soft-jawed vise.

NOTE: LH shown, RH similar.

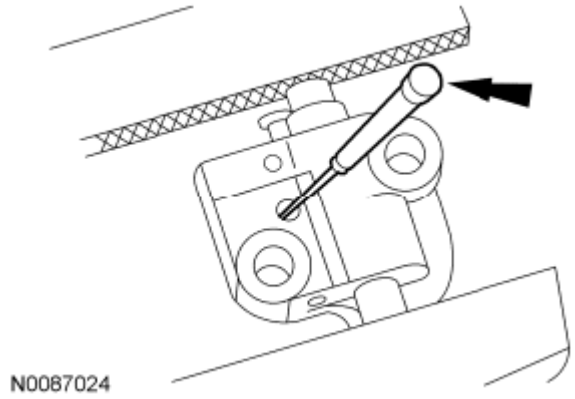


Fig. 47: Locating Ratchet Stem With Small Pick
Courtesy of FORD MOTOR CO.

3. Hold the chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

NOTE: During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

4. Slowly compress the timing chain tensioner.
5. Retain the tensioner piston with a 1.5 mm (0.06 in) diameter wire or paper clip.

 © 2011 Mitchell Repair Information Company, LLC.

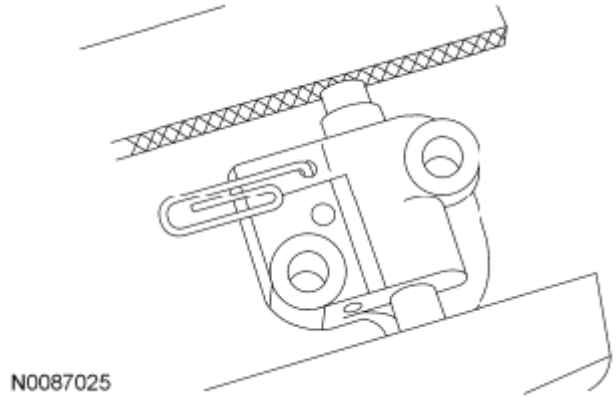


Fig. 48: Identifying Tensioner Piston With Paper Clip
Courtesy of FORD MOTOR CO.

6. If timing marks in the timing chains are not evident, use a permanent-type marker to mark the crankshaft and camshaft timing marks on the LH and RH timing chains.
    1. Mark any link to use as the crankshaft timing mark.
    2. Starting with the crankshaft timing mark, count 29 links and mark the link.
    3. Continue counting to link 42 and mark the link.

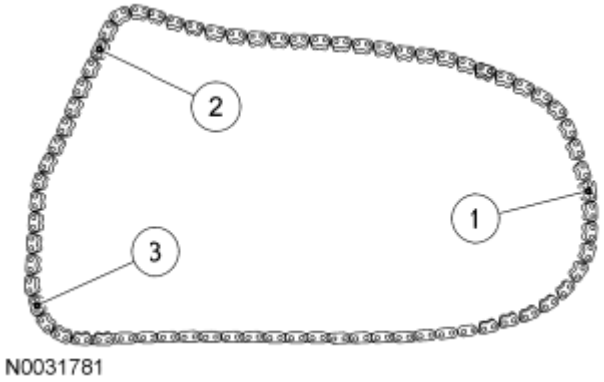


Fig. 49: Identifying Crankshaft And Camshaft Timing Marks On Timing Chains
Courtesy of FORD MOTOR CO.

7. Position the LH timing chain and guide and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

 © 2011 Mitchell Repair Information Company, LLC.

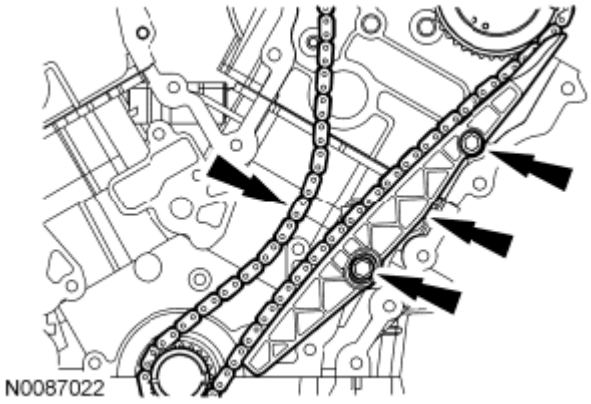


Fig. 50: Locating Bolts And LH Timing Chain Guide
Courtesy of FORD MOTOR CO.

8. Install the LH timing chain tensioner arm and the LH timing chain tensioner.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        - Tighten to 25 Nm (18 lb-ft).

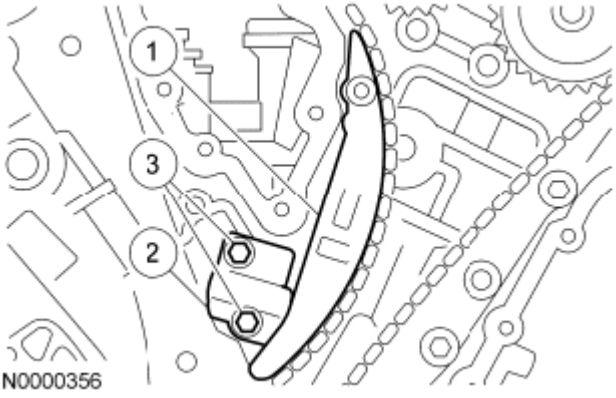


Fig. 51: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

9. Install the crankshaft pulley bolt and rotate the crankshaft clockwise 120 degrees until the crankshaft keyway is in the 3 o'clock position.

 © 2011 Mitchell Repair Information Company, LLC.

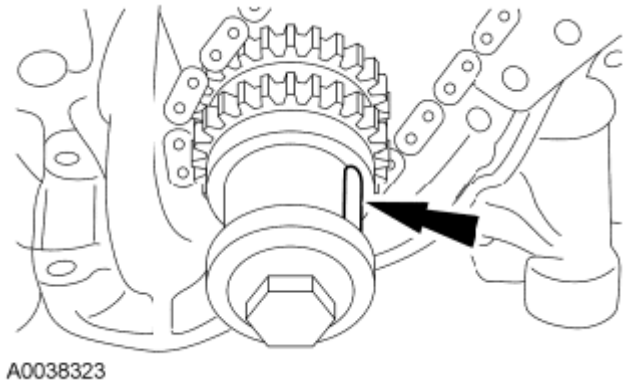


Fig. 52: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

10. Verify that the RH camshafts are correctly positioned.

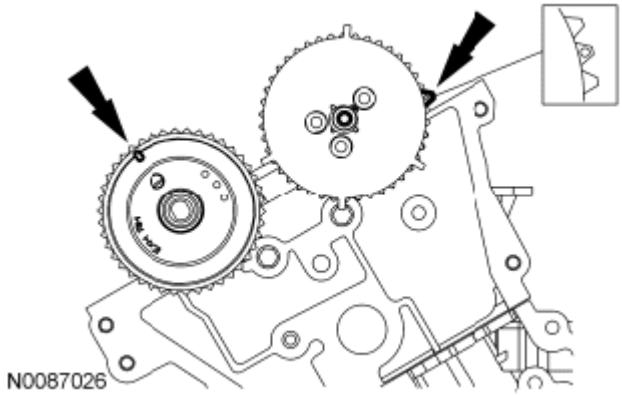


Fig. 53: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

11. Install the RH timing chain and chain guide and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

 © 2011 Mitchell Repair Information Company, LLC.

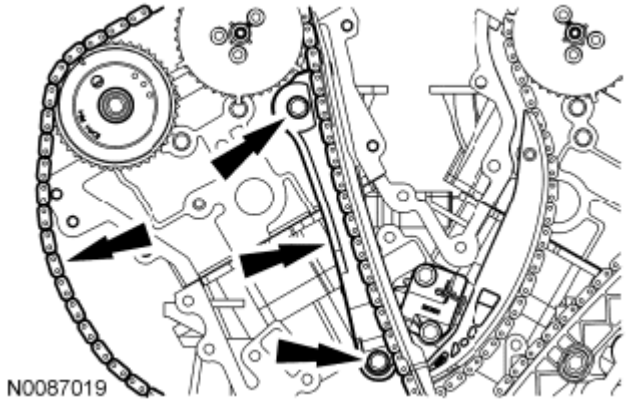


Fig. 54: Locating Bolts And RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

12. Install the RH timing chain tensioner and tensioner arm.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        - Tighten to 25 Nm (18 lb-ft).

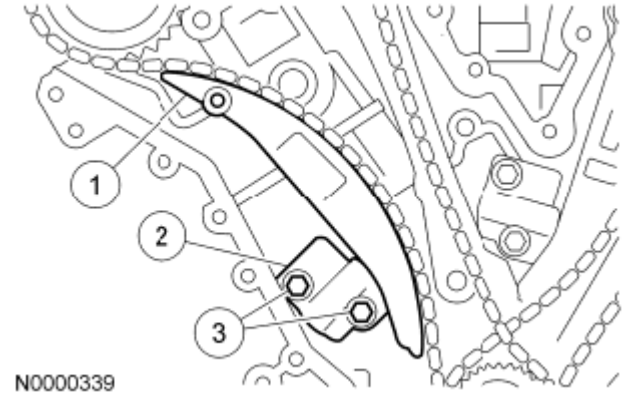


Fig. 55: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

13. Remove the LH and RH timing chain tensioner piston retaining wires.
14. Rotate the crankshaft counterclockwise 120 degrees to **TDC** .

NOTE: Failure to verify correct timing drive component alignment will result in severe engine damage.

15. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and the crankshaft timing marks.

 © 2011 Mitchell Repair Information Company, LLC.

3. There should be 30 chain links between the camshaft and the crankshaft timing marks.

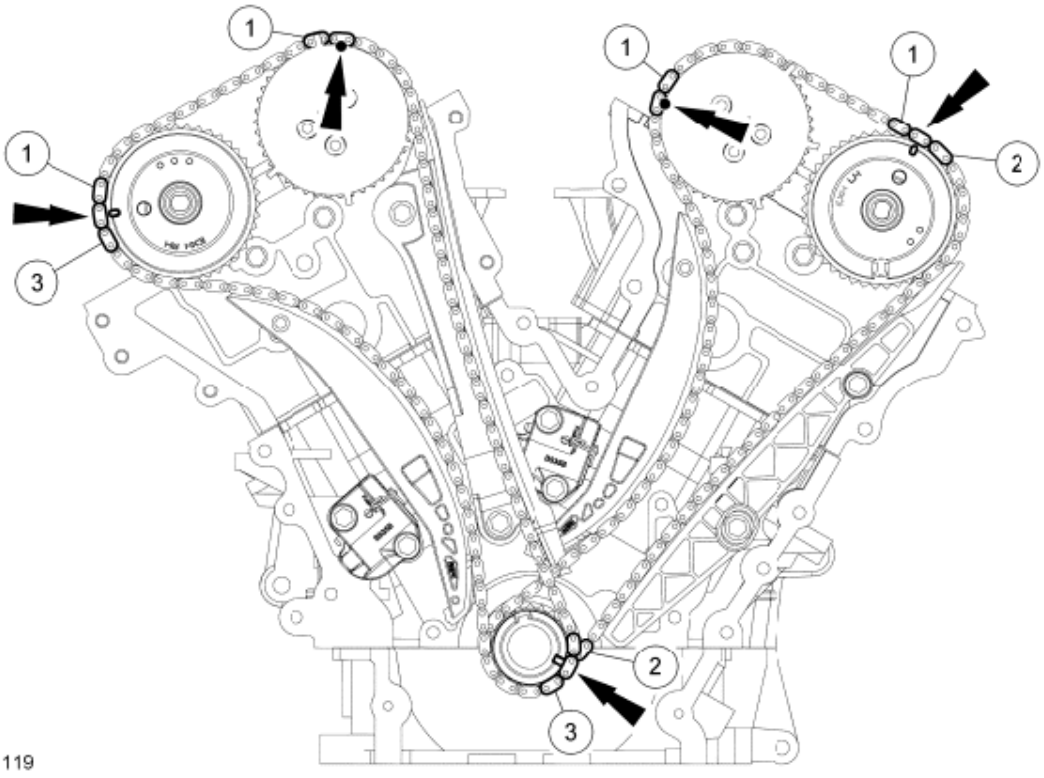


Fig. 56: Locating Chain Links Marks
Courtesy of FORD MOTOR CO.

16. Remove the crankshaft pulley bolt and washer.

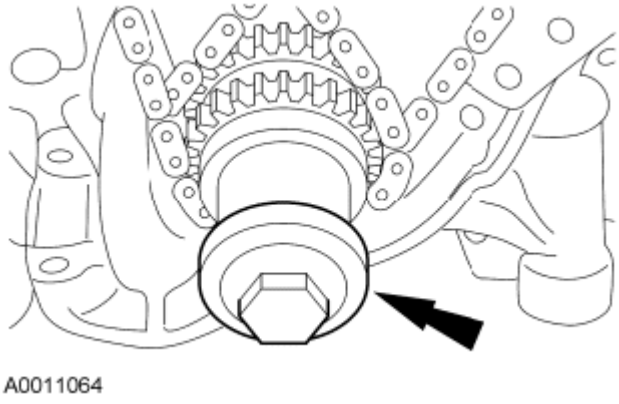


Fig. 57: Locating Crankshaft Pulley Bolt And Washer
Courtesy of FORD MOTOR CO.

NOTE: This pulse wheel is used in several different engines. Install the pulse wheel with the keyway in the slot stamped "30RFF" only (orange in color).

 © 2011 Mitchell Repair Information Company, LLC.

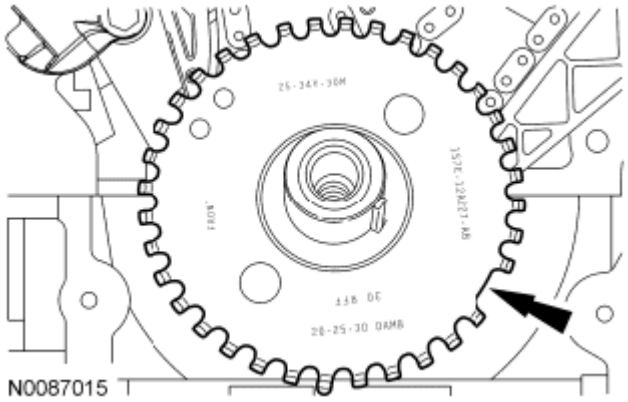


Fig. 58: Locating Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

17. Install the ignition pulse wheel.
18. Install the LH and RH spark plugs. For additional information, refer to **SPARK PLUGS** .
19. Install the engine front cover. For additional information, refer to **ENGINE FRONT COVER**.

VALVE TRAIN COMPONENTS - EXPLODED VIEW

LH Side Roller Follower, Hydraulic Lash Adjuster and Valve Spring

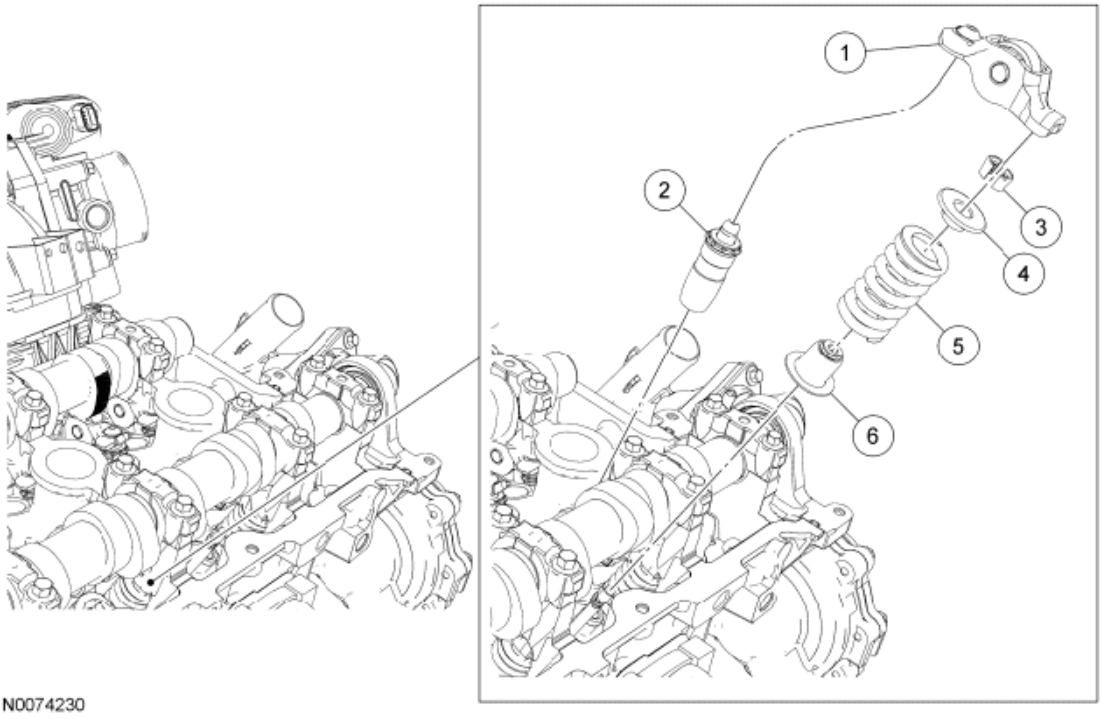


Fig. 59: Identifying LH Side Roller Follower, Hydraulic Lash Adjuster And Valve Spring Components
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

ITEM DESCRIPTION

Item	Part Number	Description
1	6529	Roller follower (12 required)
2	6C501	Hydraulic lash adjuster (12 required)
3	6518	Valve spring retainer key (24 required)
4	6514	Valve spring retainer (12 required)
5	6513	Valve spring (12 required)
6	6A517	Valve stem seal (12 required)

LH Side Intake and Exhaust Camshafts

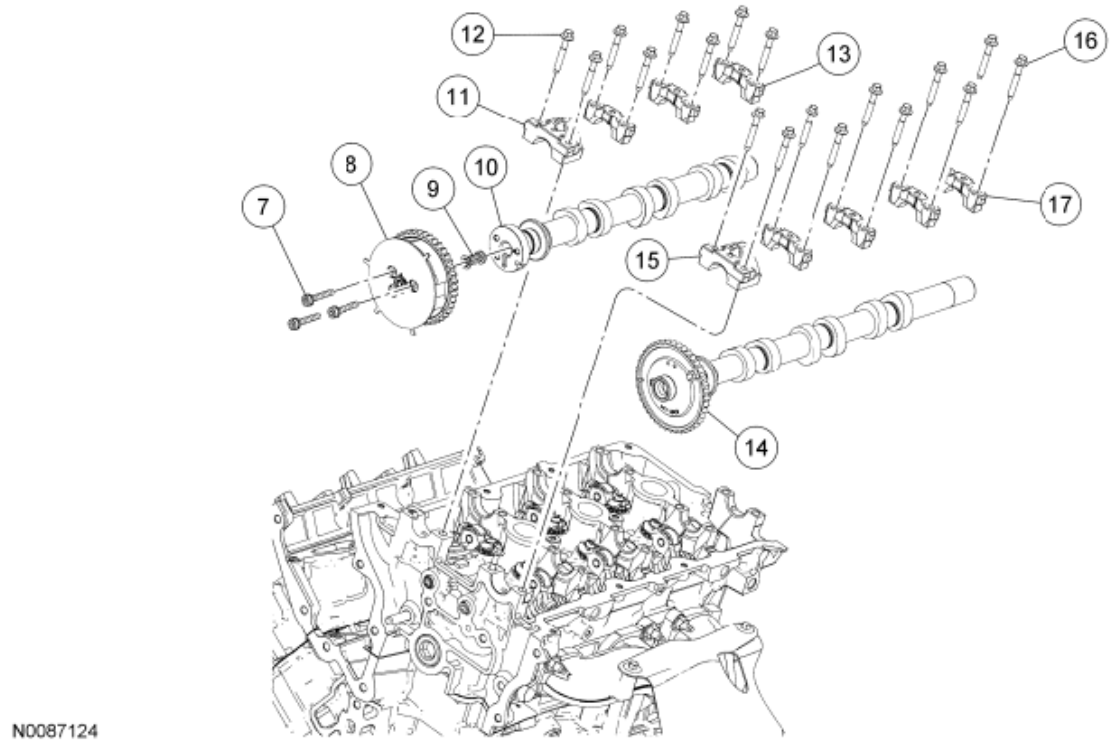


Fig. 60: Identifying LH Side Intake And Exhaust Camshafts Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
7	W713106	Camshaft phaser and sprocket bolt (3 required)
8	6C524	Camshaft phaser and sprocket
9	6C683	Variable Camshaft Timing (VCT) system oil filter
10	6250	LH intake camshaft
11	6B280	Intake camshaft thrust bearing cap
12	W710702	Intake camshaft bearing cap bolt (8 required)
13	6B280	Intake camshaft bearing cap (3 required)

 © 2011 Mitchell Repair Information Company, LLC.

14	6250	LH exhaust camshaft
15	6B280	Exhaust camshaft thrust bearing cap
16	W710702	Exhaust camshaft bearing cap bolt (10 required)
17	6B280	Exhaust camshaft bearing cap (4 required)

Coolant Pump Belt and Pulley

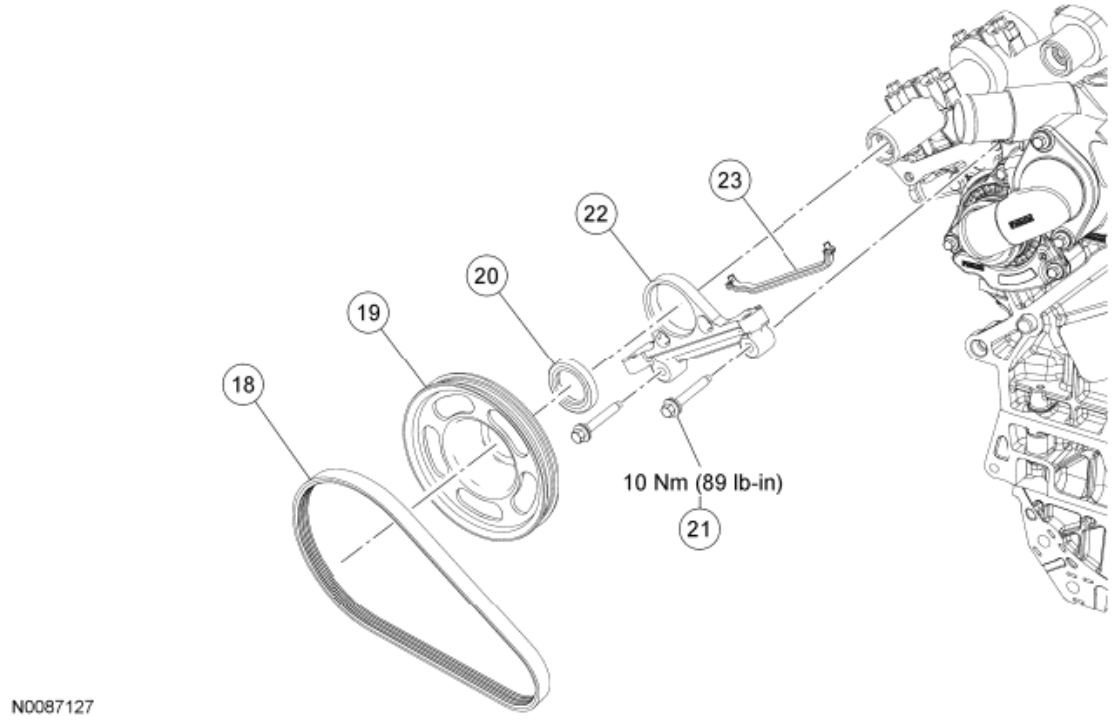


Fig. 61: Identifying Coolant Pump Belt And Pulley Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
18	8K543	Coolant pump drive belt
19	6A359	Coolant pump drive pulley
20	-	Camshaft oil seal
21	W701242	Camshaft oil seal retainer bolt (2 required)
22	6B293	Camshaft oil seal retainer
23	6B295	Camshaft oil seal retainer gasket

RH Side Roller Follower, Hydraulic Lash Adjuster and Valve Spring

 © 2011 Mitchell Repair Information Company, LLC.

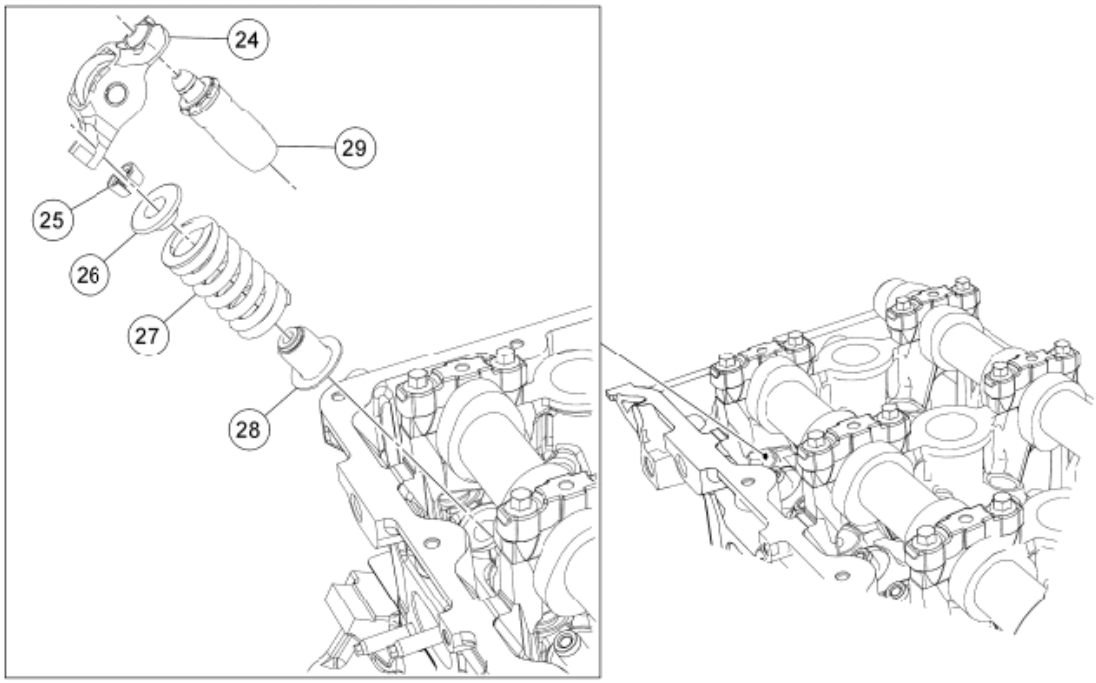


Fig. 62: Identifying RH Side Roller Follower, Hydraulic Lash Adjuster And Valve Spring Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
24	6529	Roller follower (12 required)
25	6518	Valve spring retainer key (24 required)
26	6514	Valve spring retainer (12 required)
27	6513	Valve spring (12 required)
28	6A517	Valve stem seal (12 required)
29	6C501	Hydraulic lash adjuster (12 required)

RH Side Intake and Exhaust Camshaft

 © 2011 Mitchell Repair Information Company, LLC.

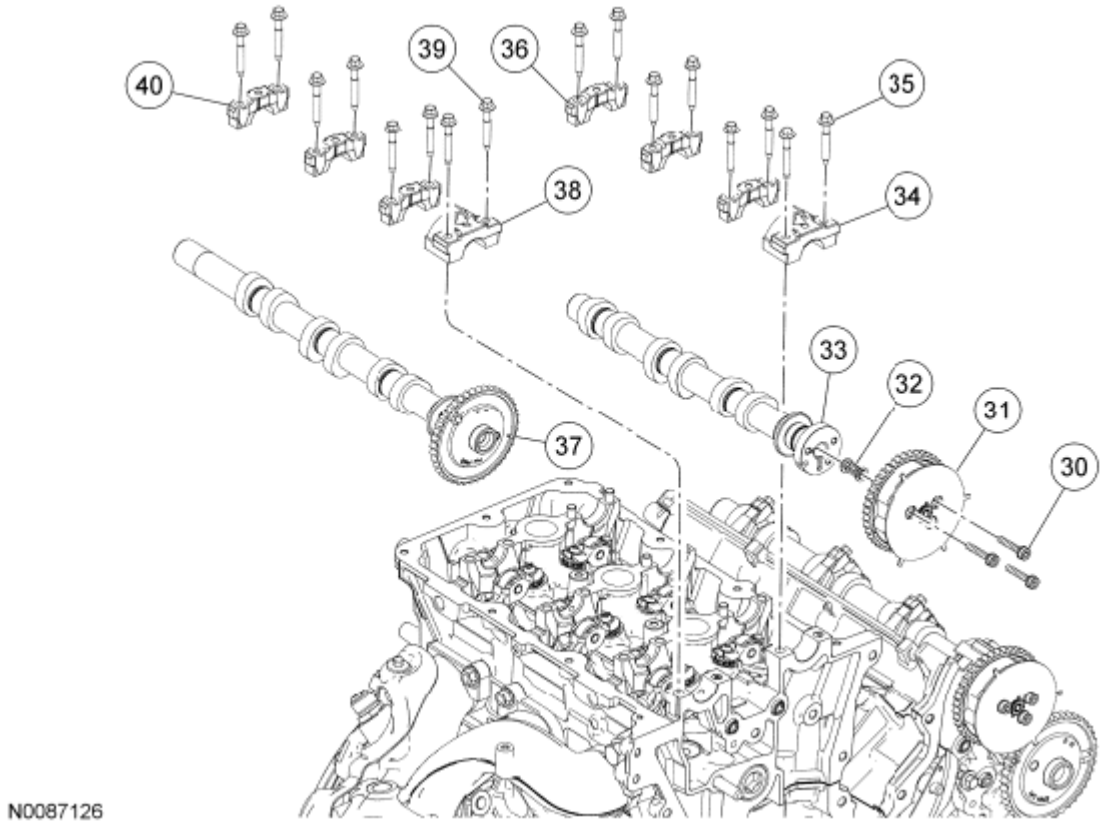


Fig. 63: Identifying RH Side Intake And Exhaust Camshaft Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
30	W713106	Camshaft phaser and sprocket bolt (3 required)
31	6C524	Camshaft phaser and sprocket
32	6C683	**VCT** system oil filter
33	6250	LH intake camshaft
34	6B280	Intake camshaft thrust bearing cap
35	W710702	Intake camshaft bearing cap bolt (8 required)
36	6B280	Intake camshaft bearing cap (3 required)
37	6250	LH exhaust camshaft
38	6B280	Exhaust camshaft thrust bearing cap
39	W710702	Exhaust camshaft bearing cap bolt (10 required)
40	6B280	Exhaust camshaft bearing cap (3 required)

1. For additional information, refer to the procedures.

CAMSHAFT PHASER AND SPROCKET

Removal and Installation

 © 2011 Mitchell Repair Information Company, LLC.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the LH intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

3. Remove the 3 bolts and the LH camshaft phaser and sprocket.
   - Tighten to 18 Nm (159 lb-in).

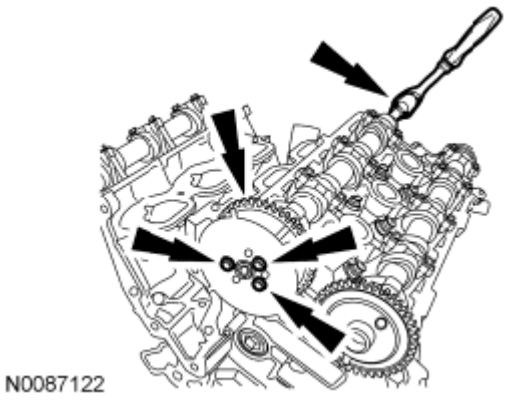


Fig. 64: Locating Bolts And LH Camshaft Phaser
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the RH intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

4. Remove the 3 bolts and the RH camshaft phaser and sprocket.
   - Tighten to 18 Nm (159 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

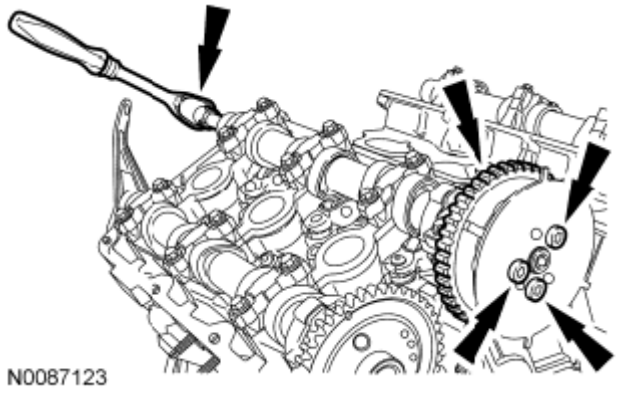


Fig. 65: Locating Bolts And RH Camshaft Phaser
Courtesy of FORD MOTOR CO.

5. To install, reverse the removal procedure.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM OIL FILTER

Removal

1. Remove the camshaft phaser and sprocket. For additional information, refer to **CAMSHAFT PHASER AND SPROCKET**.

NOTE: RH Variable Camshaft Timing (VCT) system oil filter shown, LH similar.

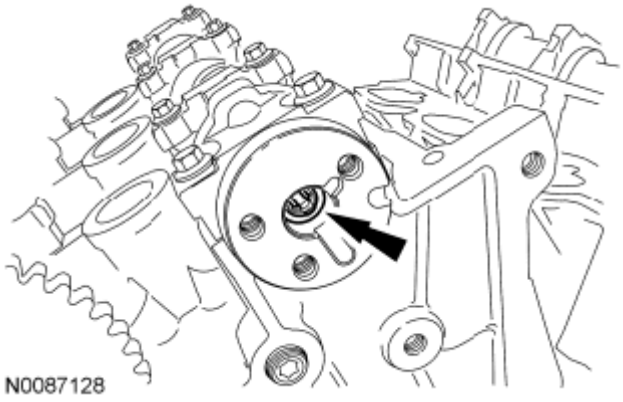


Fig. 66: Locating VCT System Oil Filter
Courtesy of FORD MOTOR CO.

2. Remove and discard the **VCT** system oil filter from the camshaft.

Installation

NOTE: RH VCT system oil filter shown, LH similar.

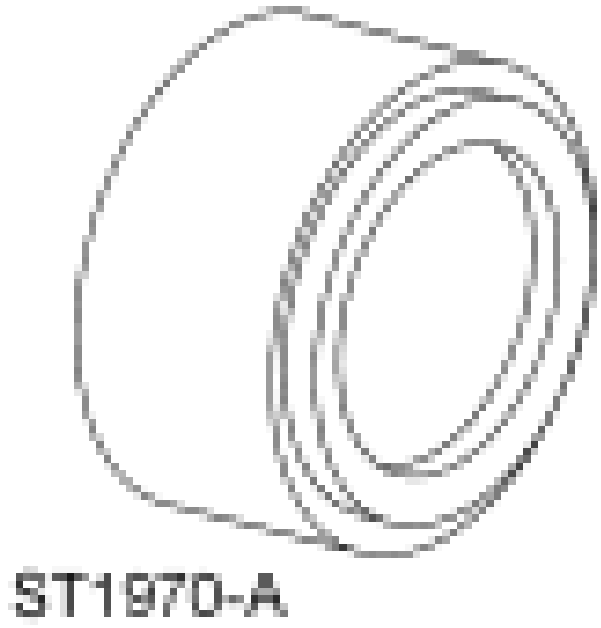
 © 2011 Mitchell Repair Information Company, LLC.

1. Install the new **VCT** system oil filter in the camshaft.
2. Install the camshaft phaser and sprocket. For additional information, refer to **CAMSHAFT PHASER AND SPROCKET**.

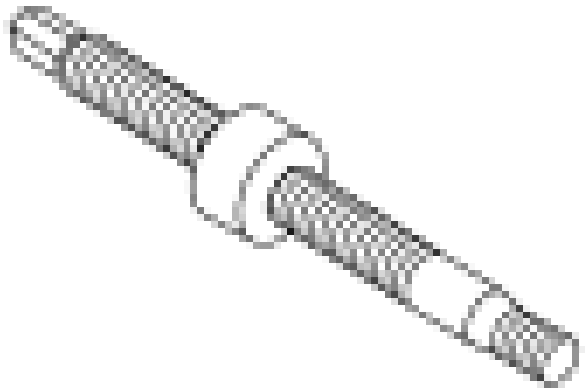
CAMSHAFTS - LH

Special Tool(s)

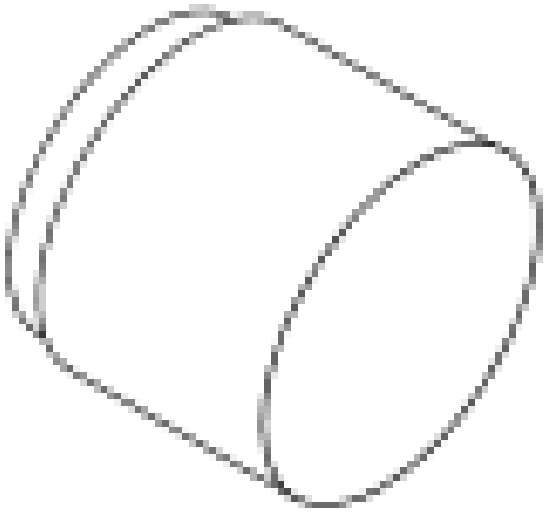
SPECIAL TOOL CHART

	Installer, Camshaft Oil Seal 303-464 (T94P-6256-BH)
	Installer, Camshaft Pulley 303-458 (T94P-6312-AH3), part of 303-S455

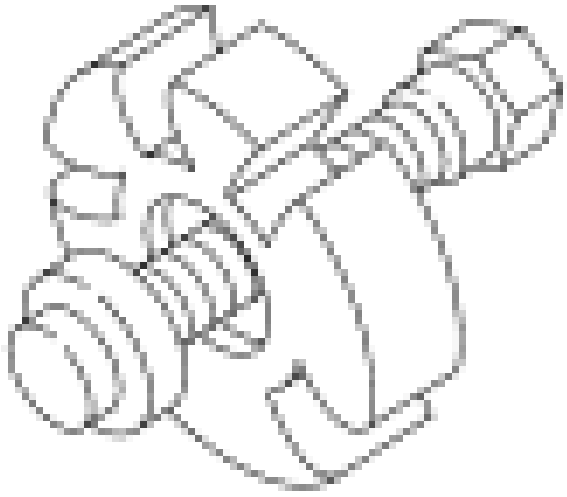
 © 2011 Mitchell Repair Information Company, LLC.

 ST3042-A	
 ST1586-A	Installer, Power Steering Pump Pulley 211-185 (T91P-3A733-A)
	Plate, Water Pump Pulley 303-456 (T94P-6312-AH1), part of 303-S455

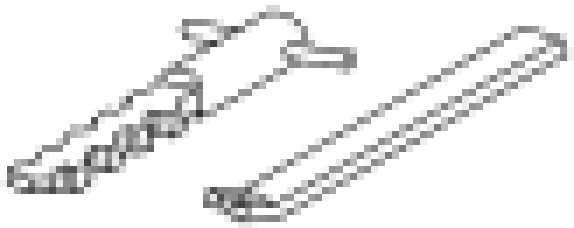
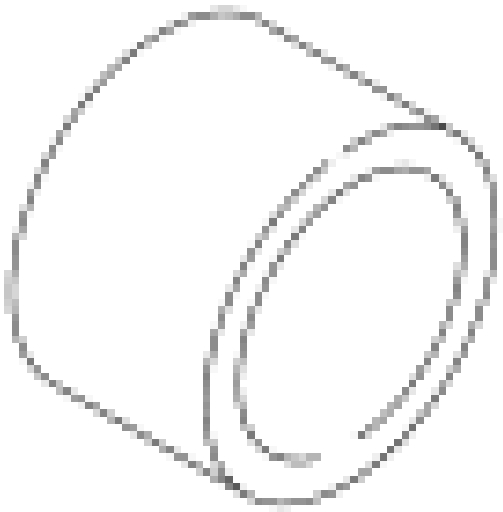
 © 2011 Mitchell Repair Information Company, LLC.

 ST3044-A	
 ST2060-A	Protector, Camshaft Oil Seal 303-463 (T94P-6256-AH)
	Protector, Water Pump Shaft

 © 2011 Mitchell Repair Information Company, LLC.

 ST3045-A	303-457 (T94P-6312-AH2), part of 303-S455
 ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
	Remover, Oil Seal

 © 2011 Mitchell Repair Information Company, LLC.

 ST1385-A	303-409 (T92C-6700-CH)
 ST3043-A	Spacer, Water Pump Pulley 303-459 (T94P-6312-AH4), part of 303-S455

Material

MATERIAL SPECIFICATIONS

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

 © 2011 Mitchell Repair Information Company, LLC.

Removal

1. Remove the coolant pump belt. For additional information, refer to **COOLANT PUMP BELT** .
2. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

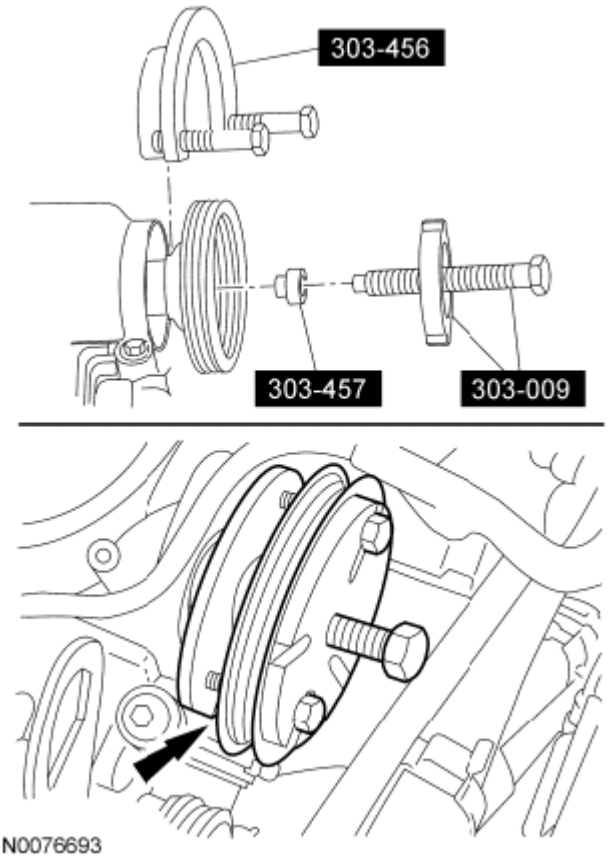


Fig. 67: Identifying Water Pump Pulley Plate, Water Pump Shaft Protector And Crankshaft Vibration Damper Remover
Courtesy of FORD MOTOR CO.

3. Using the Water Pump Pulley Plate, Water Pump Shaft Protector and the Crankshaft Vibration Damper Remover, remove the coolant pump pulley.

NOTE: Do not scratch the camshaft sealing surface while removing the camshaft oil seal. If scratched, camshaft oil seal leakage may occur.

 © 2011 Mitchell Repair Information Company, LLC.

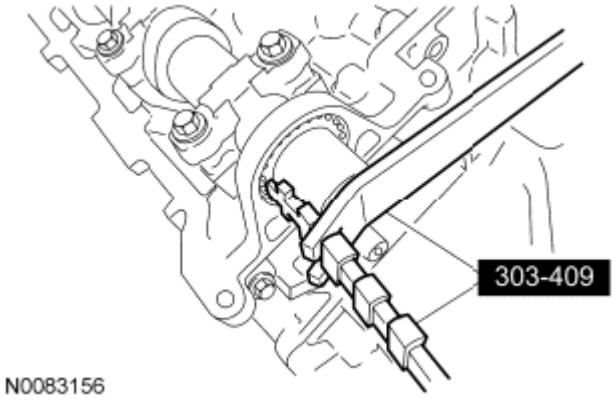


Fig. 68: Removing Camshaft Oil Seal Using Oil Seal Remover
Courtesy of FORD MOTOR CO.

4. Using the Oil Seal Remover, remove and discard the camshaft oil seal.
5. Remove the 2 bolts and the camshaft oil seal retainer.
    - Discard the press-in-place gasket.

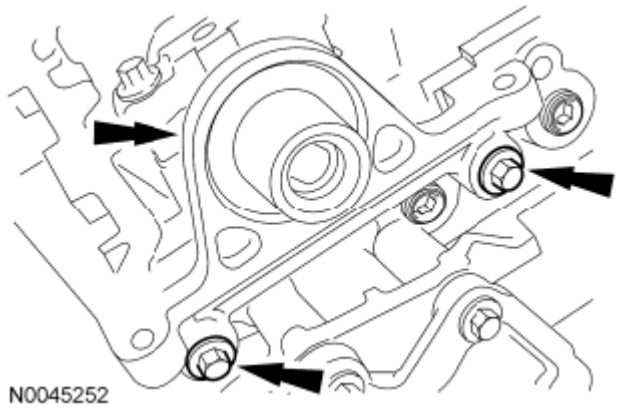


Fig. 69: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of FORD MOTOR CO.

NOTE: The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.

 © 2011 Mitchell Repair Information Company, LLC.

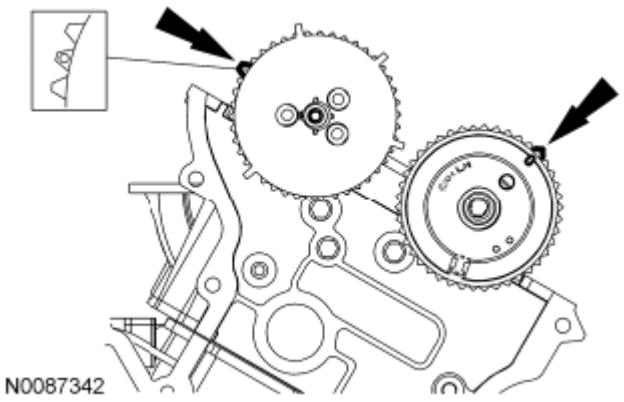


Fig. 70: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

6. Verify the LH camshafts are in the neutral position.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

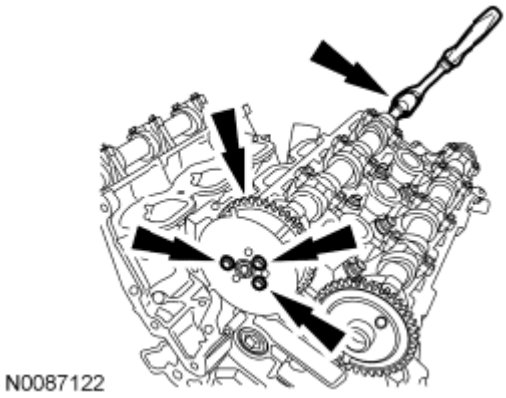


Fig. 71: Locating Bolts And LH Camshaft Phaser
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the LH camshaft phaser and sprocket.

NOTE: Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to

 © 2011 Mitchell Repair Information Company, LLC.

removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.

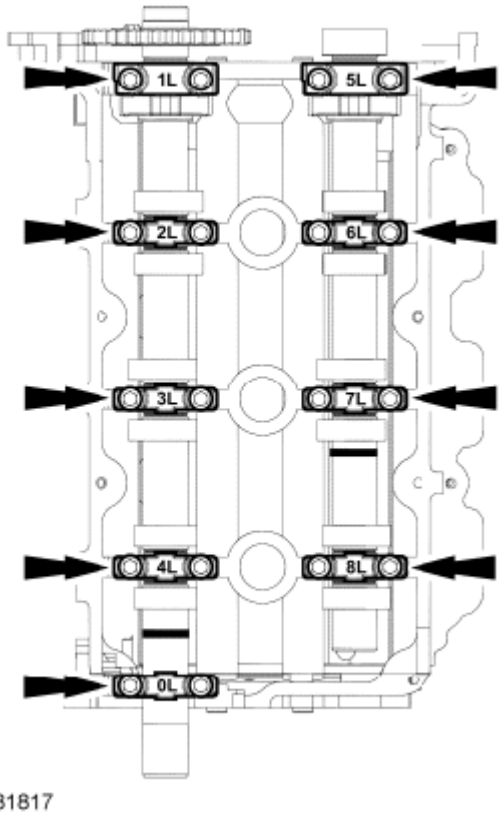


Fig. 72: Locating Camshaft Bearing Cap
Courtesy of FORD MOTOR CO.

8. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

NOTE: After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (1L and 5L) first, or damage to the thrust caps may occur.

NOTE: Make sure the camshaft bearing caps are marked as instructed in the previous step.

9. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (1L and 5L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

 © 2011 Mitchell Repair Information Company, LLC.

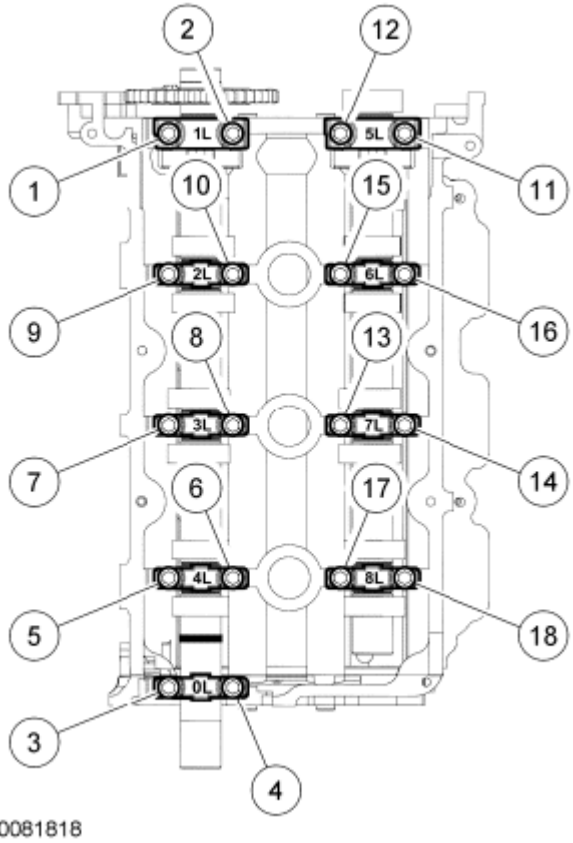
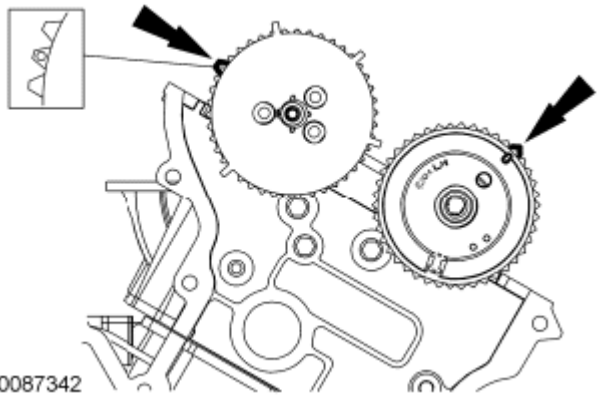


Fig. 73: Identifying Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

Installation

1. Position the camshaft phaser and sprocket onto the intake camshaft.
    - Install the 3 bolts finger-tight.
2. Lubricate the LH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the LH camshafts as shown.



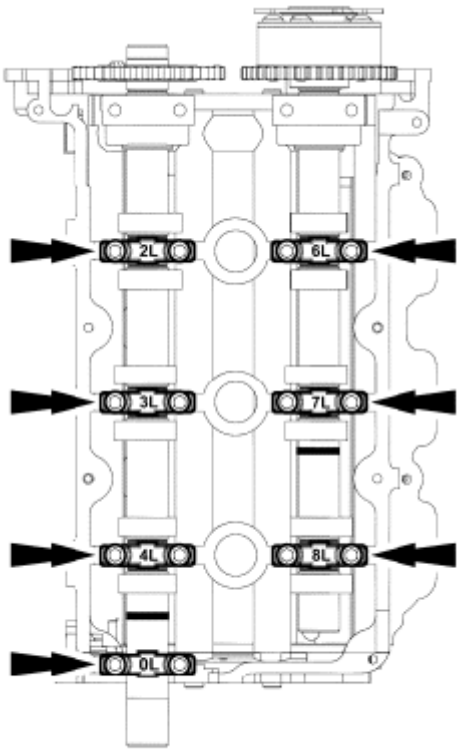
 © 2011 Mitchell Repair Information Company, LLC.

Fig. 74: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

NOTE: Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.

3. Lubricate the bearing surfaces of the LH camshaft bearing caps with clean engine oil and install the bearing caps.
   - Loosely install the bolts.



N0081819

Fig. 75: Locating Bearing Caps
Courtesy of FORD MOTOR CO.

4. Lubricate the bearing surfaces of the LH camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
   - Loosely install the bolts.

 © 2011 Mitchell Repair Information Company, LLC.

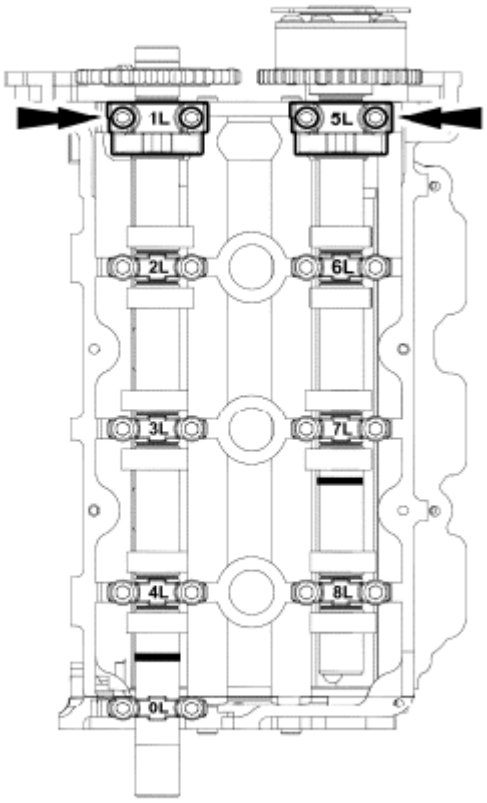


Fig. 76: Locating Bearing Caps Bolts
Courtesy of FORD MOTOR CO.

NOTE: Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.

5. Tighten the LH camshaft bearing cap bolts in the sequence shown in 2 stages.
   - Stage 1: Tighten to 10 Nm (89 lb-in).
   - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

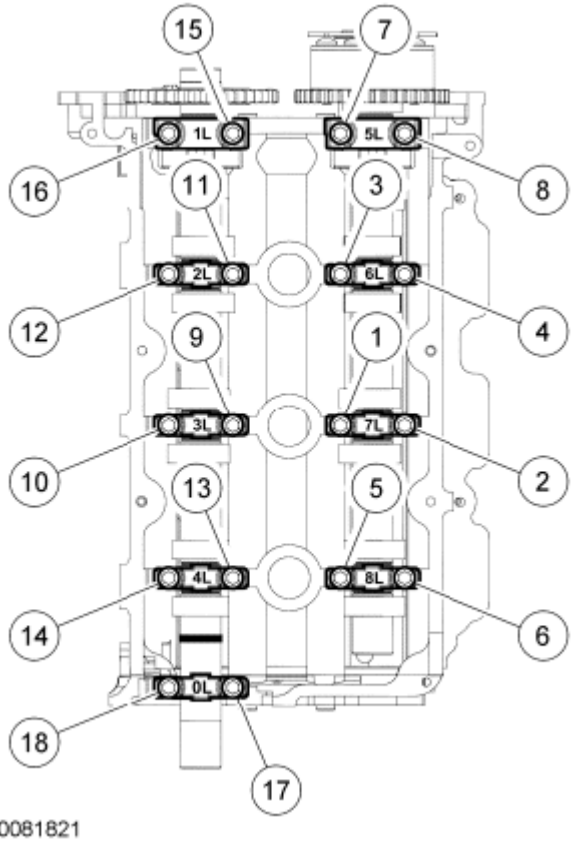
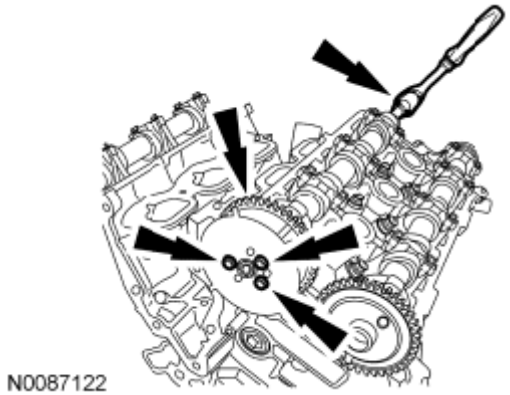


Fig. 77: Identifying LH Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 78: Locating LH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

6. Tighten the 3 LH camshaft phaser and sprocket bolts to 18 Nm (159 lb-in).

NOTE: Clean the sealing surfaces with metal surface prep before installing a new press-in-place gasket.

7. Install the camshaft oil seal retainer and the 2 bolts.
   - Tighten to 10 Nm (89 lb-in).

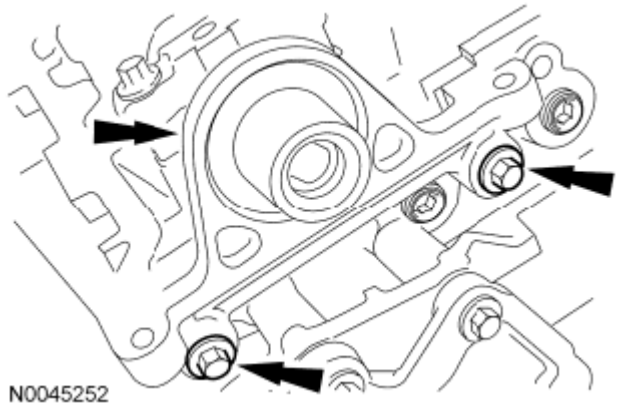


Fig. 79: Locating Camshaft Oil Seal Retainer And Bolts
Courtesy of FORD MOTOR CO.

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

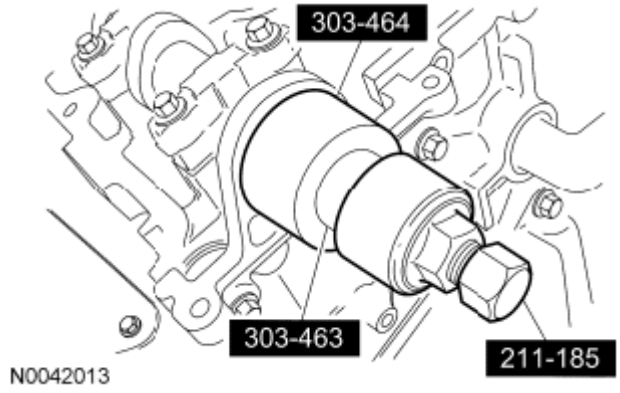


Fig. 80: Identifying Camshaft Oil Seal Installer, Camshaft Oil Seal Protector And Power Steering Pump Pulley Installer
Courtesy of FORD MOTOR CO.

8. Using the Camshaft Oil Seal Installer, Camshaft Oil Seal Protector and the Power Steering Pump Pulley Installer, install the camshaft oil seal.

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

9. Install the Camshaft Pulley Installer in the camshaft as shown in the illustration.
   - Adjust the collar on the Camshaft Pulley Installer screw to get the best thread engagement in the rear of the camshaft.

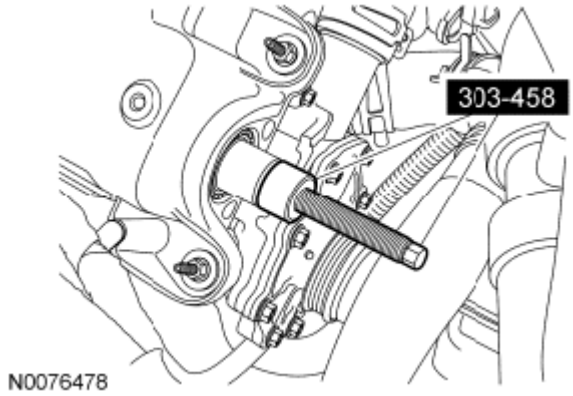


Fig. 81: Identifying Camshaft Pulley Installer
Courtesy of FORD MOTOR CO.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

NOTE: Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-458).

10. Position the coolant pump pulley over the previously installed Camshaft Pulley Installer and on the end of the camshaft. Install the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer as shown in the illustration.
    - Using the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer, install a new service coolant pump pulley flush with the end of the camshaft.

 © 2011 Mitchell Repair Information Company, LLC.

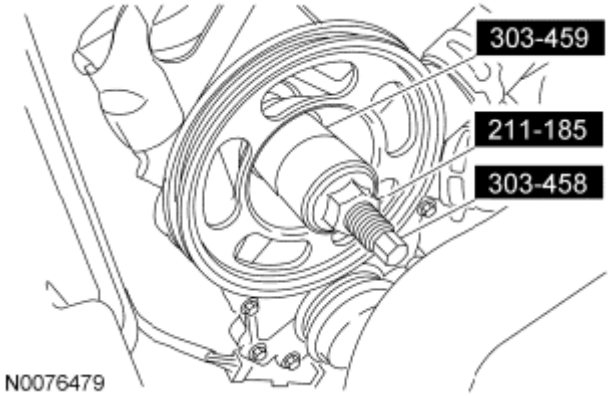


Fig. 82: Identifying Camshaft Pulley Installer, Power Steering Pump Pulley Installer And Water Pump Pulley Spacer
Courtesy of FORD MOTOR CO.

11. Install the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.
12. Install the coolant pump belt. For additional information, refer to **COOLANT PUMP BELT** .

CAMSHAFTS - RH

Material

MATERIAL SPECIFICATIONS

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

1. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.

NOTE: The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.

 © 2011 Mitchell Repair Information Company, LLC.

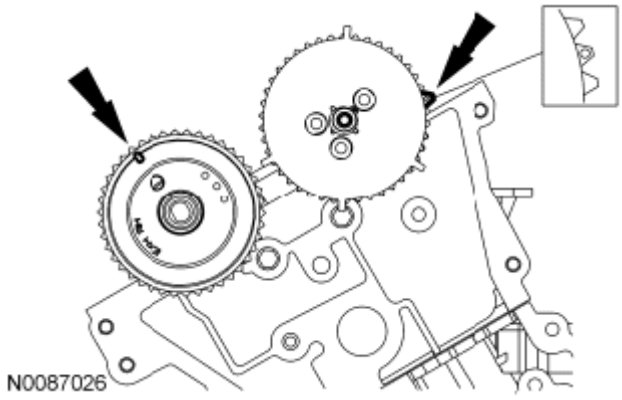


Fig. 83: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

2. Verify the RH camshafts are in the neutral position.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

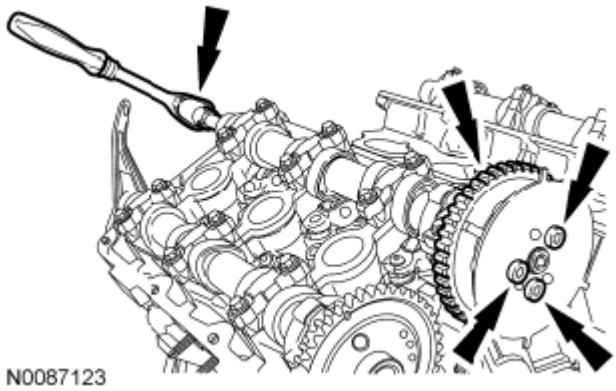


Fig. 84: Locating Bolts And RH Camshaft Phaser
Courtesy of FORD MOTOR CO.

3. Remove the 3 bolts and the RH camshaft phaser and sprocket.

NOTE: Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original

 © 2011 Mitchell Repair Information Company, LLC.

positions may result in severe engine damage.

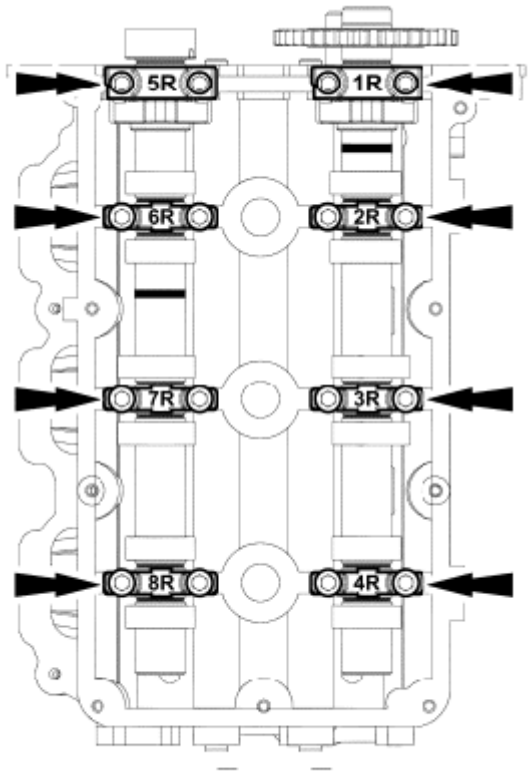


Fig. 85: Locating Camshaft Bearing Cap
Courtesy of FORD MOTOR CO.

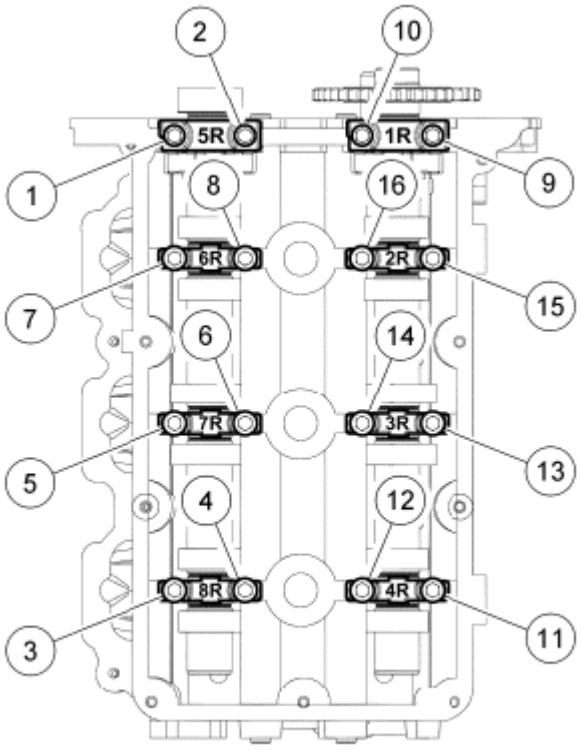
4. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

NOTE: After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (5R and 1R) first, or damage to the thrust caps may occur.

NOTE: Make sure the camshaft bearing caps are marked as instructed in the previous step.

5. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (5R and 1R).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

 © 2011 Mitchell Repair Information Company, LLC.

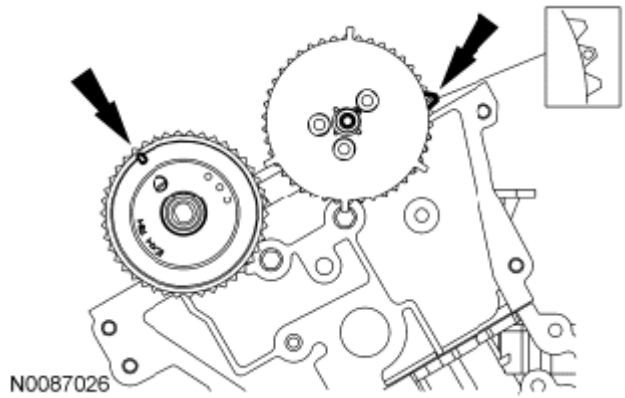


N0053678

Fig. 86: Identifying Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

Installation

1. Position the RH camshaft phaser and sprocket onto the intake camshaft.
    - Install the 3 bolts finger-tight.
2. Lubricate the RH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the RH camshafts as shown.



N0087026

 © 2011 Mitchell Repair Information Company, LLC.

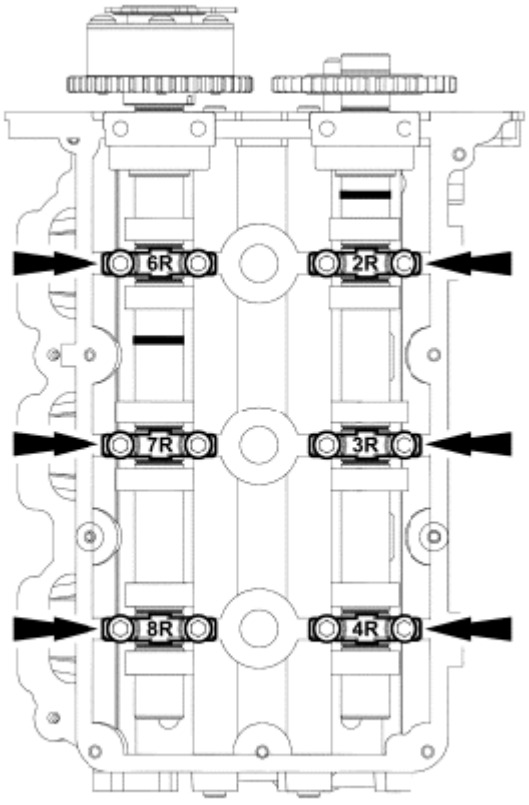
Fig. 87: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

NOTE: Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.

NOTE: Lubricate the bearing surfaces of the RH camshaft bearing caps with clean engine oil.

3. Install the camshaft bearing caps.
   - Loosely install the bolts.



N0042369

Fig. 88: Locating Camshaft Bearing Caps
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the bearing surfaces of the RH camshaft bearing thrust caps with clean engine oil.

 © 2011 Mitchell Repair Information Company, LLC.

4. Install the camshaft bearing thrust caps.
    - Loosely install the bolts.

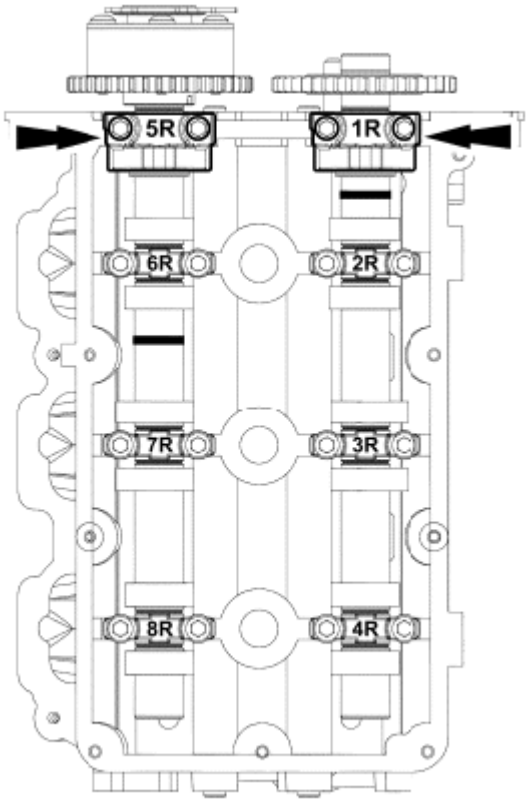
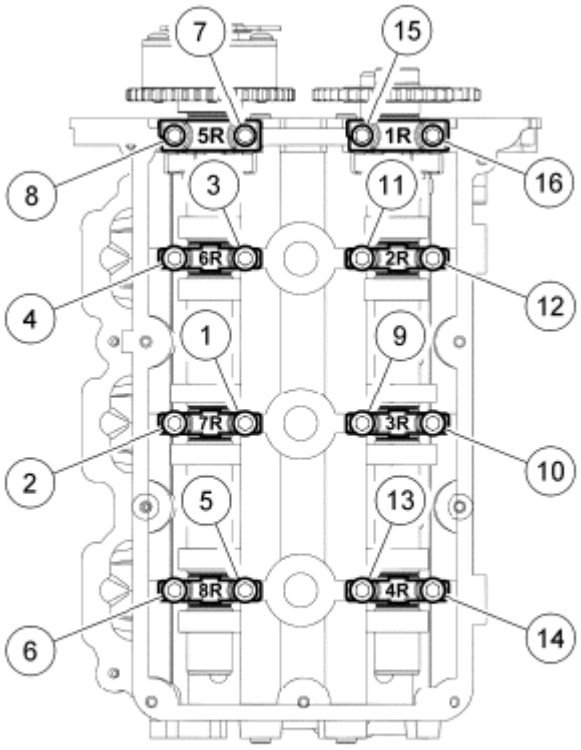


Fig. 89: Locating Camshaft Bearing Thrust Caps Bolts
Courtesy of FORD MOTOR CO.

NOTE: Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.

5. Tighten the RH camshaft bearing cap bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 10 Nm (89 lb-in).
    - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

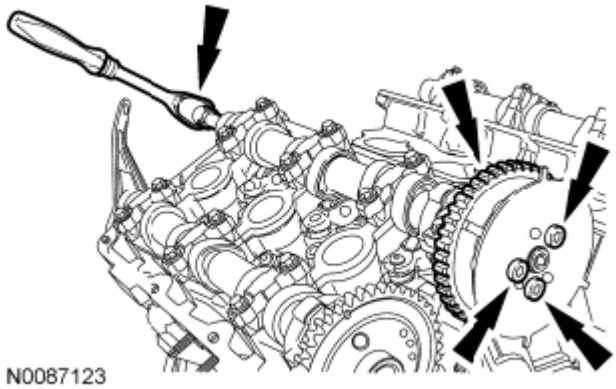


N0081822

Fig. 90: Identifying RH Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.



N0087123

 © 2011 Mitchell Repair Information Company, LLC.

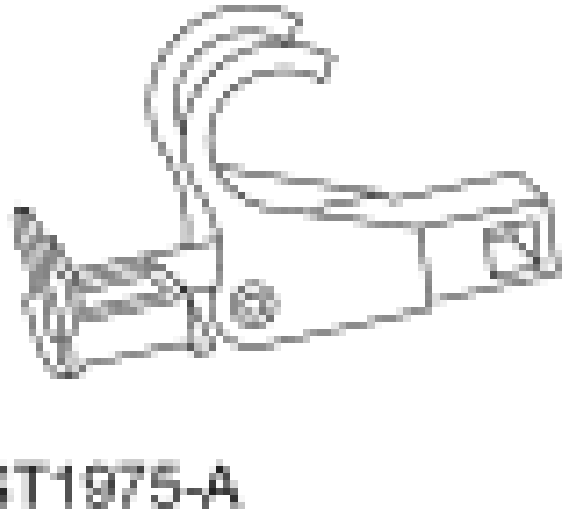
Fig. 91: Locating RH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

6. Tighten the 3 RH camshaft phaser and sprocket bolts to 18 Nm (159 lb-in).
7. Install the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.

CAMSHAFT ROLLER FOLLOWER

Special Tool(s)

SPECIAL TOOL CHART

	Compressor, Valve Spring 303-473 (T94P-6565-BH)

Material

MATERIAL SPECIFICATIONS

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the LH and RH valve covers. For additional information, refer to **VALVE COVER - LH** and **VALVE COVER - RH**.
3. Remove the LH and RH spark plugs. For additional information, refer to **SPARK PLUGS** .

 © 2011 Mitchell Repair Information Company, LLC.

4. Remove the RH splash shield.
    - To install, tighten to 9 Nm (80 lb-in).
5. Rotate the crankshaft until the camshaft lobe is pointing directly away from the roller follower.
6. Using the Valve Spring Compressor, remove the roller followers.

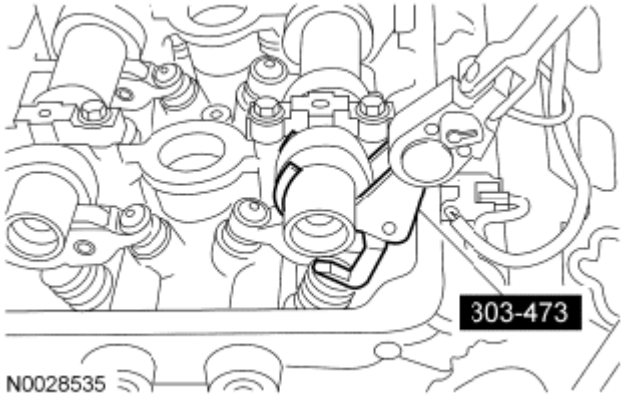


Fig. 92: Identifying Valve Spring Compressor
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the camshaft followers with clean engine oil.

7. To install, reverse the removal procedure.

HYDRAULIC LASH ADJUSTER

Material

MATERIAL SPECIFICATIONS

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

1. Remove the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER**.

NOTE: Mark the positions of the hydraulic lash adjusters to make sure they are assembled in their original positions.

2. Remove the hydraulic lash adjusters.

NOTE: Inspect the hydraulic lash adjusters for scoring marks and uneven wear in

 © 2011 Mitchell Repair Information Company, LLC.

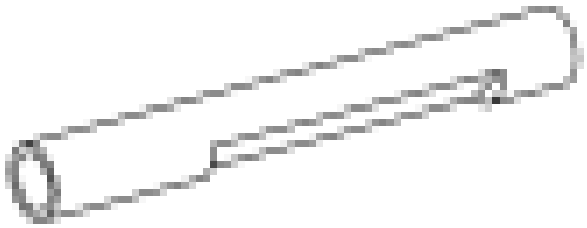
the bore. Install new lash adjusters if necessary.

3. To install, reverse the removal procedure.
    - Lubricate the hydraulic lash adjusters with clean engine oil.

VALVE SPRING, RETAINER, AND SEAL

Special Tool(s)

SPECIAL TOOL CHART

 ST1975-A	Compressor, Valve Spring 303-473 (T94P-6565-BH)
 ST1977-A	Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)

Material

 © 2011 Mitchell Repair Information Company, LLC.

MATERIAL SPECIFICATIONS

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

1. Remove the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER**.

NOTE: If air pressure has forced the piston to the bottom of the cylinder, any loss of air pressure will allow the valve(s) to fall into the cylinder. A rubber band, tape or string wrapped around the end of the valve stem will prevent this from happening.

2. Pressurize the cylinder using compressed air.
3. Using the Valve Spring Compressor, remove the key, retainer and the valve spring.

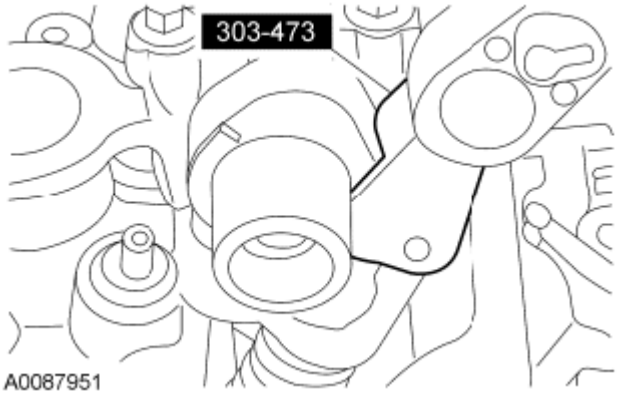


Fig. 93: Identifying Valve Spring Compressor
Courtesy of FORD MOTOR CO.

NOTE: Camshaft removed for clarity.

 © 2011 Mitchell Repair Information Company, LLC.

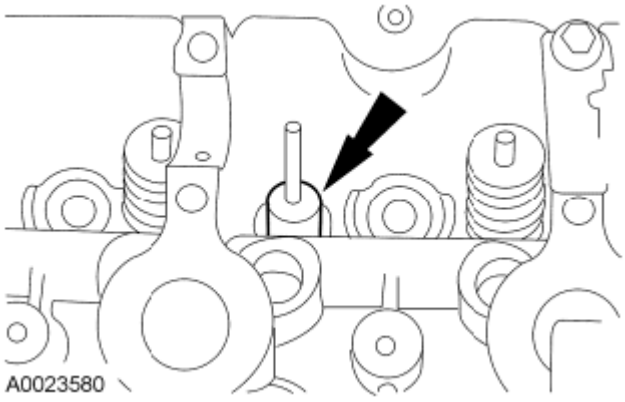


Fig. 94: Locating Valve Seal
Courtesy of FORD MOTOR CO.

4. Remove the valve seal.

Installation

NOTE: Lubricate the valve guide with clean engine oil.

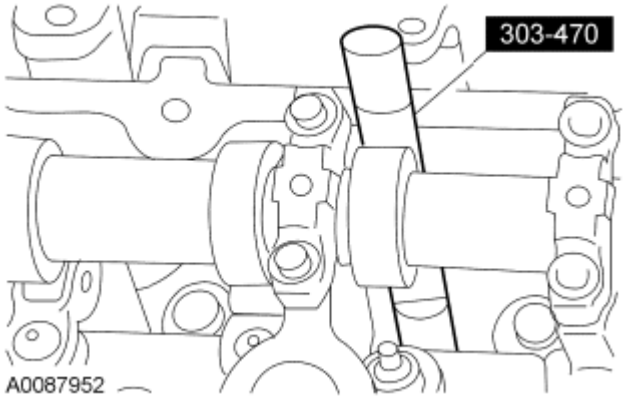


Fig. 95: Identifying Valve Stem Oil Seal Installer
Courtesy of FORD MOTOR CO.

1. Using the Valve Stem Oil Seal Installer, install the valve seal.
2. Using the Valve Spring Compressor, install the valve spring, retainer and key.

 © 2011 Mitchell Repair Information Company, LLC.

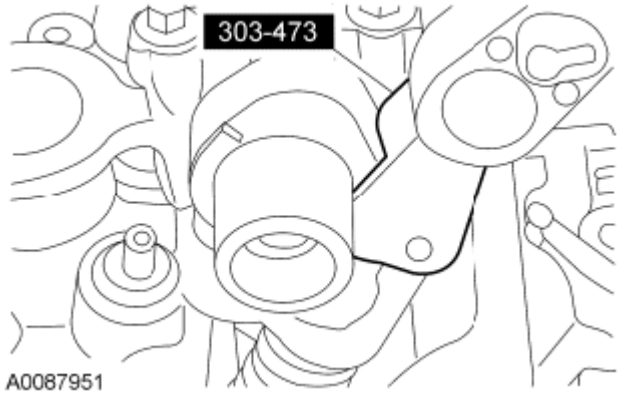


Fig. 96: Identifying Valve Spring Compressor
Courtesy of FORD MOTOR CO.

3. Install the camshaft roller followers. For additional information, refer to **CAMSHAFT ROLLER FOLLOWER**.

CYLINDER HEAD - RH

Material

MATERIAL SPECIFICATIONS

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

 © 2011 Mitchell Repair Information Company, LLC.

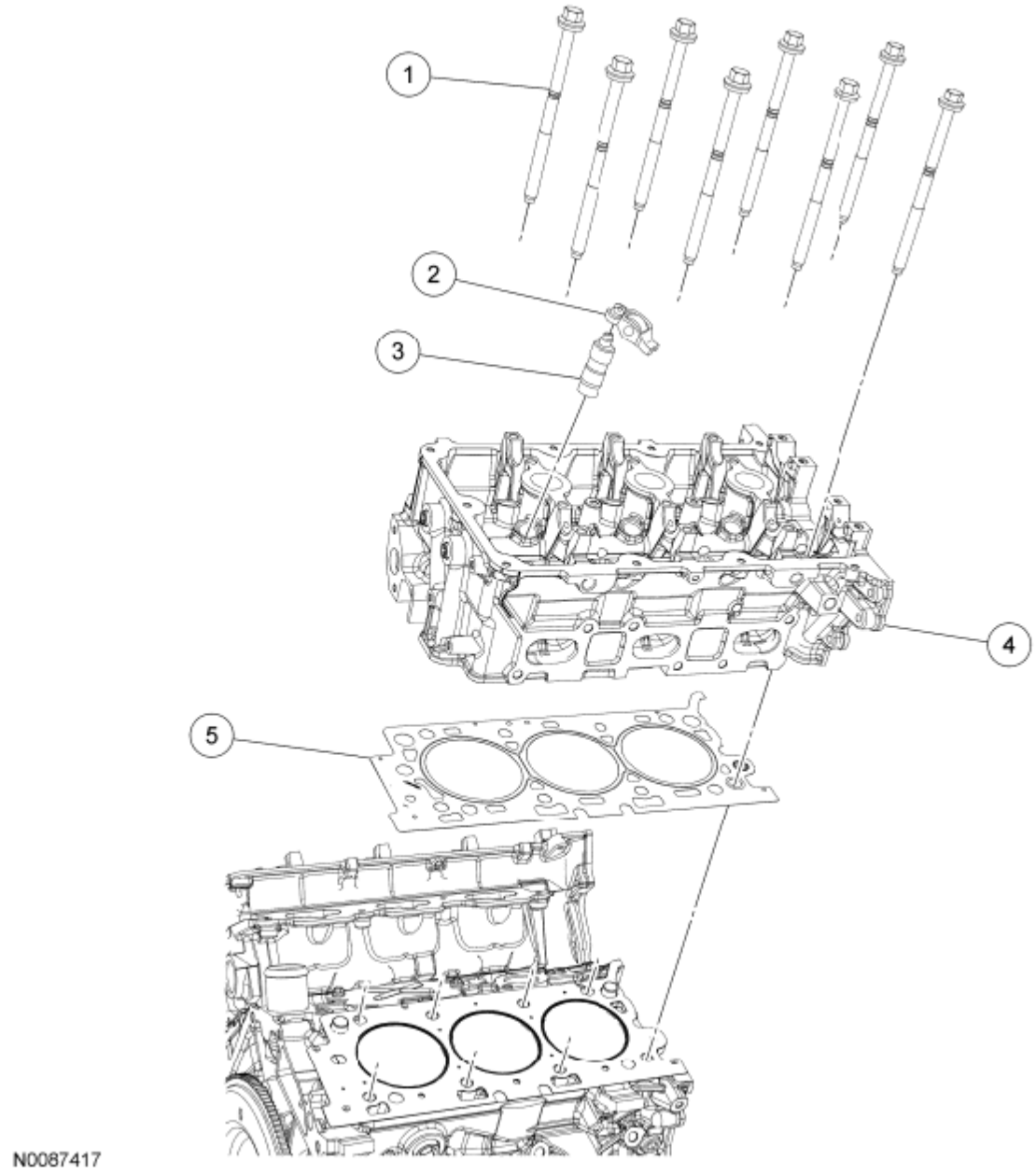


Fig. 97: Identifying Cylinder Head Components - RH
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6065	Cylinder head bolt (8 required)
2	6529	Camshaft roller follower (12 required)
3	6C501	Hydraulic lash adjuster (12 required)
4	6049	Cylinder head
5	6051	Cylinder head gasket

 © 2011 Mitchell Repair Information Company, LLC.

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the lower intake manifold. For additional information, refer to **LOWER INTAKE MANIFOLD**.
3. Remove the coolant pump housing. For additional information, refer to **COOLANT PUMP HOUSING - - 3.0L (4V)** .
4. Remove the RH camshafts. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **CAMSHAFTS - RH**.

   NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

5. Remove the camshaft roller followers.

   NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

6. Remove the hydraulic lash adjusters.
7. Remove the RH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD - RH**.

   NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

8. Remove the bolts in the sequence shown.
   - Remove the cylinder head.
   - Discard the bolts and gasket.

 © 2011 Mitchell Repair Information Company, LLC.

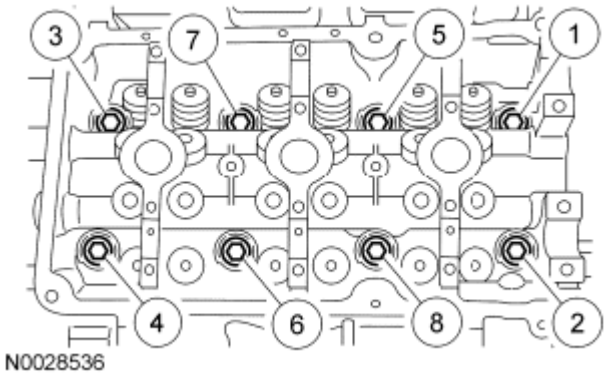


Fig. 98: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

9. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **GENERAL PROCEDURES** .

Installation

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

1. Use a plastic scraping tool to remove all traces of the head gasket.
   - Clean all surfaces with metal surface prep.
2. Position a new gasket and the cylinder head.

NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

3. Install the bolts and tighten in 6 stages in the sequence shown.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten 90 degrees.
   - Stage 3: Loosen one full turn.
   - Stage 4: Tighten to 40 Nm (30 lb-ft).
   - Stage 5: Tighten 90 degrees.
   - Stage 6: Tighten 90 degrees.

 © 2011 Mitchell Repair Information Company, LLC.

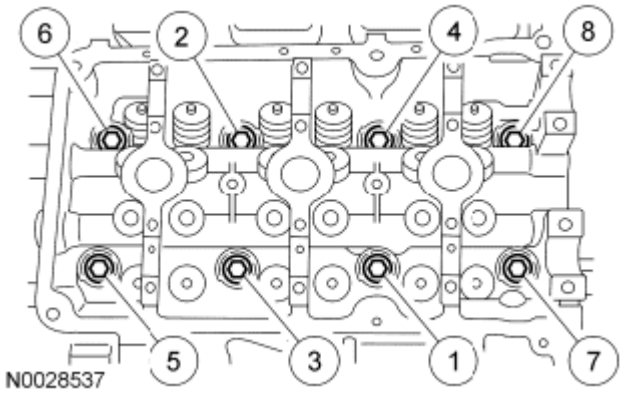


Fig. 99: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

4. Install the RH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD - RH**.

NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

5. Install the hydraulic lash adjusters.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

6. Install the camshaft roller followers.
   - Lubricate the camshaft roller followers with clean engine oil.
7. Install the RH camshafts. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **CAMSHAFTS - RH**.
8. Install the coolant pump housing. For additional information, refer to **COOLANT PUMP HOUSING -- 3.0L (4V)** .
9. Install the lower intake manifold. For additional information, refer to **LOWER INTAKE MANIFOLD**.

CYLINDER HEAD - LH

Material

MATERIAL SPECIFICATIONS

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

 © 2011 Mitchell Repair Information Company, LLC.

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

LH Cylinder Head

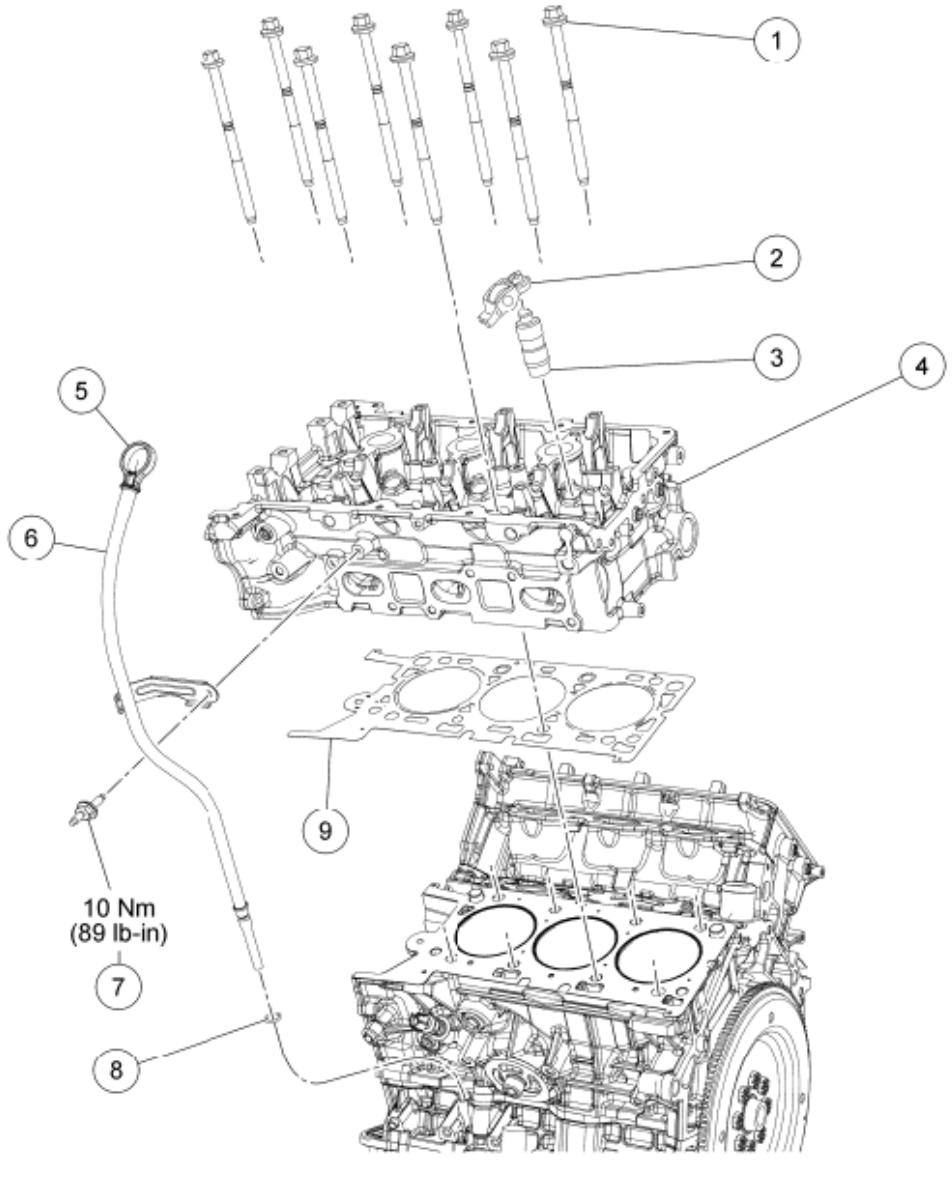


Fig. 100: Identifying LH Cylinder Head Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6065	Cylinder head bolt (8 required)
2	6529	Camshaft roller follower (12 required)
3	6C501	Hydraulic lash adjuster (12 required)

 © 2011 Mitchell Repair Information Company, LLC.

4	6050	Cylinder head
5	6750	Oil level indicator
6	6754	Oil level indicator tube
7	W701822	Oil level indicator tube stud bolt
8	110282	Oil level indicator tube O-ring
9	6083	Cylinder head gasket

Upper Radiator Support Brackets

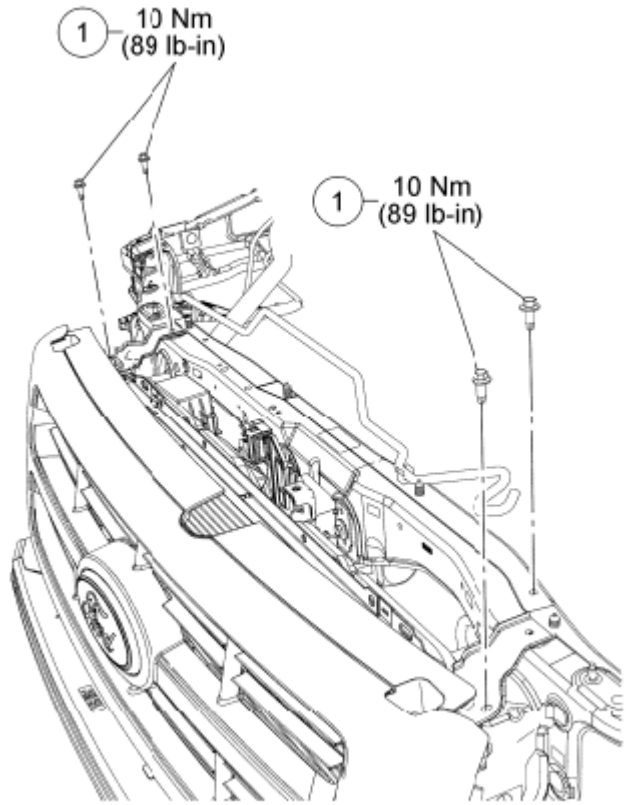


Fig. 101: Identifying Upper Radiator Support Brackets Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W707399	Upper radiator support bracket bolts

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine

 © 2011 Mitchell Repair Information Company, LLC.

failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the lower intake manifold. For additional information, refer to **LOWER INTAKE MANIFOLD**.
3. Remove the coolant pump housing. For additional information, refer to **COOLANT PUMP HOUSING -- 3.0L (4V)** .
4. Remove the LH camshafts. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **CAMSHAFTS - LH**.

NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

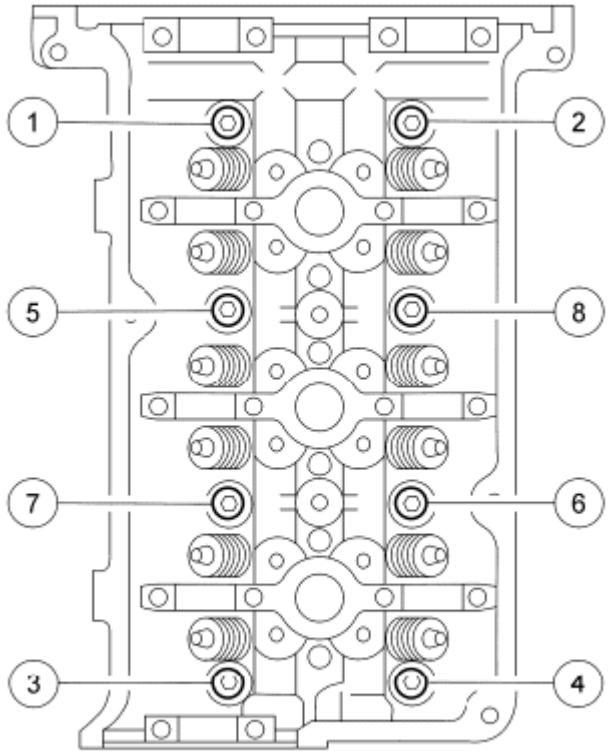
5. Remove the camshaft roller followers.

NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

6. Remove the hydraulic lash adjusters.
7. Remove the LH catalytic converter. For additional information, refer to **CATALYTIC CONVERTER -- 3.0L LH MANIFOLD** .
8. Remove the 4 upper radiator support bracket bolts.
9. Remove the oil level indicator.
10. Remove the stud bolt and then remove the oil level indicator tube by guiding it between the radiator support and the cooling fan.
    - Remove and discard the O-ring seal.

NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

 © 2011 Mitchell Repair Information Company, LLC.



N0001536

Fig. 102: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Remove the bolts in the sequence shown.

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.

12. Clean the cylinder head gasket surfaces with a plastic scraping tool and metal surface prep.
13. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **GENERAL PROCEDURES** .

Installation

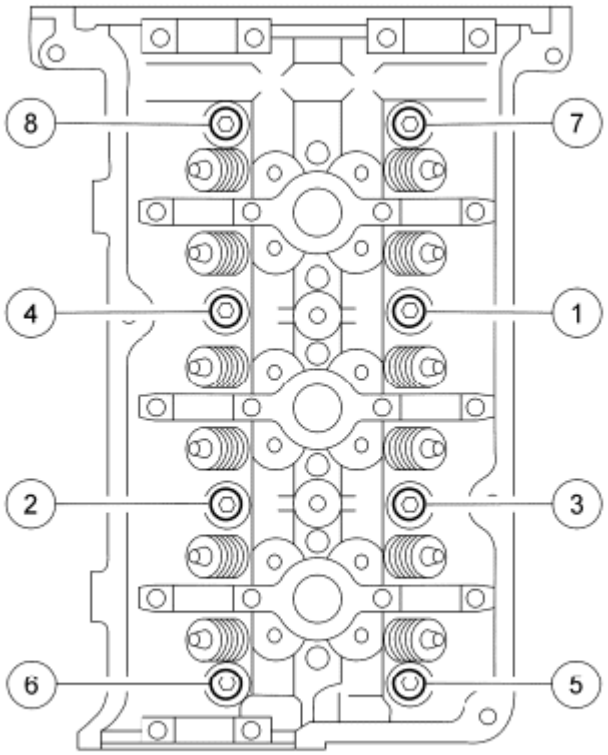
1. Position a new gasket and the cylinder head.

NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

2. Install the bolts and tighten in 6 stages in the sequence shown.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

- Stage 2: Tighten 90 degrees.
- Stage 3: Loosen one full turn.
- Stage 4: Tighten to 40 Nm (30 lb-ft).
- Stage 5: Tighten 90 degrees.
- Stage 6: Tighten 90 degrees.



N0001535

Fig. 103: Identifying Cylinder Head Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Installation of the oil level indicator may require the assistance of a second technician to align the tube with the orifice.

NOTE: Install a new O-ring seal and lubricate with clean engine oil.

3. Guide the oil level indicator tube between the radiator support and the cooling fan and install it in the orifice, install the stud bolt.
   - To install, tighten to 10 Nm (89 lb-in).
4. Install the oil level indicator.
5. Install the 4 upper radiator support bracket bolts.
   - Tighten to 10 Nm (89 lb-in).
6. Install the LH catalytic converter. For additional information, refer to **CATALYTIC CONVERTER --**

 © 2011 Mitchell Repair Information Company, LLC.

3.0L LH MANIFOLD .

NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

7. Install the hydraulic lash adjusters.
   - Lubricate the hydraulic lash adjusters with clean engine oil.

NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

8. Install the camshaft roller followers.
   - Lubricate the camshaft roller followers with clean engine oil.
9. Install the camshafts. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **CAMSHAFTS - LH**.
10. Install the coolant pump housing. For additional information, refer to **COOLANT PUMP HOUSING -- 3.0L (4V)** .
11. Install the lower intake manifold. For additional information, refer to **LOWER INTAKE MANIFOLD**.

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

Oil Pan, Oil Pan Baffle and Oil Pump Screen and Pickup Tube

 © 2011 Mitchell Repair Information Company, LLC.

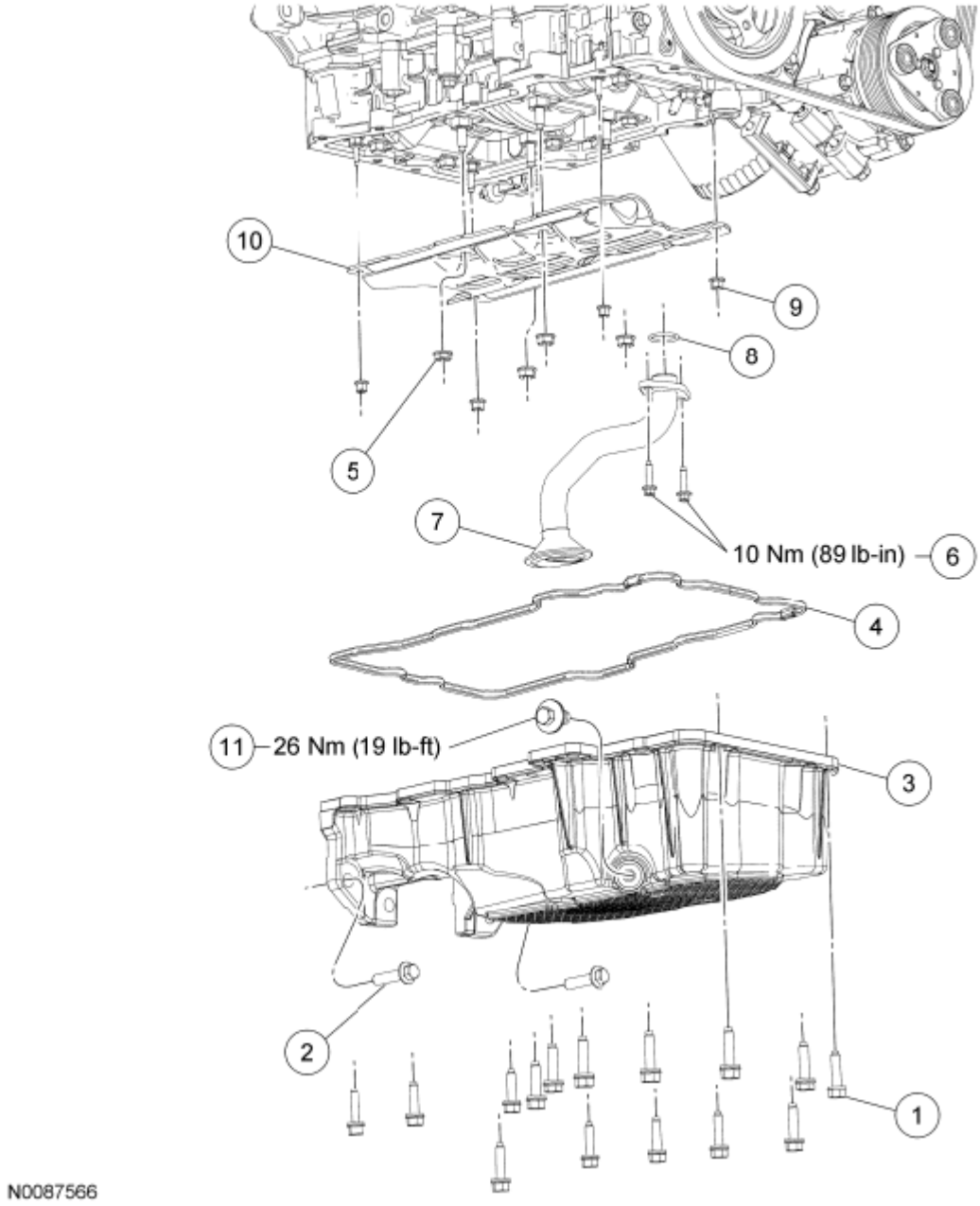


Fig. 104: Identifying Oil Pan, Oil Pan Baffle And Oil Pump Screen And Pickup Tube Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W709678	Oil pan-to-engine bolt (15 required)
2	W500120	Oil pan-to-transaxle bolt (2 required)
3	6675	Oil pan
4	6710	Oil pan gasket

 © 2011 Mitchell Repair Information Company, LLC.

5	W701582	Oil pan baffle nut (4 required)
6	W700005	Oil pump screen and pickup tube bolts (2 required)
7	6622	Oil pump screen and pickup tube
8	6625	Oil pump screen and pickup tube O-ring seal
9	W701542	Oil pan baffle nut (4 required)
10	6687	Oil pan baffle
11	6730	Oil pan drain plug

Oil Pump

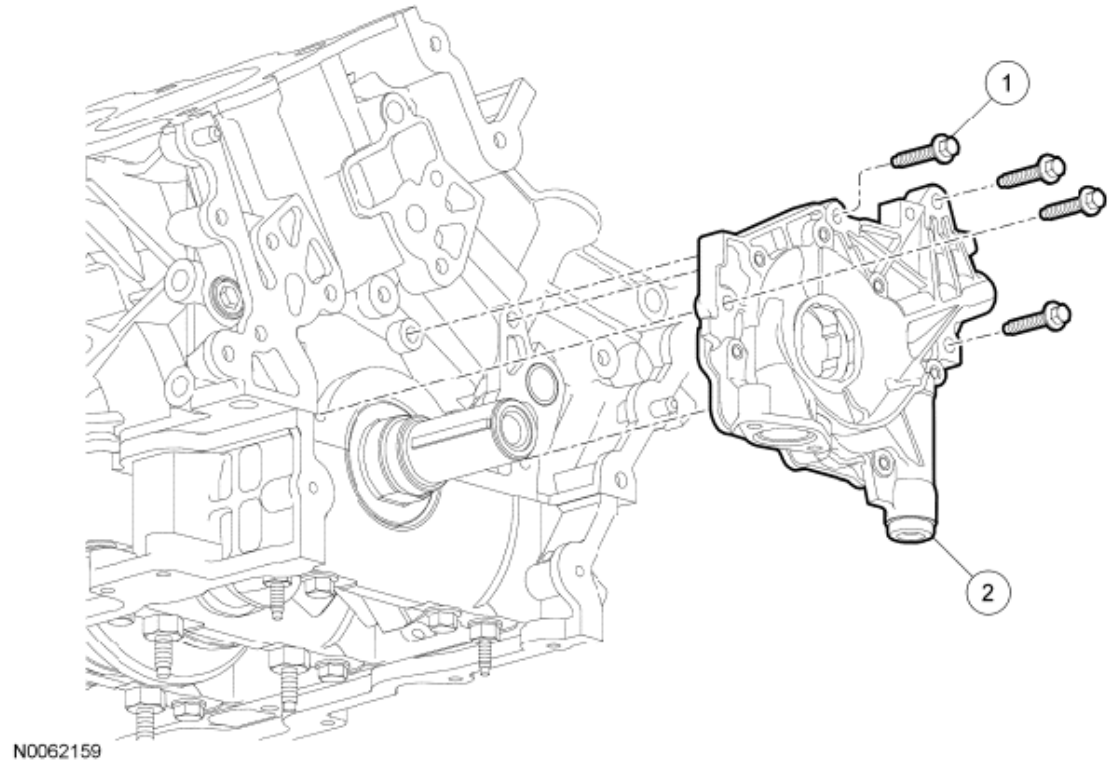


Fig. 105: Identifying Oil Pump Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W500300	Oil pump bolt (4 required)
2	6621	Oil pump

1. For additional information, refer to the procedures.

OIL PAN

Material

 © 2011 Mitchell Repair Information Company, LLC.

MATERIAL SPECIFICATIONS

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

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the exhaust Y-pipe. For additional information, refer to **EXHAUST Y-PIPE -- 3.0L** .
3. Drain the engine oil and install the drain plug.
   - Tighten to 26 Nm (19 lb-ft).
4. Remove and discard the oil filter.
5. Remove the access cover.

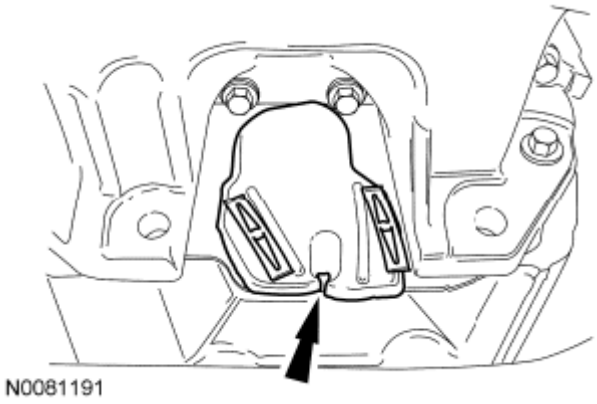


Fig. 106: Locating Access Cover
Courtesy of FORD MOTOR CO.

6. Remove the 2 oil pan-to-transaxle bolts.
7. Remove the 15 bolts and the oil pan.
   - Remove and discard the oil pan gasket.

Installation

 © 2011 Mitchell Repair Information Company, LLC.

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

1. Use a plastic scraping tool to remove all traces of the oil pan gasket.
   - Clean all sealing surfaces with metal surface prep and install a new oil pan gasket.

NOTE: The oil pan must be installed and the bolts tightened within 4 minutes of sealant application.

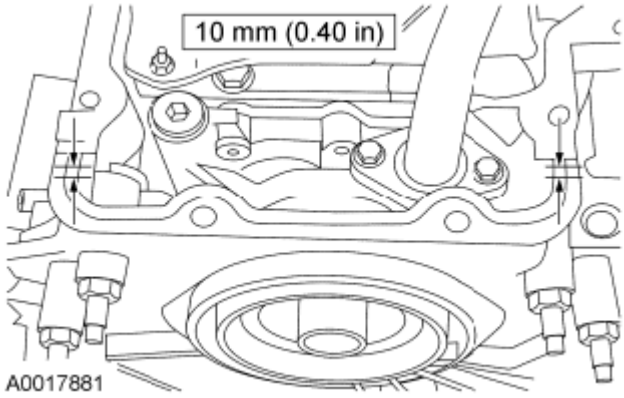


Fig. 107: Identifying Silicone Sealant Area
Courtesy of FORD MOTOR CO.

2. Apply a 10 mm (0.40 in) diameter dot of silicone sealant to the areas indicated.
3. Position the oil pan and loosely install the bolts.
4. Install the 2 oil pan-to-transaxle bolts.
   - Tighten to 40 Nm (30 lb-ft).
5. Tighten the oil pan-to-engine bolts in the sequence shown to 25 Nm (18 lb-ft).

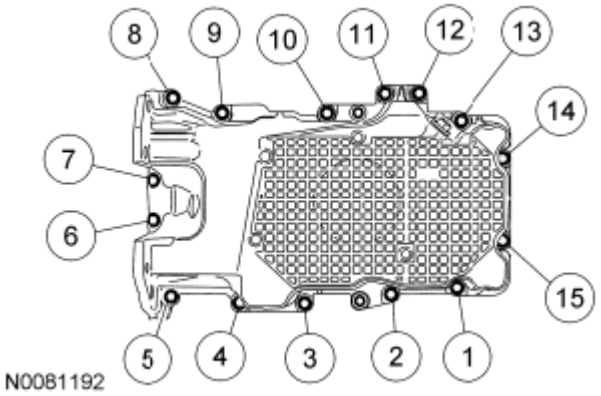


Fig. 108: Identifying Oil Pan-To-Engine Bolts In Sequence
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

6. Install the access cover.

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing.

7. Install a new oil filter.
   - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
8. Install the exhaust Y-pipe. For additional information, refer to **EXHAUST Y-PIPE -- 3.0L** .
9. Fill the engine with clean engine oil.

OIL PUMP SCREEN AND PICKUP TUBE

Material

MATERIAL SPECIFICATIONS

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

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **OIL PAN**.
3. Remove the bolts the oil pump screen and pickup tube.
   - Remove and discard the O-ring seal.

 © 2011 Mitchell Repair Information Company, LLC.

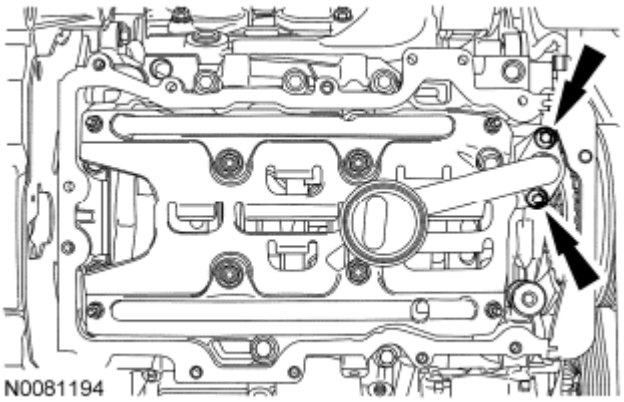


Fig. 109: Locating Bolts Oil Pump Screen And Pickup Tube
Courtesy of FORD MOTOR CO.

Installation

1. Install a new O-ring seal on the oil pump screen and pickup tube.
   - Lubricate the O-ring seal with clean engine oil.
2. Install the oil pump screen and pickup tube.
   1. Position the oil pump screen and pickup tube.
   2. Install the bolts and tighten to 10 Nm (89 lb-in).

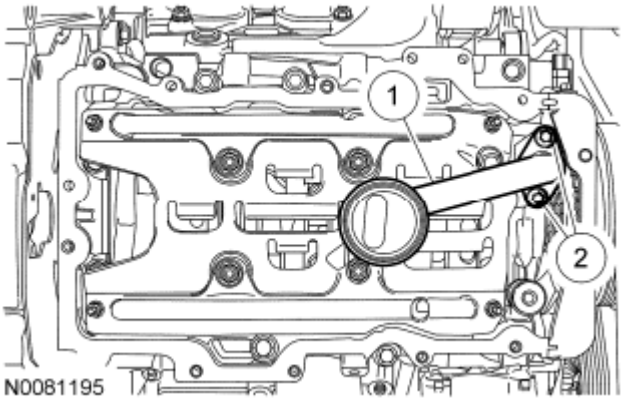


Fig. 110: Identifying Oil Pump Screen And Pickup Tube Bolt
Courtesy of FORD MOTOR CO.

3. Install the oil pan. For additional information, refer to **OIL PAN**.

OIL PAN BAFFLE

Removal and Installation

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces)

 © 2011 Mitchell Repair Information Company, LLC.

that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the oil pump screen and pickup tube. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **OIL PUMP SCREEN AND PICKUP TUBE**.
3. Remove the 8 nuts and the oil pan baffle in the following sequence.
    1. To install, tighten the 4 M6 oil pan baffle nuts in 2 stages.
        - Stage 1: Tighten to 5 Nm (44 lb-in).
        - Stage 2: Tighten an additional 45 degrees.
    2. Then install and tighten the 4 M8 oil pan baffle nuts in 2 stages.
        - Stage 1: Tighten to 15 Nm (133 lb-in).
        - Stage 2: Tighten an additional 45 degrees.

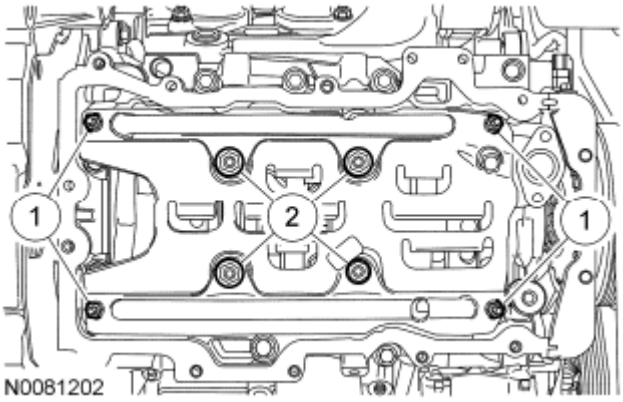


Fig. 111: Identifying M8 Oil Pan Baffle Nuts
Courtesy of FORD MOTOR CO.

4. To install, reverse the removal procedure.

OIL PUMP

Removal

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

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

 © 2011 Mitchell Repair Information Company, LLC.

2. Remove the timing drive components. For additional information, refer to **TIMING DRIVE COMPONENTS**.
3. Remove the oil pump screen and pickup tube. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **OIL PUMP SCREEN AND PICKUP TUBE**.
4. Remove the bolts in the sequence shown.

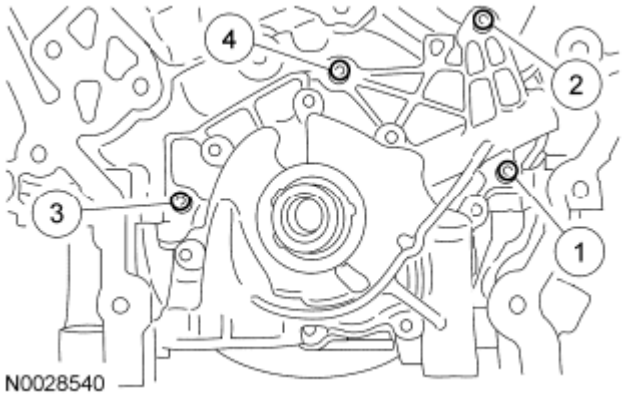


Fig. 112: Identifying Oil Pump Bolts In Sequence
Courtesy of FORD MOTOR CO.

Installation

1. Position the oil pump and install the bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

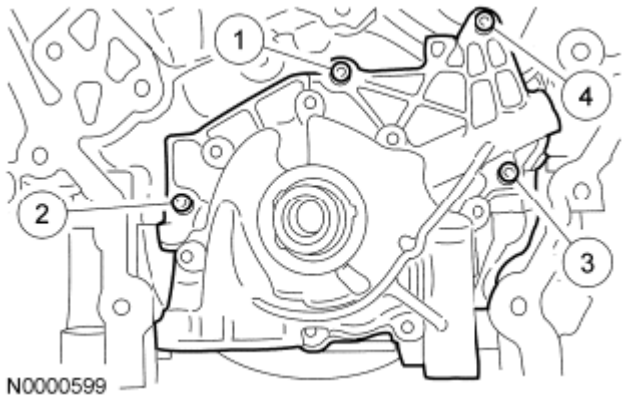


Fig. 113: Identifying Oil Pump Bolts In Sequence
Courtesy of FORD MOTOR CO.

2. Install the oil pump screen and pickup tube. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **OIL PUMP SCREEN AND PICKUP TUBE**.
3. Install the timing drive components. For additional information, refer to **TIMING DRIVE**

 © 2011 Mitchell Repair Information Company, LLC.

COMPONENTS.

ENGINE OIL PRESSURE (EOP) SWITCH

Material

MATERIAL SPECIFICATIONS

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
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

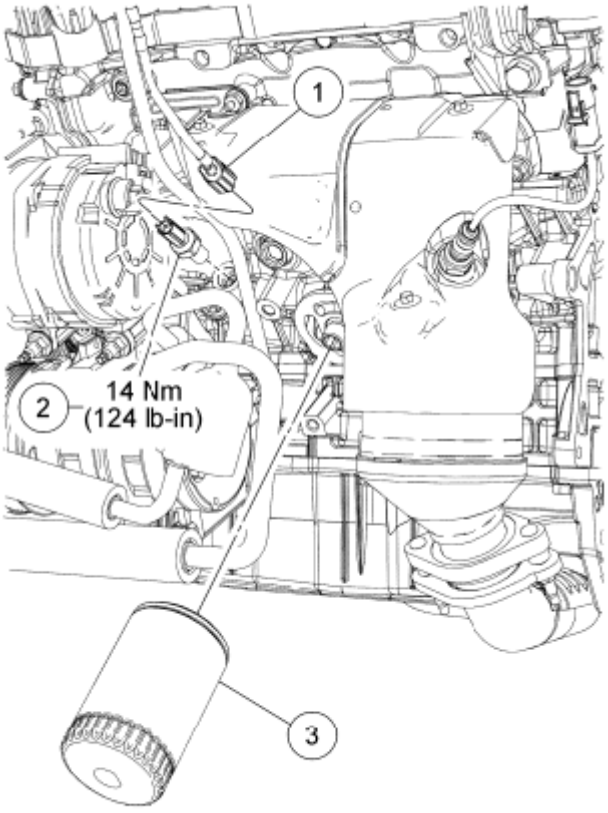


Fig. 114: Identifying Engine Oil Pressure (EOP) Switch And Oil Filter With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12A581)
2	9278	**EOP** switch

 © 2011 Mitchell Repair Information Company, LLC.

3	6714	Engine oil filter

Removal and Installation

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

NOTE: Lubricate the engine oil filter gasket with clean engine oil prior to installing.

2. Remove the engine oil filter.
   - To install, tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. Remove the **EOP** switch.
   - To install, tighten to 14 Nm (124 lb-in).
5. To install, reverse the removal procedure.
   - Apply thread sealant to the **EOP** switch threads.

OIL LEVEL INDICATOR AND TUBE

Material

MATERIAL SPECIFICATIONS

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

Oil Level Indicator and Tube

 © 2011 Mitchell Repair Information Company, LLC.

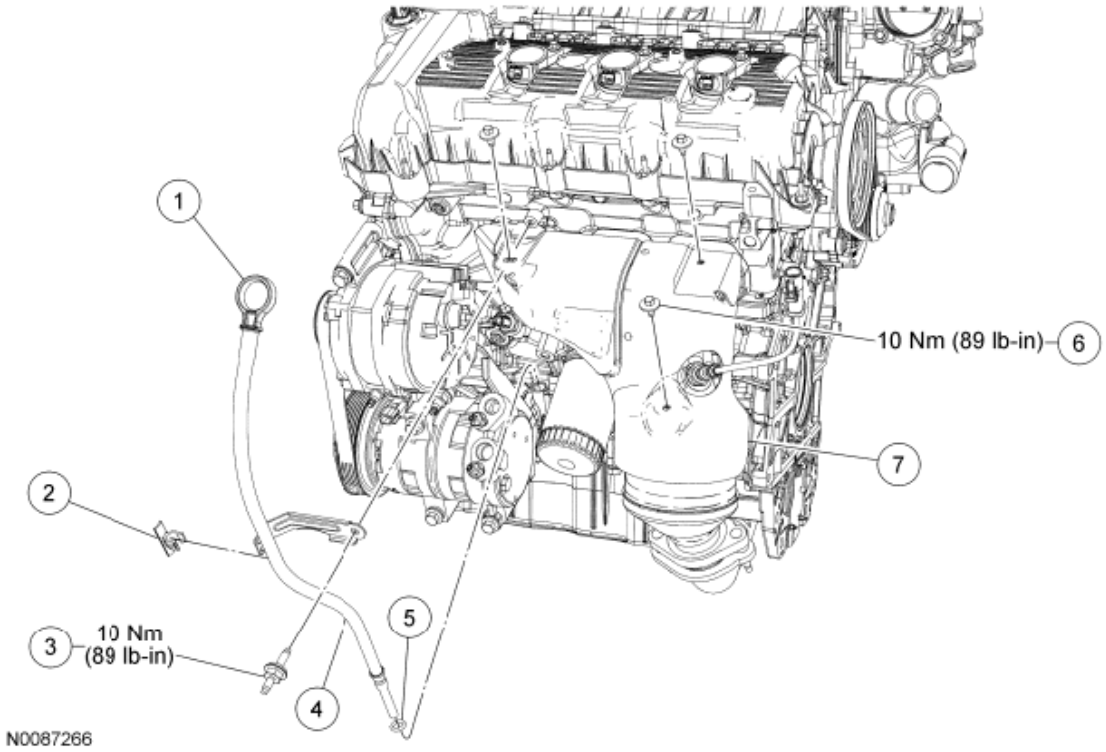


Fig. 115: Identifying Oil Level Indicator And Tube Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6750	Oil level indicator
2	13A506	Wiring harness retainer (part of 12A581)
3	W701822	Oil level indicator tube stud bolt
4	6754	Oil level indicator tube
5	110282	Oil level indicator O-ring seal
6	W503921	Heat shield bolt (3 required)
7	5K282	Heat shield

Upper Radiator Support Brackets

 © 2011 Mitchell Repair Information Company, LLC.

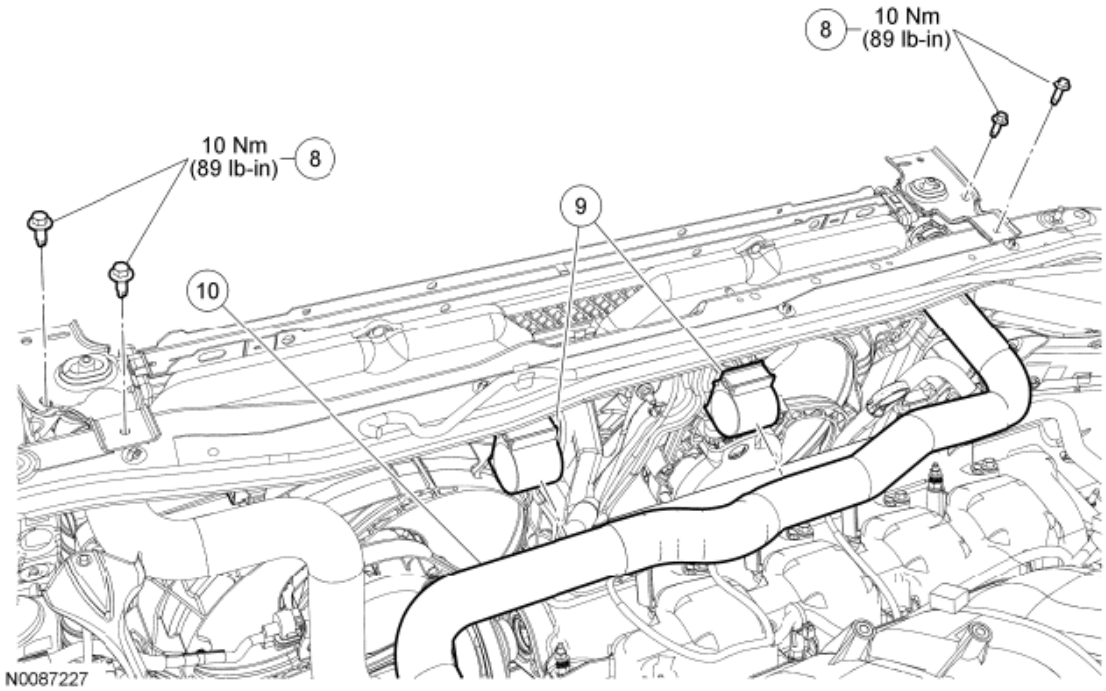


Fig. 116: Identifying Upper Radiator Support Brackets Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
8	W707399	Upper radiator support bracket bolts
9	-	Upper radiator hose retaining clips (part of 8B274)
10	8B274	Upper radiator hose

Removal and Installation

1. Remove the Air Cleaner (ACL) outlet pipe and the **ACL** . For additional information, refer to **AIR CLEANER OUTLET PIPE** .
2. Detach the upper radiator hose from the 2 retaining clips on the cooling fan shroud.
   - Position the hose aside.
3. Remove the 4 upper radiator support bracket bolts.
   - To install, tighten to 10 Nm (89 lb-in).
4. Remove the oil level indicator.
5. Remove the 3 bolts and position aside the heat shield.
   - To install, tighten to 10 Nm (89 lb-in).
6. Detach the wiring harness retainer from the oil level indicator tube.
7. Remove the stud bolt and then remove the oil level indicator tube by guiding it between the radiator support and the cooling fan.
   - Remove and discard the O-ring seal.

 © 2011 Mitchell Repair Information Company, LLC.

- To install, tighten to 10 Nm (89 lb-in).

NOTE: Install a new O-ring seal and lubricate with clean engine oil.

NOTE: Installation of the oil level indicator may require the assistance of a second technician to align the tube with the orifice.

8. To install, reverse the removal procedure.

EXHAUST MANIFOLD - RH

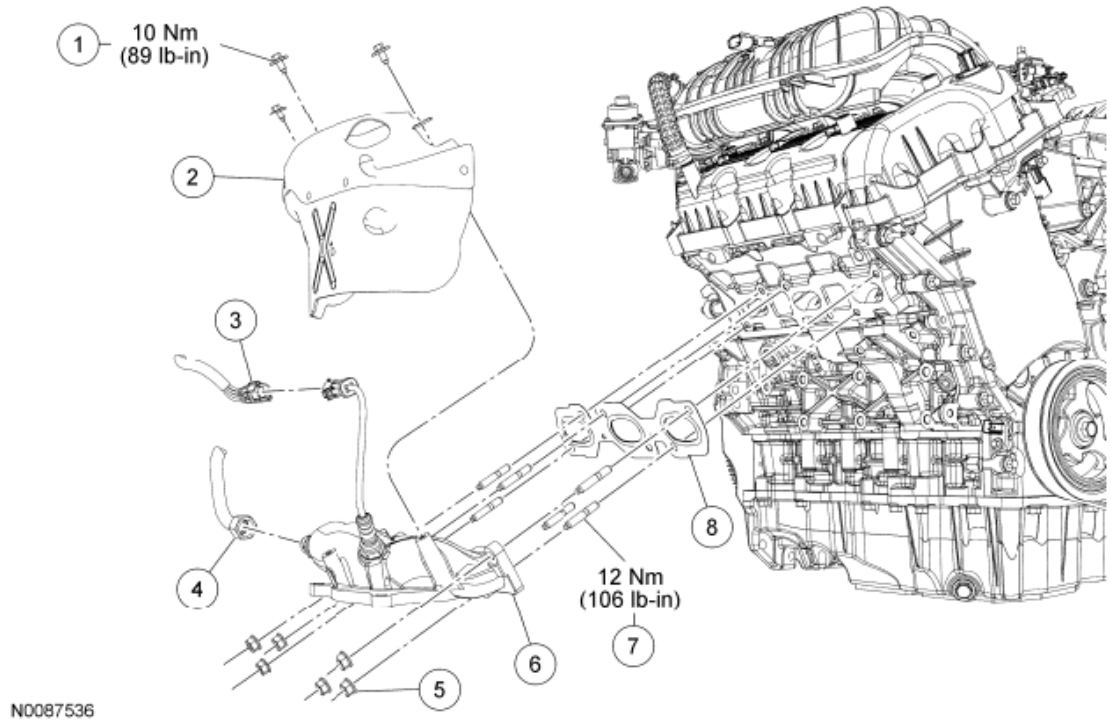


Fig. 117: Identifying Exhaust Manifold Components - RH With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	W503921	Exhaust manifold heat shield bolt (3 required)
2	5E258	Exhaust manifold heat shield
3	14A464	Heated Oxygen Sensor (HO2S) electrical connector (part of 12A581)
4	-	EGR tube nut (part of 9D477)
5	W701706	Exhaust manifold nut (6 required)
6	9430	Exhaust manifold
7	W701732	Exhaust manifold stud (6 required)
8	9448	Exhaust manifold gasket

 © 2011 Mitchell Repair Information Company, LLC.

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Remove the 3.0L RH catalytic converter. For additional information, refer to **CATALYTIC CONVERTER -- 3.0L RH** .
3. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.
4. Remove the 3 exhaust manifold heat shield bolts and the heat shield.
5. Remove the EGR tube fitting nut from the exhaust manifold.
6. Remove and discard the 6 exhaust manifold nuts.
7. Remove the exhaust manifold and discard the exhaust manifold gasket.
8. Remove and discard the 6 exhaust manifold studs.
9. Clean and inspect the exhaust manifold. For additional information, refer to **INSPECTION AND VERIFICATION** .

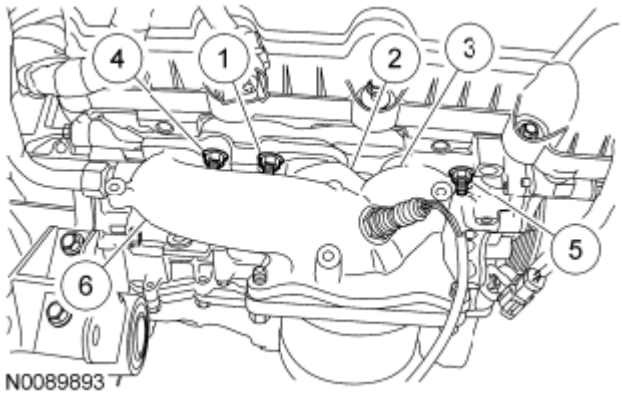
Installation

1. Install the 6 new exhaust manifold studs.
   - Tighten to 12 Nm (106 lb-in).

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

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

2. Install a new exhaust manifold gasket, the exhaust manifold and 6 new nuts.
   - Tighten the nuts in 2 stages in the sequence shown.
     - Stage 1: Tighten to 20 Nm (177 lb-in).
     - Stage 2: Tighten to 20 Nm (177 lb-in).



 © 2011 Mitchell Repair Information Company, LLC.

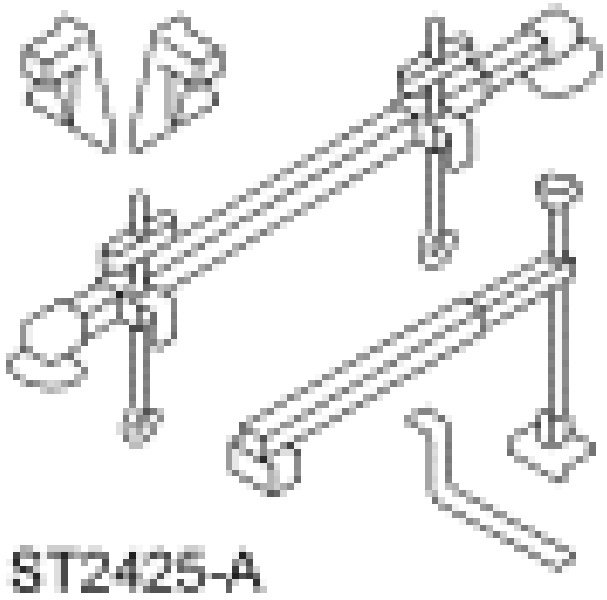
Fig. 118: Identifying Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

3. Install the EGR tube fitting nut on the exhaust manifold.
   - Tighten to 40 Nm (30 lb-ft).
4. Install the exhaust manifold heat shield and the 3 bolts.
   - Tighten to 10 Nm (89 lb-in).
5. Connect the **HO2S** electrical connector.
6. Install the 3.0L RH catalytic converter. For additional information, refer to **CATALYTIC CONVERTER -- 3.0L RH** .

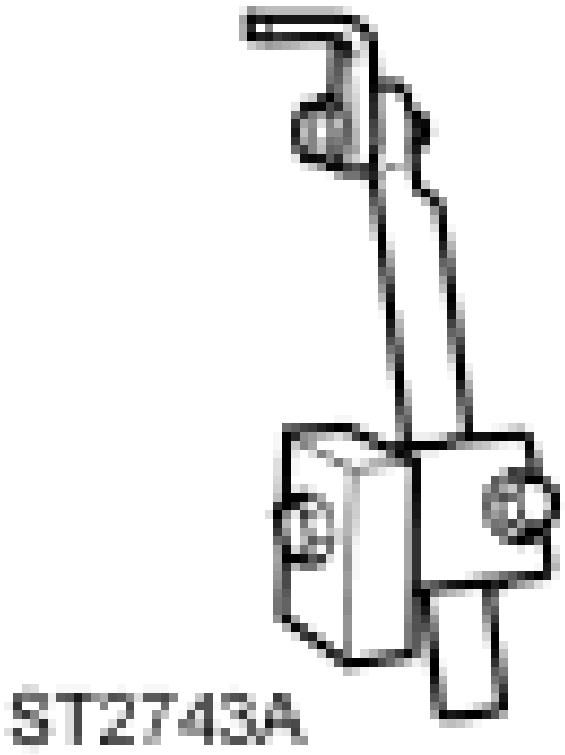
ENGINE SUPPORT INSULATORS

Special Tool(s)

SPECIAL TOOL CHART

	Support Bar, Engine 303-F072

 © 2011 Mitchell Repair Information Company, LLC.

	Universal Adapter Brackets 014-0001 or equivalent

 © 2011 Mitchell Repair Information Company, LLC.

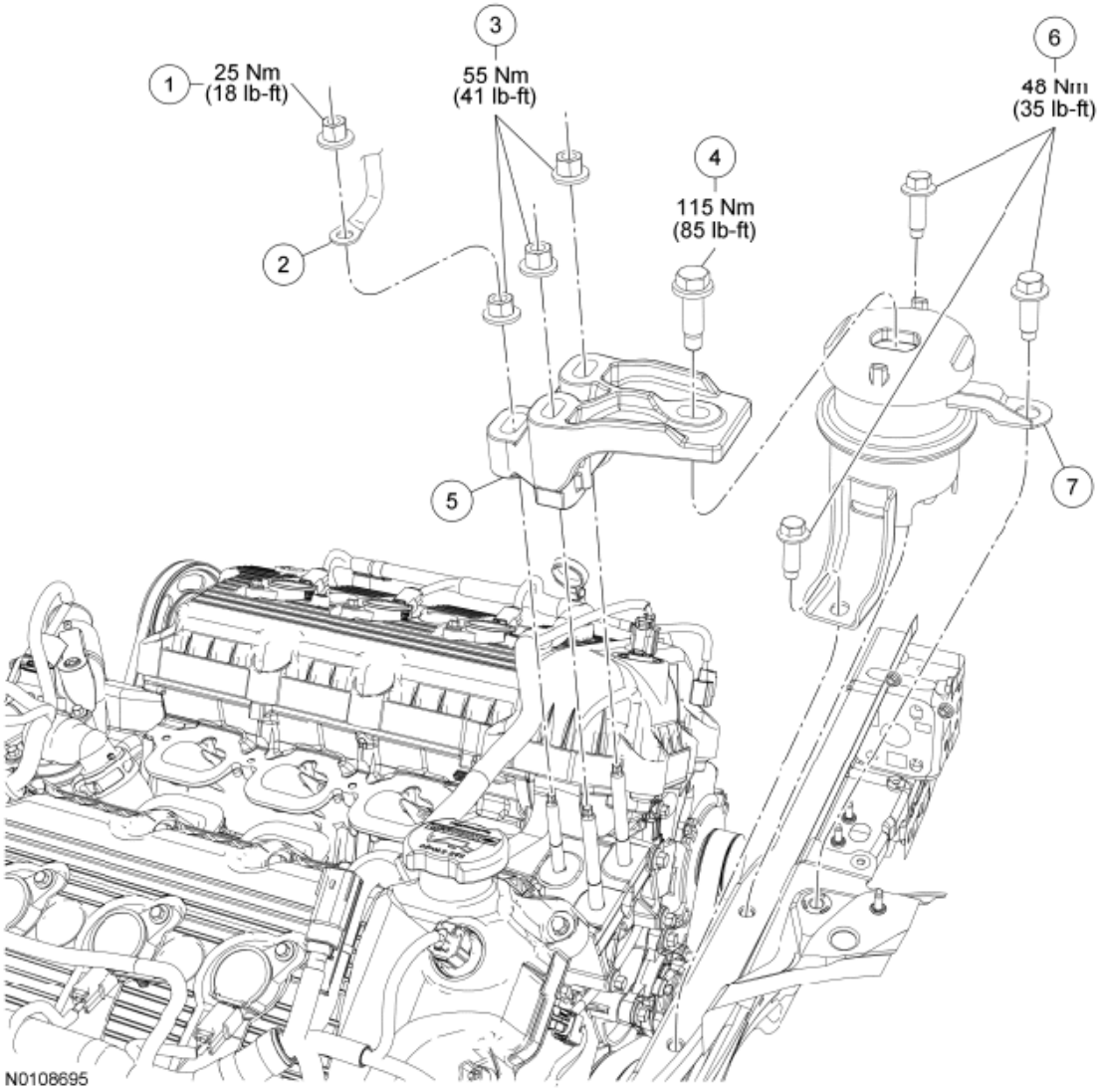


Fig. 119: Identifying Engine Support Insulators Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	N621942	Ground wire eyelet nut
2	-	Ground wire eyelet
3	N621942	Engine support insulator bracket nuts (3 required)
4	W714723	Engine support insulator bracket bolt
5	6061	Engine support insulator bracket
6	W500233	Engine support insulator bolts (3 required)
7	6068	Engine support insulator

Removal and Installation

 © 2011 Mitchell Repair Information Company, LLC.

1. Remove the lower intake manifold. For additional information, refer to **LOWER INTAKE MANIFOLD**.
2. Remove the engine support insulator bracket bolt.
   - To install, tighten to 115 Nm (85 lb-ft).
3. Install the Engine Support Bar, Universal Adapter Brackets and a suitable piece of chain in the following sequence.
   1. Position the 2 Universal Adapter Brackets on top of the cylinder block.
   2. Install 2 M8 x 1.25 x 36 mm (1.41 in) bolts and tighten to 10 Nm (89 lb-in).
   3. Use a suitable piece of chain.
   4. Fasten the chain to the 2 Universal Adapter Brackets with a suitable nut, washer and bolt.

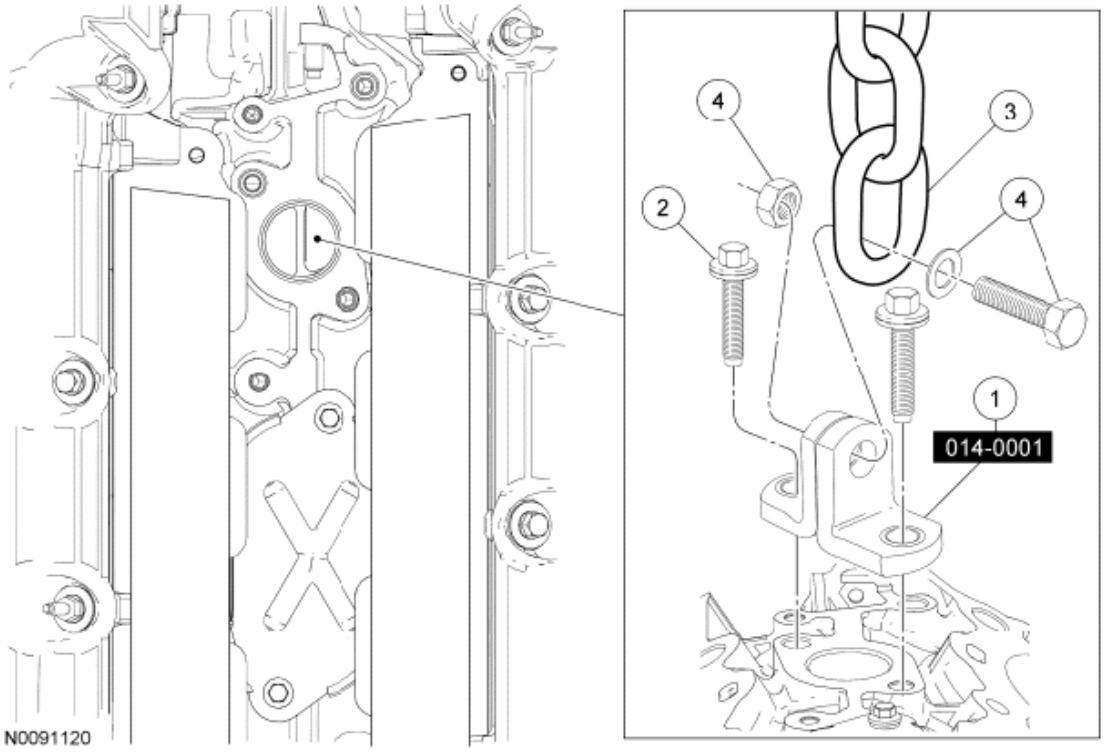


Fig. 120: Identifying Universal Adapter Brackets Nut, Washer And Bolt
Courtesy of FORD MOTOR CO.

4. Using the Engine Support Bar, lift the engine 12 mm (0.47 in).

 © 2011 Mitchell Repair Information Company, LLC.

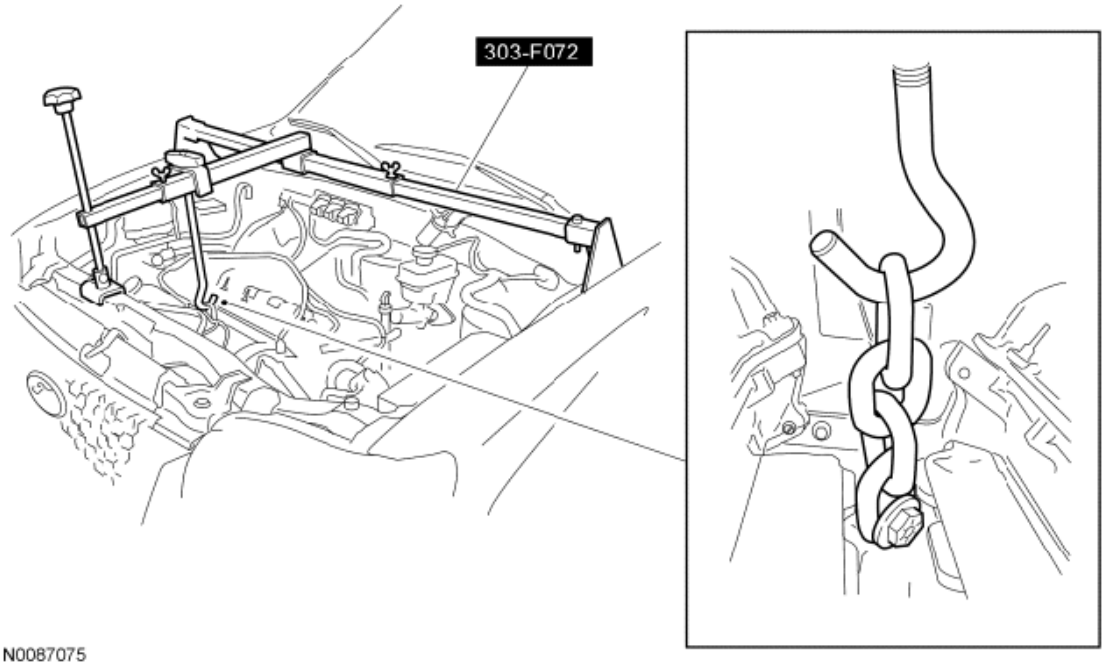


Fig. 121: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

5. Remove the nut and ground wire eyelet from the engine support insulator bracket stud.
    - To install, tighten to 25 Nm (18 lb-ft).
6. Remove the 3 nuts and the engine support insulator bracket.
    - To install, tighten to 55 Nm (41 lb-ft).
7. Remove the 3 bolts and the engine support insulator.
    - To install, tighten to 48 Nm (35 lb-ft).
8. To install, reverse the removal procedure.

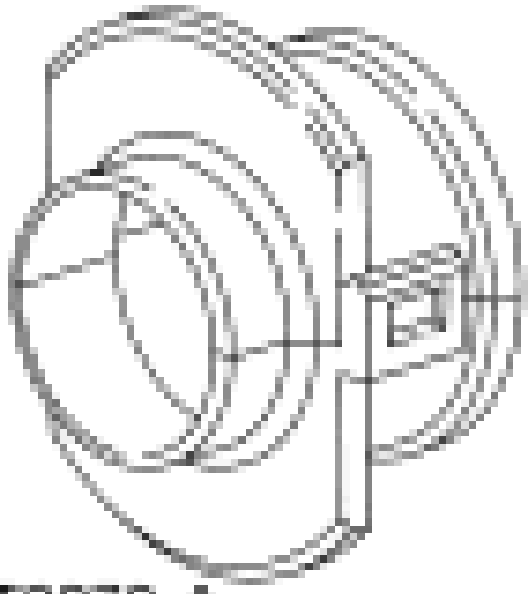
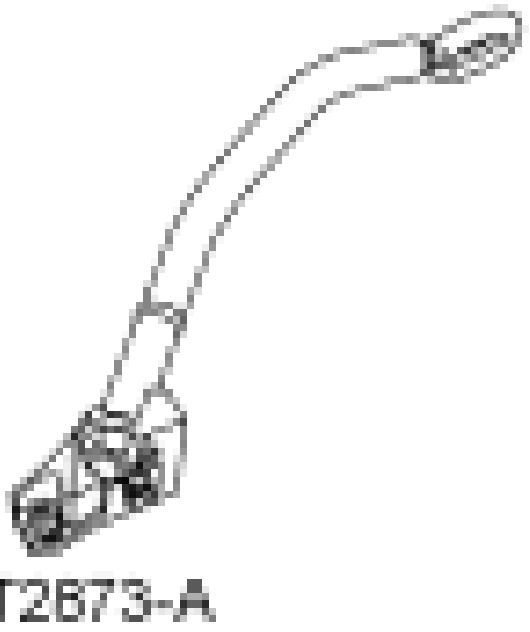
REMOVAL

ENGINE

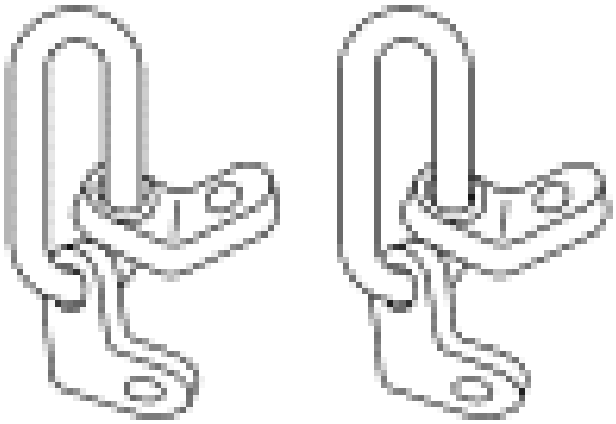
Special Tool(s)

SPECIAL TOOL CHART

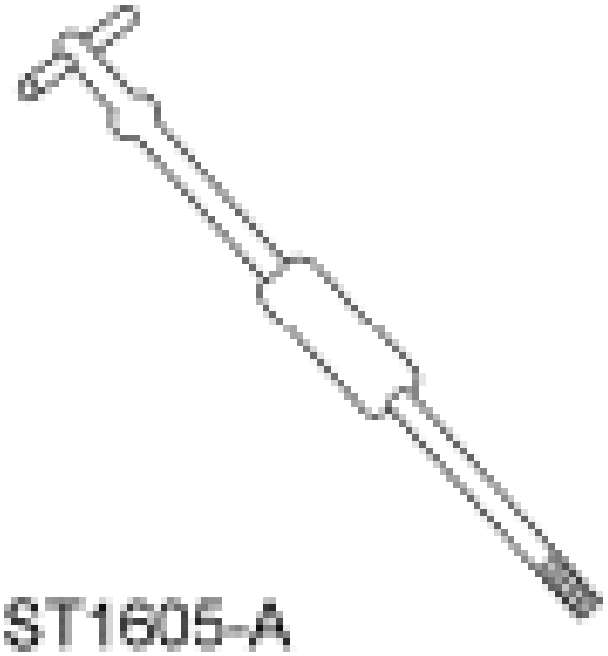
 © 2011 Mitchell Repair Information Company, LLC.

	Disconnect Tool, Transmission Cooler Line 307-569
	Engine Lifting Bracket Set 303-1140

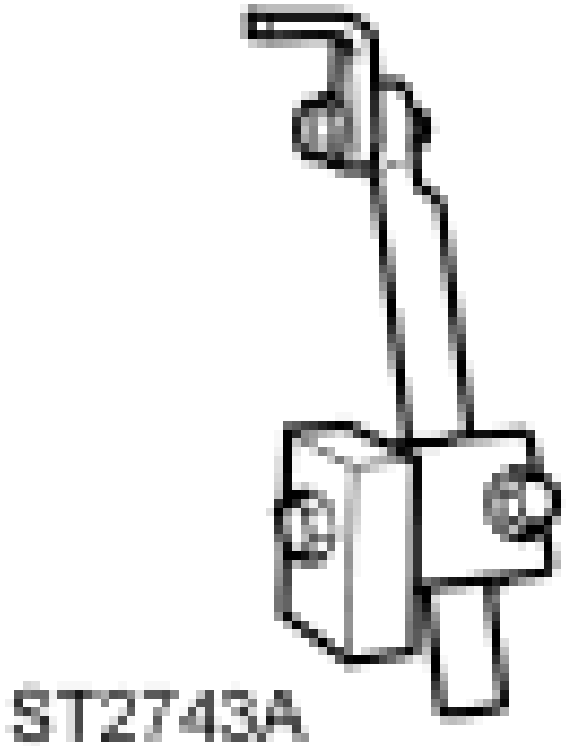
 © 2011 Mitchell Repair Information Company, LLC.

 ST1595-A	Lifting Brackets, Engine 303-050 (T70P-6000)
 ST1293-A	Powertrain Lift 014-00765 or equivalent

 © 2011 Mitchell Repair Information Company, LLC.

	Remover, Halfshaft Oil Seal 308-428
	Slide Hammer 100-001 (T50T-100-A)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3) or equivalent
 ST2743A	Universal Adapter Brackets 014-0001 or equivalent

Removal

All vehicles

 © 2011 Mitchell Repair Information Company, LLC.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING -- ESCAPE, ESCAPE HYBRID, MARINER & MARINER HYBRID** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
3. Remove the battery tray. For additional information, refer to **BATTERY TRAY -- NON-HYBRID** .
4. Remove the Air Cleaner (ACL) outlet pipe and **ACL** assembly. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 3.0L (4V)** .
5. Remove the front wheels and tires. For additional information, refer to **WHEEL AND TIRE** .
6. Remove the lower splash shields.

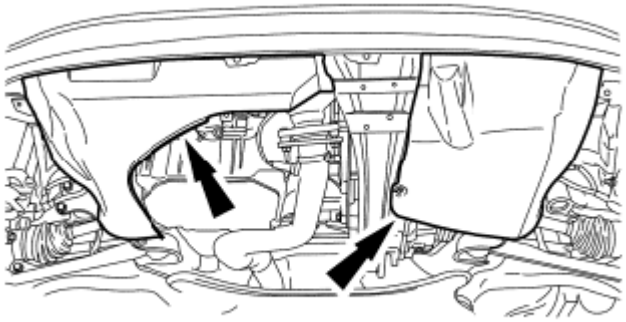


Fig. 122: Locating Lower Splash Shields
Courtesy of FORD MOTOR CO.

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

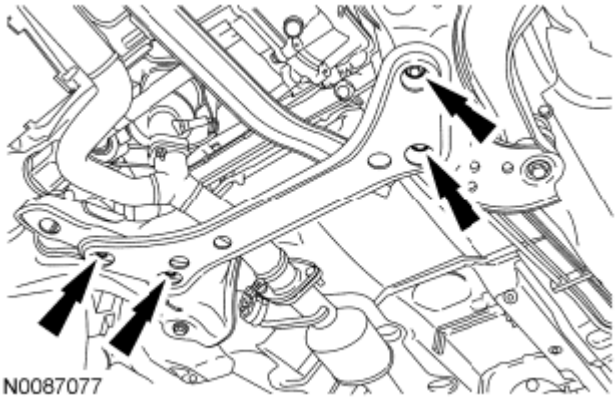


Fig. 123: Locating Bolts And Lateral Support Crossmember
Courtesy of FORD MOTOR CO.

8. Disconnect the LH Catalyst Monitor Sensor (CMS) electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

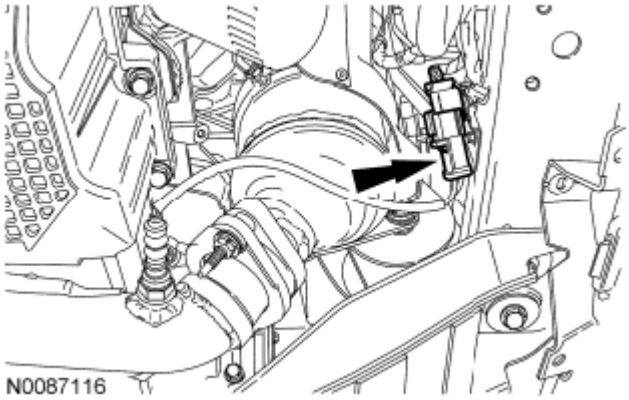


Fig. 124: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

9. Disconnect the RH **CMS** electrical connector.

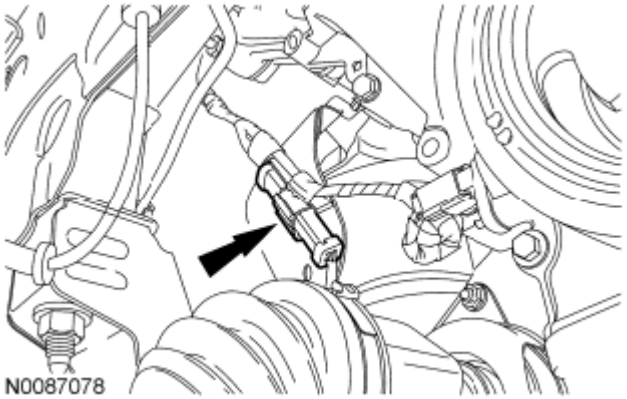


Fig. 125: Locating RH CMS Electrical Connector
Courtesy of FORD MOTOR CO.

10. Remove the exhaust Y-pipe. For additional information, refer to **EXHAUST Y-PIPE -- 3.0L** .
11. Remove the RH and LH halfshafts. For additional information, refer to **REMOVAL AND INSTALLATION** .
12. Remove the 2 intermediate shaft bearing retainer nuts.

 © 2011 Mitchell Repair Information Company, LLC.

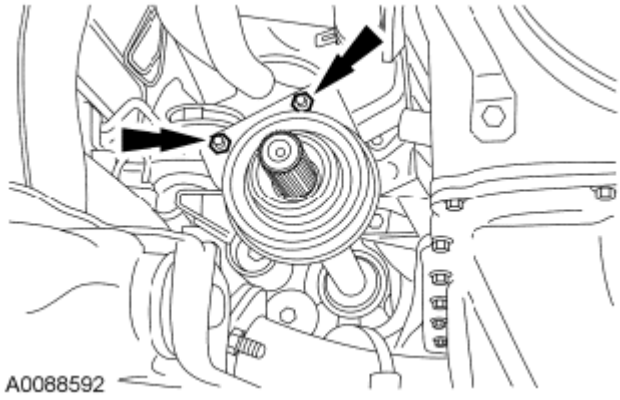


Fig. 126: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of FORD MOTOR CO.

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

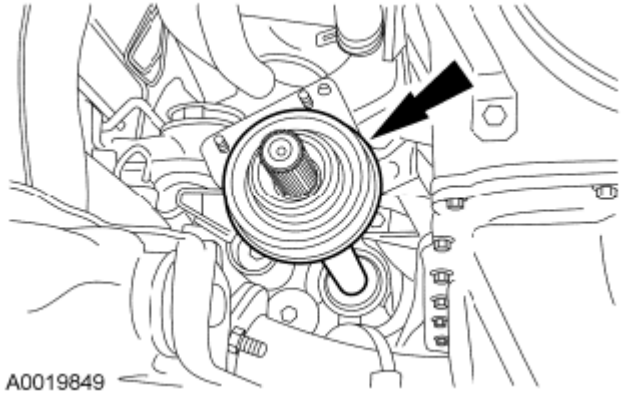


Fig. 127: Locating Intermediate Shaft
Courtesy of FORD MOTOR CO.

13. Remove the intermediate shaft.

All-Wheel Drive (AWD) vehicles

NOTE: Do not reuse the driveshaft flange bolts and washers. Install new bolts and washers or damage to the vehicle may occur.

NOTE: Index-mark the drive shaft flange and PTU flange for installation.

14. Remove and discard the 6 front driveshaft-to- **PTU** bolts and washers.
    - Position the driveshaft aside and support with mechanic's wire.

 © 2011 Mitchell Repair Information Company, LLC.

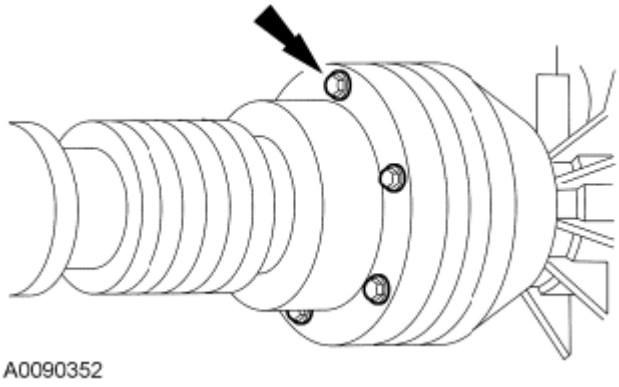


Fig. 128: Locating Front Driveshaft-To-PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

15. Rotate the accessory drive belt tensioner counterclockwise and remove the accessory drive belt.

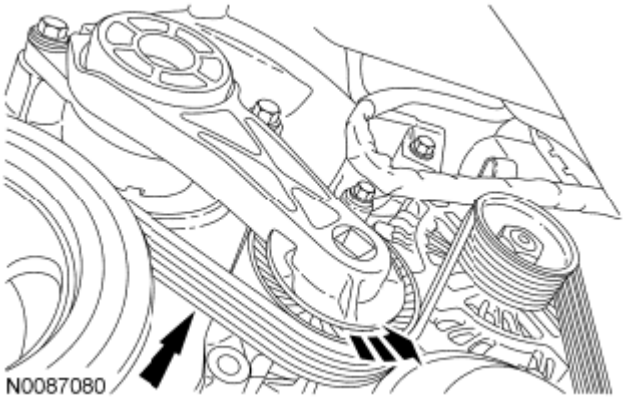


Fig. 129: Rotating Accessory Drive Belt Tensioner Counterclockwise
Courtesy of FORD MOTOR CO.

16. Drain the engine coolant. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** .
17. Drain the engine oil and install the drain plug.
    - Tighten to 26 Nm (19 lb-ft).
18. Disconnect the A/C compressor electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

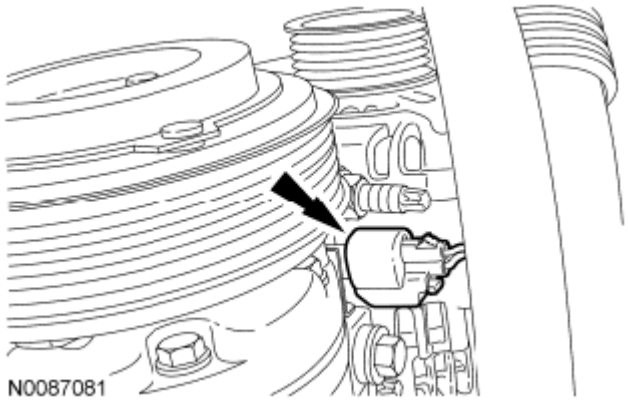


Fig. 130: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

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

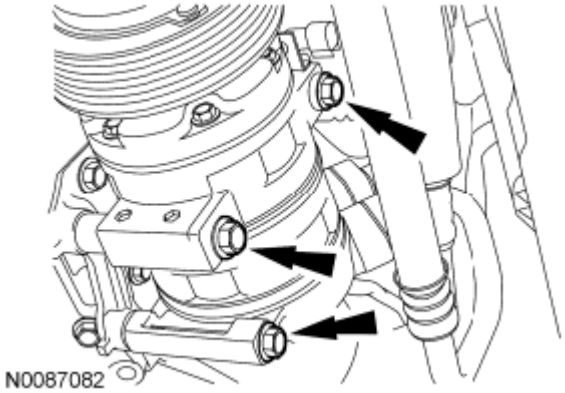


Fig. 131: Locating Bolts And A/C Compressor
Courtesy of FORD MOTOR CO.

20. Disconnect the generator electrical connector.

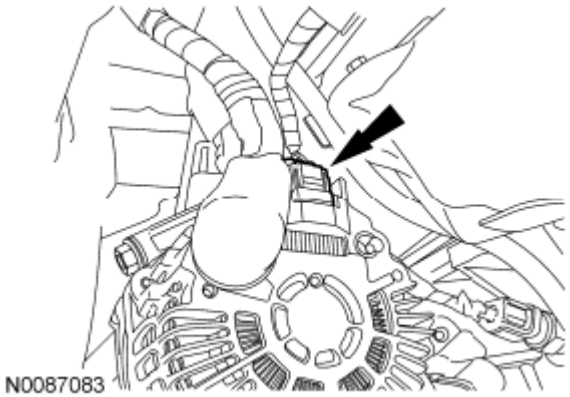


Fig. 132: Locating Generator Electrical Connector

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

21. Remove the front roll restrictor bolt and the 2 bolts for the engine support cross brace.

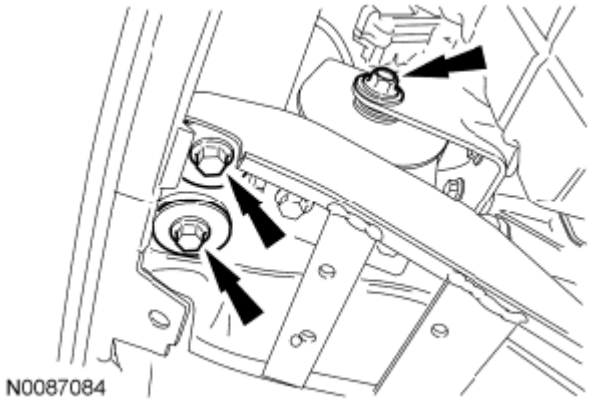


Fig. 133: Locating Front Roll Restrictor Bolts
Courtesy of FORD MOTOR CO.

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

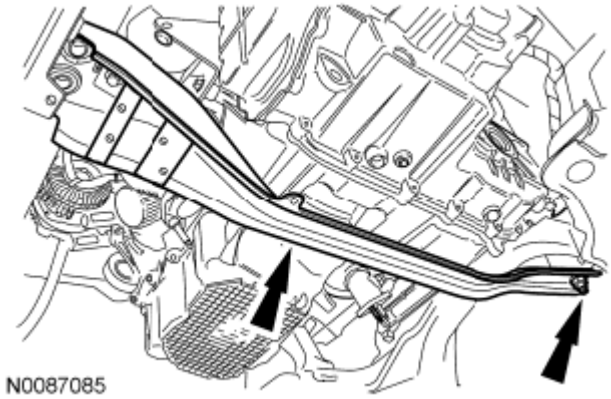


Fig. 134: Locating Nut And Engine Support Crossmember
Courtesy of FORD MOTOR CO.

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

 © 2011 Mitchell Repair Information Company, LLC.

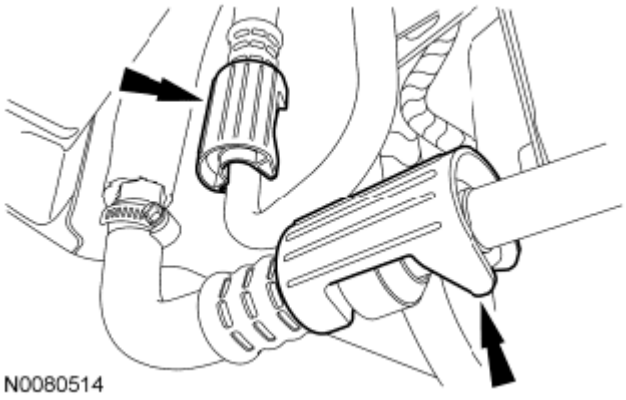


Fig. 135: Locating Secondary Latches And Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

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

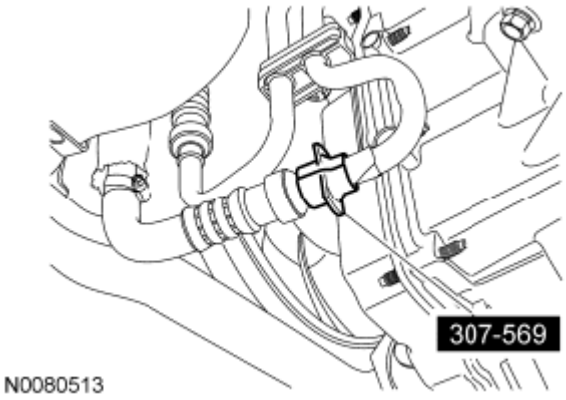
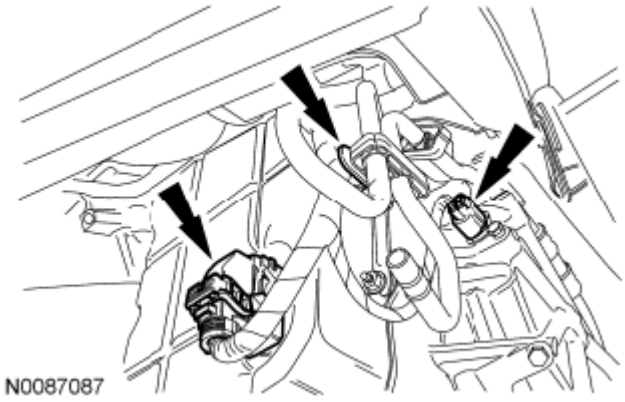


Fig. 136: Identifying Transmission Cooler Line Disconnect Tool
Courtesy of FORD MOTOR CO.

25. Disconnect the 2 transmission electrical connectors and detach the wiring retainer from the stud bolt.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 137: Locating Transmission Electrical Connectors And Wiring Retainer
Courtesy of FORD MOTOR CO.

26. Disconnect the upper and lower radiator hoses.

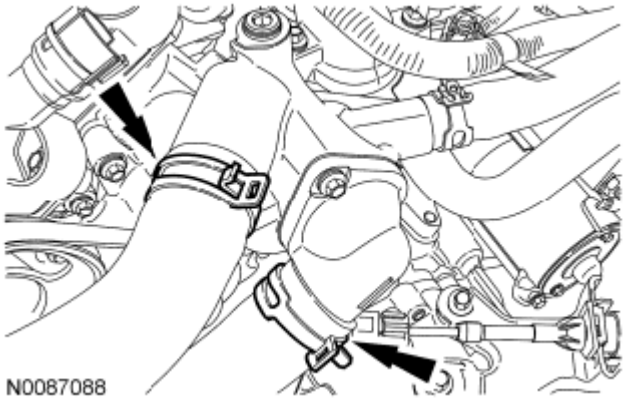


Fig. 138: Locating Upper And Lower Radiator Hoses
Courtesy of FORD MOTOR CO.

27. Disconnect the 2 heater hoses.

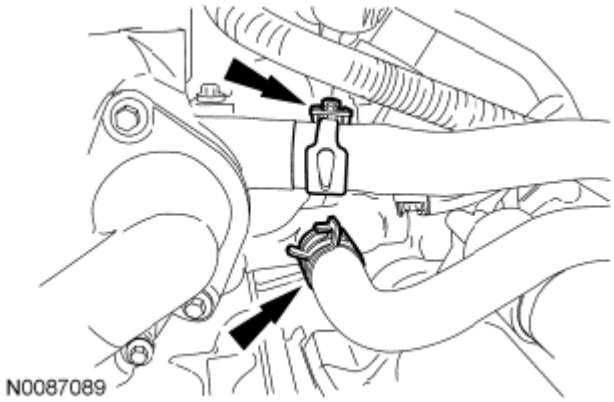


Fig. 139: Locating Heater Hoses
Courtesy of FORD MOTOR CO.

28. Disconnect the fuel supply tube quick connect coupling from the fuel rail. For additional information, refer to **QUICK CONNECT COUPLING** .

 © 2011 Mitchell Repair Information Company, LLC.

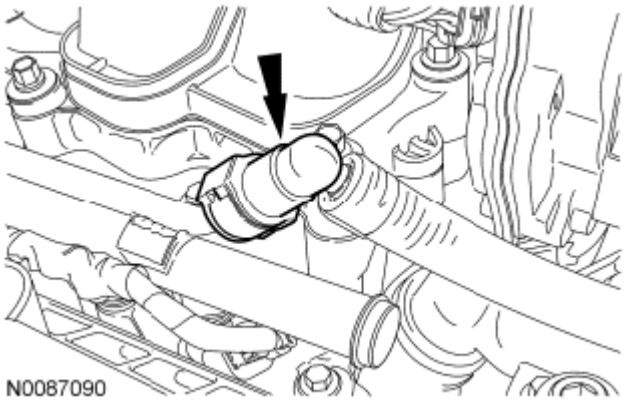


Fig. 140: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

29. Disconnect the gearshift cable from the transaxle.

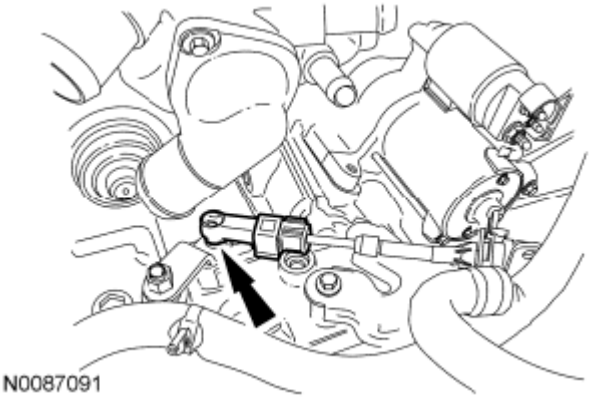


Fig. 141: Locating Gearshift Cable
Courtesy of FORD MOTOR CO.

30. Remove the 2 shift cable bracket bolts, and position the cable and bracket aside.

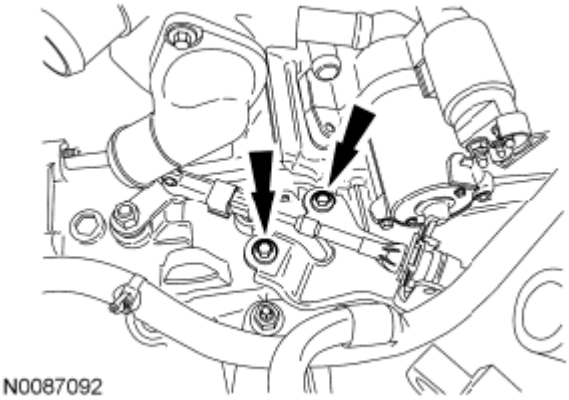


Fig. 142: Locating Shift Cable Bracket Bolts

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

31. Detach the shift cable retainer from the bracket.

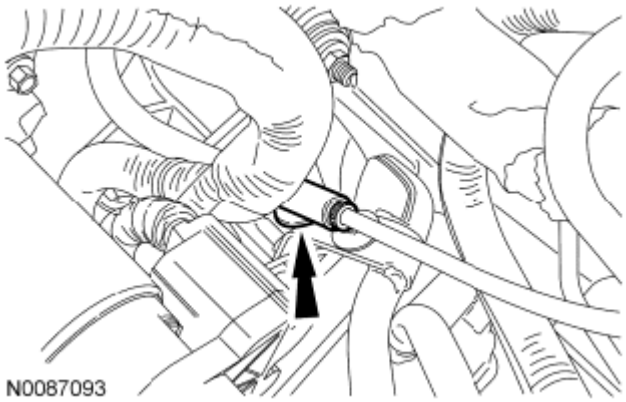


Fig. 143: Locating Shift Cable Retainer
Courtesy of FORD MOTOR CO.

32. Disconnect the Evaporative Emission (EVAP) canister purge valve tube and disconnect the brake booster vacuum tube from the intake manifold.

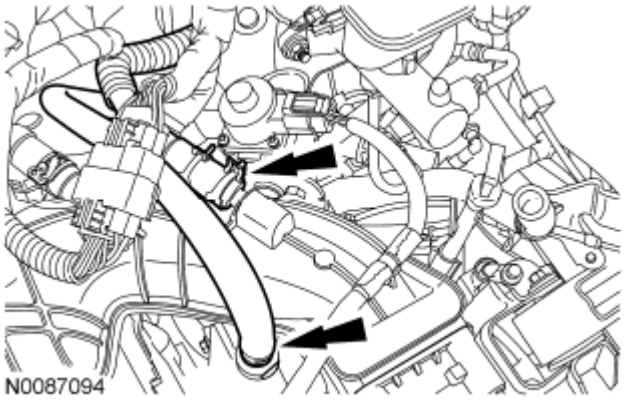


Fig. 144: Locating Evaporative Emission (EVAP) Canister Purge Valve Tube And Brake Booster Vacuum Tube
Courtesy of FORD MOTOR CO.

33. Disconnect the middle PCM electrical connector and the engine wiring harness electrical connector.
    - Detach the 2 wiring harness retainers.

 © 2011 Mitchell Repair Information Company, LLC.

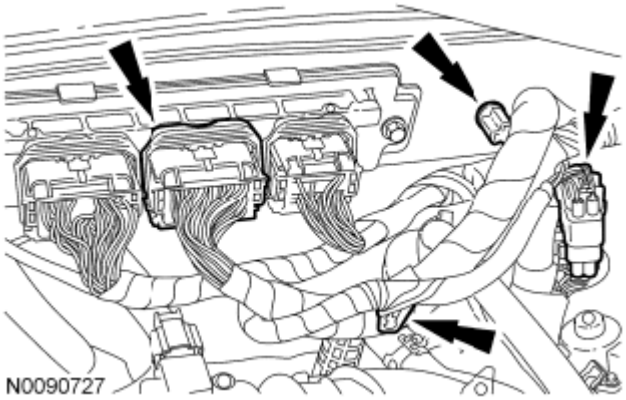


Fig. 145: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

34. Detach the wiring harness retainer from the battery tray bracket.

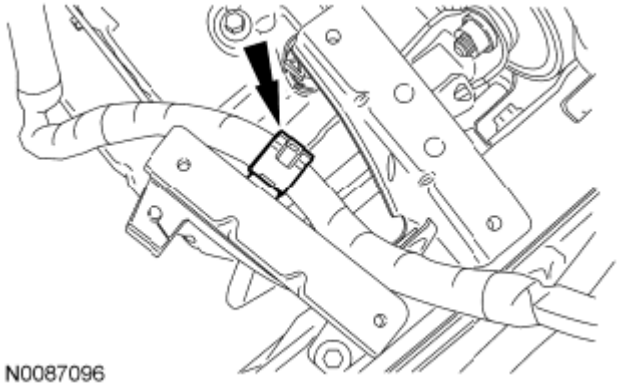


Fig. 146: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

35. Remove the bolt and detach the ground wire.

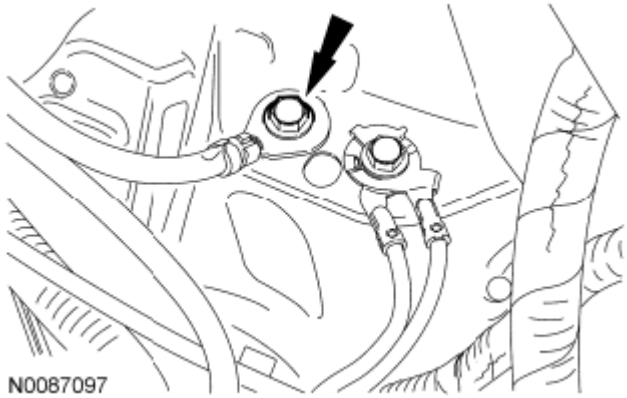


Fig. 147: Locating Bolt And Ground Wire
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

36. Remove the nut and disconnect the cable from the Power Distribution Box (PDB).

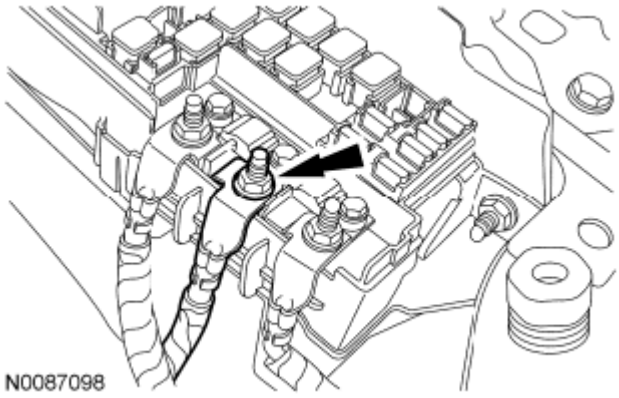


Fig. 148: Locating Nut And Cable
Courtesy of FORD MOTOR CO.

37. Disconnect the electrical connector from the **PDB** .

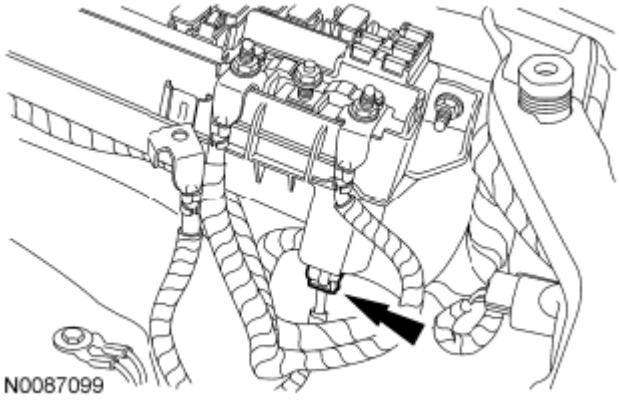


Fig. 149: Locating PDB
Courtesy of FORD MOTOR CO.

38. Remove the nut and the ground wire eyelet from the engine mount stud.

 © 2011 Mitchell Repair Information Company, LLC.

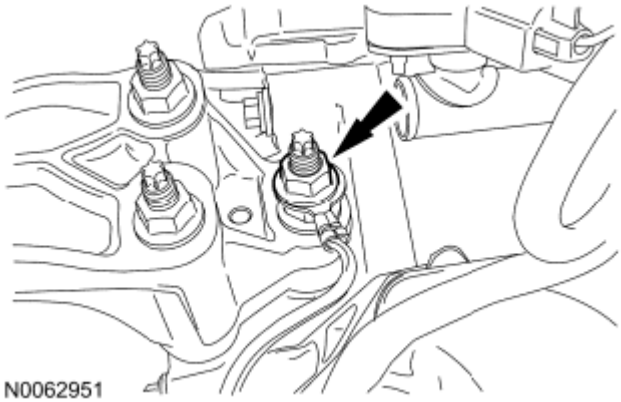


Fig. 150: Locating Nut And Ground Wire Eyelet
Courtesy of FORD MOTOR CO.

39. If equipped, disconnect the engine block heater electrical connector.

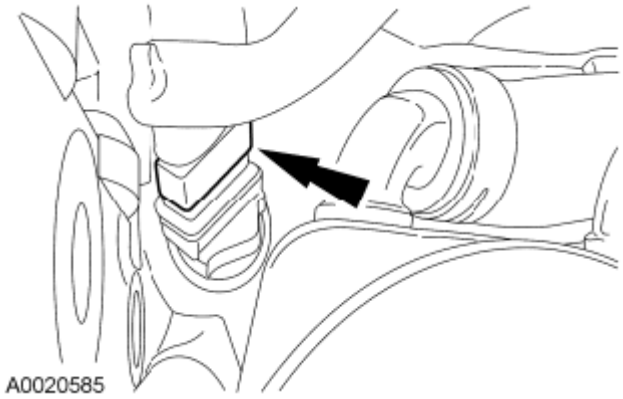


Fig. 151: Locating Engine Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

40. Remove the access cover.

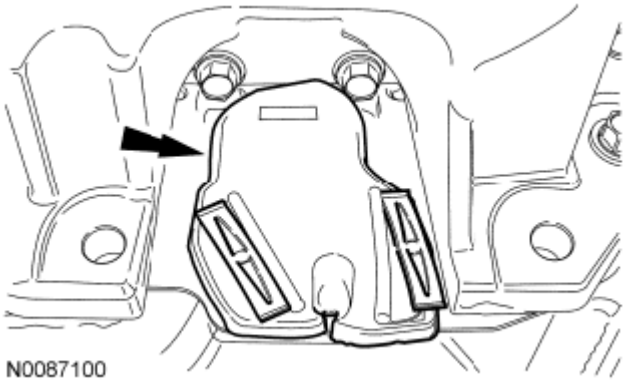


Fig. 152: Locating Access Cover
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

41. Remove the 4 torque converter nuts.



Fig. 153: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

42. Remove the 2 oil pan-to-transaxle bolts.



Fig. 154: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

43. Remove the 2 nuts and the transaxle-to-engine stud.

 © 2011 Mitchell Repair Information Company, LLC.

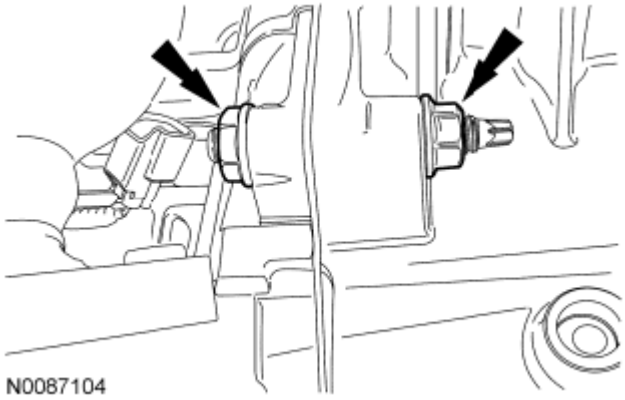


Fig. 155: Locating Nuts And Transaxle-To-Engine Stud
Courtesy of FORD MOTOR CO.

44. Remove the 3 bolts and the halfshaft support bracket.

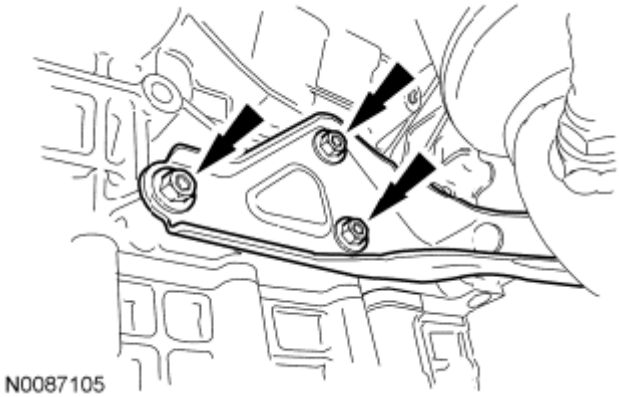
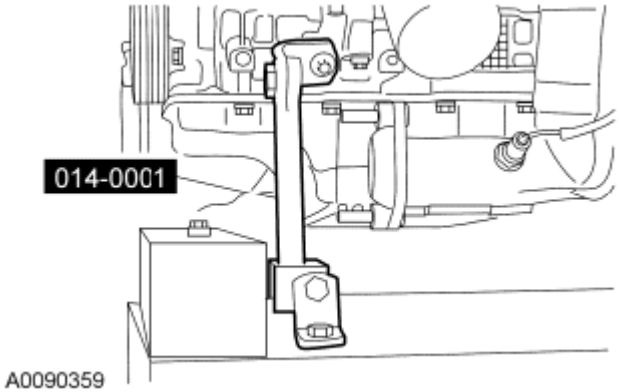


Fig. 156: Locating Bolts And Halfshaft Support Bracket
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the engine oil pan to rest on the Powertrain Lift. Doing so may cause damage to the oil pan.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 157: Identifying Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

NOTE: The next 5 steps must be carried out with the vehicle raised and the Powertrain Lift in position.

45. Using the Universal Adapter Brackets, secure the engine and transaxle to the Powertrain Lift.

NOTE: Late build AWD vehicle equipped with a mass damper shown, other vehicles similar.

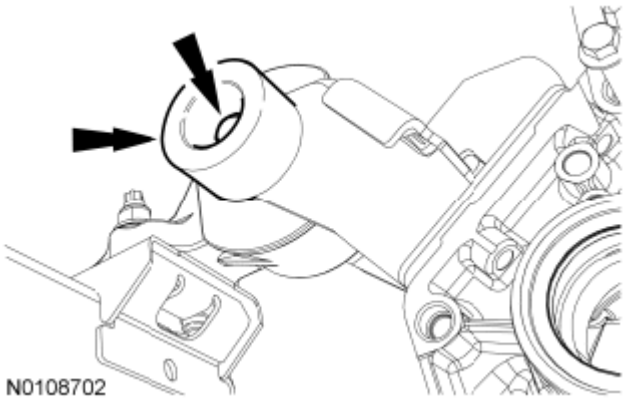


Fig. 158: Locating RH Transaxle Support Insulator Bolt And Mass Damper
Courtesy of FORD MOTOR CO.

46. Remove the RH transaxle support insulator bolt and the mass damper (if equipped).
47. Remove the bolt, nuts and the RH transaxle support insulator.

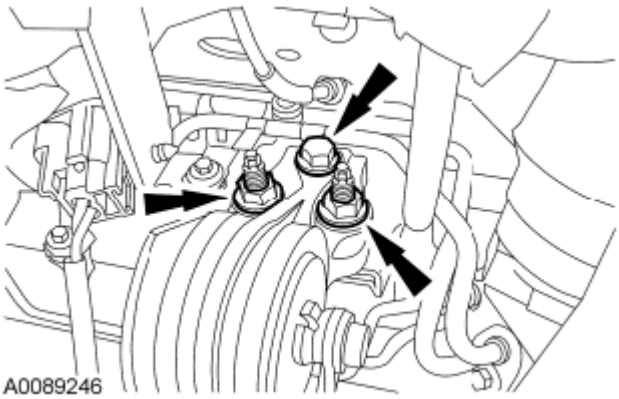


Fig. 159: Locating Bolt, Nuts And RH Transaxle Support Insulator
Courtesy of FORD MOTOR CO.

48. Remove the rear transaxle support through bolt.

 © 2011 Mitchell Repair Information Company, LLC.

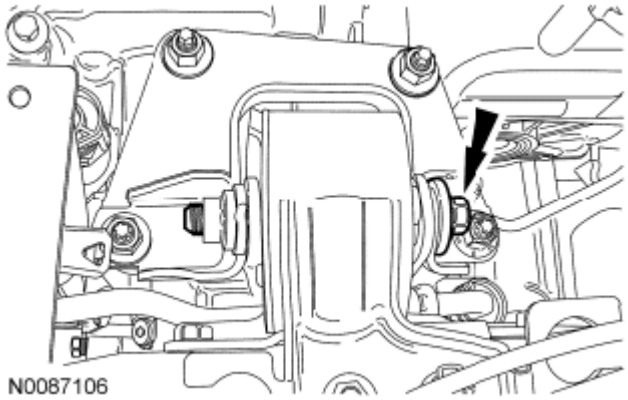


Fig. 160: Locating Rear Transaxle Support Through Bolt
Courtesy of FORD MOTOR CO.

49. Remove the 3 engine support bracket nuts and the bolt.
    - Remove the engine support bracket.

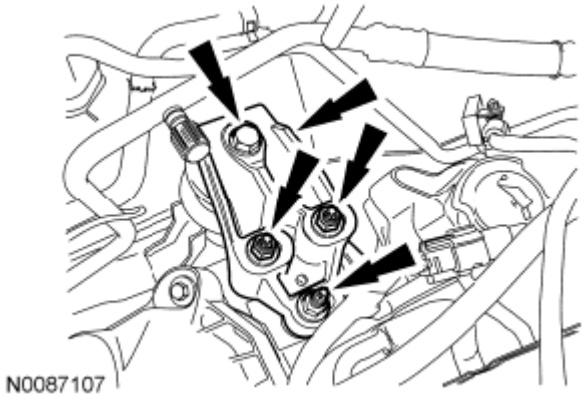


Fig. 161: Locating Engine Support Bracket Nuts And Bolt
Courtesy of FORD MOTOR CO.

50. Lower the powertrain from the vehicle.
51. Remove the nut and the starter wiring ground.

 © 2011 Mitchell Repair Information Company, LLC.

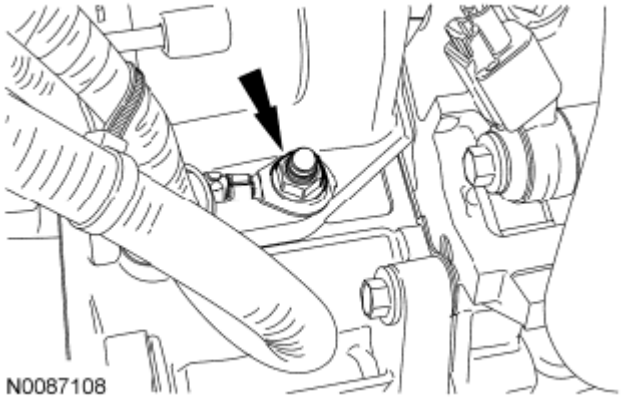


Fig. 162: Locating Nut And Starter Wiring Ground
Courtesy of FORD MOTOR CO.

52. Remove the 2 nuts and the starter wiring.

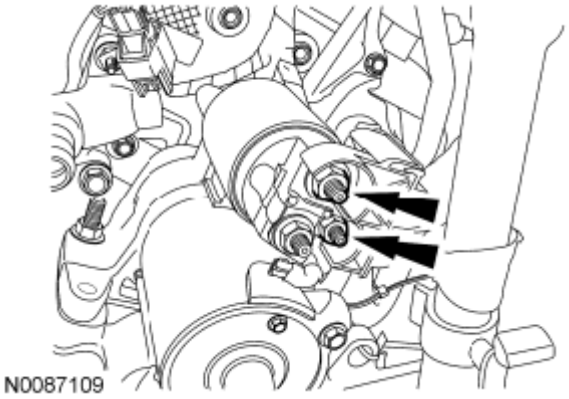


Fig. 163: Locating Nuts And Starter Wiring
Courtesy of FORD MOTOR CO.

53. Remove the 2 stud bolts and the starter.

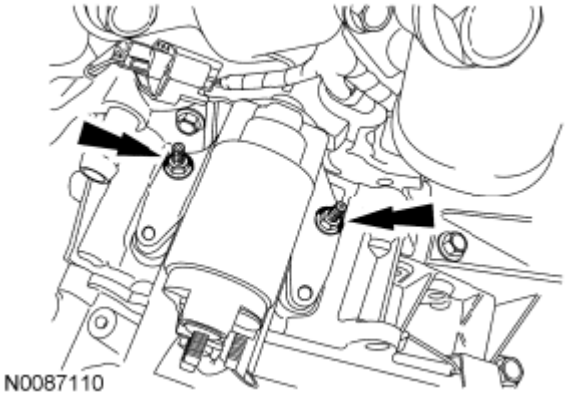


Fig. 164: Locating Stud Bolts And Starter

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

AWD vehicles

54. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.

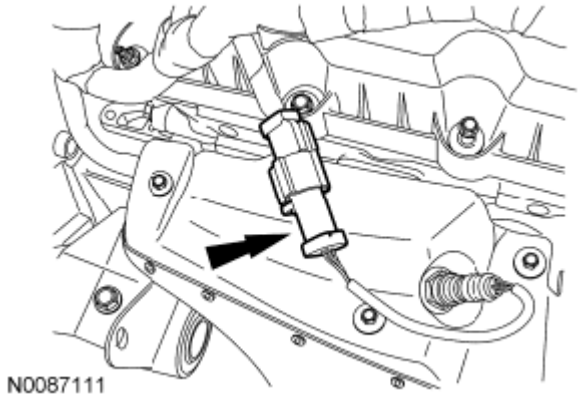


Fig. 165: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

55. Remove the 3 bolts and the RH heat shield.

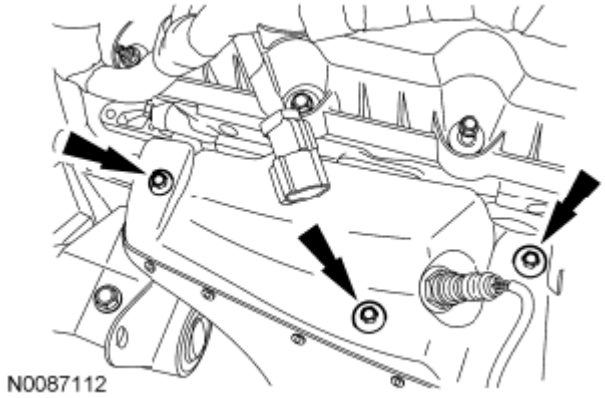


Fig. 166: Locating Bolts And RH Heat Shield
Courtesy of FORD MOTOR CO.

56. Remove the 3 nuts and the RH catalytic converter.
    - Discard the nuts and gasket.

 © 2011 Mitchell Repair Information Company, LLC.

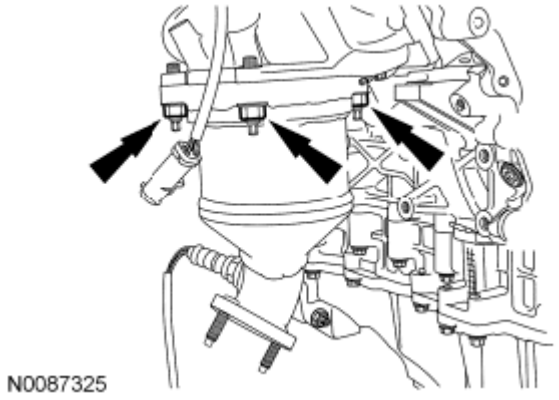


Fig. 167: Locating Nuts And RH Catalytic Converter
Courtesy of FORD MOTOR CO.

57. Remove the bolts and the Power Transfer Unit (PTU) support bracket.

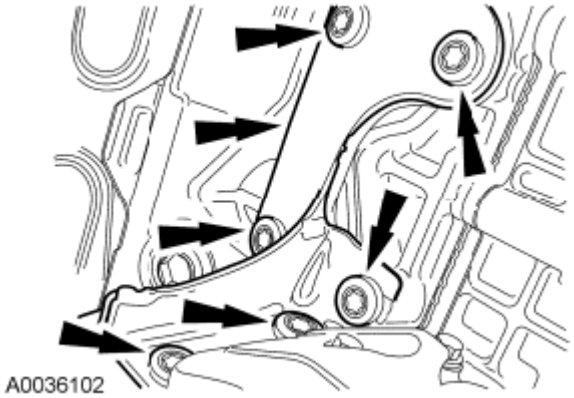


Fig. 168: Locating Bolts And Power Transfer Unit (PTU) Support Bracket
Courtesy of FORD MOTOR CO.

58. Remove the bolt, detach the pin-type retainer and position the **PTU** vent tube aside.

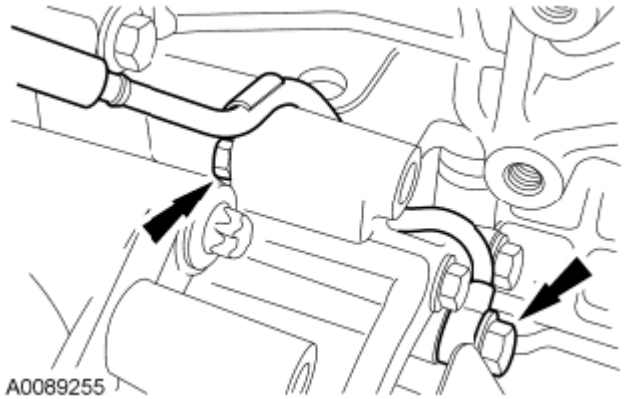


Fig. 169: Locating PTU Vent Tube Bolts
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

59. Remove the 3 **PTU** bolts.

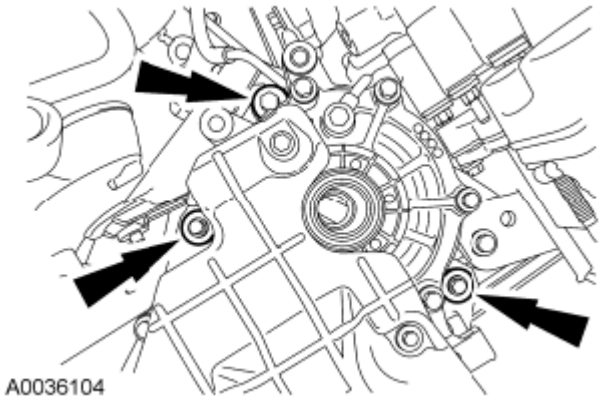


Fig. 170: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

60. Remove the bolt and the **PTU** .

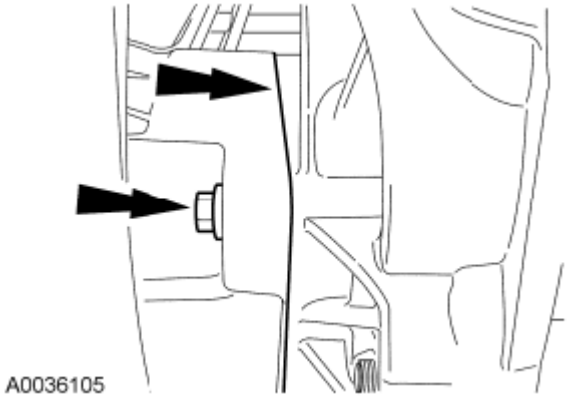


Fig. 171: Locating PTU And Bolts
Courtesy of FORD MOTOR CO.

61. Remove the 3 bolts and the **PTU** heat shield.

 © 2011 Mitchell Repair Information Company, LLC.

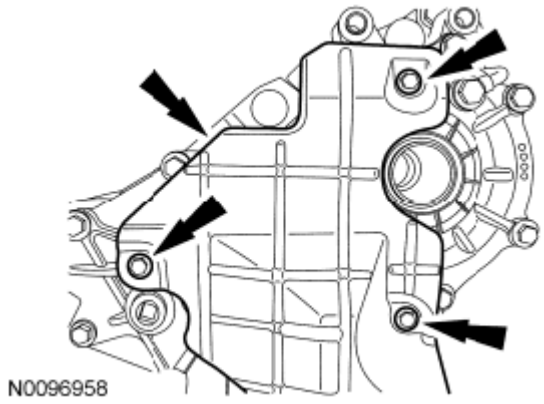


Fig. 172: Locating Bolts And PTU Heat Shield
Courtesy of FORD MOTOR CO.

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

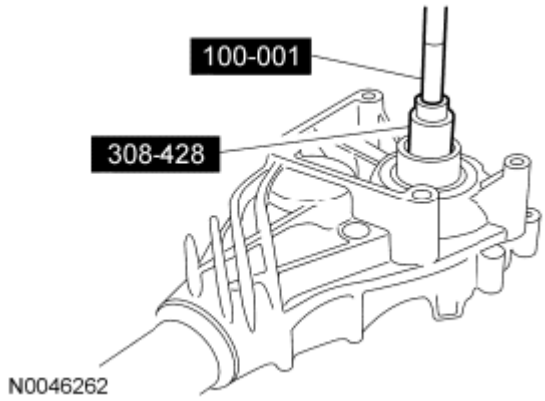


Fig. 173: Removing Intermediate Shaft Seal Using Halfshaft Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: When installing the lower half of the Engine Lifting Bracket Set, it will be easier to loosely install the upper bolt first then install the lower bolt.

 © 2011 Mitchell Repair Information Company, LLC.

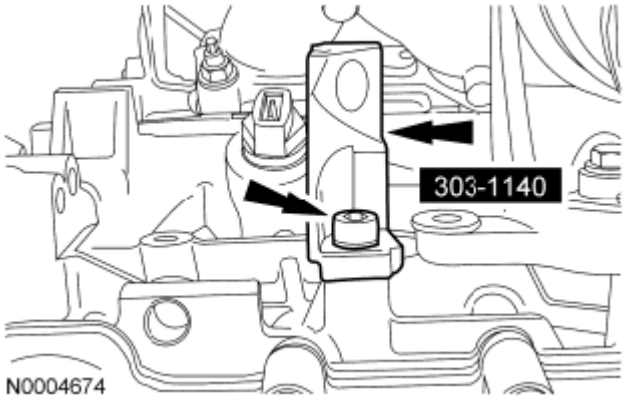


Fig. 174: Locating Lower Half Of Engine Lifting Bracket Set
Courtesy of FORD MOTOR CO.

63. Install the lower half of the Engine Lifting Bracket Set.
64. Install the upper half of the Engine Lifting Bracket Set.

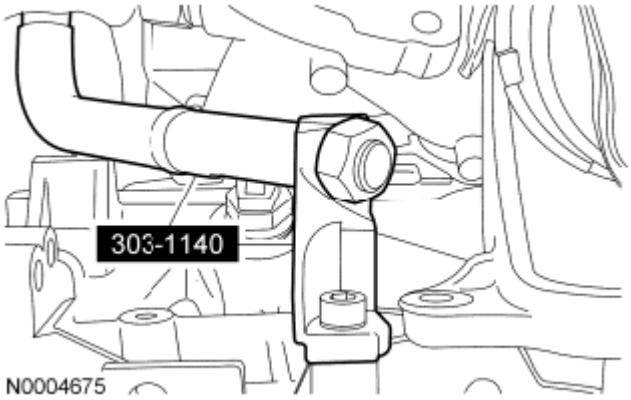


Fig. 175: Identifying Upper Half Of Engine Lifting Bracket Set
Courtesy of FORD MOTOR CO.

65. Install the Universal Adapter Brackets and the Engine Lifting Bracket to the front of the RH cylinder head.

 © 2011 Mitchell Repair Information Company, LLC.

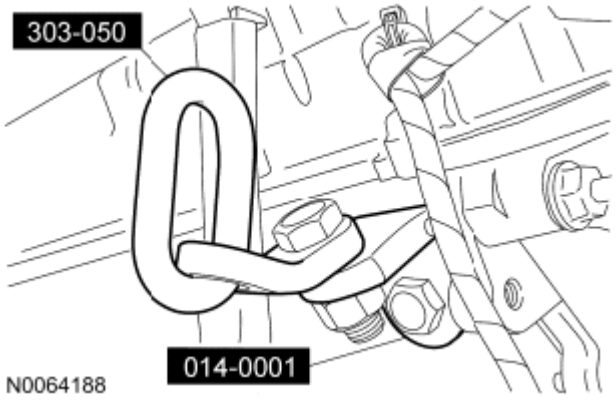


Fig. 176: Identifying Universal Adapter Brackets And Engine Lifting Bracket
Courtesy of FORD MOTOR CO.

66. Install the Universal Adapter Brackets and the Engine Lifting Bracket to the rear of the LH cylinder head.

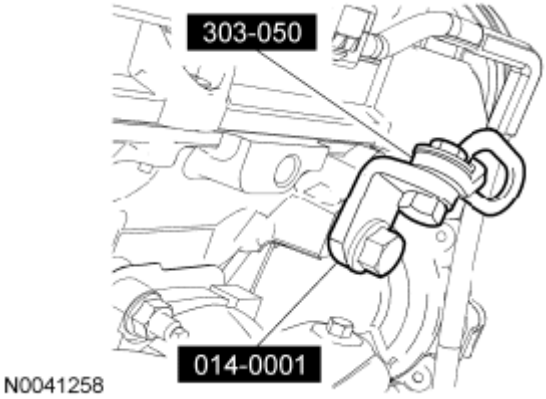
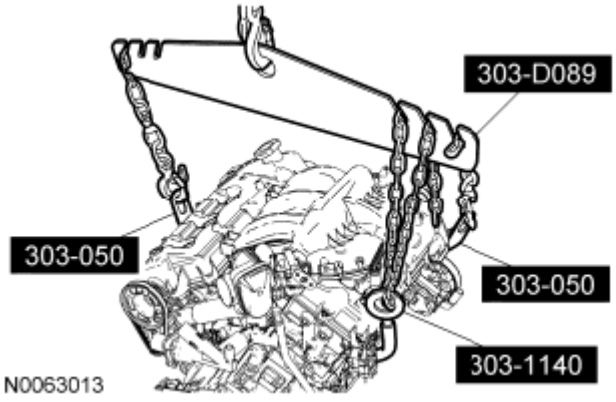


Fig. 177: Identifying Universal Adapter Brackets And Engine Lifting Bracket
Courtesy of FORD MOTOR CO.

67. Using the Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set and a suitable engine crane, remove the engine and transaxle from the Powertrain Lift.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 178: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of FORD MOTOR CO.

68. Remove the 5 remaining transaxle-to-engine bolts (3 shown).

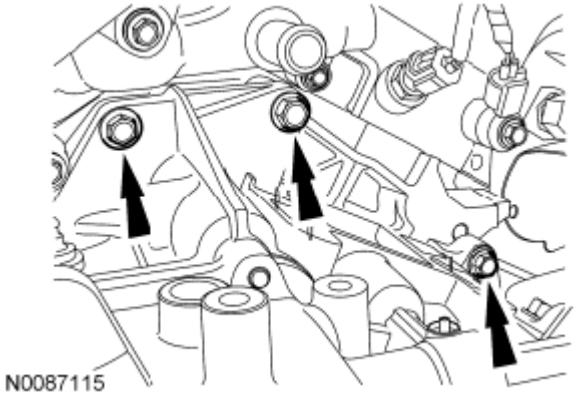


Fig. 179: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

69. Using the Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set and a suitable engine crane, separate the engine and transaxle.

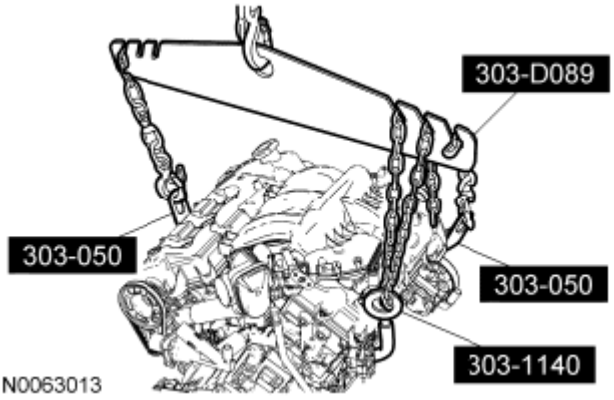


Fig. 180: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of FORD MOTOR CO.

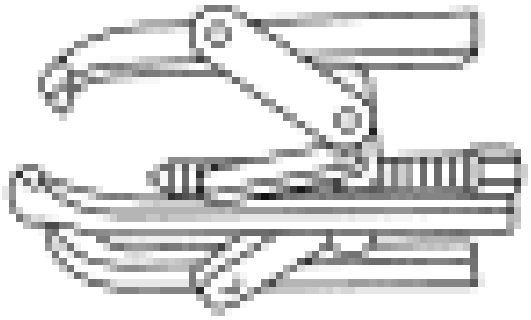
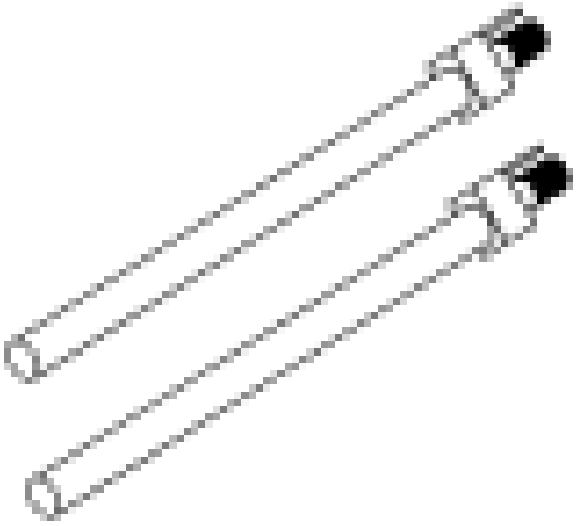
DISASSEMBLY

ENGINE

Special Tool(s)

SPECIAL TOOL CHART

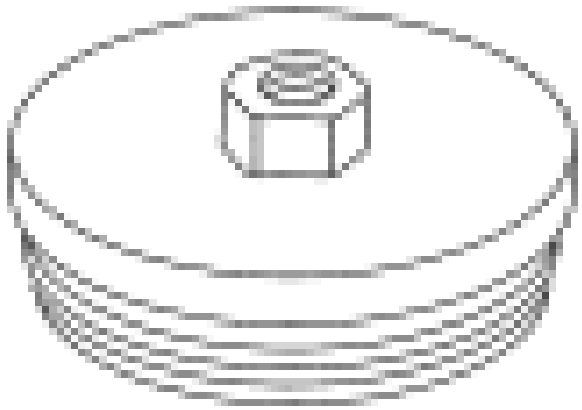
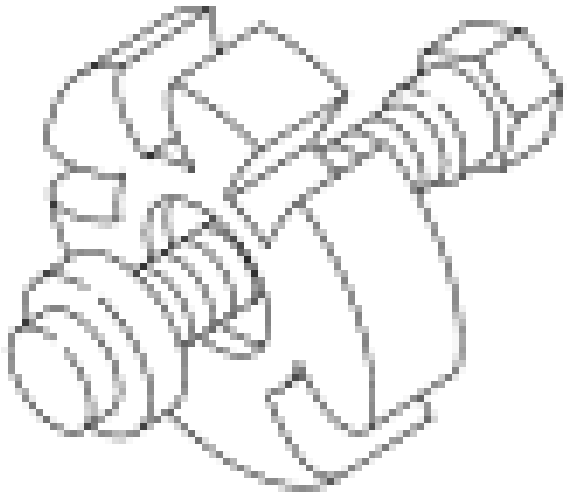
 © 2011 Mitchell Repair Information Company, LLC.

 ST1184-A	3 Jaw Puller 303-D121 (or equivalent)
 ST1982-A	Installer, Connecting Rod 303-462 (T94P-6136-AH)
	Plate, Water Pump Pulley

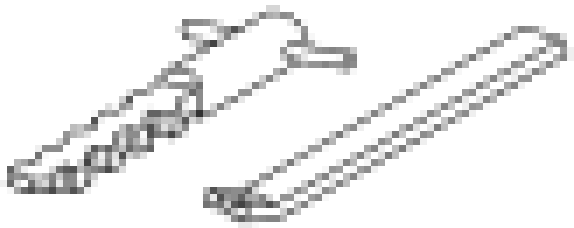
 © 2011 Mitchell Repair Information Company, LLC.

 ST3044-A	303-456 (T94P-6312-AH1), part of 303-S455
 ST3045-A	Protector, Water Pump Shaft 303-457 (T94P-6312-AH2), part of 303-S455
	Remover, Crankshaft Rear Oil Seal 303-519 (T95P-6701-EH)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1382-A	
 ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)
	Remover, Oil Seal 303-409 (T92C-6700CH)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1385-A	
 ST3085-A	Remover, Stretchy Belt 303-1419
	Slide Hammer 307-005 (T59L-100-B)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1187-A	

Material

MATERIAL SPECIFICATIONS

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

NOTE: During engine repair procedures, cleanliness is extremely important. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages, coolant passages or the oil pan may cause engine failure.

NOTE: For additional information, refer to ASSEMBLY for exploded view under the Assembly procedure .

All vehicles

1. Remove the bolts and the flexplate.

 © 2011 Mitchell Repair Information Company, LLC.

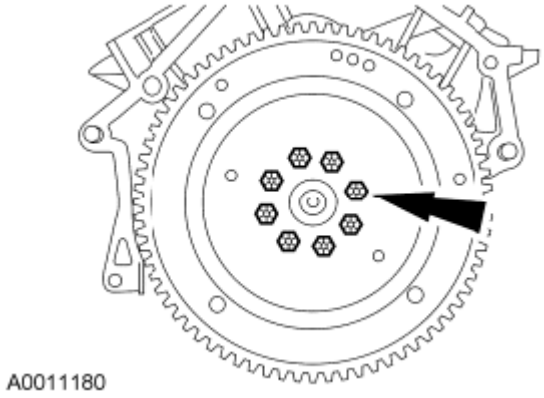


Fig. 181: Locating Bolts And Flexplate
Courtesy of FORD MOTOR CO.

2. Remove the engine-to-transaxle separator plate.

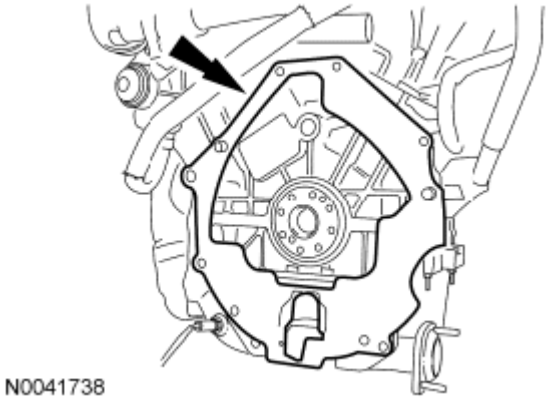


Fig. 182: Locating Engine-To-Transaxle Separator Plate
Courtesy of FORD MOTOR CO.

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

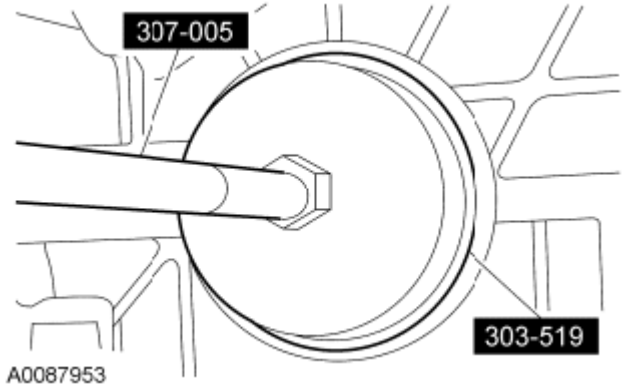


Fig. 183: Removing Crankshaft Rear Oil Seal

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

4. Mount the engine on a suitable stand.
5. Disconnect the engine block Knock Sensor (KS) electrical connector and detach the wire harness retainer, disconnect the Cylinder Head Temperature (CHT) sensor electrical connector and the cylinder head **KS** electrical connector.

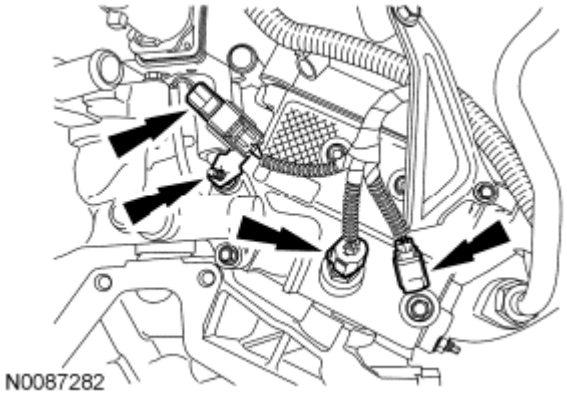


Fig. 184: Locating Engine Block Knock Sensor (KS) Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

6. Disconnect the electronic throttle control electrical connector.

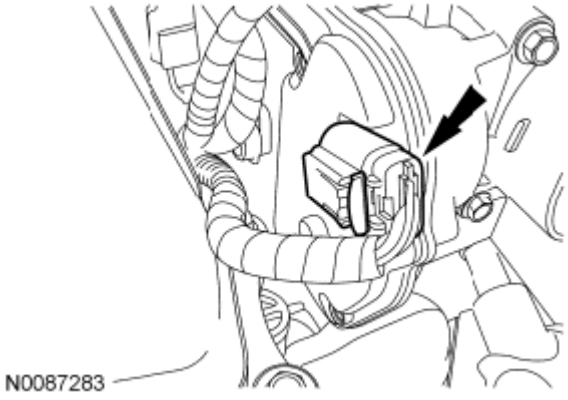


Fig. 185: Locating Electronic Throttle Control Electrical Connector
Courtesy of FORD MOTOR CO.

7. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

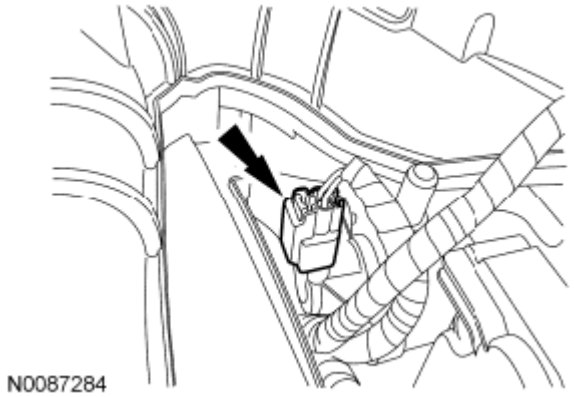


Fig. 186: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

8. Disconnect the EGR regulator electrical connector and detach the wiring retainer.

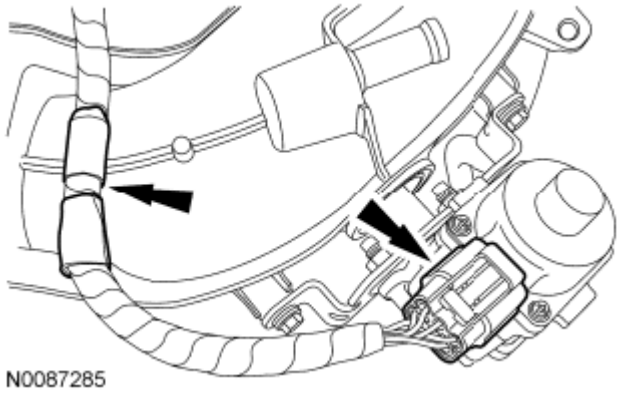


Fig. 187: Locating EGR Regulator Electrical Connector
Courtesy of FORD MOTOR CO.

9. Detach the wiring harness retainer from the upper intake manifold.

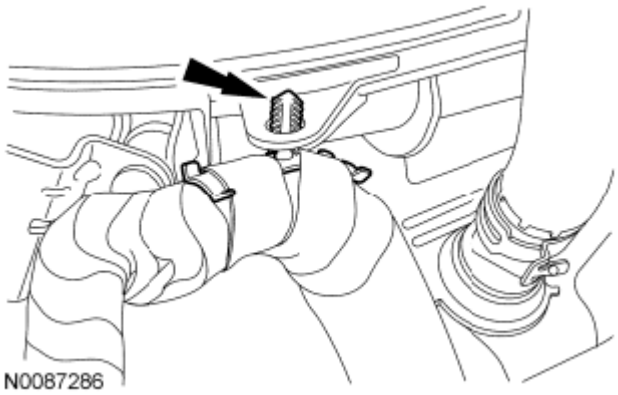


Fig. 188: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

10. Disconnect the Manifold Absolute Pressure (MAP) electrical connector and detach the wiring retainer.

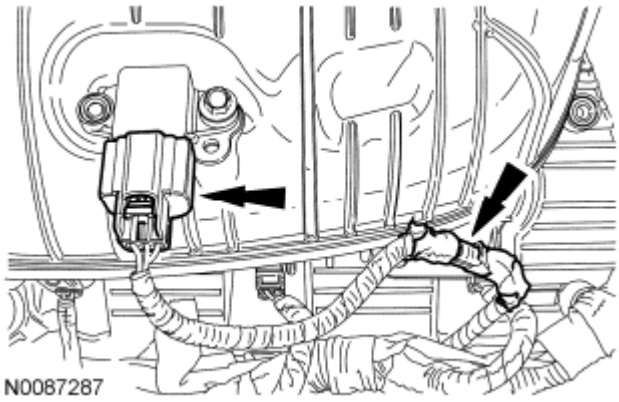


Fig. 189: Locating Manifold Absolute Pressure (MAP) Electrical Connector And Wiring Retainer
Courtesy of FORD MOTOR CO.

11. Disconnect the RH coil-on-plug electrical connectors.
    - Detach the 2 wiring harness retainers.

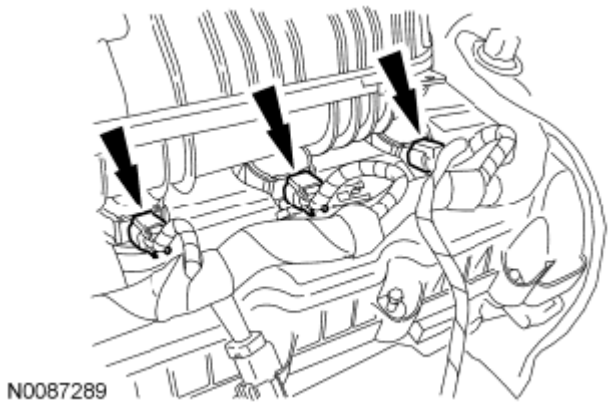


Fig. 190: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

12. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

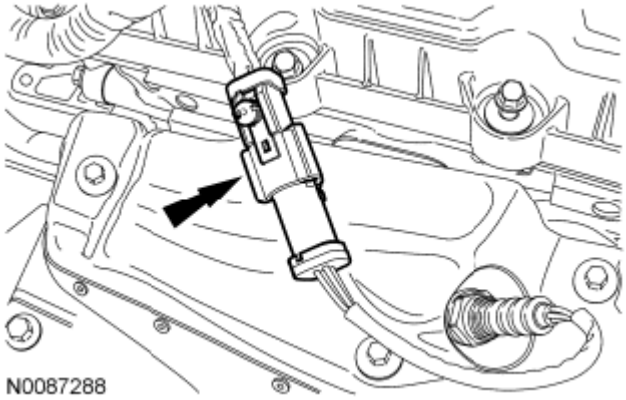


Fig. 191: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

13. Disconnect the RH Variable Camshaft Timing (VCT) electrical connector.

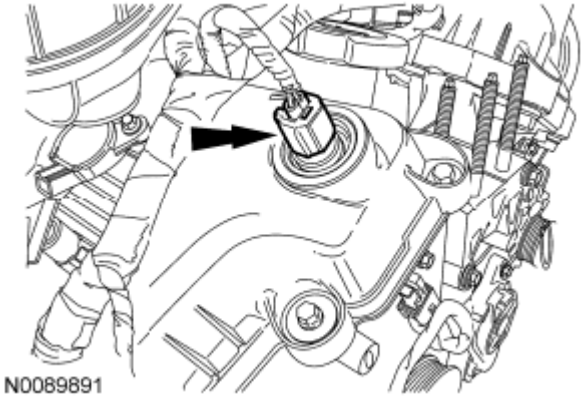


Fig. 192: Locating RH Variable Camshaft Timing (VCT) Electrical Connector
Courtesy of FORD MOTOR CO.

14. Disconnect the Crankshaft Position (CKP) sensor electrical connector and detach the 2 wiring harness retainers.

 © 2011 Mitchell Repair Information Company, LLC.

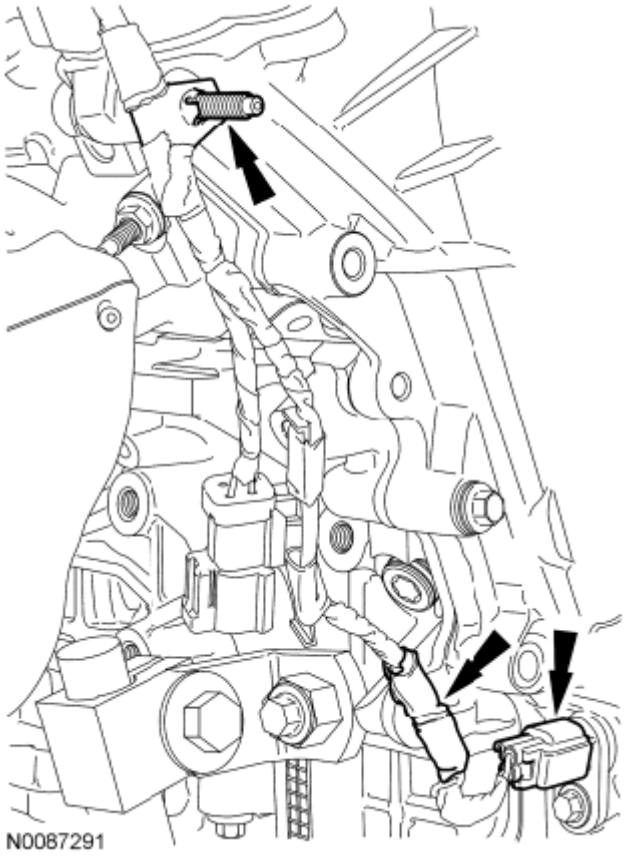


Fig. 193: Locating Crankshaft Position (CKP) Sensor Electrical Connector And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

15. Disconnect the 2 Camshaft Position (CMP) sensor electrical connectors and detach the wiring harness retainer from the engine front cover stud bolt.

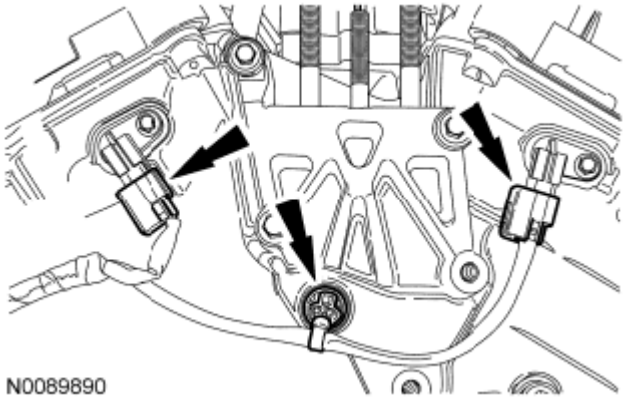


Fig. 194: Locating Camshaft Position (CMP) Sensor Electrical Connectors And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

16. Disconnect the fuel injector wiring harness electrical connector.

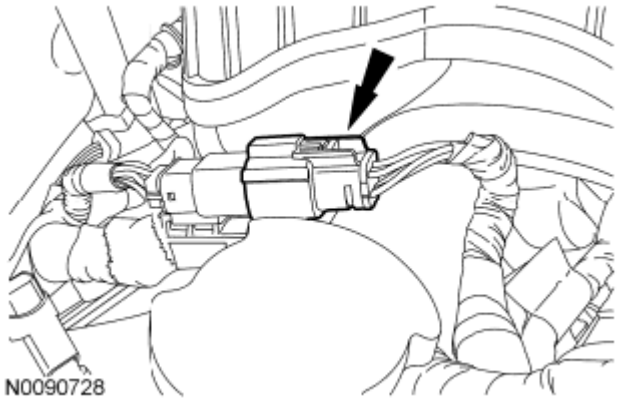


Fig. 195: Locating Fuel Injector Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

17. Disconnect the LH **VCT** electrical connector.

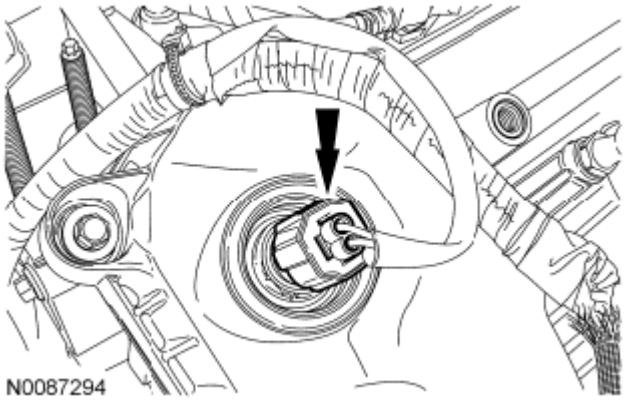


Fig. 196: Locating LH VCT Electrical Connector
Courtesy of FORD MOTOR CO.

18. Disconnect the Engine Oil Pressure (EOP) switch electrical connector and detach the wiring retainer.

 © 2011 Mitchell Repair Information Company, LLC.

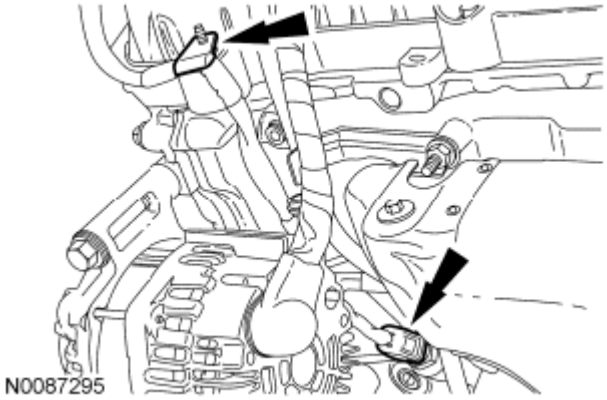


Fig. 197: Locating Engine Oil Pressure (EOP) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the LH **HO2S** electrical connector.

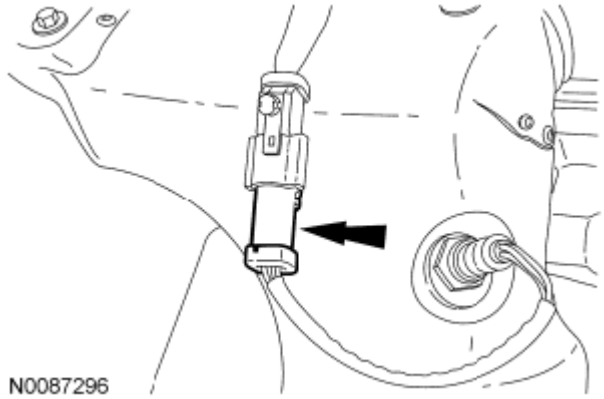
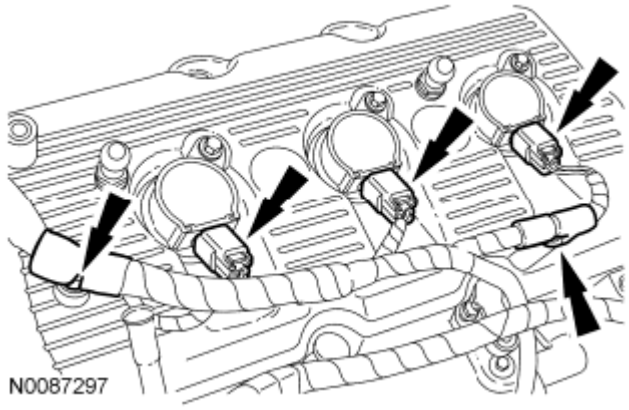


Fig. 198: Locating LH HO2S Electrical Connector
Courtesy of FORD MOTOR CO.

20. Disconnect the 3 LH coil-on-plug electrical connectors.
    - Detach the 2 wiring harness retainers.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 199: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

21. Remove the nut and the B+ wire from the generator.

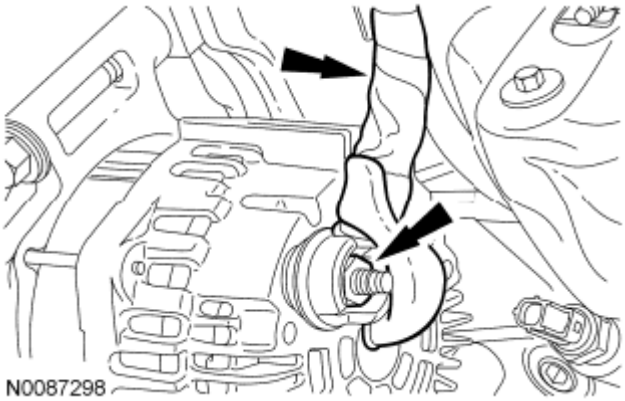


Fig. 200: Locating Nut And B+ Wire
Courtesy of FORD MOTOR CO.

22. Detach the 2 wiring harness retainers.
    - Remove the B+ harness from the engine.

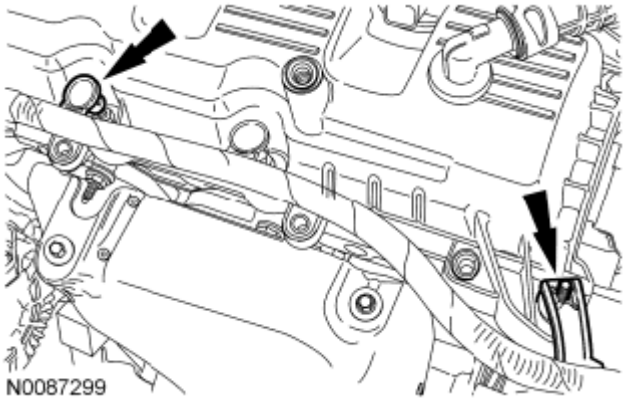


Fig. 201: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

23. Remove the EGR tube fitting from the EGR valve.

 © 2011 Mitchell Repair Information Company, LLC.

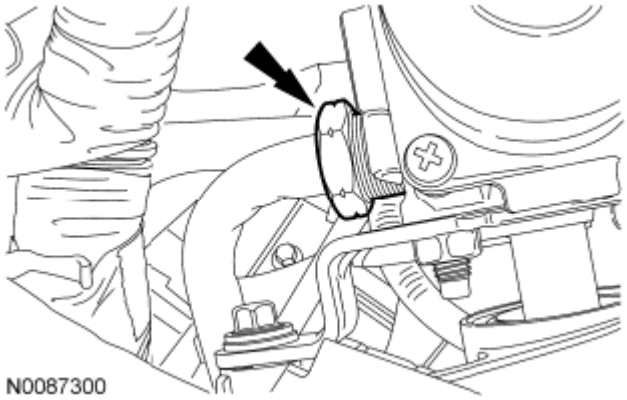


Fig. 202: Locating EGR Tube Fitting
Courtesy of FORD MOTOR CO.

24. Remove the 2 upper intake manifold bracket bolts (1 shown).

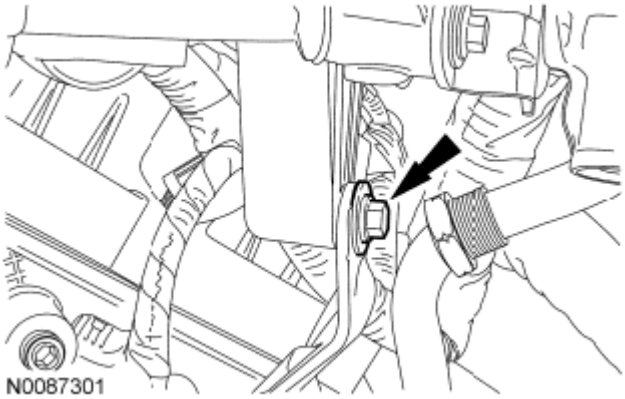


Fig. 203: Locating Upper Intake Manifold Bracket Bolt
Courtesy of FORD MOTOR CO.

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

25. Remove the 7 bolts and the upper intake manifold.
    - Remove and discard the gaskets.

 © 2011 Mitchell Repair Information Company, LLC.

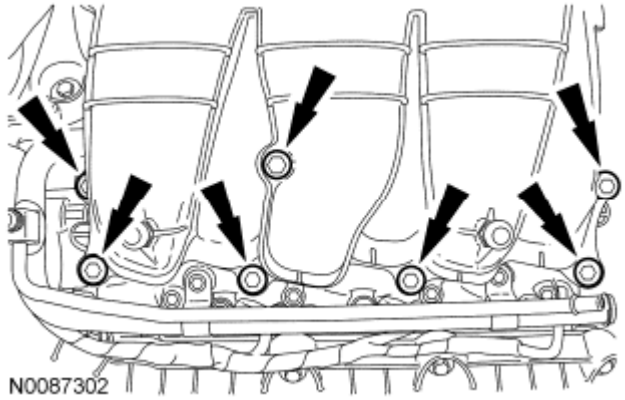


Fig. 204: Locating Bolts And Upper Intake Manifold
Courtesy of FORD MOTOR CO.

26. Remove the 4 bolts and the fuel rail and injectors as an assembly.

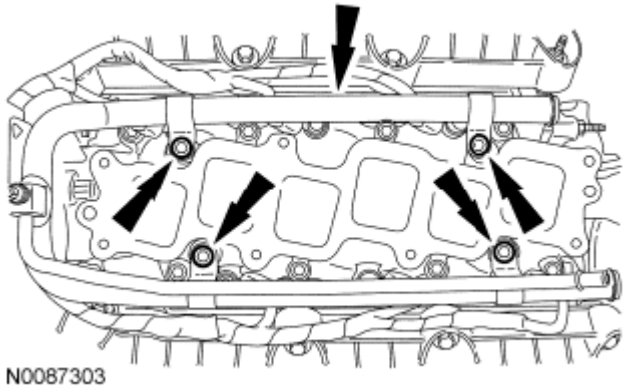


Fig. 205: Locating Bolts And Fuel Rail And Injectors
Courtesy of FORD MOTOR CO.

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

27. Remove the 8 lower intake manifold bolts and the lower intake manifold.
    - Remove and discard the gaskets.

 © 2011 Mitchell Repair Information Company, LLC.

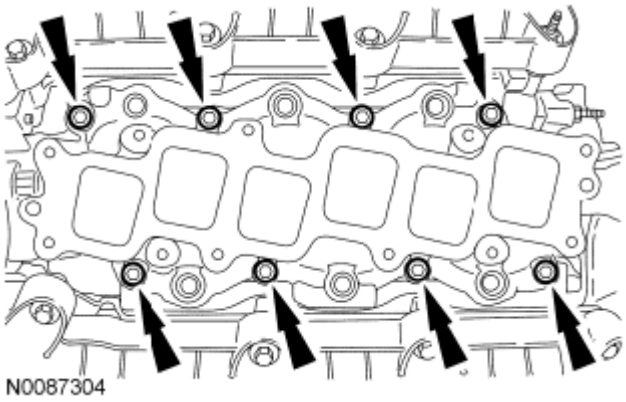


Fig. 206: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

NOTE: When removing the coil-on-plugs, a slight twisting motion will break the seal and ease removal.

NOTE: LH shown, RH similar.

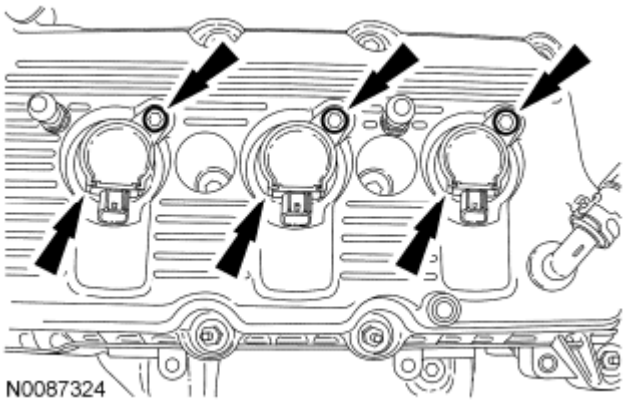


Fig. 207: Locating Bolts And Coil-On-Plugs
Courtesy of FORD MOTOR CO.

28. Remove the 6 bolts and the 6 coil-on-plugs.

FWD vehicles

29. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

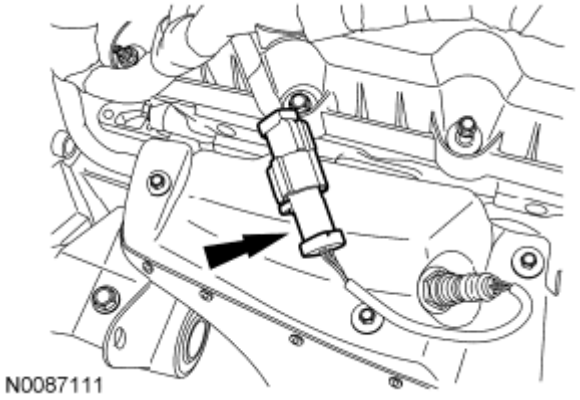


Fig. 208: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

30. Remove the 3 bolts and the RH heat shield.

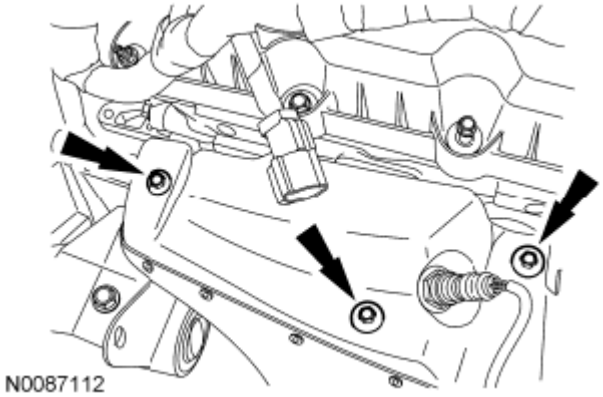
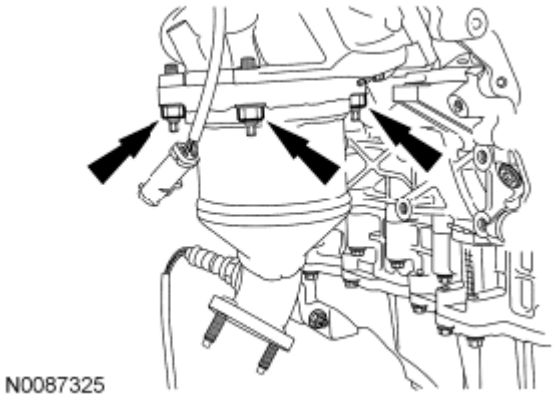


Fig. 209: Locating Bolts And RH Heat Shield
Courtesy of FORD MOTOR CO.

31. Remove the 3 nuts and the RH catalytic converter.
    - Discard the nuts and gasket.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 210: Locating Nuts And RH Catalytic Converter
Courtesy of FORD MOTOR CO.

All vehicles

32. Remove the 6 RH exhaust manifold nuts and the manifold.
    - Discard the nuts and gasket.

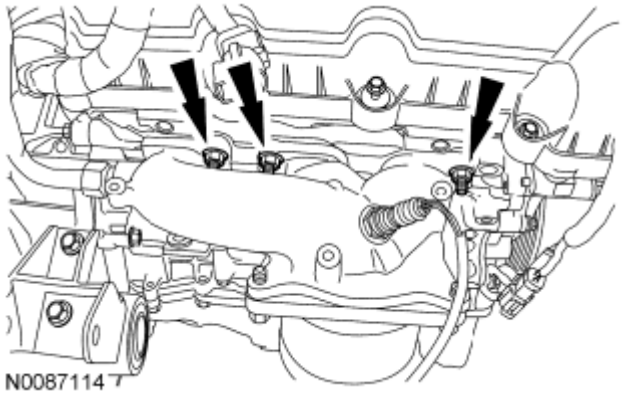


Fig. 211: Locating RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

33. Remove and discard the 6 RH exhaust manifold studs.

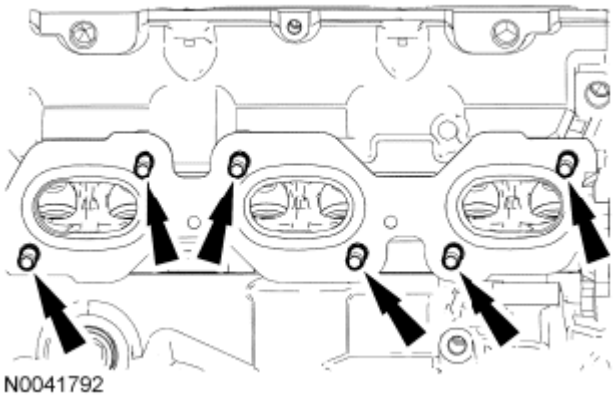


Fig. 212: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

34. Remove the bolt, 2 nuts and the generator.

 © 2011 Mitchell Repair Information Company, LLC.

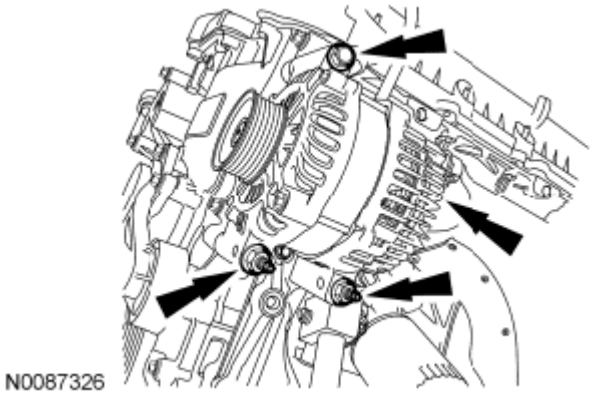


Fig. 213: Locating Bolt, Nuts And Generator
Courtesy of FORD MOTOR CO.

35. Remove the 3 bolts and the A/C compressor bracket.

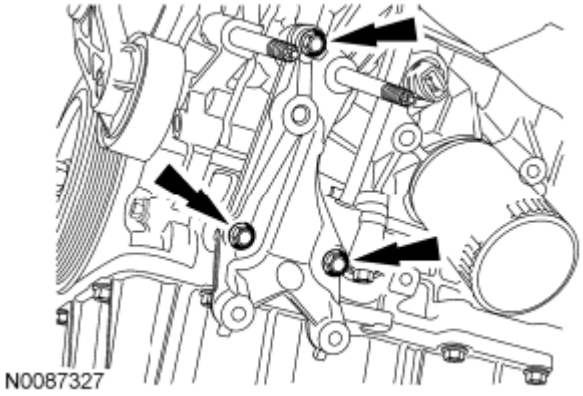


Fig. 214: Locating Bolts And A/C Compressor Bracket
Courtesy of FORD MOTOR CO.

36. Remove the 3 bolts and the LH heat shield.

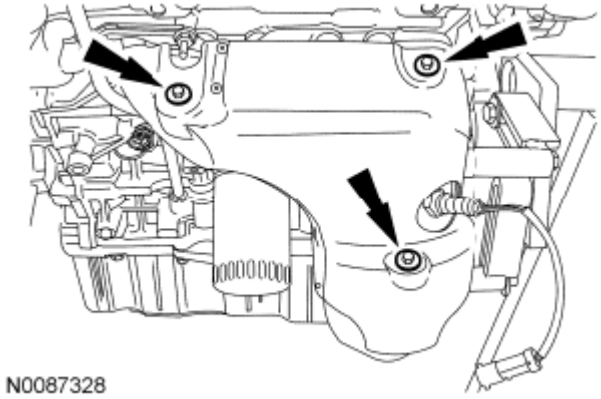


Fig. 215: Locating Bolts And LH Heat Shield
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

37. Remove the stud bolt and the oil level indicator and tube.
    - Remove and discard the O-ring seal.

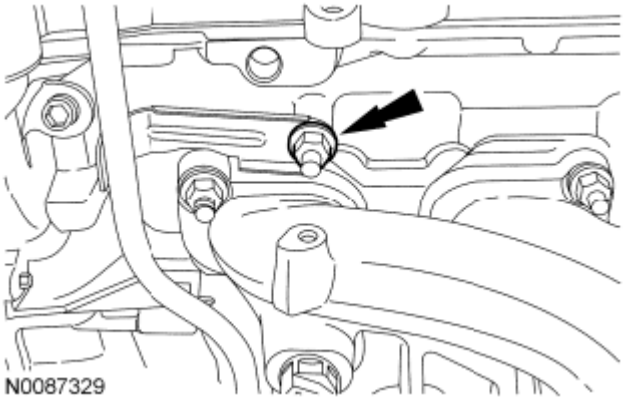


Fig. 216: Locating Stud Bolt And Oil Level Indicator And Tube
Courtesy of FORD MOTOR CO.

38. Remove the 6 nuts, the LH catalytic converter and the gasket.
    - Discard the gasket and nuts.

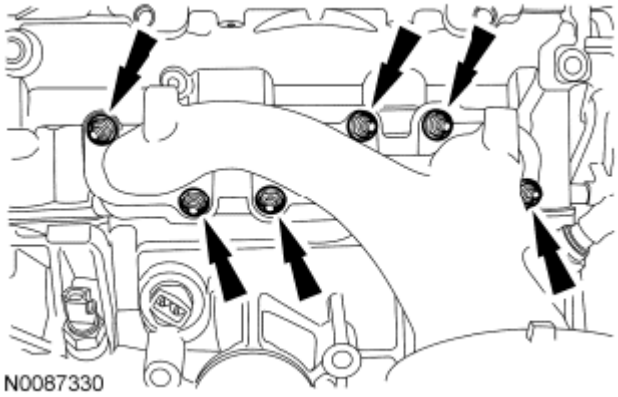


Fig. 217: Locating Nuts And LH Catalytic Converter
Courtesy of FORD MOTOR CO.

39. Remove and discard the 6 LH exhaust manifold studs.

 © 2011 Mitchell Repair Information Company, LLC.

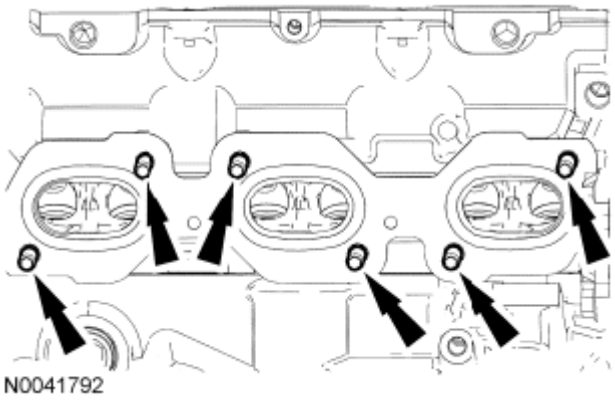


Fig. 218: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

40. Remove the **EOP** switch and, if equipped, the block heater.

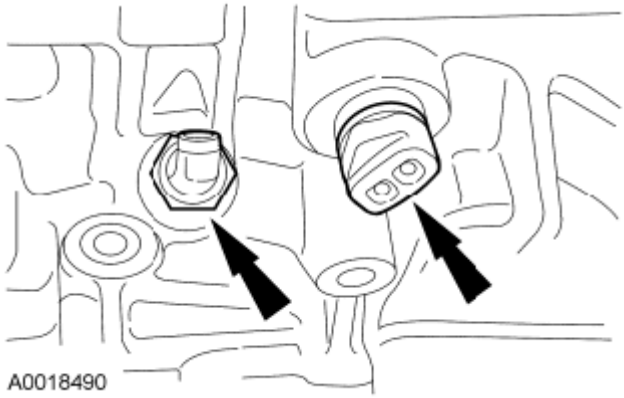


Fig. 219: Locating EOP Switch
Courtesy of FORD MOTOR CO.

41. Remove and discard the oil filter.

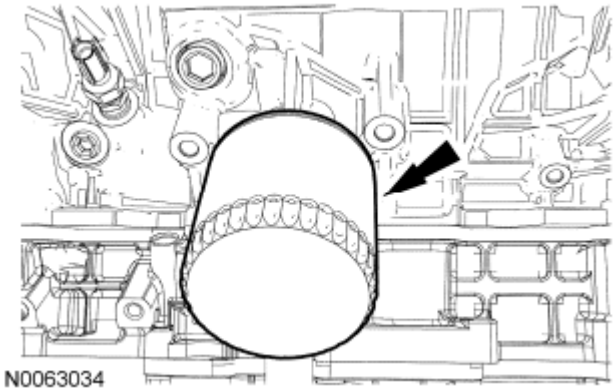


Fig. 220: Locating Oil Filter
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

42. Position the Stretchy Belt Remover under the coolant pump belt as shown.

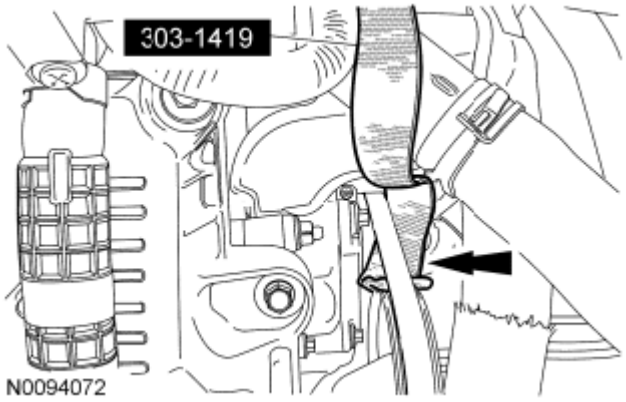


Fig. 221: Locating Stretchy Belt Remover And Coolant Pump
Courtesy of FORD MOTOR CO.

NOTE: Feed the Stretchy Belt Remover on to the camshaft coolant pump pulley approximately 90 degrees.

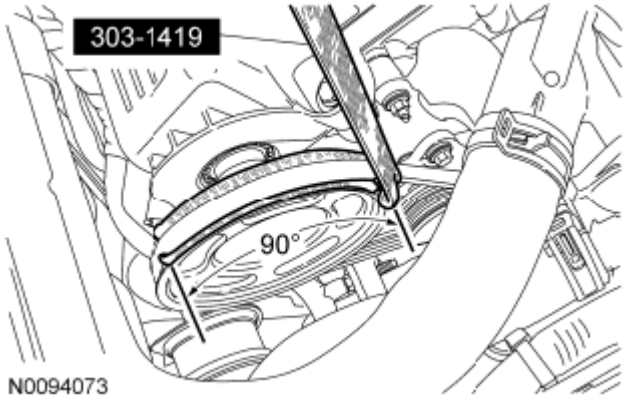


Fig. 222: Identifying Stretchy Belt Remover
Courtesy of FORD MOTOR CO.

43. With the help of an assistant, turn the crankshaft clockwise and feed the Stretchy Belt Remover evenly on the camshaft coolant pump pulley as shown.
44. Remove the coolant pump belt.
    - Fold the Stretchy Belt Remover over the top of the coolant pump belt.
    - In one quick motion, pull the Stretchy Belt Remover up and toward the front of the engine removing the coolant pump belt.

 © 2011 Mitchell Repair Information Company, LLC.



Fig. 223: Pulling Stretchy Belt Remover
Courtesy of FORD MOTOR CO.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

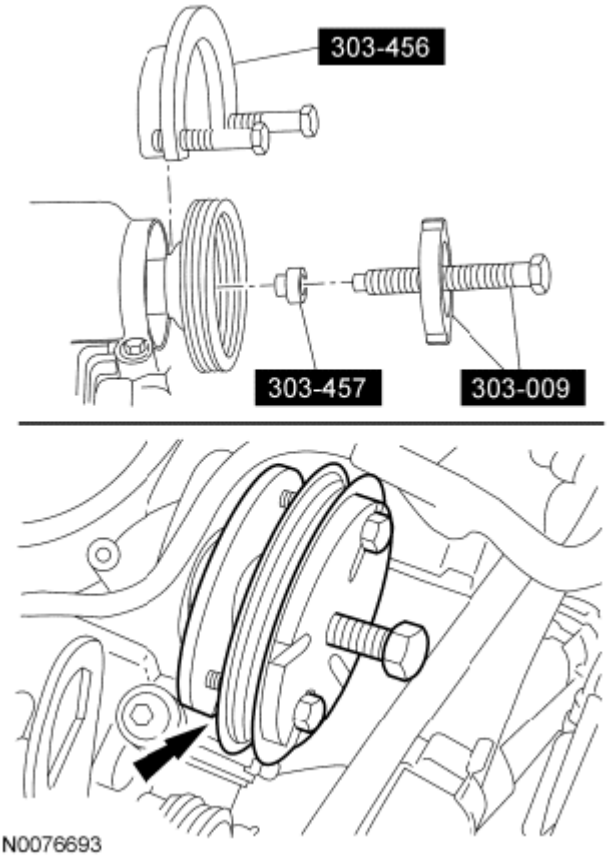


Fig. 224: Identifying Water Pump Pulley Plate, Water Pump Shaft Protector And Crankshaft Vibration Damper Remover
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

45. Using the Water Pump Pulley Plate, Water Pump Shaft Protector and the Crankshaft Vibration Damper Remover, remove the coolant pump pulley.
46. Remove the 5 coolant pump housing bolts.

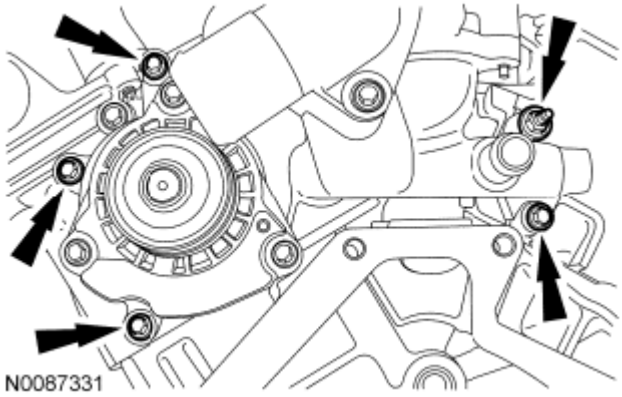


Fig. 225: Locating Coolant Pump Housing Bolts
Courtesy of FORD MOTOR CO.

47. Loosen the clamp and detach the coolant hose. Remove the coolant pump housing.

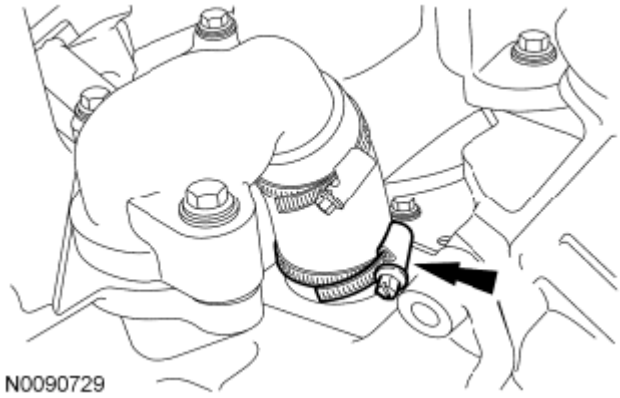


Fig. 226: Locating Clamp And Coolant Hose
Courtesy of FORD MOTOR CO.

48. Remove the nut and the radio interference capacitor.

 © 2011 Mitchell Repair Information Company, LLC.

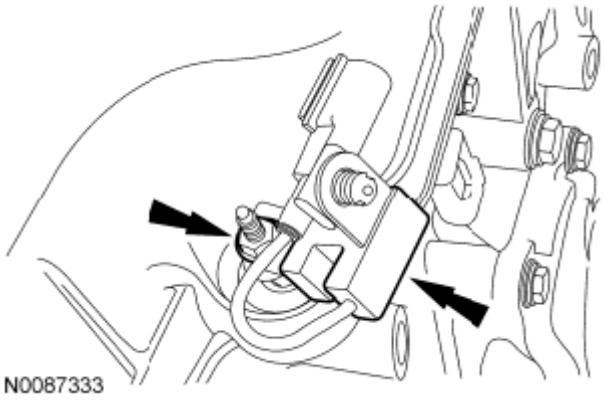


Fig. 227: Locating Nut And Radio Interference Capacitor
Courtesy of FORD MOTOR CO.

49. Remove the bolts and the RH valve cover.
    - Discard the gasket.

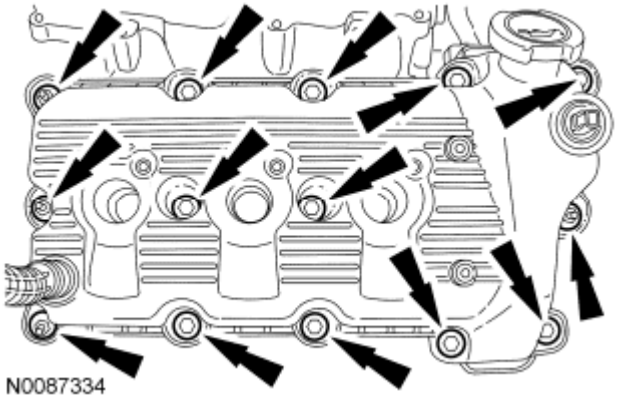


Fig. 228: Locating Bolts And RH Valve Cover
Courtesy of FORD MOTOR CO.

50. Remove the bolts and the LH valve cover.
    - Discard the gasket.

 © 2011 Mitchell Repair Information Company, LLC.

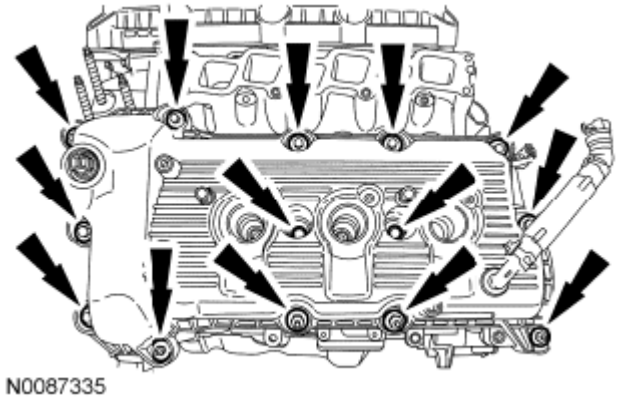


Fig. 229: Locating Bolts And LH Valve Cover
Courtesy of FORD MOTOR CO.

51. Remove the 15 bolts and the oil pan.
    - Discard the gasket.

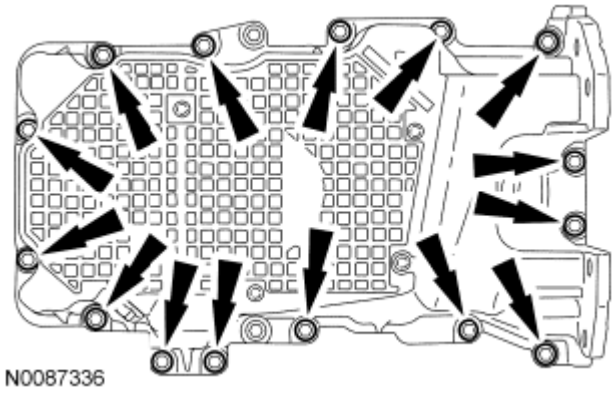
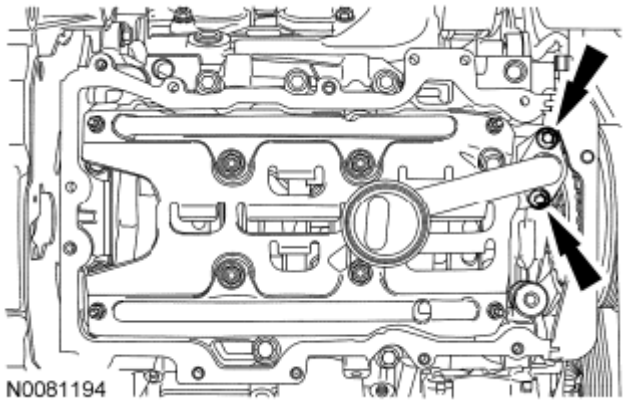


Fig. 230: Locating Bolts And Oil Pan
Courtesy of FORD MOTOR CO.

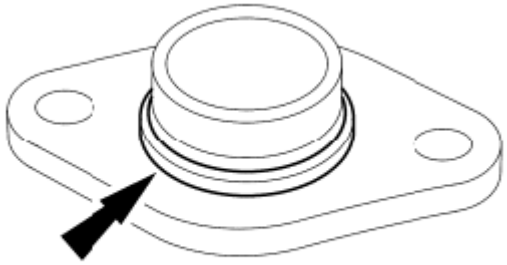
52. Remove the 2 bolts and the oil pump screen and pickup tube.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 231: Locating Bolts Oil Pump Screen And Pickup Tube
Courtesy of FORD MOTOR CO.

53. Remove and discard the O-ring seal.



A0011413

Fig. 232: Locating O-Ring Seal
Courtesy of FORD MOTOR CO.

54. Remove the oil pan baffle.
    1. Remove the 4 M6 oil pan baffle nuts.
    2. Remove the 4 M8 oil pan baffle nuts.

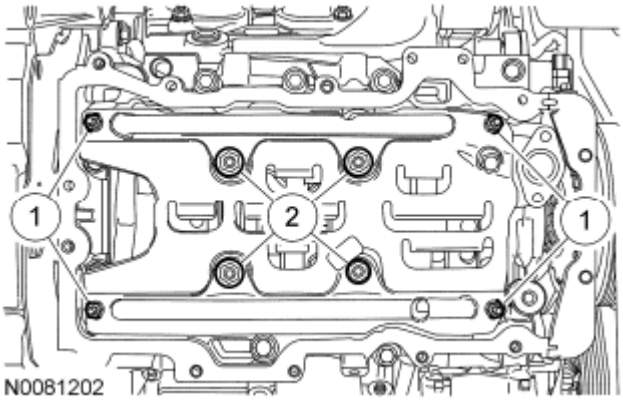


Fig. 233: Identifying Oil Pan Baffle Nuts
Courtesy of FORD MOTOR CO.

55. Remove the 3 bolts and the accessory drive belt tensioner.

 © 2011 Mitchell Repair Information Company, LLC.

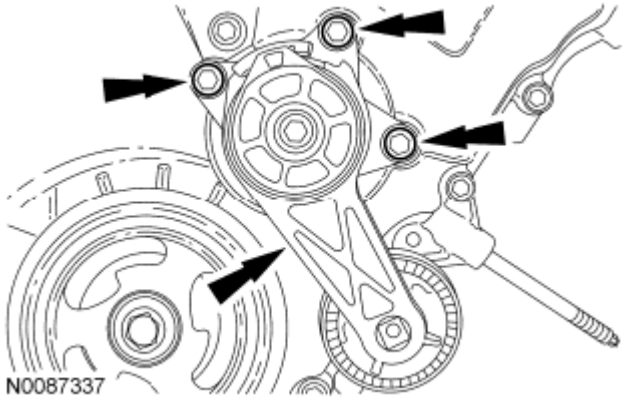


Fig. 234: Locating Bolts And Accessory Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

56. Remove the crankshaft pulley bolt and washer.
    - Discard the crankshaft pulley bolt.

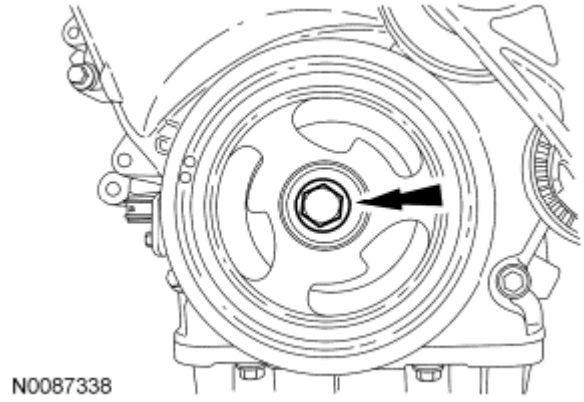


Fig. 235: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

57. Using the 3 Jaw Puller, remove the crankshaft pulley.

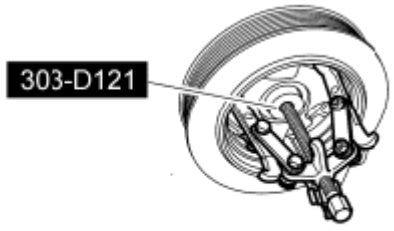


Fig. 236: Removing Crankshaft Pulley Using 3 Jaw Puller
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

58. Using the Oil Seal Remover, remove and discard the crankshaft front seal.

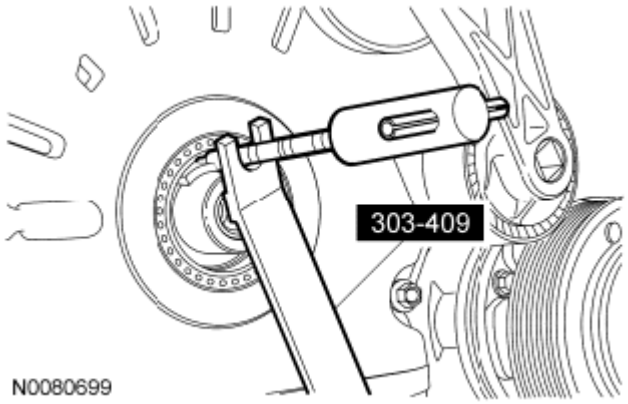


Fig. 237: Removing Crankshaft Front Seal Using Oil Seal Remover
Courtesy of FORD MOTOR CO.

NOTE: Note the position of the alignment dowel on the engine front cover.

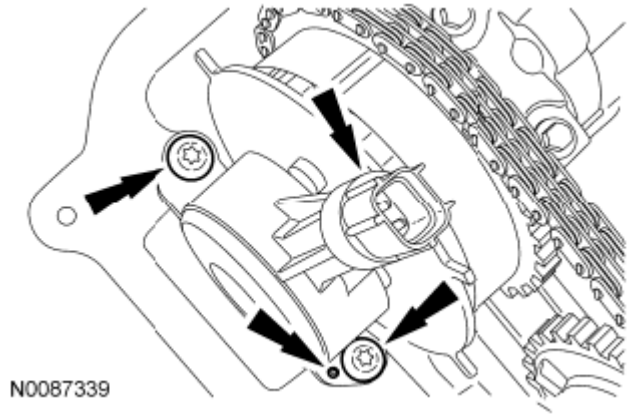


Fig. 238: Locating Bolts And LH VCT
Courtesy of FORD MOTOR CO.

59. Remove the 2 bolts and the LH **VCT** .

NOTE: Note the position of the alignment dowel on the engine front cover.

 © 2011 Mitchell Repair Information Company, LLC.

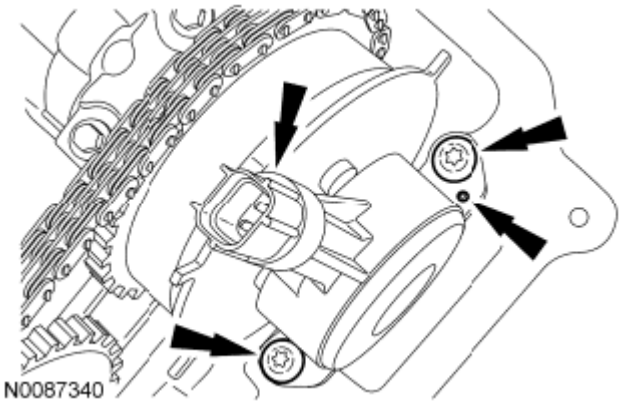


Fig. 239: Locating Bolts And RH VCT
Courtesy of FORD MOTOR CO.

60. Remove the 2 bolts and the RH **VCT** .

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

NOTE: Note the location of all bolts and stud bolts for installation.

61. Remove the 14 bolts, 2 stud bolts and the engine front cover.
    - Discard the gaskets.

 © 2011 Mitchell Repair Information Company, LLC.

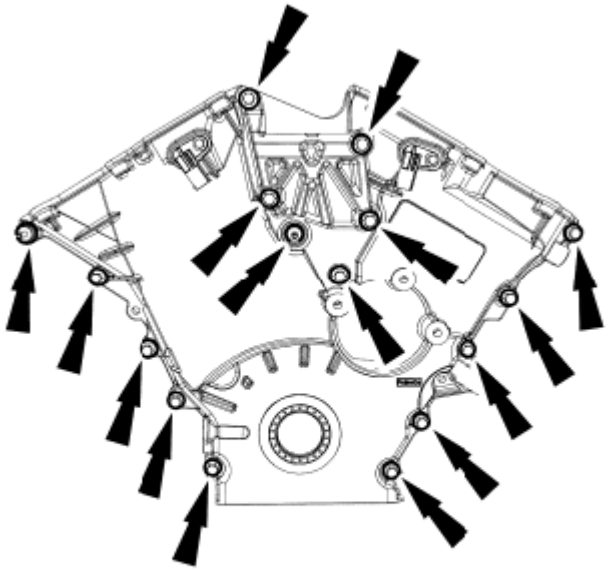


Fig. 240: Locating Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

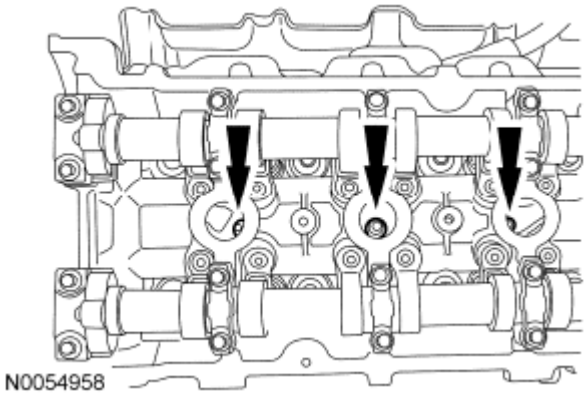


Fig. 241: Locating Spark Plugs
Courtesy of FORD MOTOR CO.

62. Remove the LH and RH spark plugs.

NOTE: This pulse wheel is used in several different engines. Install the pulse

 © 2011 Mitchell Repair Information Company, LLC.

wheel with the keyway in the slot stamped "30RFF" (orange in color).

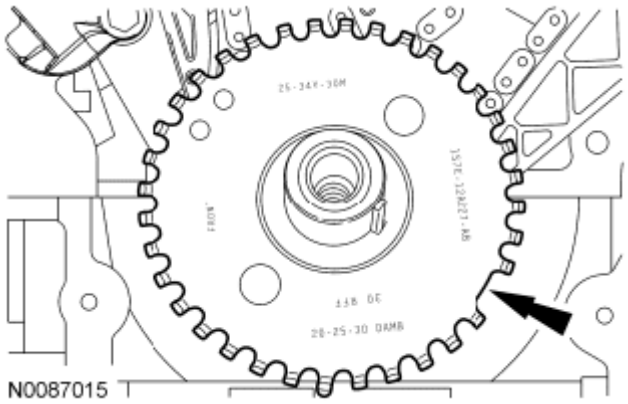


Fig. 242: Locating Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

63. Remove the ignition pulse wheel.
64. Install the crankshaft pulley bolt and washer.

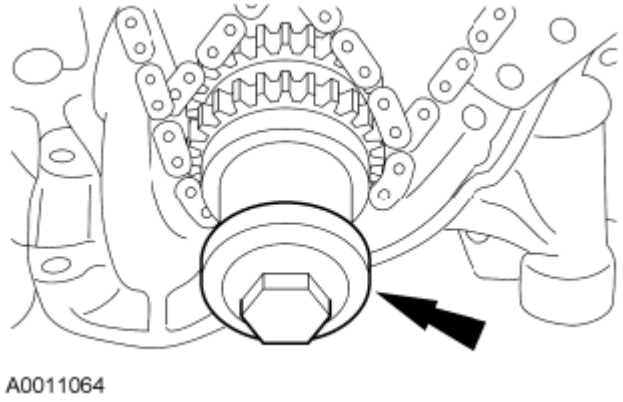


Fig. 243: Locating Crankshaft Pulley Bolt And Washer
Courtesy of FORD MOTOR CO.

65. Rotate the crankshaft clockwise to position the crankshaft keyway in the 11 o'clock position and position the camshafts in the correct position. This will position the No. 1 cylinder at Top Dead Center (TDC).
    - Verify that the camshafts are correctly located. If not, rotate the crankshaft one additional turn and recheck.

 © 2011 Mitchell Repair Information Company, LLC.

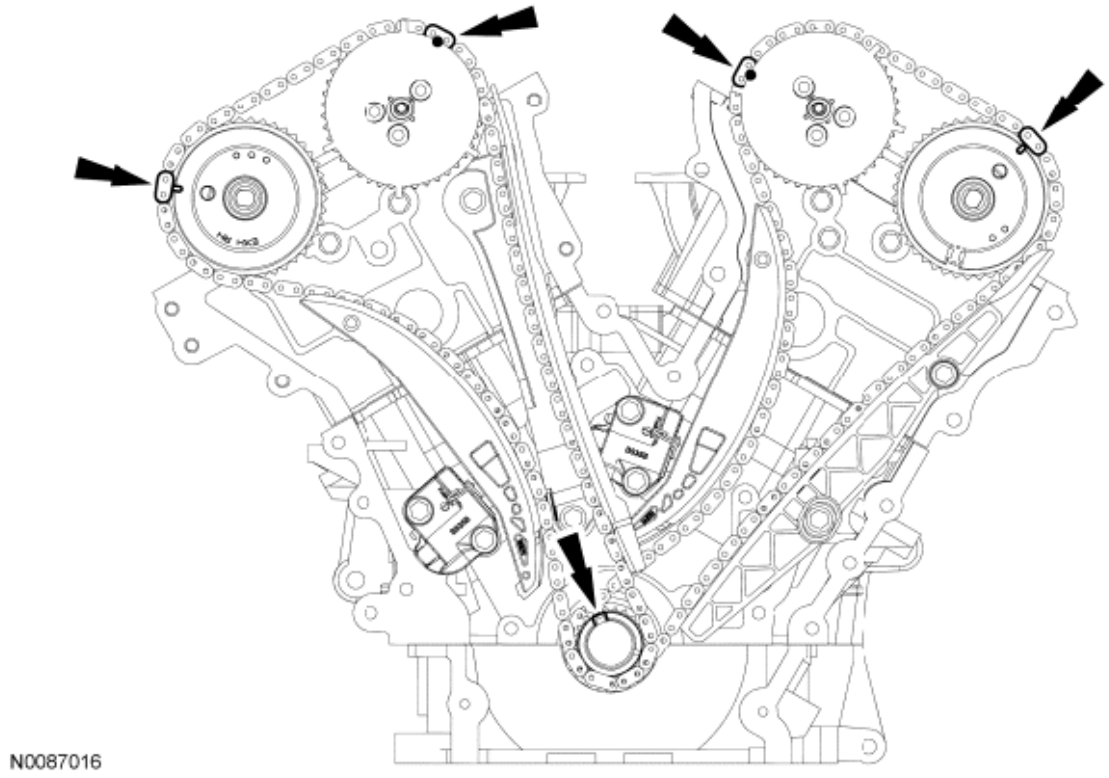


Fig. 244: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

66. Rotate the crankshaft clockwise 120 degrees to the 3 o'clock position to position the RH camshafts in the neutral position.

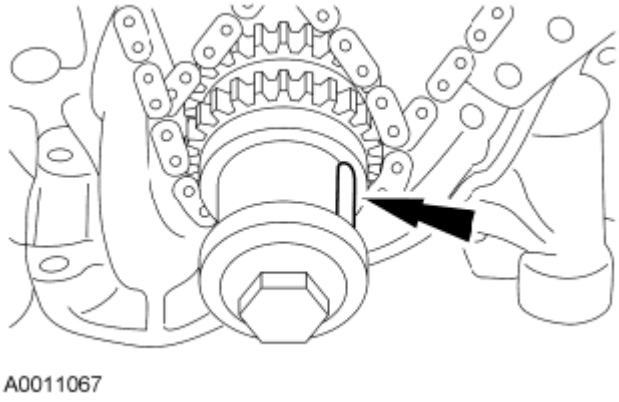


Fig. 245: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

67. Verify that the RH camshafts are in the neutral position.

 © 2011 Mitchell Repair Information Company, LLC.

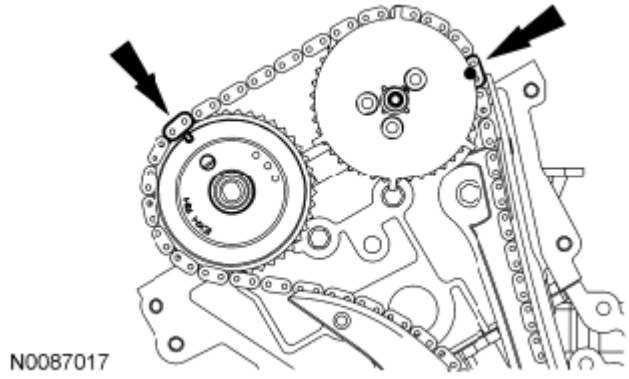


Fig. 246: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

68. Remove the RH timing chain tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

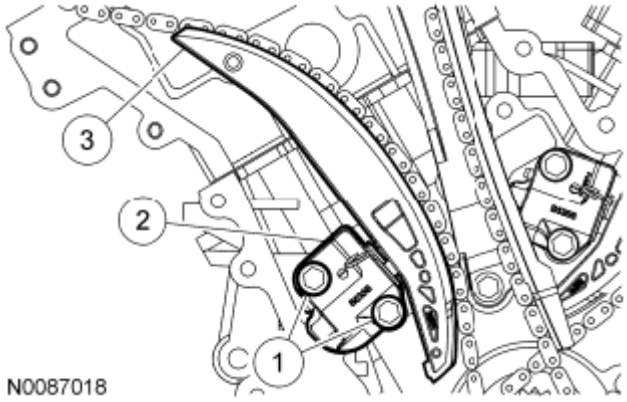


Fig. 247: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

69. Remove the 2 bolts and the RH timing chain guide.
    - Remove the RH timing chain from the engine.

 © 2011 Mitchell Repair Information Company, LLC.

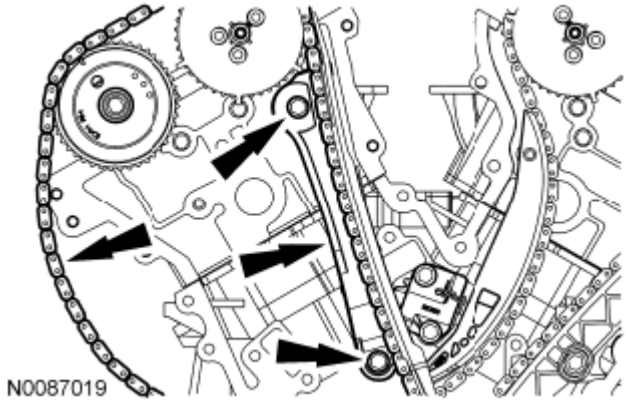


Fig. 248: Locating Bolts And RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

70. Rotate the crankcase clockwise 600 degrees (one and two-thirds turns) to position the crankcase keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

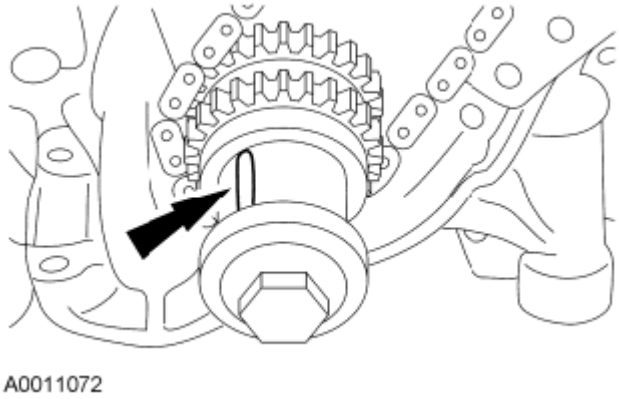
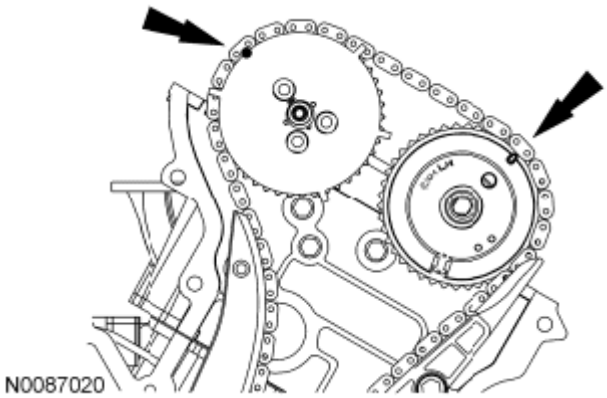


Fig. 249: Locating LH Camshafts Keywey
Courtesy of FORD MOTOR CO.

71. Verify the LH camshafts are in the neutral position.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 250: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

72. Remove the LH timing chain and tensioner arm.
    1. Remove the 2 bolts.
    2. Remove the tensioner.
    3. Remove the tensioner arm.

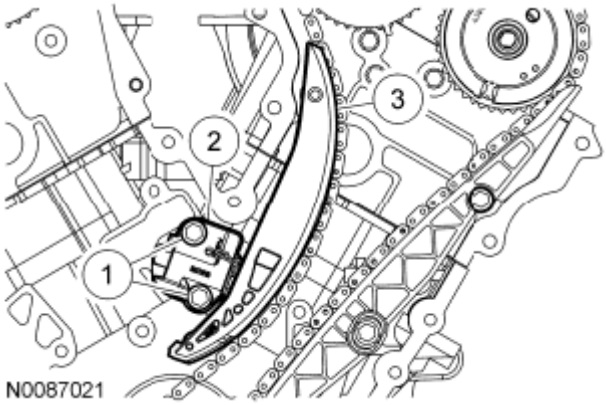


Fig. 251: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

73. Remove the 2 bolts and the LH timing chain guide.
    - Remove the LH timing chain from the engine.

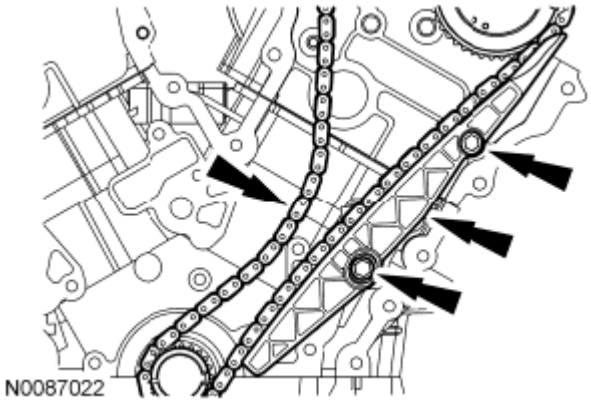


Fig. 252: Locating Bolts And LH Timing Chain Guide
Courtesy of FORD MOTOR CO.

74. Remove the crankshaft pulley bolt and the crankshaft sprocket.

 © 2011 Mitchell Repair Information Company, LLC.

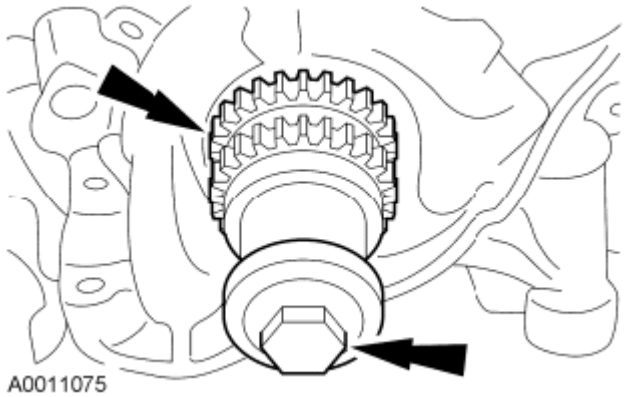


Fig. 253: Locating Crankshaft Pulley Bolt And Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

75. Remove the 4 bolts in the sequence shown.
    - Remove the oil pump.

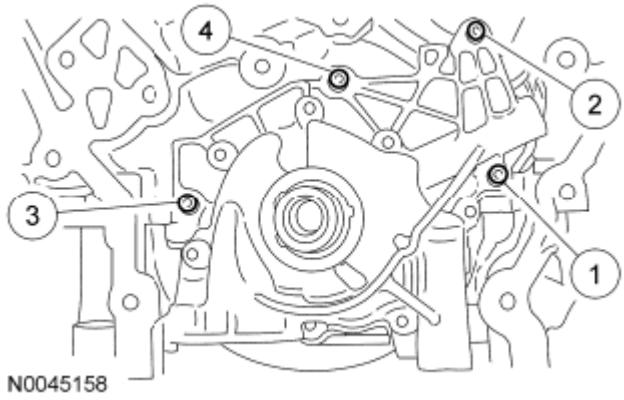


Fig. 254: Identifying Oil Pump Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Do not scratch the camshaft sealing surface while removing the camshaft oil seal. If scratched, camshaft oil seal leakage may occur.

 © 2011 Mitchell Repair Information Company, LLC.

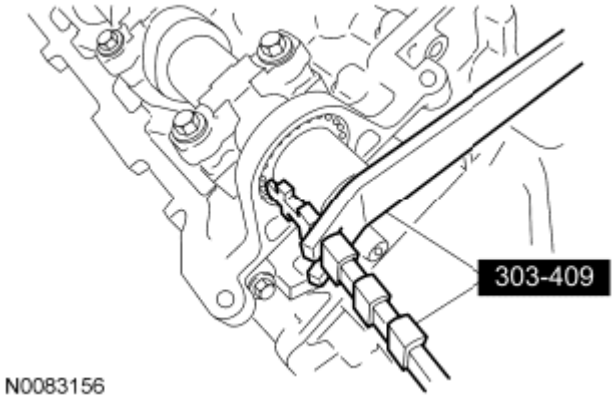


Fig. 255: Removing Camshaft Oil Seal Using Oil Seal Remover
Courtesy of FORD MOTOR CO.

76. Using the Oil Seal Remover, remove the camshaft oil seal and discard.
77. Remove the 2 bolts and the camshaft oil seal retainer.
    - Discard the press-in-place gasket.

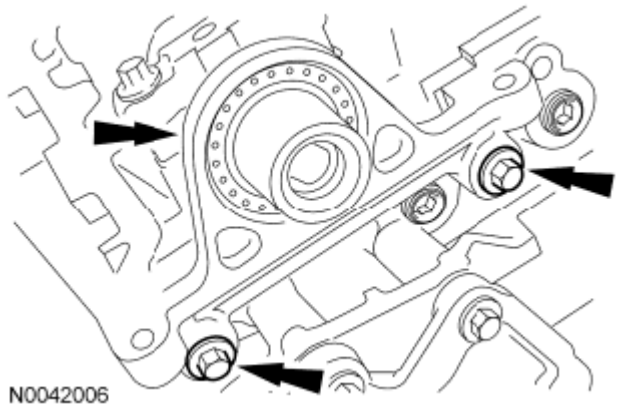


Fig. 256: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of FORD MOTOR CO.

NOTE: The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.

 © 2011 Mitchell Repair Information Company, LLC.

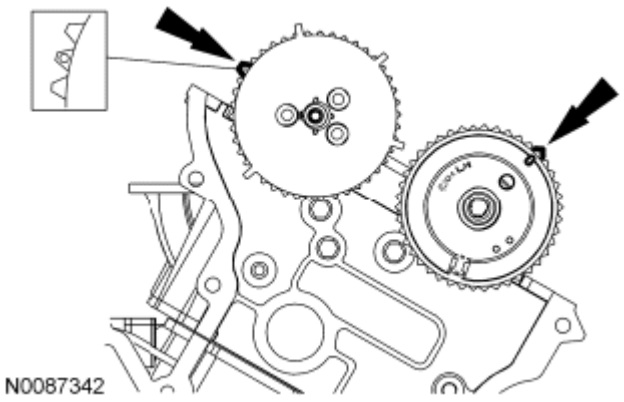


Fig. 257: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

78. Verify the LH camshafts are in the neutral position.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

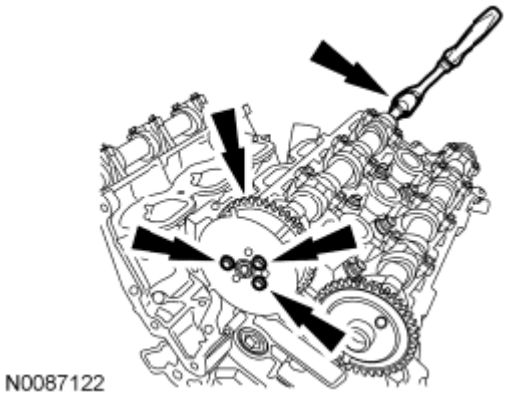


Fig. 258: Locating LH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

79. Remove the 3 bolts and the LH camshaft phaser and sprocket.
80. Remove and discard the **VCT** system oil filter screen from the LH camshaft.

 © 2011 Mitchell Repair Information Company, LLC.

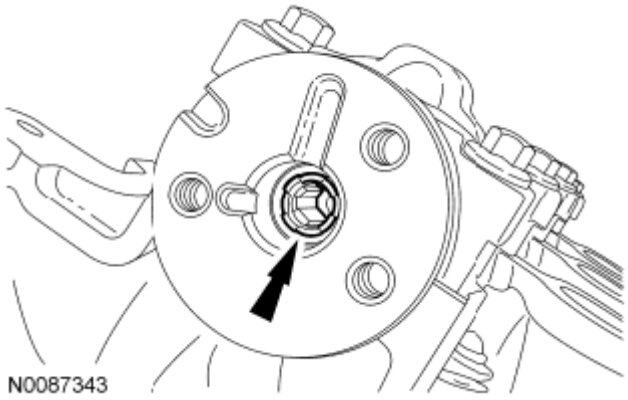


Fig. 259: Locating VCT System Oil Filter Screen
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.

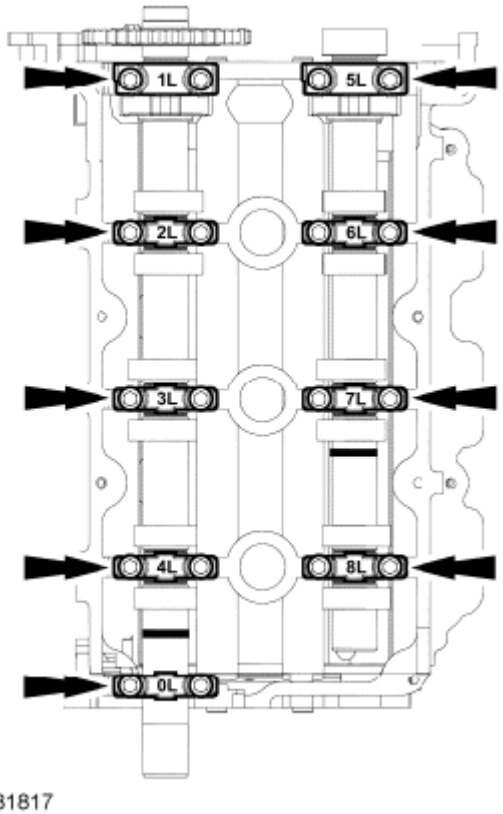


Fig. 260: Locating Camshaft Bearing Cap
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

81. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

NOTE: After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (1L and 5L) first, or damage to the thrust caps may occur.

NOTE: Make sure the camshaft bearing caps are marked as instructed in the previous step.

82. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (1L and 5L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

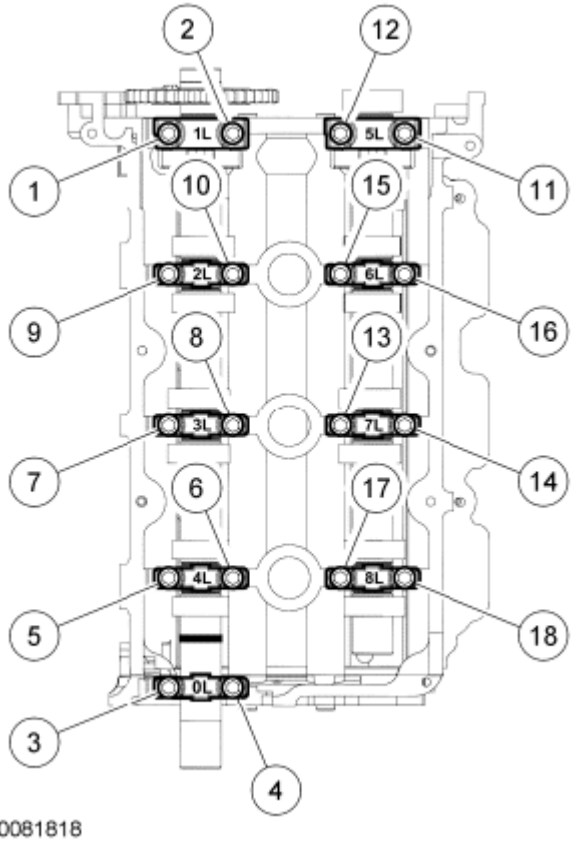


Fig. 261: Identifying Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: The camshafts must be in the neutral position before removing the bearing caps or damage to the engine may occur.

 © 2011 Mitchell Repair Information Company, LLC.

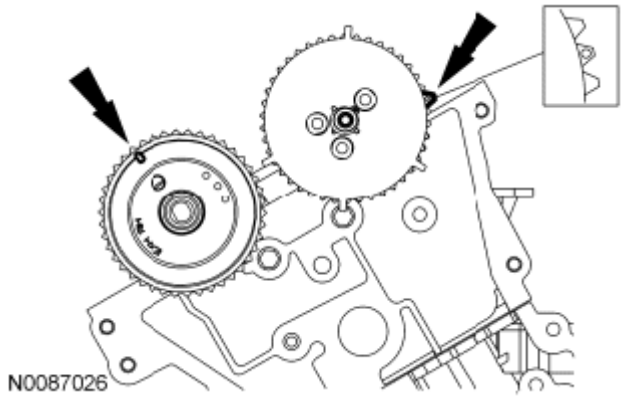


Fig. 262: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

83. Verify the RH camshafts are in the neutral position.

NOTE: Do not allow the camshaft to rotate from the neutral position while removing the camshaft phaser and sprocket or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for removal of the camshaft phaser and sprocket bolts.

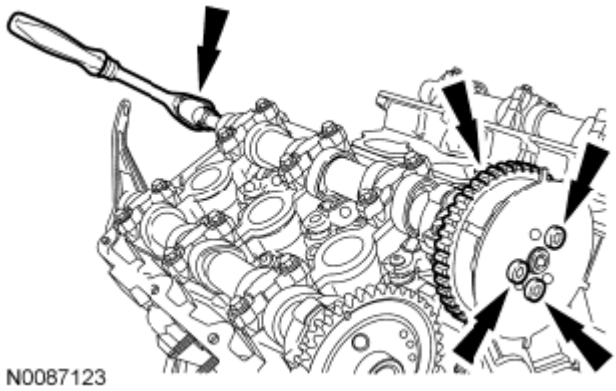


Fig. 263: Locating RH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

84. Remove the 3 bolts and the RH camshaft phaser and sprocket.
85. Remove and discard the **VCT** system oil filter screen from the RH camshaft.

 © 2011 Mitchell Repair Information Company, LLC.

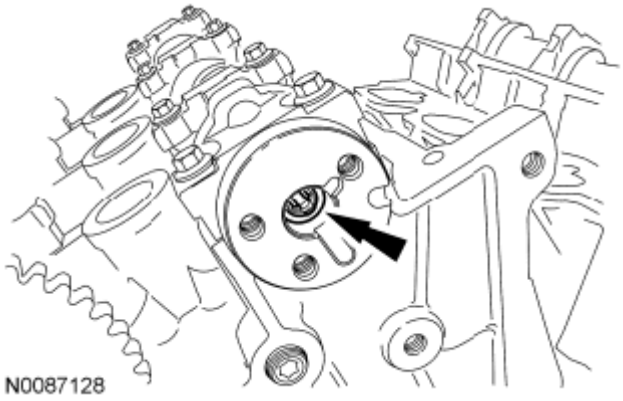


Fig. 264: Locating VCT System Oil Filter
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft bearing caps must be assembled in their original positions. Some engines have factory markings on the camshaft bearing caps (as shown in illustration). Engines that do not have the factory markings must be marked for correct position and orientation prior to removal. Failure to install the camshaft bearing caps in their original positions may result in severe engine damage.

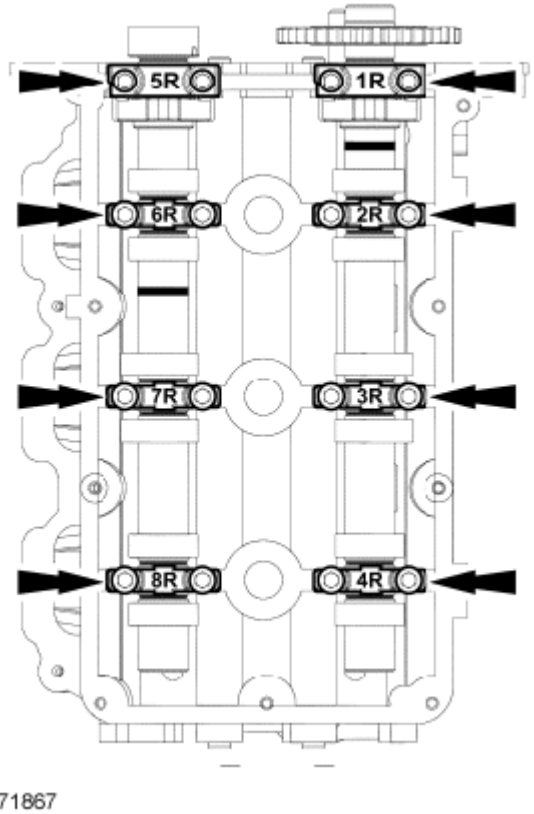


Fig. 265: Locating Camshaft Bearing Cap
Courtesy of FORD MOTOR CO.

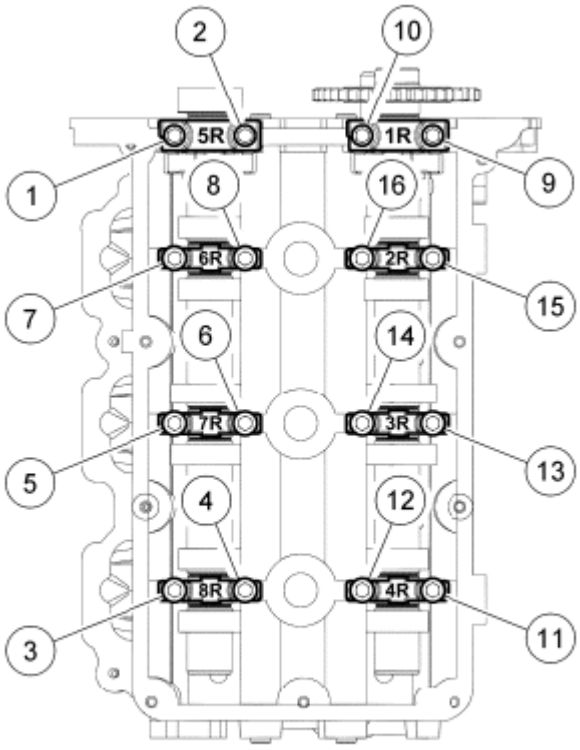
 © 2011 Mitchell Repair Information Company, LLC.

86. If necessary, mark the camshaft bearing cap position and orientation as shown in the illustration.

NOTE: After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (5R and 1R) first, or damage to the thrust caps may occur.

NOTE: Make sure the camshaft bearing caps are marked as instructed in the previous step.

87. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (5R and 1R).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.



N0053678

Fig. 266: Identifying Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: RH shown, LH similar.

88. Remove the LH and RH camshaft roller followers.
    - Mark the location of the roller followers, using a permanent-type marker.

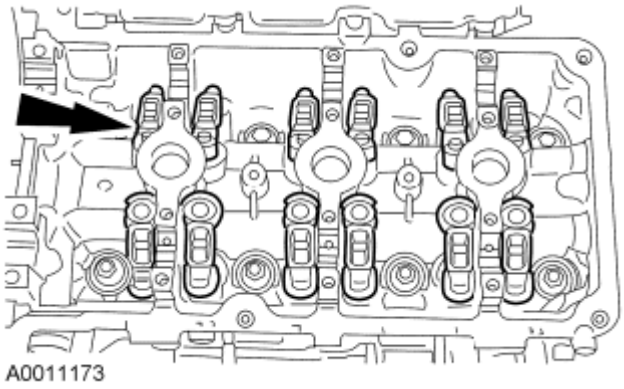


Fig. 267: Locating Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

89. Remove the hydraulic lash adjusters.

NOTE: RH shown, LH similar.

90. Loosen the bolts in the indicated sequence and remove the LH and RH cylinder heads.
    - Discard the bolts and the gaskets.

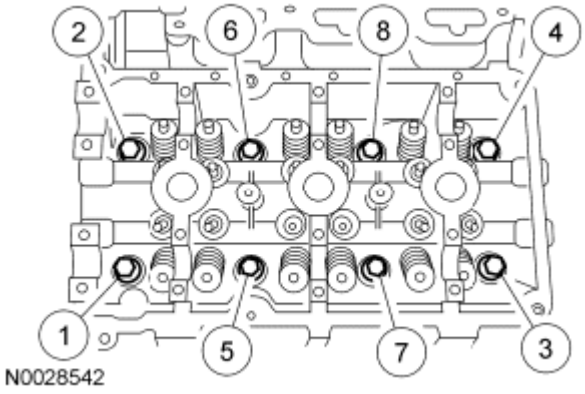


Fig. 268: Identifying Cylinder Heads Bolts In Sequence
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

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.

91. Clean the cylinder head gasket surfaces with a plastic scraping tool and metal surface prep.
92. Support the cylinder heads on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** .
93. Remove the bolts and the oil separator cover.
    - Discard the gasket.

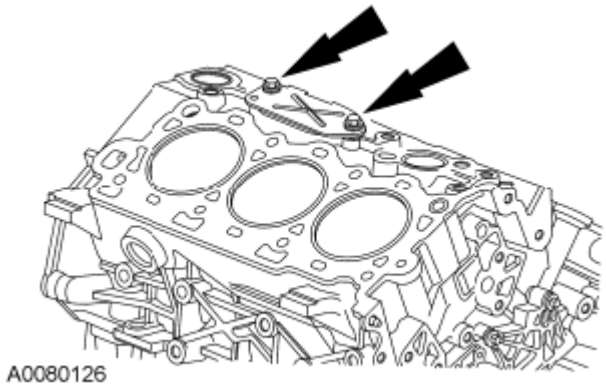


Fig. 269: Locating Bolts And Oil Separator Cover
Courtesy of FORD MOTOR CO.

94. Remove the crankshaft key.

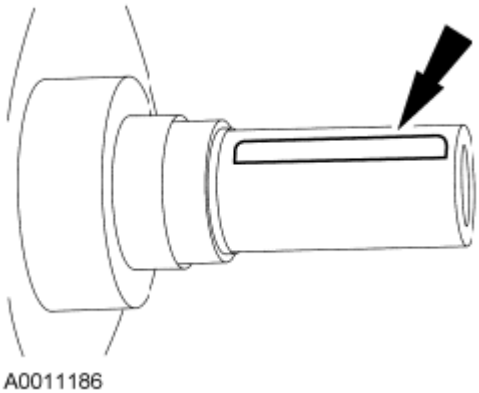


Fig. 270: Locating Crankshaft Key
Courtesy of FORD MOTOR CO.

95. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following manufacturer's instructions.

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Clearly mark the position and orientation of the pistons, connecting rods, connecting rod caps and connecting rod bearings for reassembly.

96. Remove the connecting rod cap bolts and cap.
    - Discard the connecting rod cap bolts.

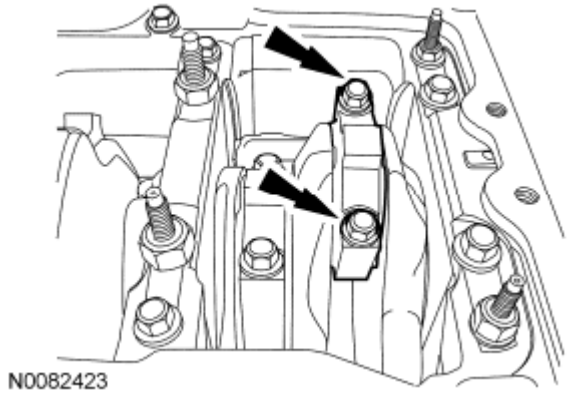


Fig. 271: Locating Connecting Rod Cap Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not scratch the cylinder walls or crankshaft journals with the connecting rod.

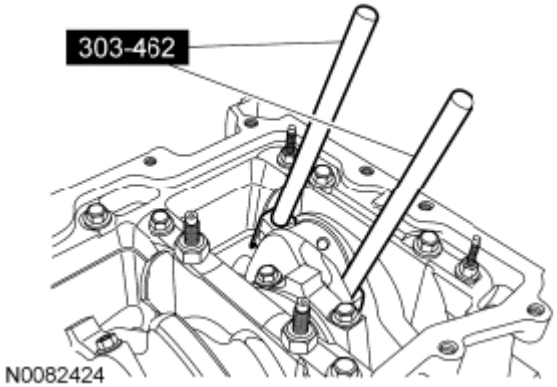


Fig. 272: Identifying Connecting Rod Installer
Courtesy of FORD MOTOR CO.

97. Using the Connecting Rod Installer, remove the piston/rod assembly from the engine block.
98. Repeat the previous 2 steps until all of the piston/rod assemblies are removed from the engine block.
99. Remove the engine block from the stand and place on a workbench.
100. Remove the bolts and studs in the indicated sequence.
    - Discard the lower cylinder block bolts.
    - Remove the lower cylinder block.

 © 2011 Mitchell Repair Information Company, LLC.

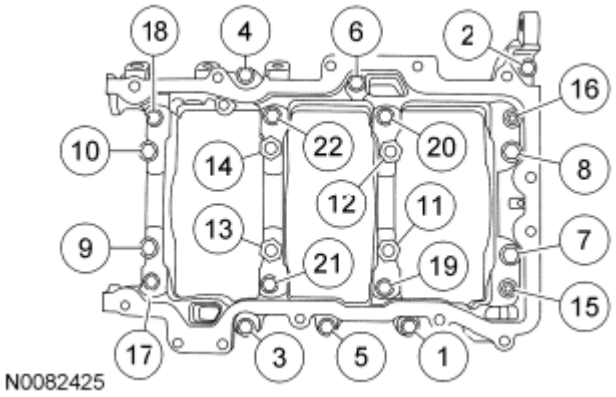


Fig. 273: Identifying Lower Cylinder Block Bolts In Sequence
Courtesy of FORD MOTOR CO.

101. Remove the crankshaft rear main seal.
    - Remove the crankshaft.

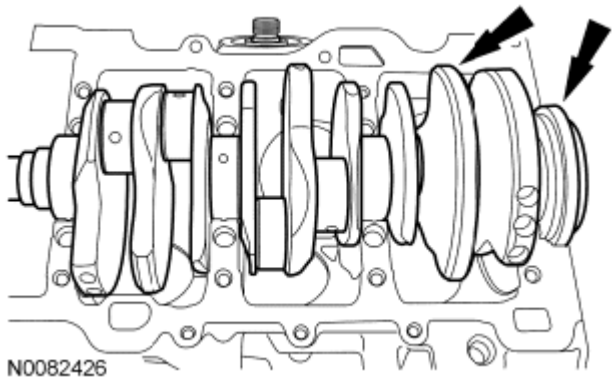


Fig. 274: Locating Crankshaft And Crankshaft Rear Main Seal
Courtesy of FORD MOTOR CO.

102. Remove the crankshaft thrust bearing from the cylinder block.

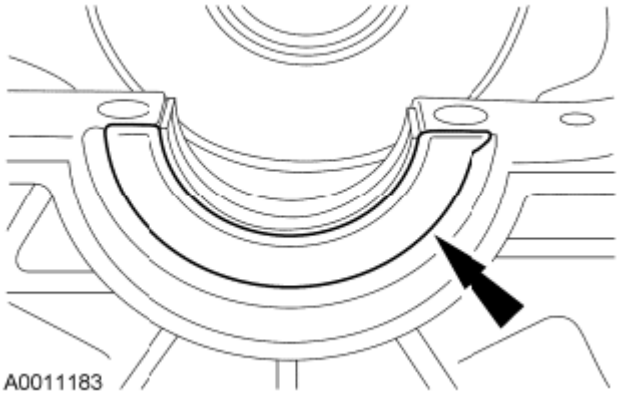


Fig. 275: Locating Crankshaft Thrust Bearing

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

NOTE: If the main bearings are being reused, mark them for correct position and orientation for reassembly.

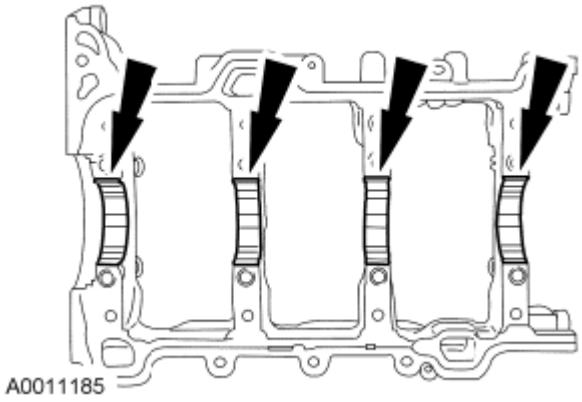


Fig. 276: Locating Bearings
Courtesy of FORD MOTOR CO.

103. Remove the bearings from the lower cylinder block.

NOTE: If the main bearings are being reused, mark them for correct position and orientation for reassembly.

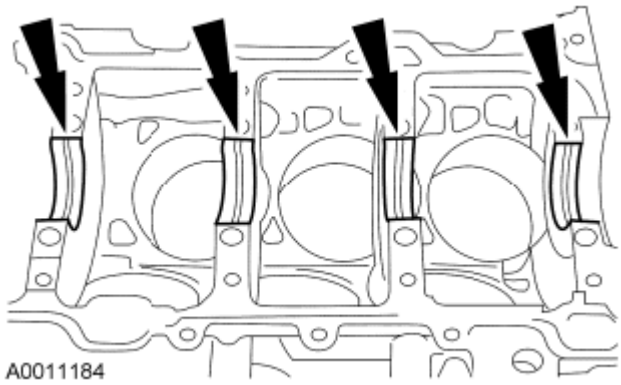


Fig. 277: Locating Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

104. Remove the crankshaft main bearings from the cylinder block.
105. Inspect the cylinder block, lower cylinder block, pistons and connecting rods. For additional information, refer to **GENERAL PROCEDURES** .

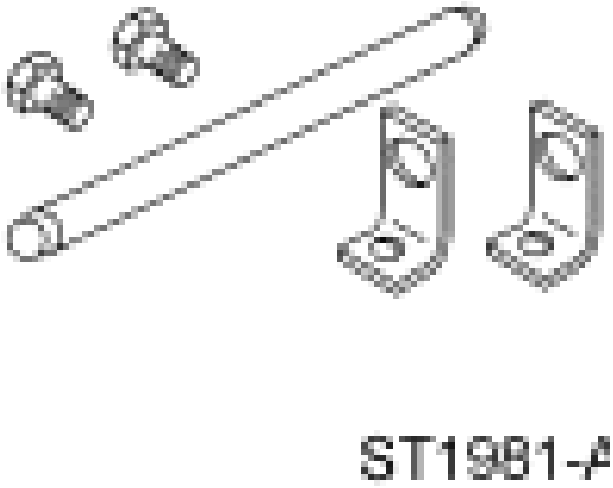
DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

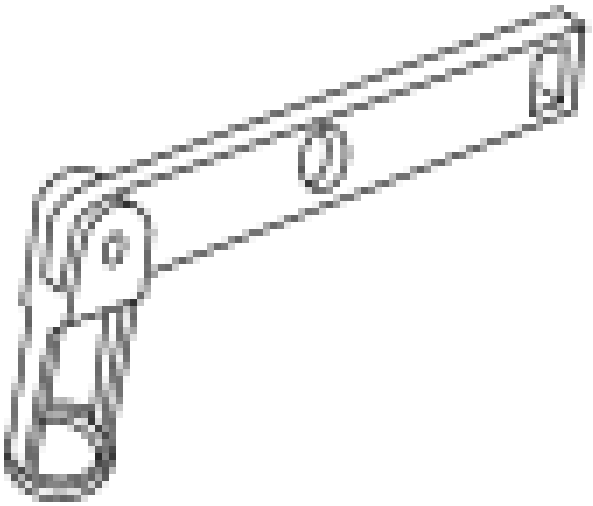
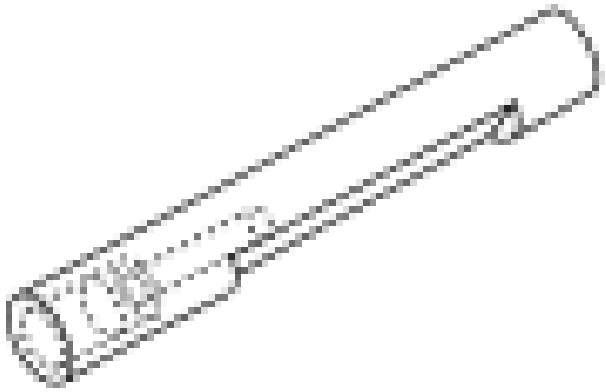
 © 2011 Mitchell Repair Information Company, LLC.

Special Tool(s)

SPECIAL TOOL CHART

 ST1981-A	Compressor, Valve Spring 303-300 (T87C-6565-A)
 ST1907-A	Compressor, Valve Spring 303-350 (T89P-6565-A)

 © 2011 Mitchell Repair Information Company, LLC.

 ST1902-A	Compressor, Valve Spring 303-1418
 ST1906-A	Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)

Cylinder Head

 © 2011 Mitchell Repair Information Company, LLC.

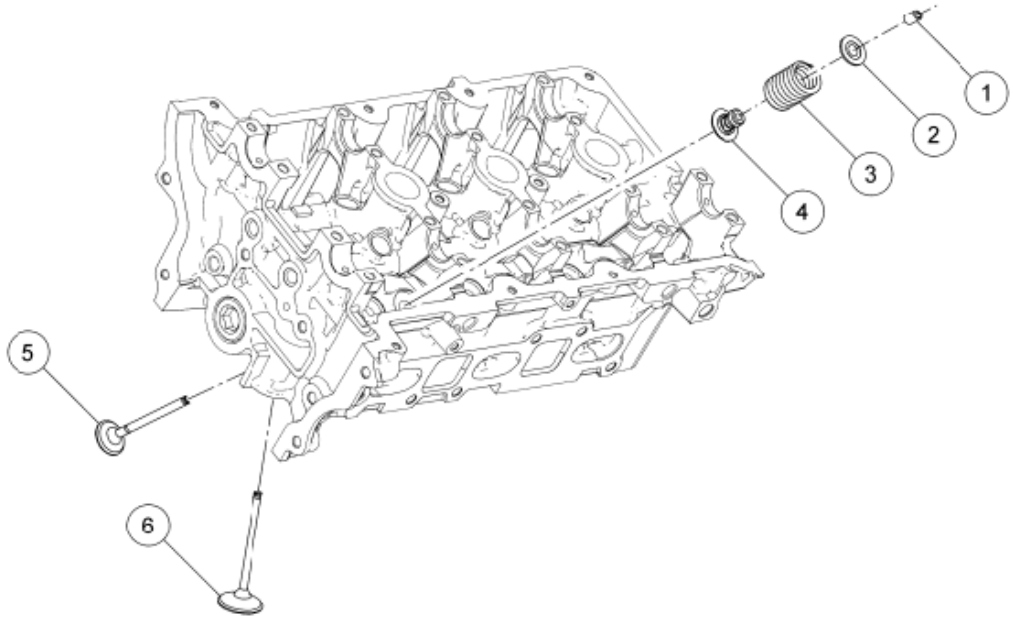


Fig. 278: Identifying Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6518	Valve spring retainer key (24 required)
2	6514	Valve spring retainer (12 required)
3	6513	Valve spring (12 required)
4	6A517	Valve stem seal (12 required)
5	6505	Intake valve (6 required)
6	6507	Exhaust valve (6 required)

Disassembly

NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components removed for locations. If not reassembled in their original positions, severe engine damage may occur.

1. Using the Valve Spring Compressors, remove the keys, retainer and spring.

 © 2011 Mitchell Repair Information Company, LLC.

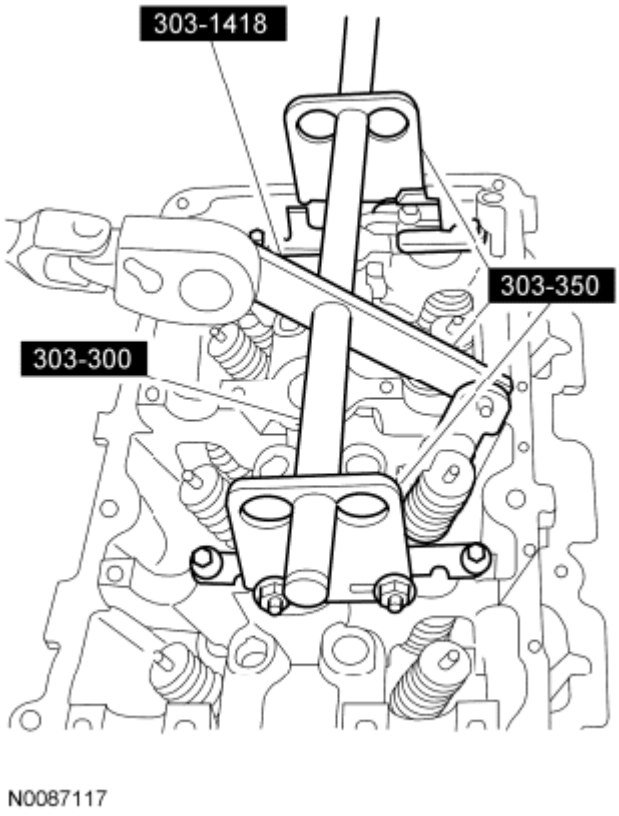


Fig. 279: Identifying Valve Spring Compressors
Courtesy of FORD MOTOR CO.

2. Remove the valve from the cylinder head.
3. Remove the valve stem seal.

Assembly

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

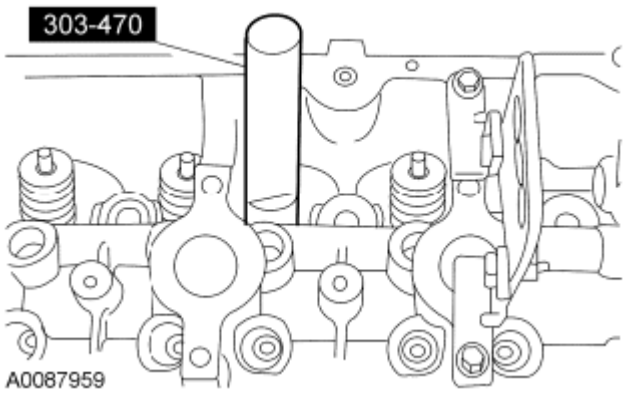


Fig. 280: Identifying Valve Stem Oil Seal Installer
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

2. Install the valve.
3. Using the Valve Spring Compressors, install the valve spring, retainer and keys.

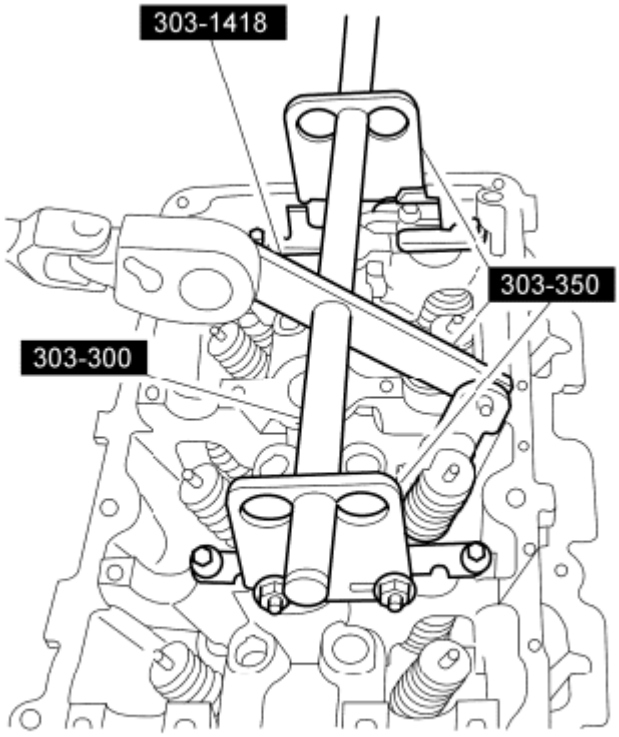


Fig. 281: Identifying Valve Spring Compressors
Courtesy of FORD MOTOR CO.

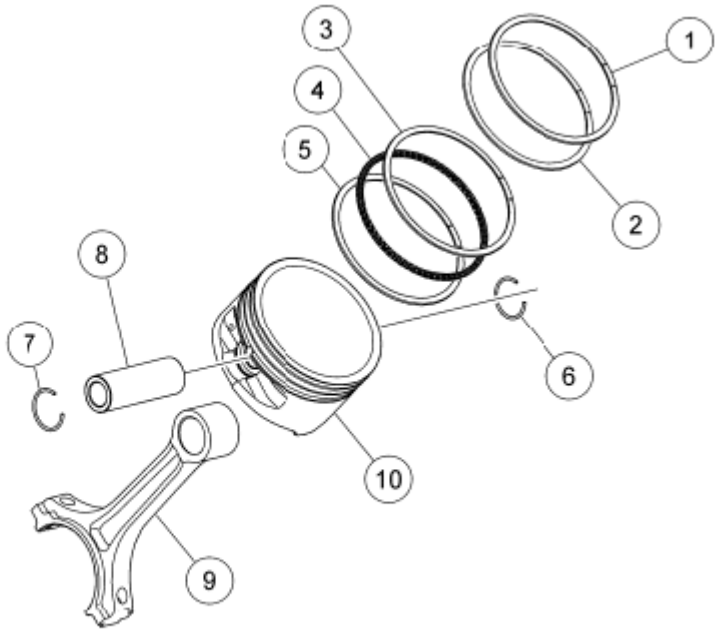
PISTON

Material

MATERIAL SPECIFICATIONS

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

 © 2011 Mitchell Repair Information Company, LLC.



N0010114

Fig. 282: Identifying Piston Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6150	Piston compression upper ring
2	6152	Piston compression lower ring
3	6159	Piston oil control upper segment ring
4	6161	Piston oil control spacer
5	6159	Piston oil control lower segment ring
6	6140	Piston pin retainer
7	6140	Piston pin retainer
8	6135	Piston pin
9	6200	Connecting rod
10	6110	Piston

Disassembly

1. Remove the piston rings from the piston.
    - Discard the piston rings.
2. Remove the 2 piston pin retainers and the piston pin.

NOTE: If the piston and connecting rod are to be reinstalled, they must be

 © 2011 Mitchell Repair Information Company, LLC.

assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.

3. Separate the piston from the connecting rod.
4. Clean and inspect the piston and connecting rod. For additional information, refer to **GENERAL PROCEDURES** .

Assembly

1. Align the piston-to-connecting rod orientation marks and position the connecting rod in the piston.
2. Lubricate the piston pin and pin bore with clean engine oil.
3. Install the piston pin in the piston and connecting rod assembly.
4. Install the piston pin retaining clips in the piston.
5. Lubricate the piston and the new piston rings with clean engine oil.

NOTE: The piston compression lower ring should be installed with the "O" mark on the ring face pointing up toward the top of the piston.

NOTE: When installing the piston oil control spacer, orient the gap such that the cut ends are pointed toward the top of the piston.

6. Install the piston rings onto the piston as shown.
    1. Center line of the piston parallel to the wrist pin bore
    2. Upper compression ring gap location
    3. Upper oil control segment ring gap location
    4. Lower oil control segment ring gap location
    5. Expander ring and lower compression ring gap location

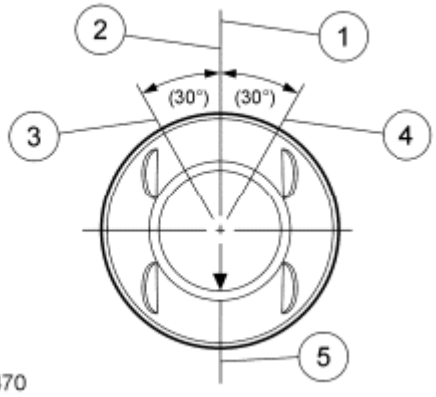


Fig. 283: Identifying Piston Ring Gap Position
Courtesy of FORD MOTOR CO.

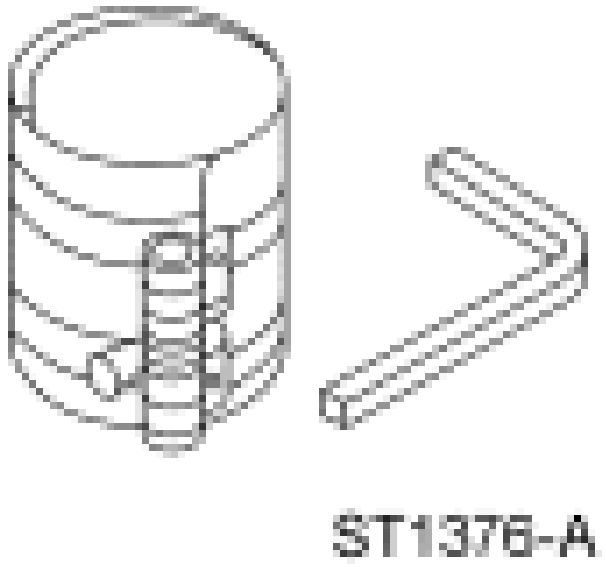
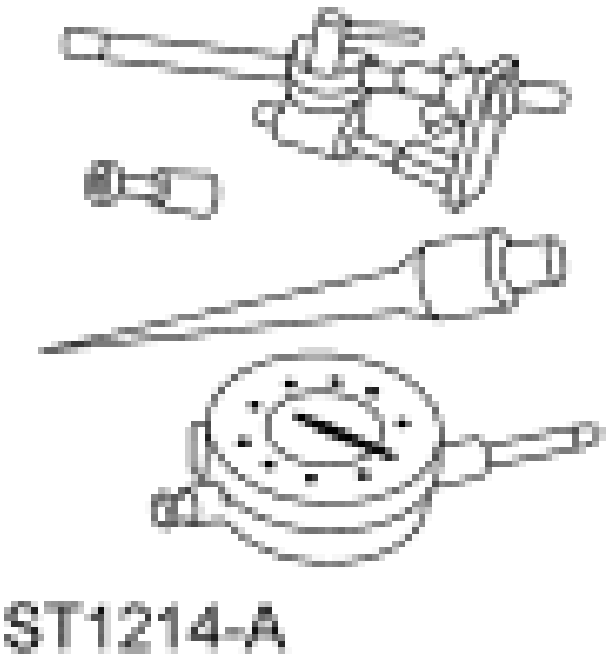
ASSEMBLY

 © 2011 Mitchell Repair Information Company, LLC.

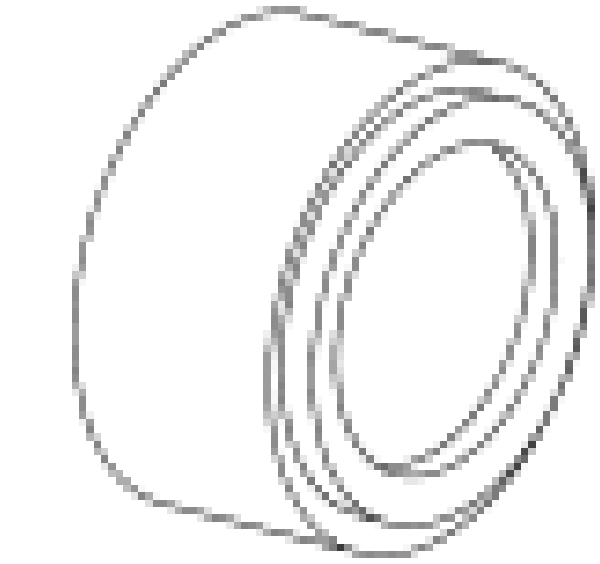
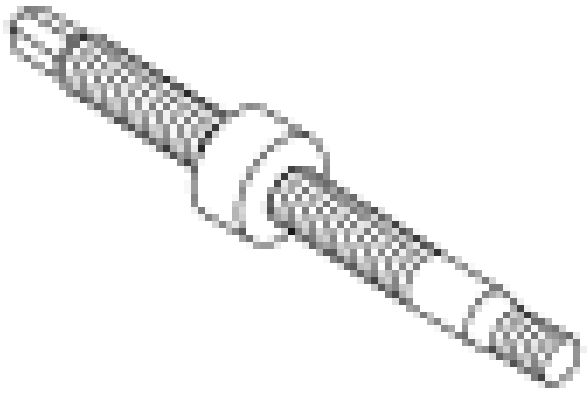
ENGINE

Special Tool(s)

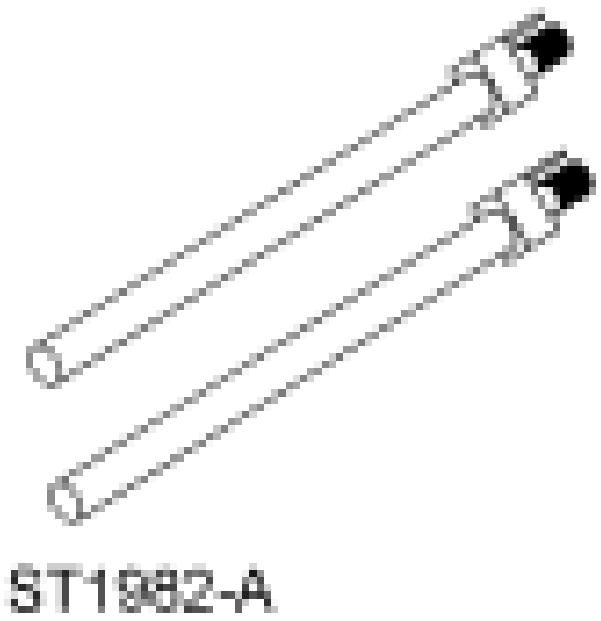
SPECIAL TOOL CHART

	Compressor, Piston Ring 303-D032 (D81L-6002-C)
	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)

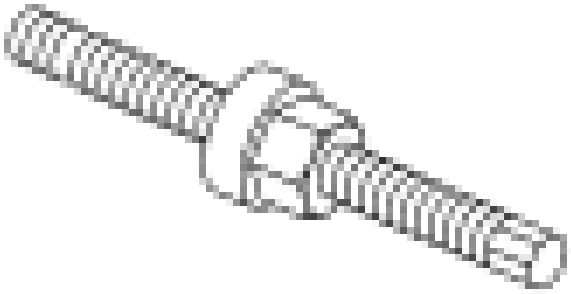
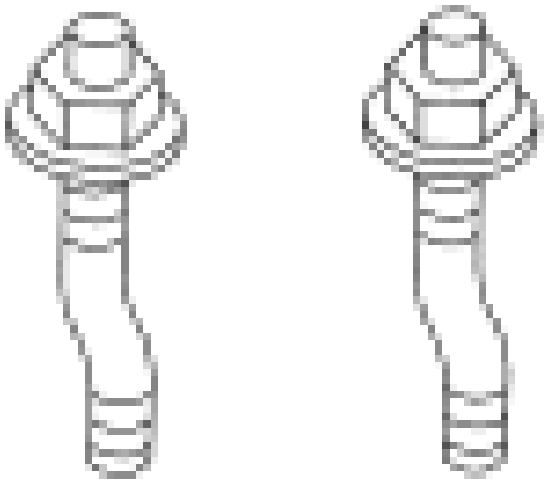
 © 2011 Mitchell Repair Information Company, LLC.

 ST1070-A	Installer, Camshaft Oil Seal 303-464 (T94P-6256-BH)
 ST3042-A	Installer, Camshaft Pulley 303-458 (T94P-6312-AH3), part of 303-S455

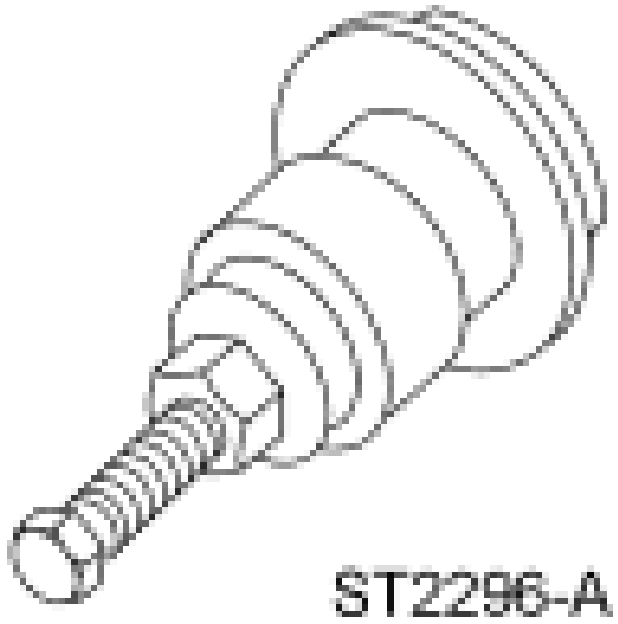
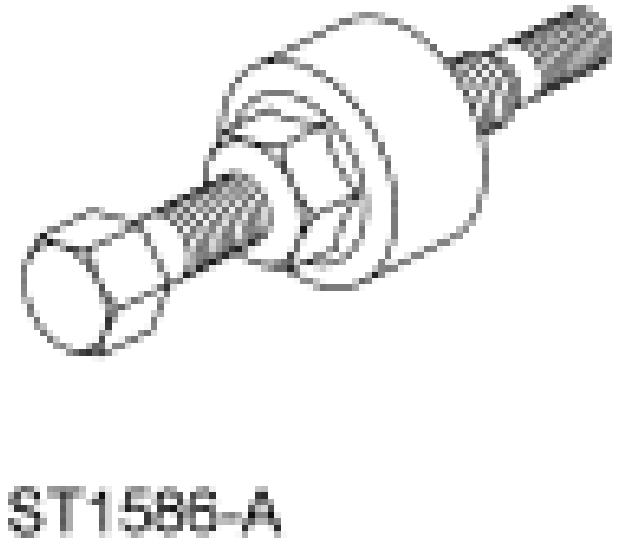
 © 2011 Mitchell Repair Information Company, LLC.

	Installer, Connecting Rod 303-462 (T94P-6136-AH)
	Installer, Crankshaft Rear Main Oil Seal 303-178 (T82L-6701-A)
	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

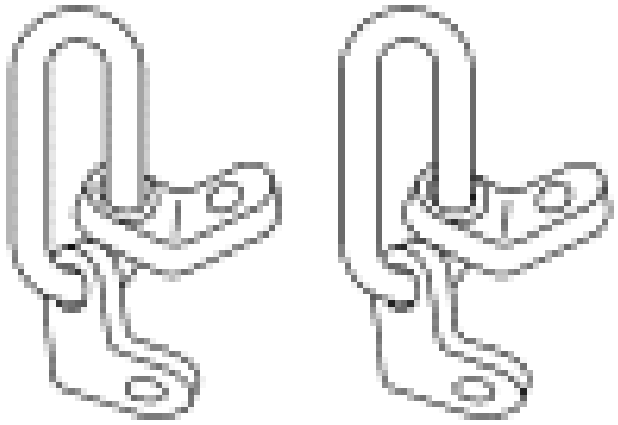
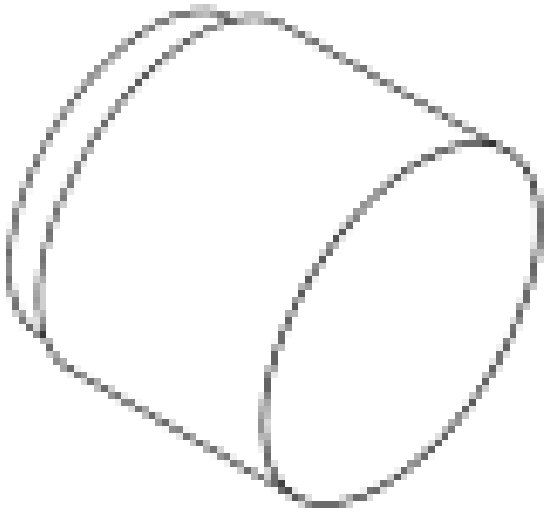
 © 2011 Mitchell Repair Information Company, LLC.

 ST1287-A	
 ST1333-A	Installer Bolts, Crankshaft Rear Main Oil Seal 303-384 (T91P-6701-A)

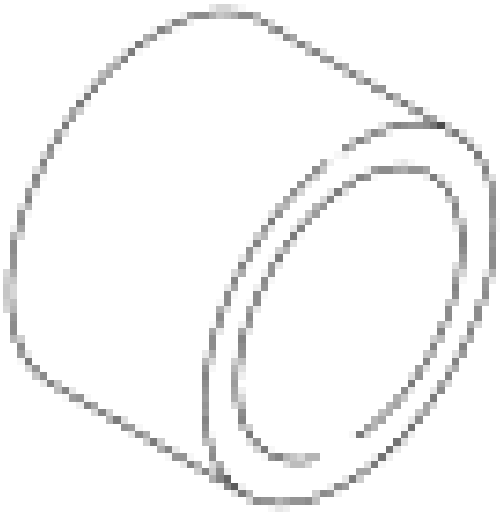
 © 2011 Mitchell Repair Information Company, LLC.

	Installer, Front Cover Oil Seal 303-335 (T88T-6701-A)
	Installer, Power Steering Pump Pulley 211-185 (T91P-3A733-A)
	Lifting Bracket, Engine

 © 2011 Mitchell Repair Information Company, LLC.

 ST1595-A	303-050 (T70P-6000)
 ST2060-A	Protector, Camshaft Oil Seal 303-463 (T94P-6256-AH)

 © 2011 Mitchell Repair Information Company, LLC.

 ST3043-A	Spacer, Water Pump Pulley 303-459 (T94P-6312-AH4), part of 303-S455
 ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3) or equivalent

Material

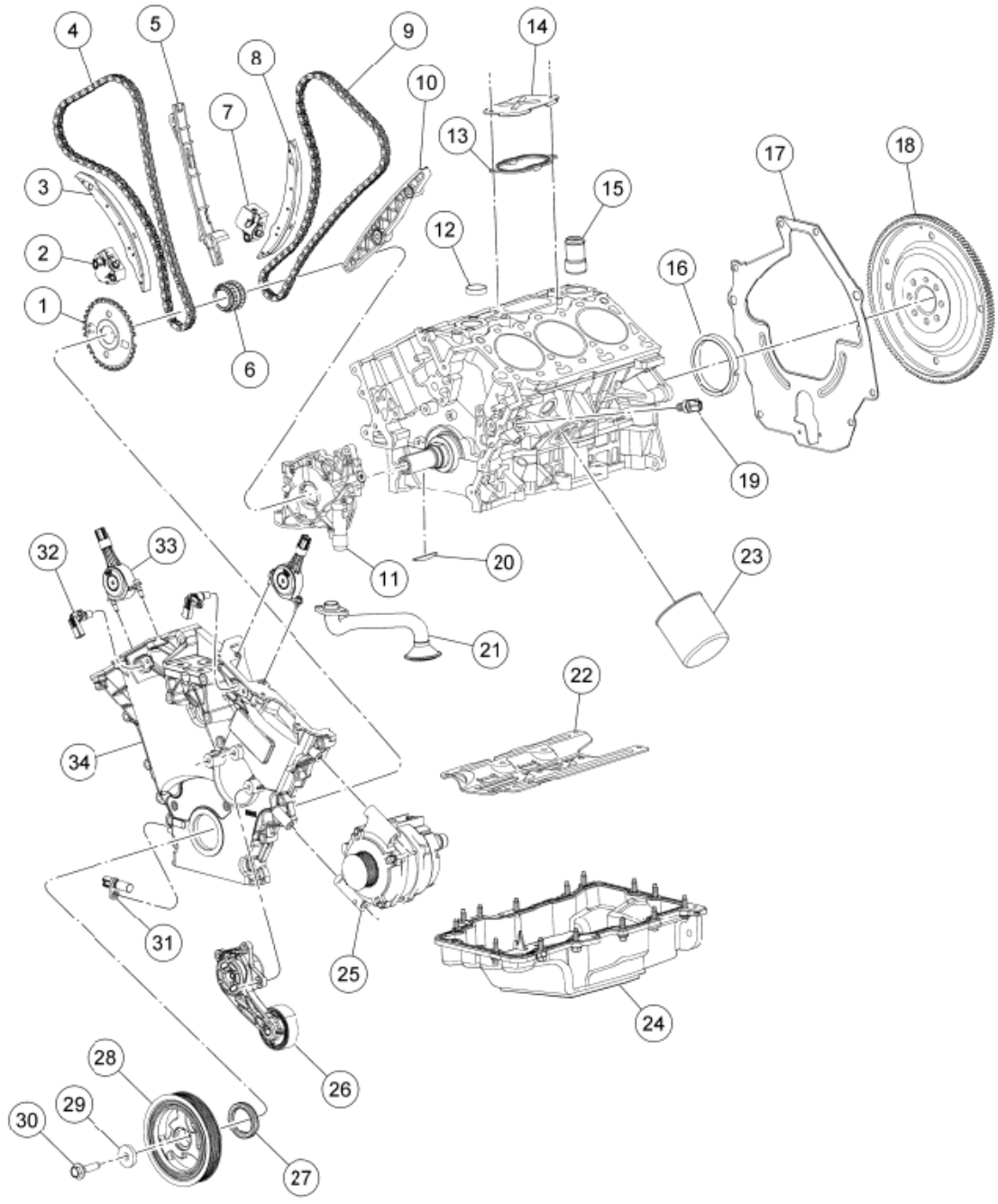
MATERIAL SPECIFICATIONS

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

 © 2011 Mitchell Repair Information Company, LLC.

XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Lower Engine Block (View 1)



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 284: Exploded View Of Lower Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	12A227	Ignition pulse wheel
2	6L266	RH timing chain tensioner
3	6K255	RH timing chain tensioner arm
4	6268	RH timing chain
5	6M256	RH timing chain guide
6	6306	Crankshaft sprocket
7	6L266	LH timing chain tensioner
8	6K255	LH timing chain tensioner arm
9	6268	LH timing chain
10	6B297	LH timing chain guide
11	6621	Oil pump
12	W701923	Cup plug
13	6B752	Oil separator gasket
14	6869	Oil separator cover
15	8A505	Water inlet tube
16	6701	Crankshaft rear oil seal
17	6A373	Spacer plate
18	6375	Flexplate
19	9278	Engine Oil Pressure (EOP) switch
20	W701528	Woodruff key
21	6622	Oil pickup tube and screen
22	6687	Oil pan baffle
23	6714	Oil filter
24	6675	Oil pan
25	10300	Generator
26	6B209	Accessory drive belt tensioner
27	6700	Crankshaft front seal
28	6316	Crankshaft vibration damper
29	N806165	Crankshaft vibration damper washer
30	W701512	Crankshaft vibration damper bolt
31	6C315	Crankshaft Position (CKP) sensor
32	12K073	Camshaft Position (CMP) sensor (2 required)
33	6M280	Variable Camshaft Timing (VCT) solenoid (2 required)
34	6019	Front cover

Lower Engine Block (View 2)

 © 2011 Mitchell Repair Information Company, LLC.

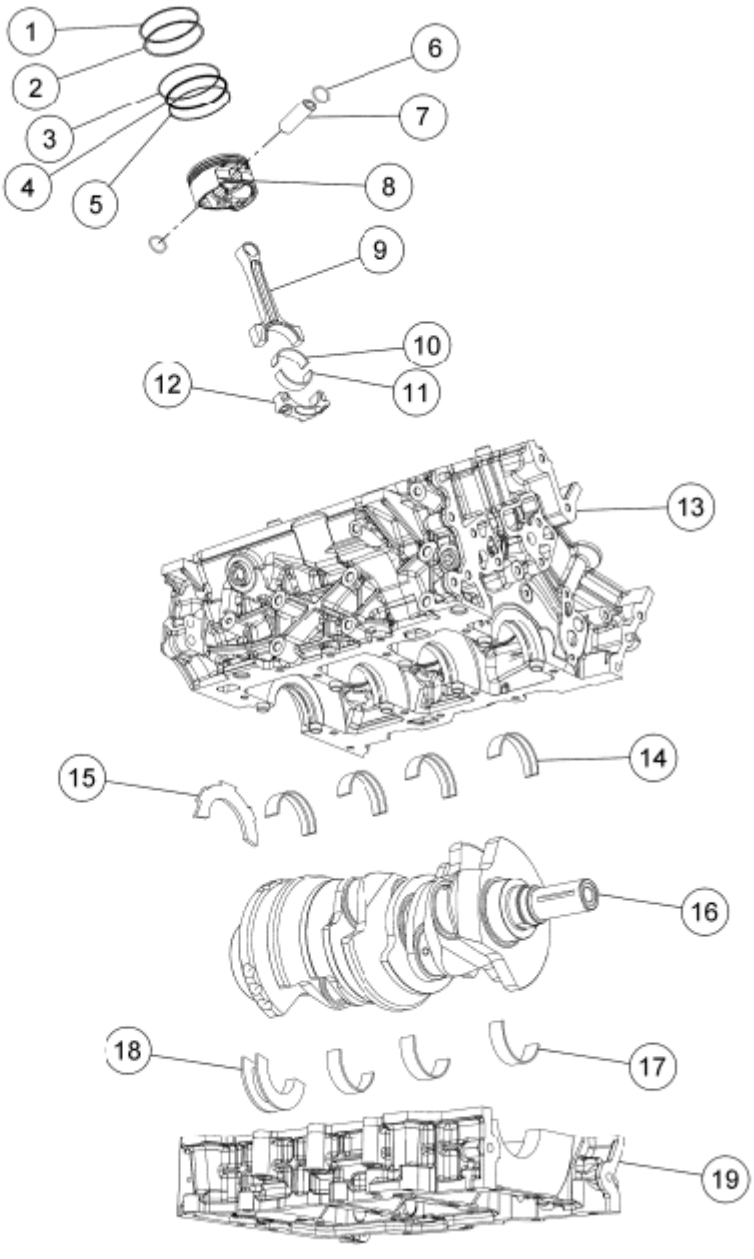


Fig. 285: Exploded View Of Lower Engine Block
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6150	Piston compression upper ring (6 required)
2	6152	Piston compression lower ring (6 required)
3	6159	Piston oil control upper segment ring (6 required)
4	6161	Piston oil control spacer (6 required)
5	6159	Piston oil control lower segment ring (6 required)
6	6140	Piston pin retainer (12 required)

 © 2011 Mitchell Repair Information Company, LLC.

7	6135	Piston pin (6 required)
8	6110	Piston (6 required)
9	6200	Connecting rod (6 required)
10	6211	Connecting rod upper bearing (6 required)
11	6211	Connecting rod lower bearing (6 required)
12	6210	Connecting rod cap (6 required)
13	6010	Cylinder block
14	6333	Cylinder block crankshaft main bearing (4 required)
15	6A341	Crankshaft upper thrust bearing
16	6303	Crankshaft
17	6333	Lower cylinder block crankshaft main bearings (3 required)
18	6337	Lower cylinder block crankshaft main thrust bearing
19	6F095	Lower cylinder block

Cylinder Heads and Intake Manifolds

 © 2011 Mitchell Repair Information Company, LLC.

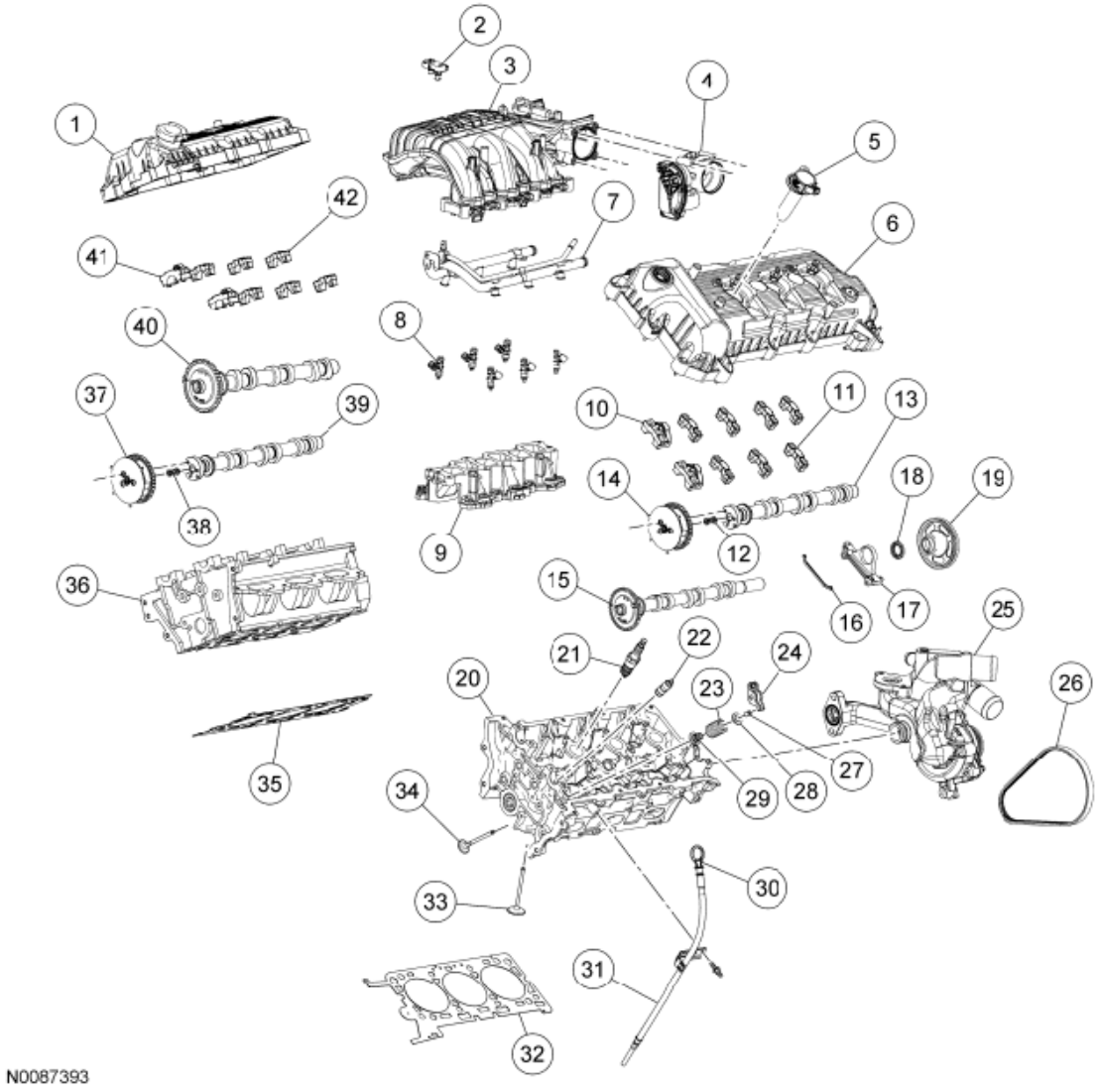


Fig. 286: Exploded View Of Cylinder Heads And Intake Manifolds
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6582	RH valve cover
2	9F479	Mass Air Flow (MAF) sensor
3	9424	Upper intake manifold
4	9F991	Throttle Body (TB)
5	12029	Coil-on-plug (6 required)
6	6A505	LH valve cover
7	9F792	Fuel rail
8	9F593	Fuel injector (6 required)
9	9424	Lower intake manifold

 © 2011 Mitchell Repair Information Company, LLC.

10	6B280	Camshaft thrust bearing cap
11	6B280	Camshaft bearing cap
12	6C683	LH Variable Camshaft Timing (VCT) system oil filter
13	6A267	LH intake camshaft
14	6C524	LH camshaft phaser and sprocket
15	6A269	LH exhaust camshaft
16	6B295	Camshaft oil seal retainer gasket
17	6B293	Camshaft oil seal retainer
18	-	Camshaft oil seal
19	6A359	Coolant pump drive pulley
20	6050	LH cylinder head
21	12405	Spark plug (6 required)
22	6C501	Hydraulic lash adjuster (24 required)
23	6513	Valve spring (24 required)
24	6529	Camshaft roller follower (24 required)
25	8501	Coolant pump housing
26	8K453	Coolant pump belt
27	6518	Valve spring retainer key (48 required)
28	6514	Valve spring retainer (24 required)
29	6A517	Valve stem seal (24 required)
30	-	Oil level indicator
31	6754	Oil level indicator tube
32	6083	LH cylinder head gasket
33	6507	Intake valve (24 required)
34	6505	Exhaust valve (24 required)
35	6051	RH cylinder head gasket
36	6050	RH cylinder head
37	6C524	RH camshaft phaser and sprocket
38	6C683	RH **VCT** system oil filter
39	6A266	RH intake camshaft
40	6A268	RH exhaust camshaft
41	6A268	Camshaft thrust bearing cap
42	6A258	Camshaft bearing cap

NOTE: During engine repair procedures, cleanliness is extremely important. All parts must be thoroughly cleaned and any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: If the oil pan was removed during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in engine oil

 © 2011 Mitchell Repair Information Company, LLC.

leaks.

NOTE: Assembly of the engine requires various inspections/measurements of the engine components (engine block, crankshaft, connecting rods, pistons and piston rings). These inspections/measurements will aid in determining if the engine components will require replacement. For additional information, refer to GENERAL PROCEDURES .

All vehicles

NOTE: This procedure is for selecting bearings using a new crankshaft.

1. Select the crankshaft main bearings for each crankshaft journal.
    1. Read the code on the crankshaft flange.
    2. Read the code on the cylinder block rear face.
        - The first 2 numbers after the asterisk make up the code for main No. 1 and the next 2 numbers for main No. 2.
        - The first 2 numbers after the second asterisk make up the code for main No. 3 and the last 2 numbers for main No. 4.

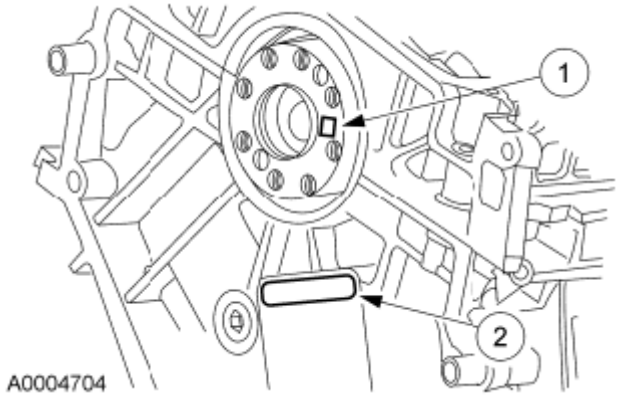


Fig. 287: Identifying Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

2. Using the chart, choose a bearing for each main. Match the block and crankshaft code with its corresponding column or row, by reading across the "crankshaft" row and down the "block" column.
    - For example: If the block code is *0609*0711* and the crankshaft code is *8580*8082*, main No. 1 should use grade 1 bearings, as determined by the intersection of the 06 block column and the 85 crankshaft row. Mains 2, 3 and 4 should all be grade 2.

 © 2011 Mitchell Repair Information Company, LLC.

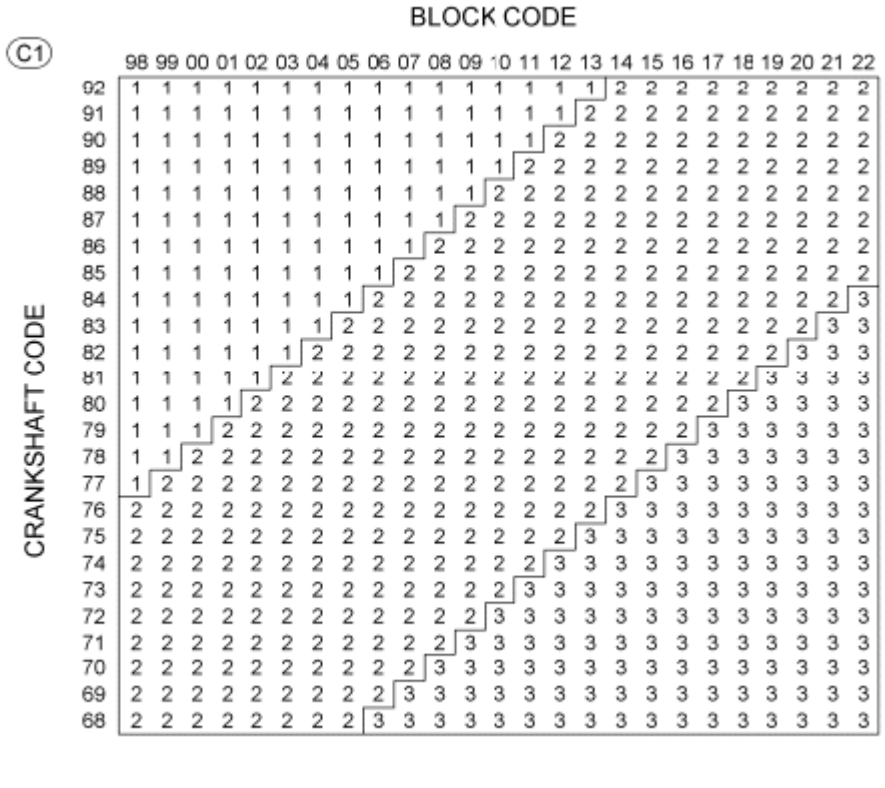


Fig. 288: Crankshaft And Block Code Chart
Courtesy of FORD MOTOR CO.

NOTE: Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.

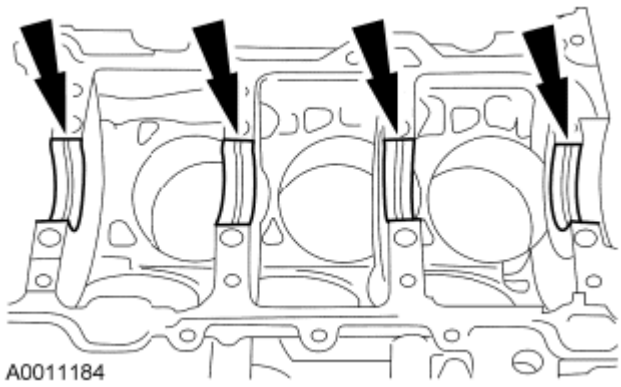


Fig. 289: Locating Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

3. Lubricate the upper crankshaft main bearings with clean engine oil and install the 4 crankshaft main bearings in the cylinder block.
4. Lubricate the lower crankshaft main bearings with clean engine oil and install the 4 crankshaft main

 © 2011 Mitchell Repair Information Company, LLC.

bearings in the lower cylinder block.

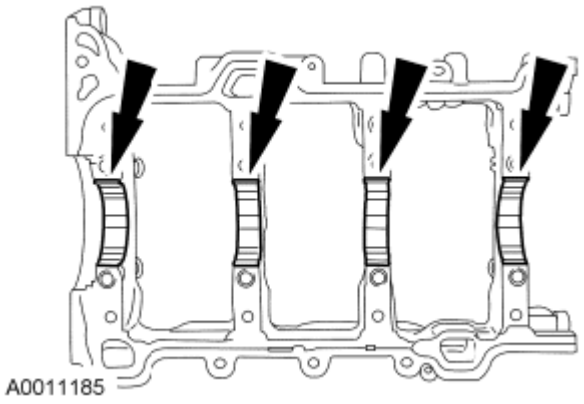


Fig. 290: Locating Bearings
Courtesy of FORD MOTOR CO.

5. Lubricate the crankshaft thrust bearing with clean engine oil and install in the cylinder block.

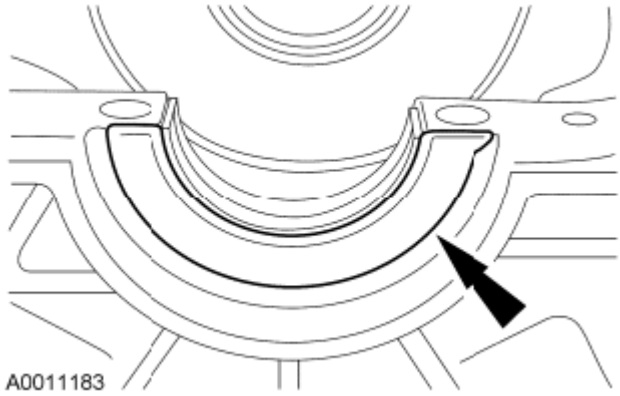
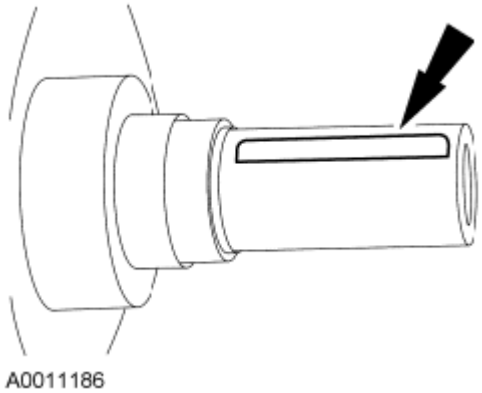


Fig. 291: Locating Crankshaft Thrust Bearing
Courtesy of FORD MOTOR CO.

6. Install the crankshaft key.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 292: Locating Crankshaft Key
Courtesy of FORD MOTOR CO.

7. Apply clean engine oil to the crankshaft main and rod bearing journals.
8. Position the crankshaft in the cylinder block.

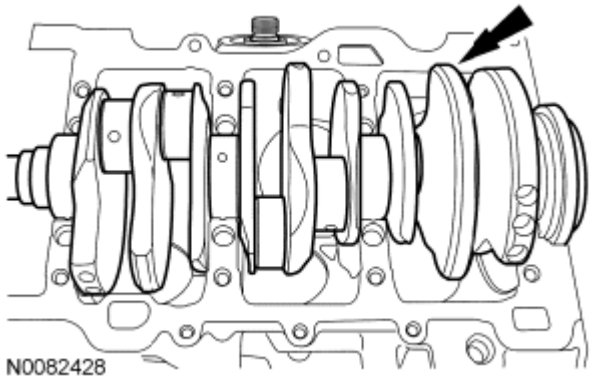


Fig. 293: Locating Crankshaft
Courtesy of FORD MOTOR CO.

NOTE: The lower cylinder block must be installed and the bolts tightened within 4 minutes of applying the sealant.

NOTE: Clean and degrease both surfaces using metal surface prep before applying sealant.

 © 2011 Mitchell Repair Information Company, LLC.

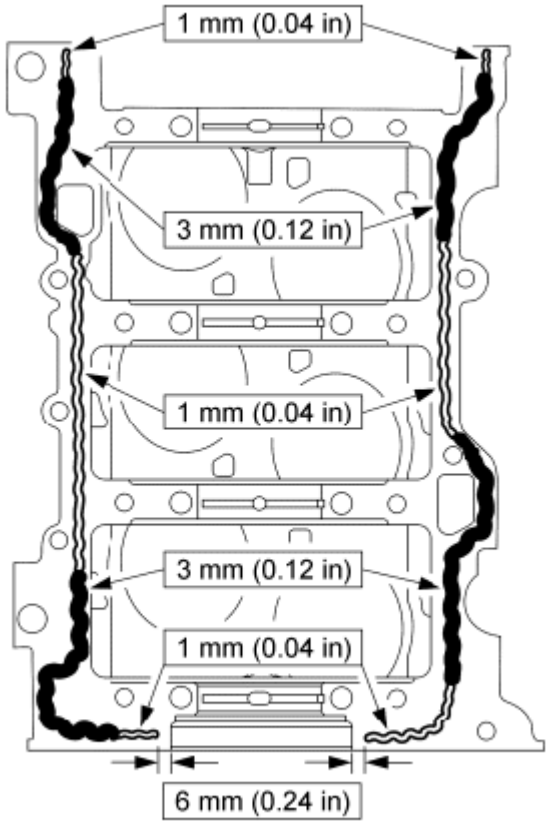


Fig. 294: Applying Gasket And Sealant To Cylinder Block
Courtesy of FORD MOTOR CO.

9. Apply gasket and sealant to the cylinder block as shown.

NOTE: Fasteners No. 5 through 8 are studs. Fasteners No. 18 through 22 are M8 x 1.25 mm x 79.3 mm (0.05 in x 3.12 in) bolts. Fasteners No. 1 through 4, 17 are M8 x 1.25 mm x 96 mm (0.05 in x 3.75 in) bolts. Fasteners 9 through 12 are M10 x 1.5 mm x 106.8 mm (0.06 in x 4.20 in)/M8 x 1.25 mm x 21.5 mm (0.05 in x 0.84 in) studs. Fasteners 13 through 16 are M10 x 1.5 mm x 106.5 mm (0.06 in x 4.17 in) bolts. The bolts and studs must be installed in the correct position or engine damage can result.

10. Position the lower cylinder block and install the new bolts and new studs.
    - Tighten the bolts and studs in the sequence shown in 4 stages.
    - Stage 1: Tighten fasteners 1 through 8 to 25 Nm (18 lb-ft).
    - Stage 2: Tighten fasteners 9 through 16 to 40 Nm (30 lb-ft).
    - Stage 3: Tighten fasteners 1 through 16 an additional 90 degrees.
    - Stage 4: Tighten fasteners 17 through 22 to 25 Nm (18 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

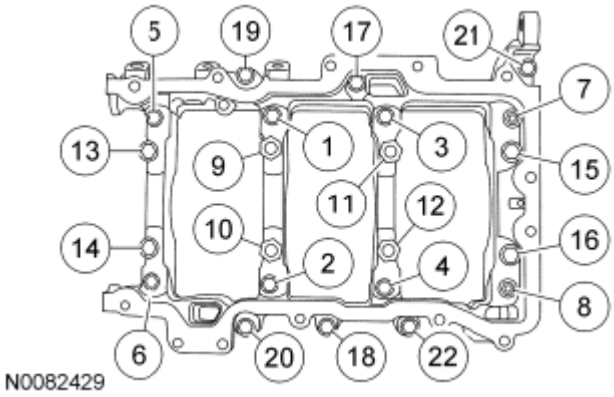


Fig. 295: Identifying Lower Cylinder Block Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Using the Dial Indicator Gauge with Holding Fixture, measure crankshaft end play.
    - Position the crankshaft to the rear of the cylinder block.
    - Zero the Dial Indicator Gauge with Holding Fixture.
    - Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
    - Acceptable crankshaft end play is 0.100-0.255 mm (0.003-0.010 in). If the crankshaft end play exceeds the specified range, install new parts as necessary.

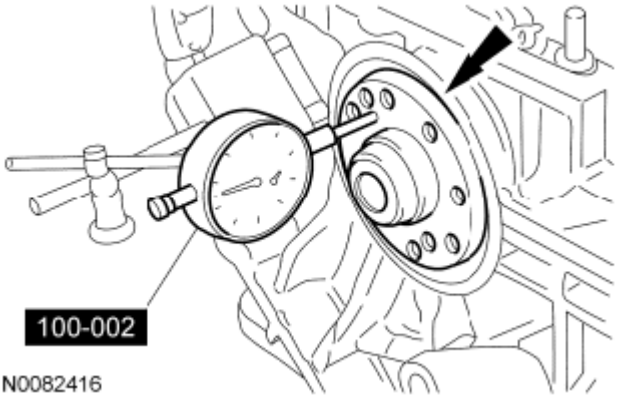


Fig. 296: Measuring Crankshaft End Play
Courtesy of FORD MOTOR CO.

12. Using the Crankshaft Rear Main Oil Seal Installer and the Crankshaft Rear Main Oil Seal Installer Bolts, install the crankshaft rear oil seal.

 © 2011 Mitchell Repair Information Company, LLC.

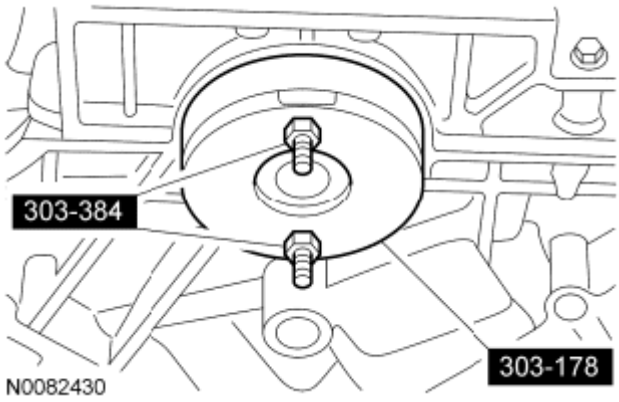


Fig. 297: Identifying Crankshaft Rear Main Oil Seal Installer And Crankshaft Rear Main Oil Seal Installer Bolts
Courtesy of FORD MOTOR CO.

13. Install the engine-to-transaxle separator plate.

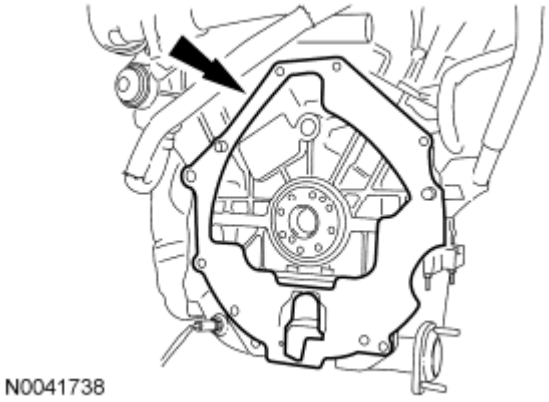


Fig. 298: Locating Engine-To-Transaxle Separator Plate
Courtesy of FORD MOTOR CO.

14. Position the flexplate and install the bolts.
    - Tighten to 80 Nm (59 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

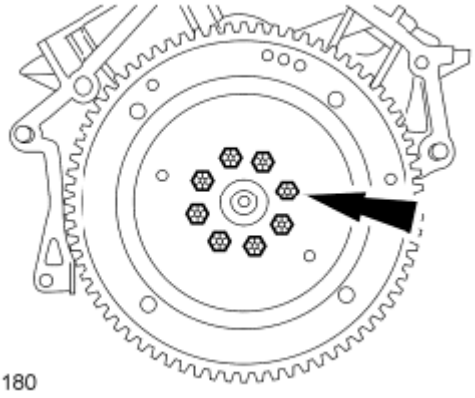


Fig. 299: Locating Bolts And Flexplate
Courtesy of FORD MOTOR CO.

15. Mount the engine on an engine stand.
16. Using the chart, select the correct piston grade size for the cylinder bores.
    - Measure the cylinder block bore diameter.
    - Mark the outside of the block with the appropriate number(s) to identify bore grade size.
    - Choose the correct piston grade size for the cylinder bore.

LITER	GRADE	CYLINDER BLOCK BORE DIAMETER	PISTON DIAMETER UNCOATED	PISTON DIAMETER COATED
3.0L	1	89.000-89.010	88.970-88.980	88.990-89.010
3.0L	2	89.010-89.020	88.978-88.992	88.998-89.022
3.0L	3	89.020-89.030	88.990-89.000	89.010-89.030
3.0L	1A	89.000-89.010	88.970-89.980	88.990-89.010
3.0L	2A	89.010-89.020	88.978-89.992	88.998-89.022
3.0L	3A	89.020-89.030	88.990-89.000	89.010-89.030

N0091569

Fig. 300: Correct Piston Grade Size Chart
Courtesy of FORD MOTOR CO.

NOTE: Be sure not to scratch the cylinder wall or crankshaft journal with the connecting rod. Push the piston down until the connecting rod bearing seats on the crankshaft journal.

NOTE: Lubricate the pistons, piston rings, connecting rod bearings and the entire cylinder bores with clean engine oil.

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Make sure the piston rings are positioned to specifications for installation. For additional information, refer to DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES - PISTON.

NOTE: Make sure the piston arrow on top is facing toward the front of the engine.

NOTE: After installation of each piston and connecting rod, rotate the crankshaft to verify smooth operation.

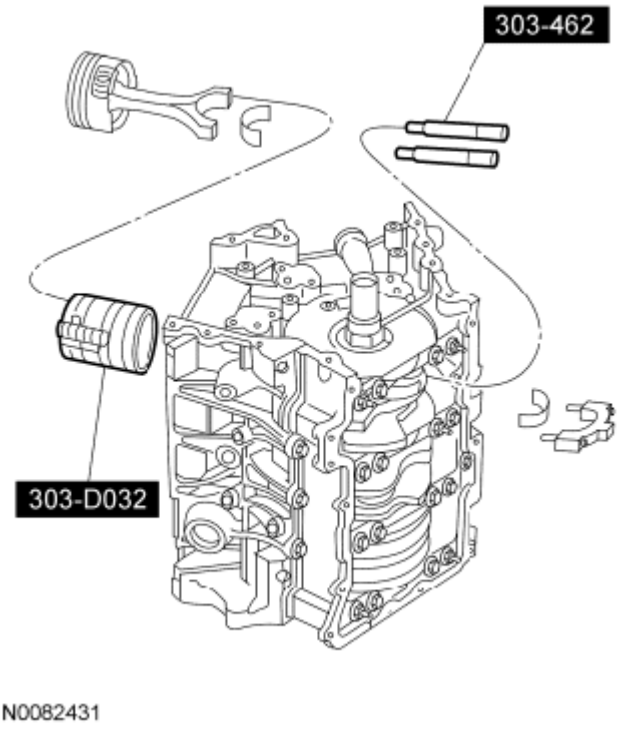


Fig. 301: Identifying Piston Ring Compressor And Connecting Rod Installer
Courtesy of FORD MOTOR CO.

17. Using the Piston Ring Compressor and the Connecting Rod Installer, install the piston and connecting rod assemblies.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

18. Install the connecting rod caps and the new bolts.
    - Tighten the bolts in 2 stages.
    - Stage 1: Tighten to 23 Nm (17 lb-ft).
    - Stage 2: Tighten to 43 Nm (32 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

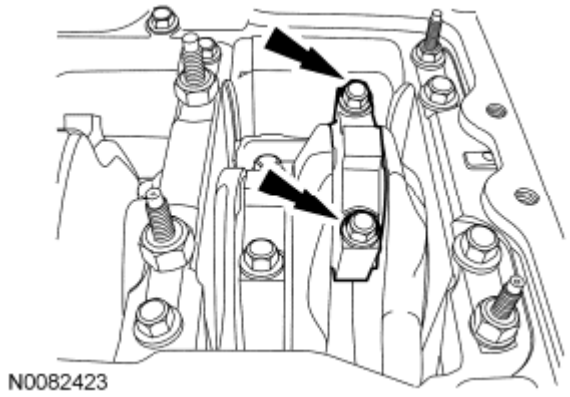


Fig. 302: Locating Connecting Rod Caps Bolts
Courtesy of FORD MOTOR CO.

19. Install the crankcase cover, a new gasket and the bolts.
    - Tighten to 10 Nm (89 lb-in).

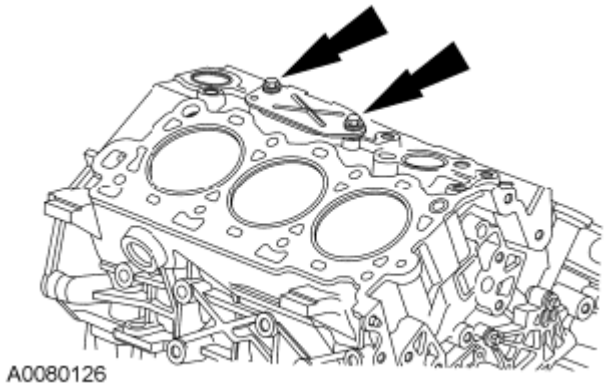


Fig. 303: Locating Bolts And Oil Separator Cover
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

20. Position the new LH and RH cylinder heads and gaskets. Install new bolts and tighten in the sequence shown in 6 stages.
    - Stage 1: Tighten to 40 Nm (30 lb-ft).
    - Stage 2: Tighten to 90 Nm (66 lb-ft).
    - Stage 3: Loosen one full turn.
    - Stage 4: Tighten to 40 Nm (30 lb-ft).
    - Stage 5: Tighten 90 degrees.
    - Stage 6: Tighten 90 degrees.

 © 2011 Mitchell Repair Information Company, LLC.

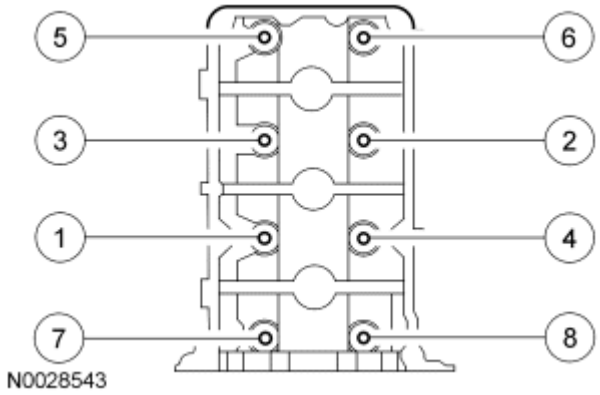


Fig. 304: Identifying Cylinder Heads Bolts In Sequence
Courtesy of FORD MOTOR CO.

21. Install the crankshaft pulley bolt and rotate the crankshaft keyway to the 11 o'clock position to locate Top Dead Center (TDC).

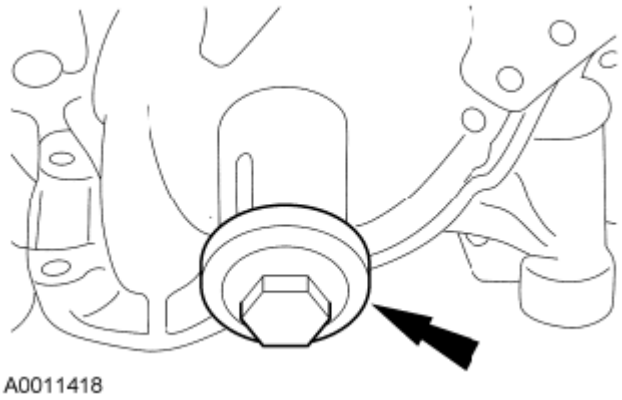


Fig. 305: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

NOTE: The hydraulic lash adjusters must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

22. Install the hydraulic lash adjusters.
    - Lubricate the hydraulic lash adjusters with clean engine oil.
23. Apply clean engine oil to the LH and RH camshaft roller followers.

NOTE: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe engine damage may occur.

NOTE: RH shown, LH similar.

 © 2011 Mitchell Repair Information Company, LLC.

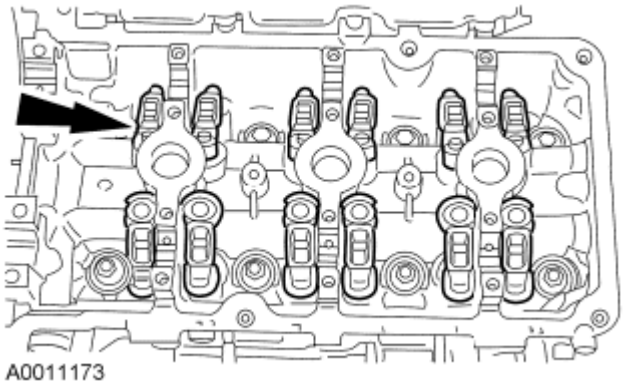


Fig. 306: Locating Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

24. Install the LH and RH camshaft roller followers.

NOTE: LH shown, RH similar.

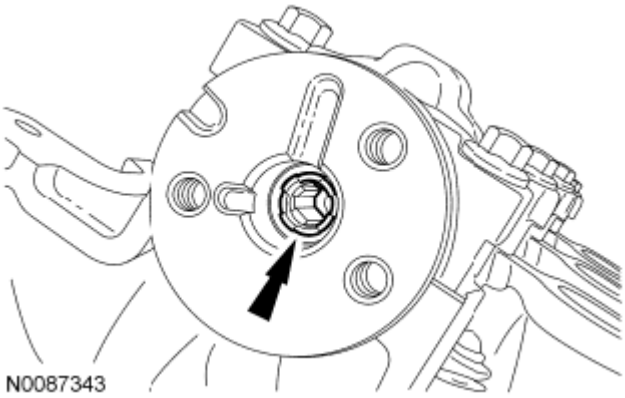


Fig. 307: Locating VCT System Oil Filter Screen
Courtesy of FORD MOTOR CO.

25. Install the new LH and RH oil filter screens in the intake camshafts.
26. Position the camshaft phaser and sprockets onto the intake camshafts.
    - Install the 3 bolts finger-tight.
27. Lubricate the LH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the LH camshafts as shown.

 © 2011 Mitchell Repair Information Company, LLC.

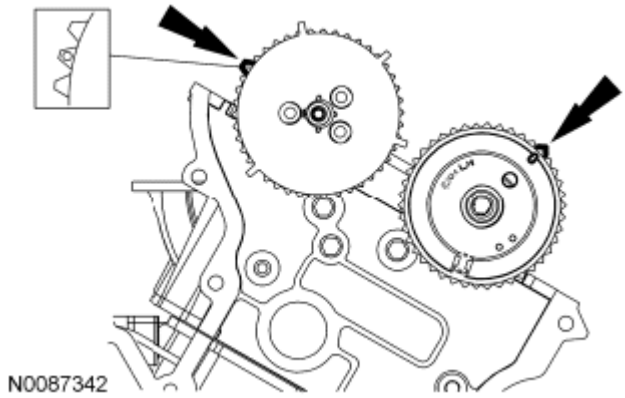


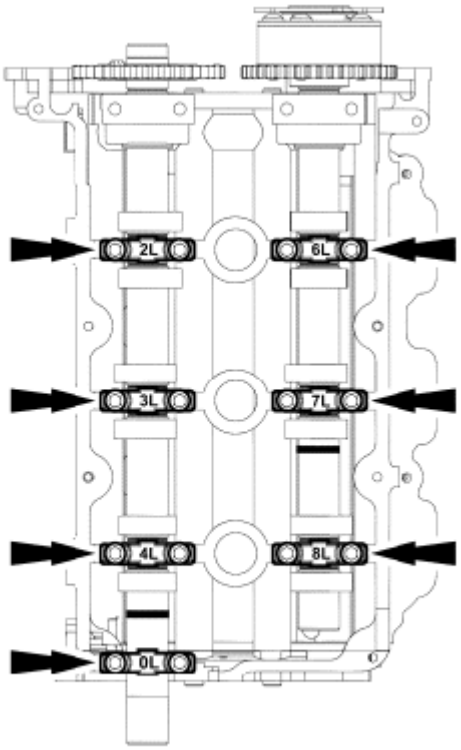
Fig. 308: Locating LH Camshafts Marks
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

NOTE: Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed, or damage to the thrust caps can occur.

28. Lubricate the bearing surfaces of the LH camshaft bearing caps with clean engine oil and install the bearing caps.
    - Loosely install the bolts.

 © 2011 Mitchell Repair Information Company, LLC.



N0081819

Fig. 309: Locating Bearing Caps
Courtesy of FORD MOTOR CO.

29. Lubricate the bearing surfaces of the LH camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
    - Loosely install the bolts.

 © 2011 Mitchell Repair Information Company, LLC.

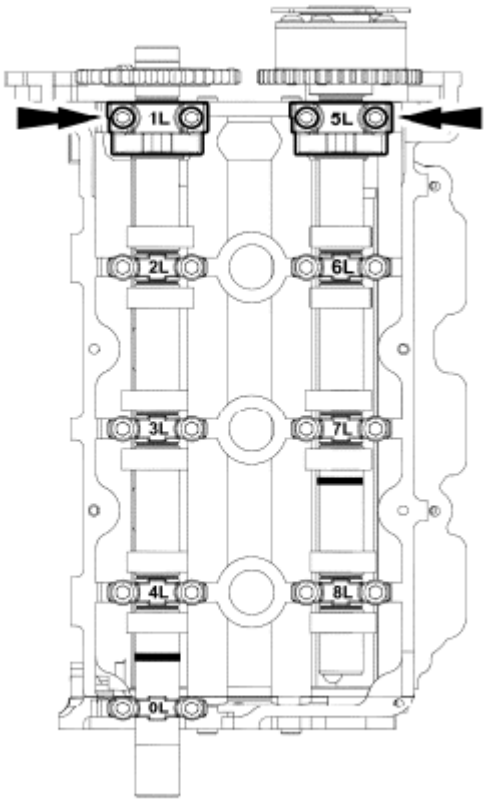


Fig. 310: Locating Bearing Caps Bolts
Courtesy of FORD MOTOR CO.

NOTE: Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.

30. Tighten the LH camshaft bearing cap bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 10 Nm (89 lb-in).
    - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

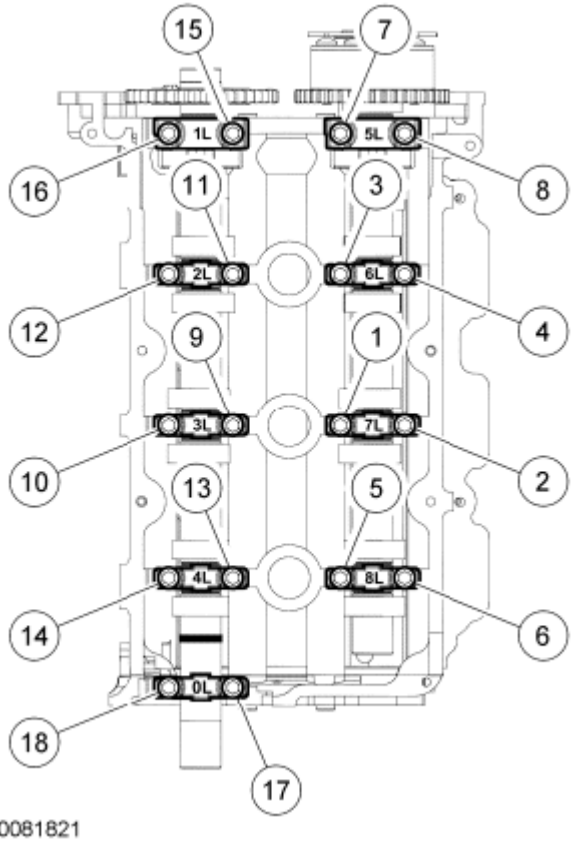
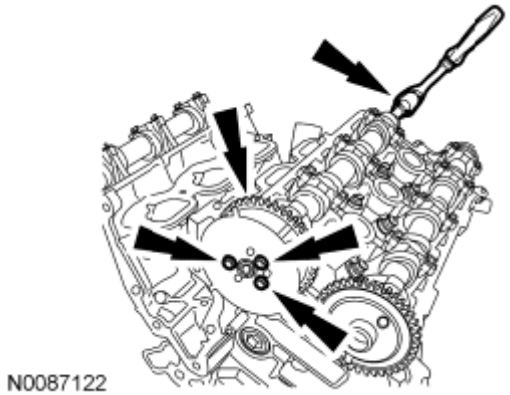


Fig. 311: Identifying LH Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 312: Locating LH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

31. Tighten the 3 LH camshaft phaser and sprocket bolts to 18 Nm (159 lb-in).

NOTE: Clean the sealing surface with metal surface prep before installing a new press-in-place gasket.

32. Install the camshaft oil seal retainer and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).

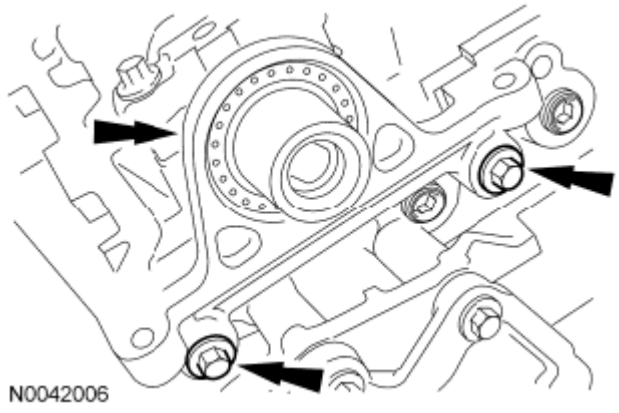


Fig. 313: Locating Bolts And Camshaft Oil Seal Retainer
Courtesy of FORD MOTOR CO.

NOTE: Apply clean engine oil to the seal lip and seal bore before installing the seal.

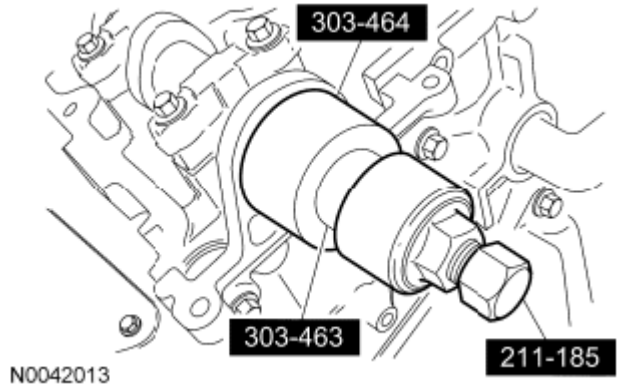


Fig. 314: Identifying Camshaft Oil Seal Installer, Camshaft Oil Seal Protector And Power Steering Pump Pulley Installer
Courtesy of FORD MOTOR CO.

33. Using the Power Steering Pump Pulley Installer, Camshaft Oil Seal Installer and the Camshaft Oil Seal Protector, install a new camshaft oil seal.

 © 2011 Mitchell Repair Information Company, LLC.

34. Lubricate the RH camshafts with clean engine oil and carefully position the camshafts onto the cylinder head.
    - Align the RH camshafts as shown.

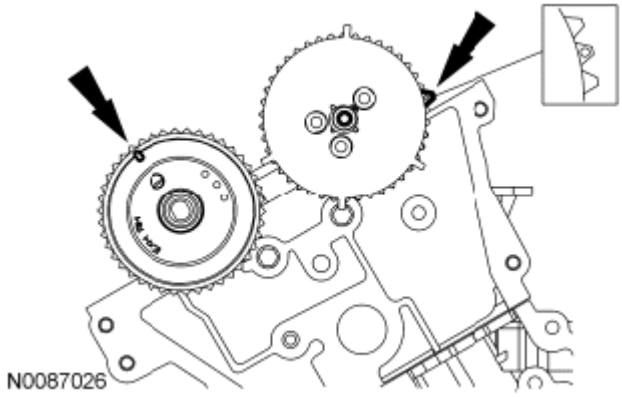


Fig. 315: Locating RH Camshafts Marks
Courtesy of FORD MOTOR CO.

NOTE: Cylinder head camshaft journal caps and cylinder heads are numbered to verify that they are assembled in their original positions. If not reassembled in their original positions, severe engine damage may occur.

NOTE: Do not install the camshaft journal thrust caps until all of the camshaft bearing caps have been installed or damage to the thrust caps can occur.

NOTE: Lubricate the bearing surfaces of the RH camshaft bearing caps with clean engine oil.

35. Install the camshaft bearing caps.
    - Loosely install the bolts.

 © 2011 Mitchell Repair Information Company, LLC.

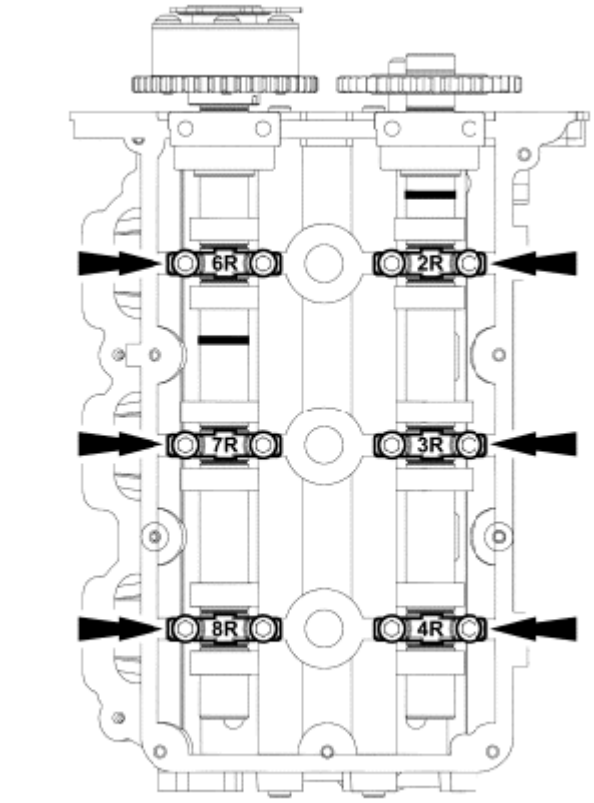


Fig. 316: Locating Camshaft Bearing Caps
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the bearing surfaces of the RH camshaft bearing thrust caps with clean engine oil.

36. Install the camshaft bearing thrust caps.
    - Loosely install the bolts.

 © 2011 Mitchell Repair Information Company, LLC.

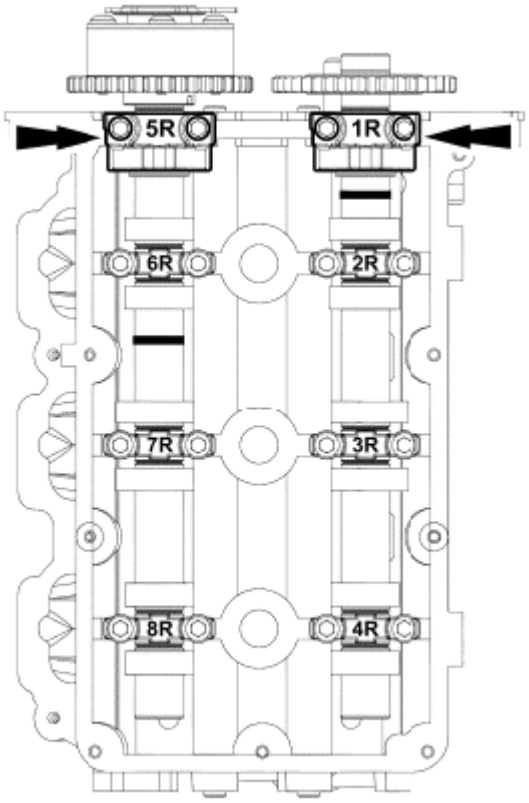


Fig. 317: Locating Camshaft Bearing Thrust Caps Bolts
Courtesy of FORD MOTOR CO.

NOTE: Make sure to tighten the camshaft bearing cap bolts in sequence in 2 stages.

37. Tighten the RH camshaft bearing cap bolts in the sequence shown in 2 stages.
    - Stage 1: Tighten to 10 Nm (89 lb-in).
    - Stage 2: Individually loosen and then tighten each camshaft bearing cap to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

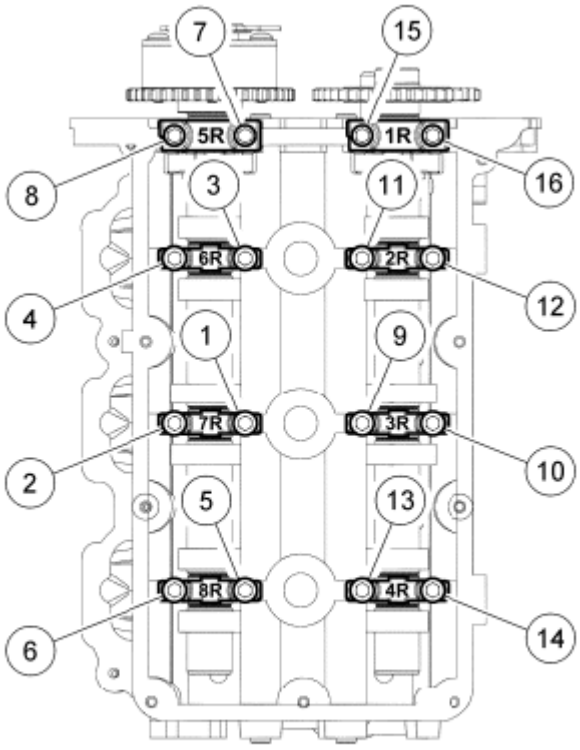
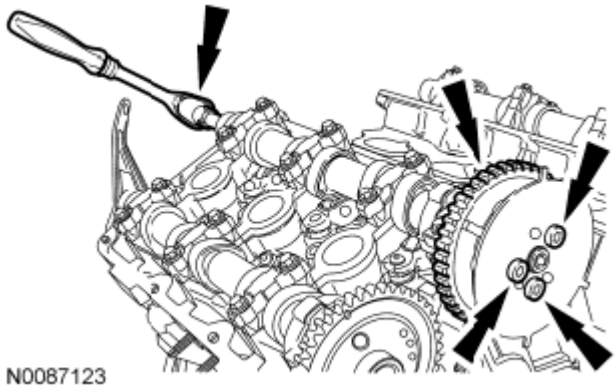


Fig. 318: Identifying RH Camshaft Bearing Cap Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft to rotate from the neutral position while tightening the camshaft phaser and sprocket bolts or damage to the engine may occur.

NOTE: Install a 3/8-in ratchet and extension into the D-slot on the rear of the intake camshaft to hold the camshaft in place for tightening of the camshaft phaser and sprocket bolts.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 319: Locating RH Camshaft Phaser And Sprocket Bolts
Courtesy of FORD MOTOR CO.

38. Tighten the 3 RH camshaft phaser and sprocket bolts to 18 Nm (159 lb-in).
39. Position the oil pump and install the bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

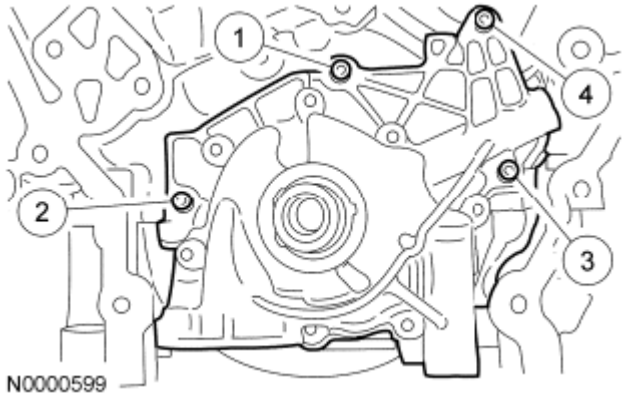


Fig. 320: Identifying Oil Pump Bolts In Sequence
Courtesy of FORD MOTOR CO.

40. Remove the crankshaft pulley bolt.

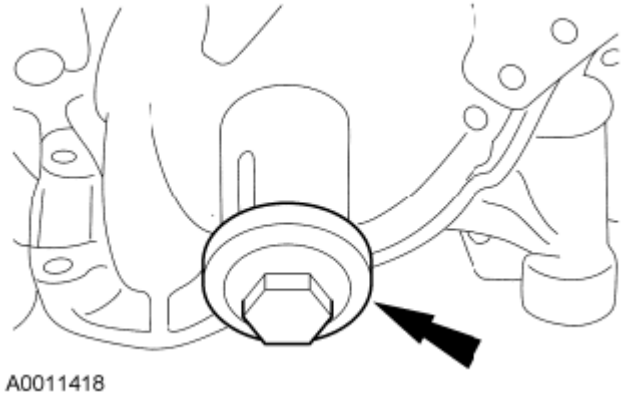


Fig. 321: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

NOTE: Failure to verify correct timing drive component alignment will result in severe engine damage.

 © 2011 Mitchell Repair Information Company, LLC.

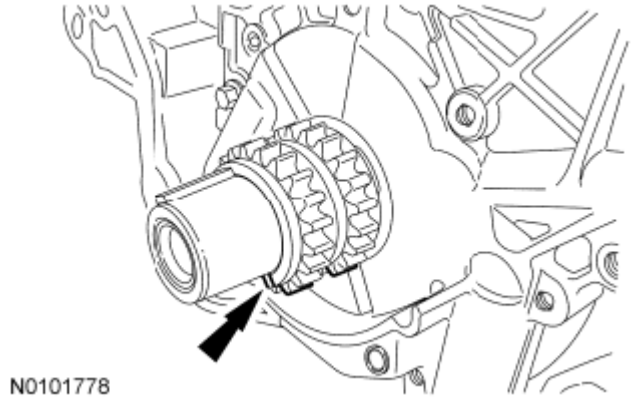


Fig. 322: Locating Crankshaft Sprocket With Timing Mark
Courtesy of FORD MOTOR CO.

41. Install the crankshaft sprocket with the timing mark facing out. The timing mark on the LH and RH timing chains will be aligned to this mark during assembly.

NOTE: LH shown, RH similar.

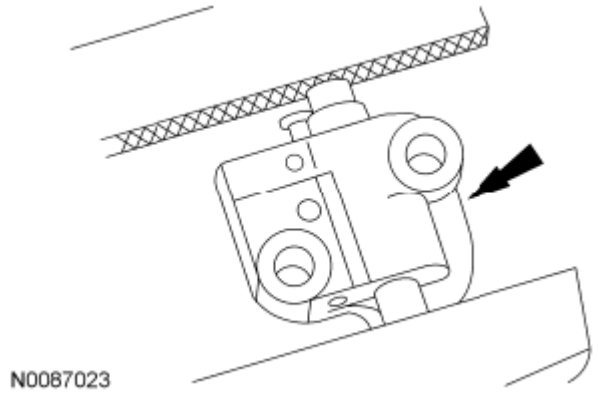


Fig. 323: Locating Chain Tensioner
Courtesy of FORD MOTOR CO.

42. Position the chain tensioner in a soft-jawed vise.

NOTE: LH shown, RH similar.

 © 2011 Mitchell Repair Information Company, LLC.

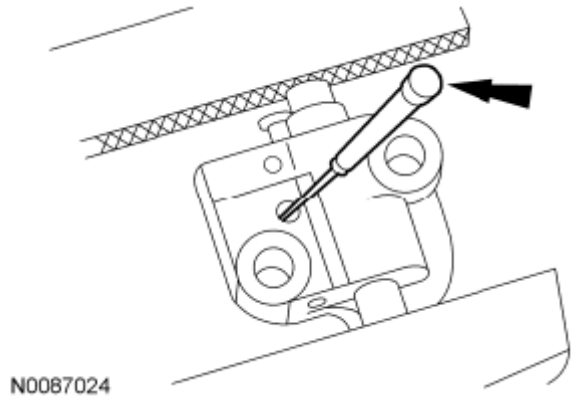


Fig. 324: Locating Ratchet Stem With Small Pick
Courtesy of FORD MOTOR CO.

43. Hold the chain tensioner ratchet lock mechanism away from the ratchet stem with a small pick.

NOTE: During tensioner compression, do not release the ratchet stem until the tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

44. Slowly compress the timing chain tensioner.
45. Retain the tensioner piston with a 1.5 mm (0.06 in) diameter wire or paper clip.

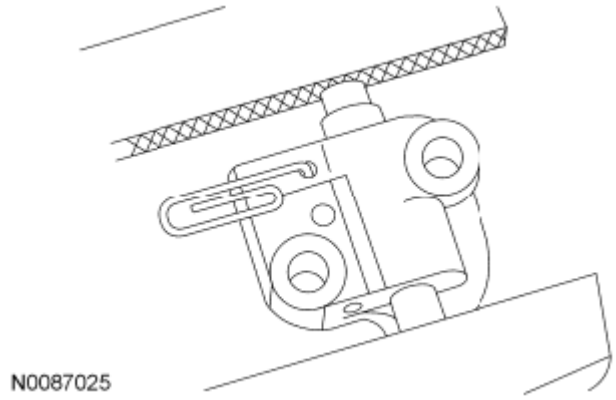


Fig. 325: Identifying Tensioner Piston With Paper Clip
Courtesy of FORD MOTOR CO.

46. If timing marks in the timing chains are not evident, use a permanent-type marker to mark the crankshaft and camshaft timing marks on the LH and RH timing chains.
    1. Mark any link to use as the crankshaft timing mark.
    2. Starting with the crankshaft timing mark, count 29 links and mark the link.
    3. Continue counting to link 42 and mark the link.

 © 2011 Mitchell Repair Information Company, LLC.

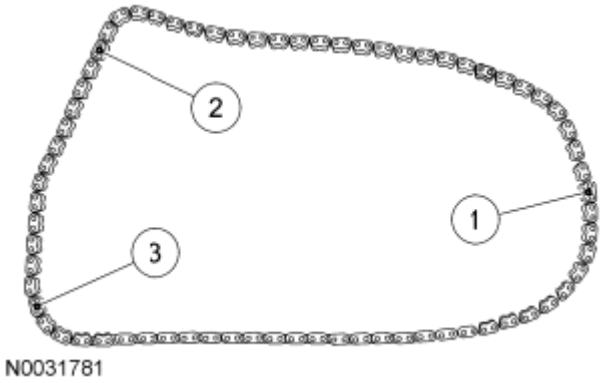


Fig. 326: Identifying Crankshaft And Camshaft Timing Marks On Timing Chains
Courtesy of FORD MOTOR CO.

47. Position the LH timing chain and guide and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

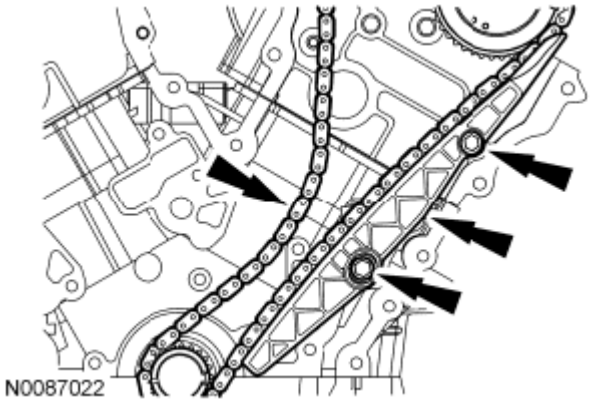


Fig. 327: Locating Bolts And LH Timing Chain Guide
Courtesy of FORD MOTOR CO.

48. Install the LH timing chain tensioner arm and the LH timing chain tensioner.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        - Tighten to 25 Nm (18 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

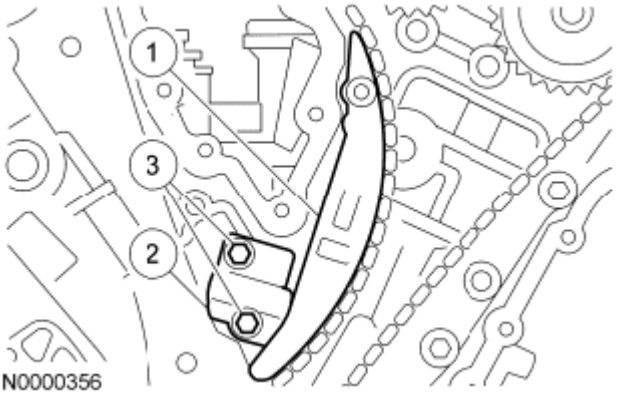


Fig. 328: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

49. Install the crankshaft pulley bolt and rotate the crankshaft clockwise 120 degrees until the crankshaft keyway is in the 3 o'clock position.

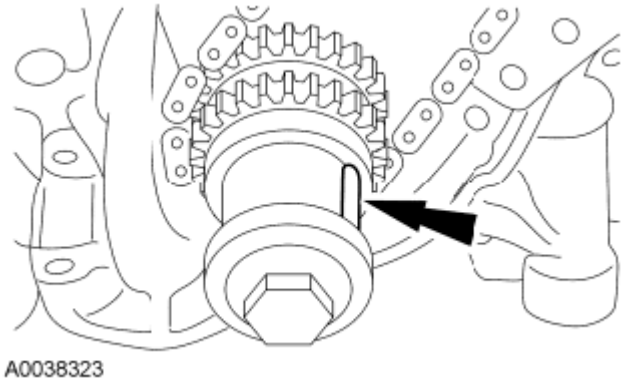


Fig. 329: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

50. Verify that the RH camshafts are correctly positioned.

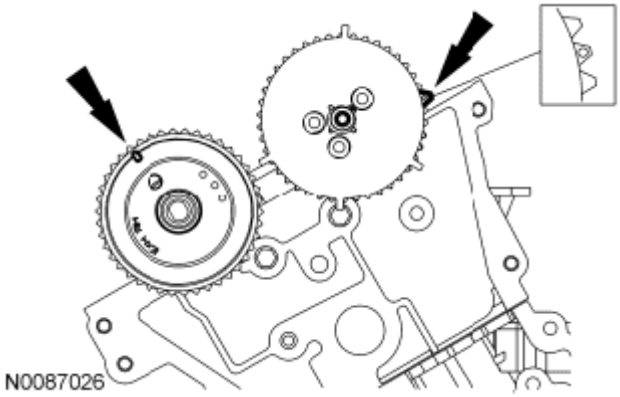


Fig. 330: Locating RH Camshafts Marks

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

51. Install the RH timing chain and chain guide and install the bolts.
    - Tighten to 25 Nm (18 lb-ft).
    - Align the marks on the timing chain with the marks on the camshaft and crankshaft sprockets.

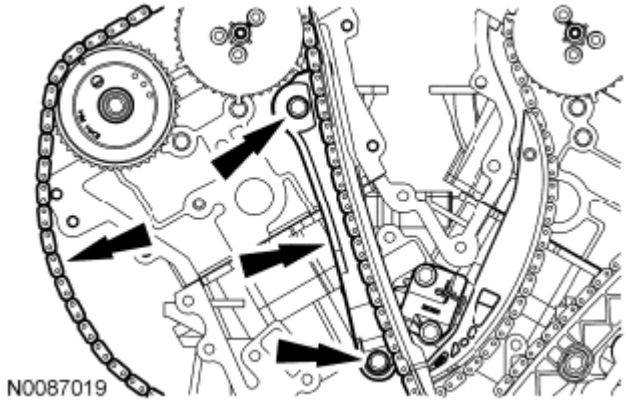


Fig. 331: Locating Bolts And RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

52. Install the RH timing chain tensioner and tensioner arm.
    1. Install the tensioner arm.
    2. Position the tensioner.
    3. Install the bolts.
        - Tighten to 25 Nm (18 lb-ft).

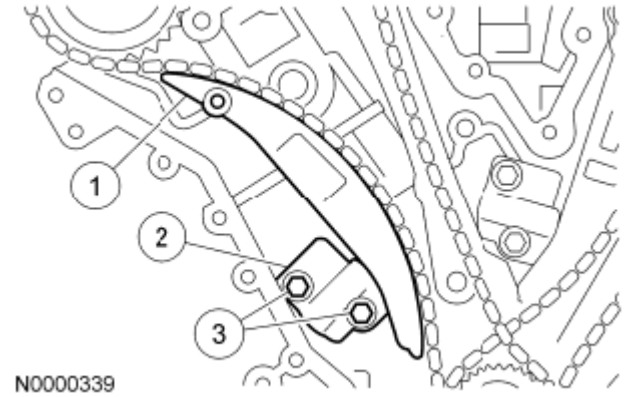


Fig. 332: Identifying Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

53. Remove the LH and RH timing chain tensioner piston retaining wires.
54. Rotate the crankshaft counterclockwise 120 degrees to **TDC** .

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Failure to verify correct timing drive component alignment will result in severe engine damage.

55. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and the crankshaft timing marks.
    3. There should be 30 chain links between the camshaft and the crankshaft timing marks.

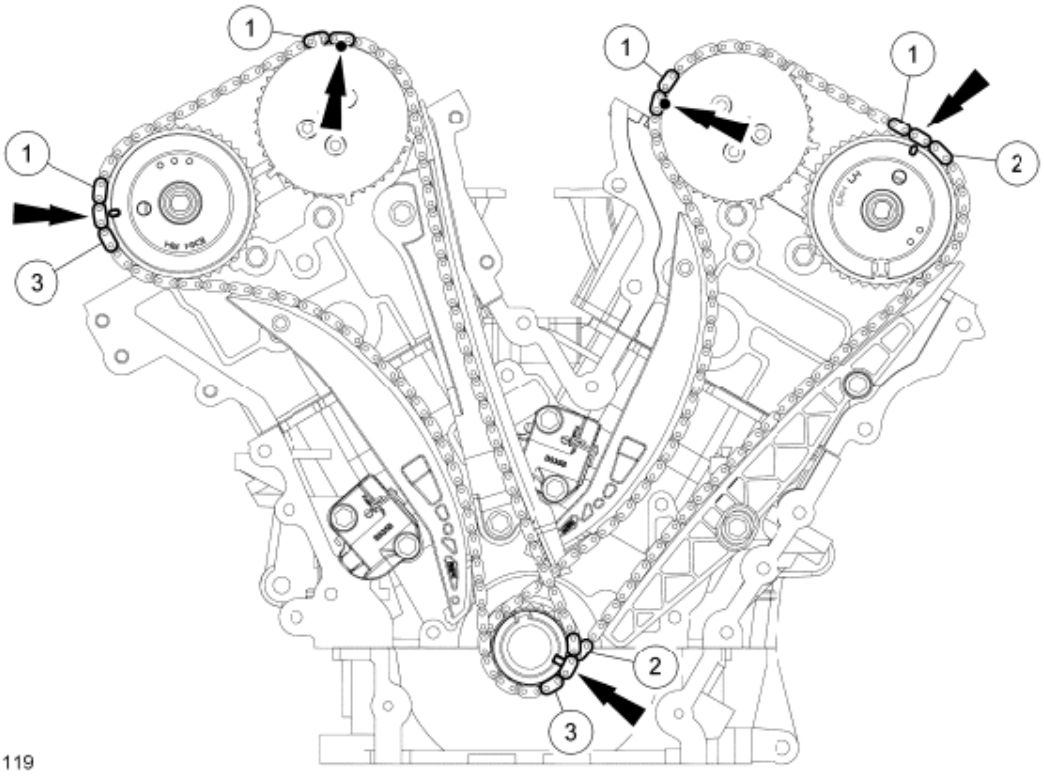


Fig. 333: Locating Chain Links Marks
Courtesy of FORD MOTOR CO.

56. Remove the crankshaft pulley bolt and washer.

 © 2011 Mitchell Repair Information Company, LLC.

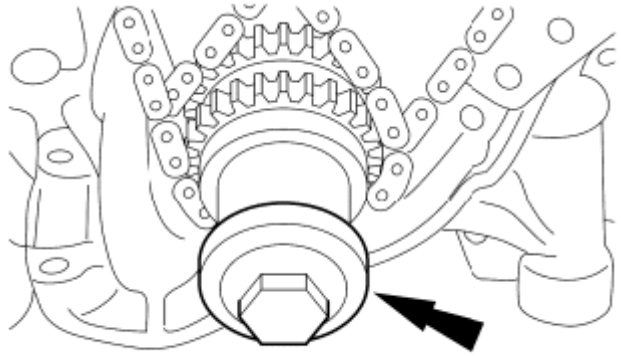


Fig. 334: Locating Crankshaft Pulley Bolt And Washer
Courtesy of FORD MOTOR CO.

NOTE: This pulse wheel is used in several different engines. Install the pulse wheel with the keyway in the slot stamped "30RFF" only (orange in color).

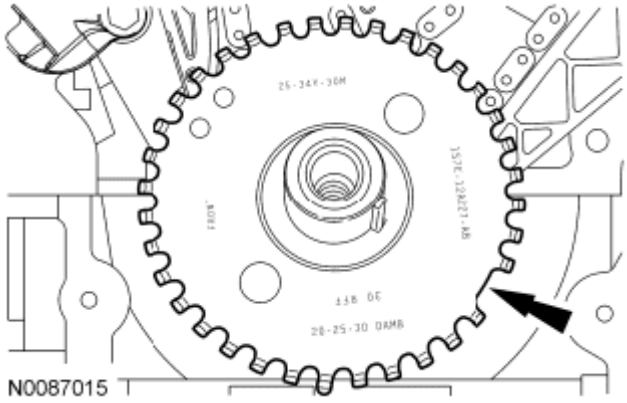


Fig. 335: Locating Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

57. Install the ignition pulse wheel.

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

58. Install the LH and RH spark plugs.
    - Tighten to 15 Nm (133 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

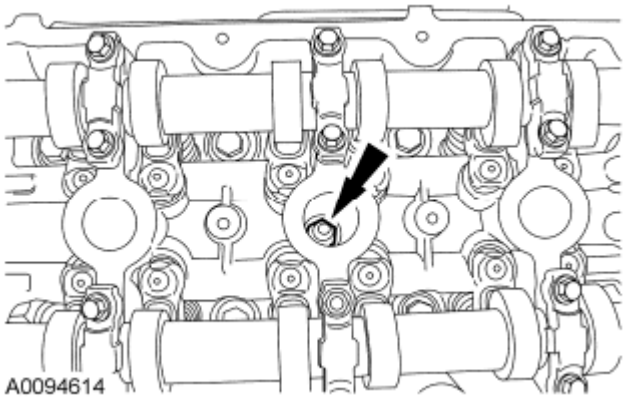


Fig. 336: Locating Spark Plug
Courtesy of FORD MOTOR CO.

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.

NOTE: Do not damage the oil pan gasket while cleaning the sealant from the lower cylinder block-to-oil pan joint.

59. Use a plastic scraping tool to remove all traces of sealant.
    - Clean all sealing surfaces with metal surface prep and install new gaskets.

NOTE: Clean and degrease the sealing surfaces with metal surface prep before applying gasket and sealant.

NOTE: The front cover must be installed and the bolts tightened within 4 minutes of sealant application.

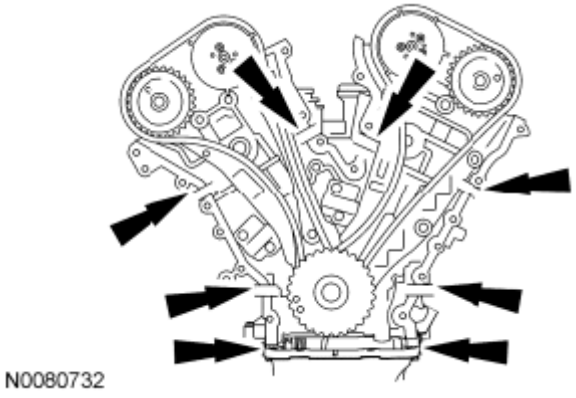


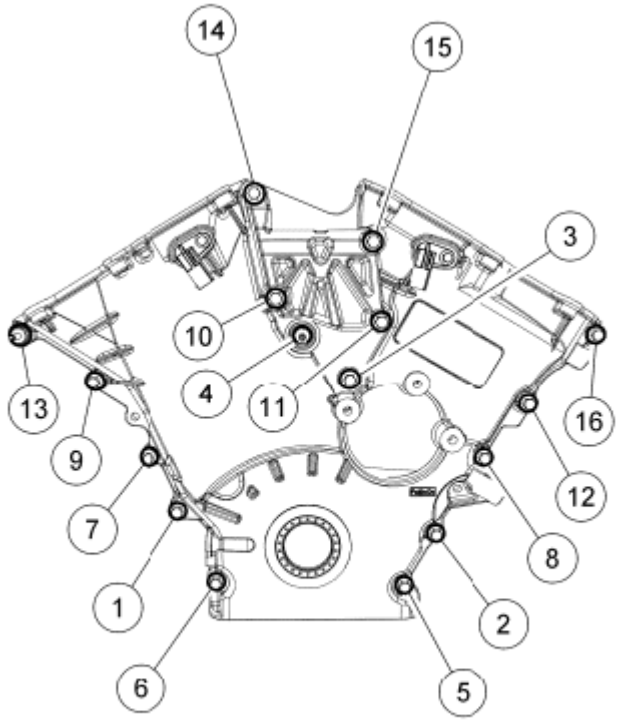
Fig. 337: Locating Silicone Gasket And Sealer Area
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

60. Apply a 6 mm (0.24 in) dot of silicone gasket and sealant to the cylinder block to lower cylinder block and cylinder head mating surfaces.

NOTE: Fasteners 4 and 13 are stud bolts.

61. Position the front cover and install the bolts and stud bolts.
    - Tighten in the sequence shown to 25 Nm (18 lb-ft).



N0089880

Fig. 338: Identifying Engine Front Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Note the position of the alignment dowel on the engine front cover.

62. Install the 2 bolts and the LH Variable Camshaft Timing (VCT) solenoid.
    - Tighten to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

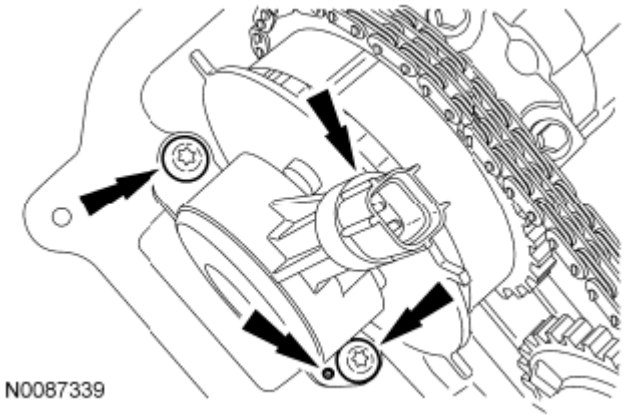


Fig. 339: Locating Bolts And LH Variable Camshaft Timing (VCT) Solenoid
Courtesy of FORD MOTOR CO.

NOTE: Note the position of the alignment dowel on the engine front cover.

63. Install the 2 bolts and the RH **VCT** solenoid.
    - Tighten to 10 Nm (89 lb-in).

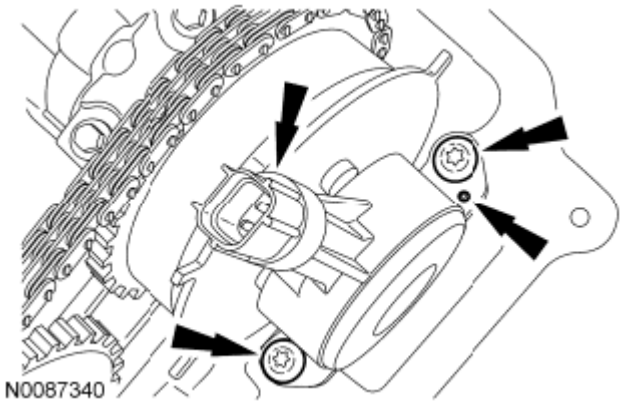


Fig. 340: Locating Bolts And RH VCT Solenoid
Courtesy of FORD MOTOR CO.

NOTE: Clean all sealing surfaces with metal surface prep.

64. Apply clean engine oil to the seal lip and seal bore before installing the seal.
65. Using the Front Cover Oil Seal Installer and the Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

 © 2011 Mitchell Repair Information Company, LLC.

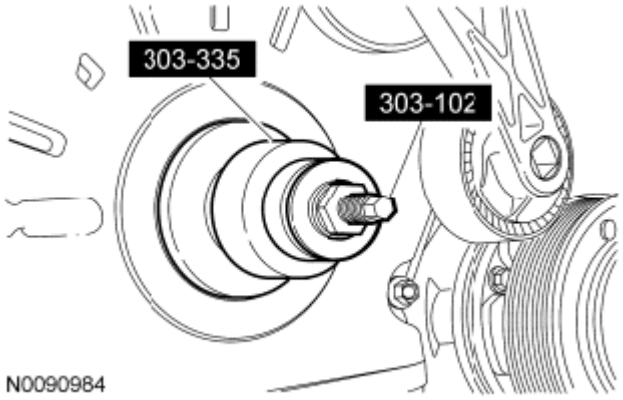


Fig. 341: Installing Crankshaft Front Seal Using Front Cover Oil Seal Installer And Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

NOTE: Clean the keyway and slot using metal surface prep before applying silicone gasket and sealant.

NOTE: Sealing surfaces must be free of dirt and oil.

NOTE: The crankshaft pulley must be installed and the bolt tightened within 4 minutes of sealant application.

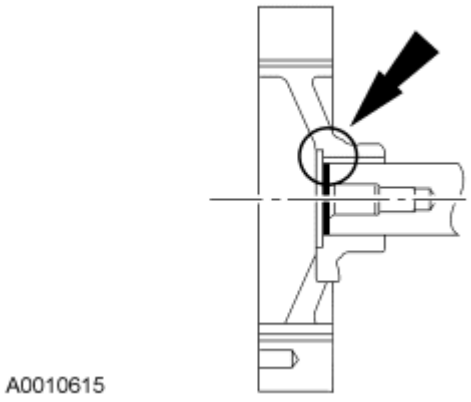


Fig. 342: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

66. Apply silicone gasket and sealant to the end of the crankshaft pulley keyway slot.

NOTE: Lubricate the outside diameter sealing surface with clean engine oil.

 © 2011 Mitchell Repair Information Company, LLC.

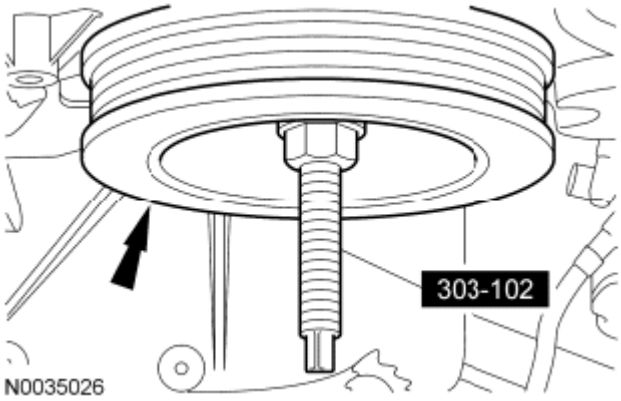


Fig. 343: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

67. Using the Crankshaft Vibration Damper Installer, install the crankshaft pulley.
68. Install the bolt and washer. Tighten the bolt in 4 stages:
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn.
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten an additional 90 degrees.

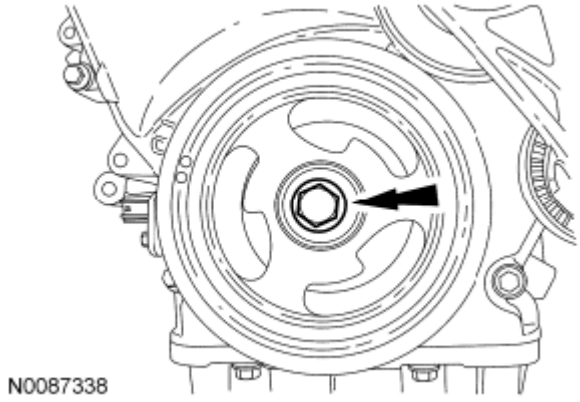


Fig. 344: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

69. Install the belt tensioner and the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

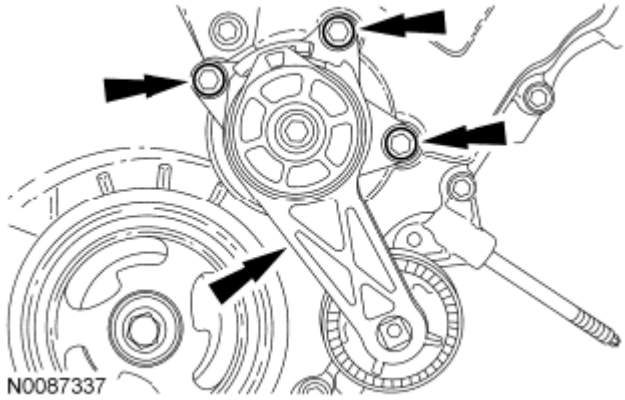


Fig. 345: Locating Belt Tensioner And Bolts
Courtesy of FORD MOTOR CO.

70. Install the 8 nuts and the oil pan baffle in the following sequence.
    1. Tighten the 4 M6 oil pan baffle nuts in 2 stages.
        - Stage 1: Tighten to 5 Nm (44 lb-in).
        - Stage 2: Tighten an additional 45 degrees.
    2. Then install and tighten the 4 M8 oil pan baffle nuts in 2 stages.
        - Stage 1: Tighten to 15 Nm (133 lb-in).
        - Stage 2: Tighten an additional 45 degrees.

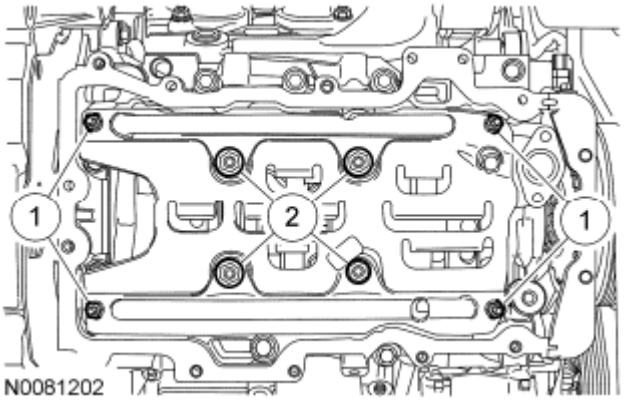


Fig. 346: Identifying Oil Pan Baffle Nuts
Courtesy of FORD MOTOR CO.

71. Install a new O-ring seal on the oil pump screen and pickup tube.
    - Lubricate the O-ring seal with clean engine oil.

 © 2011 Mitchell Repair Information Company, LLC.

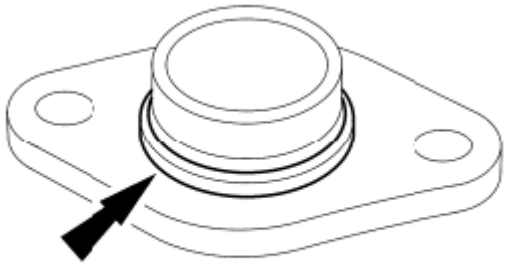


Fig. 347: Locating O-Ring Seal
Courtesy of FORD MOTOR CO.

72. Install the oil pump screen and pickup tube.
    1. Position the oil pump screen and pickup tube.
    2. Install the 2 bolts and tighten to 10 Nm (89 lb-in).

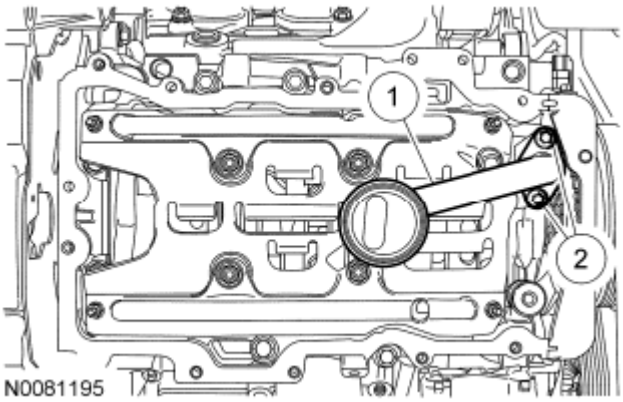


Fig. 348: Identifying Oil Pump Screen And Pickup Tube Bolt
Courtesy of FORD MOTOR CO.

NOTE: The valve cover must be installed and the bolts and studs tightened within 4 minutes of sealant application.

NOTE: Clean cylinder head and front cover surface using metal surface prep before applying silicone gasket and sealant.

 © 2011 Mitchell Repair Information Company, LLC.

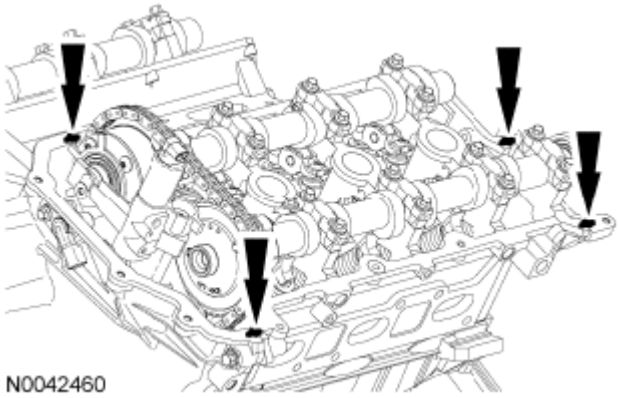


Fig. 349: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

73. Apply an 8 mm (0.31 in) dot of silicone gasket and sealant at the cylinder block to front cover mating surface and the cam seal retainer-to-cylinder head joints.

NOTE: Install a new valve cover gasket.

74. Position the LH valve cover and install the bolts and stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

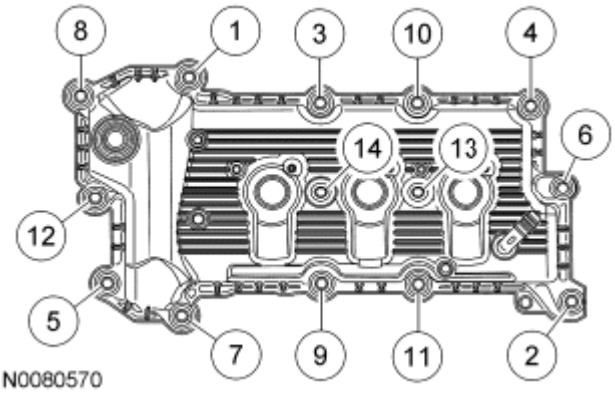


Fig. 350: Identifying LH Valve Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.

 © 2011 Mitchell Repair Information Company, LLC.

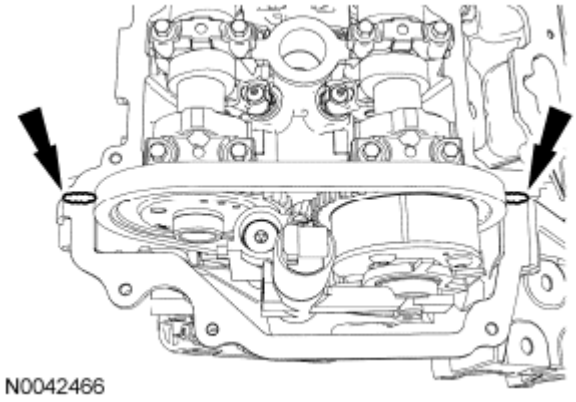


Fig. 351: Locating Silicone Gasket Sealant Area
Courtesy of FORD MOTOR CO.

75. Apply an 8 mm (0.31 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.

NOTE: Install a new valve cover gasket.

76. Position the RH valve cover and install the bolts and stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

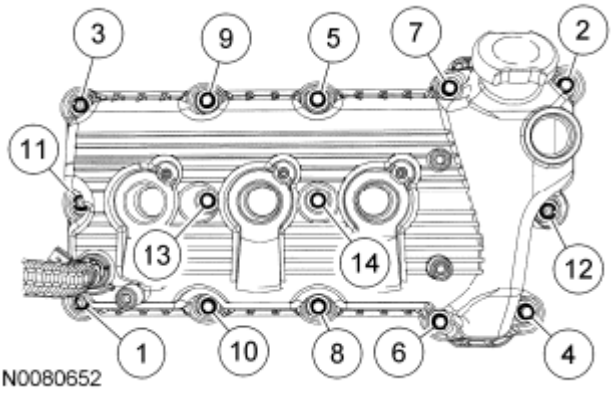


Fig. 352: Identifying RH Valve Cover Bolts In Sequence
Courtesy of FORD MOTOR CO.

77. Install the radio interference capacitor and the nut.
    - Tighten to 6 Nm (53 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

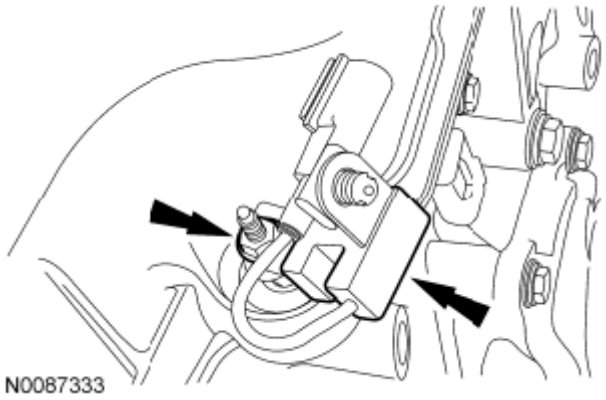


Fig. 353: Locating Radio Interference Capacitor And Nut
Courtesy of FORD MOTOR CO.

78. Position the coolant pump housing and attach the coolant hose.
    - Tighten the clamp to 7 Nm (62 lb-in).

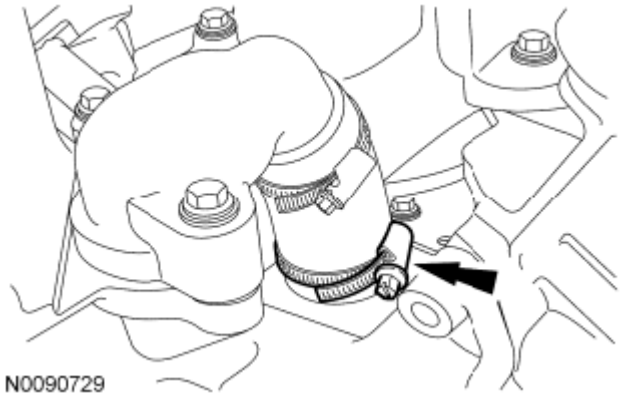


Fig. 354: Locating Clamp And Coolant Hose
Courtesy of FORD MOTOR CO.

79. Install the 5 coolant pump housing bolts.
    - Tighten to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

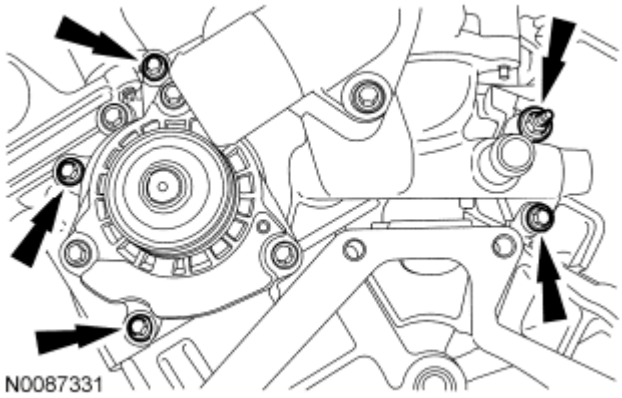


Fig. 355: Locating Coolant Pump Housing Bolts
Courtesy of FORD MOTOR CO.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

80. Install the Camshaft Pulley Installer in the camshaft as shown in the illustration.
    - Adjust the collar on the Camshaft Pulley Installer screw to get the best thread engagement in the rear of the camshaft.

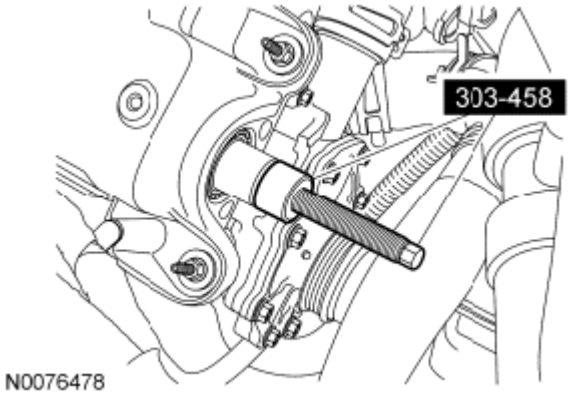


Fig. 356: Identifying Camshaft Pulley Installer
Courtesy of FORD MOTOR CO.

NOTE: Failure to use the correct special tools, assembled as shown in the illustration, will result in damage to the coolant pump pulley and/or special tools.

NOTE: Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-458).

81. Position the coolant pump pulley over the previously installed Camshaft Pulley Installer and on the end of

 © 2011 Mitchell Repair Information Company, LLC.

the camshaft. Install the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer as shown in the illustration.

- Using the Camshaft Pulley Installer, Power Steering Pump Pulley Installer and the Water Pump Pulley Spacer, install a new service coolant pump pulley flush with the end of the camshaft.

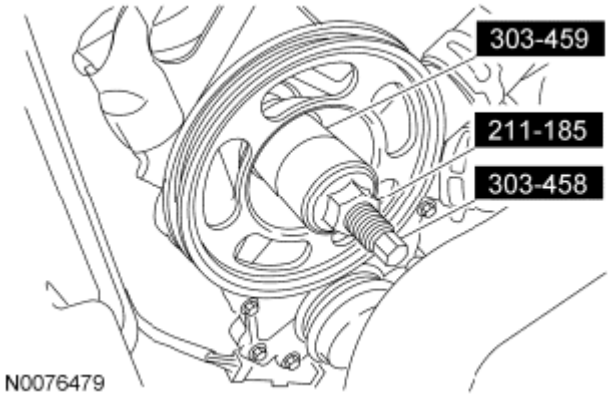


Fig. 357: Identifying Camshaft Pulley Installer, Power Steering Pump Pulley Installer And Water Pump Pulley Spacer
Courtesy of FORD MOTOR CO.

82. Install the coolant pump belt on the coolant pump pulley and position it on the camshaft pulley.

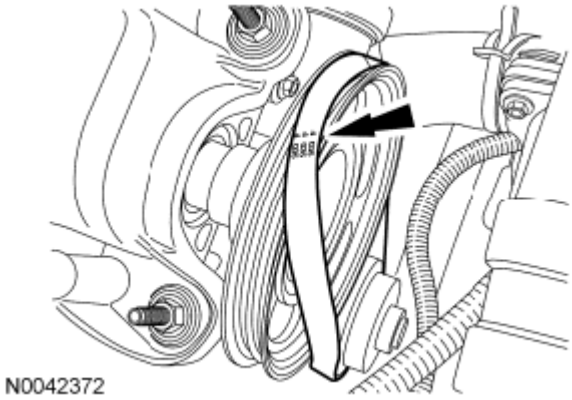


Fig. 358: Locating Coolant Pump Belt Marks
Courtesy of FORD MOTOR CO.

NOTE: Do not use any screwdrivers, pliers or other metal objects that could cause damage to the belt or camshaft pulley while installing the belt.

83. Rotate the crankshaft clockwise to seat the water pump belt on the camshaft pulley.
84. Lubricate the O-ring seal with clean engine oil and install the oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

 © 2011 Mitchell Repair Information Company, LLC.

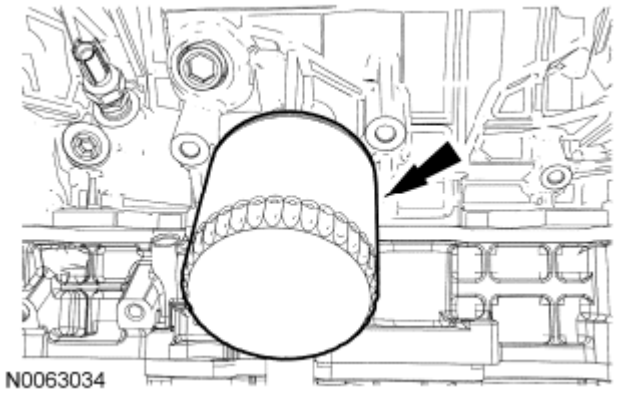


Fig. 359: Locating Oil Filter
Courtesy of FORD MOTOR CO.

85. Install the Engine Oil Pressure (EOP) switch and, if equipped, the block heater.
    - Tighten the **EOP** switch to 14 Nm (124 lb-in).
    - Tighten the block heater to 21 Nm (15 lb-ft).

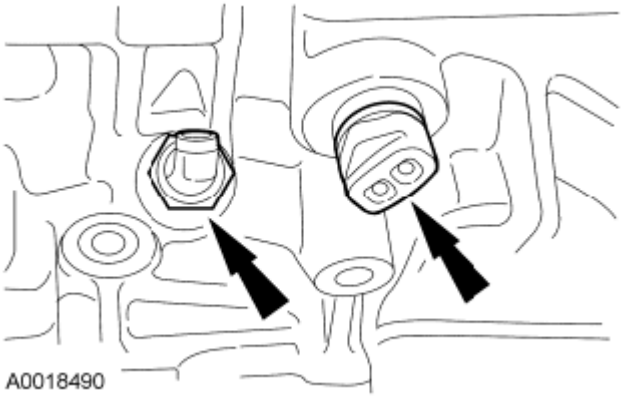


Fig. 360: Locating EOP Switch
Courtesy of FORD MOTOR CO.

86. Install 6 new LH catalytic converter studs.
    - Tighten to 12 Nm (106 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

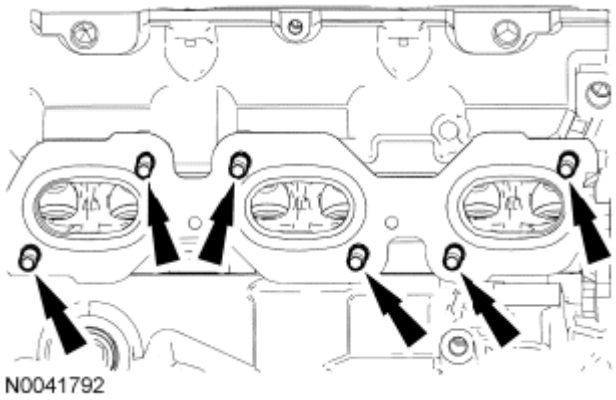


Fig. 361: Locating Catalytic Converter Studs
Courtesy of FORD MOTOR CO.

87. Install a new gasket and the LH catalytic converter and 6 new nuts.
    - Tighten in the sequence shown to 20 Nm (177 lb-in).

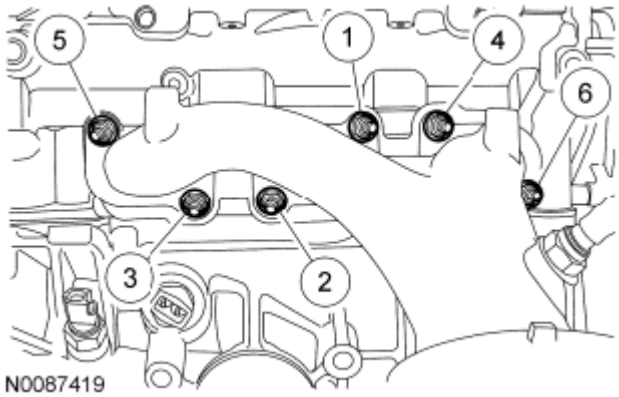
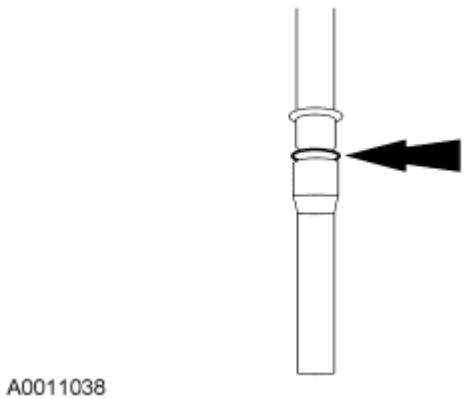


Fig. 362: Identifying LH Catalytic Converter Nuts In Sequence
Courtesy of FORD MOTOR CO.

88. Install a new O-ring on the oil level indicator tube. Apply clean engine oil to the O-ring.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 363: Locating O-Ring On Oil Level Indicator Tube
Courtesy of FORD MOTOR CO.

89. Position the oil level indicator and tube and install the stud bolt.
    - Tighten to 10 Nm (89 lb-in).

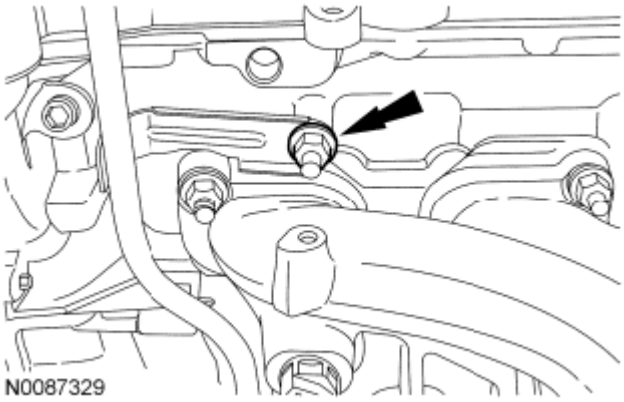


Fig. 364: Locating Stud Bolt And Oil Level Indicator And Tube
Courtesy of FORD MOTOR CO.

90. Install the 3 bolts and the LH heat shield.
    - Tighten to 10 Nm (89 lb-in).

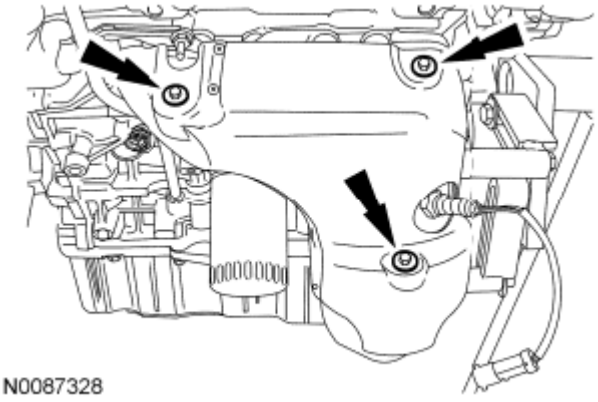


Fig. 365: Locating Bolts And LH Heat Shield
Courtesy of FORD MOTOR CO.

91. Install the 3 bolts and the A/C compressor bracket.
    - Tighten to 25 Nm (18 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

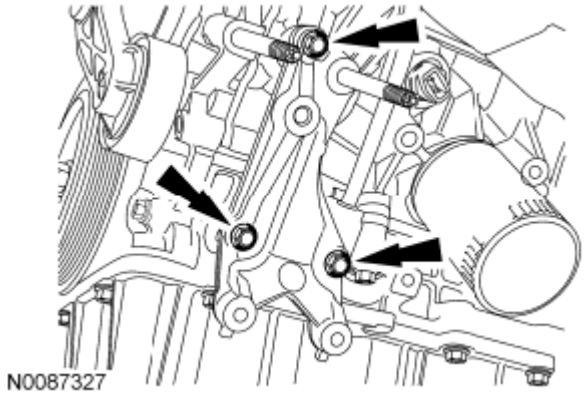


Fig. 366: Locating Bolts And A/C Compressor Bracket
Courtesy of FORD MOTOR CO.

92. Position the generator and install the bolt and 2 nuts.
    - Tighten to 47 Nm (35 lb-ft).

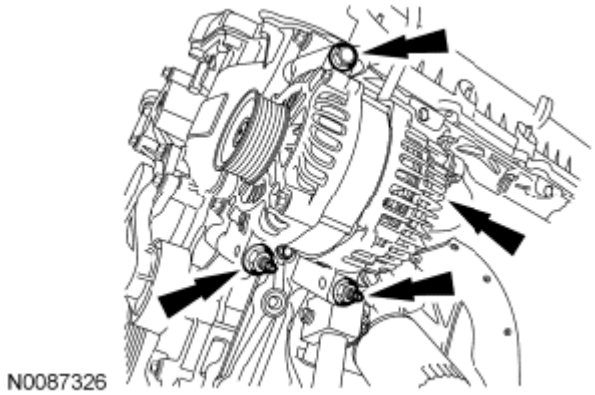


Fig. 367: Locating Bolt, Nuts And Generator
Courtesy of FORD MOTOR CO.

93. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (106 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

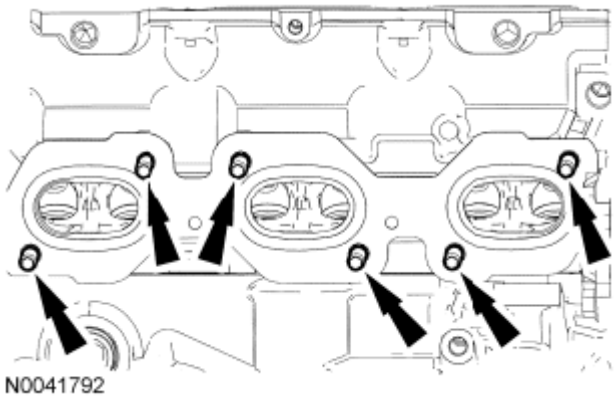


Fig. 368: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

94. Install a new gasket and the RH exhaust manifold and new nuts.
    - Tighten the nuts in 2 stages in the sequence shown.
        - Stage 1: Tighten to 20 Nm (177 lb-in).
        - Stage 2: Tighten to 20 Nm (177 lb-in).

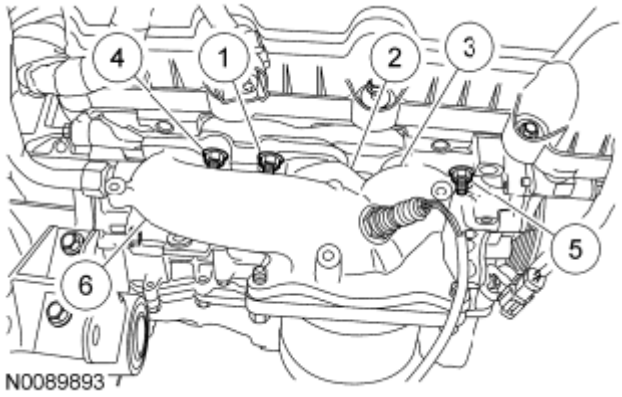


Fig. 369: Identifying RH Exhaust Manifold Nuts In Sequence
Courtesy of FORD MOTOR CO.

FWD vehicles

95. Install a new gasket and the RH catalytic converter and the 3 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

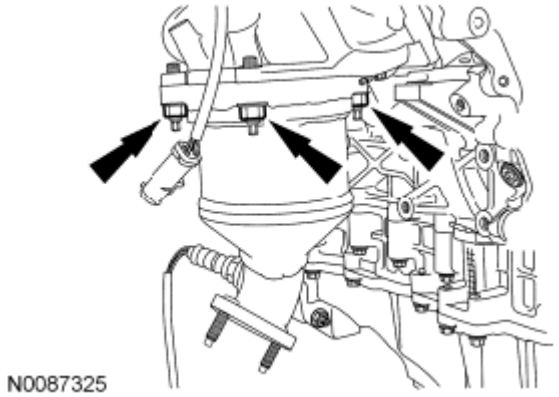


Fig. 370: Locating RH Catalytic Converter And Nuts
Courtesy of FORD MOTOR CO.

96. Install the 3 bolts and the RH heat shield.
    - Tighten to 10 Nm (89 lb-in).

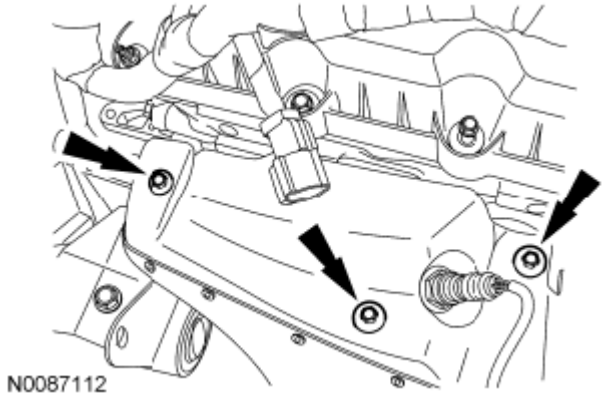
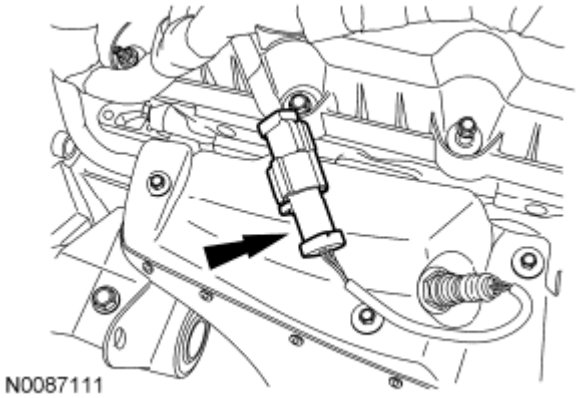


Fig. 371: Locating Bolts And RH Heat Shield
Courtesy of FORD MOTOR CO.

97. Connect the RH Heated Oxygen Sensor (HO2S) electrical connector.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 372: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: LH shown, RH similar.

98. Apply a light film of silicone brake caliper grease and dielectric compound to the interior of the spark plug boot prior to installation.

    Install the 6 coil-on-plugs and the bolts.

    - Tighten to 6 Nm (53 lb-in).

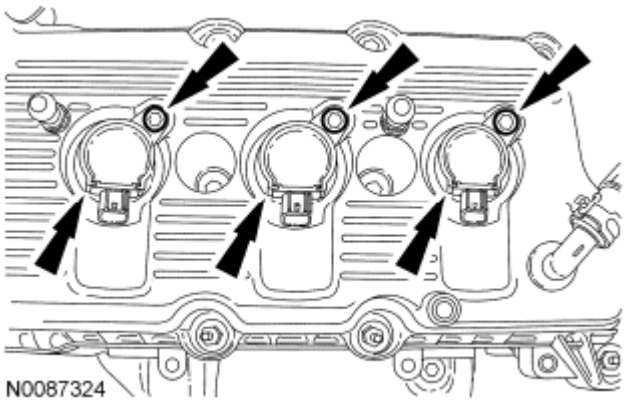


Fig. 373: Locating Bolts And Coil-On-Plugs
Courtesy of FORD MOTOR CO.

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

NOTE: Clean and inspect all sealing surfaces. Install new gaskets.

99. Position the lower intake manifold and install the 8 bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

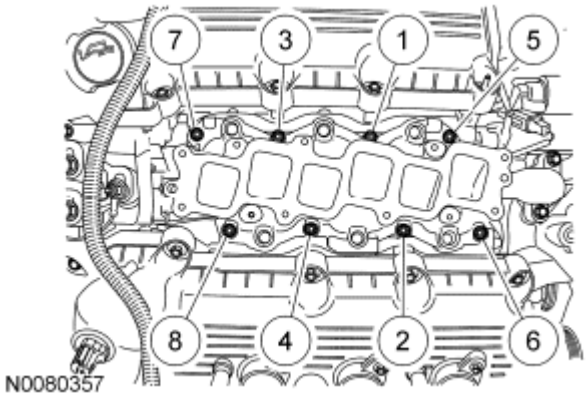


Fig. 374: Identifying Lower Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

NOTE: Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

100. 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.

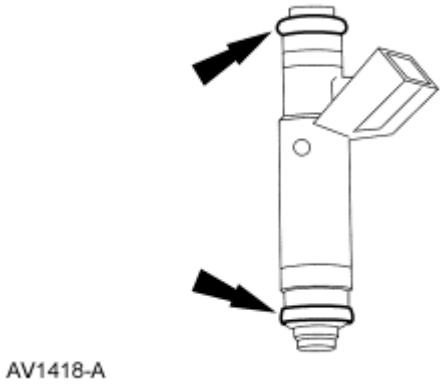


Fig. 375: Locating O-Rings
Courtesy of FORD MOTOR CO.

101. Install the 4 bolts and the fuel rail and injectors assembly.
    - Tighten to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

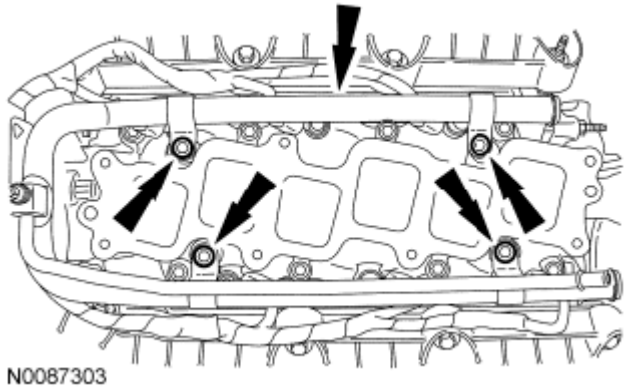


Fig. 376: Locating Bolts And Fuel Rail And Injectors Assembly
Courtesy of FORD MOTOR CO.

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

NOTE: Clean and inspect all sealing surfaces. Install new gaskets.

102. Position the upper intake manifold and install the 7 bolts.
    - Tighten the bolts in 2 stages in the sequence shown.
        - Stage 1: Tighten to 10 Nm (89 lb-in).
        - Stage 2: Tighten an additional 45 degrees.

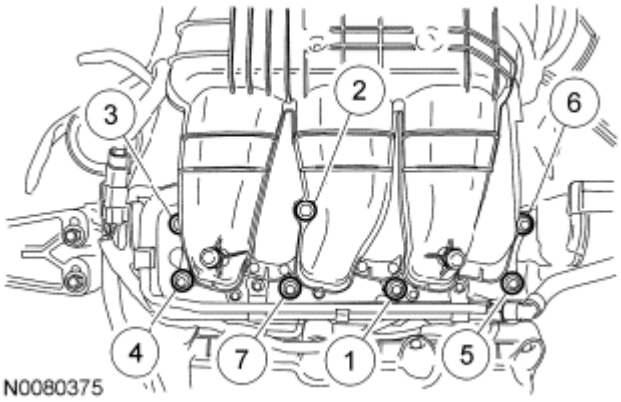


Fig. 377: Identifying Upper Intake Manifold Bolts In Sequence
Courtesy of FORD MOTOR CO.

103. Loosen the upper intake manifold bracket lower bolt. Install the upper bolts (1 shown), then tighten all the bolts.
    - Tighten to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

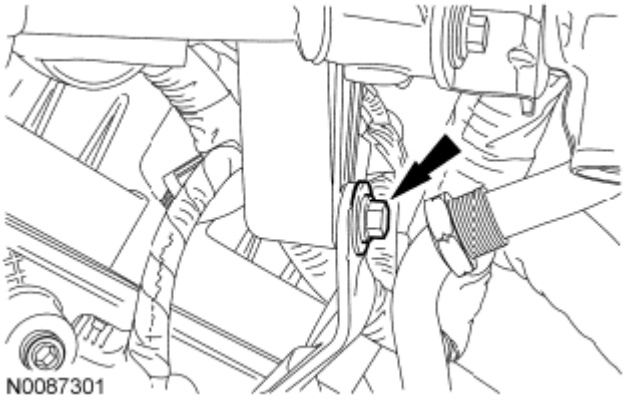


Fig. 378: Locating Upper Intake Manifold Bracket Lower Bolt
Courtesy of FORD MOTOR CO.

104. Install the EGR tube fitting in the EGR valve.
    - Tighten to 40 Nm (30 lb-ft).

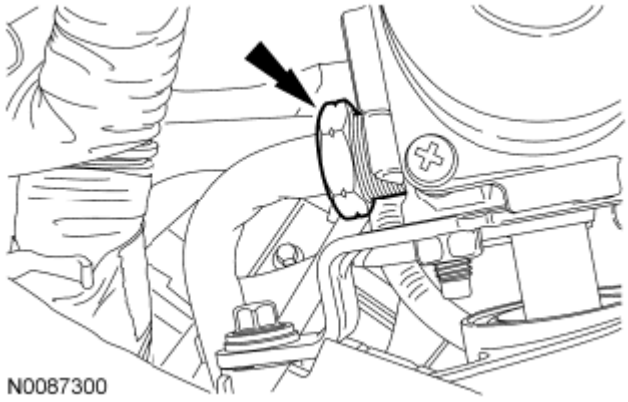
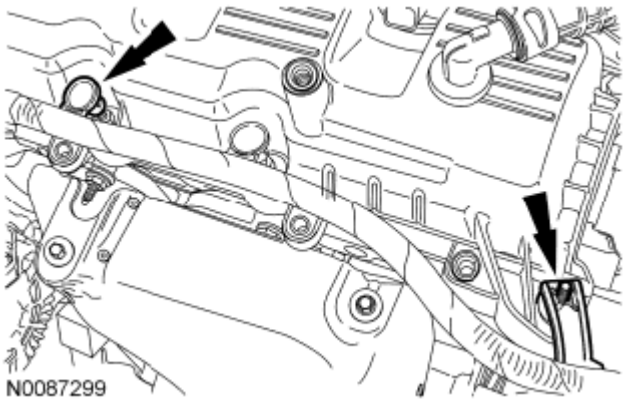


Fig. 379: Locating EGR Tube Fitting
Courtesy of FORD MOTOR CO.

105. Position and attach the 3 B+ wiring harness retainers.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 380: Locating B+ Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

106. Install the B+ wire and nut on the generator.
    - Tighten to 8 Nm (71 lb-in).

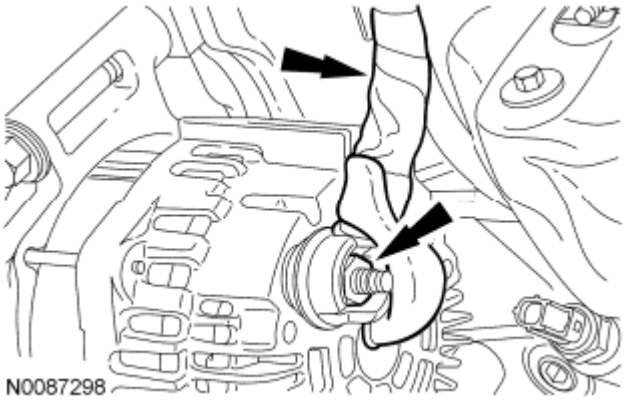


Fig. 381: Locating Nut And B+ Wire
Courtesy of FORD MOTOR CO.

107. Connect the 3 LH coil-on-plug electrical connectors.
    - Attach the 2 wiring harness retainers.

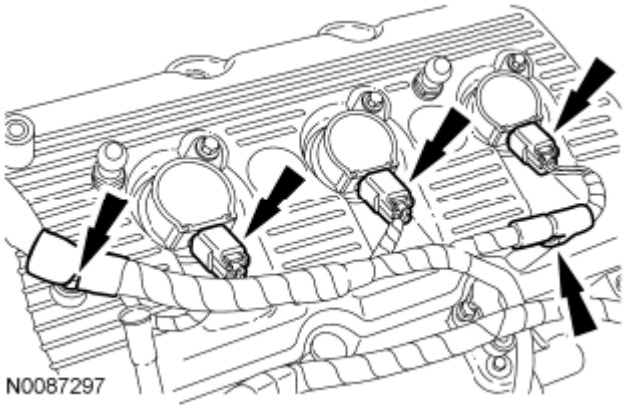


Fig. 382: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

108. Connect the LH Heated Oxygen Sensor (HO2S) electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

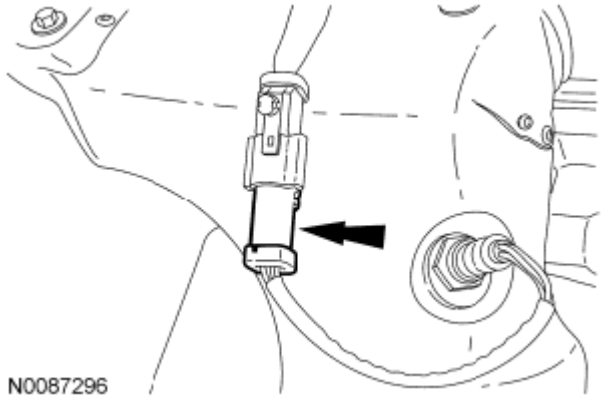


Fig. 383: Locating LH Ho2S Electrical Connector
Courtesy of FORD MOTOR CO.

109. Connect the Engine Oil Pressure (EOP) switch electrical connector and attach the wiring retainer.

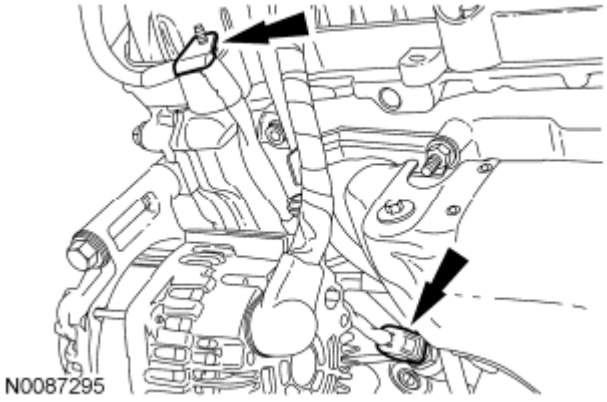


Fig. 384: Locating Engine Oil Pressure (EOP) Switch Electrical Connector
Courtesy of FORD MOTOR CO.

110. Connect the LH **VCT** electrical connector.

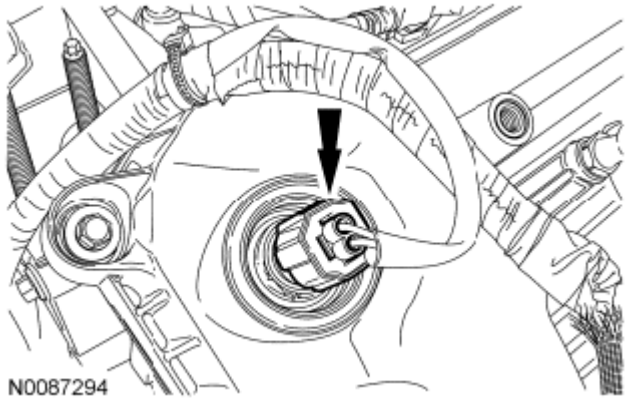


Fig. 385: Locating LH VCT Electrical Connector

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

111. Connect the fuel injector wiring harness electrical connector.

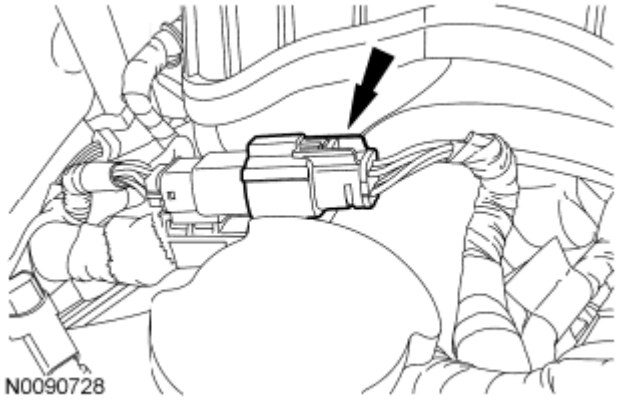


Fig. 386: Locating Fuel Injector Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

112. Connect the 2 Camshaft Position (CMP) sensor electrical connectors and attach the wiring harness retainer from the engine front cover stud bolt.

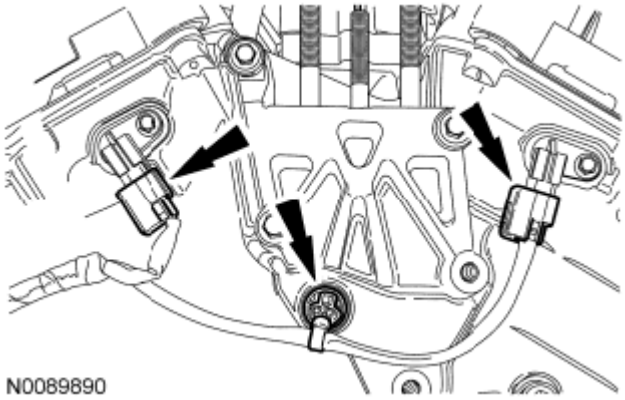


Fig. 387: Locating Camshaft Position (CMP) Sensor Electrical Connectors And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

113. Connect the Crankshaft Position (CKP) sensor electrical connector and attach the 2 wiring harness retainers.

 © 2011 Mitchell Repair Information Company, LLC.

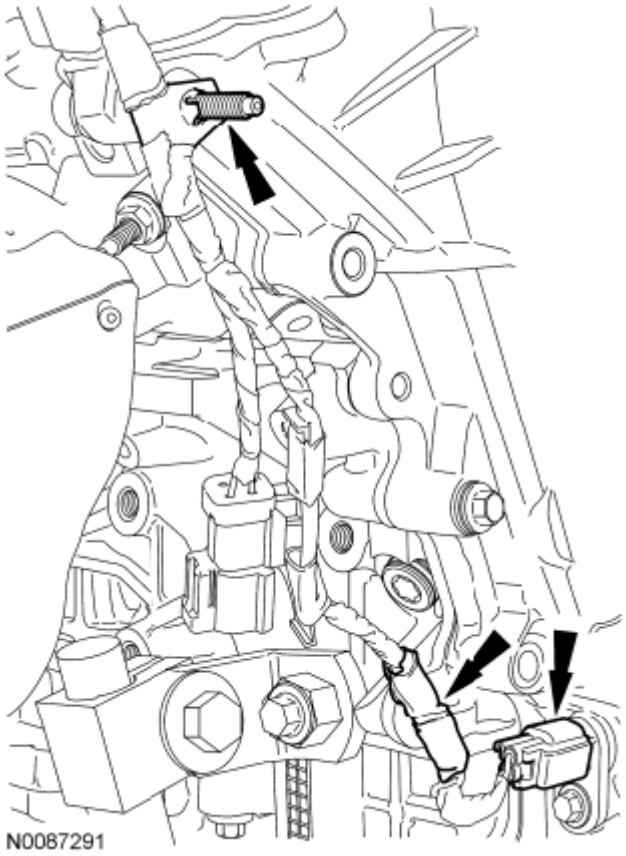


Fig. 388: Locating Crankshaft Position (CKP) Sensor Electrical Connector And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

114. Connect the RH **VCT** electrical connector.

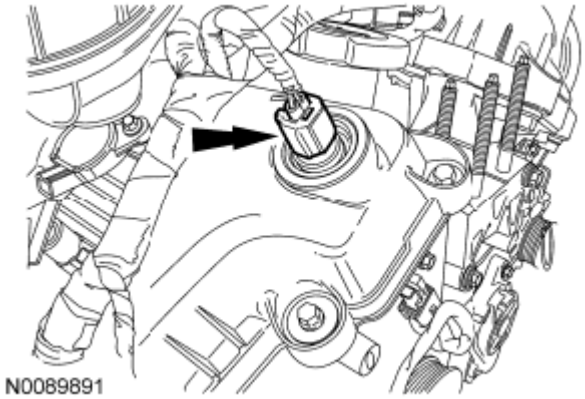


Fig. 389: Locating RH Variable Camshaft Timing (VCT) Electrical Connector
Courtesy of FORD MOTOR CO.

115. Connect the RH coil-on-plug electrical connectors.

 © 2011 Mitchell Repair Information Company, LLC.

- Attach the 2 wiring harness retainers.

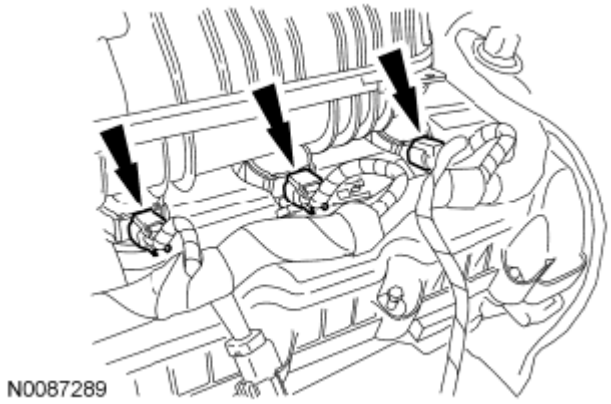


Fig. 390: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

FWD vehicles

116. Connect the RH **HO2S** electrical connector.

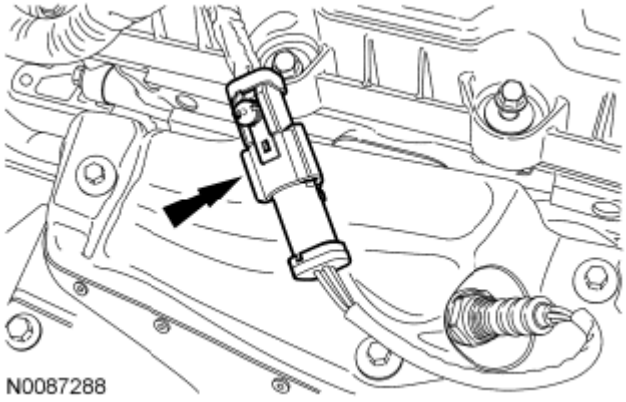


Fig. 391: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

117. Connect the Manifold Absolute Pressure (MAP) electrical connector and attach the wiring retainer.

 © 2011 Mitchell Repair Information Company, LLC.

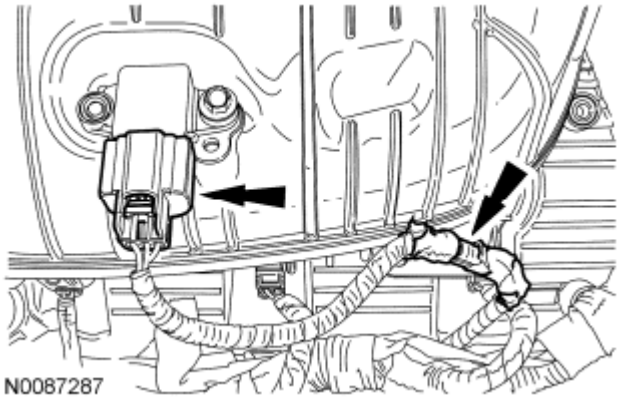


Fig. 392: Locating Manifold Absolute Pressure (MAP) Electrical Connector And Wiring Retainer
Courtesy of FORD MOTOR CO.

118. Attach the wiring harness retainer to the upper intake manifold.

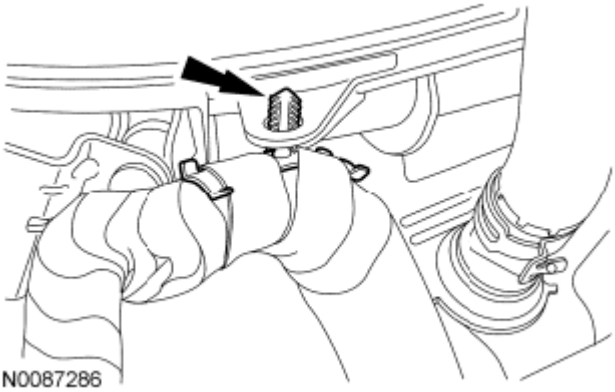


Fig. 393: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

119. Connect the EGR regulator electrical connector and attach the wiring retainer.

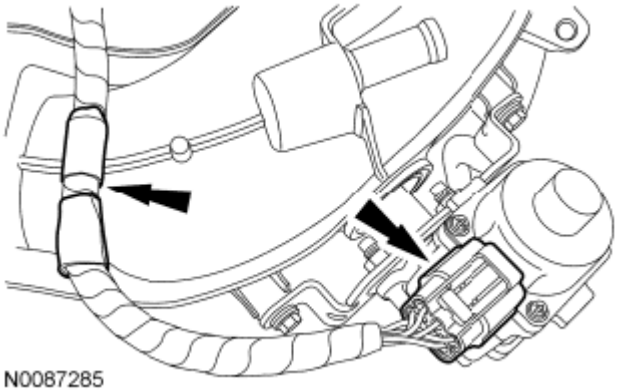


Fig. 394: Locating EGR Regulator Electrical Connector
Courtesy of FORD MOTOR CO.

 © 2011 Mitchell Repair Information Company, LLC.

120. Connect the Evaporative Emission (EVAP) canister purge valve electrical connector.

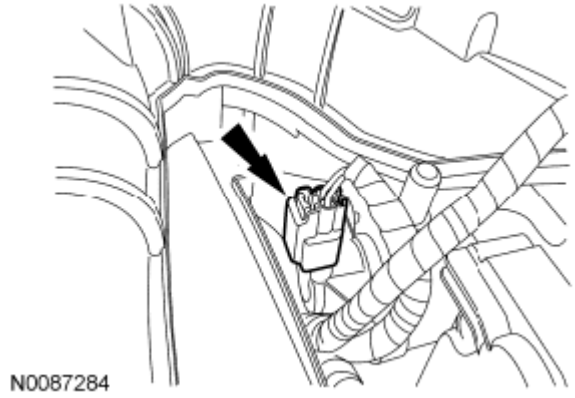


Fig. 395: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

121. Connect the electronic throttle control electrical connector.

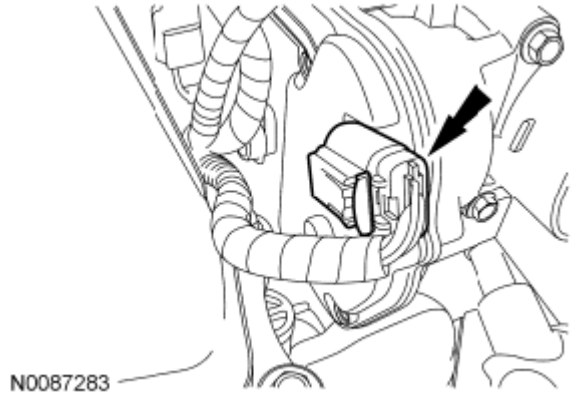


Fig. 396: Locating Electronic Throttle Control Electrical Connector
Courtesy of FORD MOTOR CO.

122. Connect the engine block Knock Sensor (KS) electrical connector and attach the wire harness retainer, connect the Cylinder Head Temperature (CHT) sensor electrical connector and the cylinder head **KS** electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

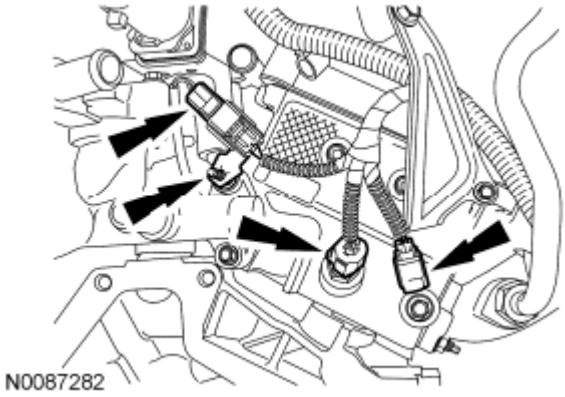


Fig. 397: Locating Engine Block Knock Sensor (KS) Electrical Connector And Wire Harness Retainer
Courtesy of FORD MOTOR CO.

123. Using the Spreader Bar and the Engine Lifting Brackets, remove the engine from the engine stand.

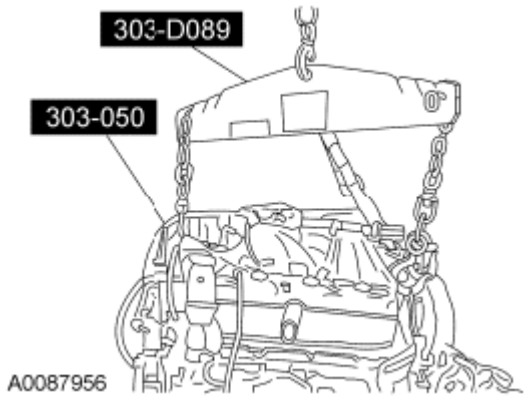


Fig. 398: Identifying Spreader Bar And Engine Lifting Brackets
Courtesy of FORD MOTOR CO.

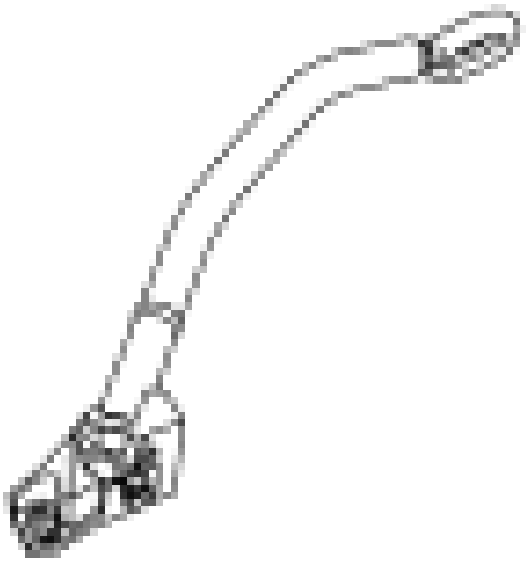
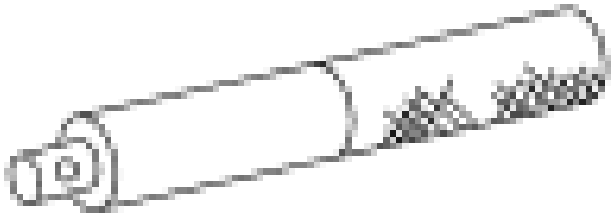
INSTALLATION

ENGINE

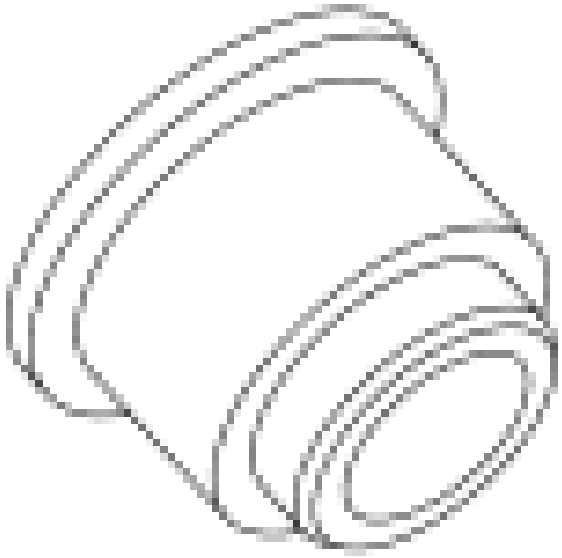
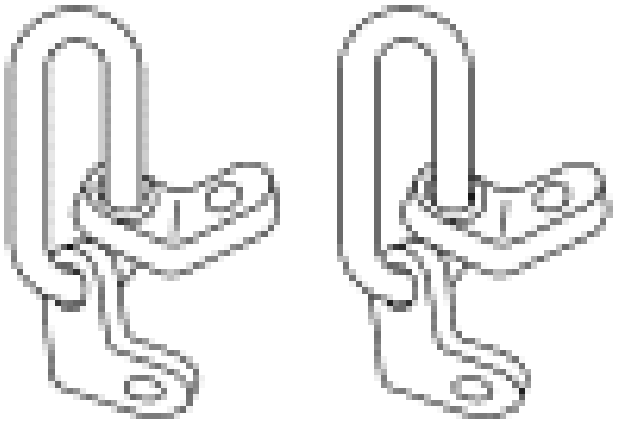
Special Tool(s)

SPECIAL TOOL CHART

 © 2011 Mitchell Repair Information Company, LLC.

 ST2673-A	Engine Lifting Bracket Set 303-1140
 ST1653-A	Handle 205-153 (T80T-4000-W)
	Installer, PTO Driven Gear Oil Seal

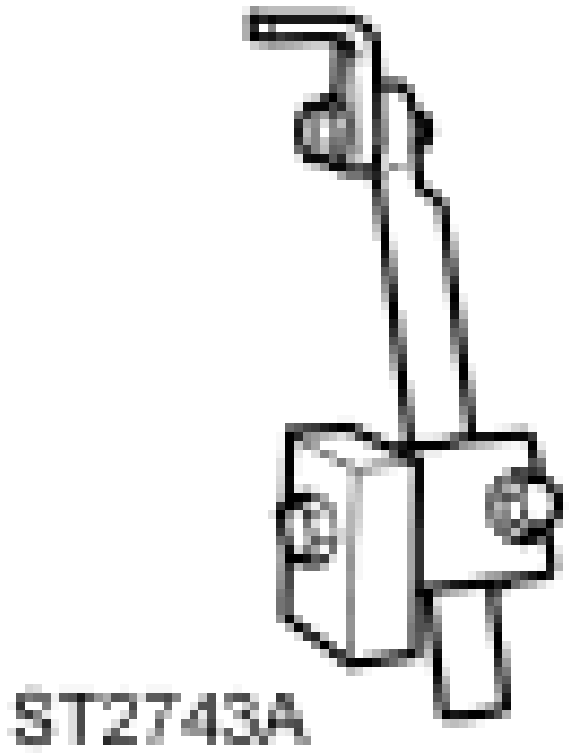
 © 2011 Mitchell Repair Information Company, LLC.

 ST2570-A	308-429
 ST1595-A	Lifting Bracket, Engine 303-050 (T70P-6000)

 © 2011 Mitchell Repair Information Company, LLC.

	Powertrain Lift 014-00765 or equivalent
	Spreader Bar 303-D089 (D93P-6001-A3) or equivalent

 © 2011 Mitchell Repair Information Company, LLC.

 ST2743A	Universal Adapter Brackets 014-0001
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

 © 2011 Mitchell Repair Information Company, LLC.

MATERIAL SPECIFICATIONS

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

Installation

NOTE: If the oil pan was removed during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in engine oil leaks.

All vehicles

1. Using the Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set and a suitable engine crane, align the engine with the transaxle.

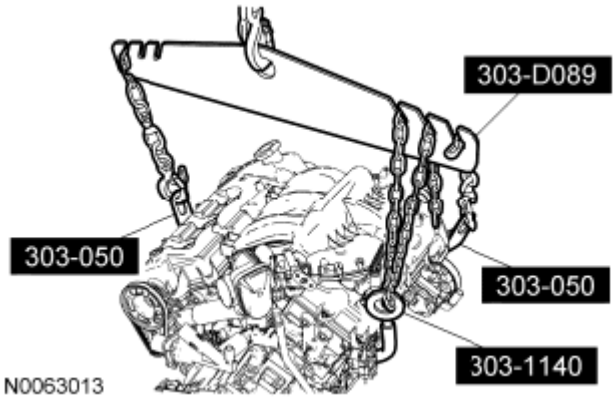


Fig. 399: Identifying Spreader Bar, Engine Lifting Brackets, Engine Lifting Bracket Set And Suitable Engine Crane
Courtesy of FORD MOTOR CO.

2. Install the 5 transaxle-to-engine bolts (3 shown).
   - Tighten to 48 Nm (35 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

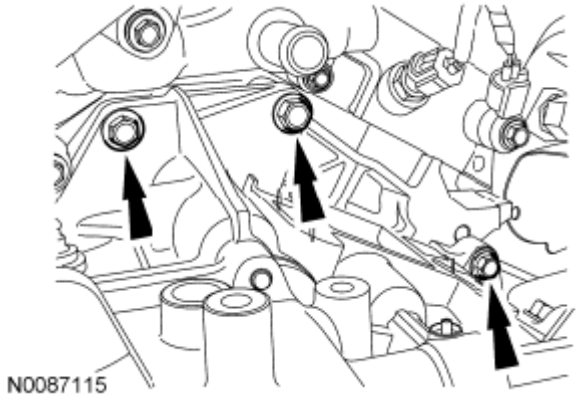


Fig. 400: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Using the Universal Adapter Brackets, secure the engine and transaxle to the Powertrain Lift.

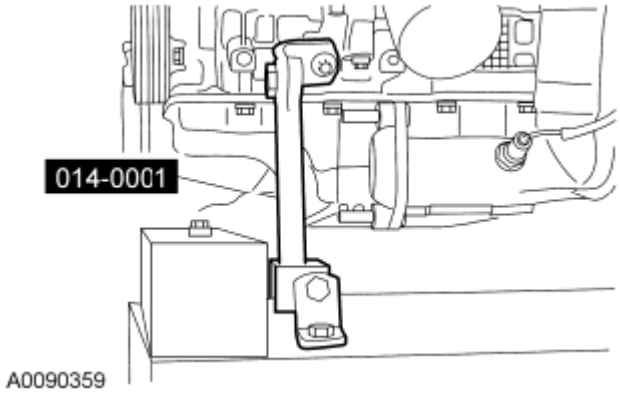
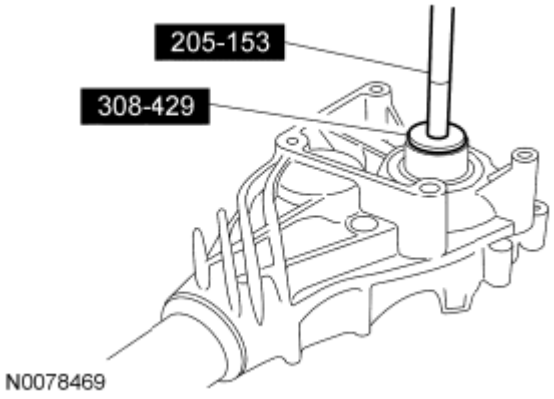


Fig. 401: Identifying Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

4. Using the Handle and PTO Driven Gear Oil Seal Installer, install the intermediate shaft seal.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 402: Identifying Handle And PTO Driven Gear Oil Seal Installer
Courtesy of FORD MOTOR CO.

5. Install the Power Transfer Unit (PTU) heat shield and the 3 bolts.
   - Tighten to 11 Nm (97 lb-in).

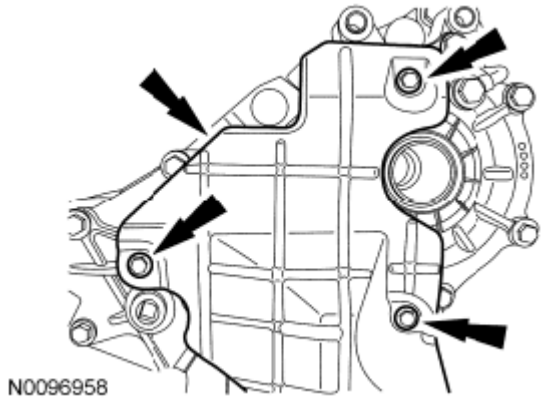


Fig. 403: Locating Bolts And PTU Heat Shield
Courtesy of FORD MOTOR CO.

6. Position the **PTU** and install the bolt.
   - Tighten to 45 Nm (33 lb-ft).

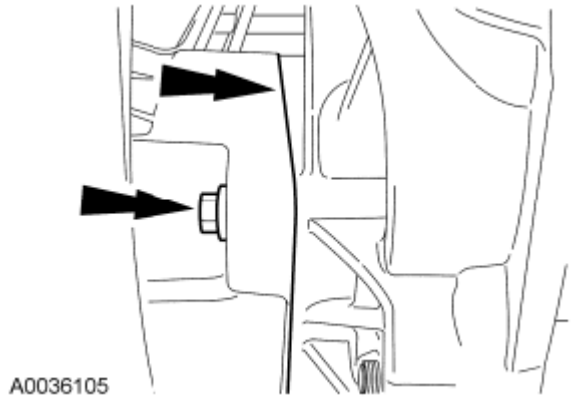


Fig. 404: Locating PTU And Bolts
Courtesy of FORD MOTOR CO.

7. Install the 3 **PTU** bolts.
   - Tighten to 45 Nm (33 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

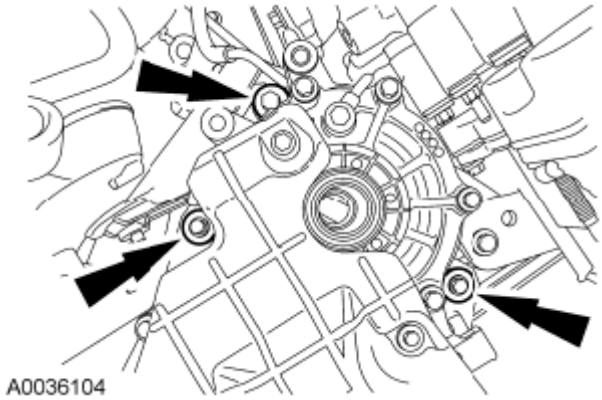


Fig. 405: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

8. Install the **PTU** vent tube, the pin-type retainer and the bolt.
    - Tighten to 14 Nm (124 lb-in).

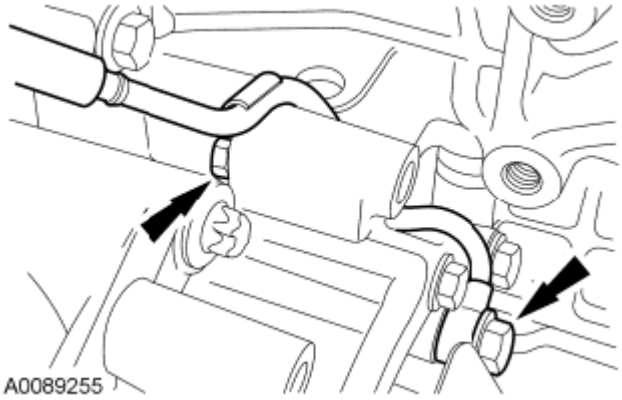


Fig. 406: Locating PTU Vent Tube Bolts
Courtesy of FORD MOTOR CO.

9. Install the **PTU** support bracket and bolts.
    - Tighten to 55 Nm (41 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

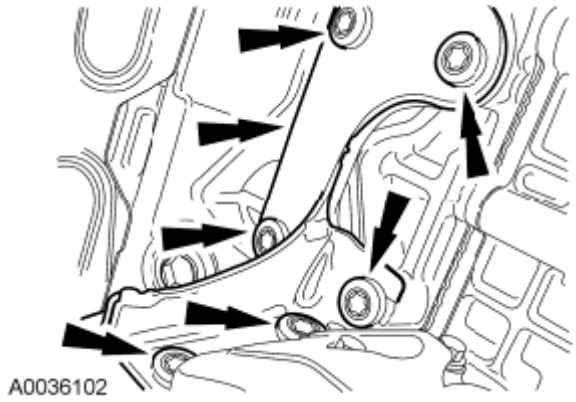


Fig. 407: Locating Bolts And Power Transfer Unit (PTU) Support Bracket
Courtesy of FORD MOTOR CO.

10. Install a new gasket and the RH catalytic converter and the 3 new nuts.
    - Tighten to 40 Nm (30 lb-ft).

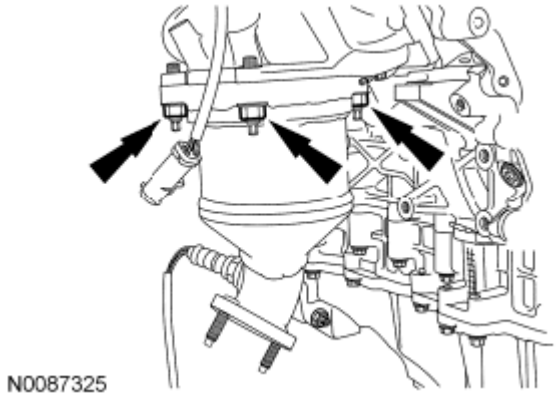


Fig. 408: Locating RH Catalytic Converter And Nuts
Courtesy of FORD MOTOR CO.

11. Install the 3 bolts and the RH heat shield.
    - Tighten to 10 Nm (89 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

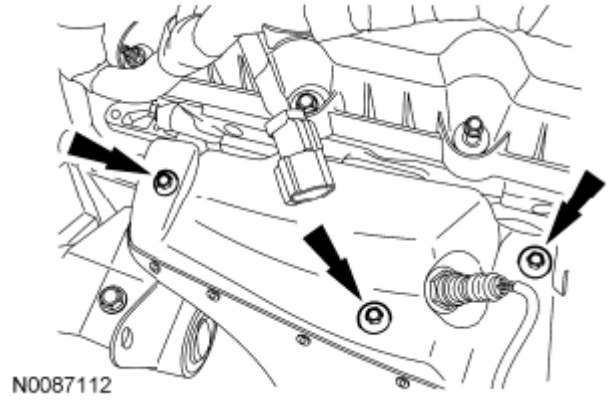


Fig. 409: Locating Bolts And RH Heat Shield
Courtesy of FORD MOTOR CO.

12. Connect the RH Heated Oxygen Sensor (HO2S) electrical connector.

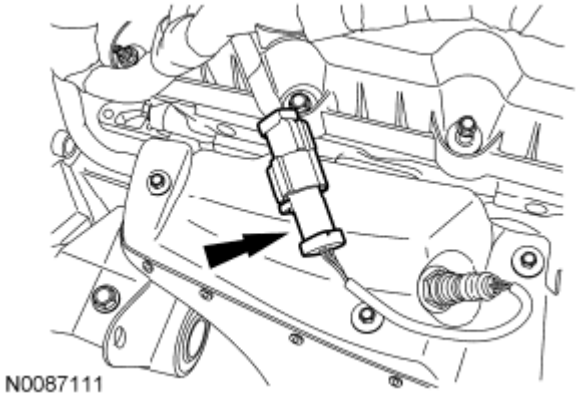


Fig. 410: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

13. Install the 2 stud bolts and the starter.
    - Tighten to 27 Nm (20 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

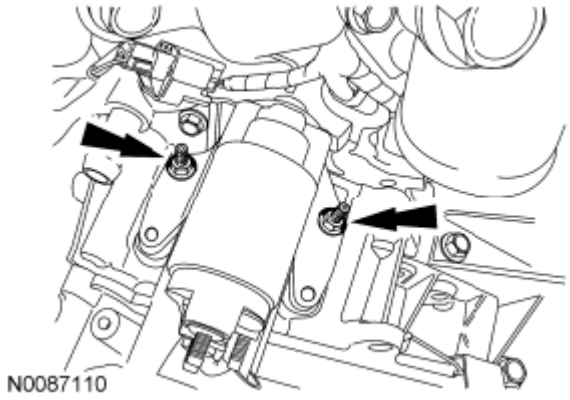


Fig. 411: Locating Stud Bolts And Starter
Courtesy of FORD MOTOR CO.

14. Install the 2 nuts and the starter wiring.
    - Tighten the small starter motor solenoid wire nut to 5 Nm (44 lb-in).
    - Tighten the large starter motor solenoid battery cable nut to 12 Nm (106 lb-in).

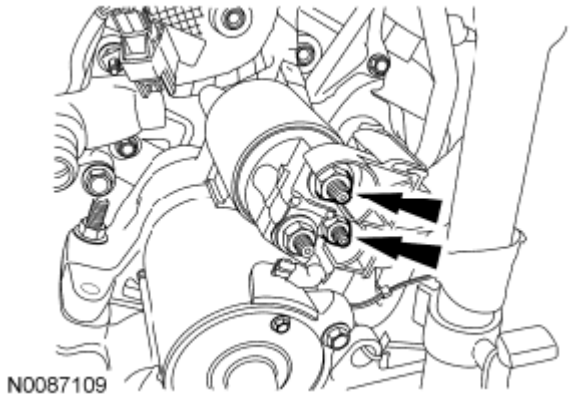


Fig. 412: Locating Nuts And Starter Wiring
Courtesy of FORD MOTOR CO.

15. Install the nut and the starter wiring ground.
    - Tighten to 18 Nm (159 lb-in).

 © 2011 Mitchell Repair Information Company, LLC.

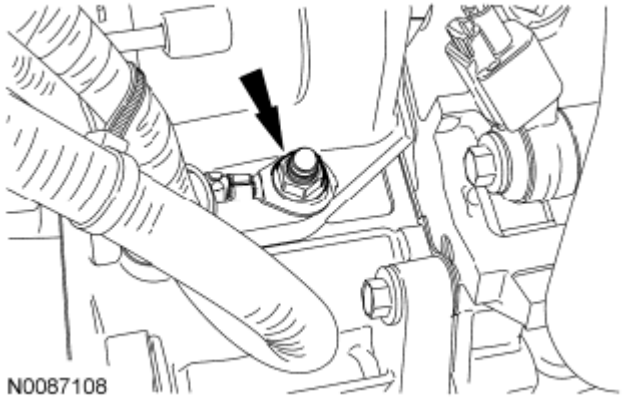


Fig. 413: Locating Nut And Starter Wiring Ground
Courtesy of FORD MOTOR CO.

16. Position the powertrain into the vehicle.

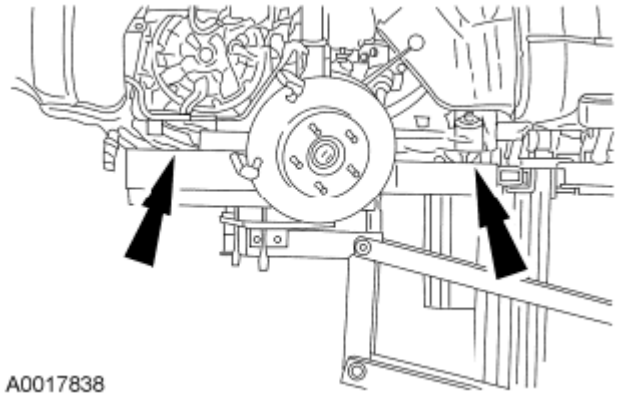


Fig. 414: Locating Powertrain Into Vehicle
Courtesy of FORD MOTOR CO.

17. Install the engine support bracket, the bolt and the 3 nuts.
    - Tighten the nuts to 55 Nm (41 lb-ft).
    - Tighten the bolt to 90 Nm (66 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

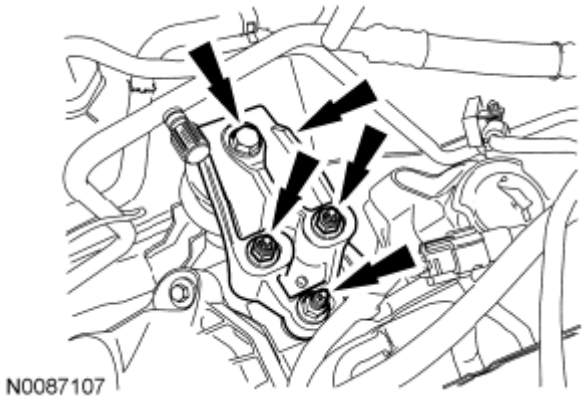


Fig. 415: Locating Engine Support Bracket Nuts And Bolt
Courtesy of FORD MOTOR CO.

18. Install the rear transaxle support through bolt.
    - Tighten to 103 Nm (76 lb-ft).

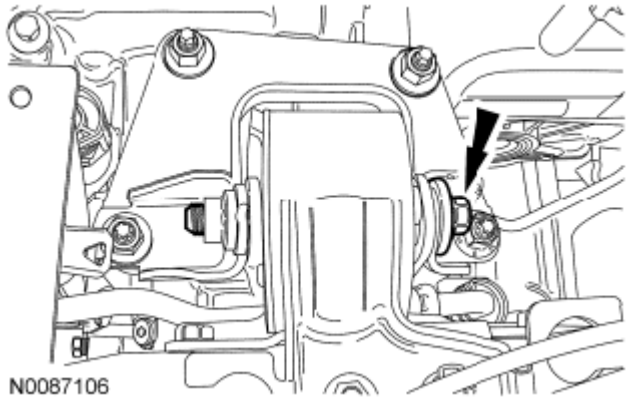


Fig. 416: Locating Rear Transaxle Support Through Bolt
Courtesy of FORD MOTOR CO.

19. Position the RH transaxle support insulator and install the bolt and nuts.
    - Tighten to 80 Nm (59 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

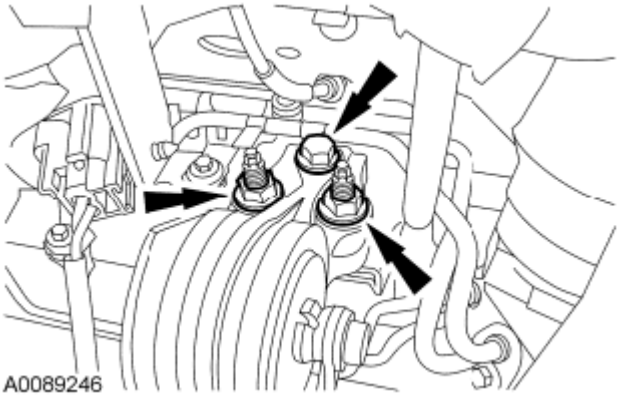


Fig. 417: Locating RH Transaxle Support Insulator Bolt And Nuts
Courtesy of FORD MOTOR CO.

NOTE: Late build AWD equipped with a mass damper shown, other vehicles similar.

20. Install the RH transaxle support insulator through bolt and mass damper (if equipped).
    - Tighten to 115 Nm (85 lb-ft).

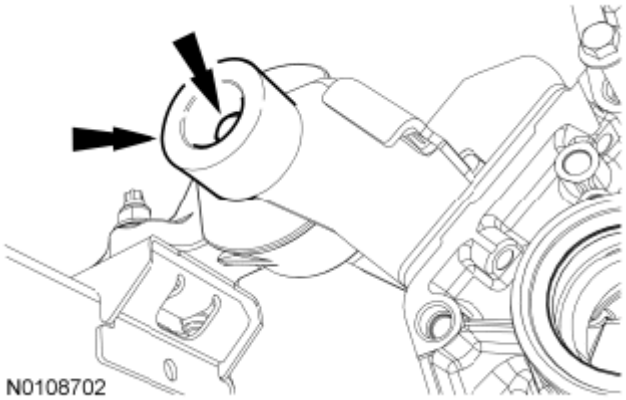


Fig. 418: Locating Rh Transaxle Support Insulator Bolt And Mass Damper
Courtesy of FORD MOTOR CO.

21. Install the 3 bolts and the halfshaft support bracket.
    - Tighten to 48 Nm (35 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

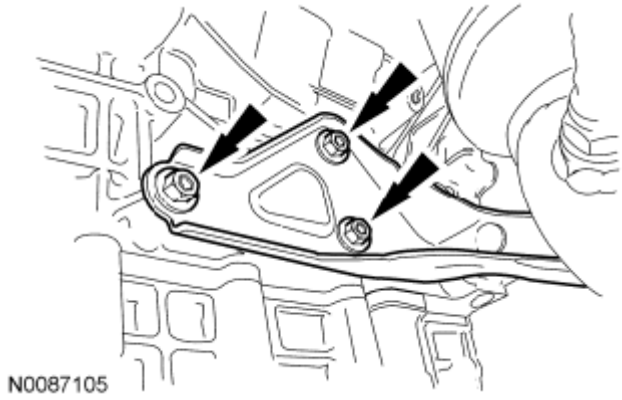


Fig. 419: Locating Bolts And Halfshaft Support Bracket
Courtesy of FORD MOTOR CO.

22. Install the transaxle-to-engine stud and 2 nuts.
    - Tighten to 48 Nm (35 lb-ft).

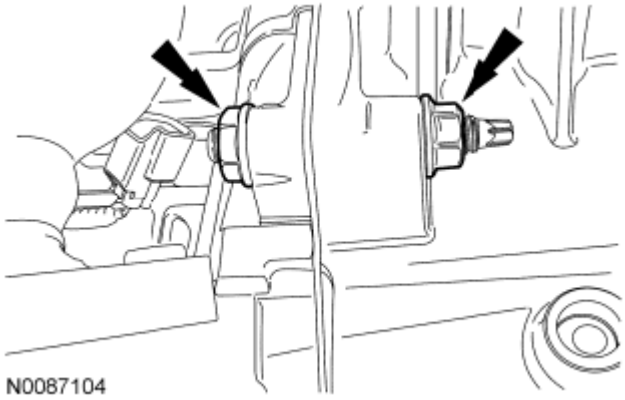


Fig. 420: Locating Transaxle-To-Engine Stud And Nuts
Courtesy of FORD MOTOR CO.

NOTE: Clean and degrease all sealing surfaces with metal surface prep.

NOTE: The oil pan must be installed and the bolts tightened within 4 minutes of the sealant application.

 © 2011 Mitchell Repair Information Company, LLC.

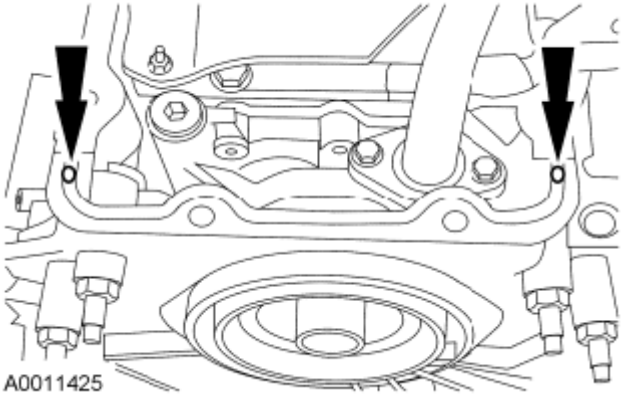


Fig. 421: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

23. Apply a 10 mm (0.39 in) dot of silicone gasket and sealant to the front cover-to-cylinder block sealing surface.

NOTE: Install a new oil pan gasket.

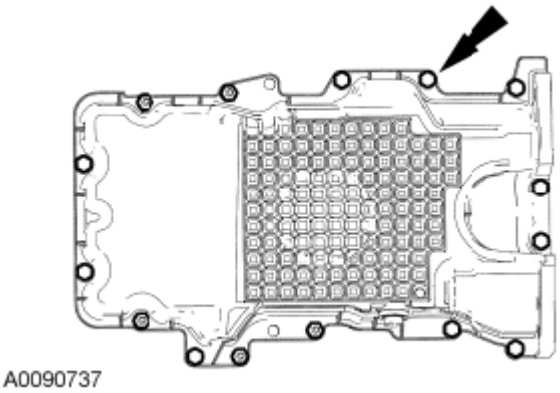


Fig. 422: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

24. Position the oil pan and gasket and loosely install the bolts and stud bolts.
25. Install the 2 oil pan-to-transaxle bolts.
    - Tighten to 40 Nm (30 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.



Fig. 423: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

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

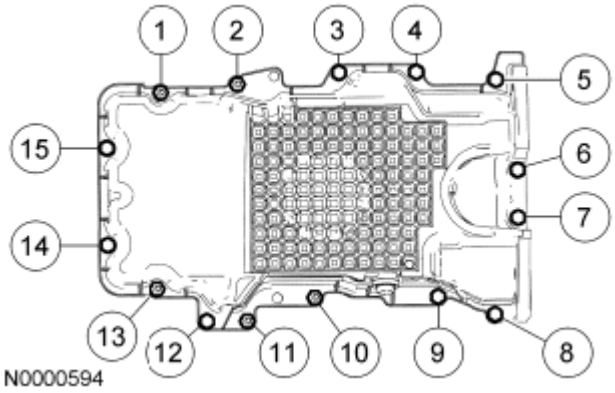


Fig. 424: Identifying Oil Pan Bolts In Sequence
Courtesy of FORD MOTOR CO.

27. Install the 4 torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 425: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

28. Install the access cover.

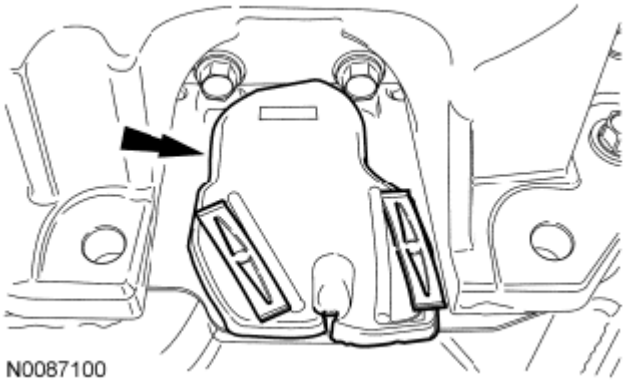


Fig. 426: Locating Access Cover
Courtesy of FORD MOTOR CO.

29. If equipped, connect the engine block heater electrical connector.

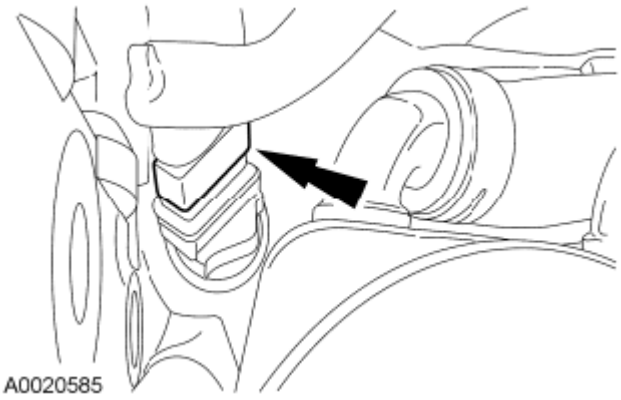


Fig. 427: Locating Engine Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

30. Install the ground wire eyelet and nut to the engine mount stud.
    - Tighten to 25 Nm (18 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

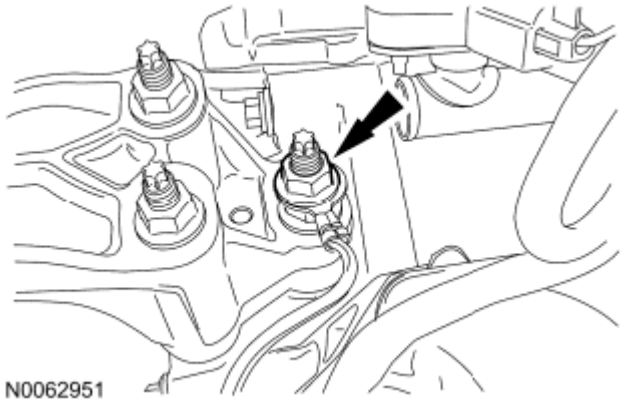


Fig. 428: Locating Ground Wire Eyelet And Nut
Courtesy of FORD MOTOR CO.

31. Connect the electrical connector to the Power Distribution Box (PDB).

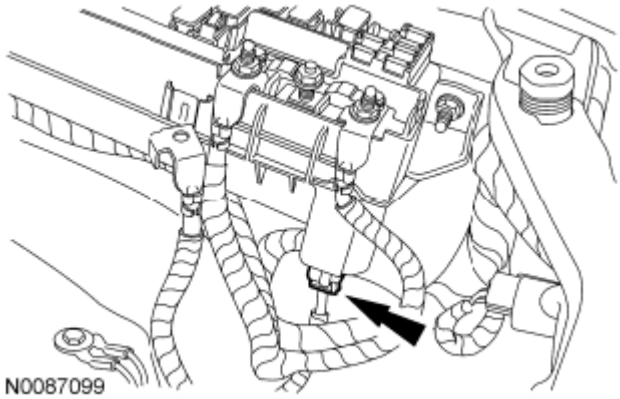
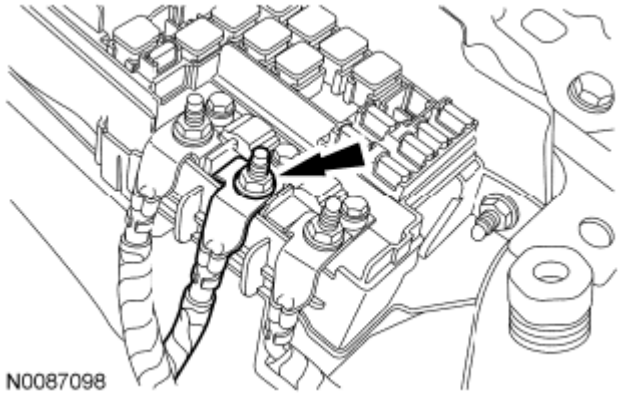


Fig. 429: Locating PDB
Courtesy of FORD MOTOR CO.

32. Install the cable and the nut to the **PDB** .
    - Tighten to 12 Nm (106 lb-in).



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 430: Locating Nut And Cable
Courtesy of FORD MOTOR CO.

33. Attach the ground wire and install the bolt.
    - Tighten to 10 Nm (89 lb-in).

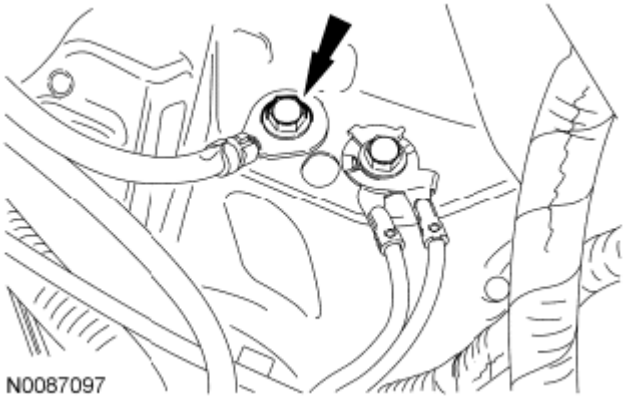


Fig. 431: Locating Bolt And Ground Wire
Courtesy of FORD MOTOR CO.

34. Attach the wiring harness retainer to the battery tray bracket.

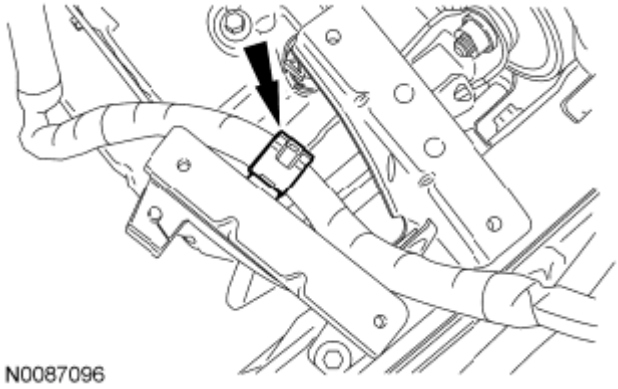


Fig. 432: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

35. Connect the middle PCM electrical connector and the engine wiring harness electrical connector.
    - Attach the 2 wiring harness retainers.

 © 2011 Mitchell Repair Information Company, LLC.

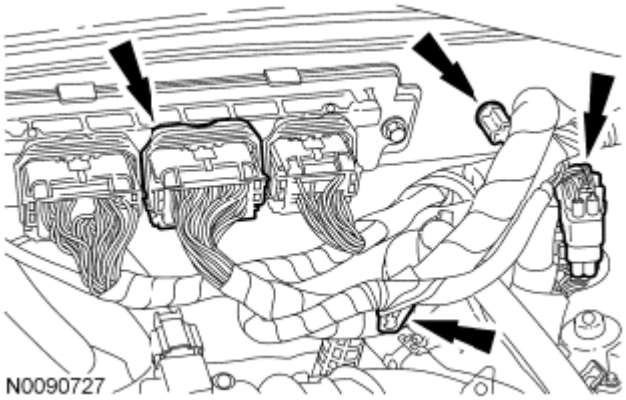


Fig. 433: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

36. Connect the Evaporative Emission (EVAP) canister purge valve tube and the brake booster vacuum tube to the intake manifold.

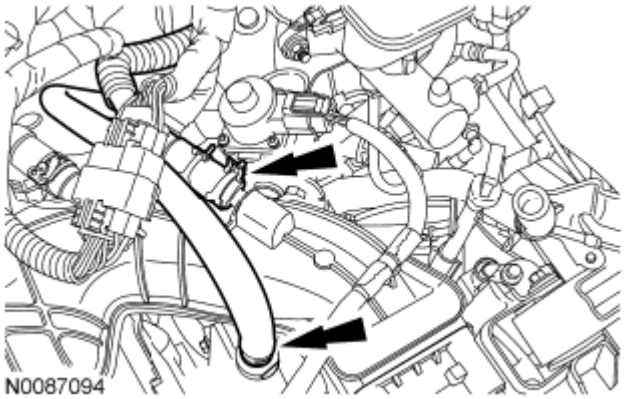


Fig. 434: Locating Evaporative Emission (EVAP) Canister Purge Valve Tube And Brake Booster Vacuum Tube
Courtesy of FORD MOTOR CO.

37. Attach the shift cable retainer to the bracket.

 © 2011 Mitchell Repair Information Company, LLC.

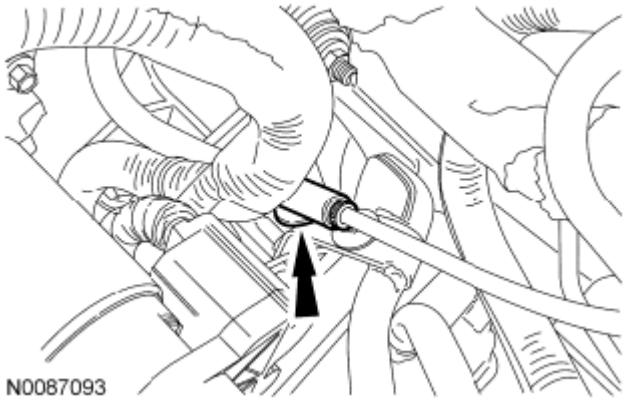


Fig. 435: Locating Shift Cable Retainer
Courtesy of FORD MOTOR CO.

38. Position the shift cable and bracket in place, install the bolts.
    - Tighten to 23 Nm (17 lb-ft).

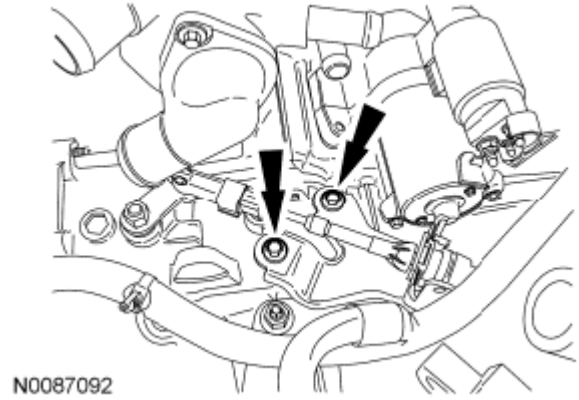
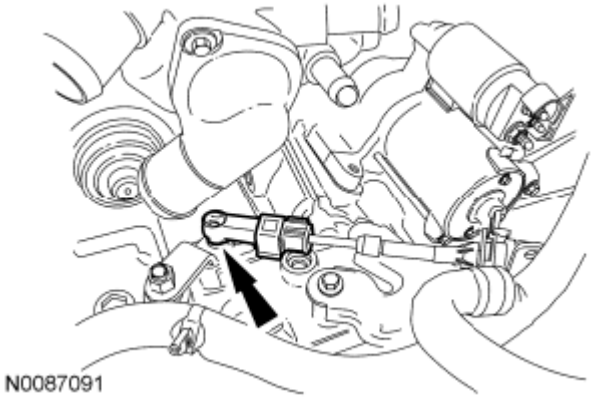


Fig. 436: Locating Shift Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

39. Connect the gearshift cable to the transaxle.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 437: Locating Gearshift Cable
Courtesy of FORD MOTOR CO.

40. Connect the fuel supply tube quick connect coupling to the fuel rail. For additional information, refer to **QUICK CONNECT COUPLING** .

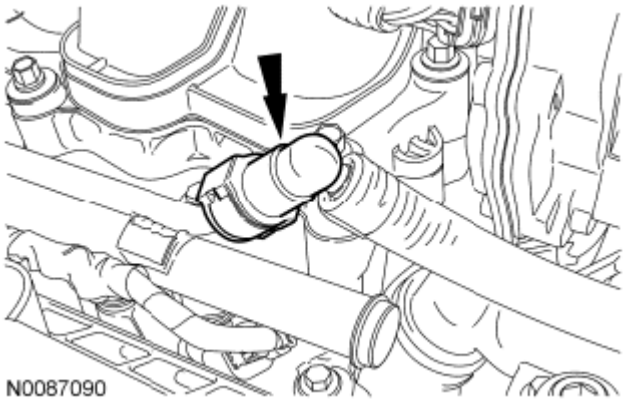


Fig. 438: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

41. Connect the 2 heater hoses.

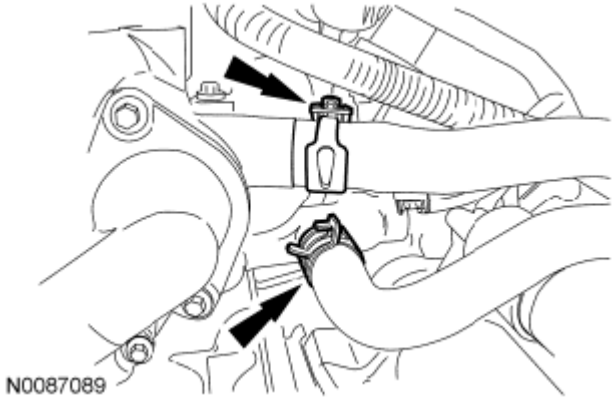


Fig. 439: Locating Heater Hoses
Courtesy of FORD MOTOR CO.

42. Connect the upper and lower radiator hoses.

 © 2011 Mitchell Repair Information Company, LLC.

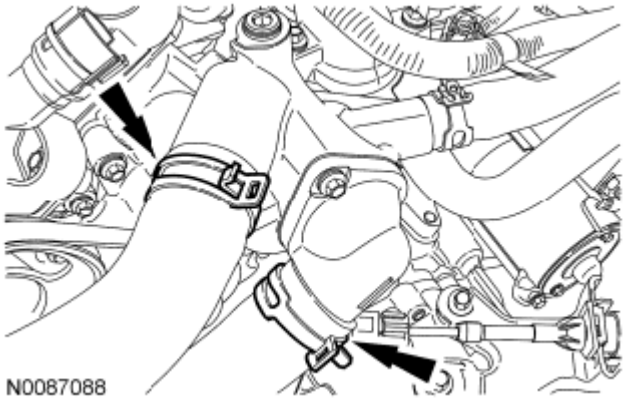


Fig. 440: Locating Upper And Lower Radiator Hoses
Courtesy of FORD MOTOR CO.

43. Connect the 2 transmission electrical connectors and attach the wiring retainer to the stud bolt.

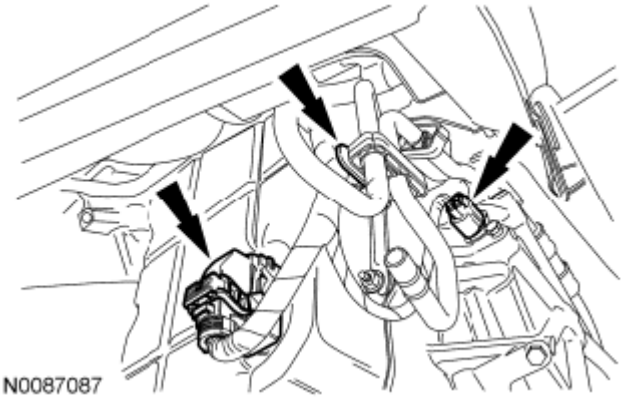


Fig. 441: Locating Transmission Electrical Connectors And Wiring Retainer
Courtesy of FORD MOTOR CO.

44. Connect the 2 transaxle fluid cooler tubes.

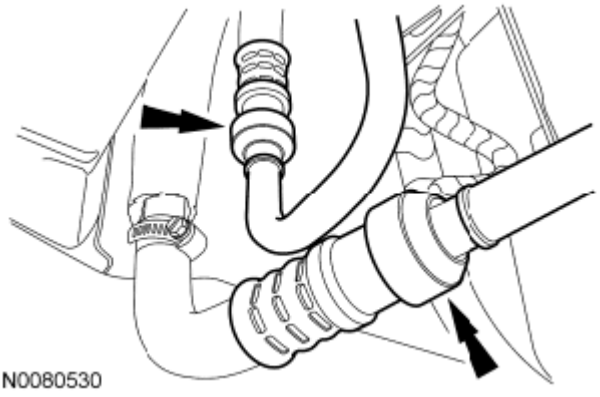


Fig. 442: Locating Transaxle Fluid Cooler Tubes

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

45. Install the 2 secondary latches to the transaxle fluid cooler tubes.

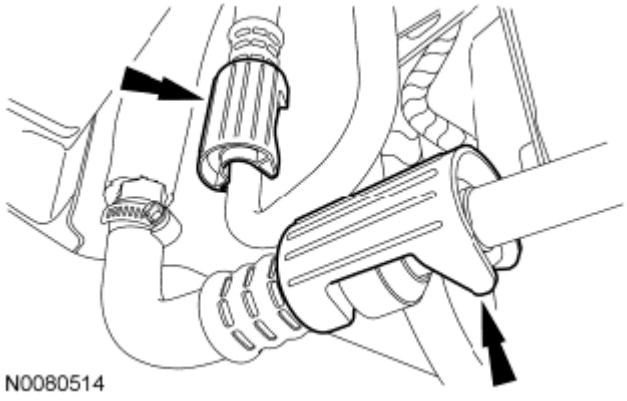


Fig. 443: Locating Secondary Latches And Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

46. Install the cross brace and the new nut finger-tight.

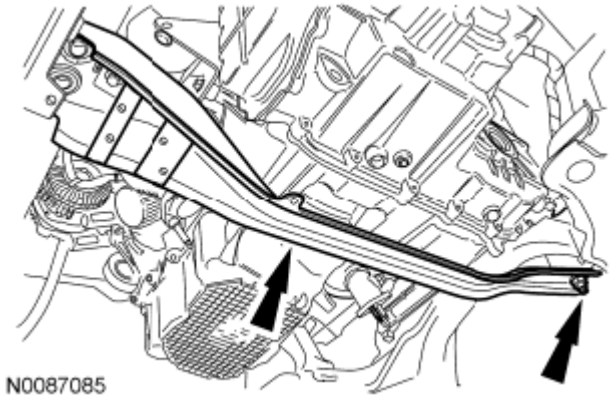


Fig. 444: Locating Nut And Engine Support Crossmember
Courtesy of FORD MOTOR CO.

47. Install the 2 bolts for the cross brace and the bolt for the front roll restrictor.
    - Tighten the 2 cross brace bolts to 90 Nm (66 lb-ft).
    - Tighten the front roll restrictor bolt to 115 Nm (85 lb-ft).

 © 2011 Mitchell Repair Information Company, LLC.

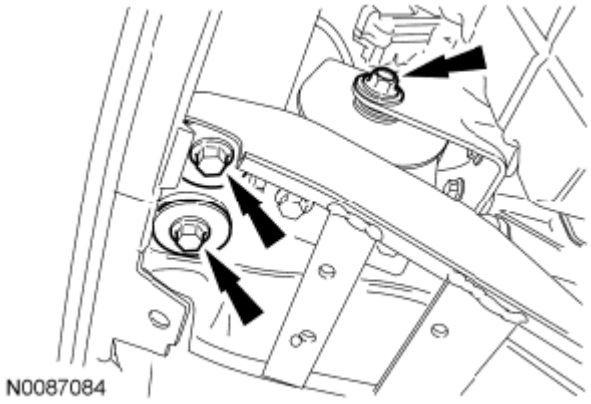


Fig. 445: Locating Front Roll Restrictor Bolts
Courtesy of FORD MOTOR CO.

48. Tighten the cross brace nut to 175 Nm (129 lb-ft).

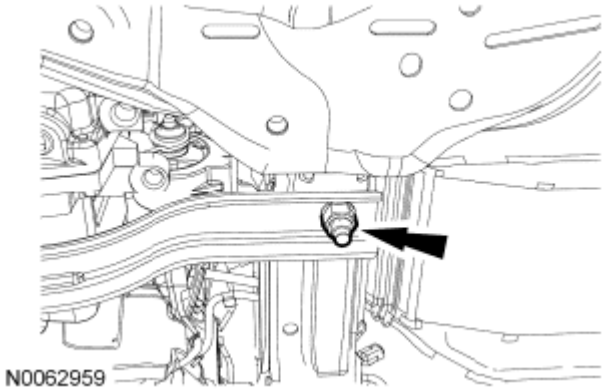


Fig. 446: Locating Cross Brace Nut
Courtesy of FORD MOTOR CO.

49. Connect the generator electrical connector.

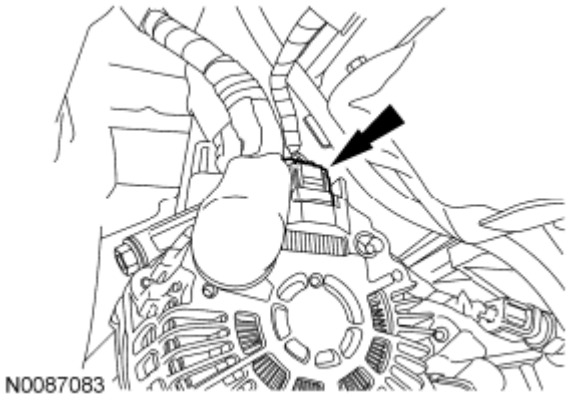


Fig. 447: Locating Generator Electrical Connector

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of FORD MOTOR CO.

50. Position the A/C compressor and install the 3 bolts.
    - Tighten to 25 Nm (18 lb-ft).

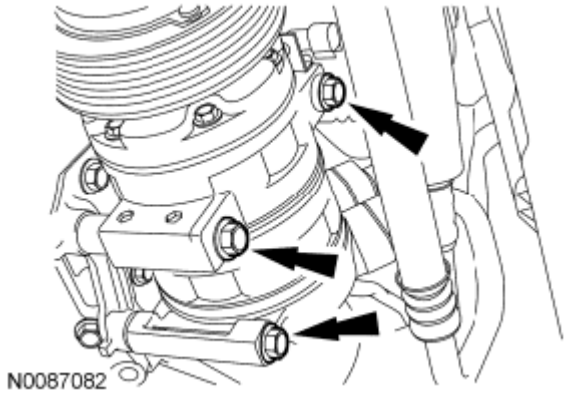


Fig. 448: Locating Bolts And A/C Compressor
Courtesy of FORD MOTOR CO.

51. Connect the A/C compressor electrical connector.

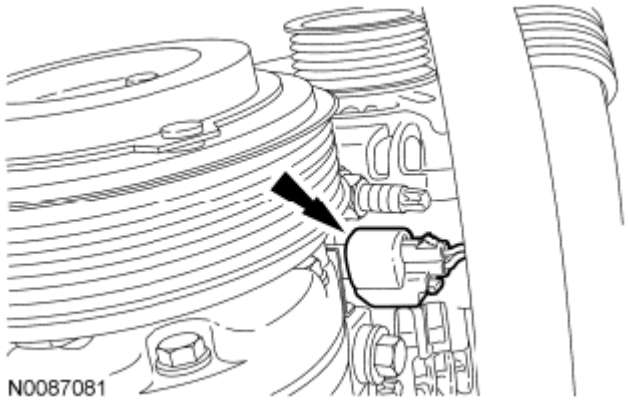


Fig. 449: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

52. Rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.

 © 2011 Mitchell Repair Information Company, LLC.

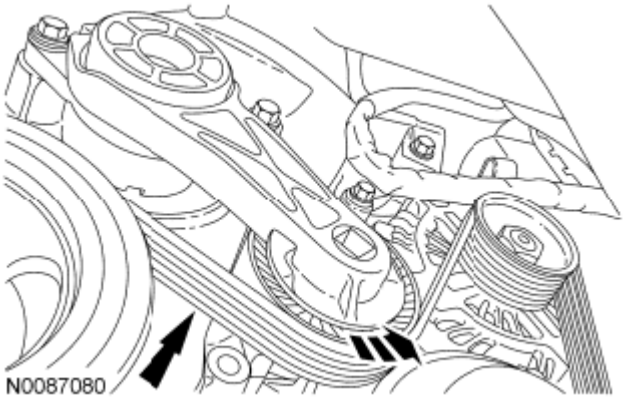


Fig. 450: Rotating Accessory Drive Belt Tensioner Counterclockwise
Courtesy of FORD MOTOR CO.

AWD vehicles

NOTE: Do not reuse the driveshaft flange bolts and washers. Install new bolts and washers or damage to the vehicle may occur.

53. Align the index-marks made during removal and install 6 new front driveshaft-to- **PTU** bolts and washers.
    - Tighten to 37 Nm (27 lb-ft).

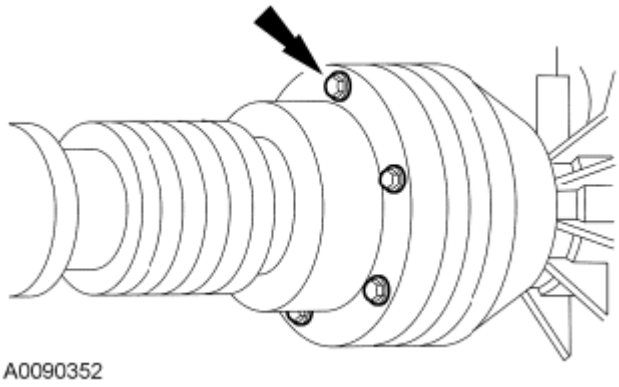


Fig. 451: Locating Front Driveshaft-To-PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

54. Install the intermediate shaft.

 © 2011 Mitchell Repair Information Company, LLC.

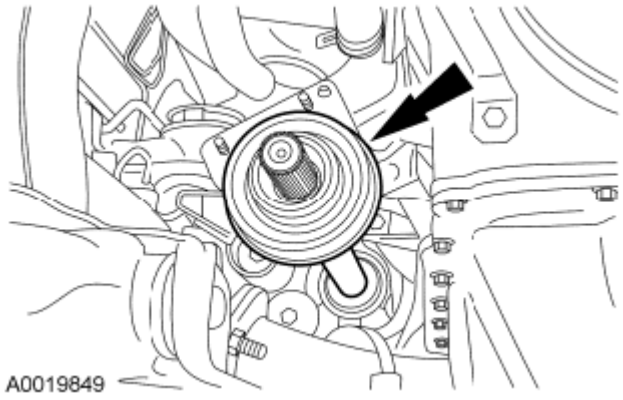


Fig. 452: Locating Intermediate Shaft
Courtesy of FORD MOTOR CO.

55. Install the 2 intermediate shaft bearing retainer nuts.
    - Tighten to 27 Nm (20 lb-ft).

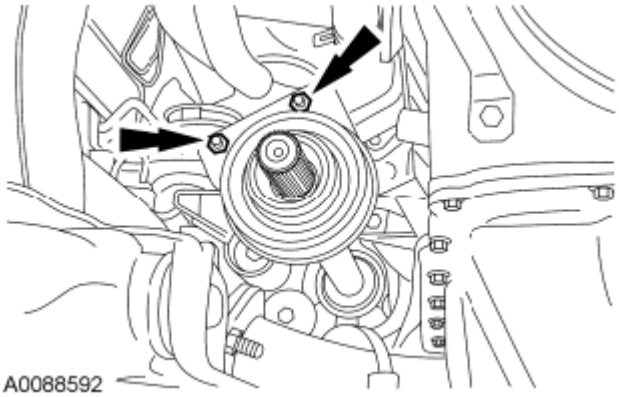


Fig. 453: Locating Intermediate Shaft Bearing Retainer Nuts
Courtesy of FORD MOTOR CO.

56. Install the RH and LH halfshaft and the intermediate shaft. For additional information, refer to **HALFSHAFT** .
57. Install the exhaust-Y-pipe. For additional information, refer to **EXHAUST Y-PIPE -- 3.0L** .
58. Connect the RH Catalyst Monitor Sensor (CMS) electrical connector.

 © 2011 Mitchell Repair Information Company, LLC.

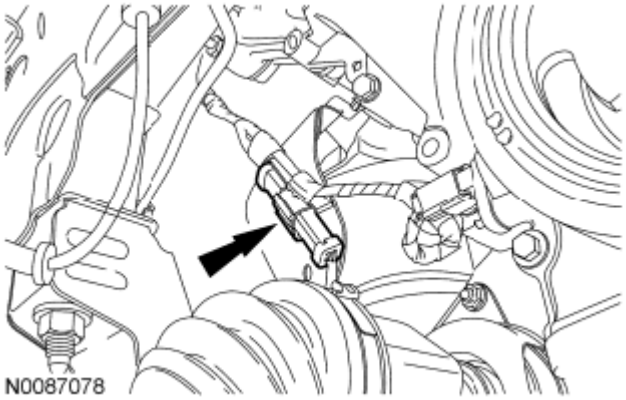


Fig. 454: Locating RH CMS Electrical Connector
Courtesy of FORD MOTOR CO.

59. Connect the LH **CMS** electrical connector.

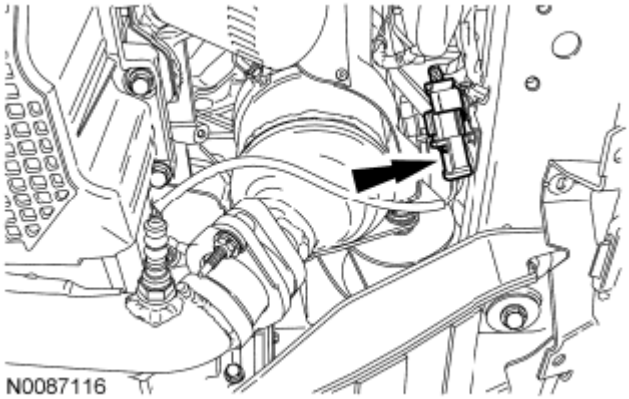
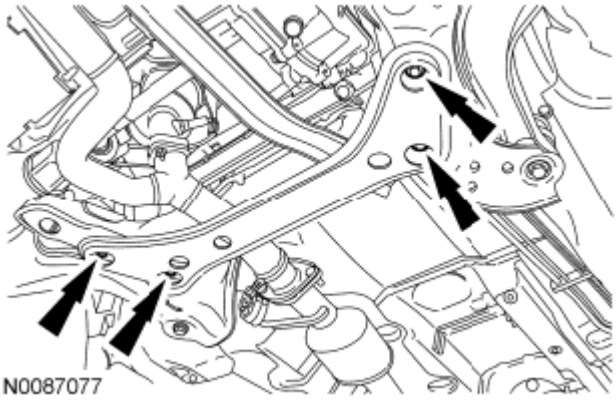


Fig. 455: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

60. Install the lateral support crossmember and the 4 bolts.
    - Tighten to 115 Nm (85 lb-ft).



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 456: Locating Bolts And Lateral Support Crossmember
Courtesy of FORD MOTOR CO.

61. Install the lower splash shields and bolts.
    - Tighten to 9 Nm (80 lb-in).

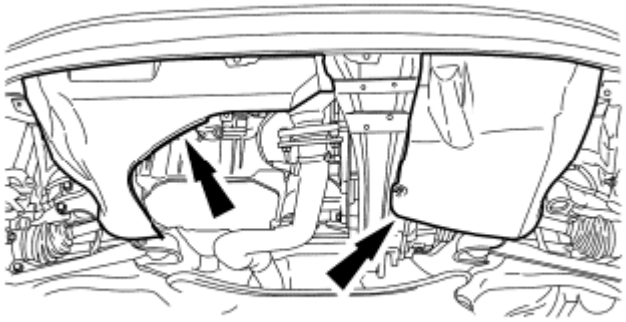


Fig. 457: Locating Lower Splash Shields
Courtesy of FORD MOTOR CO.

62. Install the front wheels and tires. For additional information, refer to **WHEEL AND TIRE** .
63. Install the Air Cleaner (ACL) outlet pipe and **ACL** . For additional information, refer to **AIR CLEANER OUTLET PIPE** .
64. Install the battery tray. For additional information, refer to **BATTERY TRAY -- NON-HYBRID** .
65. Fill the engine with clean engine oil.
66. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** .
67. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure following the on-screen instructions.

 © 2011 Mitchell Repair Information Company, LLC.