

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

2010 ENGINE**Engine Mechanical - 3.5L - Fusion & MKZ****SPECIFICATIONS****ITEM SPECIFICATION TABLE****ITEM SPECIFICATION TABLE**

Item	Specification	Fill Capacity
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6	-
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (US); Motorcraft® Premium Gold Engine Coolant (Canada) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	(1)
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	5.2L (5.5 qt) includes filter change
Motorcraft® Specialty Green Engine Coolant with Bittering Agent (US); Motorcraft® Specialty Green Engine Coolant (Canada) VC-10-A (US); CVC-10-A (Canada)	WSS-M97B55-A	(1)
Silicone Gasket Remover ZC-30	-	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-
Threadlock and Sealer TA-25	WSK-M2G351-A5	-

(1) Early build vehicle (built before July 6, 2009) cooling systems are filled with Motorcraft® Premium Gold Engine Coolant. Late build vehicle (built on or after July 6, 2009) cooling systems are filled with Motorcraft® Specialty Green Engine Coolant. Mixing coolant types degrades the corrosion protection of the coolant. Do not mix coolant types. Failure to follow these instructions may result in engine or cooling system damage.

GENERAL SPECIFICATIONS TABLE**GENERAL SPECIFICATIONS TABLE**

--	--

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Item	Specification
Engine	
Displacement	3.5L (4V) (214 CID)
No. cylinders	6
Bore/stroke	92.5/86.7 mm (3.641/3.413 in)
Fire order	1-4-2-5-3-6
Oil pressure	Minimum 30 psi @ 1,500 rpm with engine at normal operating temperature
Spark plug	AYSF-22FM Gap = 1.29-1.45 mm (0.051-0.057 in)
Compression ratio	10.3:1
Engine weight (without accessory drive components)	161 kg (355 lb)
Engine and transaxle weight (without accessory drive components)	260.8 kg (575 lb)
Cylinder Head and Valve Train	
Cylinder head gasket surface flatness ^{(1)a}	Flat within 0.08 mm (0.003 in) length end to end, area 150 mm (5.9 in) X 150 mm (5.9 in) (or full width) should be less than 0.05 mm (0.002 in)
Combustion chamber volume	55.84 cc (3.41 CI)
Valve tappet clearance intake	0.15-0.25 mm (0.006-0.01 in)
Valve tappet clearance - exhaust	0.360-0.460 mm (0.0142-0.0181 in) Engine must be at room temperature before measuring
Valve guide bore inner diameter	5.519-5.549 mm (0.217-0.218 in)
Valve stem diameter - intake	5.479-5.497 mm (0.2157-0.2164 in)
Valve stem diameter - exhaust	5.466-5.484 mm (0.2151-0.2159 in)
Valve stem-to-guide clearance - intake	0.022-0.070 mm (0.0008-0.0027 in)
Valve stem-to-guide clearance - exhaust	0.035-0.083 mm (0.0013-0.032 in)
Valve head diameter - intake	36.82-37.18 mm (1.44-1.46 in)
Valve head diameter - exhaust	30.82-31.18 mm (1.21-1.22 in)
Valve face runout	0.05 mm (0.0001 in)
Valve face angle	44.5-45.5 degrees
Valve seat width - intake	1.3-1.5 mm (0.051-0.059 in)
Valve seat width - exhaust	1.4-1.6 mm (0.055-0.062 in)
Valve seat runout	0.04 mm (0.0001 in) MAX
Valve seat angle	44.5-45.5 degrees
Valve spring free length (approx.)	48.4 mm (1.90 in)
Valve spring compression pressure (N @ spec. length)	510 N @ 27.32 mm (115 lb @ 1.08 in)
Valve spring installed height	37.0 mm (1.45 in)
Valve spring installed height pressure (N @ spec. length)	235 N @ 37.0 mm (53 lb @ 1.45 in)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Valve spring installed pressure - service limit	10% force loss @ specified height
Camshaft	
Theoretical valve lift @ 0 lash	9.6798 mm (0.38 in)
Lobe lift - intake	9.6798 mm (0.38 in)
Lobe lift - exhaust	9.6798 mm (0.38 in)
Allowable lobe lift loss	0.062 mm (0.0024 in)
Camshaft journal bore inside diameter - 1st journal	31.0375-31.0625 mm (1.221-1.222 in)
Camshaft journal bore inside diameter - intermediate journals	25.9875-26.0125 mm (1.023-1.024 in)
Camshaft bearing outside diameter - 1st journal	30.993-31.013 mm (1.2202-1.2209 in)
Camshaft bearing outside diameter - intermediate journals	25.937-25.963 mm (1.021-1.022 in)
Camshaft journal-to-bearing clearance, 1st journal - service limit	0.070 mm (0.0027 in) MAX
Camshaft journal-to-bearing clearance, intermediate journals - service limit	0.0755 mm (0.0029 in) MAX
Runout	0.040 mm (0.0015 in) MAX
End play - standard	0.032-0.170 mm (0.0012-0.0066 in)
End play - service limit	0.190 mm (0.00748 in) MAX
Cylinder Block	
Cylinder bore diameter - grade 1	92.500-92.520 mm (3.641-3.642 in)
Main bearing bore inside diameter	72.400-72.424 mm (2.8503-2.8513 in)
Head gasket surface flatness	Flat within 0.150 mm (0.006 in) from end to end using a 61 cm (24 in) straightedge, area 150 mm (5.9 in) X 150 mm (5.9 in) should be less than 0.05 mm (0.002 in)
Crankshaft	
Main bearing journal diameter	67.5 mm (2.657 in)
Main bearing journal maximum taper	0.004 mm (0.00015 in)
Main bearing journal maximum out-of-round	0.006 mm (0.00023 in)
Main bearing journal-to-cylinder block clearance	0.026-0.041 mm (0.0010-0.0016 in)
Connecting rod journal diameter	55.983-56.003 mm (2.204-2.205 in)
Connecting rod journal maximum taper	0.004 mm (0.00015 in)
Connecting rod journal maximum out-of-round	0.006 mm (0.00023 in)
Crankshaft maximum end play	0.101-0.291 mm (0.0039-0.0114 in)
Piston and Connecting Rod	
Piston diameter - single grade	92.476-92.490 mm (3.6407-3.6413 in)
Piston-to-cylinder bore clearance	0.010 to 0.044 mm (0.0003-0.0017 in)
Piston ring end gap - compression (top, gauge diameter)	0.15-0.25 mm (0.0059-0.0098 in)
Piston ring end gap - compression (bottom, gauge diameter)	0.30-0.55 mm (0.0118-0.0216 in)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Piston ring end gap - oil ring (steel rail, gauge diameter)	0.15-0.45 mm (0.0059-0.0177 in)
Piston ring groove width - compression (top)	1.230-1.25 mm (0.0484-0.0492 in)
Piston ring groove width - compression (bottom)	1.530-1.55 mm (0.0602-0.0610 in)
Piston ring groove width - oil ring	2.53-2.55 mm (0.0996-0.1003 in)
Piston ring width - upper comp ring	1.17-1.19 mm (0.0460-0.0468 in)
Piston ring width - lower comp ring	1.47-1.49 mm (0.0578-0.0586 in)
Piston ring-to-groove clearance (upper and lower compression rings)	0.040-0.080 mm (0.0015-0.0031 in)
Piston pin bore diameter	23.002-23.006 mm (0.9055-0.9057 in)
Piston pin diameter	22.997-23.000 mm (0.9053-0.9055 in)
Piston pin length	55.975 mm (2.203 in)
Piston pin-to-piston fit	0.002 to 0.009 mm (0.00007-0.0003 in)
Piston-to-connecting rod clearance	2.7 mm (0.1 in)
Connecting rod-to-pin clearance - standard	0.007-0.022 mm (0.0002-0.0009 in)
Connecting rod pin bore diameter	23.007-23.019 mm (0.905-0.906 in)
Connecting rod length (center-to-center)	152.68 mm (6.01 in)
Connecting rod maximum allowed bend	0.038 mm (0.0014 in)
Connecting rod maximum allowed twist	0.050 mm (0.0019 in)
Connecting rod bearing bore diameter - grade 1	59.866-59.872 mm (2.3569-2.3571 in)
Connecting rod bearing bore diameter - grade 2	59.873-59.879 mm (2.3572-2.3574 in)
Connecting rod bearing bore diameter - grade 3	59.880-59.886 mm (2.3574-2.3577 in)
Connecting rod bearing-to-crankshaft clearance	0.020-0.054 mm (0.0007-0.0021 in)
Connecting rod side clearance (assembled to crank) - standard	0.175-0.425 mm (0.0068-0.0167 in)
Connecting rod side clearance (assembled to crank) - service limit	0.175-0.425 mm (0.0068-0.0167 in)
(1) Refer to the appropriate procedure(s).	

TORQUE SPECIFICATIONS TABLE**TORQUE SPECIFICATIONS TABLE**

Description	Nm	lb-ft	lb-in
A/C compressor bolts and nut	25	18	-
A/C compressor stud	9	-	80
A/C manifold bolt	25	18	-
A/C tube bracket bolts	10	-	89
A/C tube fitting bolts and nuts	8	-	71
A/C tube retaining clamp bolt	8	-	71

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

A/C tube retaining clamp bolts and nut	10	-	89
Accessory drive belt tensioner bolts	11	-	97
Block drain plug - RH	40	30	-
Block drain plug - LH ⁽¹⁾ _a	-	-	-
Block heater	40	30	-
Camshaft cap bolts ⁽²⁾ _b	-	-	-
Camshaft Position (CMP) sensor bolts	10	-	89
Camshaft sprocket bolts ⁽²⁾ _b	-	-	-
Catalytic converter nuts	40	30	-
Catalytic converter bracket-to-engine bolts and nuts	40	30	-
Catalytic converter bracket-to-converter bolts	20	-	177
Connecting rod cap bolts ⁽²⁾ _b	-	-	-
Coolant pump bolts ⁽²⁾ _b	-	-	-
Crankshaft Position (CKP) sensor bolt	10	-	89
Crankshaft pulley bolt ⁽²⁾ _b	-	-	-
Crankcase rear seal retainer plate bolts ⁽²⁾ _b	-	-	-
Cylinder head bolts ⁽²⁾ _b	-	-	-
Cylinder Head Temperature (CHT) sensor	10	-	89
Engine coolant degas bottle nut and bolt	9	-	80
Engine front cover bolts ⁽²⁾ _b	-	-	-
Engine lifting eye bolts	24	18	-
Engine mount brace bolts	25	18	-
Engine mount bracket bolts ⁽¹⁾ _a	-	-	-
Engine mount studs ⁽²⁾ _b	-	-	-

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Engine mount-to-engine nuts ^{(1)a}	-	-	-
Engine mount-to-frame bolts	55	41	-
Engine mount-to-frame nut	63	46	-
Engine oil filter ^{(3)c}	-	-	-
Engine Oil Pressure (EOP) switch	18	-	159
Engine roll-restrictor bolt	90	66	-
Engine-to-transaxle bolts	48	35	-
Exhaust manifold heat shield bolts	10	-	89
Exhaust manifold nuts ^{(2)b}	-	-	-
Exhaust manifold studs	12	-	106
Exhaust Y-pipe nuts	40	30	-
Flexplate bolts	80	59	-
Fuel rail bolts	10	-	89
Generator bolt and nut	48	35	-
Generator B+ terminal nut	12	-	106
Ground wire-to-body bolt	12	-	106
Ground wire-to-engine mount bolt	10	-	89
Ground wire-to-transaxle bolt	12	-	106
Heat shield nut and bolt	10	-	89
Ignition coil-on-plug bolts	7	-	62
Intermediate steering shaft bolt	25	18	-
Knock Sensor (KS) bolts	20	-	177
Lower intake manifold bolts ^{(2)b}	-	-	-
Main bearing bolts ^{(2)b}	-	-	-
Main bearing cap support brace bolts ^{(2)b}	-	-	-
Oil filter adapter bolts ^{(2)b}	-	-	-
Oil pan bolts ^{(2)b}	-	-	-

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Oil pan-to-transaxle bolts	48	35	-
Oil pan drain plug	27	20	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube bolts	10	-	89
Positive battery cable nuts	9	-	80
Power Steering Pressure (PSP) hose bracket and nut	9	-	80
PSP tube banjo bolt	37	27	-
PSP tube bracket-to-cylinder head bolt	10	-	89
Power steering pump bolts	25	18	-
Power Transfer Unit (PTU)	90	66	-
PTU bracket bolts	70	52	-
Rear drive shaft-to- PTU flange bolts	70	52	-
Stabilizer bar link nuts	40	30	-
Starter bolts	26	19	-
Starter B+ terminal nut	12	-	106
Starter S-terminal nut	5	-	44
Subframe bracket bolts	103	76	-
Subframe nuts	150	111	-
Thermostat housing bolts	10	-	89
Tie-rod end nuts	48	35	-
Timing chain guide bolts	10	-	89
Timing chain tensioner bolts	10	-	89
Torque converter-to-flexplate nuts	36	27	-
Transaxle control cable bracket bolts and nut	12	-	106
Transaxle support insulator bracket bolt and nut	80	59	-
Transaxle support insulator through bolt and nut	90	66	-
Transaxle-to-engine bolts	48	35	-
Upper intake manifold	-	-	-

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

bolts (2) ^b			
Upper intake manifold support bracket bolt	10	-	89
Variable Camshaft Timing (VCT) assembly bolts (2) ^b	-	-	-
VCT housing bolts (2) ^b	-	-	-
Valve cover bolts and stud bolts (2) ^b	-	-	-
Wiring harness retainer bolt and stud bolt	10	-	89
Wiring harness retainer bracket nuts	4	-	35

(1) Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

(2) Refer to the appropriate procedure(s).

(3) Tighten to 5 Nm (44 lb-in) plus an additional 180 degrees.

DESCRIPTION AND OPERATION

ENGINE

NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

The 3.5L (4V) is a V-6 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- An aluminum lower intake manifold and a composite upper intake manifold
- Aluminum cylinder heads
- An aluminum, 60-degree V-cylinder block
- Timing chain driven coolant pump
- Variable Camshaft Timing (VCT) system

- The electronic ignition system with 6 ignition coils

Engine Identification

For quick identification, refer to the 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:

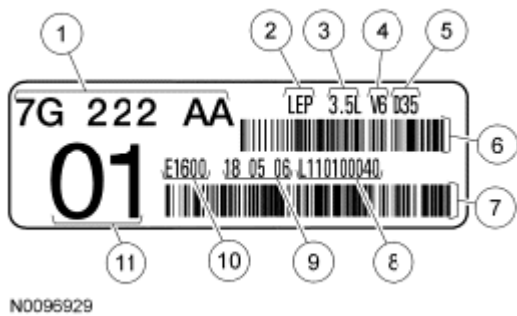
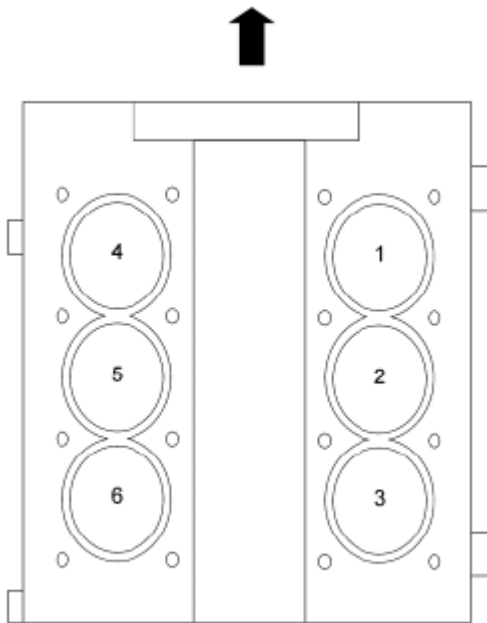


Fig. 1: Identifying Engine Code Information Label
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Description
1	Engine part number
2	Engine plant (Lima)
3	Engine displacement
4	Engine configuration
5	Duratech 3.5L
6	Bar code
7	Bar code
8	Running number
9	Engine build date (DDMMYY)
10	Plant shift line
11	Derivative 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 is covered in the **INTRODUCTION -- GASOLINE MODELS** .

Induction System

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 valve train uses Direct Acting Mechanical Buckets (DAMB). The camshaft lobes are positioned directly above mechanical buckets which are positioned on top of the valves.

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 PCV 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, timing chain tensioners and **VCT** solenoids. The flow of oil to the valve tappets and valve train is controlled by a restricting orifice located in the cylinder head, front camshaft cap.

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.
- 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:

- Radiator
- Timing chain driven coolant pump
- Electric fan assembly(s)
- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses

DIAGNOSIS AND TESTING**ENGINE**

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

GENERAL PROCEDURES

VALVE CLEARANCE CHECK

1. Remove the valve covers. For additional information, refer to **Removal** (Valve Cover - LH) and **Removal** (Valve Cover - RH).
2. Use a feeler gauge to measure the clearance of each valve and record its location. A midrange clearance is the most desirable:
 - Intake: 0.15-0.25 mm (0.006-0.01 in)
 - Exhaust: 0.360-0.460 mm (0.0142-0.0181 in)

NOTE: Engine must be at room temperature before measuring. The valve clearance must be measured with the camshaft at base circle. The engine will have to be rotated with the crankshaft pulley bolt to bring each valve to base circle.

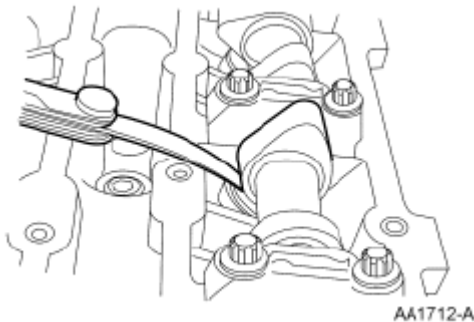


Fig. 3: Measuring Clearance Of Valve
Courtesy of FORD MOTOR CO.

3. If any of the valve clearances are out of specification, select new tappets using this formula: tappet thickness = measured clearance + the base tappet thickness - most desirable thickness.

NOTE: The number on the valve tappet reflects the thickness of the valve tappet. For example, a tappet with the number 3.310 has the thickness of 3.31 mm (0.13 in).

Select the tappets and mark the installation location.

4. If required, install the new selected valve tappets in the marked locations. For additional information, refer to **VALVE TAPPETS**.

IN-VEHICLE REPAIR

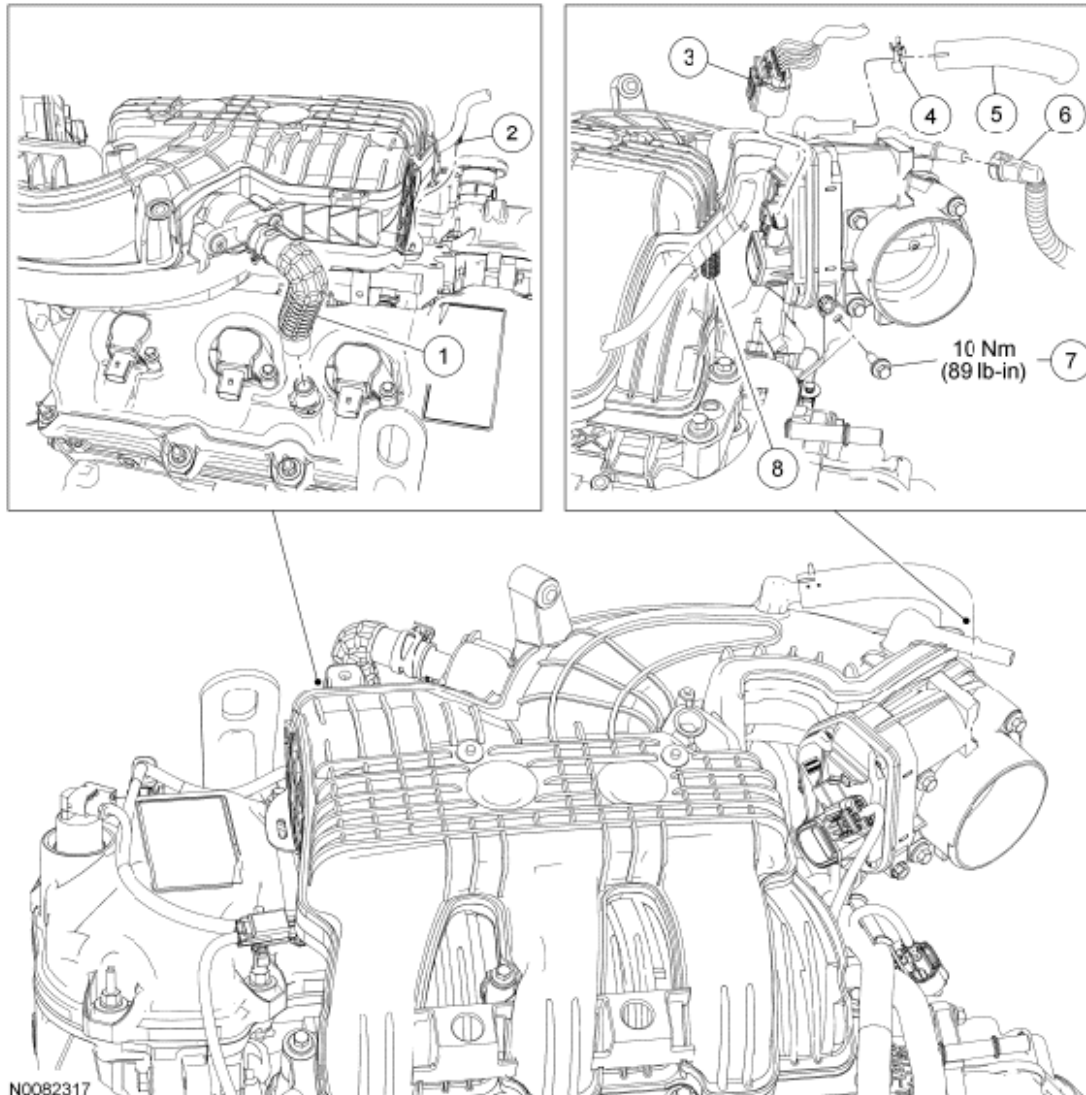
UPPER INTAKE MANIFOLD**Upper Intake Manifold (View 1 of 2)**

Fig. 4: Identifying Upper Intake Manifold Components With Torque Specifications (1 Of 2)
 Courtesy of FORD MOTOR CO.

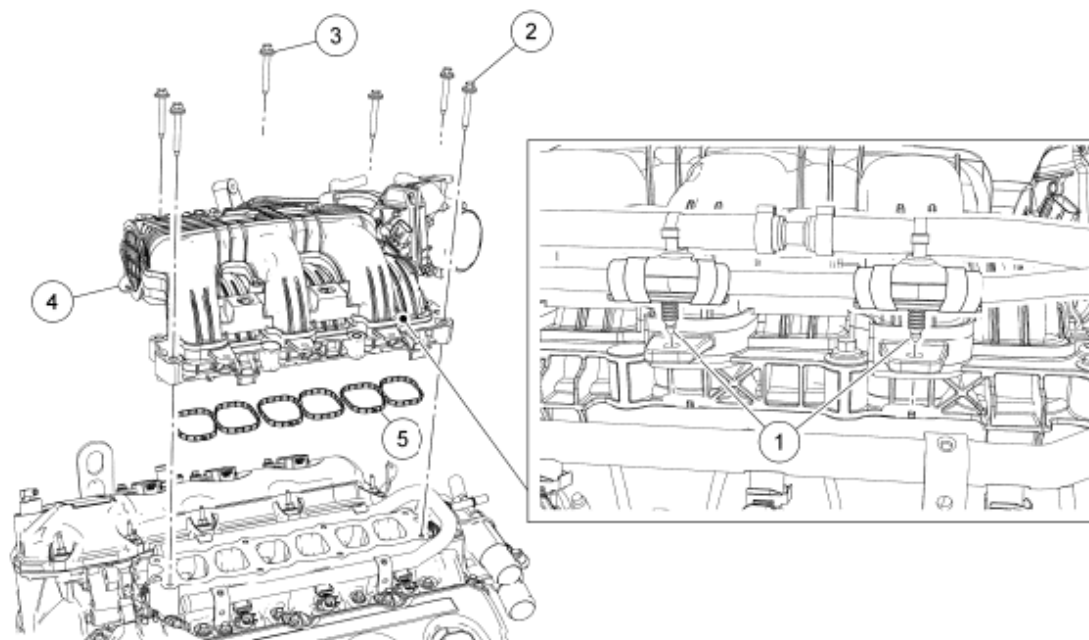
ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6K817	PCV hose
2	13A506	Block heater wiring harness retainer (part of 6B018)
3	14A464	Throttle Body (TB) electrical connector (part of 12C508)
4	CS16140	Brake booster-to-intake manifold vacuum hose clamp
5	6K817	Brake booster-to-intake manifold vacuum hose

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

6	9D661	Evaporative Emission (EVAP)-to-intake manifold tube
7	W503274	Upper intake manifold support bracket bolt
8	-	Engine control wiring harness retainer (part of 12C508)

Upper Intake Manifold (View 2 of 2)

N0093883

Fig. 5: Identifying Upper Intake Manifold Components (2 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	13A506	Wire harness pin-type retainers (part of 14B060)
2	W503282	Upper intake manifold bolt (5 required)
3	W707083	Upper intake manifold bolt
4	9S455	Upper intake manifold
5	9H486	Upper intake manifold gasket (3 required)

Removal

1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.
2. Disconnect the Throttle Body (TB) electrical connector.
3. Disconnect the Evaporative Emission (EVAP) tube from the intake manifold. For additional information,

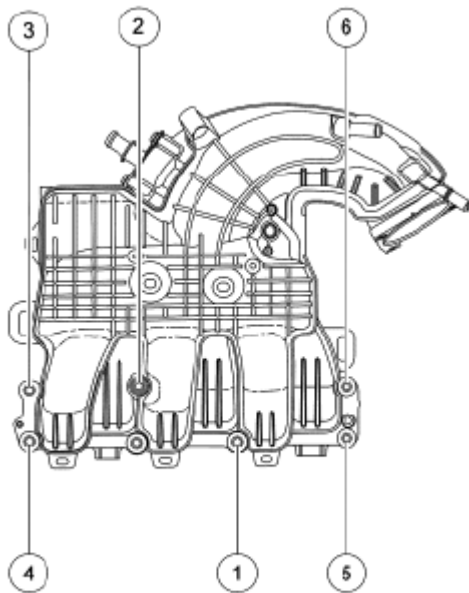
refer to **FUEL SYSTEM - GENERAL INFORMATION** .

4. Disconnect the brake booster vacuum hose from the intake manifold.
5. Disconnect the PCV tube from the PCV valve.
6. Detach all the wiring harness retainers from the upper intake manifold.
7. If equipped, detach the cylinder block heater wiring harness retainer from the upper intake manifold.
8. Remove the upper intake manifold support bracket bolt.
9. Remove the 6 bolts and the upper intake manifold.
 - Remove and discard the gaskets.
 - Clean and inspect all of the sealing surfaces of the upper and lower intake manifold.

Installation

1. Using new gaskets, install the upper intake manifold and the 6 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

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.



N0081211

Fig. 6: Identifying Upper Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the upper intake manifold support bracket bolt.
 - Tighten to 10 Nm (89 lb-in).

3. If equipped, attach the cylinder block heater wiring harness retainer to the upper intake manifold.
4. Attach all the wiring harness retainers to the upper intake manifold.
5. Connect the PCV tube to the PCV valve.
6. Connect the brake booster vacuum hose to the intake manifold.
7. Connect the **EVAP** tube to the intake manifold. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION**.
8. Connect the **TB** electrical connector.
9. Install the **ACL** outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.

LOWER INTAKE MANIFOLD

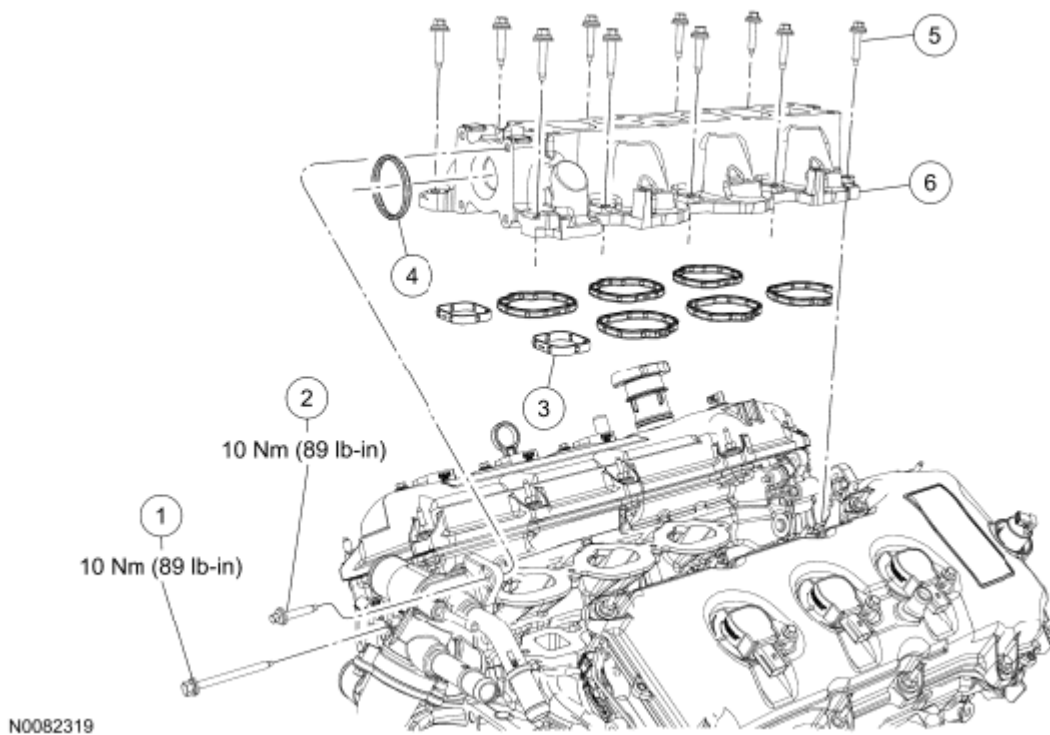


Fig. 7: Identifying Lower Intake Manifold Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W708607	Thermostat housing-to-lower intake manifold bolt
2	W503279	Thermostat housing-to-lower intake manifold bolt
3	9439	Lower intake manifold gasket (8 required)
4	8A571	Thermostat housing gasket
5	W503279	Lower intake manifold bolt (10 required)
6	9K461	Lower intake manifold

Removal

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the fuel rail. For additional information, refer to **REMOVAL**.
3. Drain the cooling system. For additional information, refer to **DRAINING**.
4. Remove the 2 thermostat housing-to-lower intake manifold bolts.
5. Remove the 10 bolts and the lower intake manifold.
 - Remove and discard the intake manifold and thermostat housing gaskets.
 - Clean and inspect all sealing surfaces.

Installation

1. Using new intake manifold and thermostat housing gaskets, install the lower intake manifold and the 10 bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

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

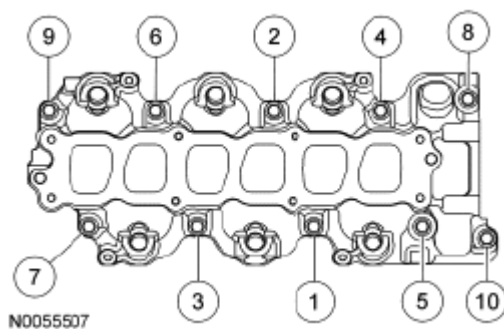
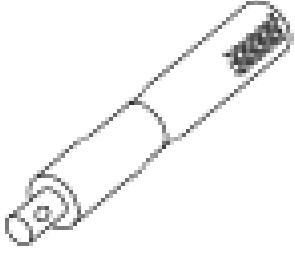
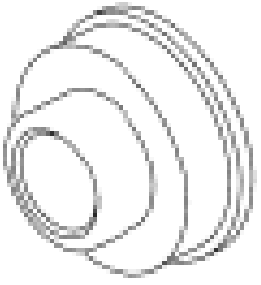
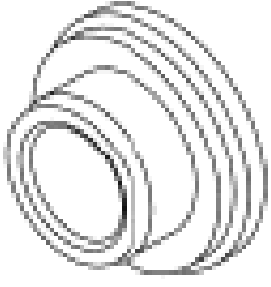


Fig. 8: Identifying Lower Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the 2 thermostat housing-to-lower intake manifold bolts.
 - Tighten to 10 Nm (89 lb-in).
3. Install the fuel rail. For additional information, refer to **INSTALLATION**.
4. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM**

DRAINING, FILLING AND BLEEDING .**VALVE COVER - LH****Special Tool(s)****SPECIAL TOOL TABLE**

 <p>ST1326-A</p>	Handle 205-153 (T80T-4000-W)
 <p>ST2983-A</p>	Installer, VCT Spark Plug Tube Seal 303-1247/2
 <p>ST2982-A</p>	Remover, VCT Spark Plug Tube Seal 303-1247/1

Material**ITEM SPECIFICATION TABLE**

Item	Specification

Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

Valve Cover - LH (View 1 of 2)

NOTE: Early build shown in illustration, late build similar.

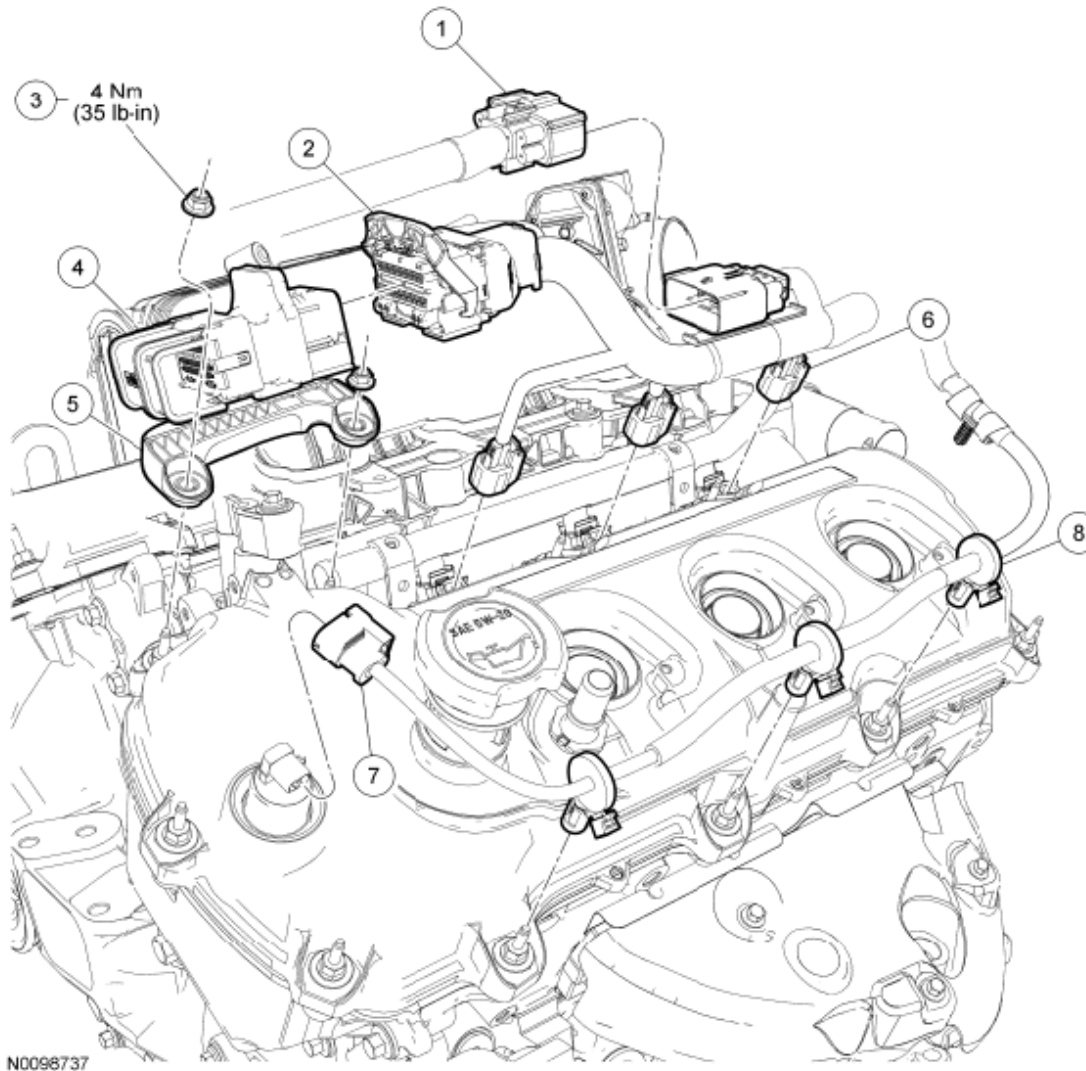


Fig. 9: Identifying Valve Cover Components With Torque Specifications LH (1 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14A464	Engine control wiring harness electrical connector (part of 12C508)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

2	14A464	Engine control wiring harness electrical connector (part of 12C508)
3	W520100	Wiring harness retaining bracket nut (2 required)
4	14A464	Engine control wiring harness electrical connector (part of 12C508)
5	-	Wiring harness retaining bracket (part of 12C508)
6	14A464	LH fuel injector electrical connector (3 required) (part of 12C508)
7	14A464	LH Variable Camshaft Timing (VCT) electrical connector (part of 12C508)
8	W700497	Engine control wiring harness retainer (part of 12C508)

Valve Cover - LH (View 2 of 2)

NOTE: Early build shown in illustration, late build similar.

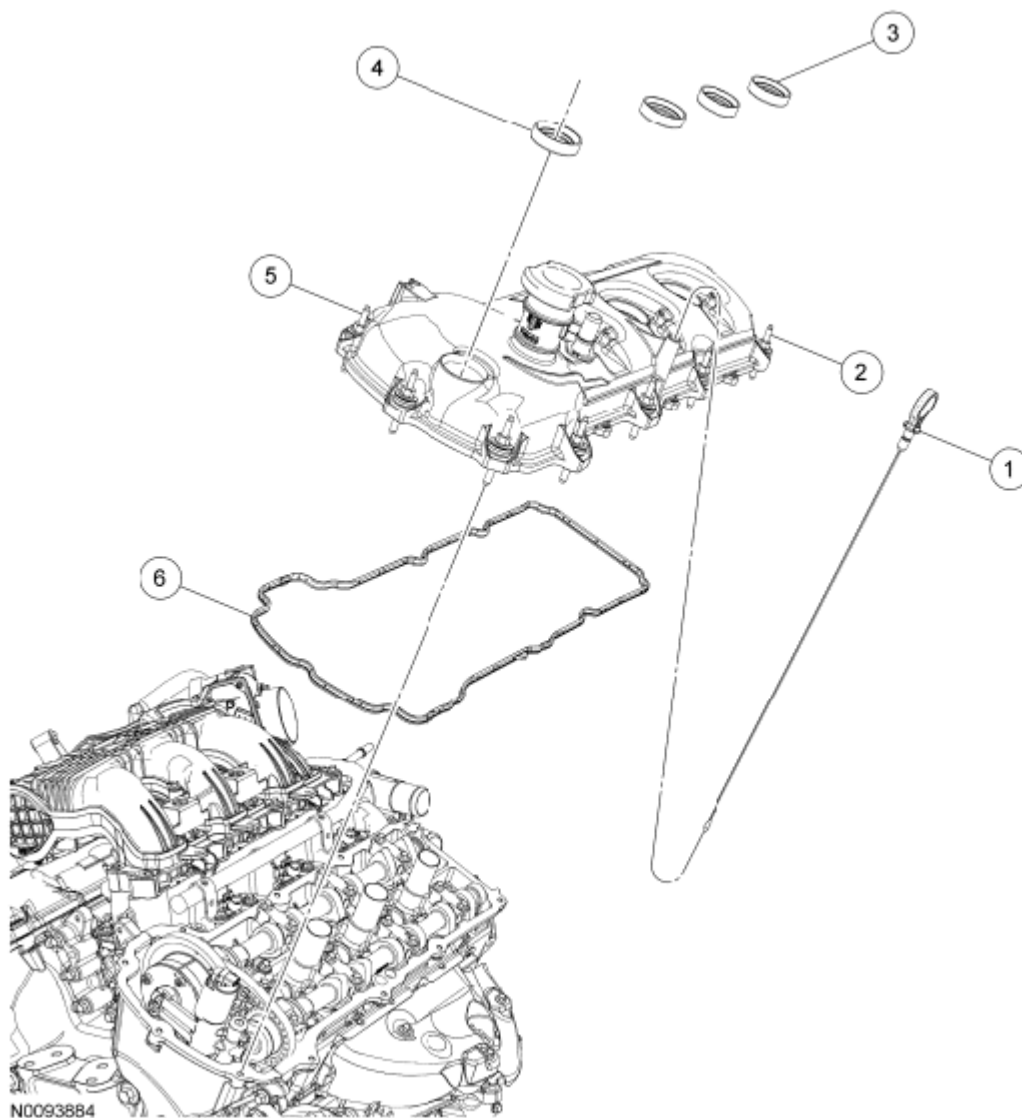


Fig. 10: Identifying Valve Cover Components - LH (2 Of 2)
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6750	Oil level indicator
2	6C519	Valve cover stud bolt (11 required)
3	6C535	Spark plug tube seal (3 required)
4	6C535	Variable Camshaft Timing (VCT) solenoid seal
5	6A505	LH valve cover
6	6A559	LH valve cover gasket

Removal

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

NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

All vehicles

1. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
2. Remove the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L** .
3. Remove the oil level indicator.
4. Disconnect the LH Variable Camshaft Timing (VCT) solenoid electrical connector.
5. Detach the 2 wiring harness retainers.

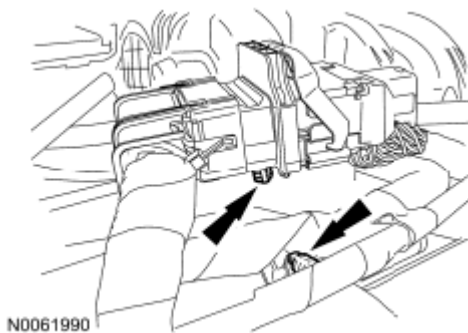


Fig. 11: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

6. Disconnect the 2 engine control wiring harness electrical connectors.

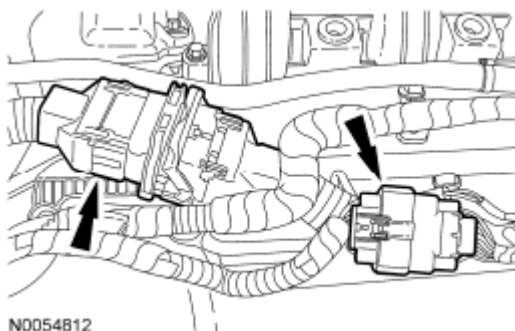


Fig. 12: Locating Engine Control Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Remove the 2 nuts and the wiring harness retaining bracket.

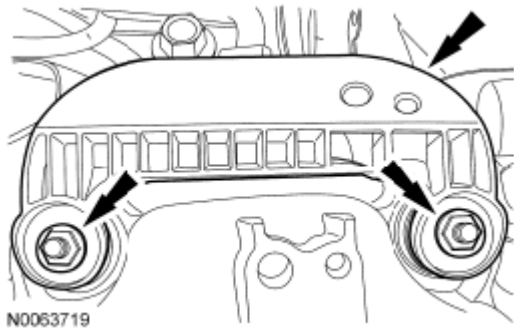


Fig. 13: Locating Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

8. Detach all of the wiring harness retainers from the valve cover and the stud bolts.
9. Disconnect the 3 LH fuel injector electrical connectors.

Early build vehicles

10. Loosen the 11 stud bolts and remove the LH valve cover.
 - Discard the gasket.

Late build vehicles

11. Loosen the 9 stud bolts and remove the LH valve cover.
 - Discard the gasket.

All vehicles

12. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
 - Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

NOTE: VCT solenoid seal removal shown in illustration, spark plug tube seal removal similar.

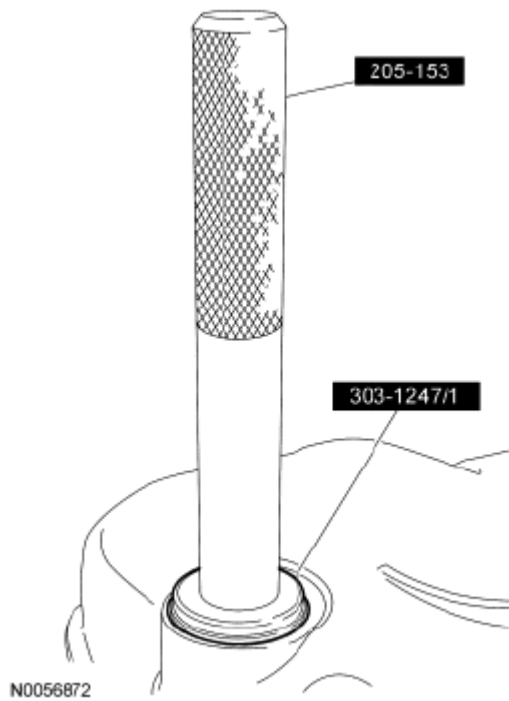


Fig. 14: Identifying VCT Spark Plug Tube Seal Remover And Handle
Courtesy of FORD MOTOR CO.

13. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface prep.

Installation

All vehicles

1. Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown in illustration, VCT solenoid seal installation similar.

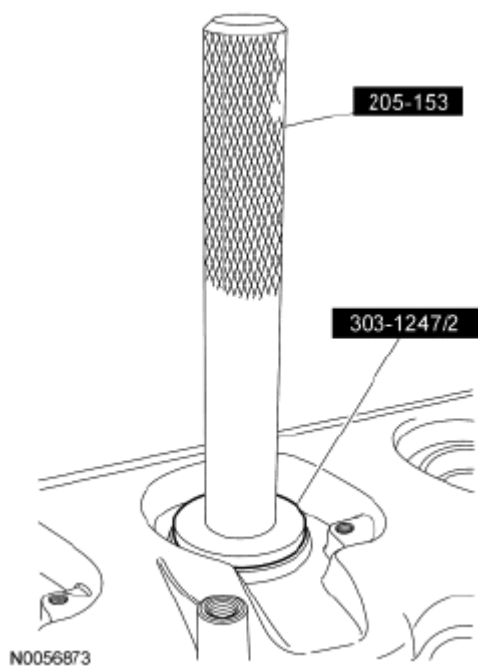


Fig. 15: Identifying VCT Spark Plug Tube Seal Installer And Handle
Courtesy of FORD MOTOR CO.

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

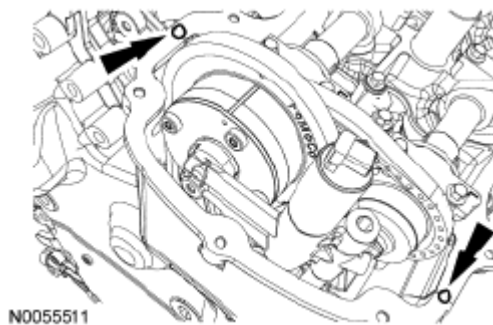


Fig. 16: Identifying Engine RTV Silicone Applying Area To Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Late build vehicles

3. Using a new gasket, install the LH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

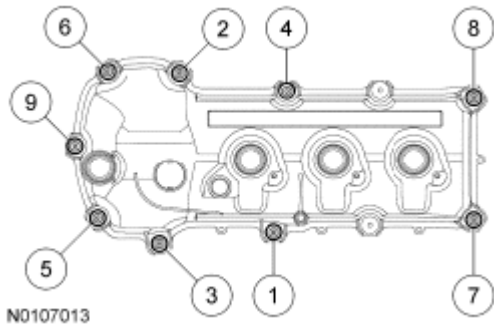


Fig. 17: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Early build vehicles

4. Using a new gasket, install the LH valve cover and 11 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

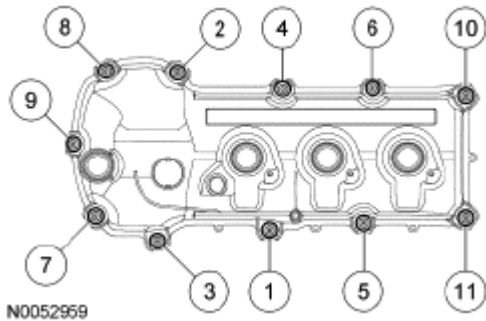


Fig. 18: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

All vehicles

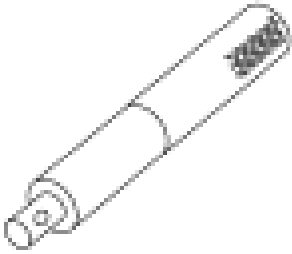
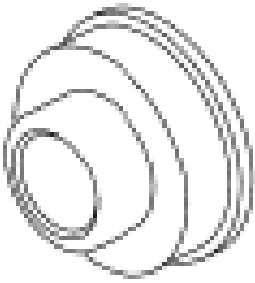
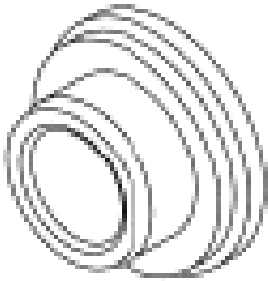
5. Connect the 3 LH fuel injector electrical connectors.
6. Attach all of the wiring harness retainers to the valve cover and the stud bolts.
7. Install the wiring harness retaining bracket and the 2 nuts.
 - Tighten to 4 Nm (35 lb-in).
8. Connect the 2 engine control wiring harness electrical connectors.
9. Attach the 2 wiring harness retainers.
10. Connect the LH VCT solenoid electrical connector.

11. Install the oil level indicator.
12. Install the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L**.
13. Install the ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.

VALVE COVER - RH

Special Tool(s)

SPECIAL TOOL TABLE

 <p>ST1326-A</p>	<p>Handle 205-153 (T80T-4000-W)</p>
 <p>ST2983-A</p>	<p>Installer, VCT Spark Plug Tube Seal 303-1247/2</p>
 <p>ST2982-A</p>	<p>Remover, VCT Spark Plug Tube Seal 303-1247/1</p>

Material

ITEM SPECIFICATION TABLE

Item	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft® Metal Surface Prep ZC-31-A	-
Silicone Gasket Remover ZC-30	-

Valve Cover - RH (View 1 of 3)

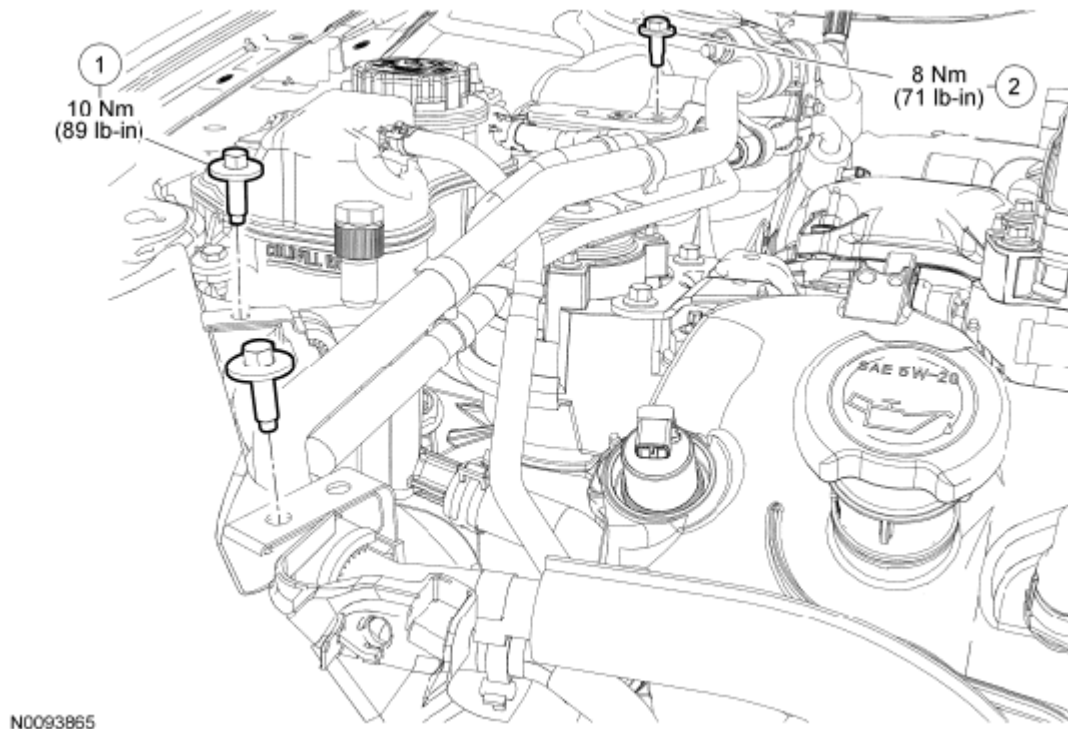


Fig. 19: Identifying Valve Cover Components With Torque Specifications RH (1 Of 3)
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W503924	A/C tube retaining clamp bolt (2 required)
2	W505422	A/C tube retaining clamp bolt

Valve Cover - RH (View 2 of 3)

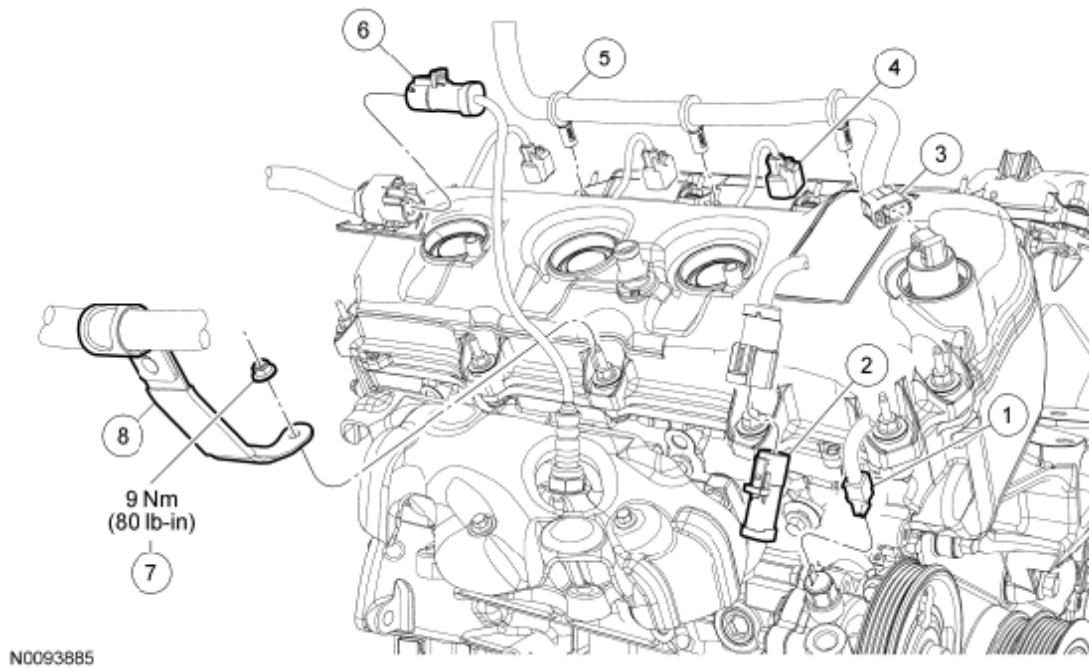


Fig. 20: Identifying Valve Cover Components With Torque Specifications RH (2 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14A464	Power Steering Pressure (PSP) switch electrical connector (part of 12C508)
2	14A464	RH Catalyst Monitor Sensor (CMS) electrical connector (part of 12C508)
3	14A464	RH Variable Camshaft Timing (VCT) electrical connector (part of 12C508)
4	14A464	RH fuel injector electrical connector (3 required) (part of 12C508)
5	W700497	Engine control wiring harness retainer (part of 12C508)
6	14A464	RH Heated Oxygen Sensor (HO2S) electrical connector (part of 12C508)
7	W520100	PSP hose bracket nut
8	3A719	PSP hose bracket

Valve Cover - RH (View 3 of 3)

NOTE: Early build shown in illustration, late build similar.

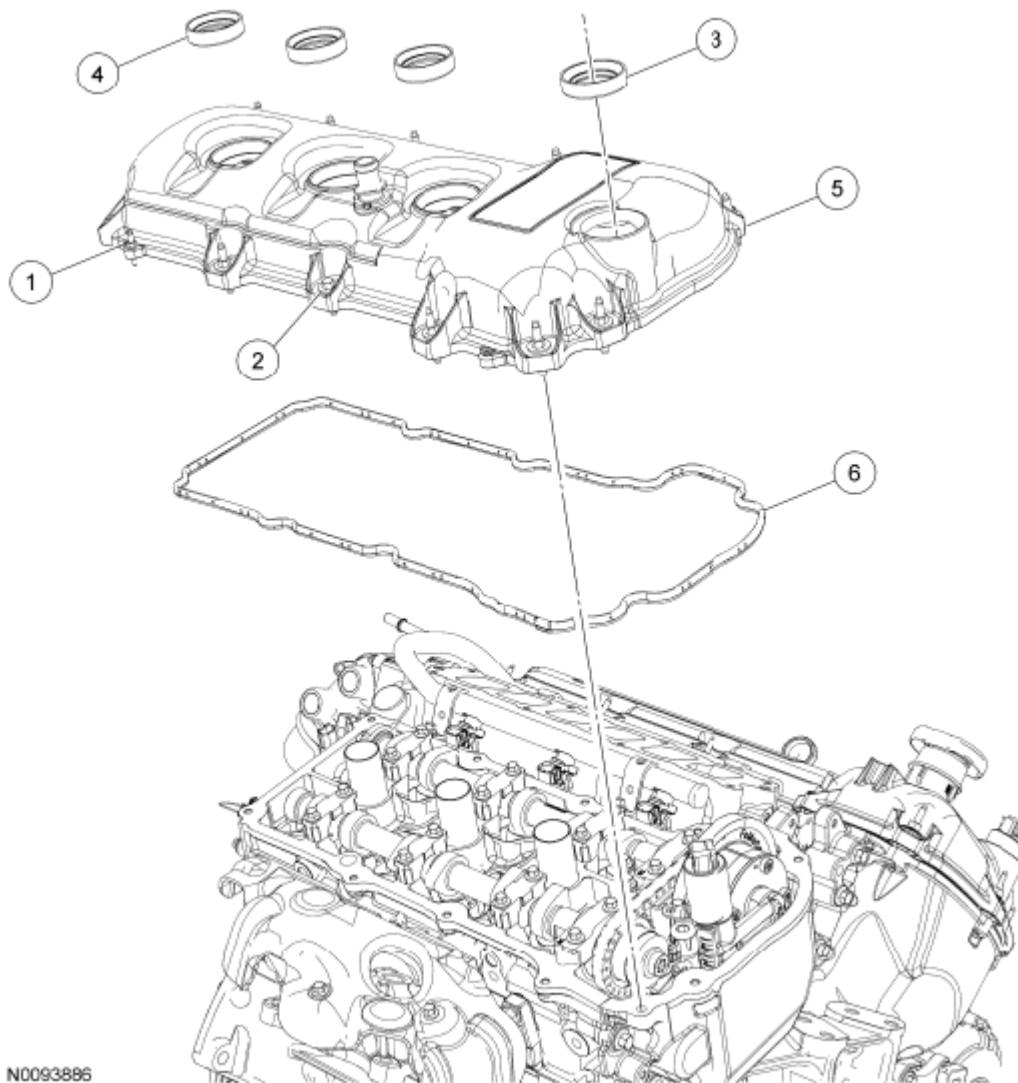


Fig. 21: Identifying Valve Cover Components RH (3 Of 3)
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6C519	Valve cover stud bolt (10 required)
2	6C520	Valve cover bolt
3	6C535	Variable Camshaft Timing (VCT) solenoid seal
4	6C535	Spark plug tube seal (3 required)
5	6582	RH valve cover
6	6584	RH valve cover gasket

Removal

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

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

NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

All vehicles

1. Remove the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L**.
2. Remove the power steering fluid reservoir. For additional information, refer to **REMOVAL AND INSTALLATION**.
3. Disconnect the Power Steering Pressure (PSP) switch electrical connector.
4. Disconnect the RH Catalyst Monitor Sensor (CMS) electrical connector and retainer.
5. Remove the **PSP** hose bracket nut from the valve cover stud bolt and position the bracket aside.

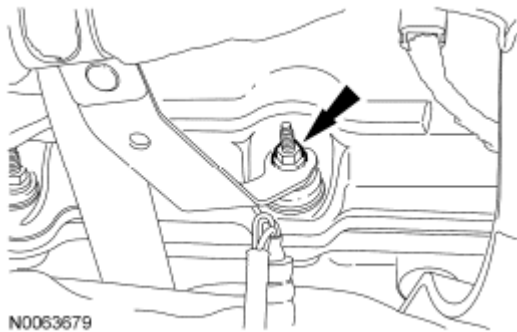


Fig. 22: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

6. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.
7. Disconnect the RH Variable Camshaft Timing (VCT) electrical connector.
8. Disconnect the 3 RH fuel injector electrical connectors.
9. Detach all of the wiring harness retainers from the valve cover and the stud bolts.
10. Remove the A/C tube retaining clamp bolt.
11. Remove the 2 A/C tube retaining clamp bolts.

Early build vehicles

12. Loosen the bolt, the 10 stud bolts and remove the RH valve cover.
 - Discard the gasket.

NOTE: It is necessary to reposition the A/C tubes to remove the valve cover.

Late build vehicles

13. Loosen the 9 stud bolts and remove the RH valve cover.
 - Discard the gasket.

NOTE: It is necessary to reposition the A/C tubes to remove the valve cover.

All vehicles

14. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
 - Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

NOTE: VCT solenoid seal removal shown in illustration, spark plug tube seal removal similar.

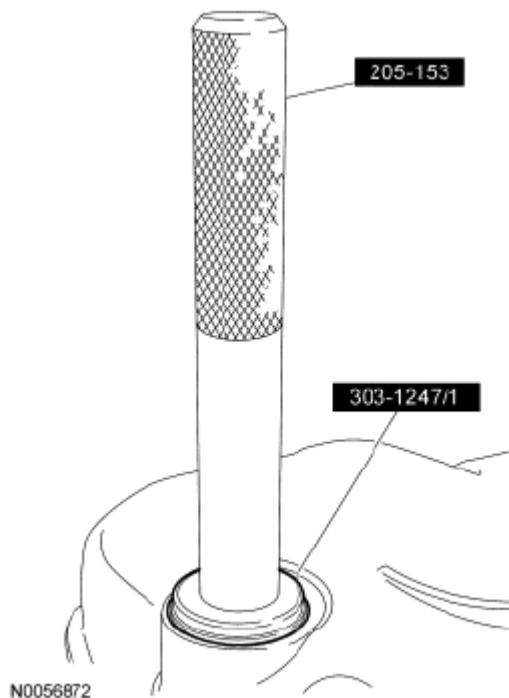


Fig. 23: Identifying VCT Spark Plug Tube Seal Remover And Handle
Courtesy of FORD MOTOR CO.

15. Clean the valve cover, cylinder head and engine front cover sealing surfaces with metal surface prep.

Installation**All vehicles**

1. Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown in illustration, VCT solenoid seal installation similar.

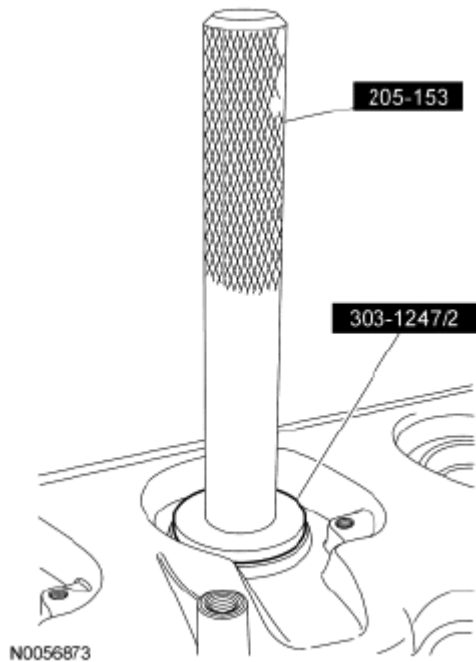


Fig. 24: Identifying VCT Spark Plug Tube Seal Installer And Handle
Courtesy of FORD MOTOR CO.

2. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

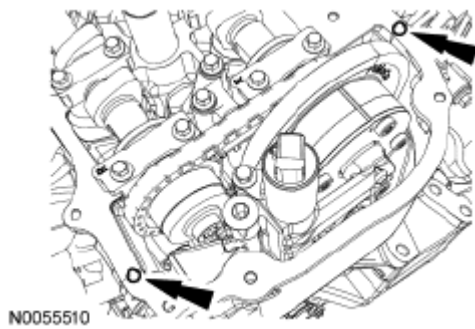


Fig. 25: Locating Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Late build vehicles

3. Using a new gasket, install the RH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

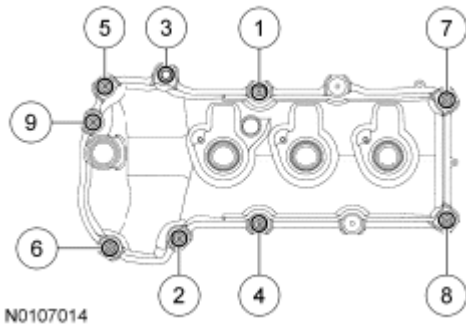


Fig. 26: Identifying RH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Early build vehicles

4. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

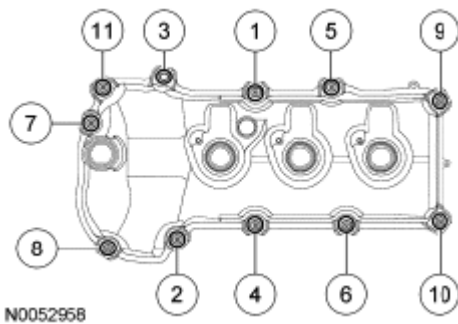


Fig. 27: Identifying RH Valve Cover Stud Bolt Tightening Sequence

Courtesy of FORD MOTOR CO.

All vehicles

5. Position the A/C tubes and install the 2 retaining clamp bolts.
 - Tighten to 10 Nm (89 lb-in).
6. Install the A/C tube retaining clamp bolt.
 - Tighten to 8 Nm (71 lb-in).
7. Attach all of the wiring harness retainers to the valve cover and the stud bolts.
8. Connect the 3 LH fuel injector electrical connectors.
9. Connect the LH VCT electrical connector.
10. Connect the RH HO2S electrical connector.
11. Install the PSP hose bracket and nut.
 - Tighten to 9 Nm (80 lb-in).
12. Connect the RH CMS electrical connector and retainer.
13. Connect the PSP switch electrical connector.
14. Install the power steering fluid reservoir. For additional information, refer to **REMOVAL AND INSTALLATION**.
15. Install the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 3.5L**.

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

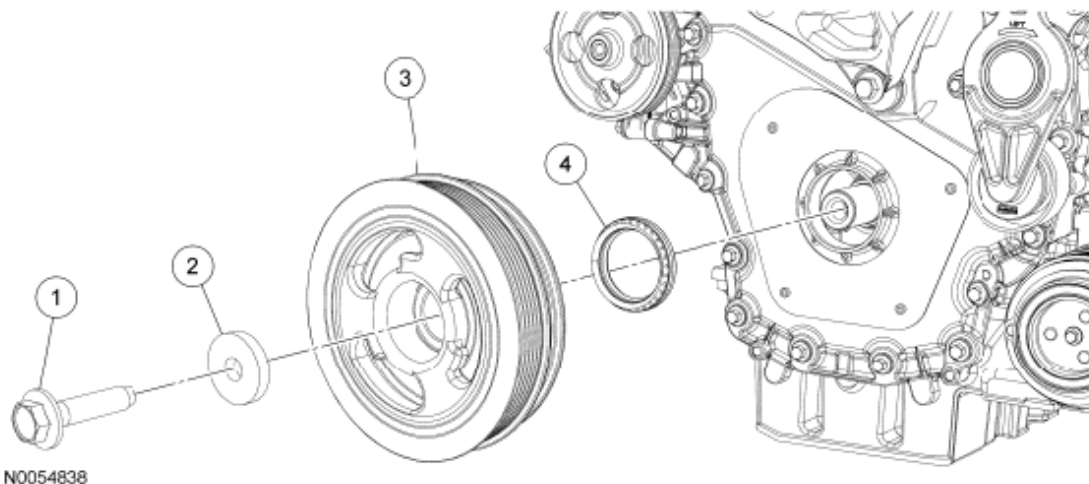


Fig. 28: Identifying Crankshaft Front Seal, Crankshaft Pulley, Crankshaft Pulley Bolt & Washer
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W701512	Crankshaft pulley bolt

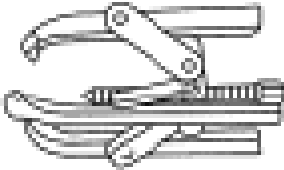
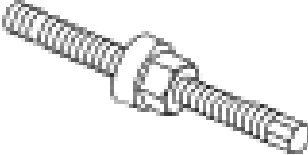
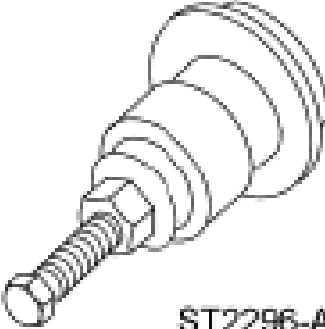
2010 Ford Fusion SE

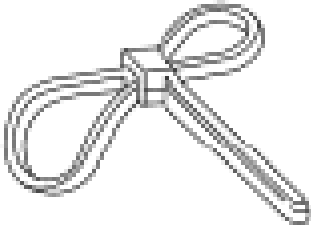
2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

2	N806165	Washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal

1. For additional information, refer to the appropriate procedures.

CRANKSHAFT PULLEY**Special Tool(s)****SPECIAL TOOL TABLE**

 ST1184-A	3 Jaw Puller 303-D121 or equivalent
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 ST2296-A	Installer, Front Cover Oil Seal 303-335
	Strap Wrench 303-D055 (D85L-6000-A) or equivalent



ST1438-A

Material**ITEM SPECIFICATION TABLE**

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

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the accessory drive belt and the power steering belt. For additional information, refer to **REMOVAL**.
3. Using the Strap Wrench, remove the crankshaft pulley bolt and washer.
 - Discard the bolt.

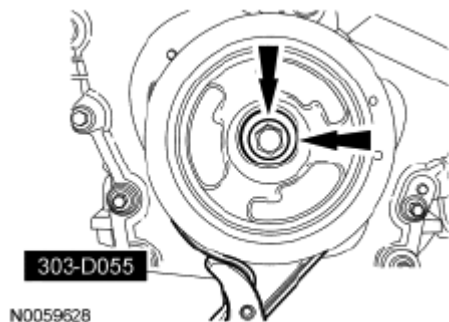


Fig. 29: Locating Crankshaft Pulley Bolt & Washer
Courtesy of FORD MOTOR CO.

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

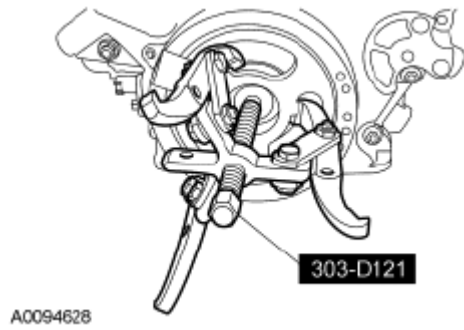


Fig. 30: Identifying Jaw Puller
Courtesy of FORD MOTOR CO.

Installation

1. Lubricate the crankshaft front seal inner lip with clean engine oil.
2. Using the Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the crankshaft pulley.

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

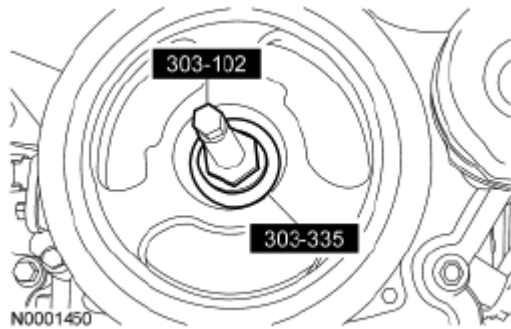


Fig. 31: Installing Crankshaft Pulley Using Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

3. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten 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.

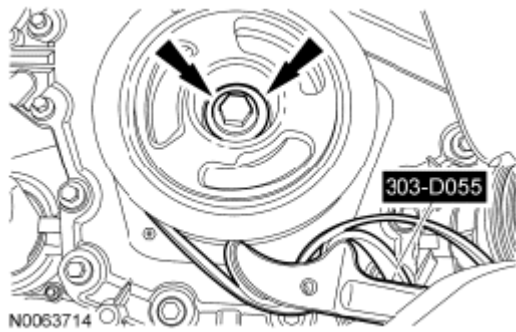


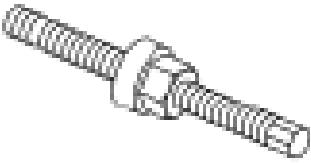

Fig. 32: Locating Crankshaft Pulley Washer And Bolt
 Courtesy of FORD MOTOR CO.

4. Install the accessory drive belt and the power steering belt. For additional information, refer to **INSTALLATION**.

CRANKSHAFT FRONT SEAL

Special Tool(s)

SPECIAL TOOL TABLE

 <p>ST1287-A</p>	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)
 <p>ST2981-A</p>	Installer, Front Crankshaft Seal 303-1251
	Remover, Oil Seal 303-409 (T92C-6700CH)



ST1385-A

Material

ITEM SPECIFICATION TABLE

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

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the crankshaft pulley. For additional information, refer to **Removal**.
3. Using the Oil Seal Remover, remove and discard the crankshaft front seal.
 - Clean all sealing surfaces with metal surface prep.

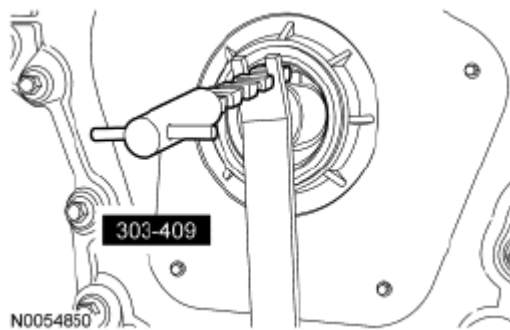


Fig. 33: Identifying Oil Seal Remover
Courtesy of FORD MOTOR CO.

Installation

1. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

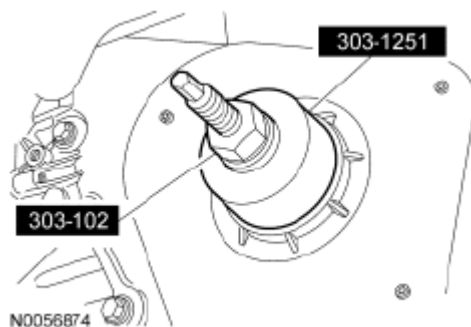
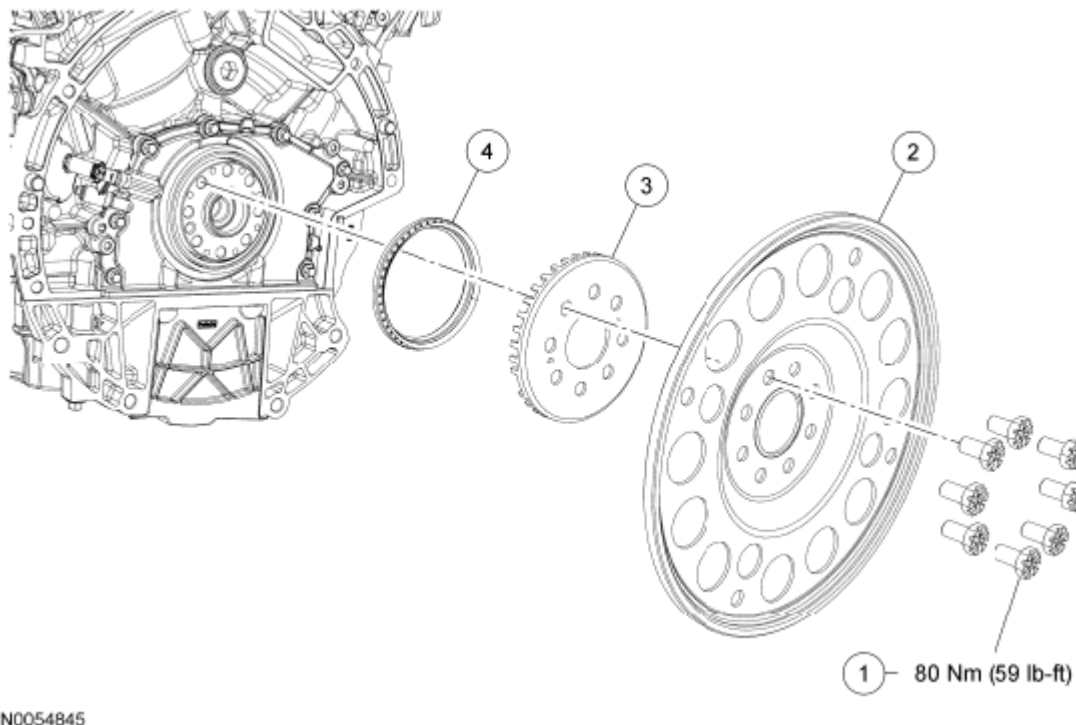


Fig. 34: Identifying Crankshaft Vibration Damper Installer And Front Crankshaft Installer
Courtesy of FORD MOTOR CO.

2. Install the crankshaft pulley. For additional information, refer to **Installation**.

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



N0054845

Fig. 35: Identifying Crankshaft Rear Seal, Crankshaft Sensor Ring, Flexplate & Flexplate Bolt With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

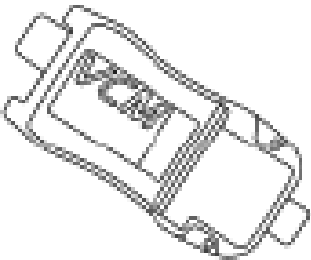
Item	Part Number	Description
1	W701559	Flexplate bolt (8 required)
2	6375	Flexplate
3	12A227	Crankshaft sensor ring
4	6701	Crankshaft rear seal

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

FLEXPLATE

Special Tool(s)

SPECIAL TOOL TABLE

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent diagnostic tool
--	---

Removal and Installation

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

NOTE: One of the 8 flexplate holes are offset so the flexplate can only be installed in one position.

4. To install, reverse the removal procedure.
5. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

CRANKSHAFT REAR SEAL

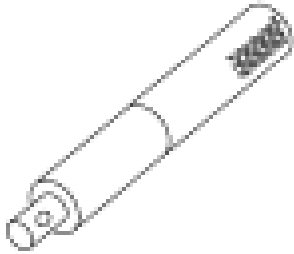
Special Tool(s)

SPECIAL TOOL TABLE

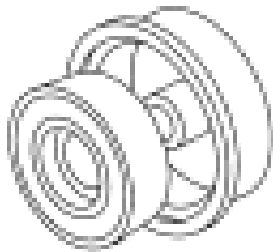
--	--

2010 Ford Fusion SE

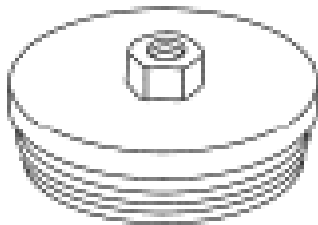
2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST1326-A**

Handle 205-153 (T80T-4000-W)

**ST2980-A**

Installer, Rear Main Seal 303-1250

**ST1382-A**

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

**ST1187-A**

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

Material**ITEM SPECIFICATION TABLE**

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

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

WSS-M2C930-A

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the flexplate. For additional information, refer to **Removal and Installation**.
3. Remove the crankshaft sensor ring.
4. Using the Crankshaft Rear Oil Seal Remover and Slide Hammer, remove and discard the crankshaft rear seal.
 - Clean all sealing surfaces with metal surface prep.

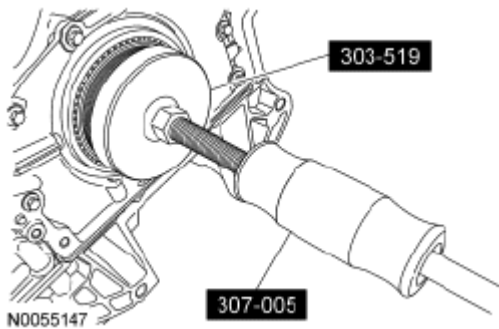


Fig. 36: Identifying Crankshaft Rear Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

Installation

1. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

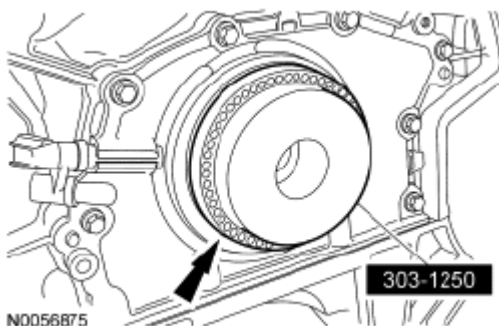


Fig. 37: Identifying Rear Main Seal Installer

Courtesy of FORD MOTOR CO.

- Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

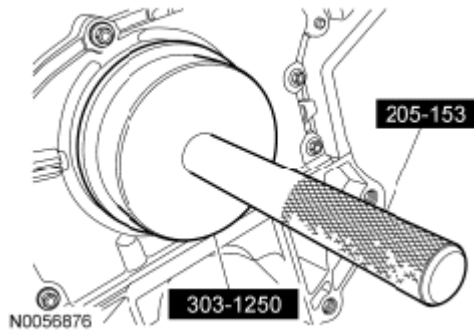


Fig. 38: Installing Crankshaft Rear Seal Using Rear Main Seal Installer
Courtesy of FORD MOTOR CO.

- Install the crankshaft sensor ring.
- Install the flexplate. For additional information, refer to **Removal and Installation**.
- Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

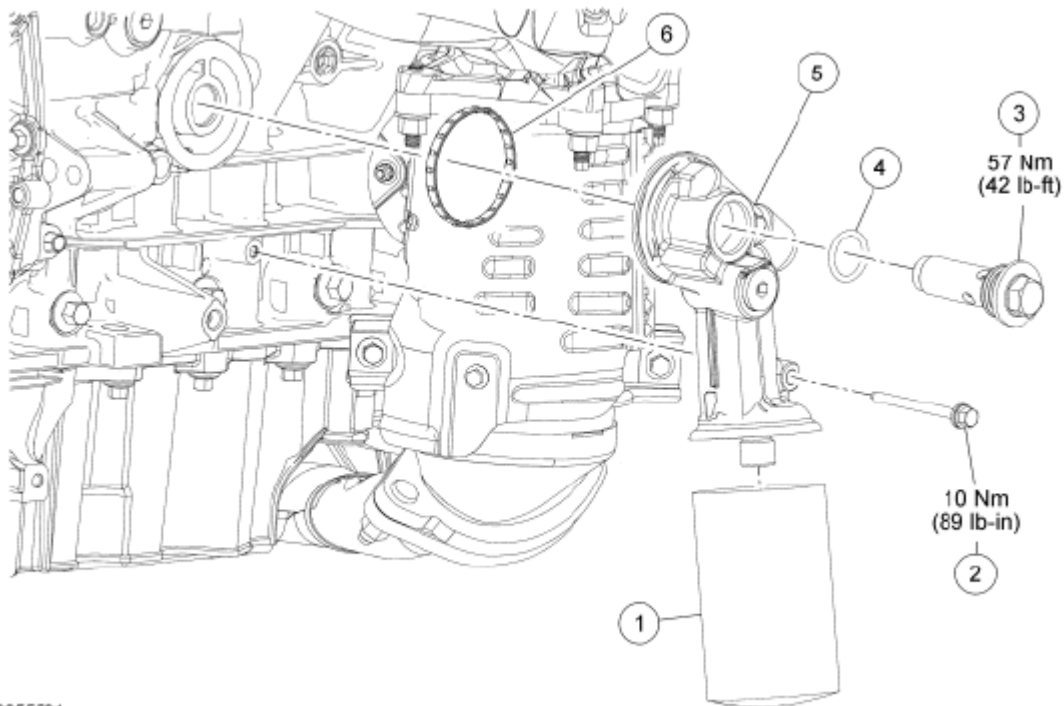
OIL FILTER ADAPTER

Material

ITEM SPECIFICATION TABLE

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

Early Build Vehicles



N0055591

Fig. 39: Identifying Oil Filter Adapter Components With Torque Specifications - Early Build Engines
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6714	Engine oil filter
2	W708607	Oil filter adapter bolt
3	6895	Oil filter adapter bolt
4	6K649	O-ring seal
5	6881	Oil filter adapter
6	6A636	Oil filter adapter gasket

Late Build Vehicles

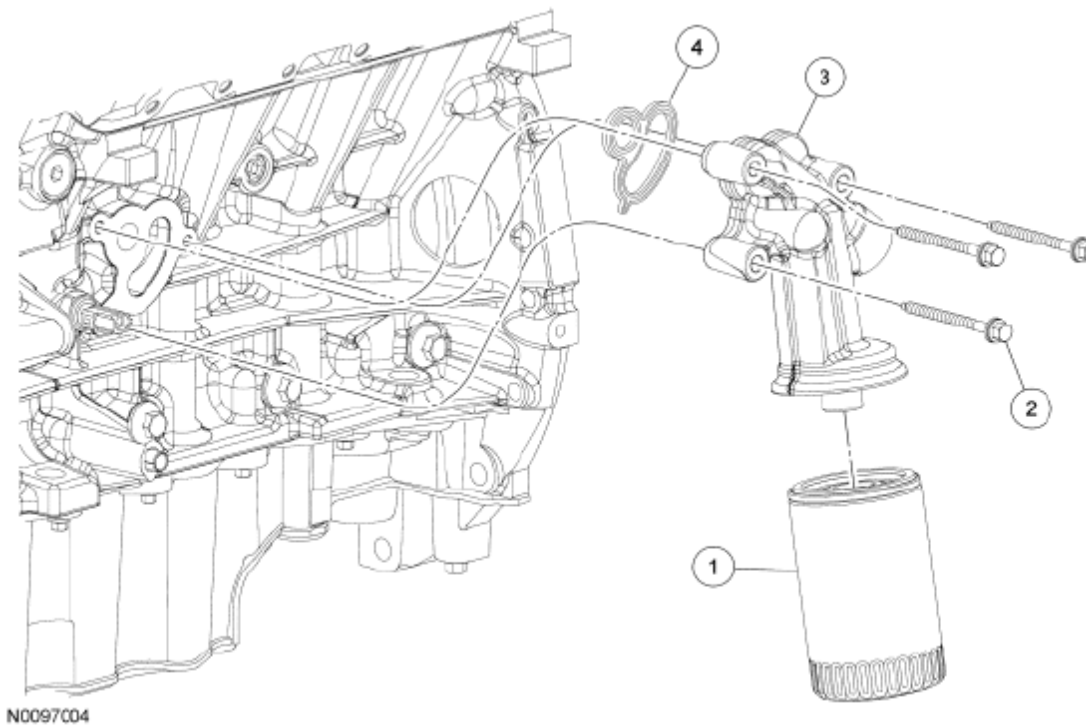


Fig. 40: Identifying Oil Filter Adapter Components - Late Build Engines
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6714	Engine oil filter
2	W503283	Oil filter adapter bolt (3 required)
3	6881	Oil filter adapter
4	6A636	Oil filter adapter gasket

Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. If equipped, remove the 6 screws and the underbody shield.

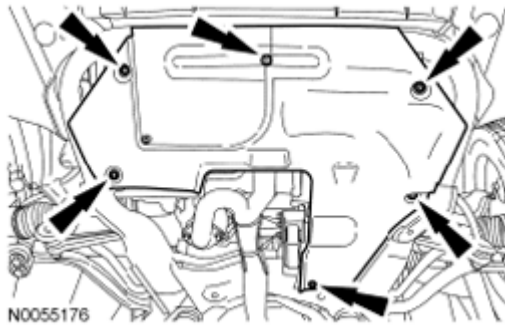


Fig. 41: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Remove and discard the engine oil filter.

Early build vehicles

4. Remove the 2 bolts and the oil filter adapter.
 - Discard the gasket and O-ring seal.
 - Clean and inspect all sealing surfaces.

Late build vehicles

5. Remove the 3 bolts and the oil filter adapter.
 - Discard the gasket.
 - Clean and inspect all sealing surfaces.

Installation

Late build vehicles

1. Using a new gasket, install the oil filter adapter and the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).

Early build vehicles

2. Using a new gasket and O-ring seal, install the oil filter adapter and the 2 bolts.
 - Tighten the large bolt to 57 Nm (42 lb-ft).
 - Tighten the small bolt to 10 Nm (89 lb-in).

All vehicles

3. Install a new engine oil filter.
 - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

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

4. If equipped, install the 6 screws and the underbody shield.

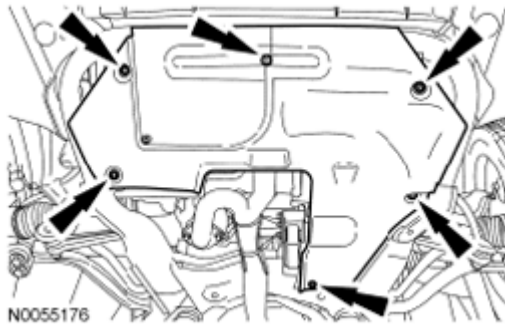


Fig. 42: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

ENGINE OIL PRESSURE (EOP) SWITCH

Material

ITEM SPECIFICATION TABLE

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

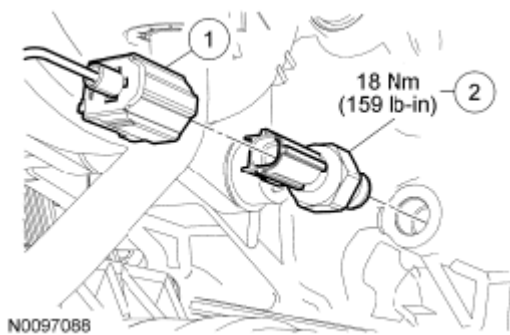


Fig. 43: Identifying Engine Oil Pressure Switch Electrical Connector & EOP Switch With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12C508)
2	9278	EOP switch

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. If equipped, remove the 6 screws and the underbody shield.

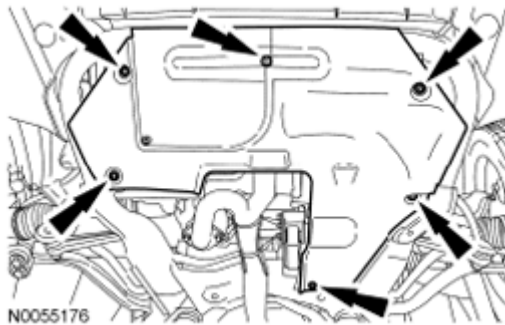


Fig. 44: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

3. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
4. Remove the **EOP** switch.
 - To install, tighten to 18 Nm (159 lb-in).
5. To install, reverse the removal procedure.
 - Apply thread sealant with PTFE to the **EOP** switch threads prior to installation.

EXHAUST MANIFOLD - LH**Material****ITEM SPECIFICATION TABLE**

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

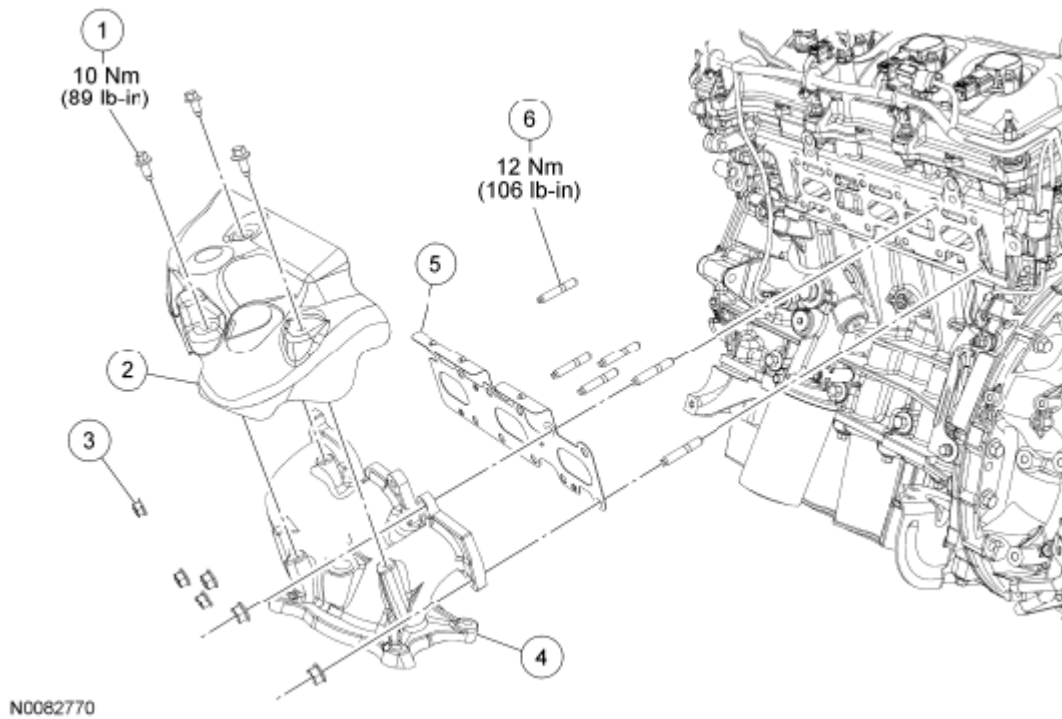


Fig. 45: Identifying Exhaust Manifold Components LH With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W713299	LH exhaust manifold heat shield bolt (3 required)
2	9Y427	LH exhaust manifold heat shield
3	W701706	LH exhaust manifold nut (6 required)
4	9431	LH exhaust manifold
5	9448	LH exhaust manifold gasket
6	W701732	LH exhaust manifold stud (6 required)

Removal

1. Remove the LH catalytic converter. For additional information, refer to **REMOVAL AND INSTALLATION**.
2. Remove the LH Heated Oxygen Sensor (HO2S). For additional information, refer to **REMOVAL AND INSTALLATION**.
3. Remove the 3 bolts and the LH exhaust manifold heat shield.
4. Remove the 6 nuts and the LH exhaust manifold.
 - Discard the nuts and gasket.
5. Clean and inspect the LH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
6. Remove and discard the 6 LH exhaust manifold studs.

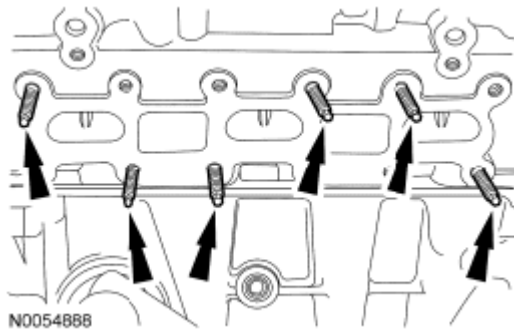


Fig. 46: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

7. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.

Installation

1. Install 6 new LH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
2. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

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

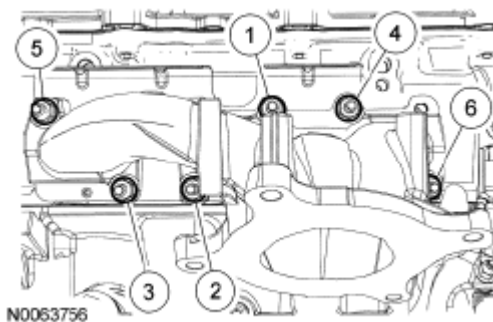


Fig. 47: Identifying LH Exhaust Manifold Studs Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the LH exhaust manifold heat shield and the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).
4. Install the LH **HO2S** . For additional information, refer to **REMOVAL AND INSTALLATION** .
5. Install the LH catalytic converter. For additional information, refer to **REMOVAL AND INSTALLATION** .

EXHAUST MANIFOLD - RH

Material

ITEM SPECIFICATION TABLE

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

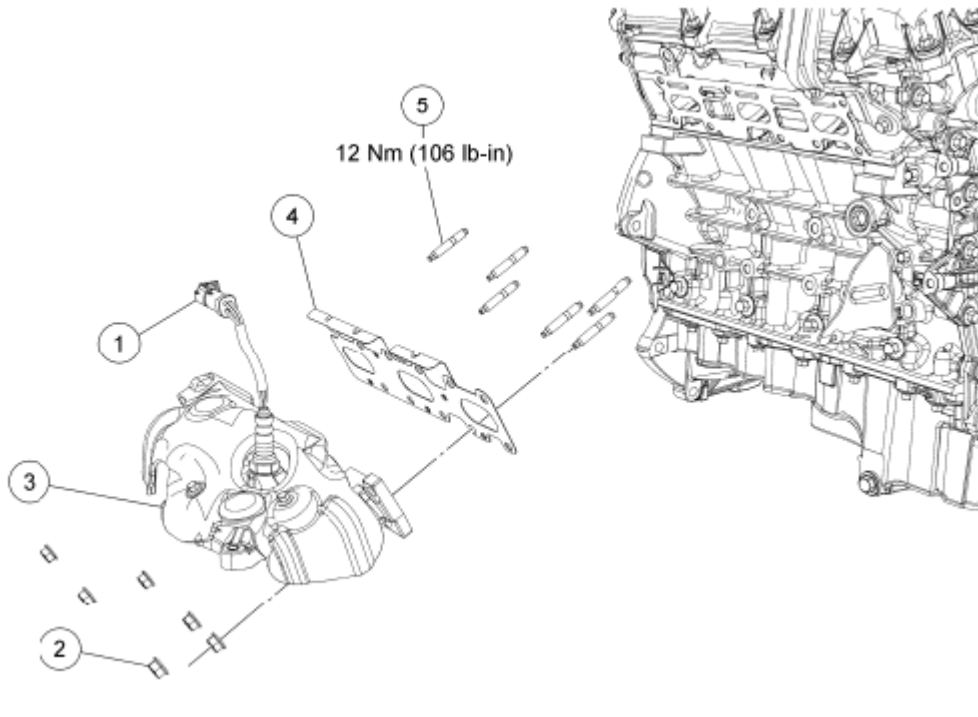


Fig. 48: Identifying Exhaust Manifold Component With Torque Specifications RH
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14A464	RH Heated Oxygen Sensor (HO2S) electrical connector
2	W701706	RH exhaust manifold nut (6 required)
3	9430	RH exhaust manifold
4	9448	RH exhaust manifold gasket
5	W701732	RH exhaust manifold stud (6 required)

Removal

1. Remove the RH catalytic converter. For additional information, refer to **REMOVAL AND INSTALLATION**.
2. Disconnect the RH Heated Oxygen Sensor (HO2S) electrical connector.
3. Remove the 6 nuts and the RH exhaust manifold.
 - Discard the nuts and gasket.
4. Clean and inspect the RH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
5. Remove and discard the 6 RH exhaust manifold studs.

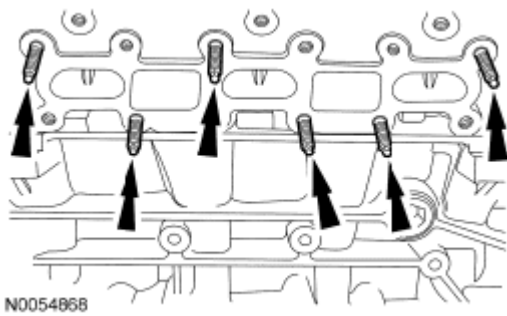


Fig. 49: Locating Exhaust Manifold Studs RH
Courtesy of FORD MOTOR CO.

6. Clean the exhaust manifold mating surface of the cylinder head with metal surface prep. Follow the directions on the packaging.

NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.

Installation

1. Install 6 new RH exhaust manifold studs.
 - Tighten to 12 Nm (106 lb-in).
2. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

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

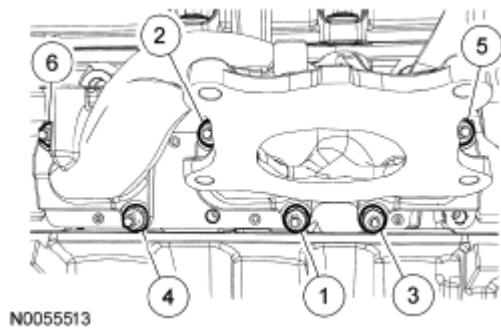


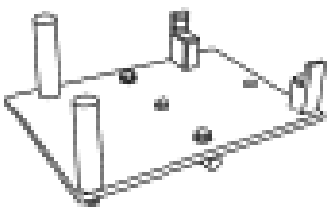
Fig. 50: Identifying Exhaust Manifold Nut Tightening Sequence RH Side
Courtesy of FORD MOTOR CO.

3. Connect the RH **HO2S** electrical connector.
4. Install the RH catalytic converter. For additional information, refer to **REMOVAL AND INSTALLATION**.

ENGINE MOUNT

Special Tool(s)

SPECIAL TOOL TABLE

 <p>ST3034-A</p>	Oil Pan Holding Fixture 303-1295
---	----------------------------------

Engine Mount (View 1 of 3)

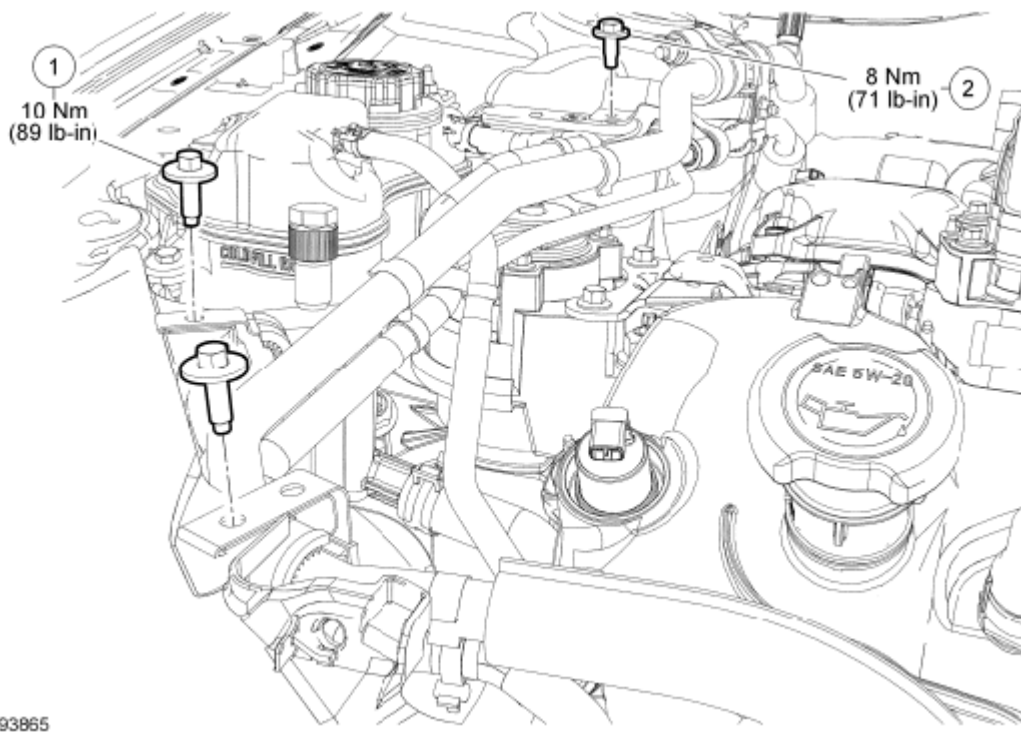


Fig. 51: Identifying Engine Mount Components With Torque Specifications (1 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W503924	A/C tube retaining clamp bolt (2 required)
2	W505422	A/C tube retaining clamp bolt

Engine Mount (View 2 of 3)

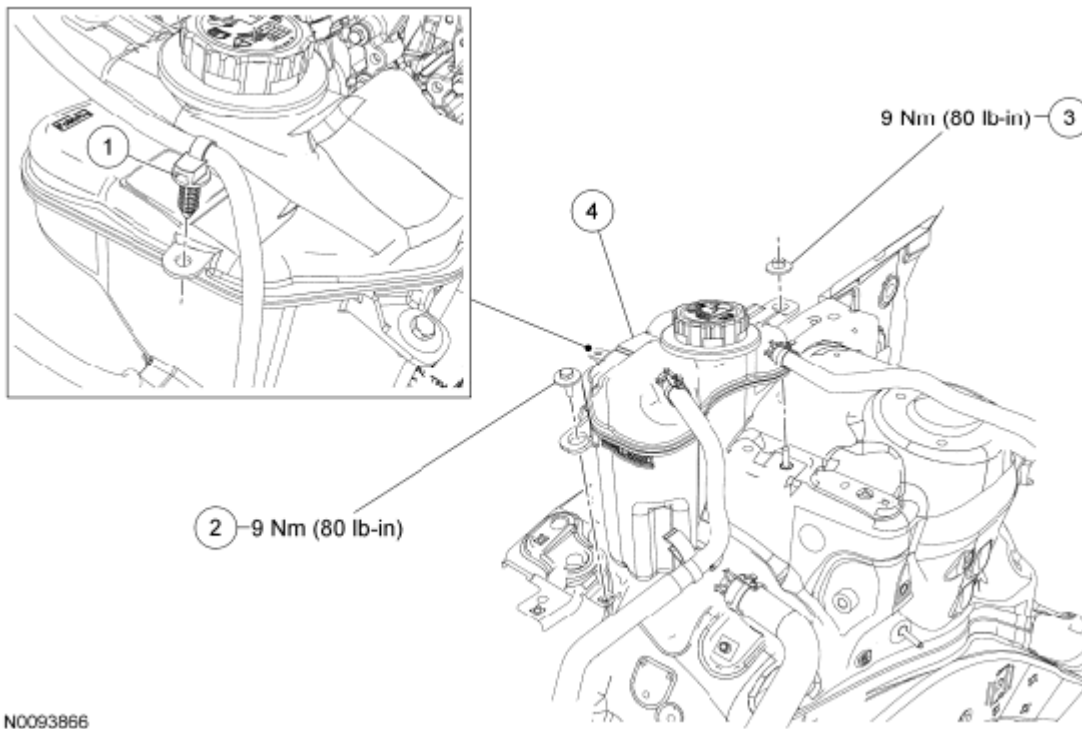
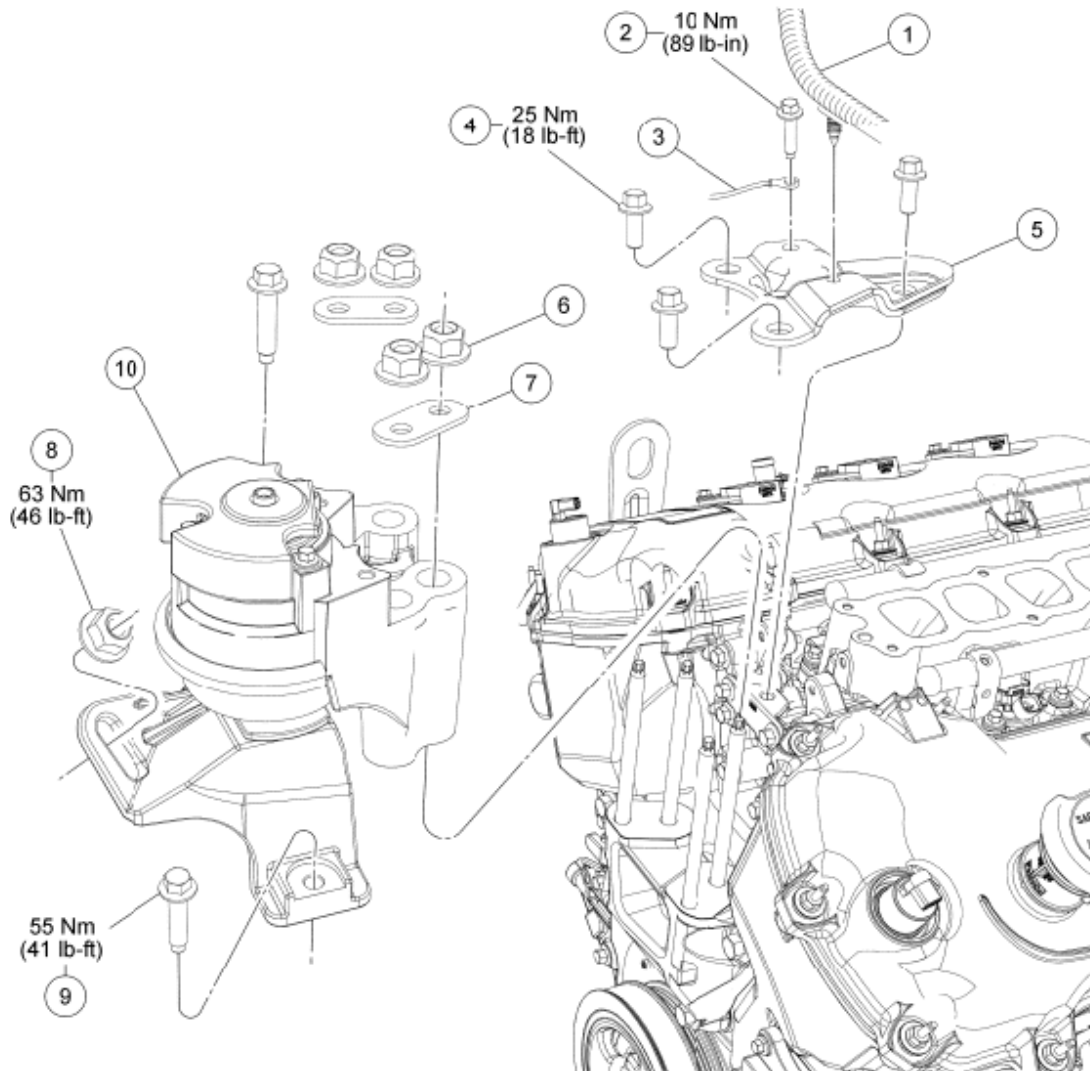


Fig. 52: Identifying Engine Mount Components With Torque Specifications (2 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14197	Wiring harness retainer
2	W707398	Engine coolant degas bottle-to-fender bolt
3	W709603	Engine coolant degas bottle-to-fender nut
4	8A080	Engine coolant degas bottle

Engine Mount (View 3 of 3)



ND101508

Fig. 53: Identifying Engine Mount Components With Torque Specifications (3 Of 3)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	3493	Power steering hose retainer
2	W705936	Ground wire bolt
3	19A905	Ground wire
4	W708764	Engine mount brace bolt (3 required)
5	6K075	Engine mount brace
6	W705891	Engine mount-to-engine nut (4 required)
7	6B095	Engine mount spacer (2 required)
8	W705891	Engine mount-to-frame nut
9	W500720	Engine mount-to-frame bolt (2 required)

10

6F012

Engine mount

Removal and Installation

1. Remove the exhaust Y-pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.
2. Position a floor jack and the Oil Pan Holding Fixture under the oil pan.

NOTE: The Oil Pan Holding Fixture must be carefully aligned to the mounting bosses on the oil pan. Failure to follow these instructions may result in damage to the oil pan.

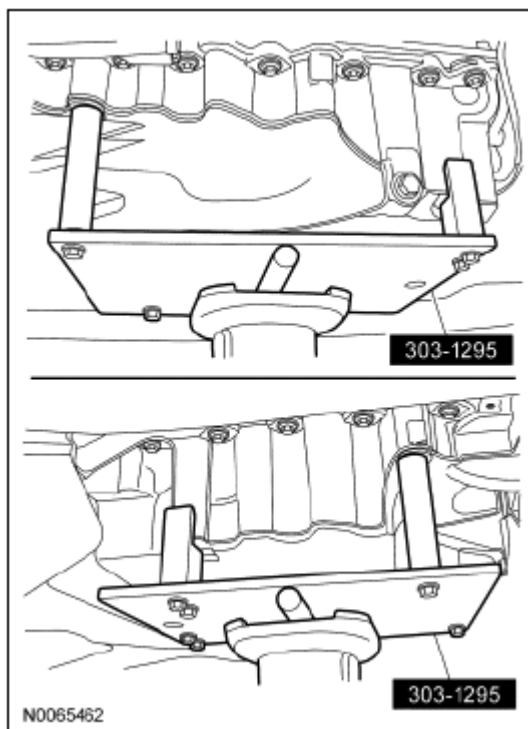


Fig. 54: Positioning Floor Jack & Oil Pan Holding Fixture
Courtesy of FORD MOTOR CO.

3. Remove the A/C tube retaining clamp bolt.
 - To install, tighten to 8 Nm (71 lb-in).
4. Remove the 2 A/C tube retaining clamp bolts.
 - To install, tighten to 10 Nm (89 lb-in).
5. Detach the wiring harness retainer from the degas bottle.
6. Remove the nut, bolt and position the engine coolant degas bottle aside.
 - To install, tighten to 9 Nm (80 lb-in).
7. Detach the power steering hose retainer from the engine mount brace.
8. Remove the bolt and the ground wire from the engine mount brace.

- To install, tighten to 10 Nm (89 lb-in).
9. Remove the 3 bolts and the engine mount brace.
- To install, tighten to 25 Nm (18 lb-ft).
10. Remove the 4 engine mount-to-engine nuts.
- To install, tighten in the sequence shown in illustration below to 70 Nm (52 lb-ft).

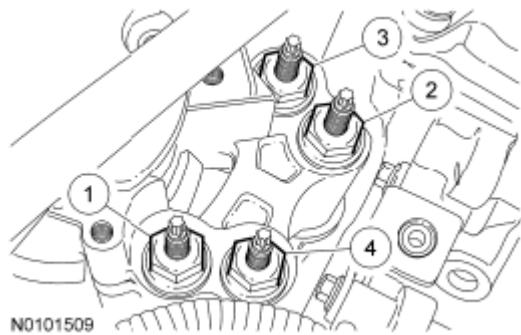


Fig. 55: Identifying Engine Mount Nut Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Remove the 2 engine mount spacers.
12. Using the Oil Pan Holding Fixture, lower the engine 25 mm (1 in).
13. Remove the nut, the 2 bolts and the engine mount.
- To install, tighten the bolts to 55 Nm (41 lb-ft) and the nut to 63 Nm (46 lb-ft).

NOTE: It is necessary to reposition the A/C tubes to remove the engine mount.

14. To install, reverse the removal procedure.

REMOVAL

ENGINE

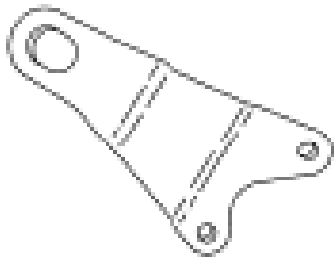
Special Tool(s)

SPECIAL TOOL TABLE

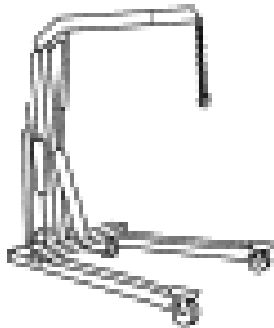
	Engine Lift Eye 303-1245
--	--------------------------

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

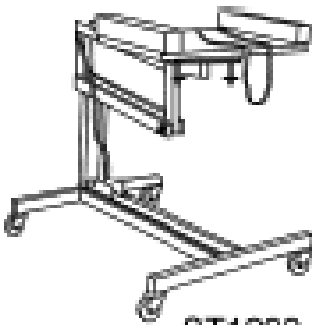


ST2976A



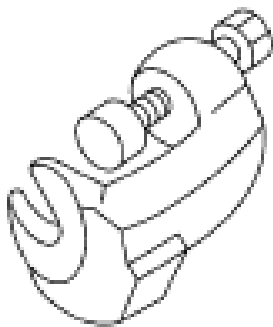
ST1341-A

Heavy Duty Floor Crane 014-00071 or equivalent



ST1293-A

Powertrain Lift 014-00765 or equivalent



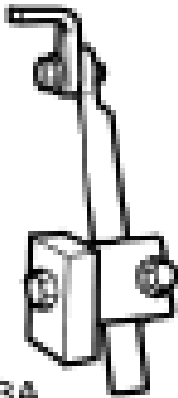
ST1408-A

Remover, Tie-Rod End 211-105



ST1400.A

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



ST2743A

Universal Adapter Brackets 014-00001 or equivalent

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

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
3. Recover the A/C system. For additional information, refer to **REFRIGERANT SYSTEM RECOVERY** .
4. Remove the accessory drive belt and the power steering belt. For additional information, refer to **REMOVAL** .
5. Remove the LH halfshaft and the intermediate shaft. For additional information, refer to **REMOVAL** .
6. If equipped, remove the 6 screws and the underbody shield.

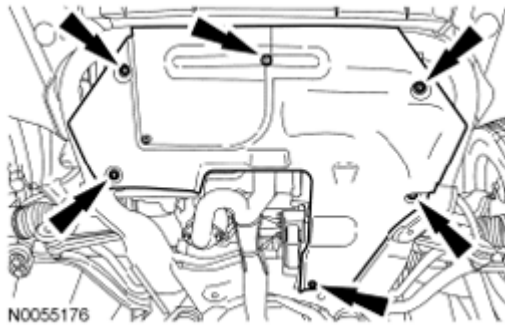


Fig. 56: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

7. Disconnect the power steering cooler tube and drain the power steering fluid into a suitable drain pan.

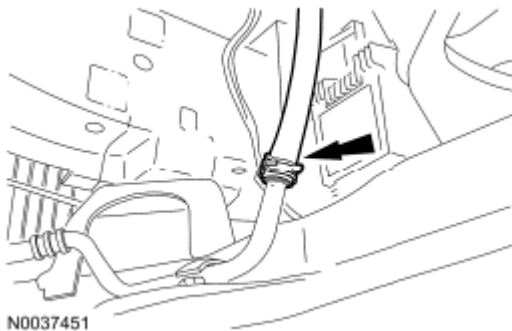


Fig. 57: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

8. Drain the cooling system. For additional information, refer to **DRAINING**.
9. Remove the degas bottle. For additional information, refer to **REMOVAL AND INSTALLATION**.
10. Remove the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.
11. Remove the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION**.
12. Disconnect the 2 engine wiring harness electrical connectors.

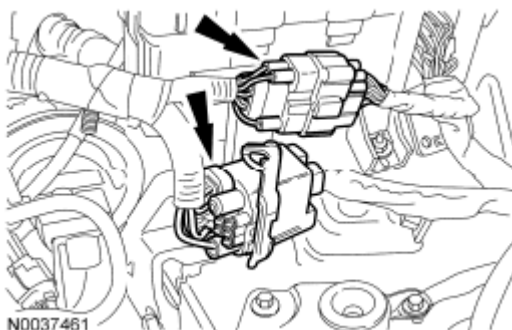


Fig. 58: Locating Engine Wiring Harness Electrical Connectors

Courtesy of FORD MOTOR CO.

13. Detach the 2 wiring harness retainers from the transmission mount and the battery tray bracket.

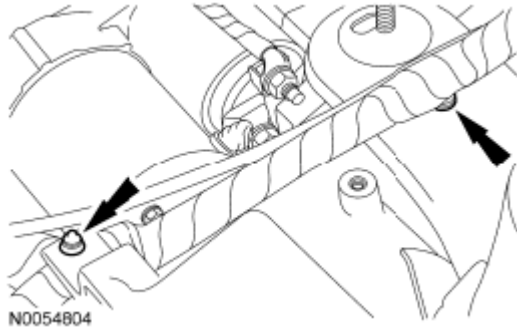


Fig. 59: Locating Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

14. Remove the 2 nuts and the battery cables from the positive battery cable.

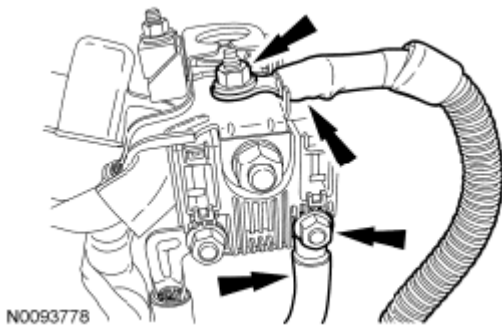


Fig. 60: Locating Battery Cables Nuts
Courtesy of FORD MOTOR CO.

15. Remove the bolt and position aside the ground wire.

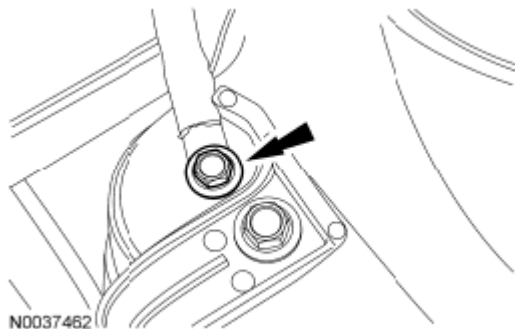


Fig. 61: Locating Ground Wire Bolt
Courtesy of FORD MOTOR CO.

16. Disconnect the vacuum hose and the Evaporative Emission (EVAP) tube from the upper intake manifold.

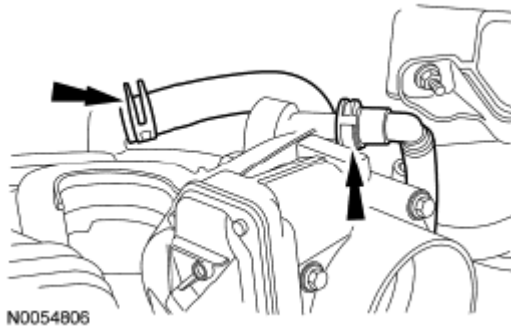


Fig. 62: Locating Vacuum Hose & Evaporative Emission Tube
Courtesy of FORD MOTOR CO.

17. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

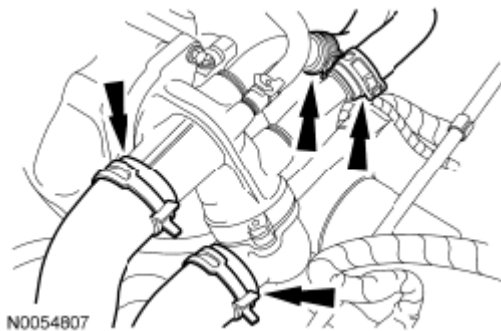


Fig. 63: Locating Steering Column Opening Trim Panel Screws
Courtesy of FORD MOTOR CO.

18. Disconnect the transaxle control cable from the control lever.

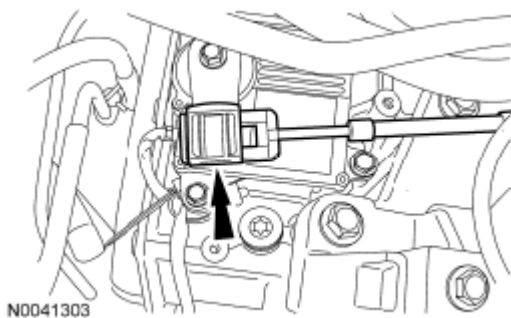


Fig. 64: Locating Transaxle Control Cable
Courtesy of FORD MOTOR CO.

19. Remove the 3 nuts and position the transaxle control cable bracket aside.

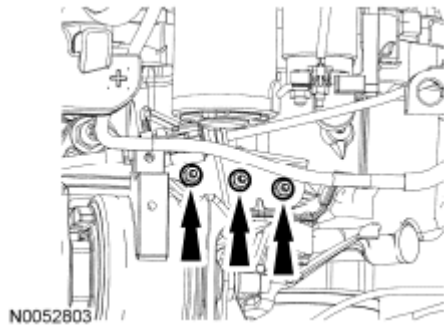


Fig. 65: Locating Transaxle Control Cable Bracket & Nuts
Courtesy of FORD MOTOR CO.

20. Remove the bolt and position the ground wire aside.

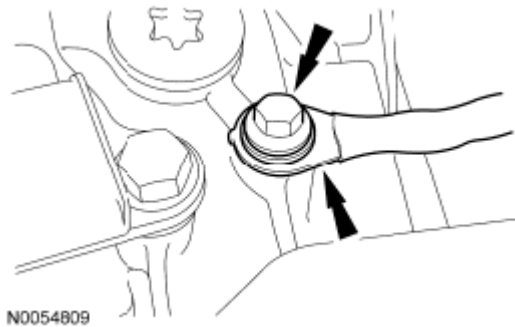


Fig. 66: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

21. If equipped, detach the engine block heater harness from the radiator support, power steering hose, A/C tube and the engine wiring harness.
22. Detach the coolant tube retainer clips from the A/C tube.



Fig. 67: Locating Parking Brake Handle & Position
Courtesy of FORD MOTOR CO.

23. Remove the nut and disconnect the A/C tube from the condenser.
 - Discard the O-ring seal.

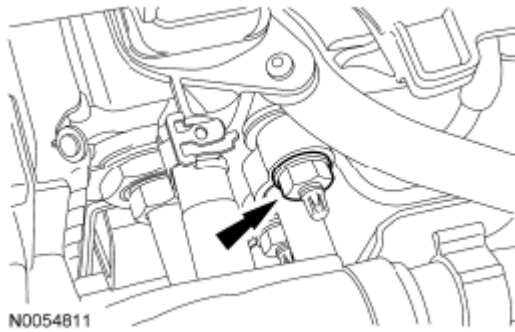


Fig. 68: Locating Steering Column Reinforcement Panel Bolts
Courtesy of FORD MOTOR CO.

24. Remove the 2 A/C tube bracket bolts.

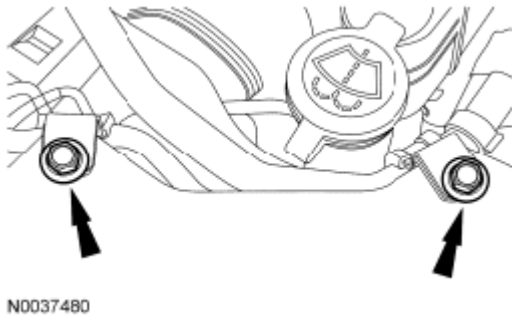


Fig. 69: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

25. Remove the A/C tube bracket bolt.

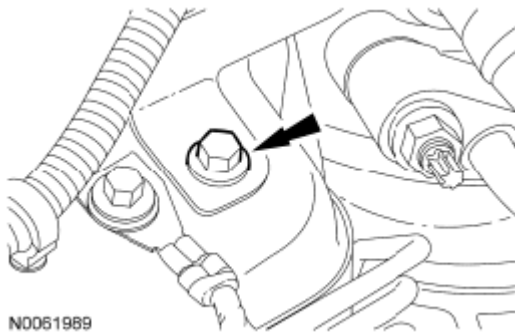
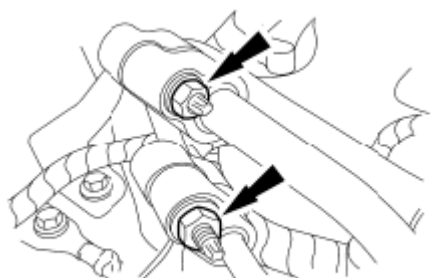


Fig. 70: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

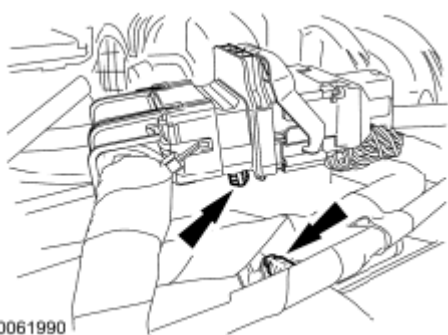
26. Remove the 2 nuts and disconnect the A/C tubes.
- Discard the O-ring seal.



N0041237

Fig. 71: Locating A/C Tubes & Nuts
Courtesy of FORD MOTOR CO.

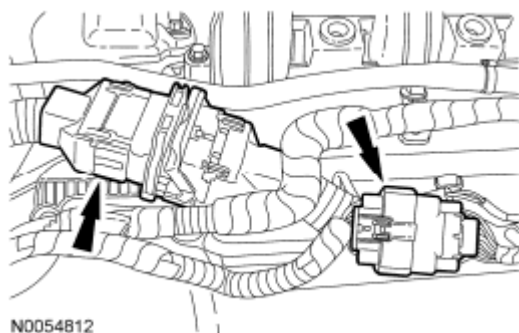
27. Detach the 2 wiring harness retainers.



N0061990

Fig. 72: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

28. Disconnect the 2 engine wiring harness electrical connectors.



N0054812

Fig. 73: Locating Engine Control Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

29. Remove the 2 wiring harness retainers from the LH valve cover stud bolts and position the wiring harness aside.

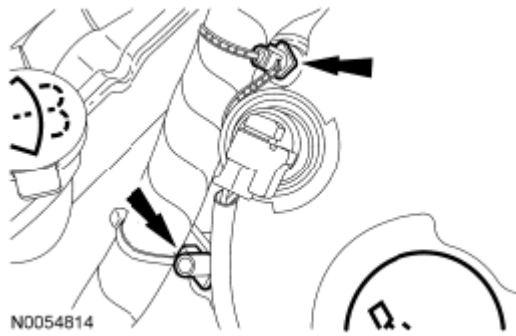


Fig. 74: Locating LH Valve Cover Stud Bolts & Wiring Harness
Courtesy of FORD MOTOR CO.

30. Remove the oil level indicator.

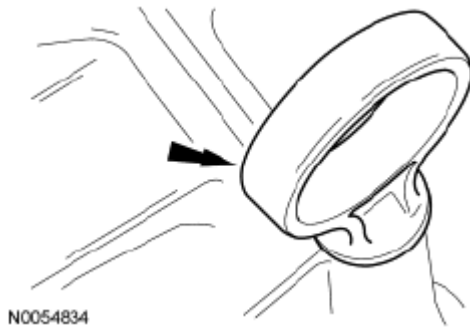


Fig. 75: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

31. Disconnect the hose from the power steering reservoir.
 - Detach the pin-type retainer from the engine mount brace.

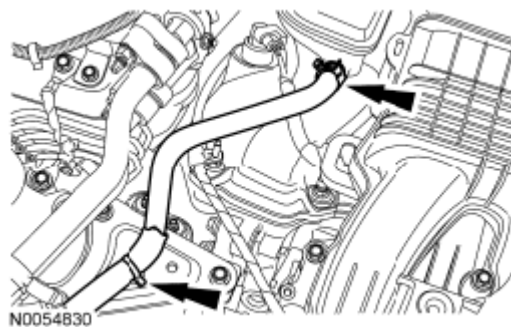


Fig. 76: Locating Hose
Courtesy of FORD MOTOR CO.

32. Using a small screwdriver, release the retaining clip and detach the power steering reservoir from the cowl.

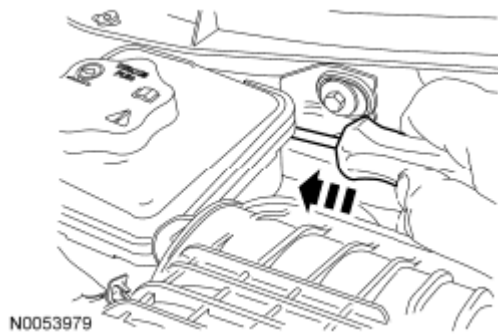


Fig. 77: Releasing Retaining Clip
Courtesy of FORD MOTOR CO.

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

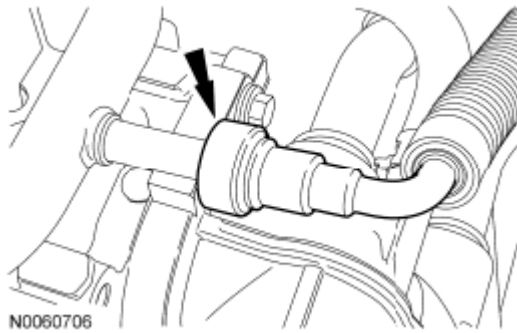


Fig. 78: Locating Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

34. Remove the bolt and the ground wire from the engine mount brace.

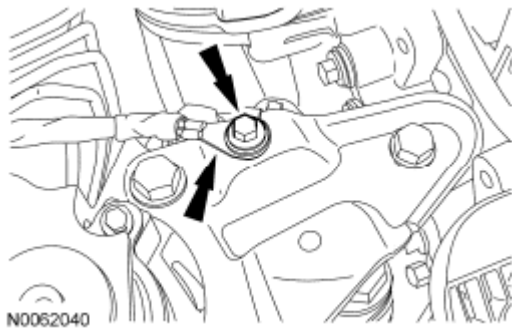


Fig. 79: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

35. Remove the 3 bolts and the engine mount brace.

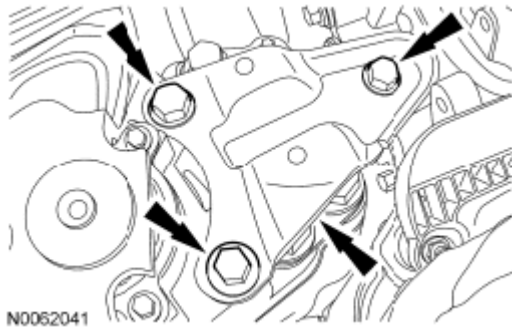


Fig. 80: Locating Engine Mount Brace & Bolt
Courtesy of FORD MOTOR CO.

36. Disconnect the PCM electrical connectors and pin-type retainers.

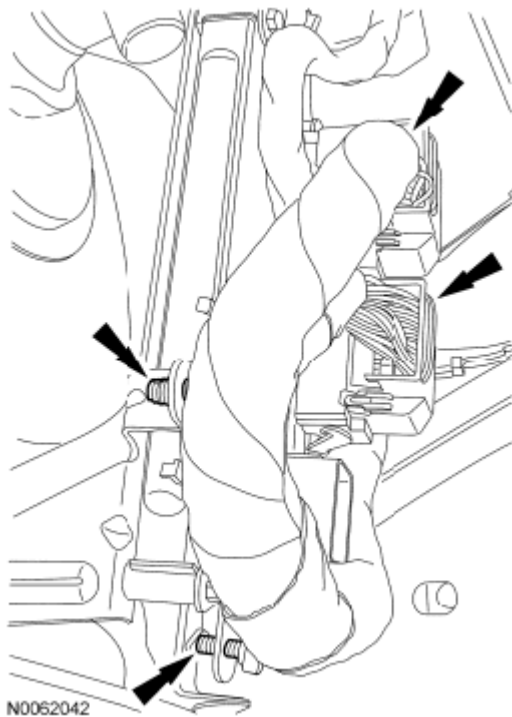


Fig. 81: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

37. Remove the Power Steering Pressure (PSP) hose bracket bolt.

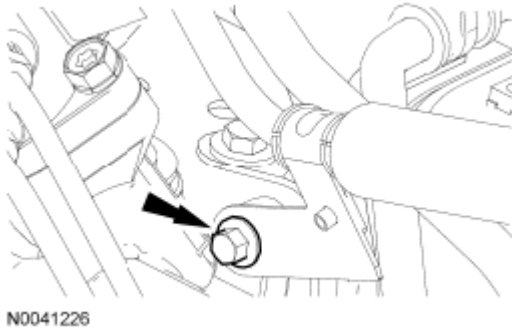


Fig. 82: Locating Power Steering Pressure Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

38. Remove and discard the PSP hose banjo bolt and the 2 seals from the steering gear.

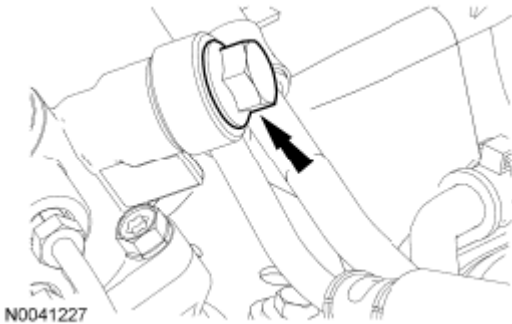


Fig. 83: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

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

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

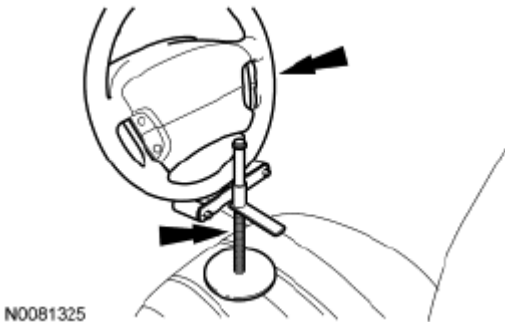


Fig. 84: Identifying Steering Wheel Holding Device
Courtesy of FORD MOTOR CO.

40. Remove the 2 nuts and the steering joint cover.

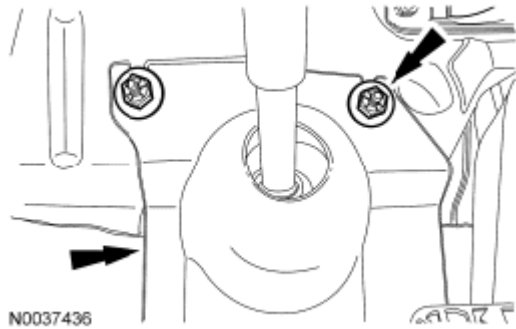


Fig. 85: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

41. Remove the bolt and disconnect the steering column shaft from the steering gear.
 - Discard the bolt.

NOTE: Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to REMOVAL .

NOTE: Index-mark the steering column shaft position to the steering gear for reference during installation.

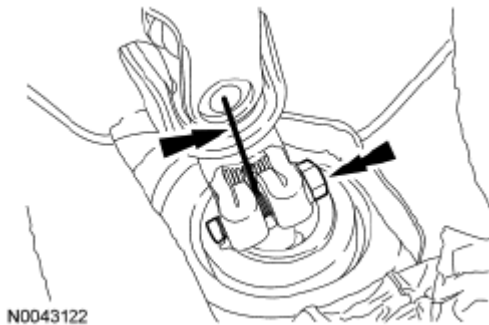


Fig. 86: Locating Steering Column Shaft & Bolt
Courtesy of FORD MOTOR CO.

42. Remove the 4 screws and position the LH fender splash shield aside.

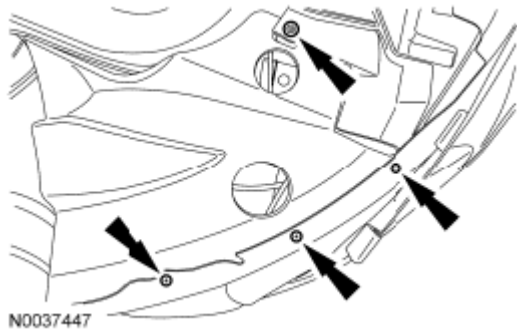


Fig. 87: Locating LH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

43. Remove the 6 pin-type retainers (4 shown in illustration) and the LH splash shield.

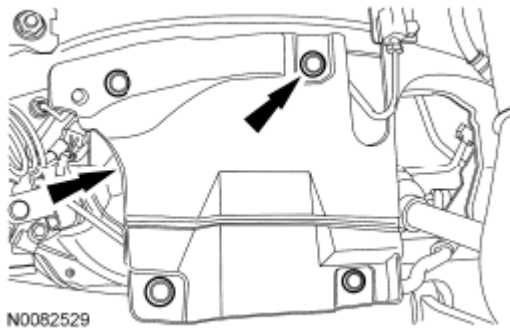


Fig. 88: Identifying Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

44. Release the 4 clips and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

NOTE: The steering gear-to-dash seal must be removed or it will be damaged when lowering the subframe.

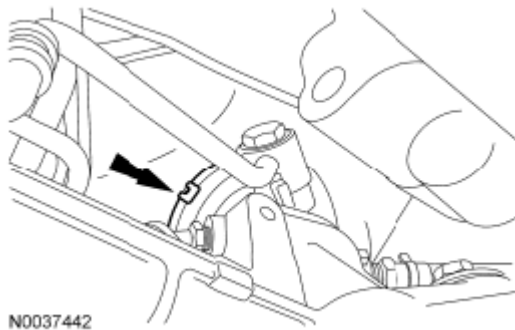


Fig. 89: Locating Steering Gear Clips
Courtesy of FORD MOTOR CO.

45. Disconnect the transaxle cooler hoses.

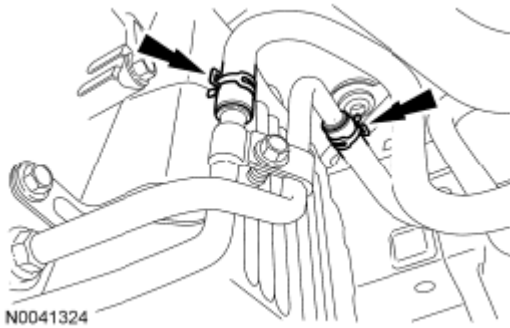


Fig. 90: Locating Transaxle Cooler Hoses
Courtesy of FORD MOTOR CO.

46. Remove the drain plug and drain the engine oil.
- Install the drain plug and tighten to 27 Nm (20 lb-ft).

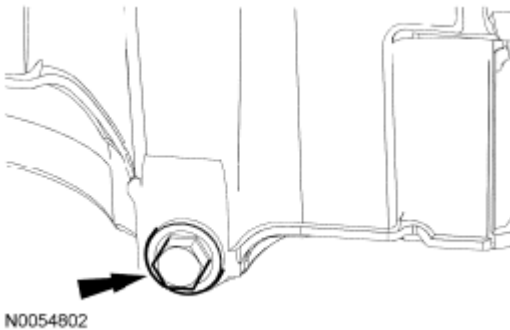


Fig. 91: Locating Drain Plug
Courtesy of FORD MOTOR CO.

47. Remove and discard the engine oil filter.
48. Remove the 6 nuts and the Y-pipe assembly.
- Discard the gaskets and nuts.

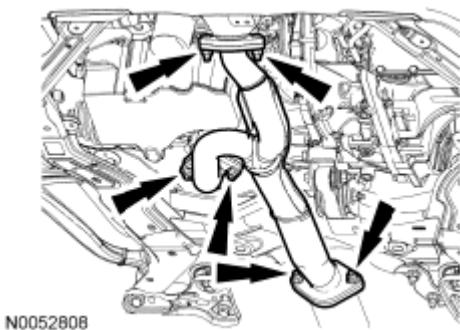


Fig. 92: Locating Spark Plug Wire Retainer

Courtesy of FORD MOTOR CO.

49. Remove the 4 oil pan-to-transaxle bolts.



Fig. 93: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

50. Remove the 2 fasteners and the inspection cover.

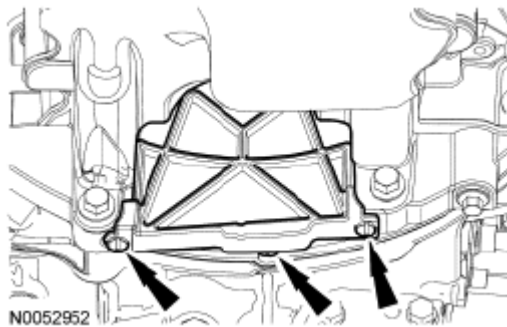


Fig. 94: Locating Fasteners & Inspection Cover
Courtesy of FORD MOTOR CO.

51. Remove and discard the 4 torque converter nuts.

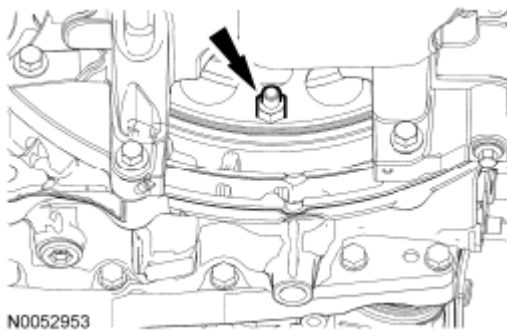


Fig. 95: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

52. Remove and discard the 4 bolts (3 shown in illustration) and support the driveshaft with a length of mechanic's wire.

NOTE: Index-mark the driveshaft for installation.

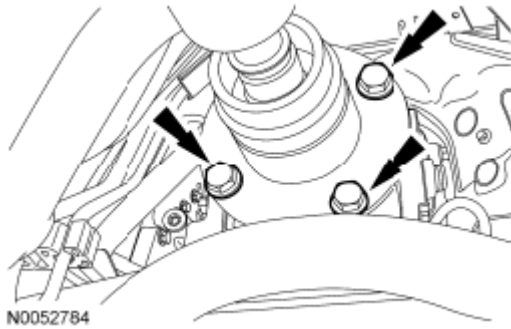


Fig. 96: Locating PTU Flange & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

53. Remove the engine roll restrictor-to-subframe through bolt.

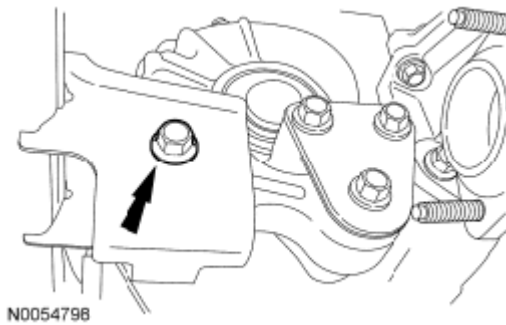


Fig. 97: Locating Engine Roll Restrictor-To-Subframe Through Bolt
Courtesy of FORD MOTOR CO.

54. Remove the cotter pins and nuts from the tie-rod ends.

NOTE: LH shown in illustration, RH similar.

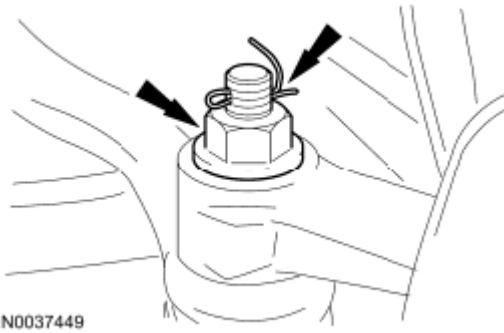


Fig. 98: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

55. Using the Tie-Rod End Remover, separate the tie-rod ends from the steering knuckles.

NOTE: LH shown in illustration, RH similar.

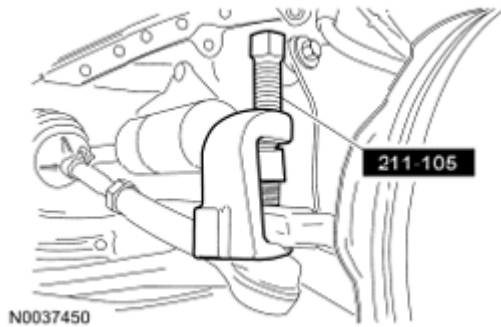


Fig. 99: Separating Tie-Rod Ends From Steering Knuckles
Courtesy of FORD MOTOR CO.

56. Remove the nuts and separate the stabilizer bar links from the struts.

NOTE: LH shown in illustration, RH similar.



Fig. 100: Locating Stabilizer Bar Links & Nuts

Courtesy of FORD MOTOR CO.

57. Position the Powertrain Lift under the subframe assembly.

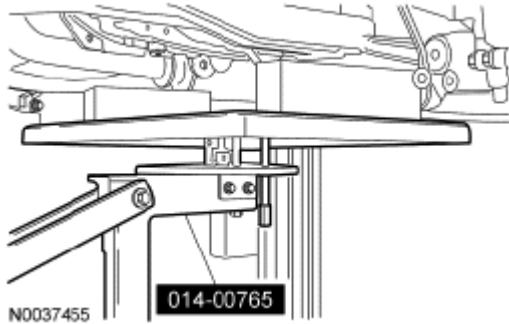


Fig. 101: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

58. Remove the 4 subframe bracket-to-body bolts.

NOTE: LH shown in illustration, RH similar.

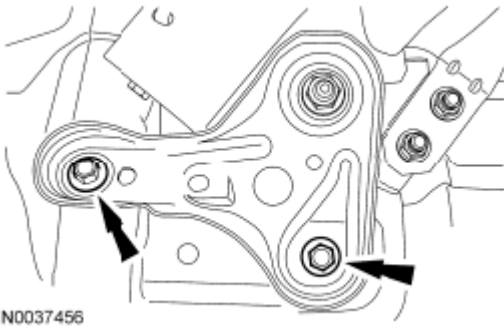


Fig. 102: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

59. Remove the 2 rear subframe nuts and the 2 subframe brackets.

NOTE: LH shown in illustration, RH similar.

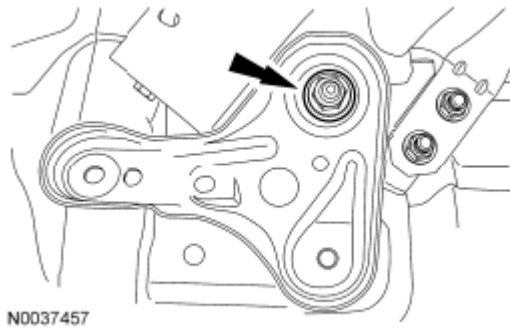


Fig. 103: Locating Rear Subframe Nuts & Subframe Brackets
Courtesy of FORD MOTOR CO.

60. Remove the 2 front subframe nuts.

NOTE: LH shown in illustration, RH similar.

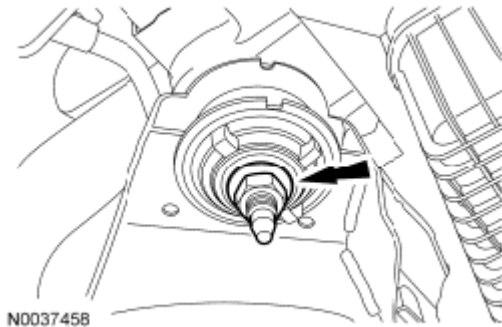


Fig. 104: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

61. Lower the subframe assembly from the vehicle.
62. Remove the 2 RH catalytic converter bracket bolts.

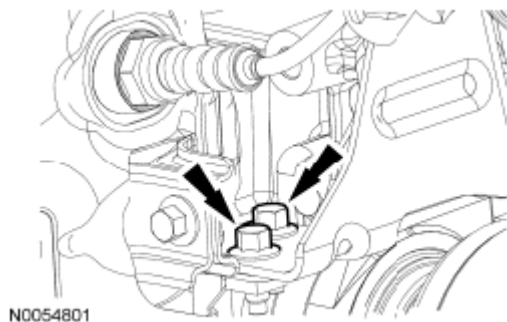


Fig. 105: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

63. Remove the 2 nuts and remove the RH catalytic converter bracket.

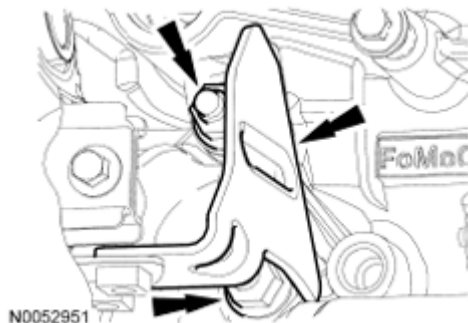


Fig. 106: Locating RH Catalytic Converter Bracket & Nuts
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

64. Disconnect the RH Catalyst Monitor Sensor (CMS) electrical connector.

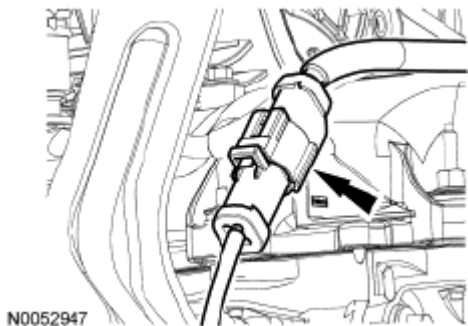


Fig. 107: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

65. Remove the 4 nuts and the RH catalytic converter.
- Discard the gasket.

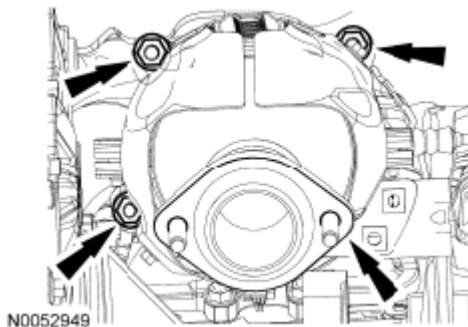


Fig. 108: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

66. Remove the 5 bolts and the Power Transfer Unit (PTU) support bracket.

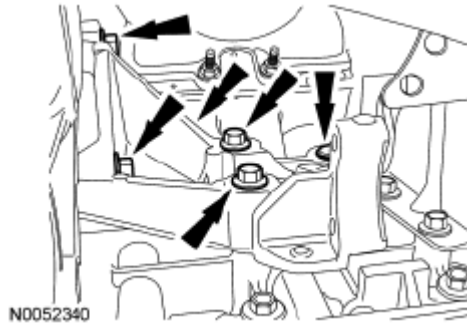


Fig. 109: Locating Power Transfer Unit Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

67. Remove the 5 bolts and the PTU .

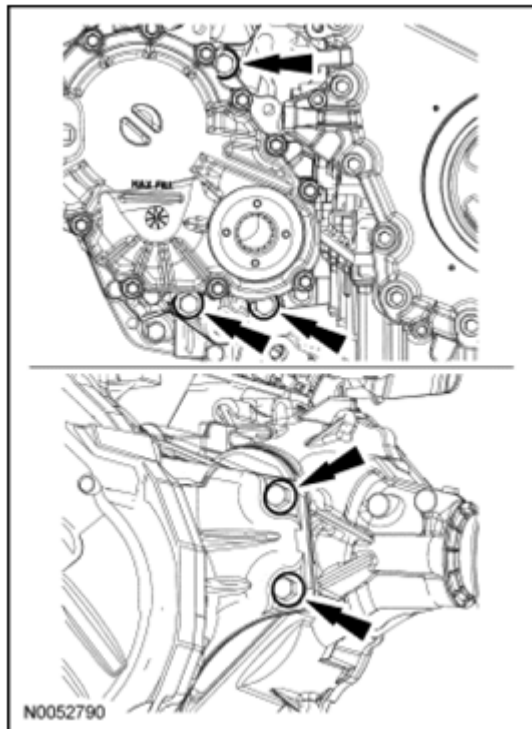


Fig. 110: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

All vehicles

68. Install the Powertrain Lift and Universal Adapter Brackets.

NOTE: Position a block of wood under the transaxle.

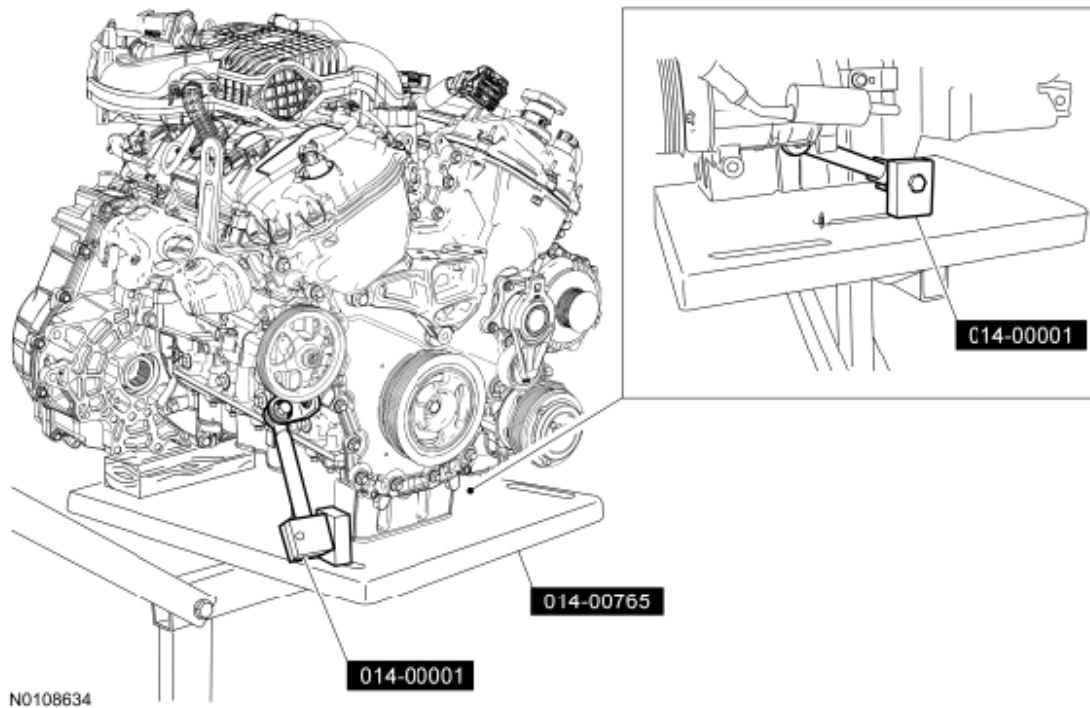


Fig. 111: Identifying Powertrain Lift & Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

69. Remove the transaxle support insulator through bolt and nut.



Fig. 112: Locating Transaxle Support Insulator Through Bolt & Nut
Courtesy of FORD MOTOR CO.

70. Remove the transaxle support insulator bracket bolt and the 2 nuts.

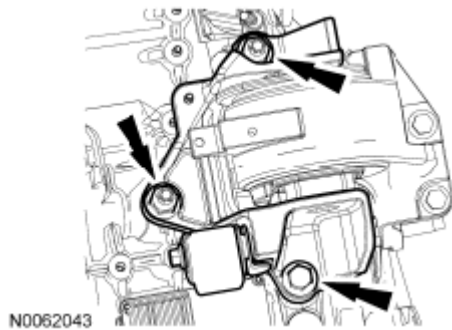


Fig. 113: Locating Transaxle Support Insulator Bracket Bolt & Nuts
Courtesy of FORD MOTOR CO.

71. Remove the 4 engine mount nuts.
 - Remove the 2 engine mount spacers.

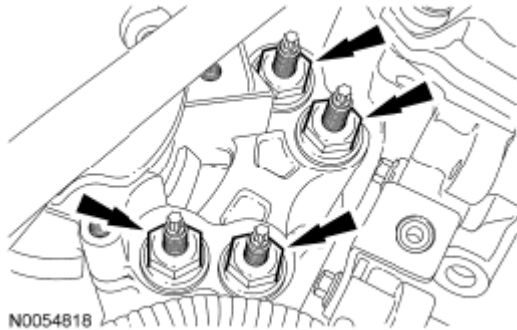


Fig. 114: Locating RH Instrument Panel Electrical Connectors
Courtesy of FORD MOTOR CO.

72. Remove the nut, 2 bolts and the engine mount.

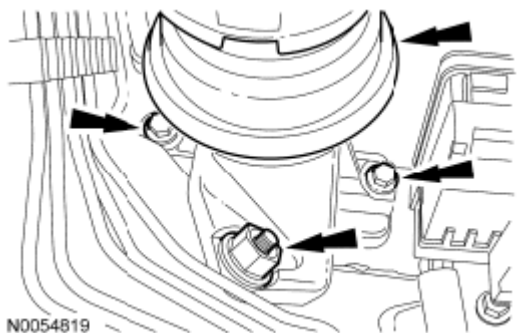


Fig. 115: Locating Engine Mount Bolts & Nut
Courtesy of FORD MOTOR CO.

73. Lower the engine and transaxle assembly from the vehicle.
74. Disconnect the wiring harness fasteners from the transaxle-to-engine stud bolt and the starter.

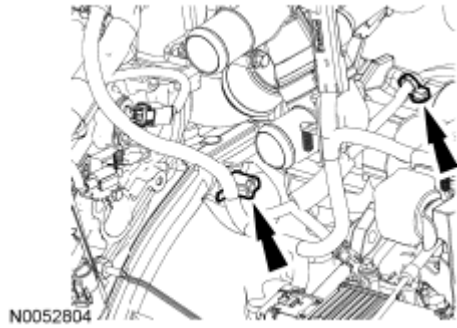


Fig. 116: Locating Transaxle Assembly Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

75. Remove the bolt and ground wire.



Fig. 117: Locating Ground Wire Bolt
Courtesy of FORD MOTOR CO.

76. Disconnect the Transmission Control Module (TCM) electrical connector.

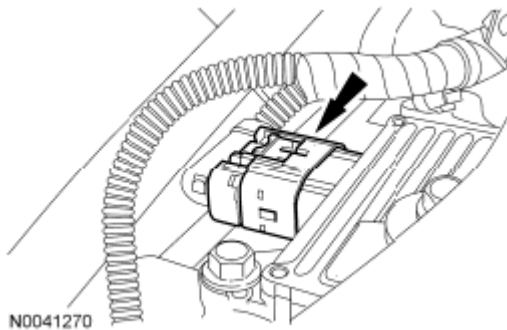


Fig. 118: Locating Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

77. Remove the 2 nuts and the starter motor wiring.

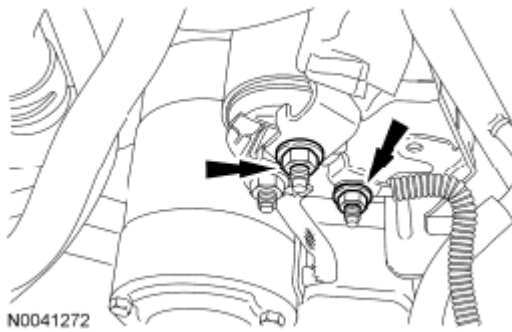


Fig. 119: Locating Starter Motor Wiring & Nuts
Courtesy of FORD MOTOR CO.

78. Remove the 2 bolts and the starter.

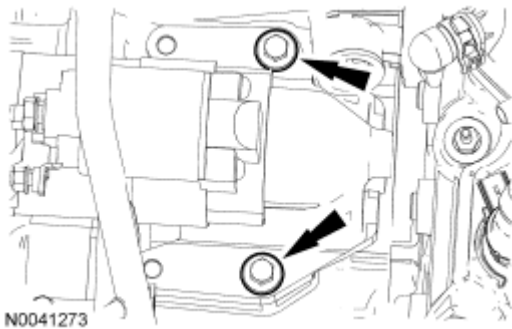


Fig. 120: Locating Starter & Bolts
Courtesy of FORD MOTOR CO.

79. Install the Engine Lift Eye on the LH cylinder head.

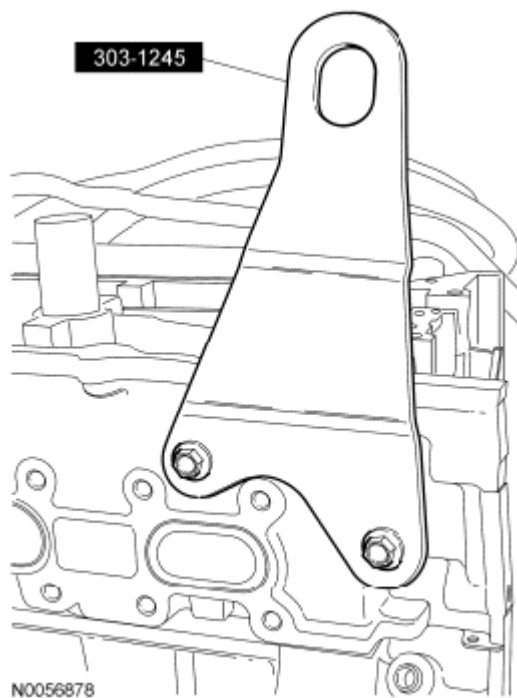


Fig. 121: Locating Engine Lift Eye On LH Cylinder Head
Courtesy of FORD MOTOR CO.

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

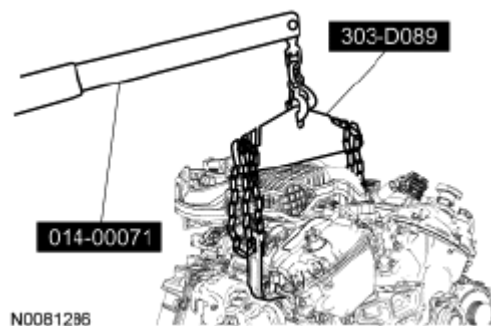


Fig. 122: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

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



Fig. 123: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

82. Remove the transaxle-to-engine stud bolt and the 4 transaxle-to-engine bolts.
- Separate the transaxle from the engine.

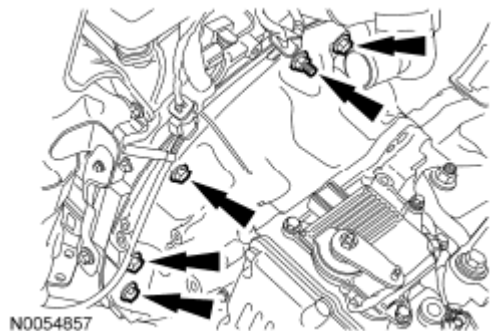
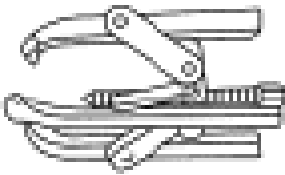


Fig. 124: Locating Transaxle-To-Engine Stud Bolt
Courtesy of FORD MOTOR CO.

ENGINE FRONT COVER

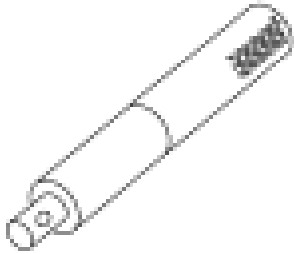
Special Tool(s)

SPECIAL TOOL TABLE

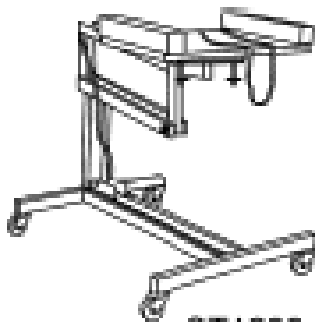
 ST1184-A	3 Jaw Puller 303-D121 or equivalent
	Handle 205-153 (T80T-4000-W)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ



ST1326-A



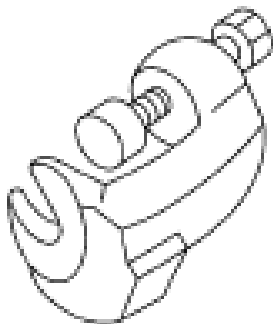
ST1293-A

Powertrain Lift 014-00765 or equivalent



ST1385-A

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



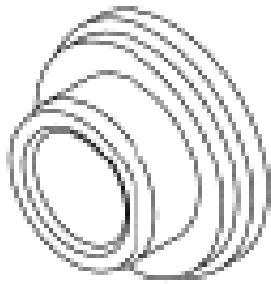
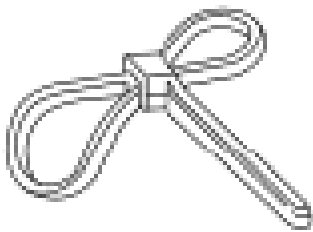
ST1408-A

Remover, Tie-Rod End 211-105

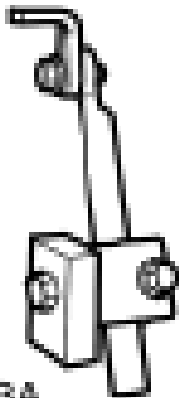
Remover, VCT Spark Plug Tube Seal 303-1247/1

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST2982-A****ST1438-A**

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

**ST2743A**

Universal Adapter Brackets 014-00001 or equivalent

Material**ITEM SPECIFICATION TABLE**

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

Removal and Installation

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.

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: Early build engines have 11 fastener valve covers, late build engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
3. Recover the A/C system. For additional information, refer to **REFRIGERANT SYSTEM RECOVERY**.
4. Remove the accessory drive belt and the power steering belt. For additional information, refer to **REMOVAL**.
5. Remove the LH halfshaft and the intermediate shaft. For additional information, refer to **REMOVAL**.
6. If equipped, remove the 6 screws and the underbody shield.

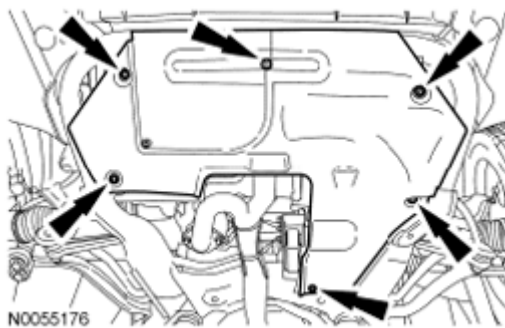


Fig. 125: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

7. Disconnect the power steering cooler tube and drain the power steering fluid into a suitable drain pan.

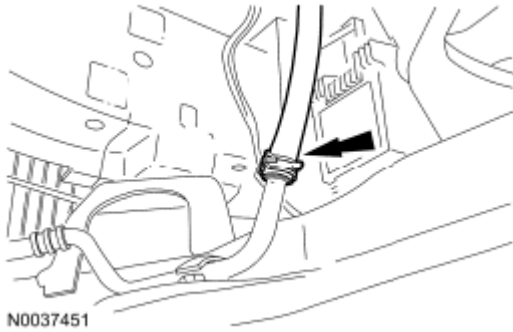


Fig. 126: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

8. Drain the cooling system. For additional information, refer to **DRAINING** .
9. Remove the degas bottle. For additional information, refer to **REMOVAL AND INSTALLATION** .
10. Remove the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
11. Remove the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
12. Disconnect the 2 engine wiring harness electrical connectors.

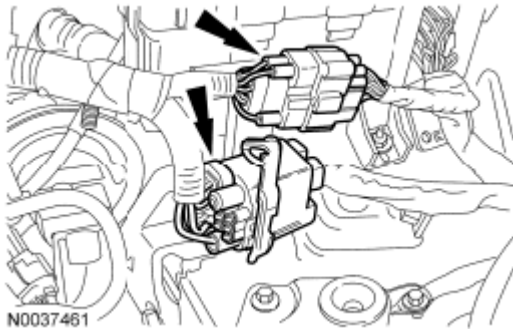


Fig. 127: Locating Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

13. Detach the 2 wiring harness retainers from transmission mount and the battery tray bracket.

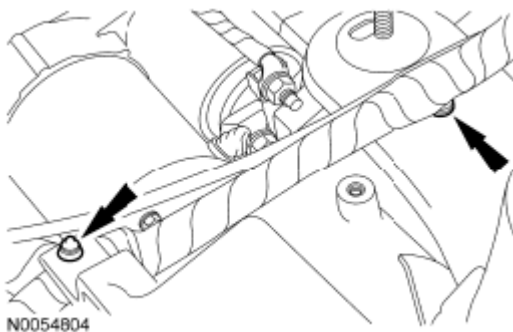


Fig. 128: Locating Transmission Mount & Battery Tray Bracket

Courtesy of FORD MOTOR CO.

14. Remove the 2 nuts and the battery cables from the positive battery cable.

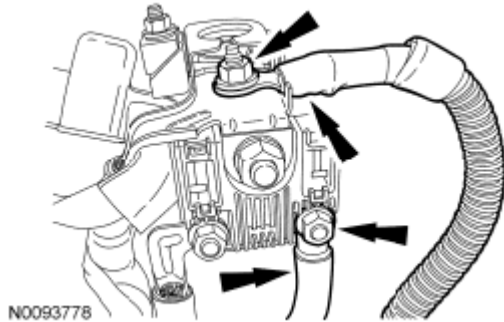


Fig. 129: Locating Battery Cables & Nuts
Courtesy of FORD MOTOR CO.

15. Remove the bolt and position aside the ground wire.

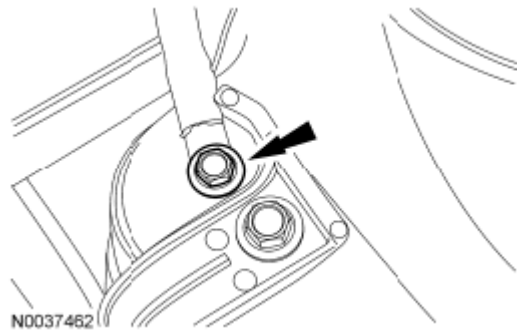


Fig. 130: Locating Ground Wire Bolt
Courtesy of FORD MOTOR CO.

16. Disconnect the vacuum hose and the Evaporative Emission (EVAP) tube from the upper intake manifold.

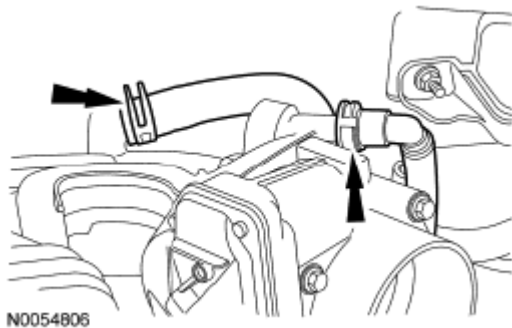


Fig. 131: Locating Vacuum Hose & Evaporative Emission Tube
Courtesy of FORD MOTOR CO.

17. Disconnect the upper radiator hose, lower radiator hose and 2 heater hoses from the thermostat housing.

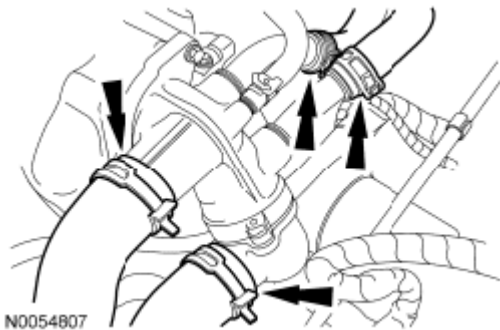


Fig. 132: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

18. Disconnect the transaxle control cable from the control lever.

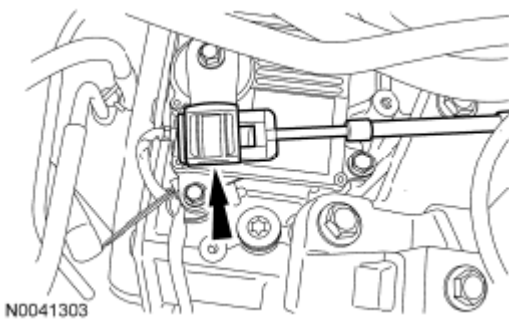


Fig. 133: Locating Transaxle Control Cable
Courtesy of FORD MOTOR CO.

19. Remove the 3 nuts and position the transaxle control cable bracket aside.

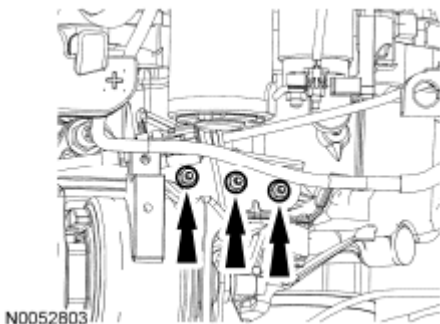


Fig. 134: Locating Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

20. Remove the bolt and position the ground wire aside.

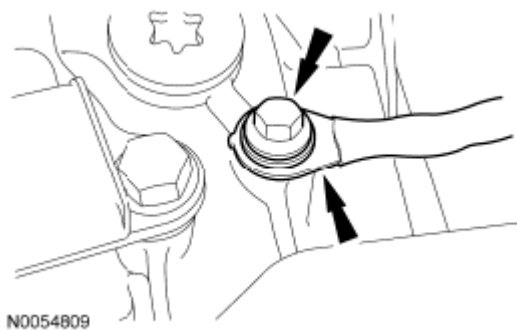


Fig. 135: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

21. If equipped, detach the engine block heater harness from the radiator support, power steering hose, A/C tube and the engine wiring harness.
22. Detach the coolant tube retainer clips from the A/C tube.



Fig. 136: Locating Coolant Tube Retainer Clips & A/C Tube
Courtesy of FORD MOTOR CO.

23. Remove the nut and disconnect the A/C tube from the condenser.
 - Discard the O-ring seals.

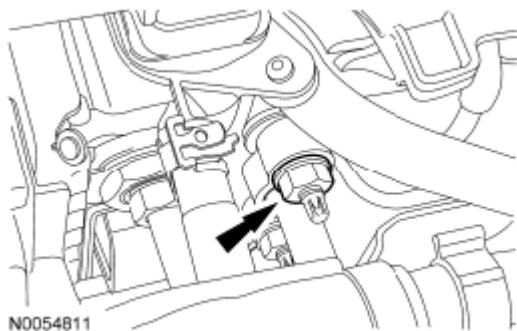


Fig. 137: Locating A/C Tube & Nut
Courtesy of FORD MOTOR CO.

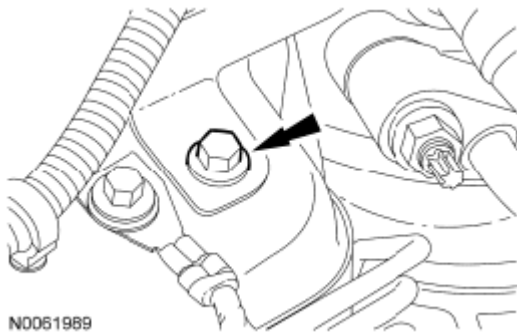
24. Remove the 2 A/C tube retaining clamp bolts.



N0037480

Fig. 138: Locating A/C Tube Retaining Clamp Bolts
Courtesy of FORD MOTOR CO.

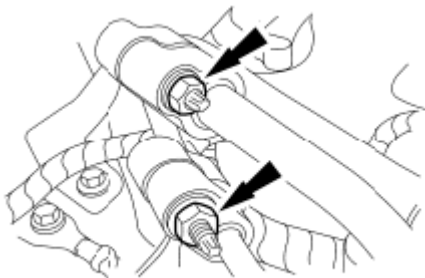
25. Remove the A/C tube bracket bolt.



N0051989

Fig. 139: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

26. Remove the 2 nuts and disconnect the A/C tubes.
 - Discard the O-ring seals.



N0041237

Fig. 140: Locating A/C Tubes & Nuts
Courtesy of FORD MOTOR CO.

27. Detach the 2 wiring harness retainers.

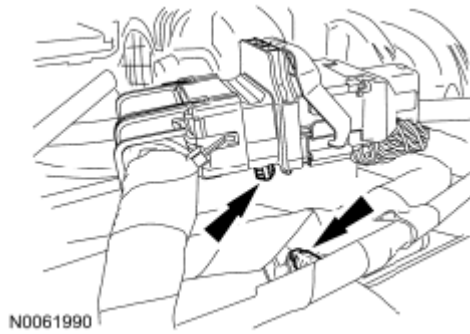


Fig. 141: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

28. Disconnect the 2 engine wiring harness electrical connectors.

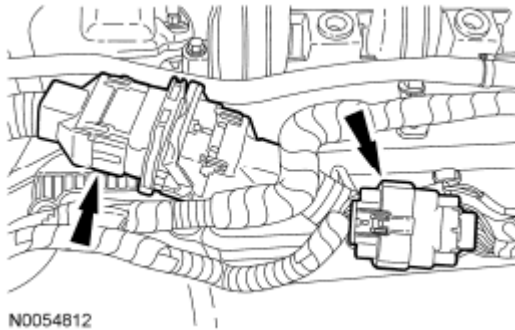


Fig. 142: Locating Engine Control Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

29. Remove the 2 wiring harness retainers from the LH valve cover stud bolts and position the wiring harness aside.

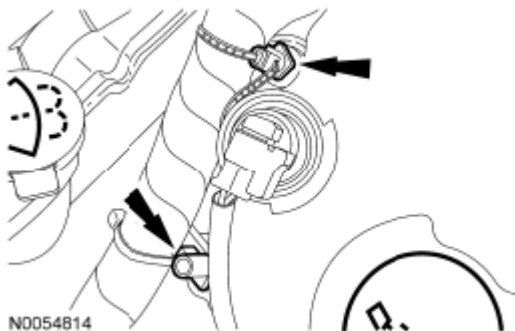


Fig. 143: Locating LH Valve Cover Stud Bolts & Wiring Harness
Courtesy of FORD MOTOR CO.

30. Remove the oil level indicator.

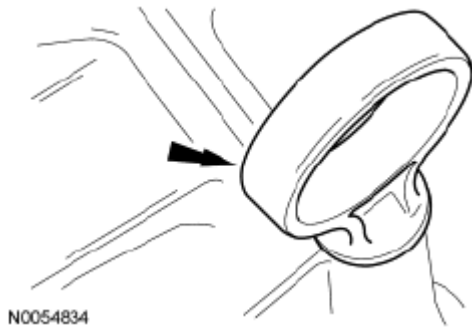


Fig. 144: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

31. Disconnect the hose from the power steering reservoir.
 - Detach the pin-type retainer from the engine mount brace.

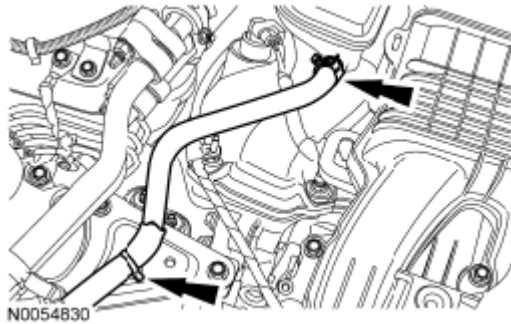


Fig. 145: Locating Hose
Courtesy of FORD MOTOR CO.

32. Using a small screwdriver, release the retaining clip and detach the power steering reservoir from the cowl.

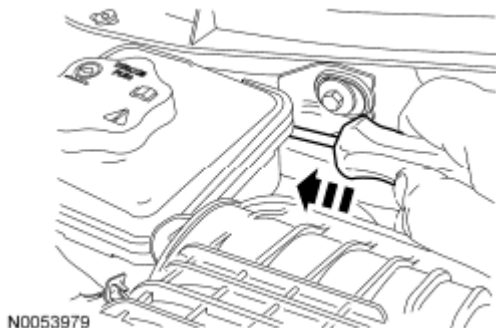


Fig. 146: Releasing Retaining Clip
Courtesy of FORD MOTOR CO.

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

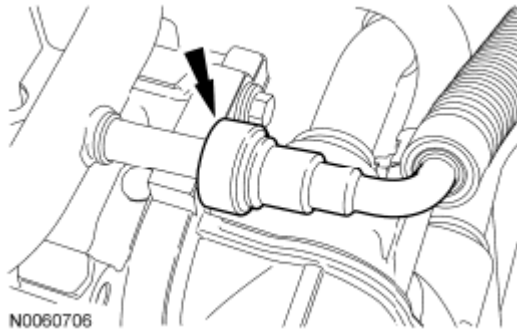


Fig. 147: Locating Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

34. Remove the bolt and the ground wire from the engine mount brace.

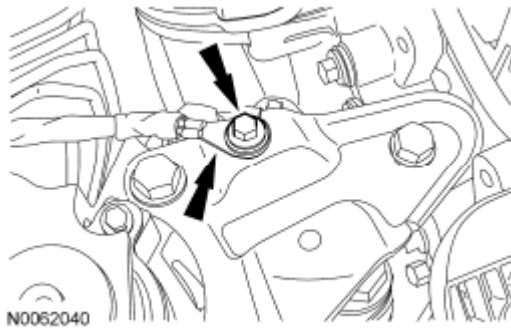


Fig. 148: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

35. Remove the 3 bolts and the engine mount brace.

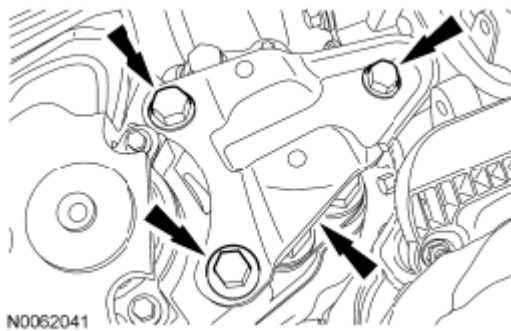


Fig. 149: Locating Engine Mount Brace & Bolt
Courtesy of FORD MOTOR CO.

36. Disconnect the PCM electrical connectors and pin-type retainers.

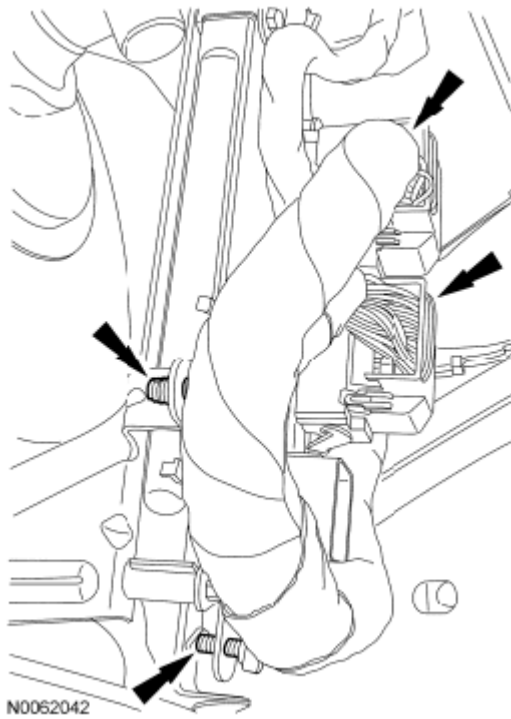


Fig. 150: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

37. Remove the Power Steering Pressure (PSP) hose bracket bolt.

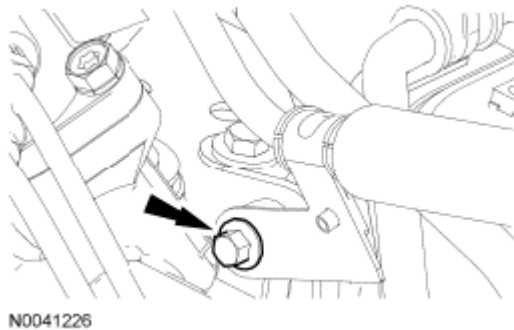


Fig. 151: Locating Power Steering Pressure Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

38. Remove and discard the **PSP** banjo bolt and the 2 seals from the steering gear.

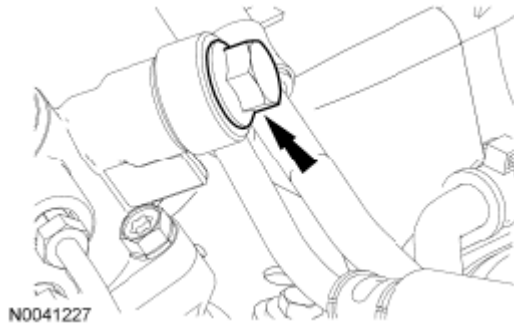


Fig. 152: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

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

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

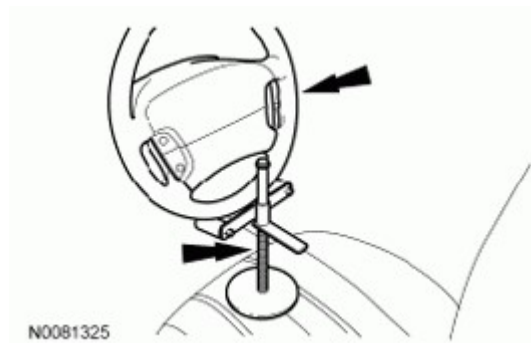


Fig. 153: Identifying Steering Wheel Holding Device
Courtesy of FORD MOTOR CO.

40. Remove the 2 nuts and the steering joint cover.

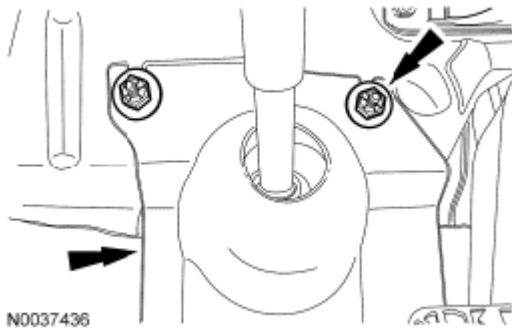


Fig. 154: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

41. Remove the bolt and disconnect the steering column shaft from the steering gear.
 - Discard the bolt.

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

NOTE: Index-mark the steering column shaft position to the steering gear for reference during installation.

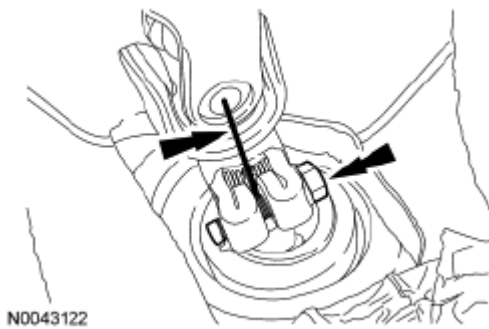


Fig. 155: Locating Steering Column Shaft & Bolt
Courtesy of FORD MOTOR CO.

42. Remove the 4 screws and position the LH fender splash shield aside.

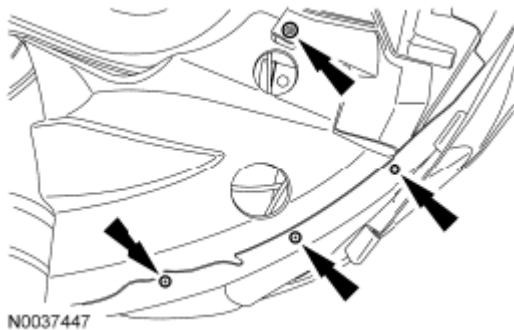


Fig. 156: Locating LH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

43. Remove the 6 pin-type retainers (4 shown in illustration) and the LH splash shield.

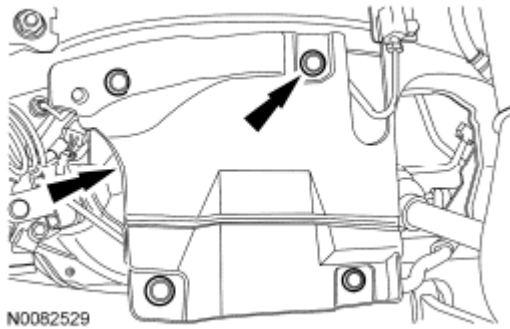


Fig. 157: Locating Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

44. Release the 4 clips and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

NOTE: The steering gear-to-dash seal must be removed or it will be damaged when lowering the subframe.

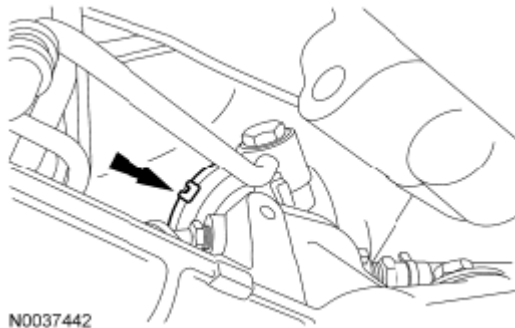


Fig. 158: Locating Steering Gear Clips
Courtesy of FORD MOTOR CO.

45. Disconnect the transaxle cooler hoses.

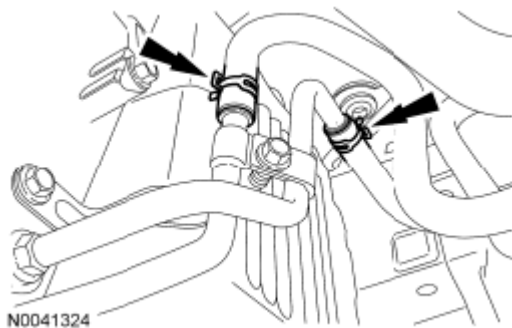


Fig. 159: Locating Transaxle Cooler Hoses
Courtesy of FORD MOTOR CO.

46. Remove the drain plug and drain the engine oil.
 - Install the drain plug and tighten to 27 Nm (20 lb-ft).

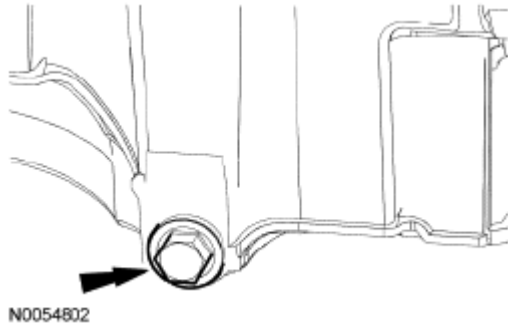


Fig. 160: Locating Drain Plug
Courtesy of FORD MOTOR CO.

47. Remove and discard the engine oil filter.
48. Remove the 6 nuts and the Y-pipe assembly.
 - Discard the gaskets and nuts.

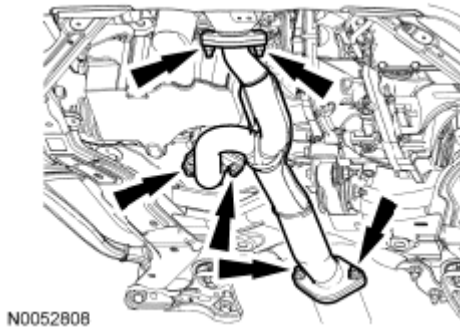


Fig. 161: Locating Y-Pipe Assembly & Nuts
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

49. Remove and discard the 4 bolts (3 shown in illustration) and support the driveshaft with a length of mechanic's wire.

NOTE: Index-mark the driveshaft for installation.

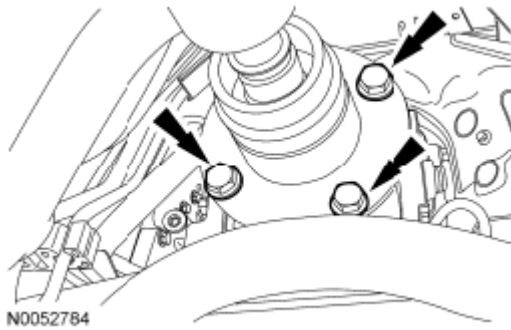


Fig. 162: Locating PTU Flange & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

50. Remove the engine roll restrictor-to-subframe through bolt.

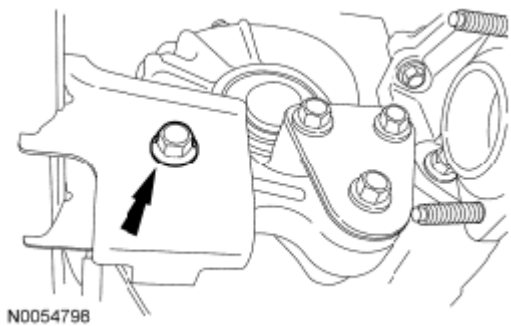


Fig. 163: Locating Engine Roll Restrictor-To-Subframe Through Bolt
Courtesy of FORD MOTOR CO.

51. Remove the cotter pins and nuts from the tie-rod ends.

NOTE: LH shown in illustration, RH similar.

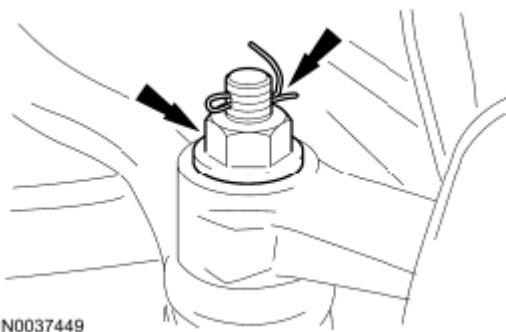


Fig. 164: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

52. Using the Tie-Rod End Remover, separate the tie-rod ends from the steering knuckles.

NOTE: LH shown in illustration, RH similar.

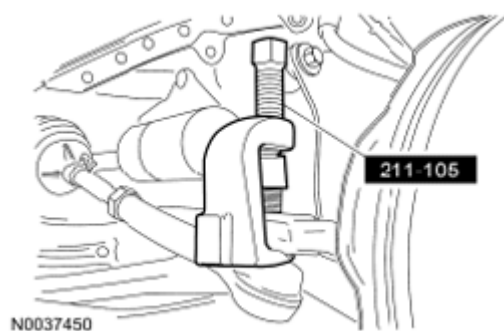


Fig. 165: Separating Tie-Rod Ends
Courtesy of FORD MOTOR CO.

53. Remove the nuts and separate the stabilizer bar links from the struts.

NOTE: LH shown in illustration3, RH similar.

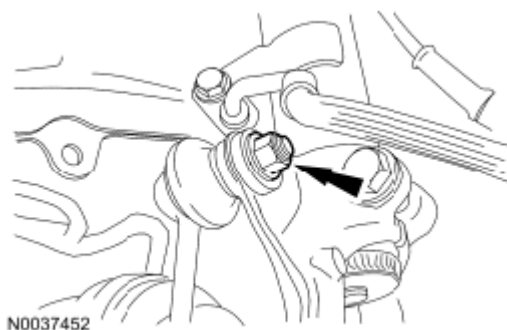


Fig. 166: Locating Stabilizer Bar Links & Nuts
Courtesy of FORD MOTOR CO.

54. Position the Powertrain Lift under the subframe assembly.

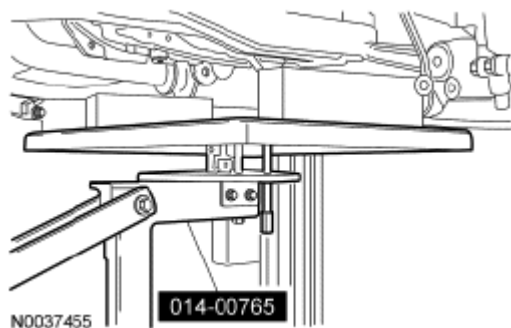


Fig. 167: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

55. Remove the 4 subframe bracket-to-body bolts.

NOTE: LH shown in illustration, RH similar.

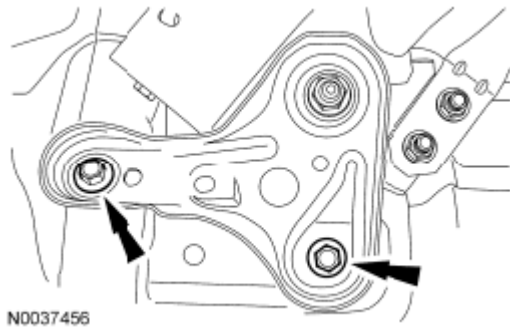


Fig. 168: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

56. Remove the 2 subframe nuts and the 2 subframe brackets.

NOTE: LH shown in illustration, RH similar.

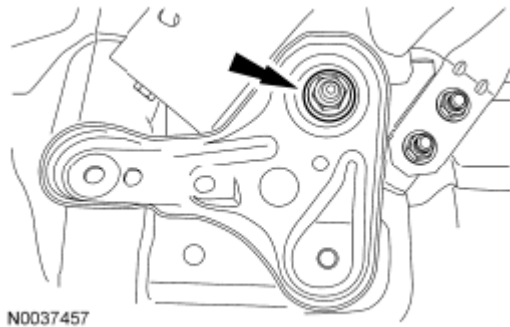


Fig. 169: Locating Rear Subframe Nuts & Subframe Brackets
Courtesy of FORD MOTOR CO.

57. Remove the 2 front subframe nuts.

NOTE: LH shown in illustration, RH similar.

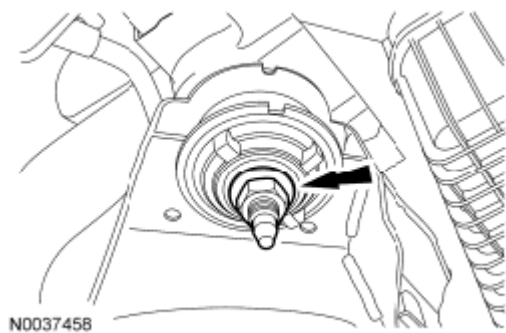


Fig. 170: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

58. Using the Powertrain Lift, lower the subframe assembly from the vehicle.

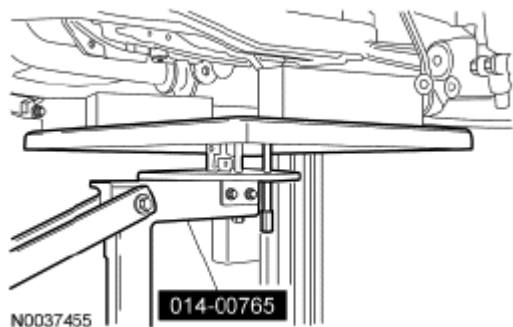


Fig. 171: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

59. Remove the 2 RH catalytic converter bracket bolts.

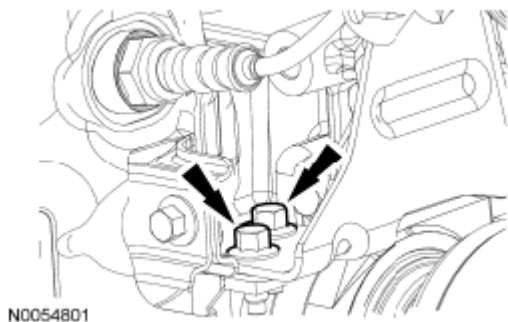


Fig. 172: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

60. Remove the 2 nuts and remove the RH catalytic converter bracket.

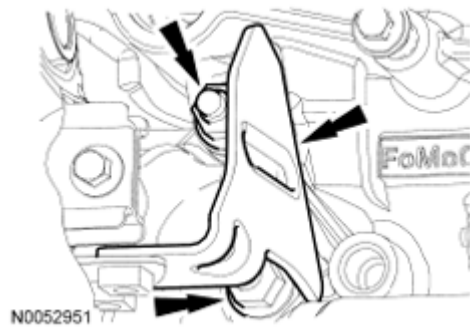


Fig. 173: Locating RH Catalytic Converter Bracket & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

61. Install the Powertrain Lift and Universal Adapter Brackets.

NOTE: Position a block of wood under the transaxle.

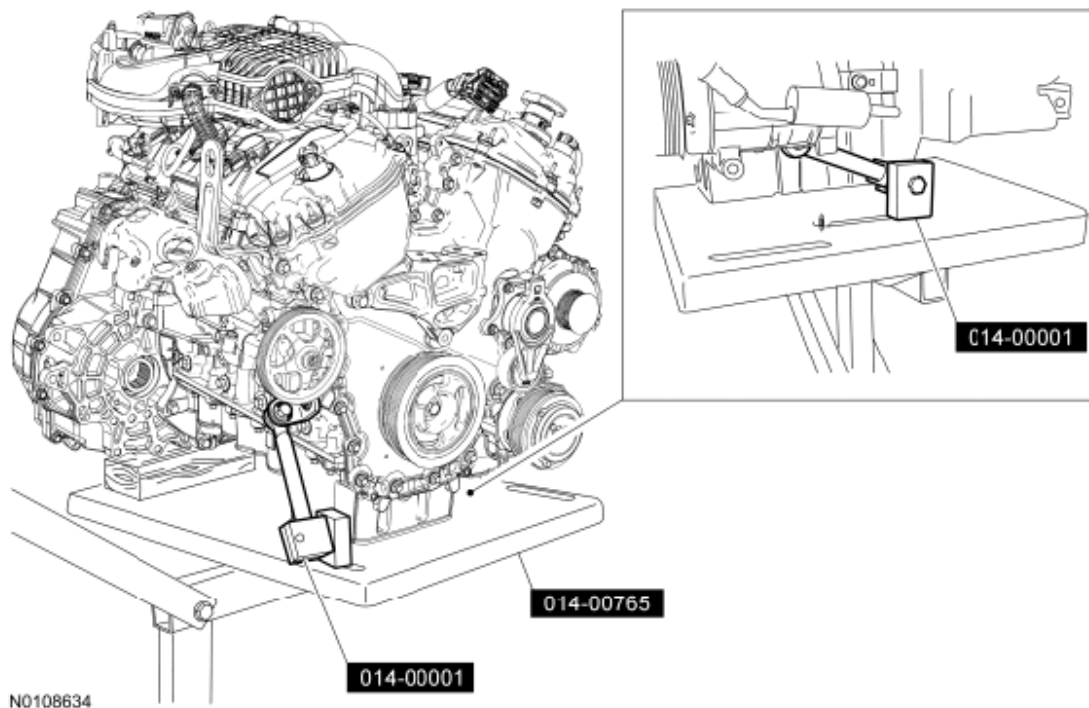


Fig. 174: Identifying Powertrain Lift & Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

62. Remove the transaxle support insulator through bolt.



Fig. 175: Locating Transaxle Support Insulator Through Bolt & Nut
Courtesy of FORD MOTOR CO.

63. Remove the transaxle support insulator bracket bolt and the 2 nuts.

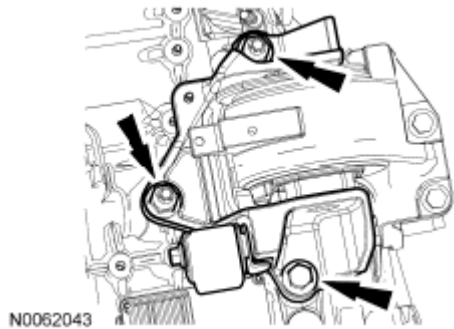


Fig. 176: Locating Transaxle Support Insulator Bracket Bolt & Nuts
Courtesy of FORD MOTOR CO.

64. Remove the 4 engine mount nuts.
- Remove the 2 engine mount spacers.

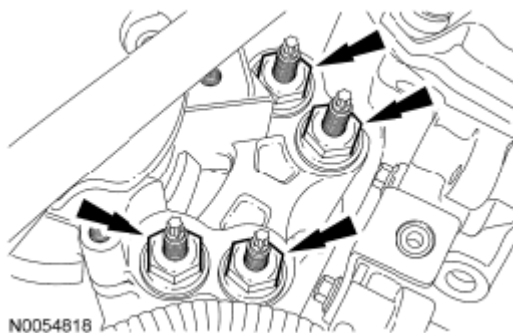


Fig. 177: Locating Engine Mount Nuts
Courtesy of FORD MOTOR CO.

65. Remove the nut, 2 bolts and the engine mount.

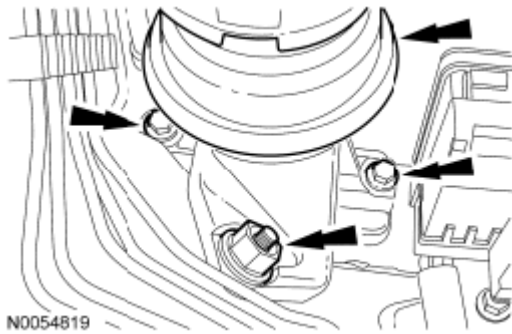


Fig. 178: Locating Engine Mount Bolts & Nut
Courtesy of FORD MOTOR CO.

66. Lower the engine and transaxle assembly from the vehicle.
67. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.

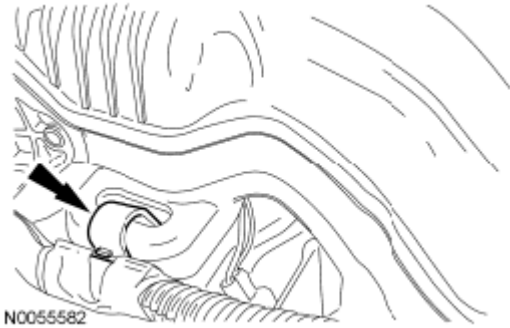


Fig. 179: Locating Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

68. If equipped, detach the block heater wiring harness retainers from the **PSP** hose and the power steering reservoir hose.

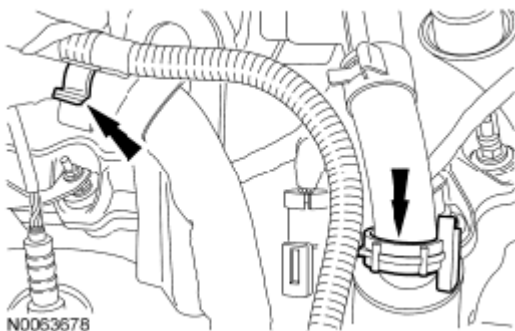


Fig. 180: Locating Block Heater Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

69. Disconnect the PCV hose from the PCV valve.

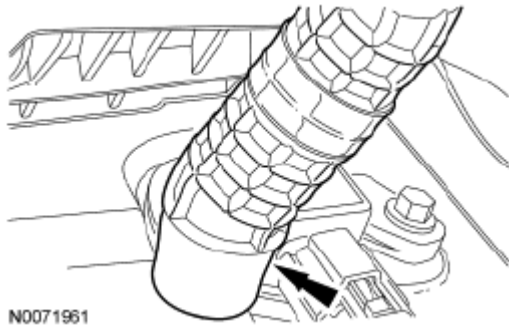


Fig. 181: Locating PCV Hose
Courtesy of FORD MOTOR CO.

70. Disconnect the Throttle Body (TB) electrical connector.

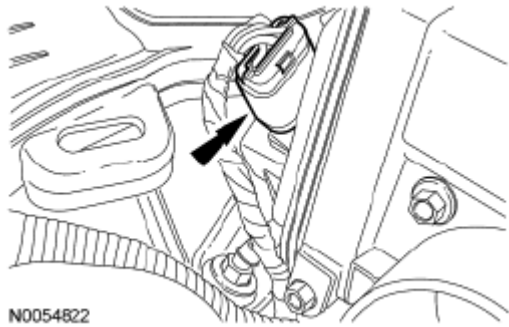


Fig. 182: Locating Instrument Panel Bolts LH
Courtesy of FORD MOTOR CO.

71. Detach the wiring harness retainers from the upper intake manifold.

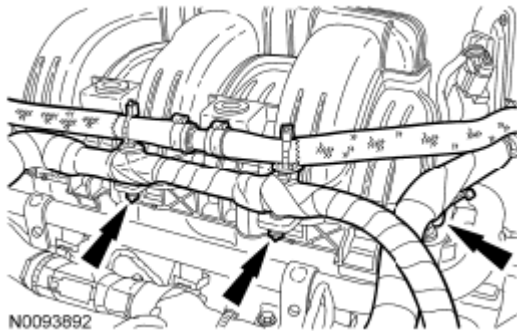


Fig. 183: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

72. Remove the upper intake manifold support bracket bolt.

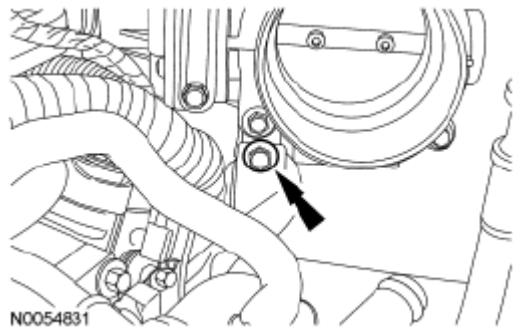


Fig. 184: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

73. Remove the 6 bolts and the upper intake manifold.
- Discard the gaskets.

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

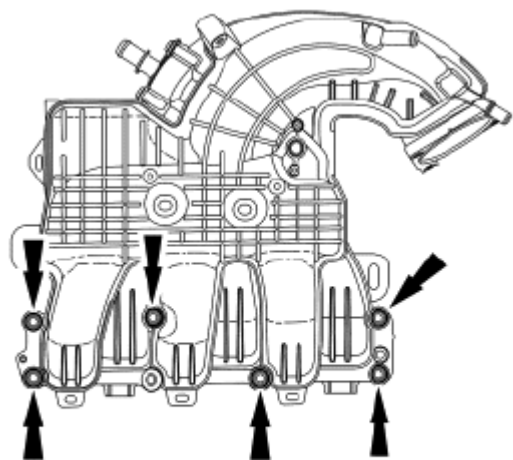


Fig. 185: Locating Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

74. Disconnect the RH Catalyst Monitor Sensor (CMS) electrical connector.

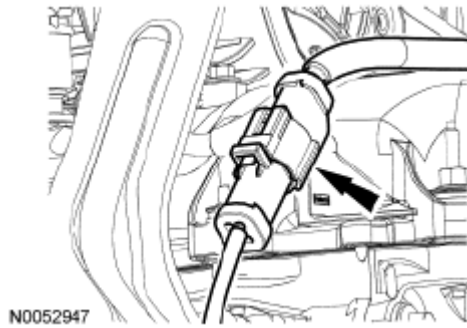


Fig. 186: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

75. Disconnect the **PSP** switch electrical connector.

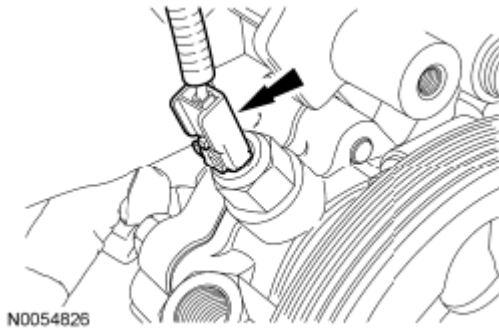


Fig. 187: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

76. Disconnect the RH **VCT** solenoid electrical connector.

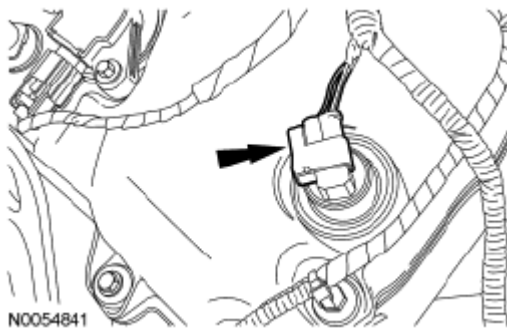


Fig. 188: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

77. Disconnect the 3 RH coil-on-plug electrical connectors.

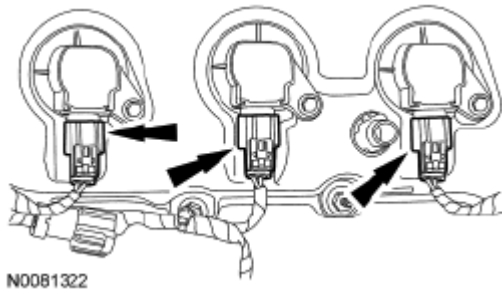


Fig. 189: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

78. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
79. Disconnect the LH VCT solenoid electrical connector.

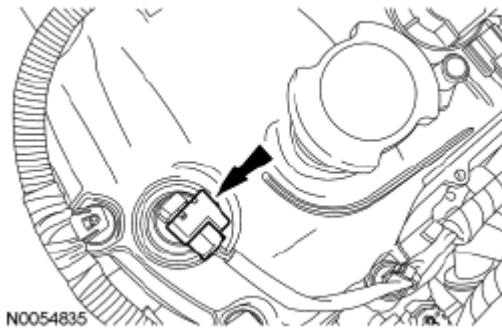


Fig. 190: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

80. Disconnect the 3 LH coil-on-plug electrical connectors.

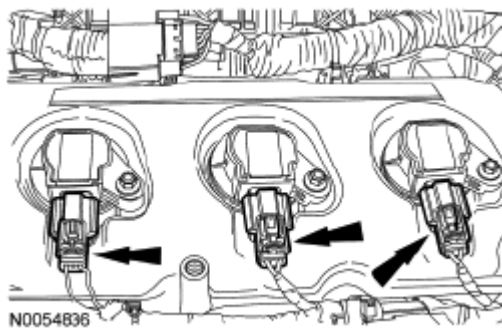


Fig. 191: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

81. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.
82. Remove the 6 bolts and the 6 coil-on-plugs.

NOTE: LH shown in illustration, RH similar.

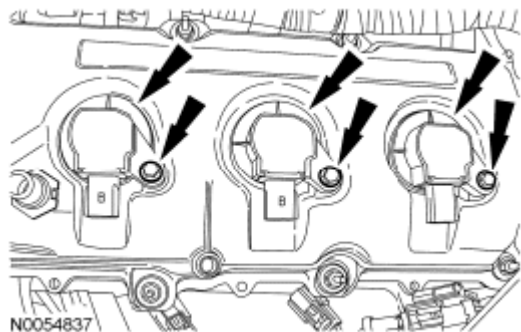


Fig. 192: Locating Coil-On-Plugs & Bolts
Courtesy of FORD MOTOR CO.

83. Detach the **PSP** hose retainer from the engine lifting eye.

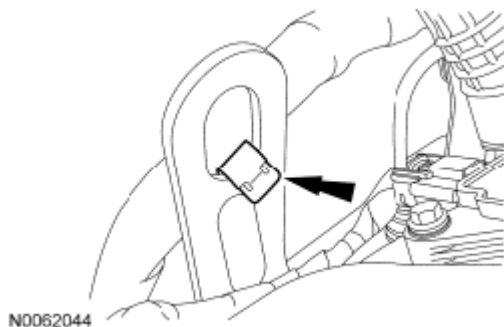


Fig. 193: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

84. Remove the **PSP** hose bracket nut and position the **PSP** hose aside.

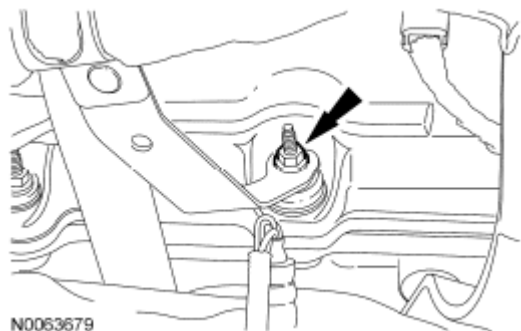


Fig. 194: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

85. Remove the 2 nuts and the wiring harness retaining bracket.

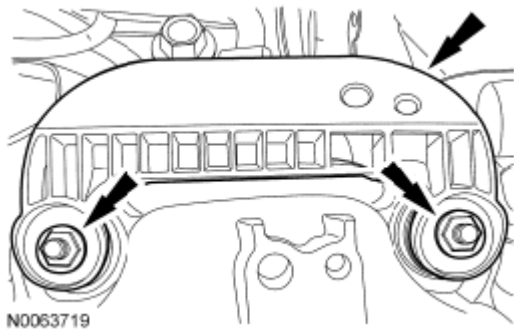


Fig. 195: Locating Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

Early build vehicles

86. Loosen the 11 stud bolts and remove the LH valve cover.
 - Discard the gasket.

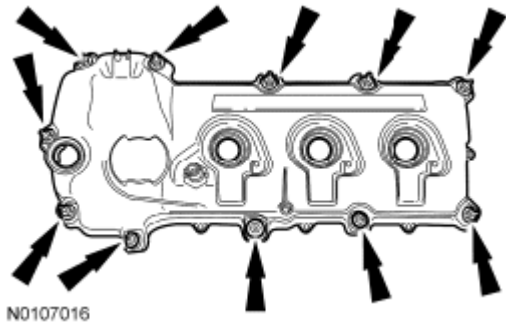


Fig. 196: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

87. Loosen the bolt, the 10 stud bolts and remove the RH valve cover.
 - Discard the gasket.

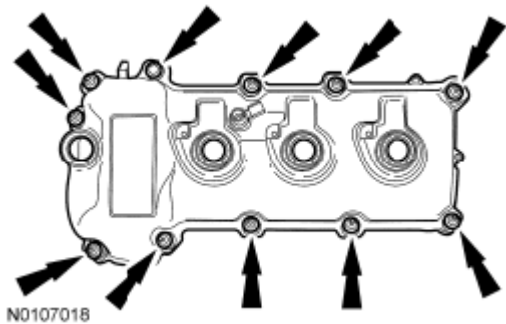


Fig. 197: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

Late build vehicles

88. Loosen the 9 stud bolts and remove the LH valve cover.
- Discard the gasket.

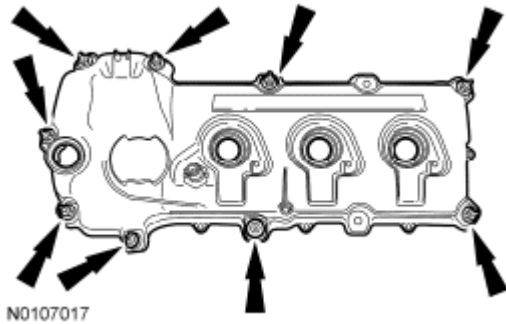


Fig. 198: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

89. Loosen the 9 stud bolts and remove the RH valve cover.
- Discard the gasket.

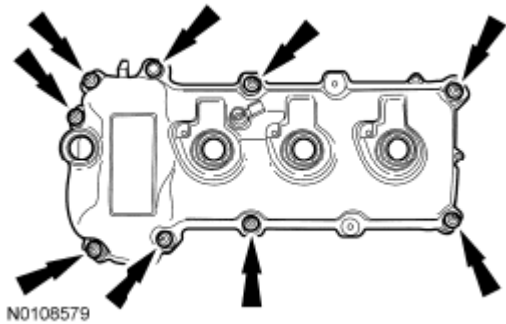


Fig. 199: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

All vehicles

90. Inspect the VCT solenoid seals and the spark plug tube seals. Install new seals if damaged.
- Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

NOTE: VCT solenoid seal removal shown in illustration, spark plug tube seal removal similar.

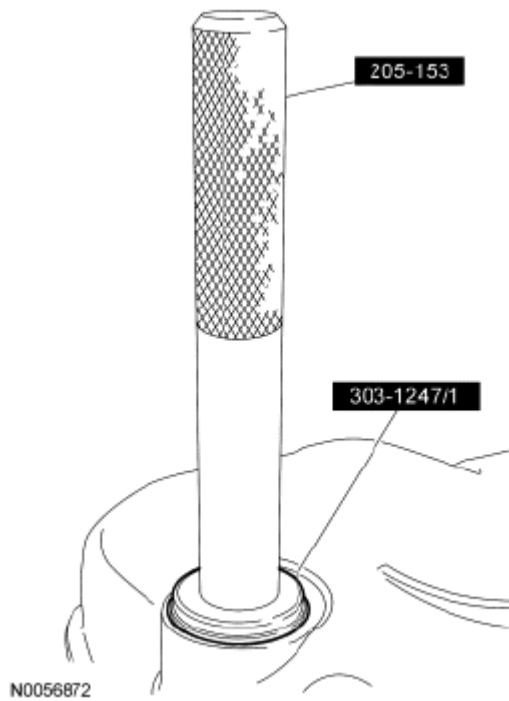


Fig. 200: Identifying VCT Spark Plug Tube Seal Remover And Handle
Courtesy of FORD MOTOR CO.

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

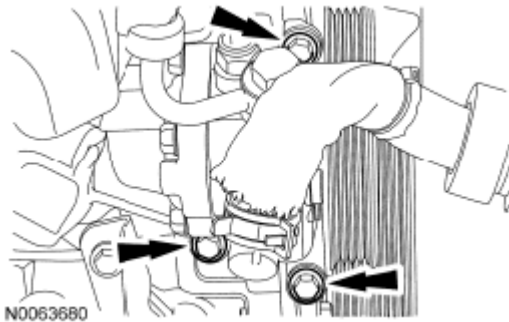


Fig. 201: Locating Power Steering Pump & Bolts
Courtesy of FORD MOTOR CO.

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

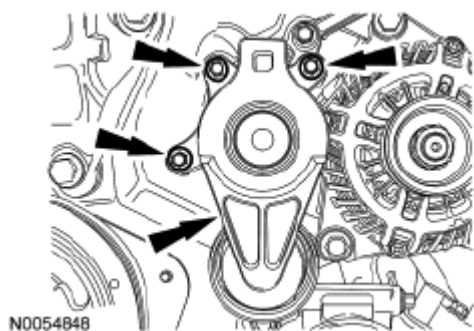


Fig. 202: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

93. Using the Strap Wrench, remove the crankshaft pulley bolt and washer.
- Discard the bolt.

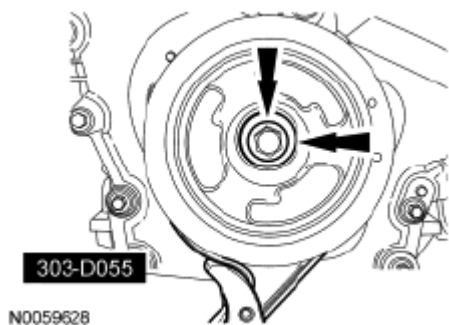


Fig. 203: Locating Crankshaft Pulley Bolt & Washer
Courtesy of FORD MOTOR CO.

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

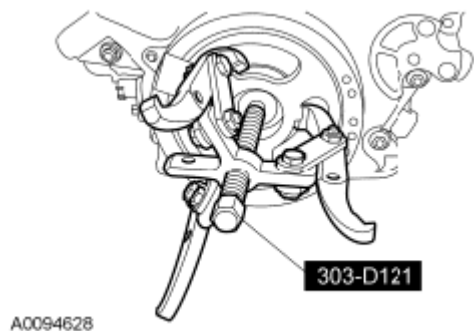


Fig. 204: Removing Crankshaft Pulley
Courtesy of FORD MOTOR CO.

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

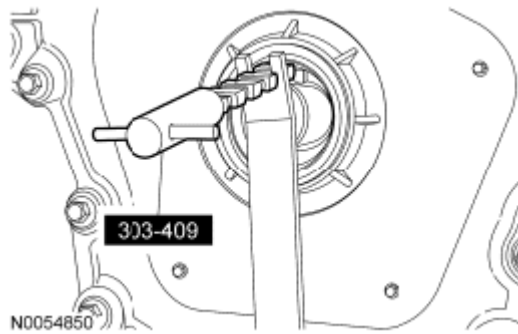


Fig. 205: Locating Crankshaft Front Seal Using Oil Seal Remover
Courtesy of FORD MOTOR CO.

96. Remove the 2 bolts and the engine mount bracket.

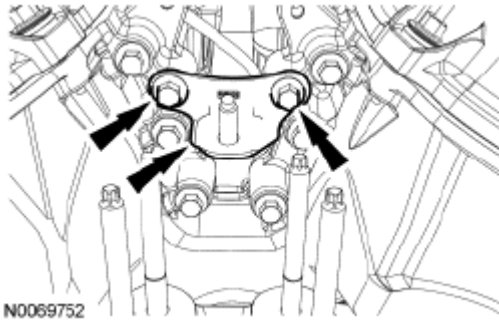


Fig. 206: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

97. Remove the 2 engine mount studs.

NOTE: Only use hand tools to remove the studs.

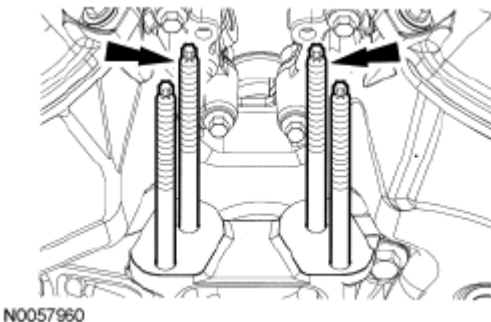


Fig. 207: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

98. Remove the 3 bolts and the engine mount bracket.

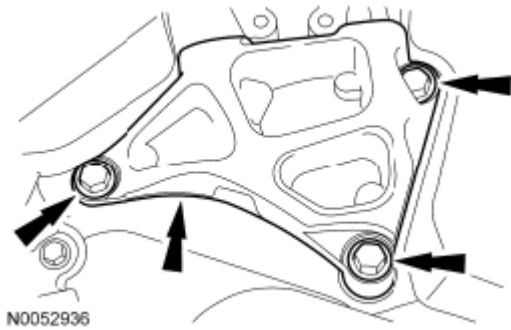


Fig. 208: Locating Engine Mount Bracket & Bolts
 Courtesy of FORD MOTOR CO.

99. Remove the 22 engine front cover bolts.

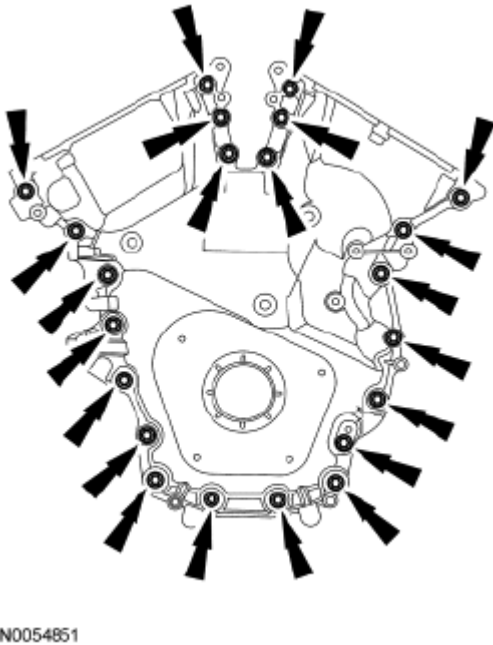
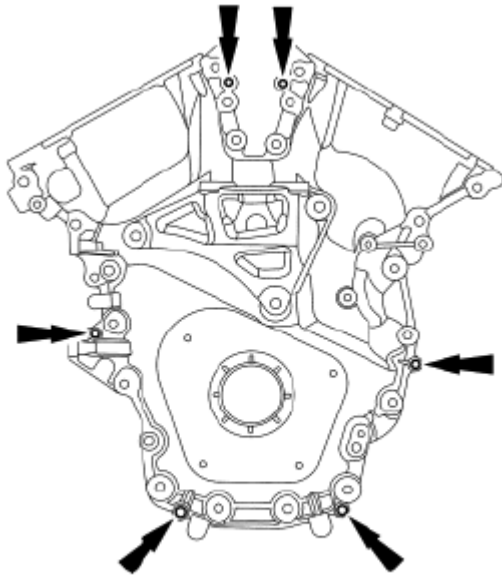


Fig. 209: Locating Engine Front Cover Bolts
 Courtesy of FORD MOTOR CO.

100. Install 6 of the engine front cover bolts (finger-tight) into the 6 threaded holes in the engine front cover in the following sequence.
1. Tighten the bolts one turn at a time in a crisscross pattern until the engine front cover-to-cylinder block seal is released.
 2. Remove the engine front cover.



N0082530

Fig. 210: Identifying Engine Front Cover Bolt
Courtesy of FORD MOTOR CO.

101. Clean the engine front cover using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
- Thoroughly wash the engine front cover to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover. These tools cause scratches and gouges that make leak paths.

102. Clean all engine sealing surfaces, including the cylinder heads, the oil pan and cylinder block in the following sequence.
1. Remove any large deposits of silicone or gasket material.
 2. Apply silicone gasket remover and allow to set for several minutes.
 3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
 4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
 5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

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

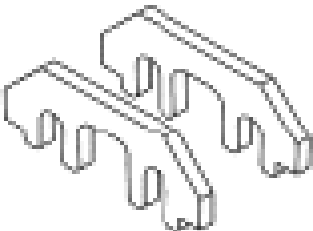
foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

NOTE: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

TIMING DRIVE COMPONENTS

Special Tool(s)

SPECIAL TOOL TABLE

 ST2979-A	Tool, Camshaft Holding 303-1248
--	---------------------------------

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

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

All vehicles

1. Remove the engine front cover. For additional information, refer to [Removal and Installation](#).

Engines equipped with early build RH timing chain guides

2. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown in illustration.

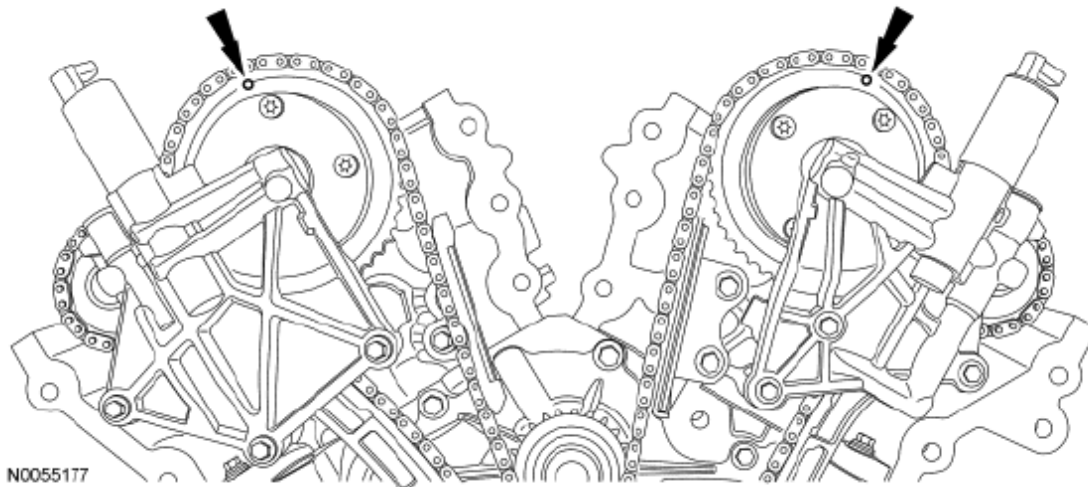


Fig. 211: Locating Timing Marks On Variable Camshaft Timing (VCT)
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

3. Rotate the crankshaft clockwise and align the timing marks on the Variable Camshaft Timing (VCT) assemblies as shown in illustration.

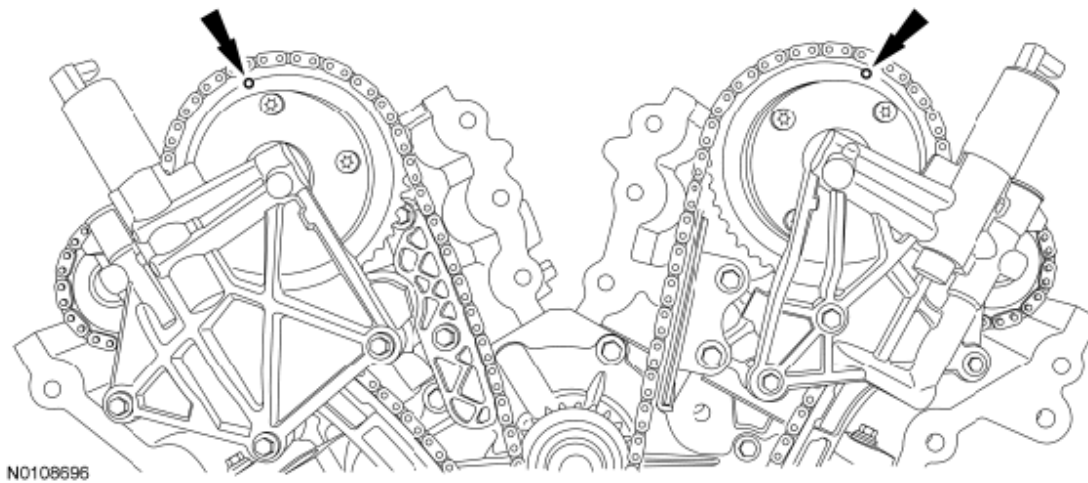


Fig. 212: Locating Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

All vehicles

4. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

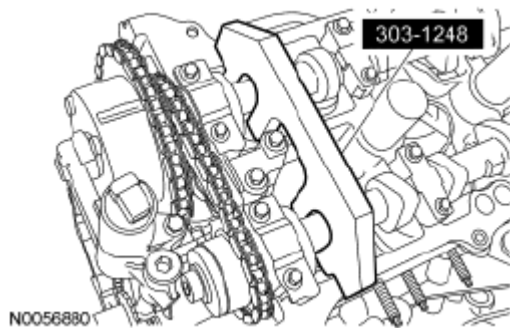


Fig. 213: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

5. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

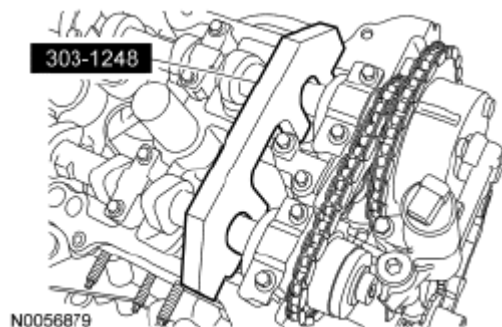


Fig. 214: Installing Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the RH VCT housing.

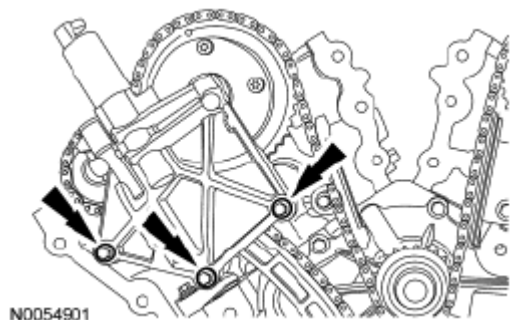


Fig. 215: Locating RH VCT Housing Bolts
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the LH VCT housing.

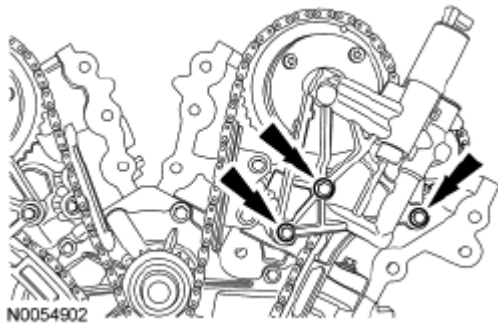


Fig. 216: Locating LH VCT Housing Bolts
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

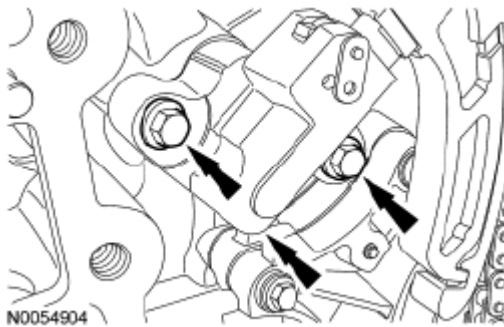


Fig. 217: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

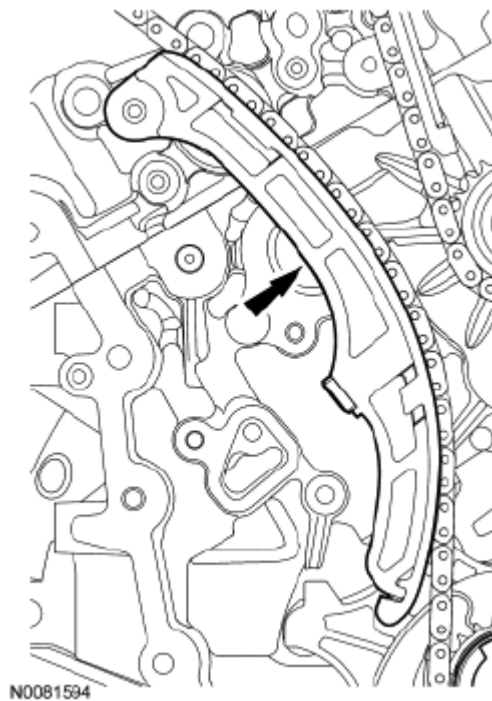


Fig. 218: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

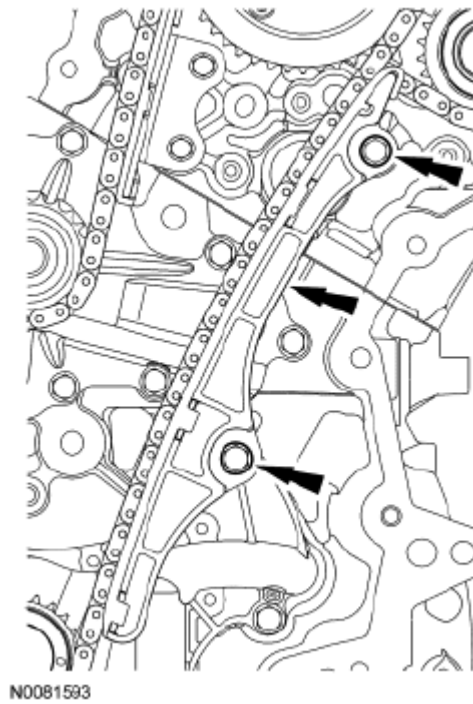
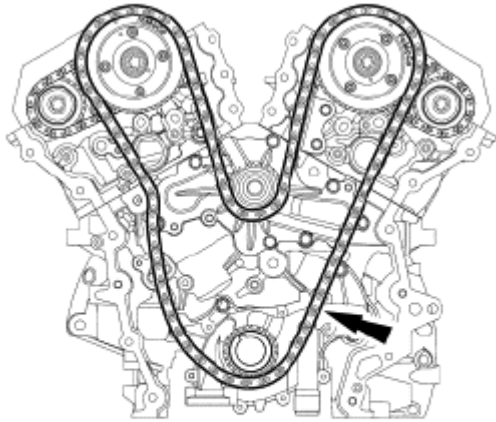


Fig. 219: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

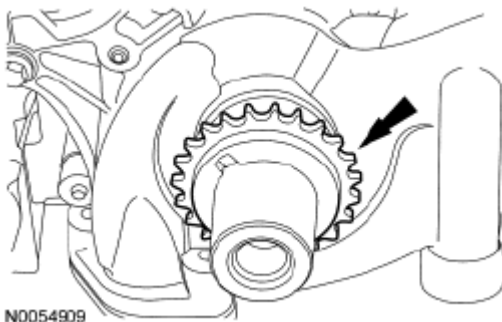
11. Remove the primary timing chain.



N0054908

Fig. 220: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.



N0054909

Fig. 221: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

13. Remove the 2 bolts and the upper LH primary timing chain guide.

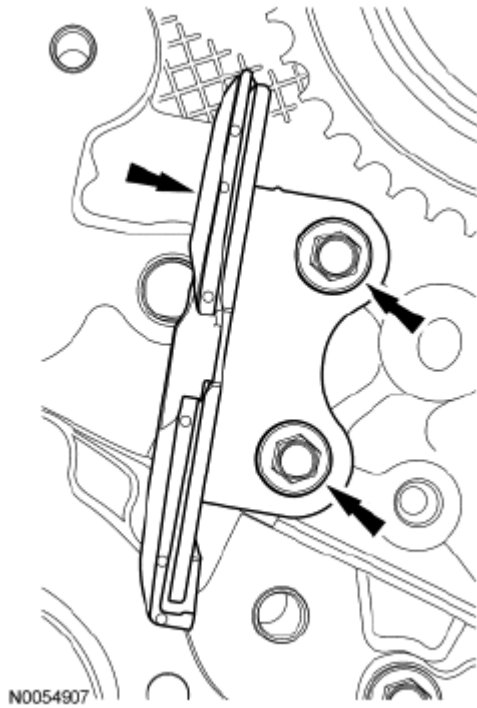


Fig. 222: Locating Upper LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

14. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

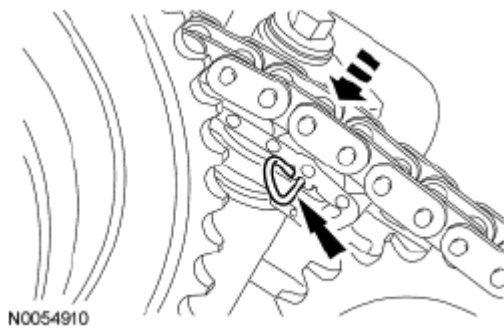


Fig. 223: Compressing LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

15. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
 - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

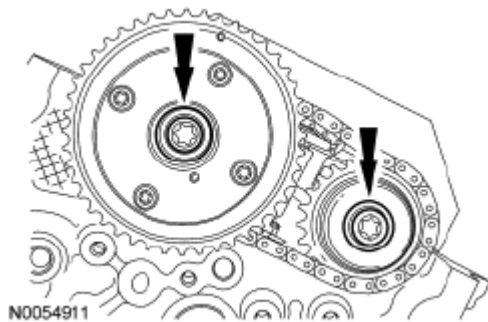


Fig. 224: Locating VCT Bolt & Exhaust Camshaft Bolt
 Courtesy of FORD MOTOR CO.

16. Remove the 2 bolts and the LH secondary timing chain tensioner.

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

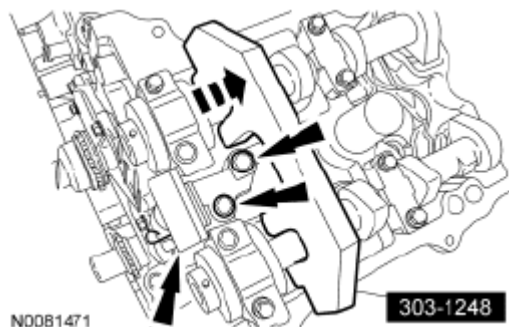


Fig. 225: Identifying Camshaft Holding Tool
 Courtesy of FORD MOTOR CO.

17. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

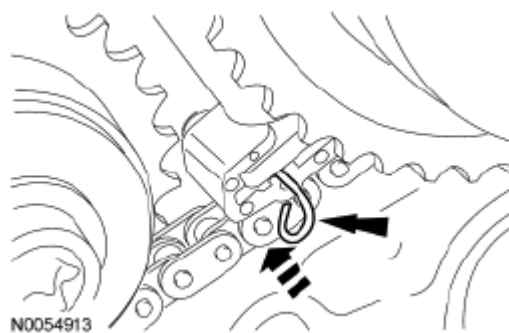


Fig. 226: Compressing RH Secondary Timing Chain Tensioner
 Courtesy of FORD MOTOR CO.

18. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
 - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

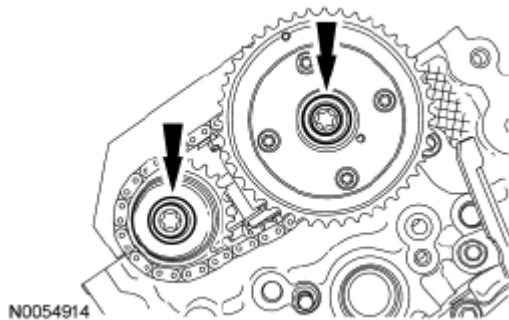


Fig. 227: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

19. Remove the 2 bolts and the RH secondary timing chain tensioner.

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

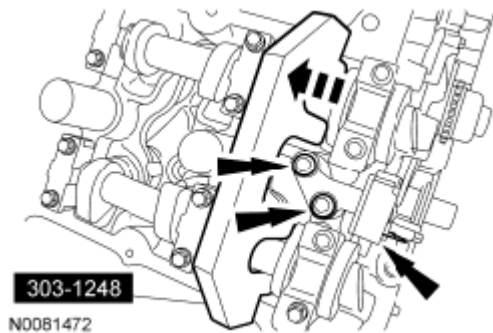


Fig. 228: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

20. Remove the 2 bolts and the RH primary timing chain guide.

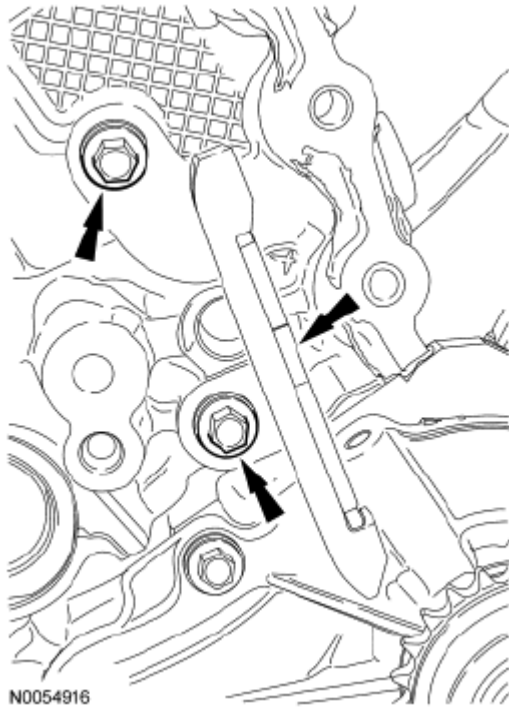


Fig. 229: Locating RH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

21. Remove the 2 bolts and the RH primary timing chain guide.

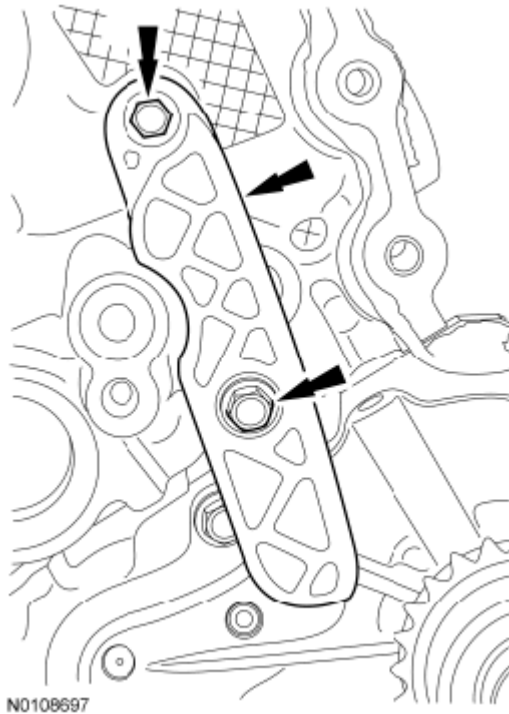
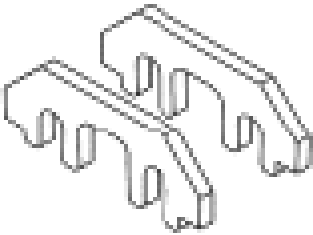


Fig. 230: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

CAMSHAFT

Special Tool(s)

SPECIAL TOOL TABLE

 ST2979-A	Tool, Camshaft Holding 303-1248
---	---------------------------------

Removal and Installation

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

All camshafts

1. Remove the engine front cover. For additional information, refer to **Removal and Installation**.

Engines equipped with early build RH timing chain guides

2. Rotate the crankshaft clockwise and align the timing marks on the Variable Camshaft Timing (VCT) assemblies as shown in illustration.

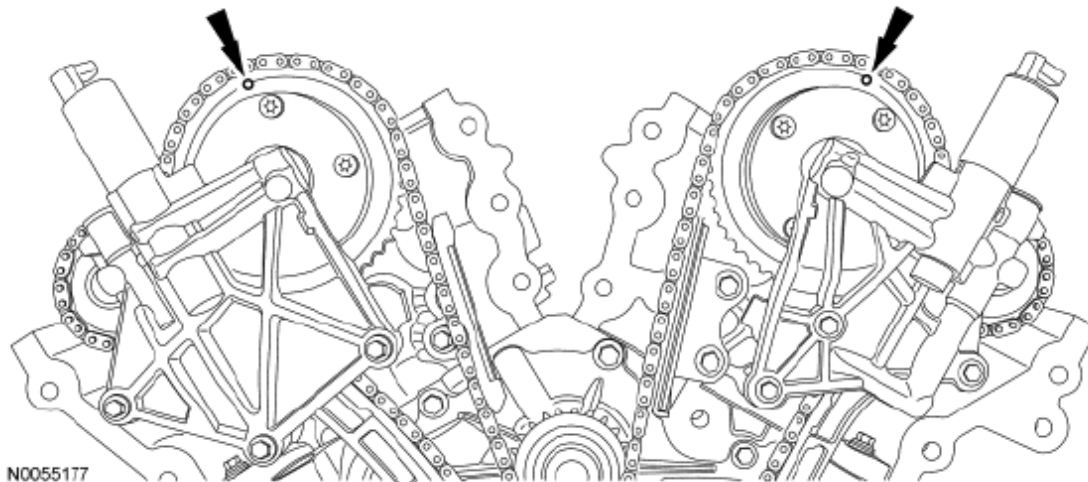


Fig. 231: Locating Timing Marks On Variable Camshaft Timing (VCT)
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

3. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown in illustration.

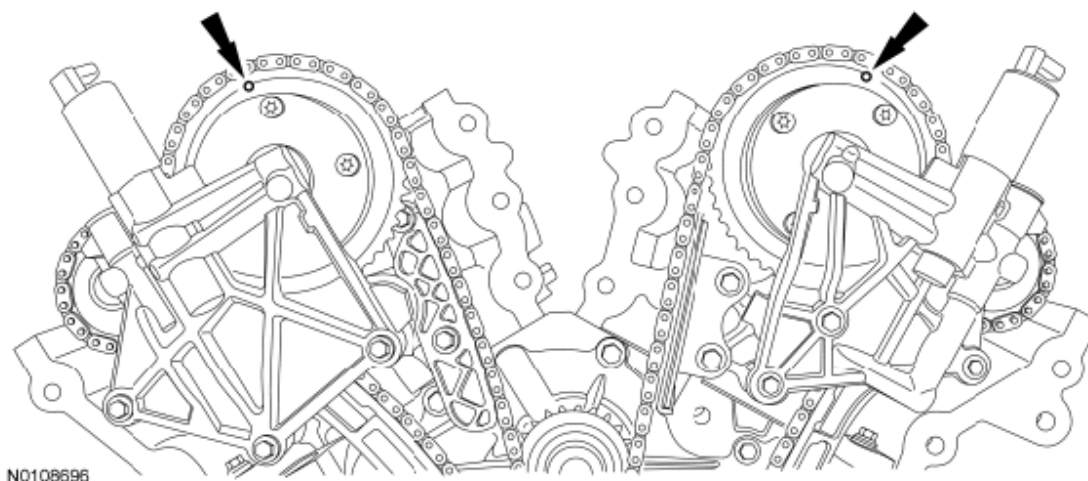


Fig. 232: Locating Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

All vehicles

4. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

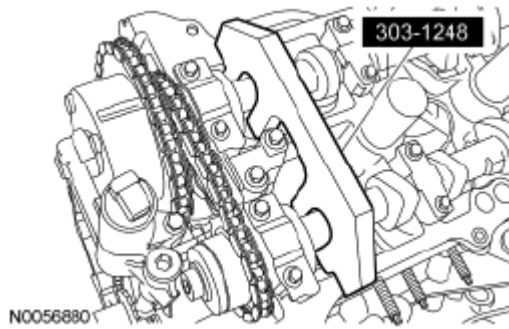


Fig. 233: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

5. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

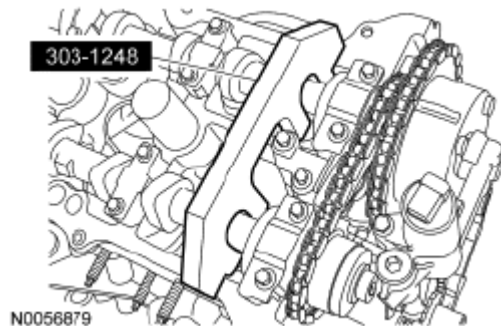


Fig. 234: Installing Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the RH VCT housing.

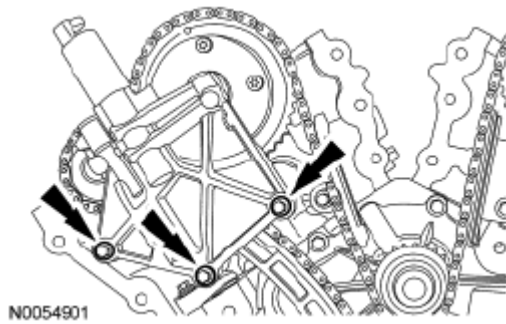


Fig. 235: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the LH VCT housing.

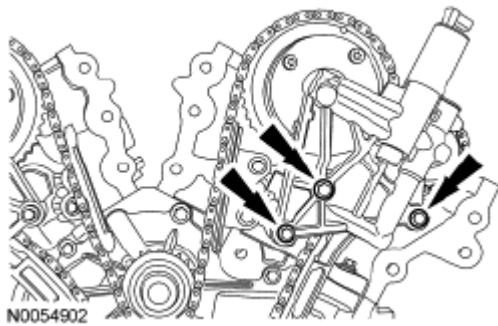


Fig. 236: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

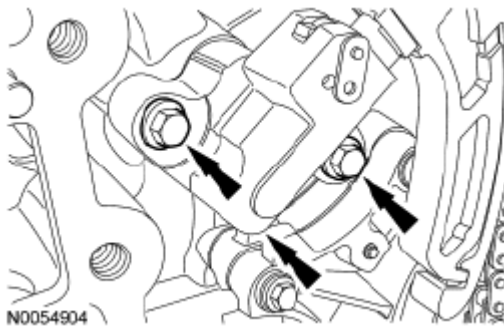


Fig. 237: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

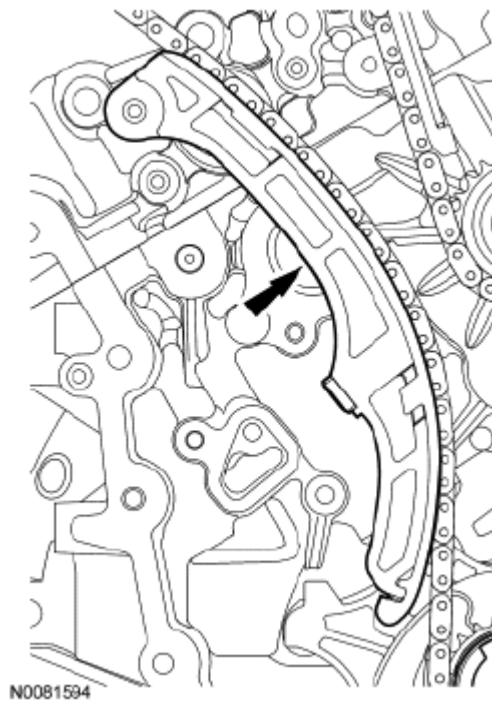


Fig. 238: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

10. Remove the 2 bolts and the lower LH primary timing chain guide.

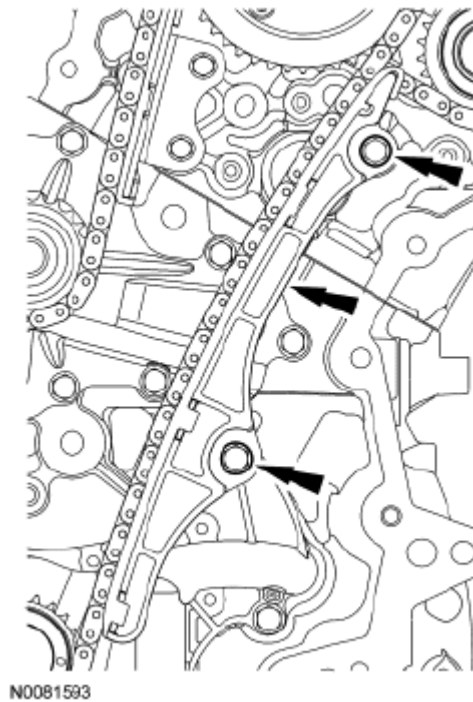
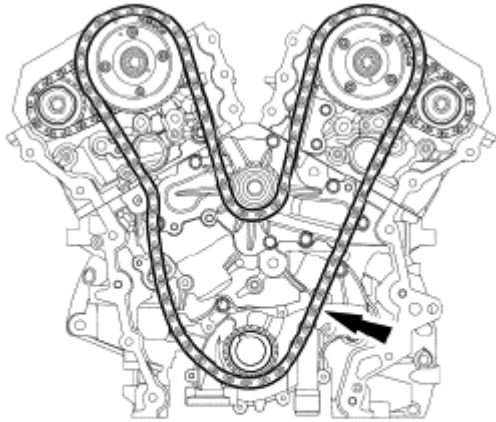


Fig. 239: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.

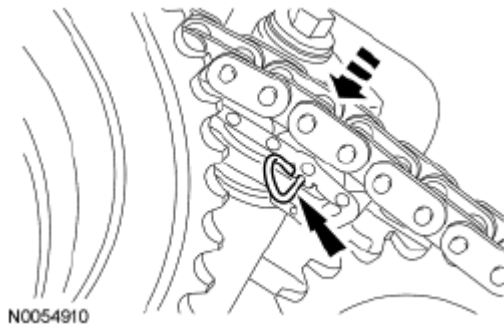


N0054908

Fig. 240: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

LH camshafts

12. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.



N0054910

Fig. 241: Compressing LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

13. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
 - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

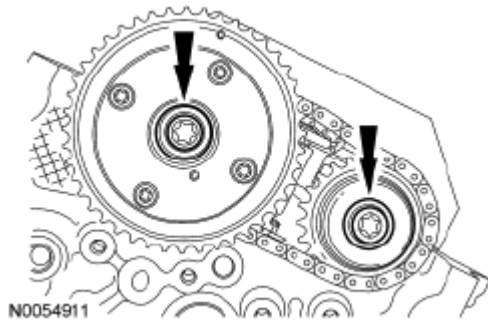


Fig. 242: Locating VCT Bolt & Exhaust Camshaft Bolt
Courtesy of FORD MOTOR CO.

14. Remove the Camshaft Holding Tool from the LH camshafts.

NOTE: When the Camshaft Holding Tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.

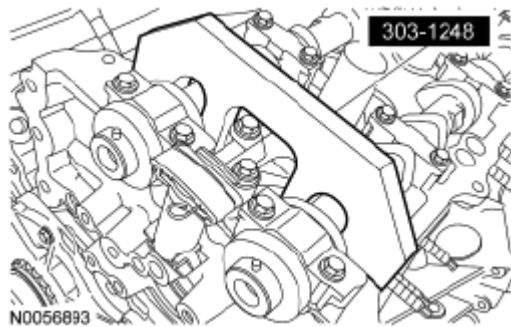


Fig. 243: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

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

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

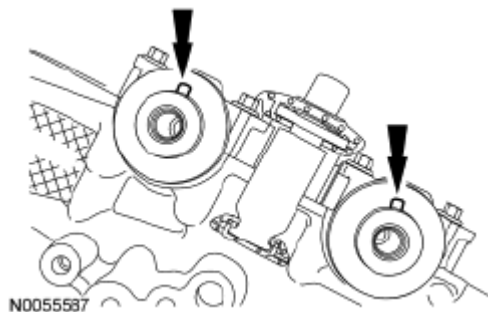


Fig. 244: Positioning Camshafts Onto LH Cylinder Head In Neutral Position

Courtesy of FORD MOTOR CO.

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

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

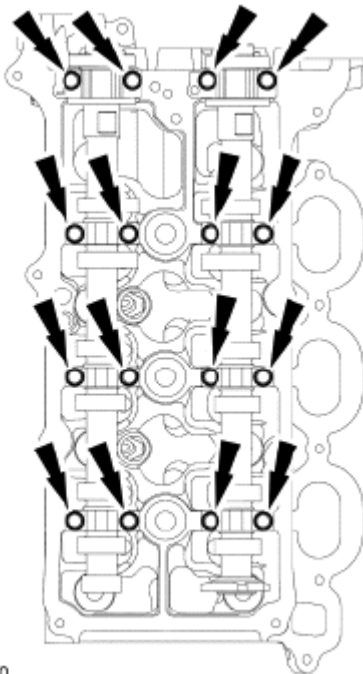


Fig. 245: Locating LH Camshaft Bearing Caps Bolts
Courtesy of FORD MOTOR CO.

RH camshafts

17. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

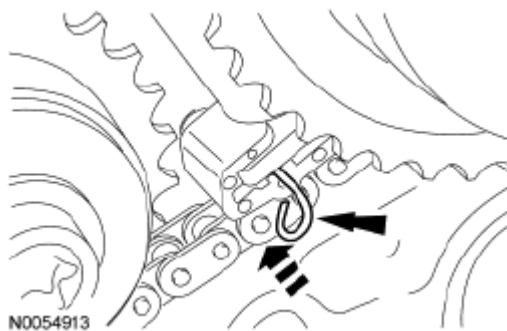


Fig. 246: Compressing RH Secondary Timing Chain Tensioner

Courtesy of FORD MOTOR CO.

18. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
- Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

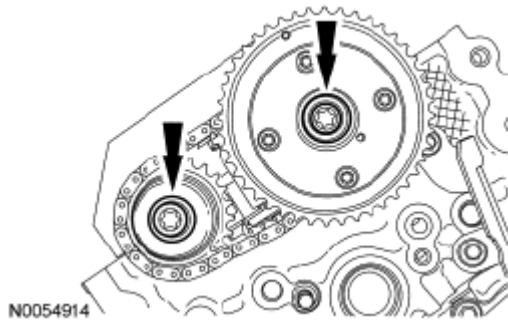


Fig. 247: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

19. Remove the Camshaft Holding Tool from the RH camshafts.

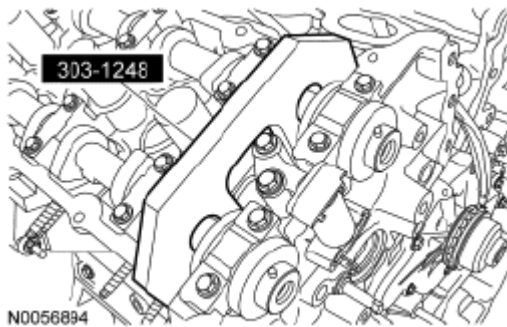


Fig. 248: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

20. Rotate the RH camshafts counterclockwise to the neutral position.

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

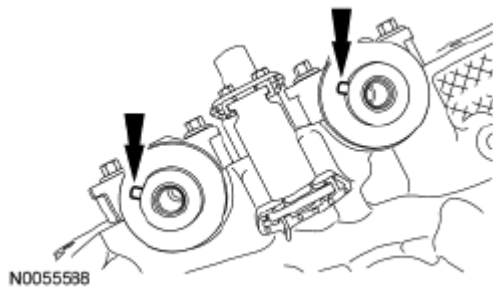


Fig. 249: Positioning Of Camshafts In Neutral Position
 Courtesy of FORD MOTOR CO.

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

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

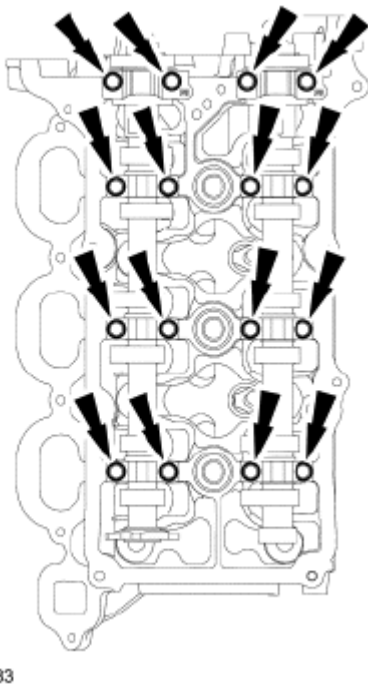


Fig. 250: Locating RH Camshaft Bearing Caps And Bolts
 Courtesy of FORD MOTOR CO.

VALVE TAPPETS

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. Depending on the valve tappets being serviced, remove the LH and/or the RH camshafts. For additional information, refer to **Removal and Installation**.
2. Remove the valve tappets from the cylinder head.

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

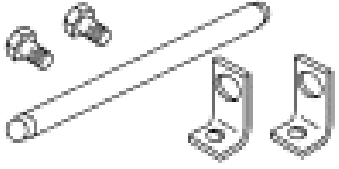
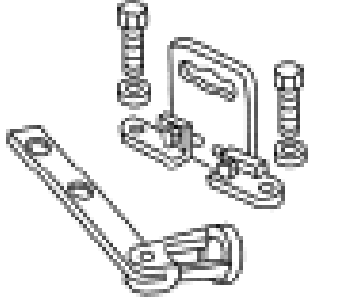


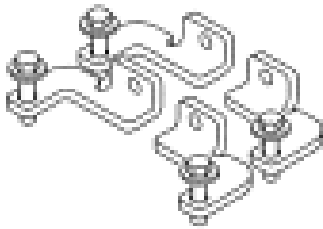
Fig. 251: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

VALVE SPRING, RETAINER AND SEAL

Special Tool(s)

SPECIAL TOOL TABLE

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



ST3028-A

Compressor, Valve Spring 303-1249

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 valve tappets from the cylinder being serviced. For additional information, refer to Removal and Installation.
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke.
3. Pressurize the cylinder using compressed air.

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

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

NOTE: If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Removal and Installation (Cylinder Head - RH) or Removal and Installation (Cylinder Head - LH).

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

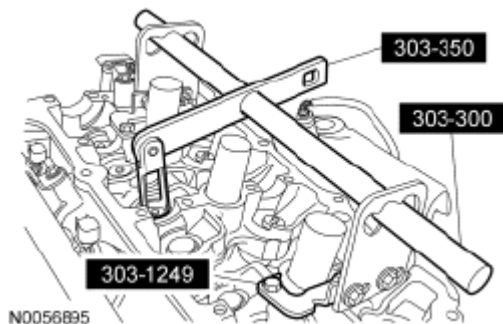


Fig. 252: Identifying Valve Springs Compressors
Courtesy of FORD MOTOR CO.

5. Remove and discard the valve stem seal.

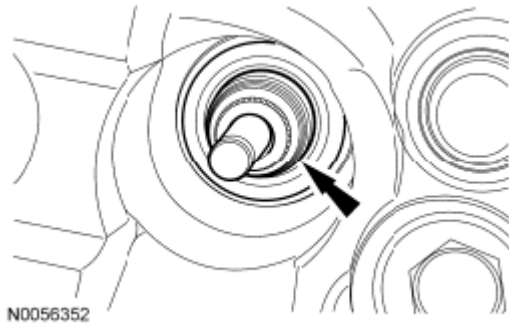


Fig. 253: Locating Valve Stem Seal
Courtesy of FORD MOTOR CO.

CYLINDER HEAD - RH

Material

ITEM SPECIFICATION TABLE

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

Removal and Installation

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

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

All vehicles

1. Remove the RH camshafts. For additional information, refer to **Removal and Installation**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
 - Remove the block heater wiring harness from the engine.

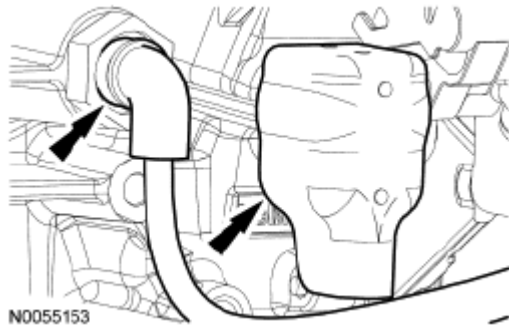


Fig. 254: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

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

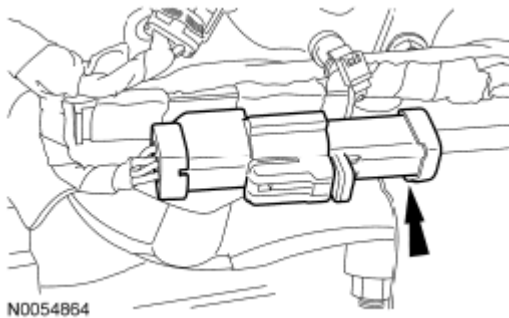


Fig. 255: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

4. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.

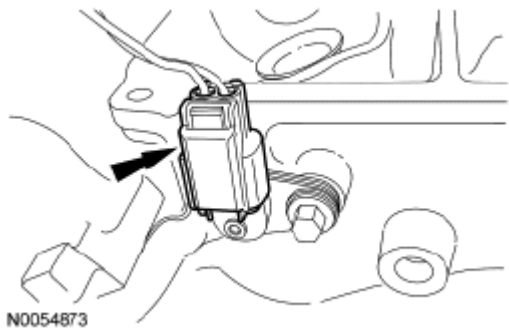


Fig. 256: Locating RH Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the bolt and the Power Steering Pressure (PSP) tube and bracket assembly.

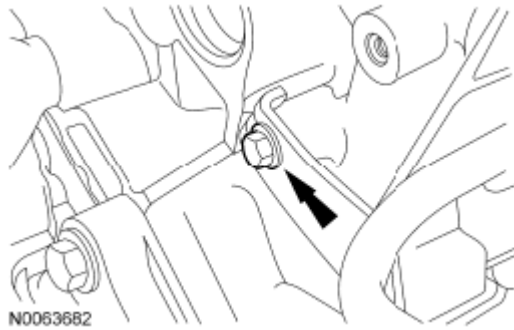


Fig. 257: Locating Power Steering Pressure Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

6. Disconnect the 6 fuel injector electrical connectors (3 shown in illustration).

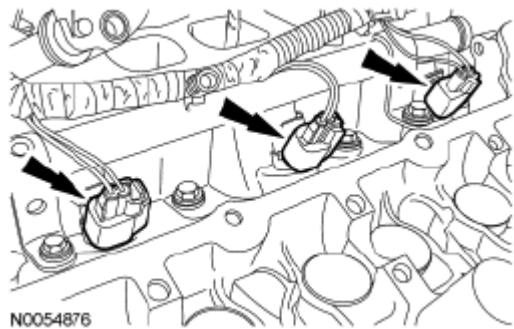


Fig. 258: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

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

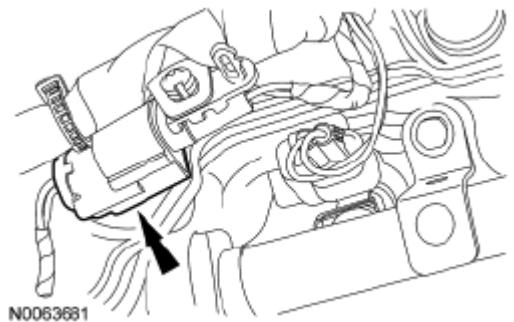


Fig. 259: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

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

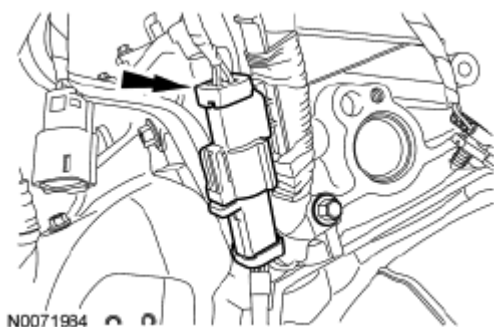


Fig. 260: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

9. Remove the 2 LH catalytic converter bracket bolts.

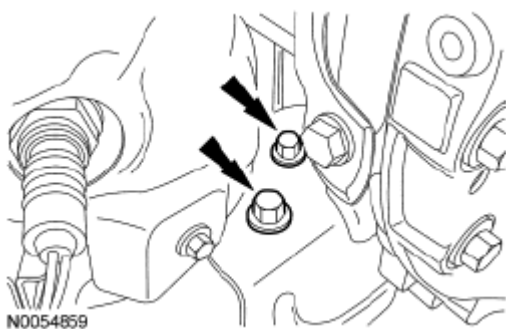


Fig. 261: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

10. Remove the 4 nuts (3 shown in illustration) and the LH catalytic converter.
 - Discard the nuts and the gasket.

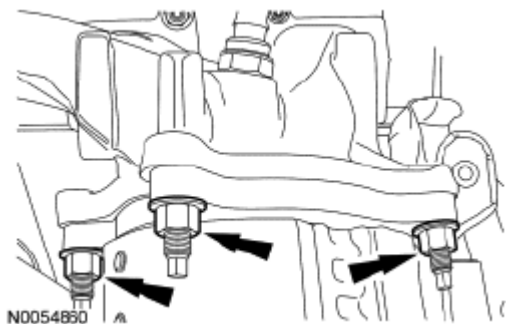


Fig. 262: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

11. Remove the LH cylinder block drain plug.
 - Allow coolant to drain from the cylinder block.

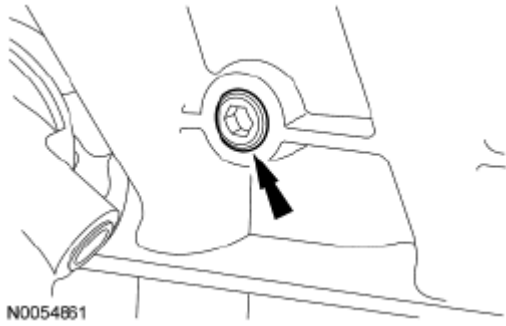


Fig. 263: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

12. Remove the 2 RH catalytic converter bracket bolts.

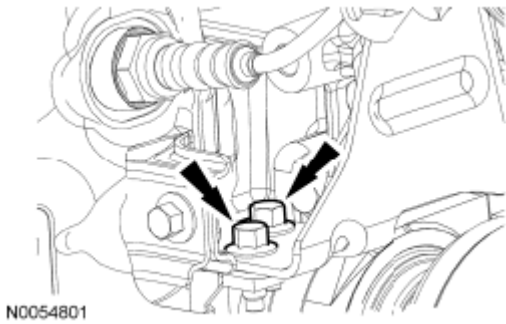


Fig. 264: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

All vehicles

13. Remove the 4 nuts and the RH catalytic converter.
 - Discard the nuts and the gasket.

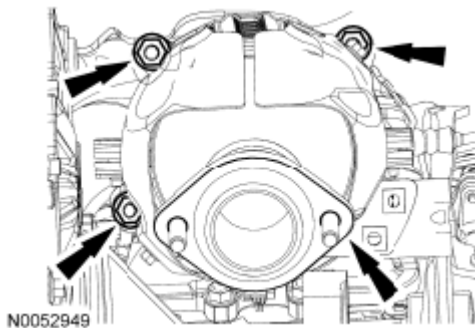


Fig. 265: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

14. Remove the RH cylinder block drain plug or, if equipped, the block heater.
 - Allow coolant to drain from the cylinder block.

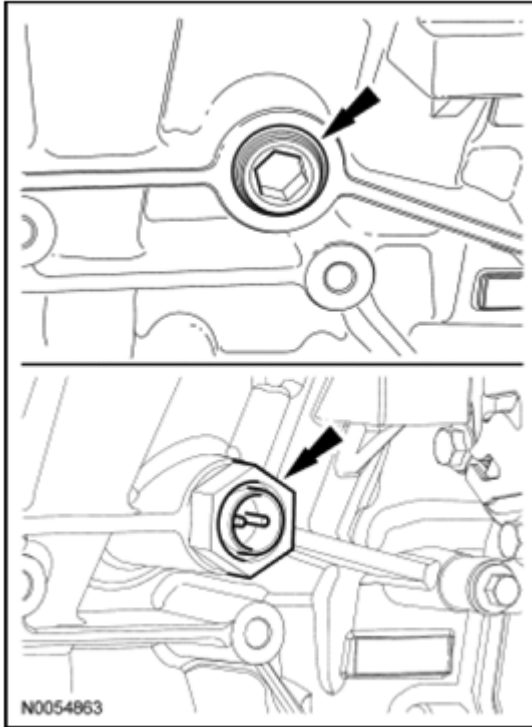


Fig. 266: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

15. Remove the 3 bolts and the RH exhaust manifold heat shield.

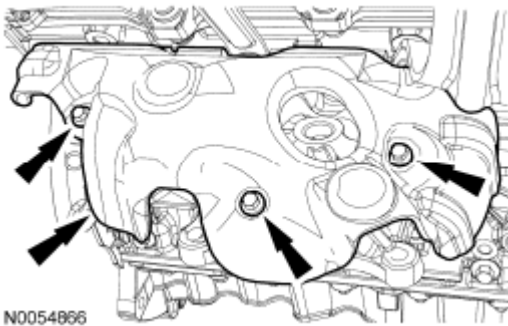
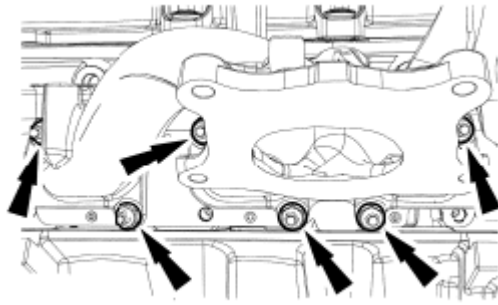


Fig. 267: Locating RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

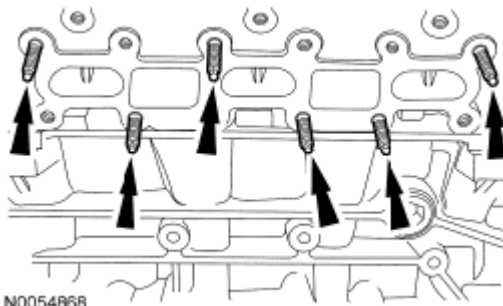
16. Remove the 6 nuts and the RH exhaust manifold.
 - Discard the nuts and exhaust manifold gaskets.



N0054867

Fig. 268: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

17. Clean and inspect the RH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
18. Remove and discard the 6 RH exhaust manifold studs.



N0054868

Fig. 269: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

19. Remove the 2 bolts and the RH primary timing chain guide.

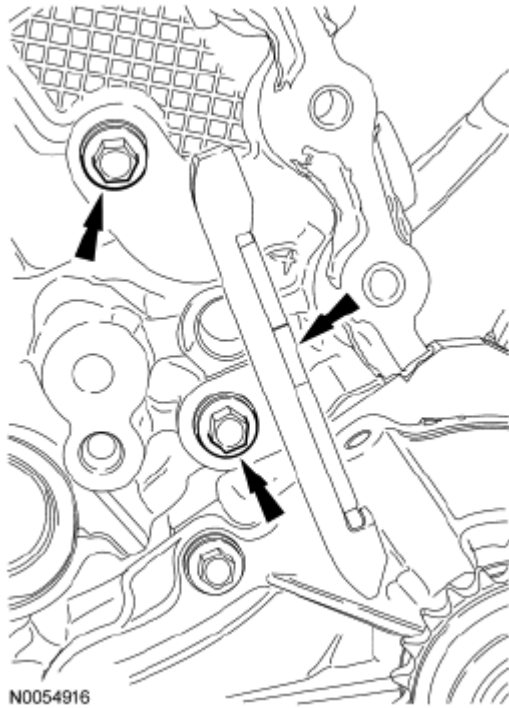


Fig. 270: Locating RH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

20. Remove the 2 bolts and the RH primary timing chain guide.

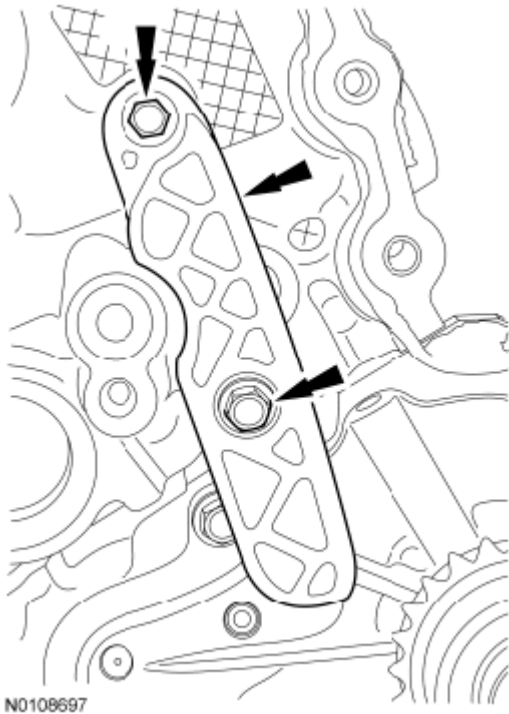


Fig. 271: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

21. Remove the 2 bolts and the RH secondary timing chain tensioner.

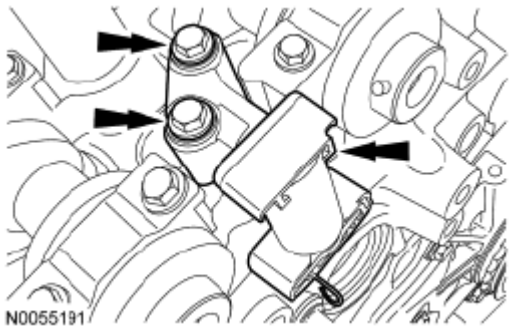


Fig. 272: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

22. Remove the 2 bolts and the engine lifting eye.

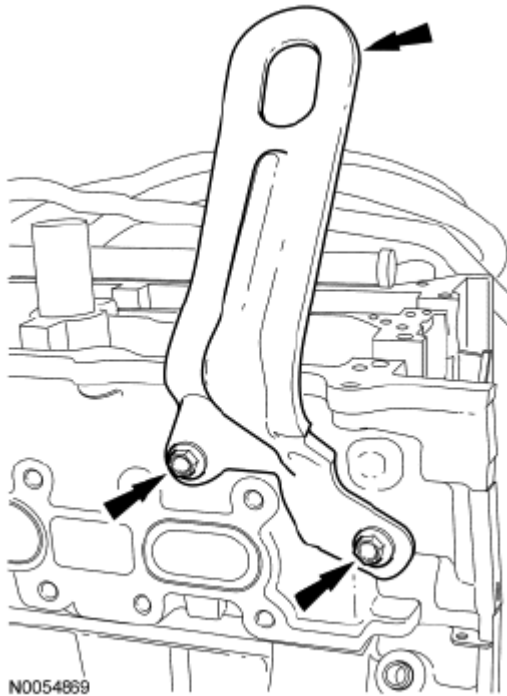


Fig. 273: Locating Engine Lifting Eye & Bolts
 Courtesy of FORD MOTOR CO.

23. Remove the bolt and the upper intake manifold support bracket.

NOTE: Index-mark the location of the bracket on the cylinder head for installation.

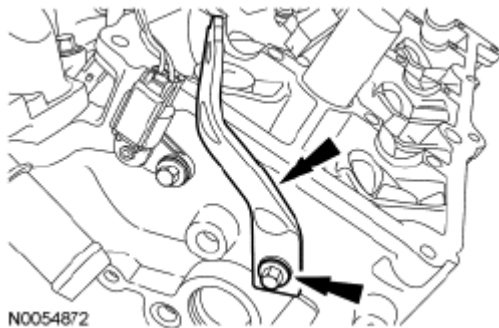


Fig. 274: Locating Upper Intake Manifold Support Bracket & Bolt
 Courtesy of FORD MOTOR CO.

24. Remove the bolt and the RH CMP sensor.

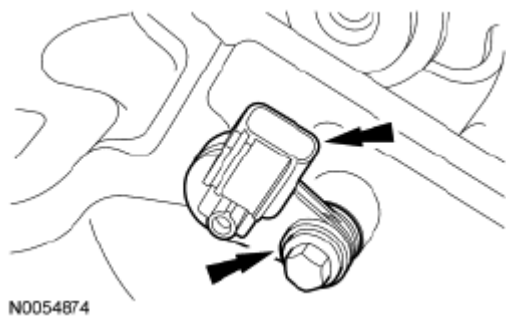


Fig. 275: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

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

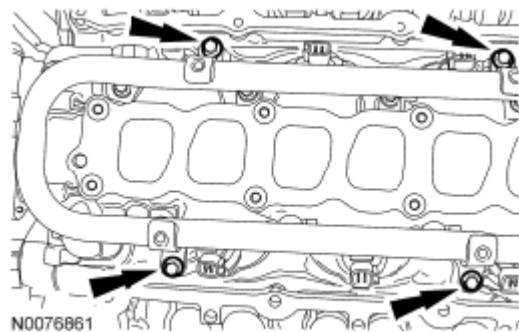


Fig. 276: Locating Fuel Rail & Injectors Assembly Bolts
Courtesy of FORD MOTOR CO.

26. Disconnect the coolant bypass hose from the thermostat housing.

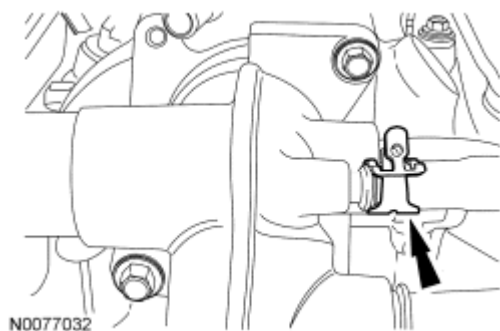


Fig. 277: Locating Coolant Bypass Hose To Thermostat Housing
Courtesy of FORD MOTOR CO.

27. Remove the 2 thermostat housing-to-lower intake manifold bolts.
 - Remove the thermostat housing and discard the gasket and O-ring seal.

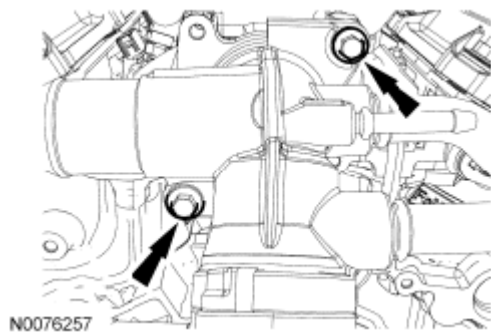


Fig. 278: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

28. Remove the 10 bolts and the lower intake manifold.
 - Discard the gaskets.

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

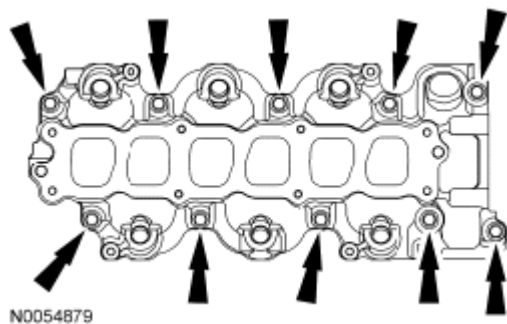


Fig. 279: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

29. Disconnect and remove the CHT sensor jumper harness.

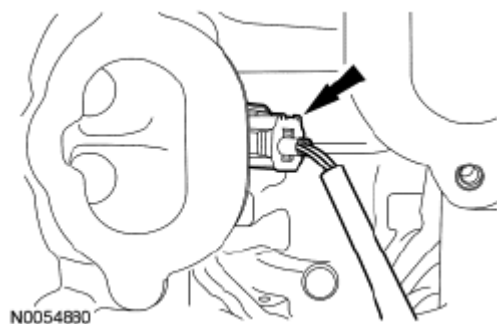


Fig. 280: Locating CHT Sensor Jumper Harness

Courtesy of FORD MOTOR CO.

30. Remove the valve tappets from the cylinder head.

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



Fig. 281: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

31. Remove and discard the M6 bolt.

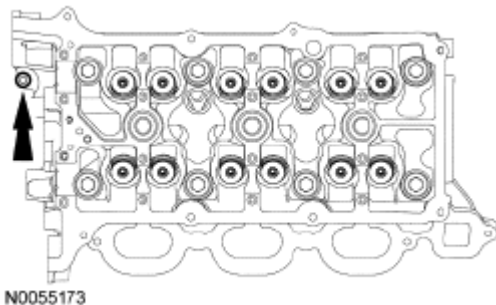


Fig. 282: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

32. Remove and discard the 8 bolts from the cylinder head.
- Remove the cylinder head.
 - Discard the cylinder head gasket.

NOTE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

NOTE: Aluminum surfaces are soft and may be scratched easily. Never place the

cylinder head gasket surface, unprotected, on a bench surface.

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

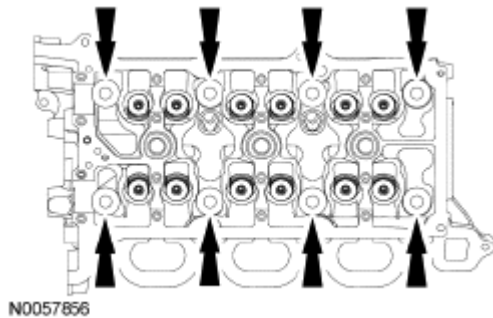


Fig. 283: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

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

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

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

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

34. 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 **CYLINDER HEAD DISTORTION** and **CYLINDER BLOCK DISTORTION**.

CYLINDER HEAD - LH

Material**ITEM SPECIFICATION**

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

Removal and Installation

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

All vehicles

1. Remove the LH camshafts. For additional information, refer to **Removal and Installation**.
2. If equipped, remove the heat shield and disconnect the block heater electrical connector.
 - Remove the block heater wiring harness from the engine.

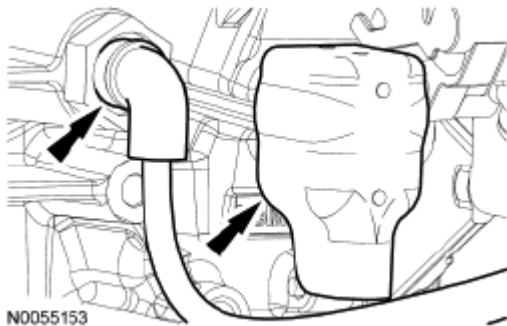


Fig. 284: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

3. Disconnect the A/C compressor electrical connector.

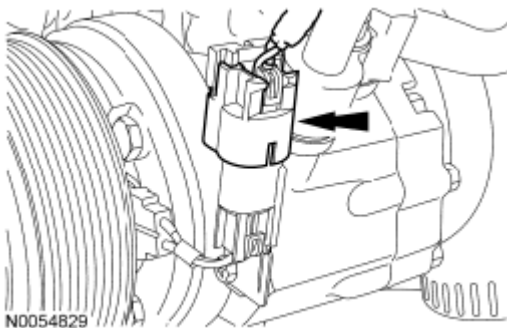


Fig. 285: Locating A/C Compressor Electrical Connector

Courtesy of FORD MOTOR CO.

4. Remove the nut and disconnect the generator B+ cable.

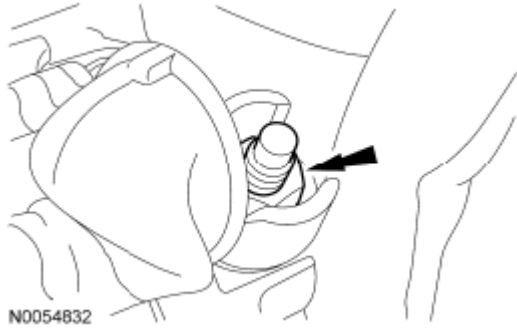


Fig. 286: Locating Generator B+ Cable Nut
Courtesy of FORD MOTOR CO.

5. Disconnect the generator electrical connector.

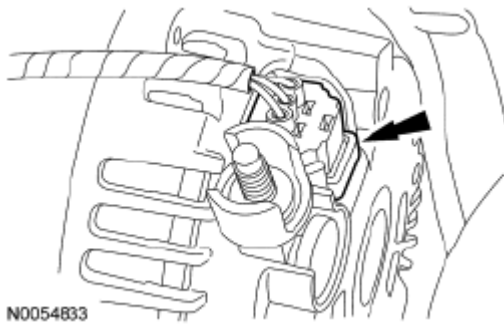


Fig. 287: Locating Generator Electrical Connector
Courtesy of FORD MOTOR CO.

6. Detach the wiring harness retainer from the generator.

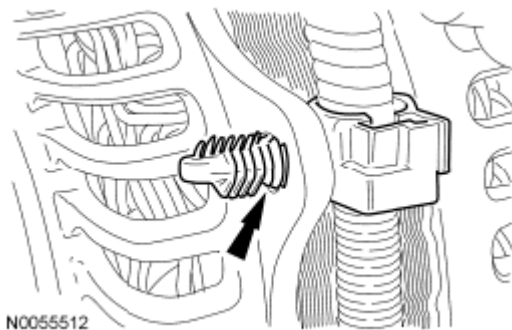


Fig. 288: Locating Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

7. Remove the nut, bolt and the generator.

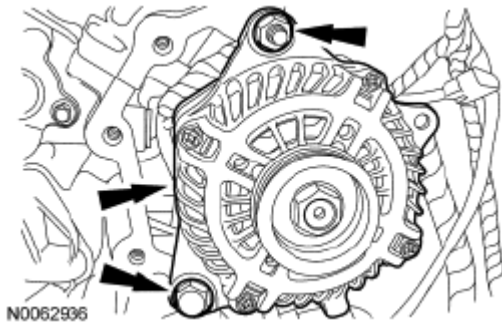


Fig. 289: Locating Nut, Bolt & Generator
Courtesy of FORD MOTOR CO.

8. Detach the wiring harness pin-type retainer.

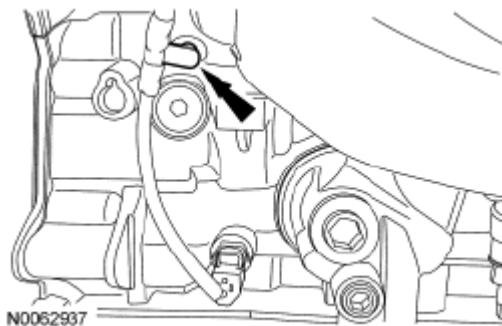


Fig. 290: Locating Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

9. Disconnect the 6 fuel injector electrical connectors (3 shown in illustration).

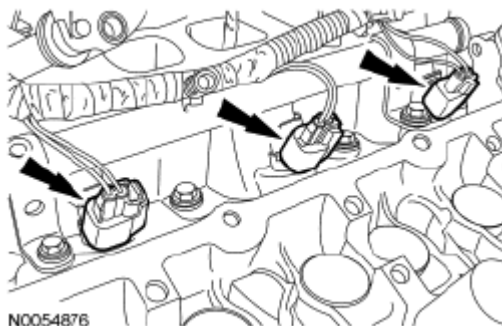


Fig. 291: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

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

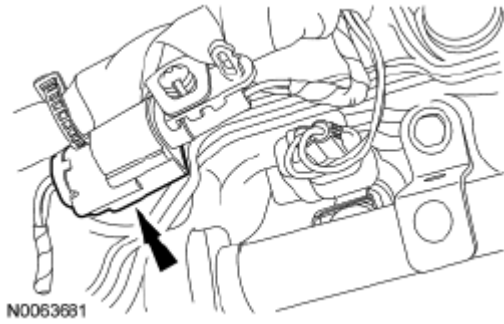


Fig. 292: Locating Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Disconnect the LH Camshaft Position (CMP) sensor electrical connector.

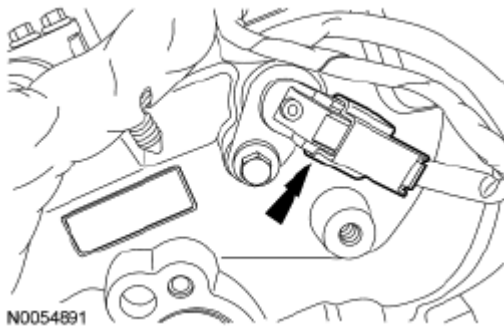


Fig. 293: Locating Camshaft Position (CMP) Sensor Electrical Connector LH Side
Courtesy of FORD MOTOR CO.

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

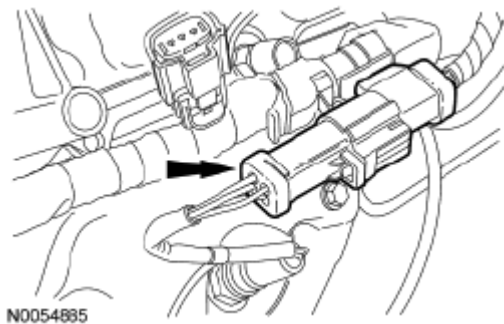


Fig. 294: Locating LH Heated Oxygen Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

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

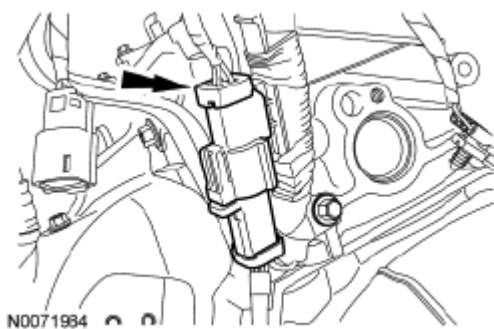


Fig. 295: Locating LH Catalyst Monitor Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

14. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

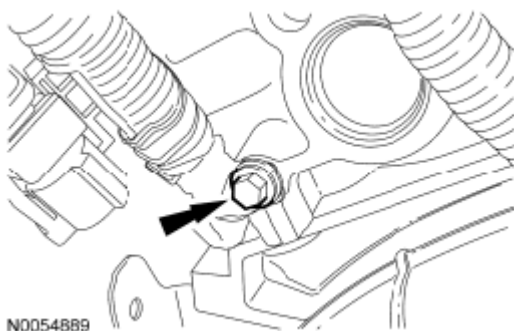


Fig. 296: Locating Wiring Harness Retainer Bolt
Courtesy of FORD MOTOR CO.

15. Remove the 2 LH catalytic converter bracket bolts.

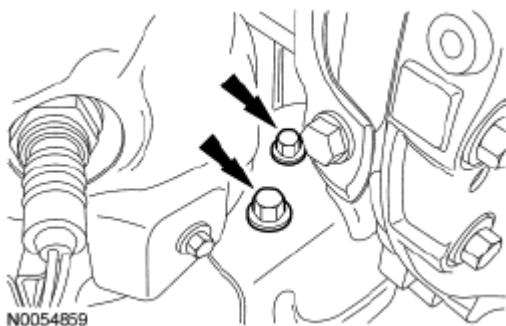


Fig. 297: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

16. Remove the 4 nuts (3 shown in illustration) and the LH catalytic converter.
- Discard the nuts and the gasket.

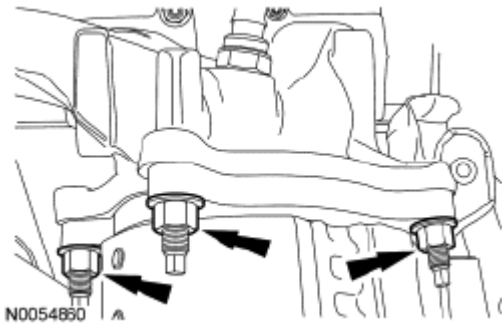


Fig. 298: Locating Catalytic Converter Nuts (LH)
Courtesy of FORD MOTOR CO.

17. Remove the 3 bolts and the LH exhaust manifold heat shield.

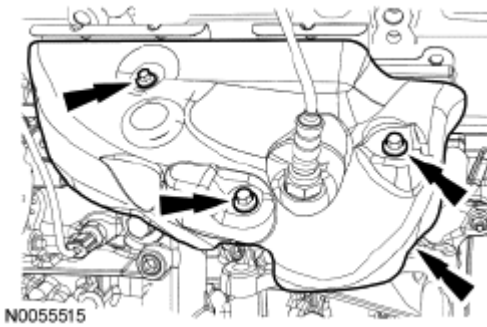


Fig. 299: Locating Exhaust Manifold Heat Shield Bolts (LH)
Courtesy of FORD MOTOR CO.

18. Remove the 6 nuts and the LH exhaust manifold.
- Discard the nuts and the exhaust manifold gasket.

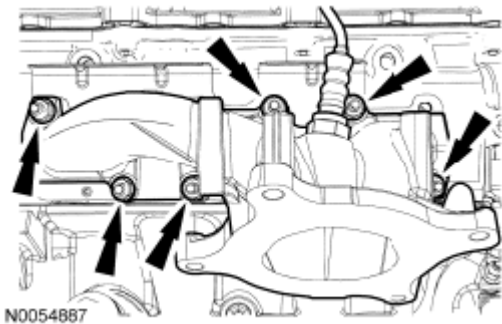


Fig. 300: Locating Exhaust Manifold Gasket & Nut
Courtesy of FORD MOTOR CO.

19. Clean and inspect the LH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
20. Remove and discard the 6 LH exhaust manifold studs.

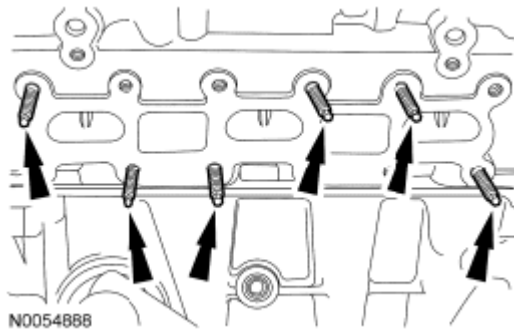


Fig. 301: Locating LH Exhaust Manifold Studs
 Courtesy of FORD MOTOR CO.

21. Remove the LH cylinder block drain plug.
 - Allow coolant to drain from the cylinder block.

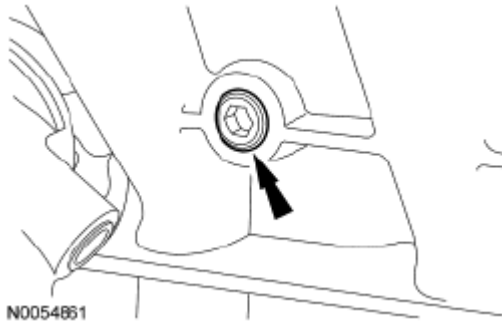


Fig. 302: Locating LH Cylinder Block Drain Plug
 Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

22. Remove the 2 RH catalytic converter bracket bolts.

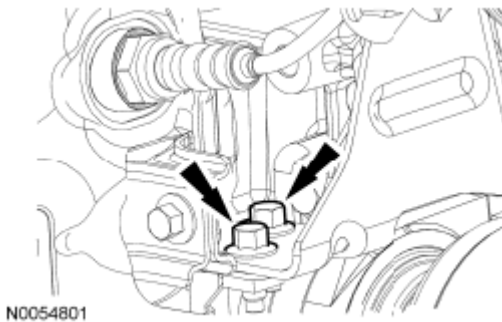


Fig. 303: Locating RH Catalytic Converter Bracket Bolts
 Courtesy of FORD MOTOR CO.

All vehicles

23. Remove the 4 nuts and the RH catalytic converter.
- Discard the nuts and the gasket.

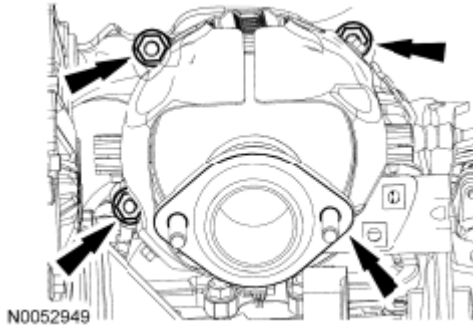


Fig. 304: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

24. Remove the RH cylinder block drain plug or, if equipped, the block heater.
- Allow coolant to drain from the cylinder block.

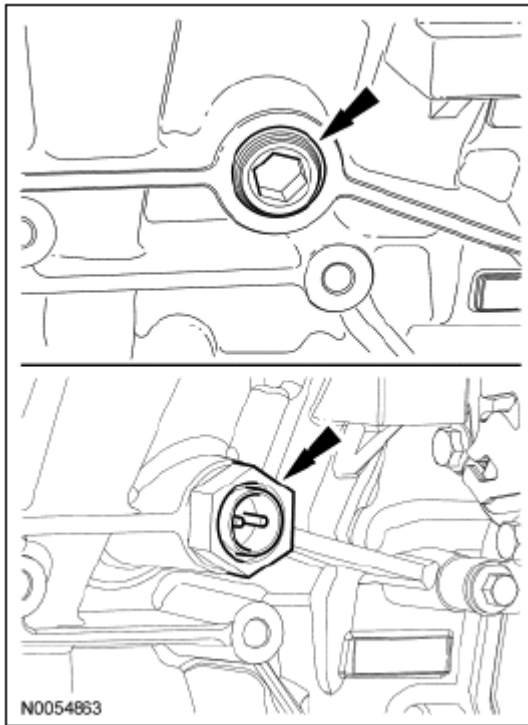


Fig. 305: Locating RH Cylinder Block Drain Plug & Block Heater
Courtesy of FORD MOTOR CO.

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

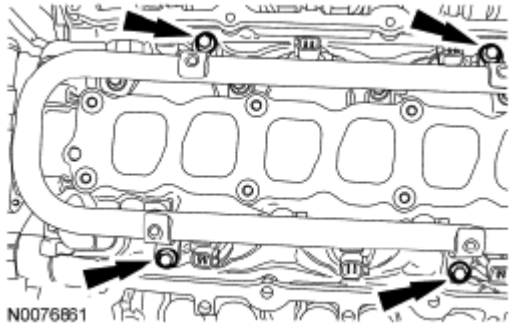


Fig. 306: Locating Injectors Assembly Bolts & Fuel Rail
 Courtesy of FORD MOTOR CO.

26. Disconnect the coolant bypass hose from the thermostat housing.

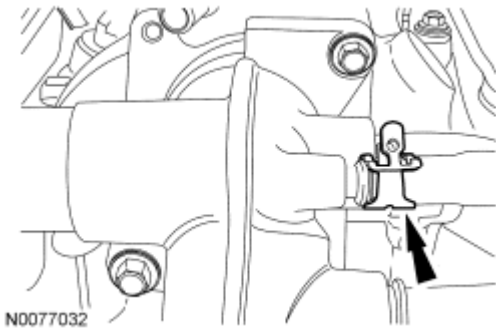


Fig. 307: Locating Coolant Bypass Hose To Thermostat Housing
 Courtesy of FORD MOTOR CO.

27. Remove the 2 thermostat housing-to-lower intake manifold bolts.
 - Remove the thermostat housing and discard the gasket and O-ring seal.

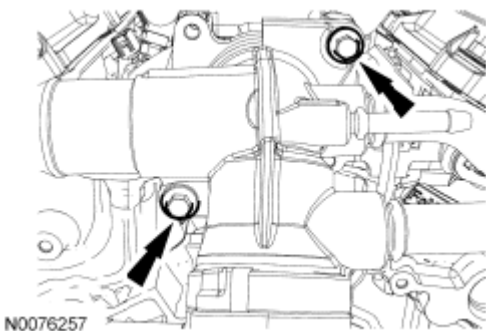


Fig. 308: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
 Courtesy of FORD MOTOR CO.

28. Remove the 10 bolts and the lower intake manifold.
 - Discard the gaskets.

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

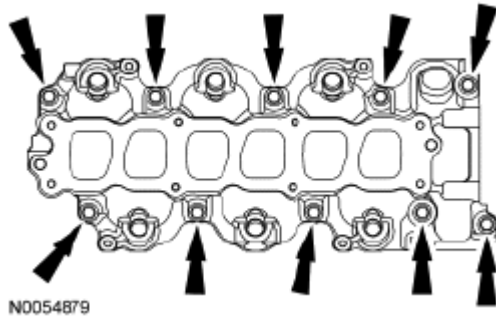


Fig. 309: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

29. Remove the bolt and the LH CMP sensor.

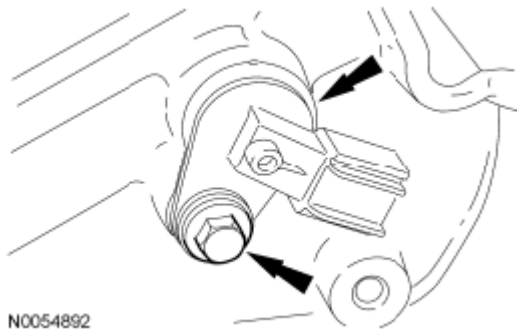


Fig. 310: Locating CMP Sensor Bolt LH
Courtesy of FORD MOTOR CO.

30. Remove the 2 bolts and the upper LH primary timing chain guide.

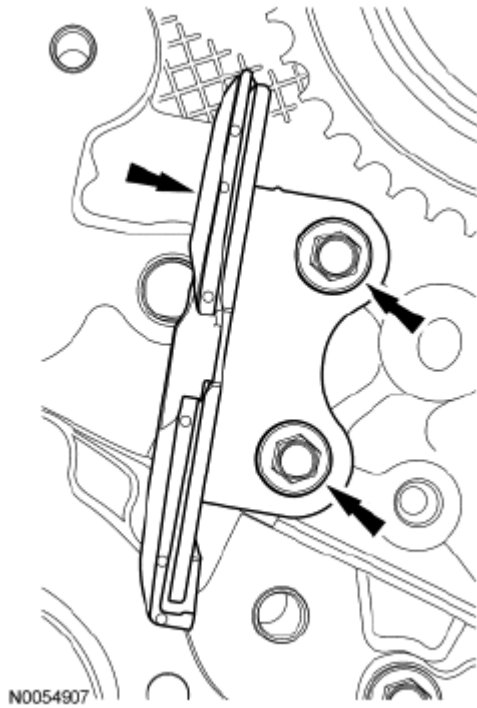


Fig. 311: Locating Upper LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

31. Remove the 2 bolts and the LH secondary timing chain tensioner.

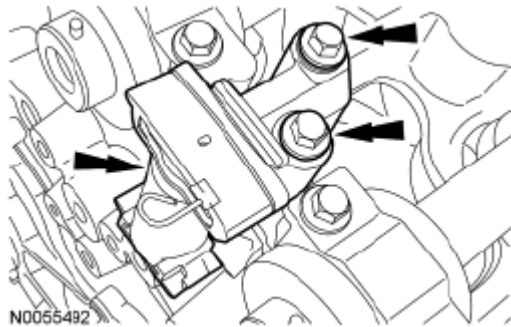


Fig. 312: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

32. Remove the valve tappets from the cylinder head.

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



Fig. 313: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

33. Remove and discard the M6 bolt.

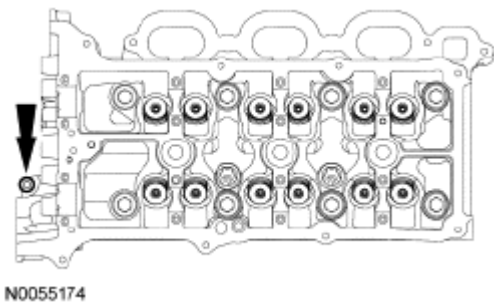


Fig. 314: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

34. Remove and discard the 8 bolts from the cylinder head.
- Remove the cylinder head.
 - Discard the cylinder head gasket.

NOTE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

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

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

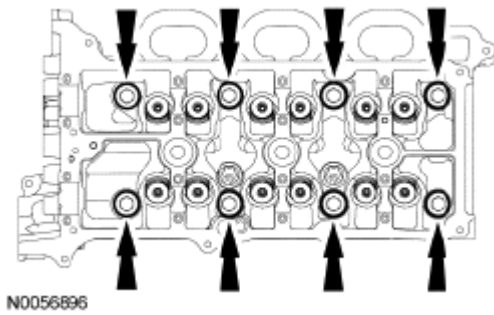


Fig. 315: Locating Cylinder Head Bolts

Courtesy of FORD MOTOR CO.

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

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

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

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

36. 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 **CYLINDER HEAD DISTORTION** and **CYLINDER BLOCK DISTORTION**.

OIL PAN

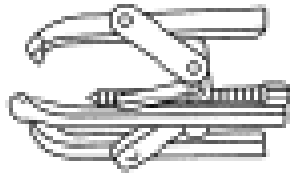
Special Tool(s)

SPECIAL TOOL TABLE

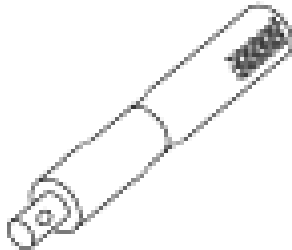
	3 Jaw Puller 303-D121 or equivalent
--	-------------------------------------

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST1184-A**

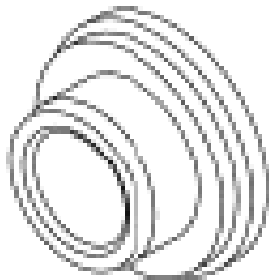
Handle 205-153 (T80T-4000-W)

**ST1326-A**

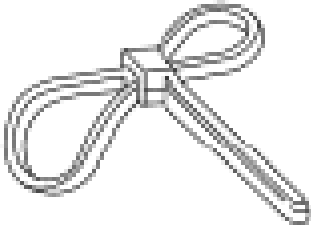
Remover, Oil Seal 303-409 (T92C-6700CH)

**ST1385-A**

Remover, VCT Spark Plug Tube Seal 303-1247/1

**ST2982-A**

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



ST1438-A

Material**ITEM SPECIFICATION TABLE**

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

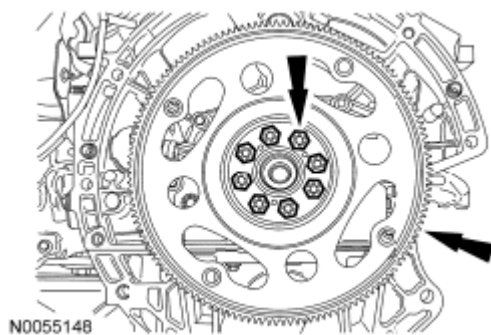
Removal and Installation

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

NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

All vehicles

1. Remove the engine from the vehicle. For additional information, refer to **ENGINE**.
2. Remove the 8 bolts and the flywheel.

**Fig. 316: Locating Flywheel Bolts**

Courtesy of FORD MOTOR CO.

3. Remove the crankshaft sensor ring.

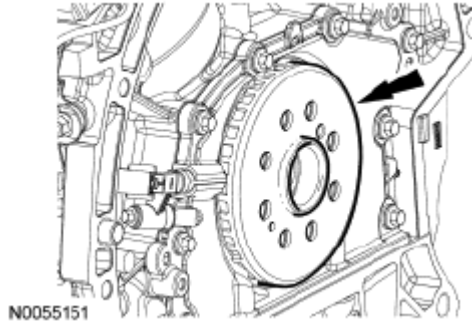


Fig. 317: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

4. Mount the engine on a suitable engine stand.

NOTE: Install the engine stand bolts into the cylinder block only. Do not install the bolts into the oil pan.

5. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.

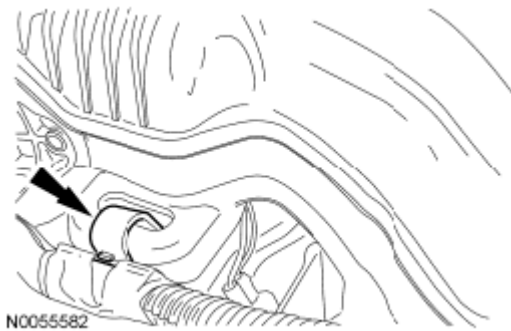


Fig. 318: Locating Block Heater Wiring Harness Retainer & Upper Intake Manifold
Courtesy of FORD MOTOR CO.

6. If equipped, remove the heat shield and disconnect the block heater electrical connector.

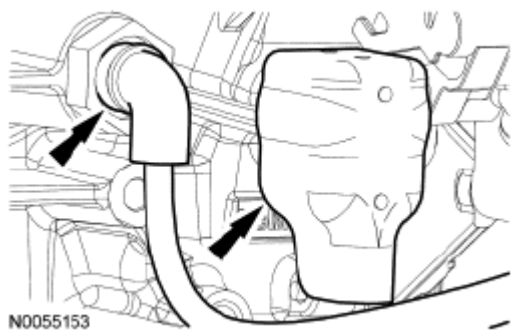


Fig. 319: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

7. If equipped, detach the block heater wiring harness retainer from the power steering reservoir hose and the Power Steering Pressure (PSP) hose.
 - Remove the block heater wiring harness from the engine.

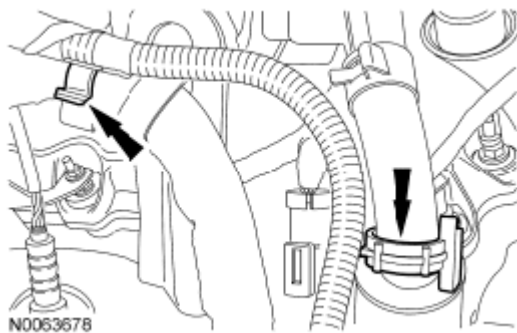


Fig. 320: Locating Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

8. Disconnect the PCV hose from the PCV valve.

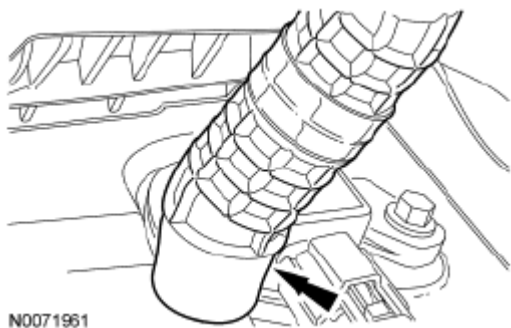


Fig. 321: Locating PCV Hose
Courtesy of FORD MOTOR CO.

9. Disconnect the Throttle Body (TB) electrical connector.

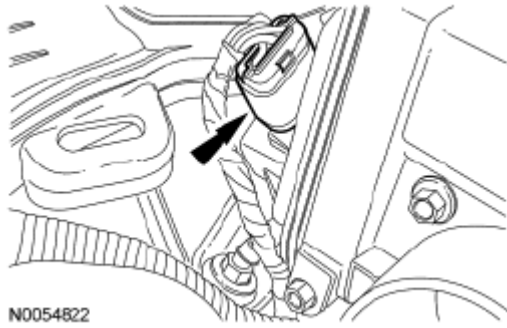


Fig. 322: Locating Throttle Body (TB) Electrical Connector
Courtesy of FORD MOTOR CO.

10. Detach the wiring harness retainers from the upper intake manifold.

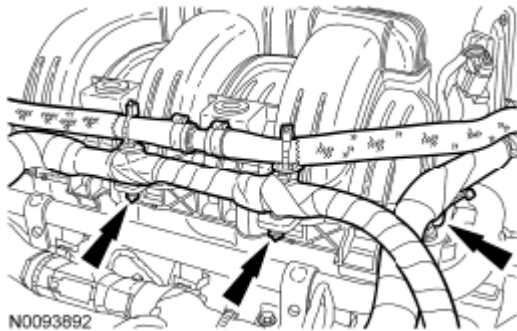


Fig. 323: Locating Wiring Harness Retainers To Upper Intake Manifold
Courtesy of FORD MOTOR CO.

11. Remove the upper intake manifold support bracket bolt.

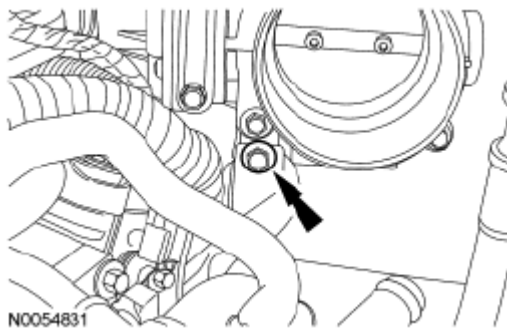
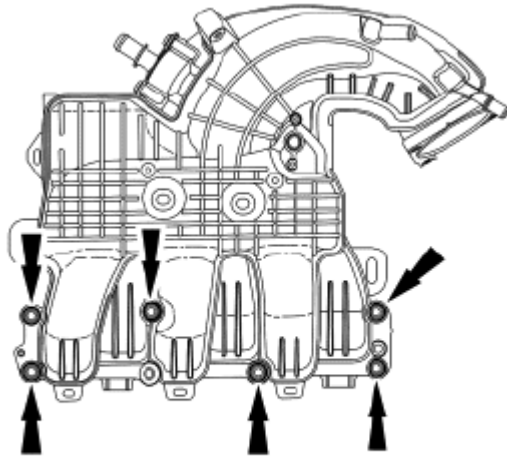


Fig. 324: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

12. Remove the 6 bolts and the upper intake manifold.
- Discard the gaskets.

NOTE: If the engine is repaired or replaced because of upper engine failure,

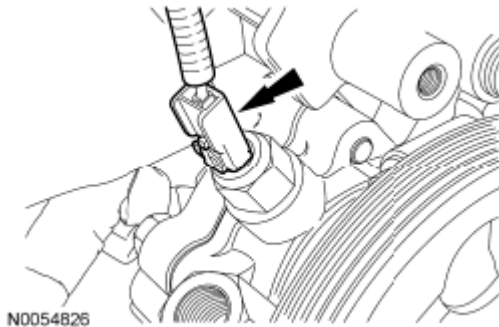
typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.



N0054825

Fig. 325: Locating Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

13. Disconnect the **PSP** switch electrical connector.



N0054826

Fig. 326: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

14. Disconnect the RH Catalyst Monitor Sensor (CMS) sensor electrical connector.

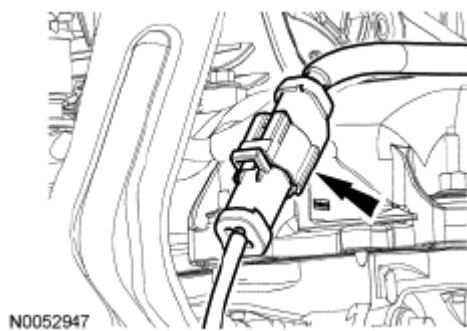


Fig. 327: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

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

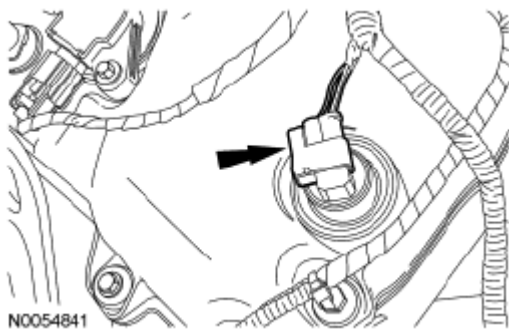


Fig. 328: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

16. Disconnect the 3 RH coil-on-plug electrical connectors.

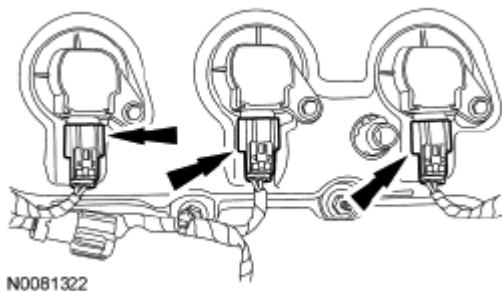


Fig. 329: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

17. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
18. Disconnect the LH CMS sensor electrical connector.

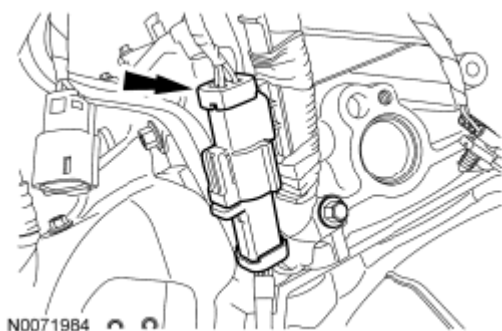


Fig. 330: Locating LH CMS Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

19. Disconnect the LH VCT solenoid electrical connector.

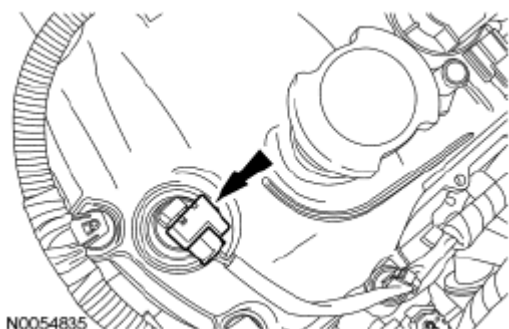


Fig. 331: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

20. Disconnect the 3 LH coil-on-plug electrical connectors.

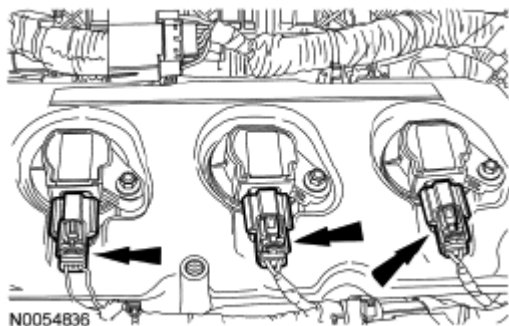


Fig. 332: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

21. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.
22. Remove the A/C compressor nut and stud.

NOTE: The A/C compressor must remain bolted to the cylinder block prior to

installing the oil pan.

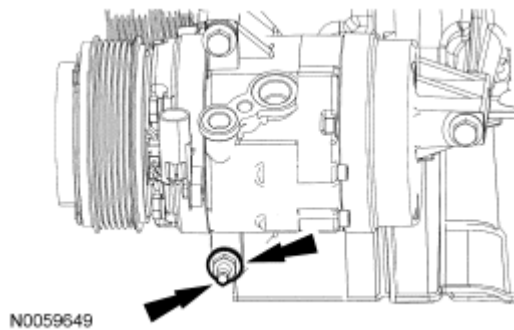


Fig. 333: Locating A/C Compressor Nut & Stud
Courtesy of FORD MOTOR CO.

23. Detach the PSP hose retainer from the engine lifting eye.

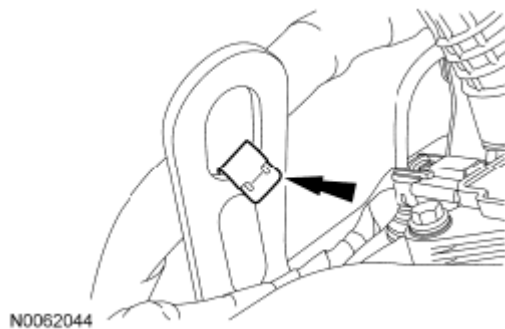


Fig. 334: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

24. Remove the PSP hose bracket nut.

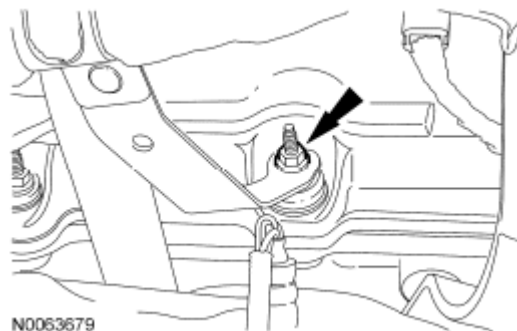


Fig. 335: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

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

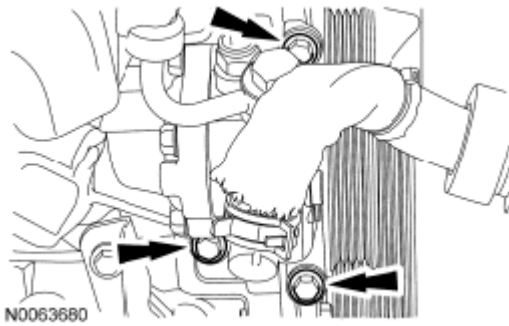


Fig. 336: Locating Power Steering Pump & Bolts
 Courtesy of FORD MOTOR CO.

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

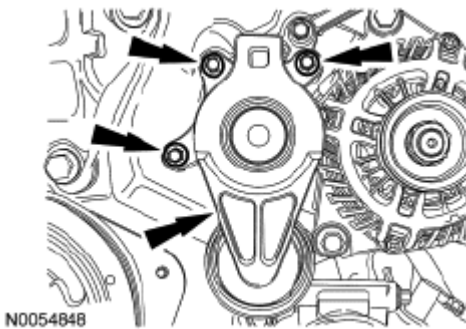


Fig. 337: Locating Accessory Drive Belt Tensioner Bolts
 Courtesy of FORD MOTOR CO.

27. Remove the 4 nuts (3 shown in illustration) and the LH catalytic converter.
 - Discard the nuts and the gasket.

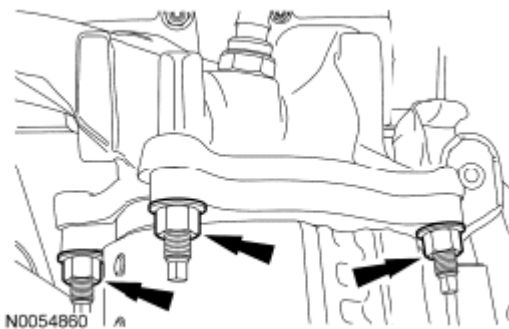


Fig. 338: Locating LH Catalytic Converter & Nuts
 Courtesy of FORD MOTOR CO.

FWD vehicles

28. Remove the 4 nuts and the RH catalytic converter.

- Discard the nuts and the gasket.

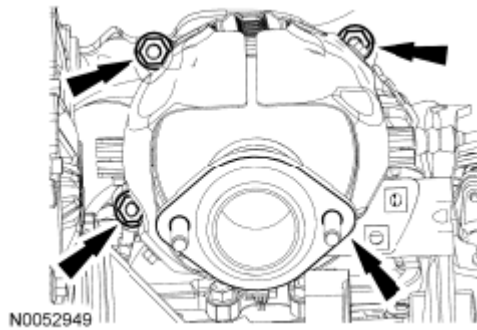


Fig. 339: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

29. Remove the RH cylinder block drain plug or, if equipped, the block heater.
 - Allow coolant to drain from the cylinder block.

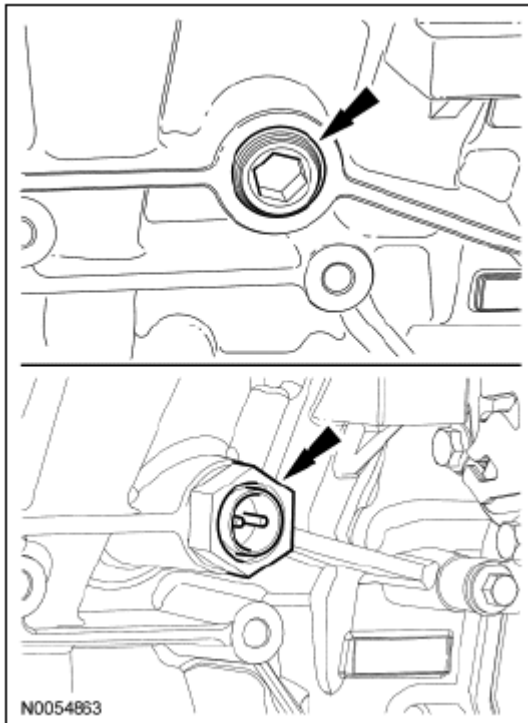


Fig. 340: Locating RH Cylinder Block Drain Plug & Block Heater
Courtesy of FORD MOTOR CO.

30. Remove the LH cylinder block drain plug.
 - Allow coolant to drain from the cylinder block.

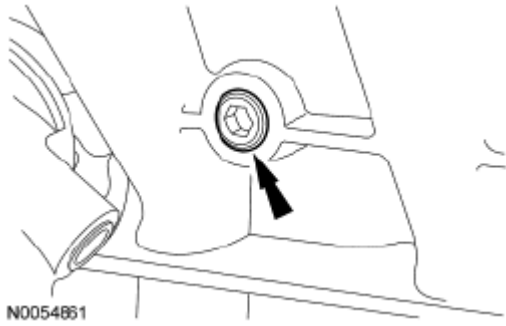


Fig. 341: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown in illustration, RH similar.

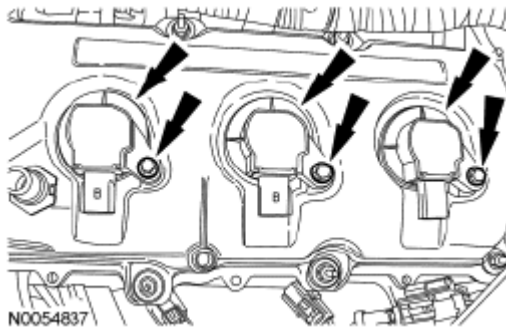


Fig. 342: Locating Bolts And Coil-On-Plug Assemblies
Courtesy of FORD MOTOR CO.

32. Remove the 2 nuts and the wiring harness retaining bracket.

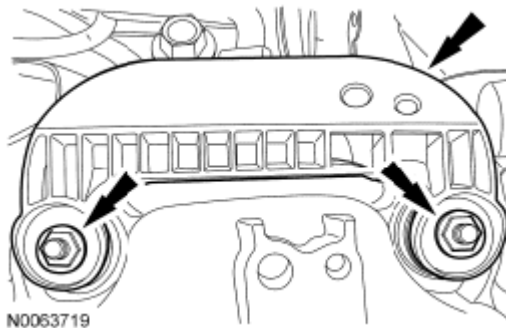


Fig. 343: Locating Wiring Harness Retaining Bracket & Nuts
Courtesy of FORD MOTOR CO.

Early build vehicles

33. Loosen the 11 stud bolts and remove the LH valve cover.

- Discard the gasket.

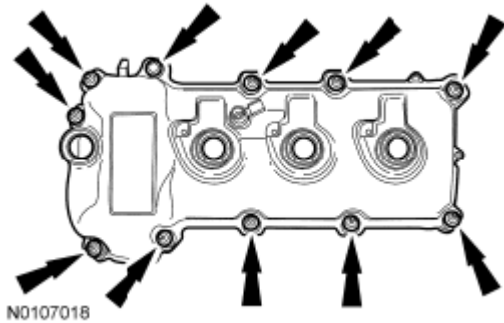


Fig. 344: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

34. Loosen the bolt, the 10 stud bolts and remove the RH valve cover.

- Discard the gasket.

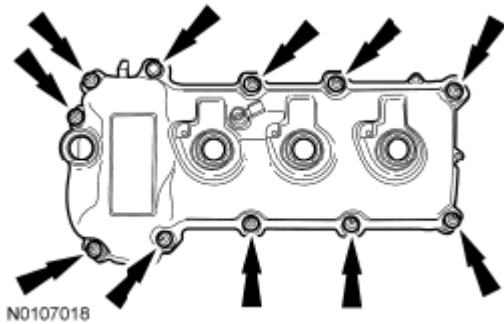


Fig. 345: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

Late build vehicles

35. Loosen the 9 stud bolts and remove the LH valve cover.

- Discard the gasket.

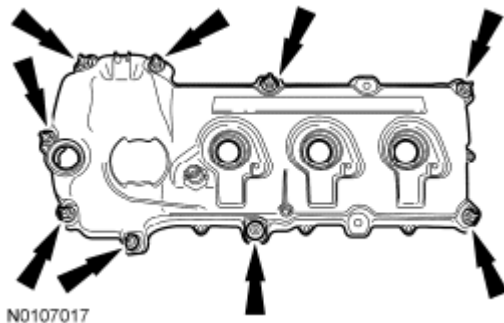


Fig. 346: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

36. Loosen the 9 stud bolts and remove the RH valve cover.
- Discard the gasket.

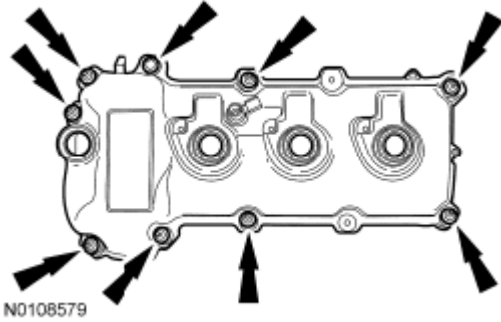


Fig. 347: Locating Stud Bolts & RH Valve Cover
Courtesy of FORD MOTOR CO.

All vehicles

37. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
- Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

NOTE: VCT solenoid seal removal shown in illustration, spark plug tube seal removal similar.

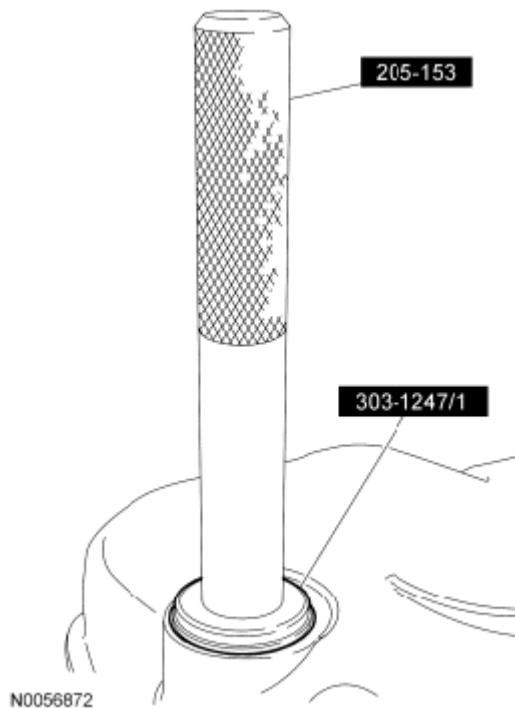


Fig. 348: Identifying VCT Spark Plug Tube Seal Remover And Handle
Courtesy of FORD MOTOR CO.

38. Using the Strap Wrench, remove the crankshaft pulley bolt and washer.
 - Discard the bolt.

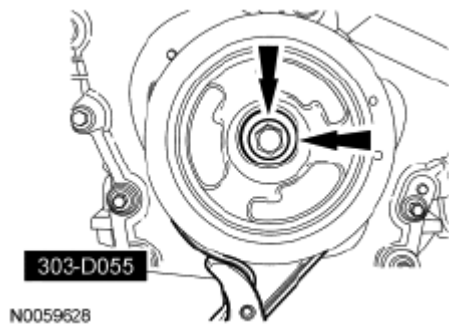


Fig. 349: Locating Crankshaft Pulley Bolt & Washer
Courtesy of FORD MOTOR CO.

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

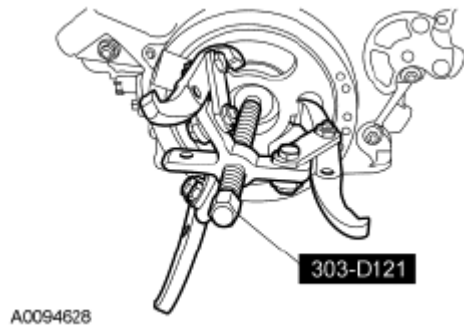


Fig. 350: Identifying Jaw Puller
Courtesy of FORD MOTOR CO.

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

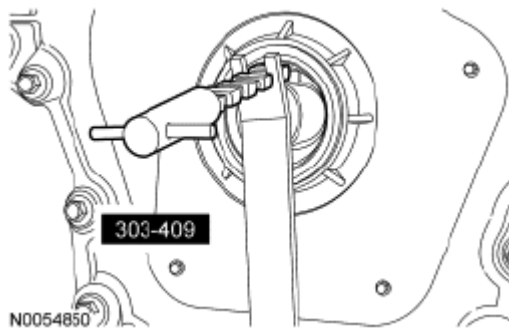


Fig. 351: Identifying Oil Seal Remover
Courtesy of FORD MOTOR CO.

41. Remove the 2 bolts and the engine mount bracket.

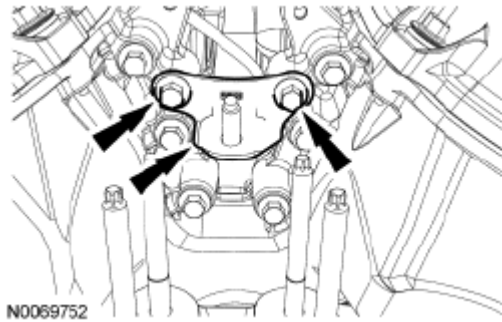


Fig. 352: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

42. Remove the 2 engine mount studs.

NOTE: Only use hand tools to remove the studs.

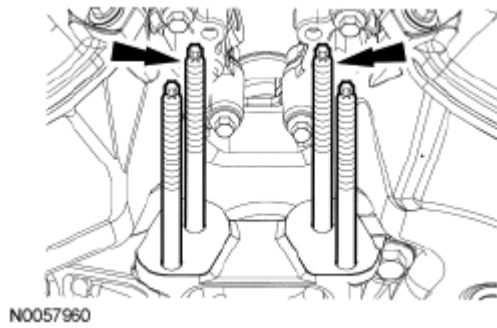


Fig. 353: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

43. Remove the 3 bolts and the engine mount bracket.

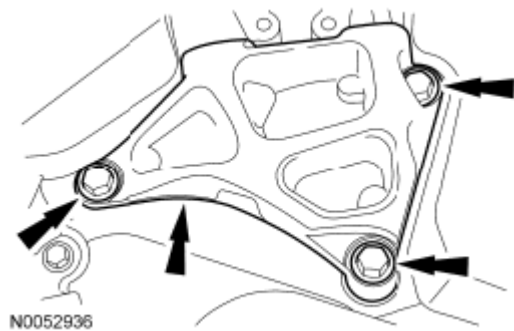
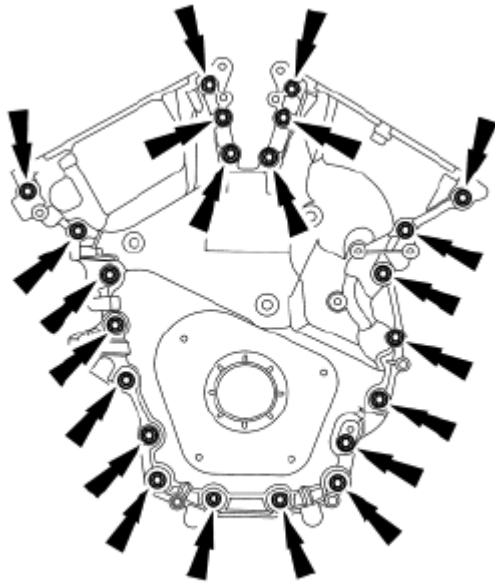


Fig. 354: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

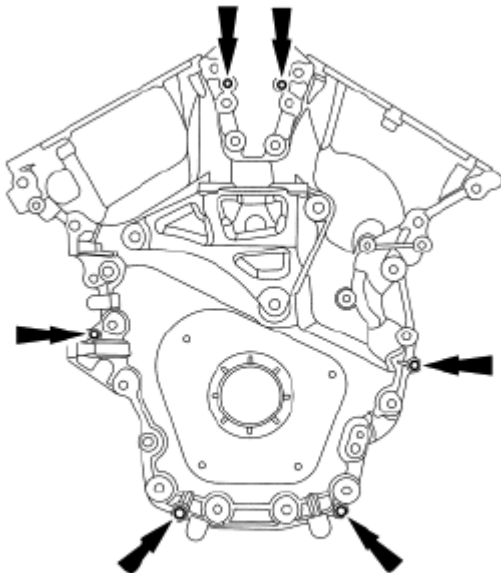
44. Remove the 22 engine front cover bolts.



N0054851

Fig. 355: Locating Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

45. Install 6 of the engine front cover bolts (finger-tight) into the 6 threaded holes in the engine front cover in the following sequence.
1. Tighten the bolts one turn at a time in a crisscross pattern until the engine front cover-to-cylinder block seal is released.
 2. Remove the engine front cover.



N0082530

Fig. 356: Identifying Engine Front Cover Bolt
Courtesy of FORD MOTOR CO.

46. Remove the 16 oil pan bolts.

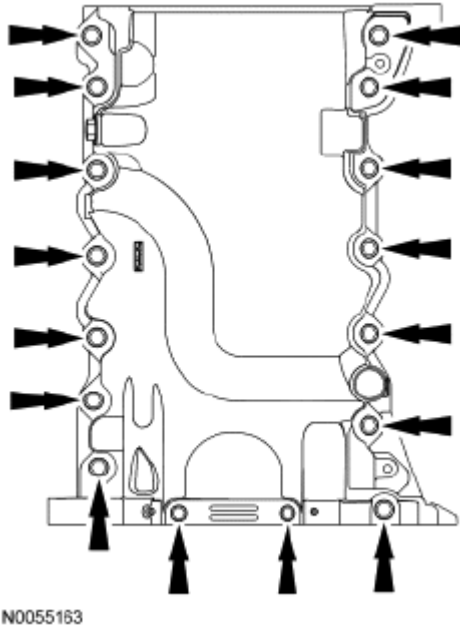
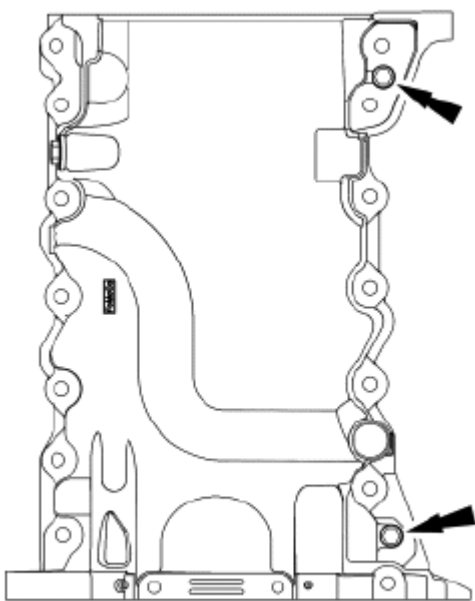


Fig. 357: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

47. Install 2 of the oil pan bolts (finger-tight) into the 2 threaded holes in the oil pan.
- Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
 - Remove the oil pan.



N0055164

Fig. 358: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

48. Clean the engine front cover and oil pan using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
- Thoroughly wash the engine front cover and oil pan to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover and oil pan. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

49. Clean all engine sealing surfaces of the cylinder block in the following sequence.
1. Remove any large deposits of silicone or gasket material.
 2. Apply silicone gasket remover and allow to set for several minutes.
 3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
 4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
 5. Make sure the 2 locating dowel pins are seated correctly in the cylinder block.

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

foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, can cause engine failure.

NOTE: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

OIL PUMP SCREEN AND PICKUP TUBE

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 oil pan. For additional information, refer to Removal and Installation.
2. Remove the 2 bolts and the oil pump screen and pickup tube.
 - Discard the O-ring seal.

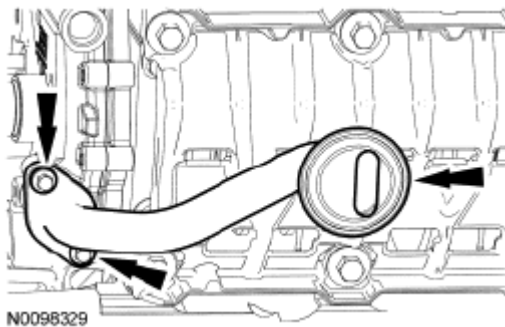


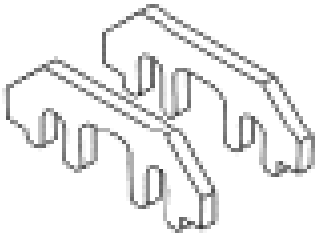
Fig. 359: Locating Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

OIL PUMP

Special Tool(s)

SPECIAL TOOL TABLE

	Tool, Camshaft Holding 303-1248
--	---------------------------------



ST2979-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 can cause engine failure.

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

All vehicles

1. Remove the engine front cover. For additional information, refer to **Removal and Installation**.

Engines equipped with early build RH timing chain guides

2. Rotate the crankshaft clockwise and align the timing marks on the Variable Camshaft Timing (VCT) assemblies as shown in illustration.

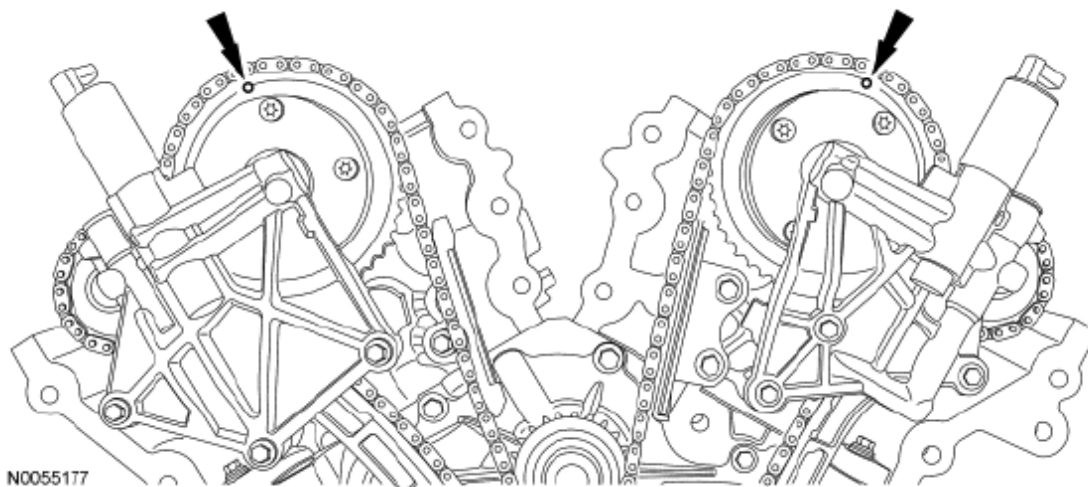


Fig. 360: Locating Timing Marks On Variable Camshaft Timing (VCT)
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

3. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown in illustration.

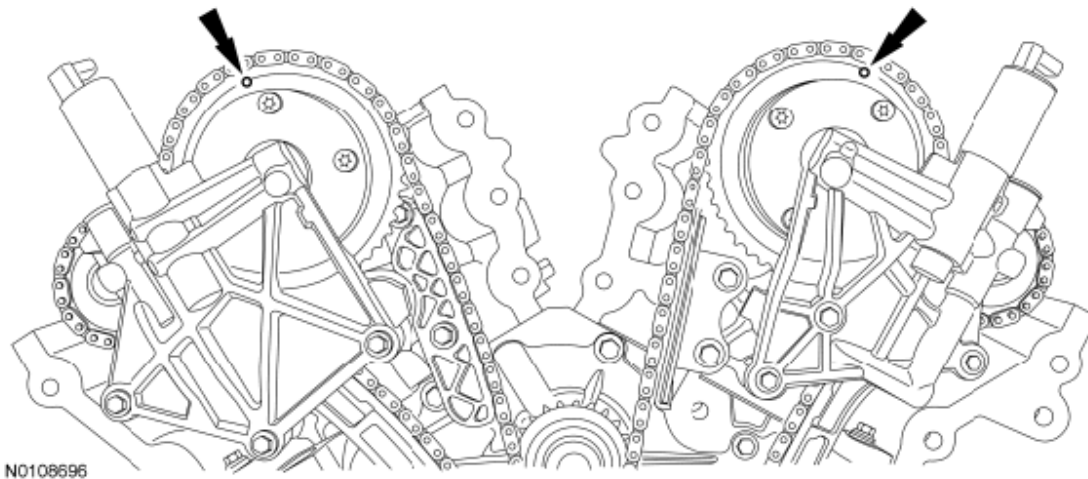


Fig. 361: Locating Timing Marks On Variable Camshaft Timing (VCT) Assemblies
Courtesy of FORD MOTOR CO.

All vehicles

4. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

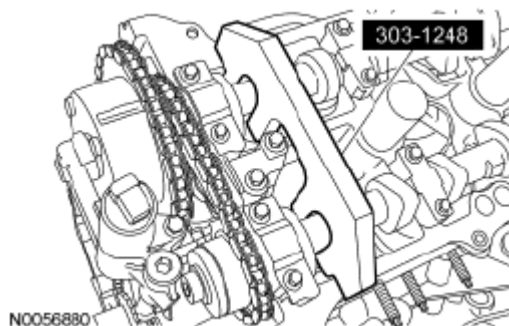


Fig. 362: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

5. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

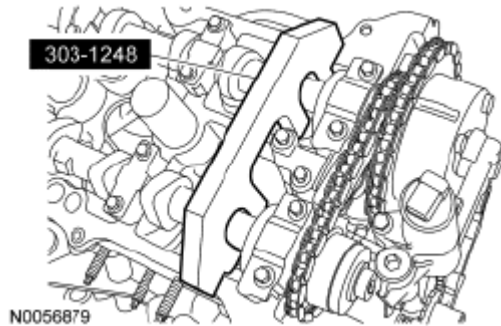


Fig. 363: Installing Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

6. Remove the 3 bolts and the RH VCT housing.

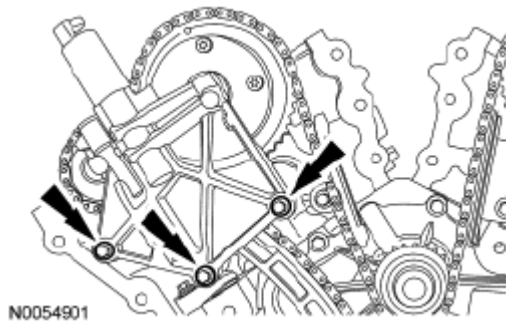


Fig. 364: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

7. Remove the 3 bolts and the LH VCT housing.

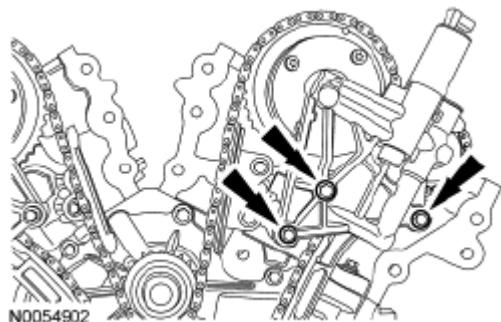


Fig. 365: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

8. Remove the 2 bolts and the primary timing chain tensioner.

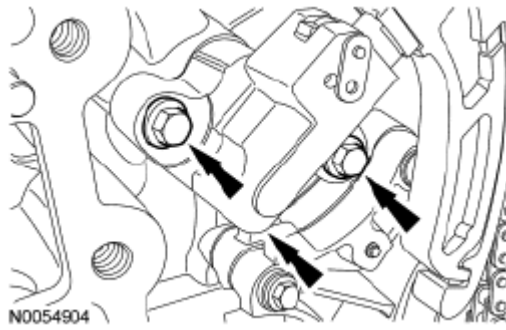


Fig. 366: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

9. Remove the primary timing chain tensioner arm.

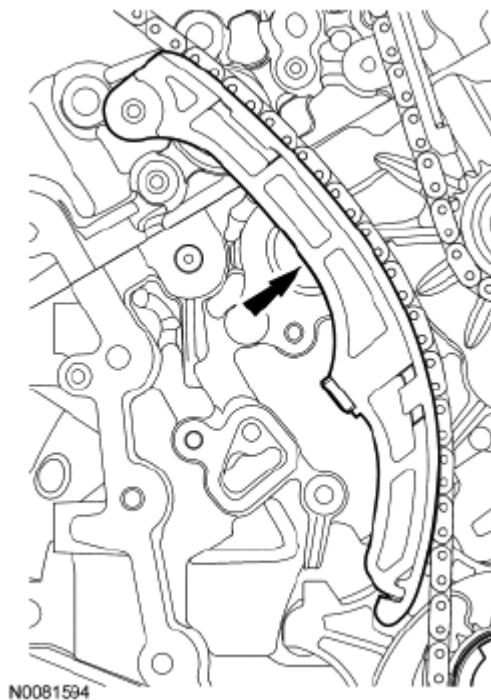
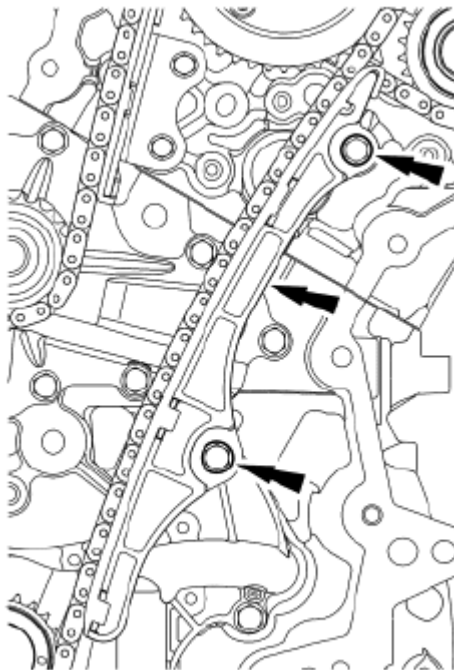


Fig. 367: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

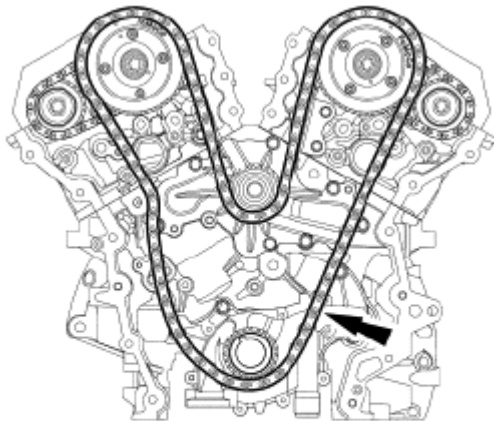
10. Remove the 2 bolts and the lower LH primary timing chain guide.



N0081593

Fig. 368: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

11. Remove the primary timing chain.



N0054908

Fig. 369: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

12. Remove the crankshaft timing chain sprocket.

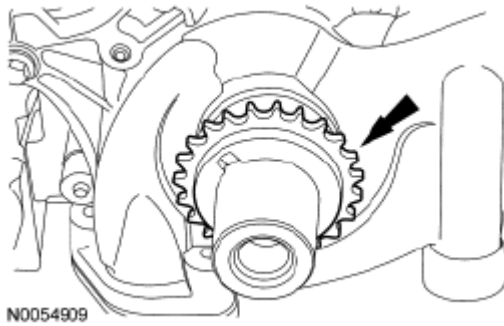


Fig. 370: Locating Crankshaft Timing Chain Sprocket
 Courtesy of FORD MOTOR CO.

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

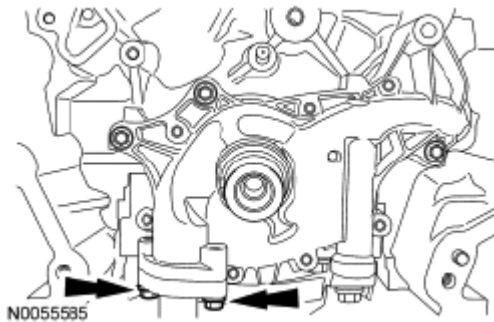


Fig. 371: Locating Oil Pump Screen & Pickup Tube Bolts
 Courtesy of FORD MOTOR CO.

14. Remove the 3 oil pump bolts.
 - Rotate the oil pump clockwise and separate the oil pump from the oil pump screen and pickup tube.
 - Remove the oil pump.
 - Discard the oil pump screen and pickup tube O-ring seal.

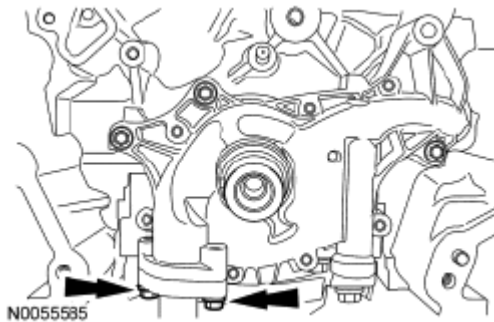


Fig. 372: Locating Oil Pump Screen & Pickup Tube Bolts
 Courtesy of FORD MOTOR CO.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

Special Tool(s)

SPECIAL TOOL TABLE

 ST1341-A	Heavy Duty Floor Crane 014-00071 or equivalent
 ST1382-A	Remover, Crankshaft Rear Oil Seal 303-519 (T95P-6701-EH)
 ST1187-A	Slide Hammer 307-005 (T59L-100-B)
 ST1602-A	Spreader Bar 303-D089 (D93P-6001-A3) or equivalent

Material

ITEM SPECIFICATION TABLE

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

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: This procedure is for removal of the crankshaft rear seal and retainer plate and requires removal of the oil pan. If only removing the crankshaft rear seal, refer to Removal.

1. Remove the oil pan. For additional information, refer to Removal and Installation.
2. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the stand.

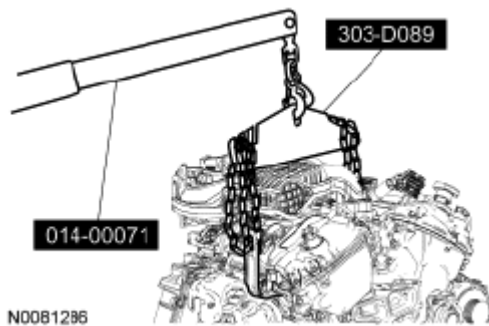


Fig. 373: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

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

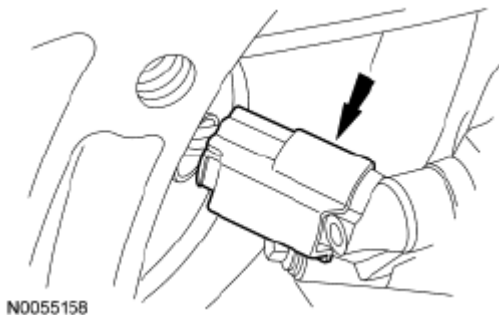


Fig. 374: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

4. Remove the bolt and the CKP sensor.

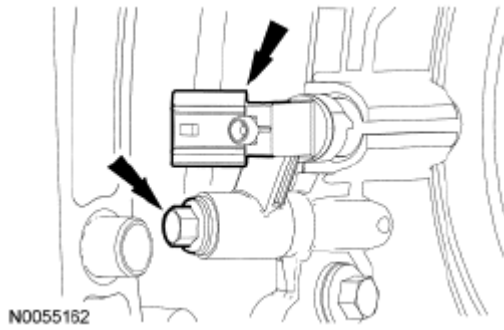


Fig. 375: Locating CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

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

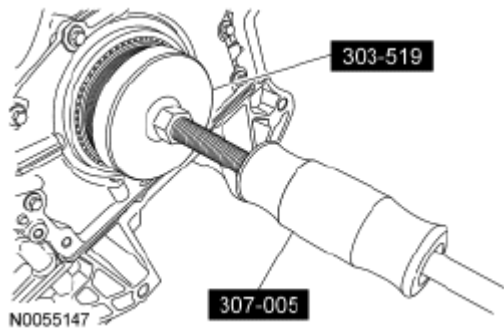


Fig. 376: Identifying Crankshaft Rear Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

6. Remove the 8 crankshaft rear seal retainer bolts.

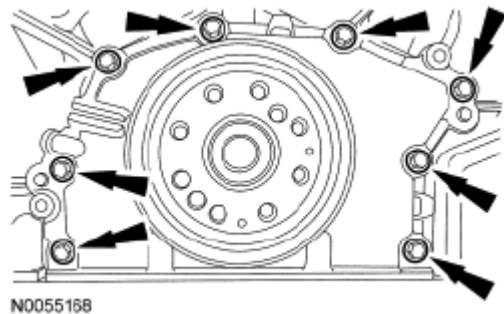


Fig. 377: Locating Crankshaft Rear Seal Retainer Bolts
Courtesy of FORD MOTOR CO.

7. Install the 2 M6 oil pan bolts (finger-tight) into the 2 threaded holes in the crankshaft rear seal retainer.
 - Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.

- Remove the crankshaft rear seal retainer.

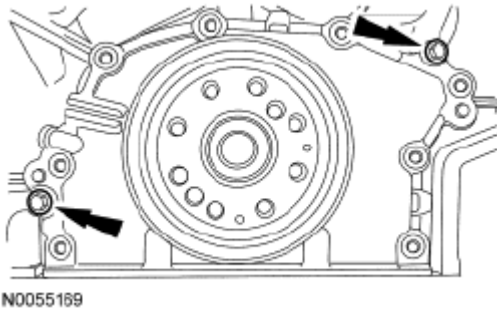


Fig. 378: Locating M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

8. Clean the crankshaft rear seal retainer plate using a 3M™ Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
 - Thoroughly wash the crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: Only use a 3M™ Roloc® Bristle Disk (2-in white, part number 07528) to clean the crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

9. Clean the sealing surfaces of the cylinder block in the following sequence.
 1. Remove any large deposits of silicone or gasket material.
 2. Apply silicone gasket remover and allow to set for several minutes.
 3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.
 4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

NOTE: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

NOTE: Do not use wire brushes, power abrasive discs or 3M™ Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces

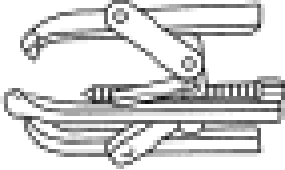
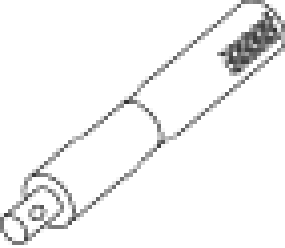
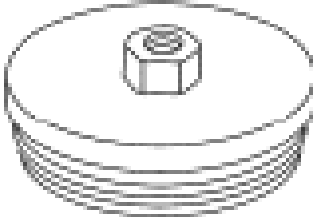
of the gasket.

DISASSEMBLY

ENGINE

Special Tool(s)

SPECIAL TOOL TABLE

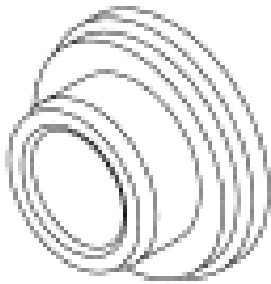
 ST1184-A	3 Jaw Puller 303-D121 or equivalent
 ST1326-A	Handle 205-153 (T80T-4000-W)
 ST1382-A	Remover, Crankshaft Rear Oil Seal 303-519 (T95P-6701-EH)
	Remover, Oil Seal 303-409 (T92C-6700CH)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST1385-A**

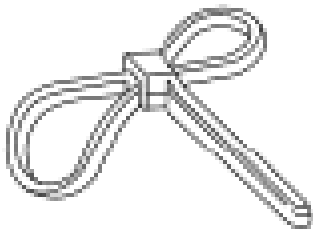
Remover, VCT Spark Plug Tube Seal 303-1247/1

**ST2982-A**

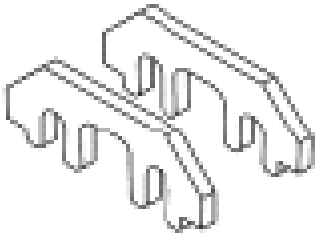
Slide Hammer 307-005 (T59L-100-B)

**ST1187-A**

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

**ST1438-A**

Tool, Camshaft Holding 303-1248



ST2979-A

Material**ITEM SPECIFICATION TABLE**

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

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

NOTE: Early build engines have 11 fastener valve covers, late build engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

NOTE: For additional information, refer to ASSEMBLY .

All vehicles

1. Remove the 8 bolts and the flexplate.

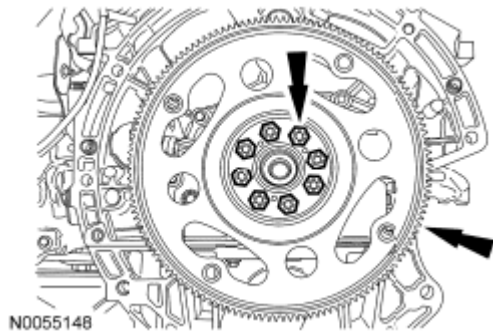


Fig. 379: Locating Flexplate & Bolts
Courtesy of FORD MOTOR CO.

2. Remove the crankshaft sensor ring.

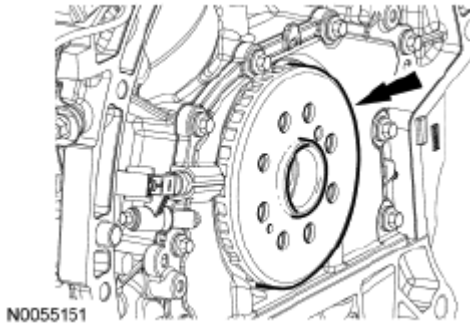


Fig. 380: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

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

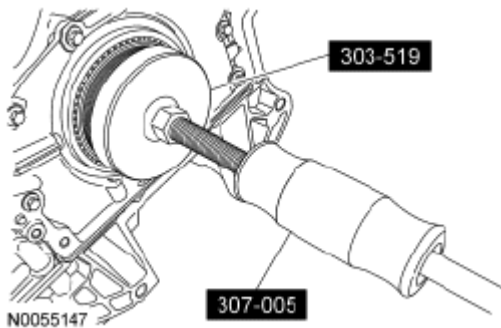


Fig. 381: Identifying Crankshaft Rear Oil Seal Remover And Slide Hammer
Courtesy of FORD MOTOR CO.

4. Mount the engine on a suitable engine stand.

NOTE: Install the engine stand bolts into the cylinder block only. Do not install

the bolts into the oil pan.

5. If equipped, detach the block heater wiring harness retainer from the upper intake manifold.



Fig. 382: Locating Block Heater Wiring Harness Retainer From Upper Intake Manifold
Courtesy of FORD MOTOR CO.

6. If equipped, remove the heat shield and disconnect the block heater electrical connector.

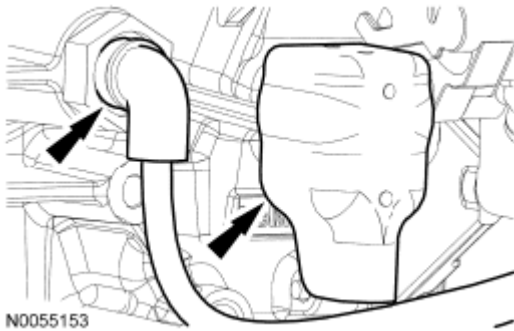


Fig. 383: Locating Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

7. If equipped, detach the block heater wiring harness retainer from the power steering reservoir hose and the Power Steering Pressure (PSP) hose.
- Remove the block heater wiring harness from the engine.

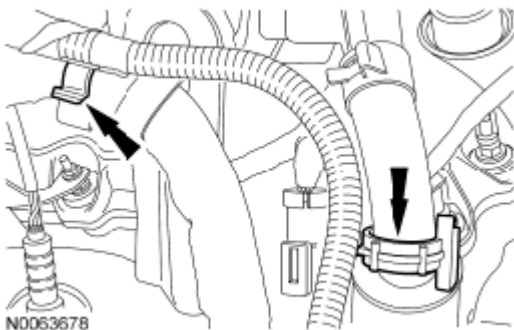


Fig. 384: Locating Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

8. Disconnect the PCV hose from the PCV valve.

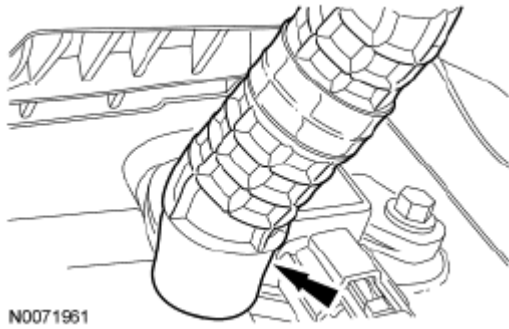


Fig. 385: Locating PCV Hose
Courtesy of FORD MOTOR CO.

9. Disconnect the Throttle Body (TB) electrical connector.

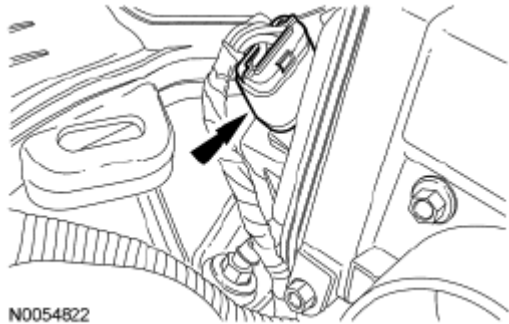


Fig. 386: Locating Throttle Body (TB) Electrical Connector
Courtesy of FORD MOTOR CO.

10. Detach the wiring harness retainers from the upper intake manifold.

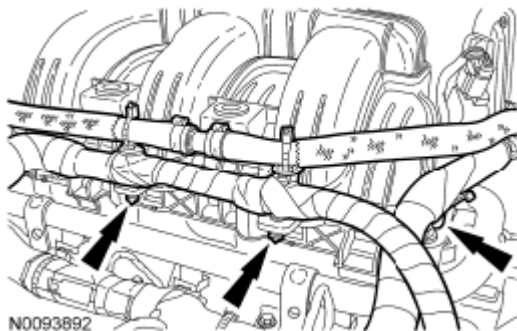


Fig. 387: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

11. Remove the upper intake manifold support bracket bolt.

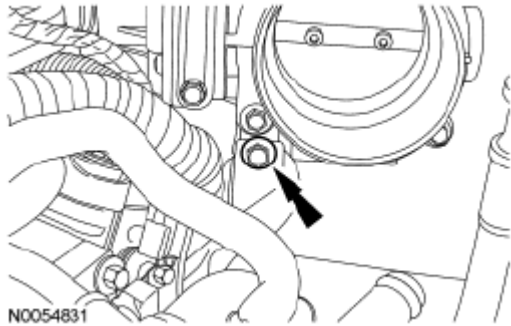


Fig. 388: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

12. Remove the 6 bolts and the upper intake manifold.
 - Discard the gaskets.

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

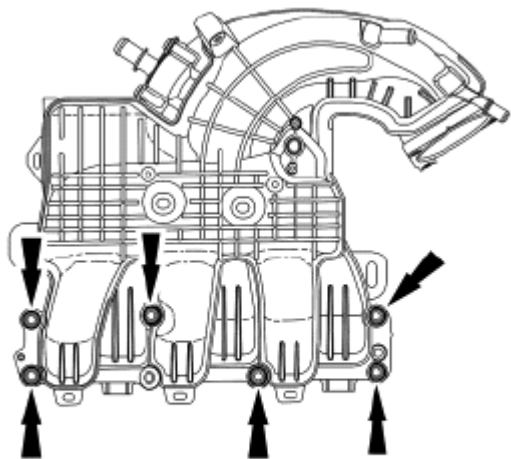


Fig. 389: Locating Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

13. Disconnect the **PSP** switch electrical connector.

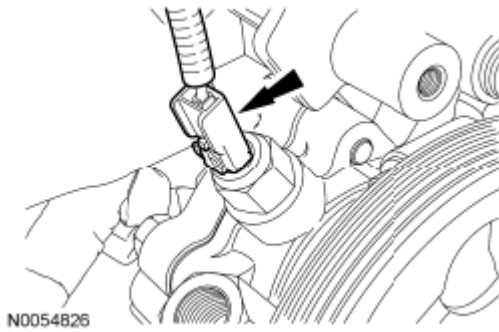


Fig. 390: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

14. Disconnect the RH Catalyst Monitor Sensor (CMS) sensor electrical connector.

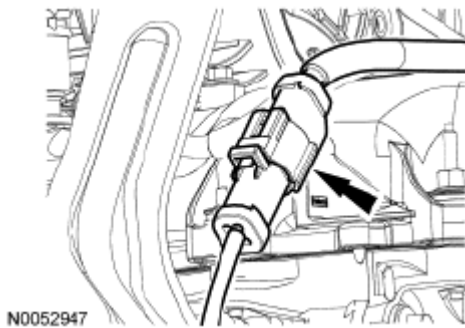


Fig. 391: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

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

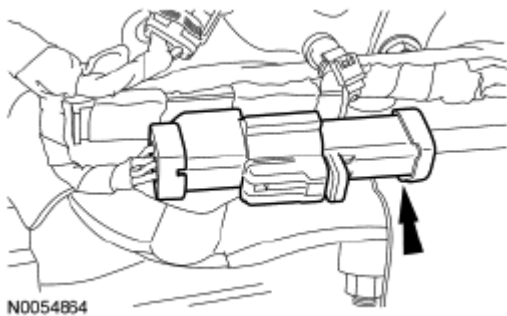


Fig. 392: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

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

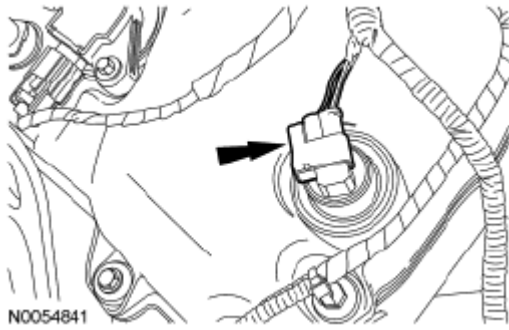


Fig. 393: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

17. Disconnect the 3 RH coil-on-plug electrical connectors.

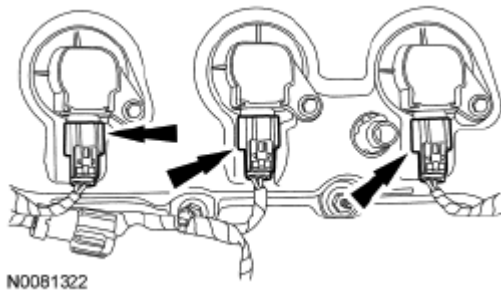


Fig. 394: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

18. Detach all of the wiring harness retainers from the RH valve cover and stud bolts.
19. Disconnect the coolant bypass hose from the thermostat housing.

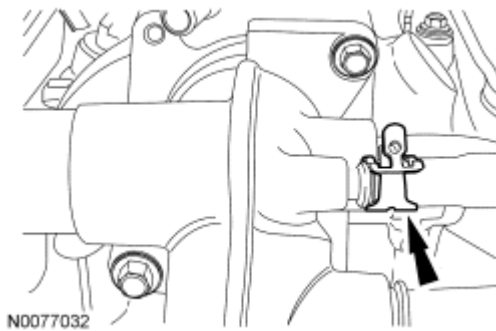


Fig. 395: Locating Coolant Bypass Hose To Thermostat Housing
Courtesy of FORD MOTOR CO.

20. Disconnect the RH Camshaft Position (CMP) sensor electrical connector.

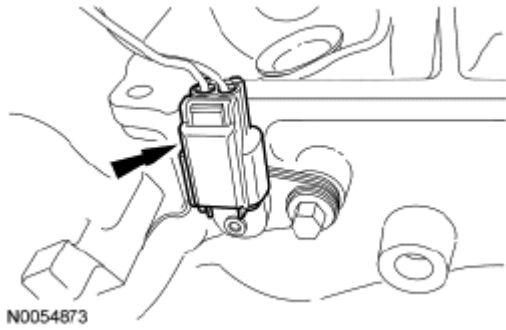


Fig. 396: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

21. Disconnect the Knock Sensor (KS) electrical connector.

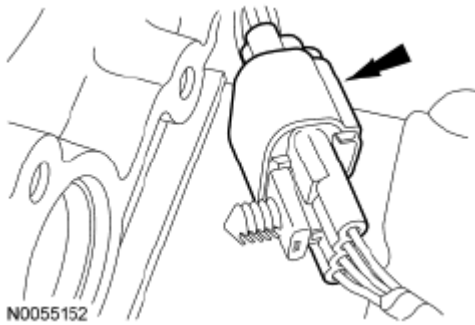


Fig. 397: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

22. Disconnect the 6 fuel injector electrical connectors (3 shown in illustration).

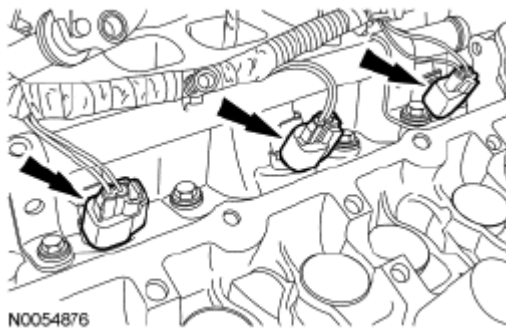


Fig. 398: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

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

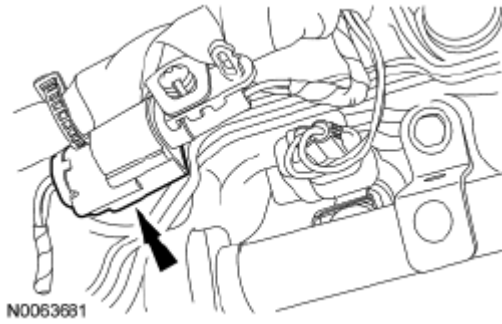


Fig. 399: Identifying Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Disconnect the LH CMP sensor electrical connector.

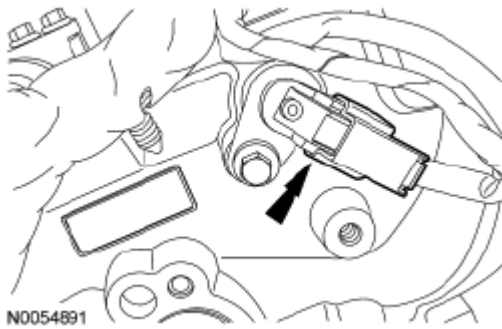


Fig. 400: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

25. Disconnect the LH CMS sensor electrical connector.

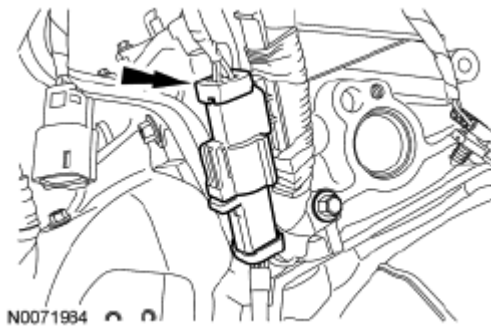


Fig. 401: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

26. Disconnect the LH HO2S electrical connector.

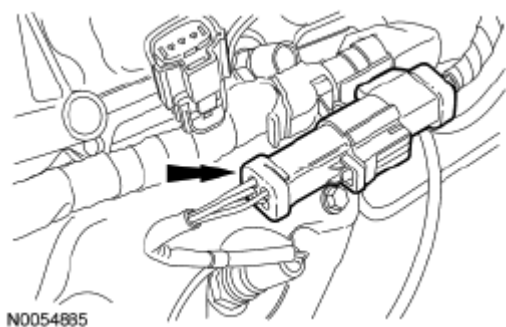


Fig. 402: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

27. Disconnect the 3 LH coil-on-plug electrical connectors.

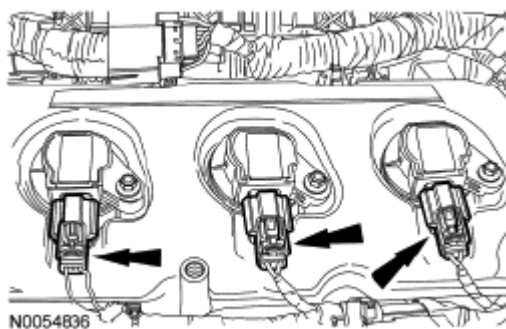


Fig. 403: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

28. Disconnect the LH VCT solenoid electrical connector.

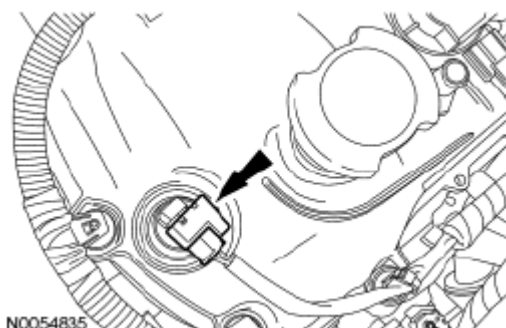


Fig. 404: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

29. Detach all of the wiring harness retainers from the LH valve cover and stud bolts.
30. Remove the wiring harness retainer bolt from the rear of the LH cylinder head.

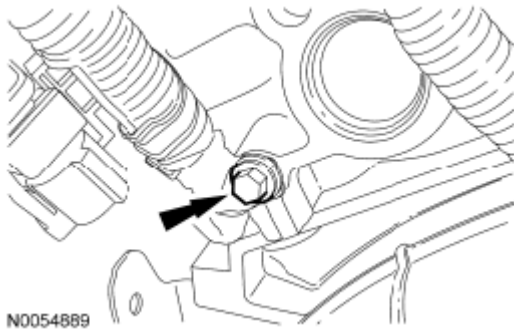


Fig. 405: Locating Wiring Harness Retainer Bolt
Courtesy of FORD MOTOR CO.

31. Remove the nut, the bolt and the heat shield.

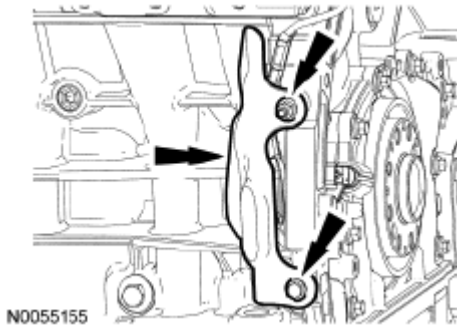


Fig. 406: Locating Nut, Bolt & Heat Shield
Courtesy of FORD MOTOR CO.

32. Remove the wiring harness retainer stud bolt.



Fig. 407: Locating Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

33. Remove the wiring harness grommet.

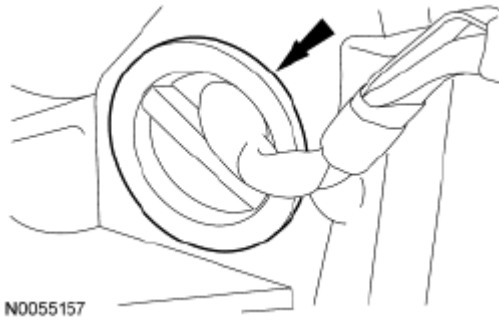


Fig. 408: Locating Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

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

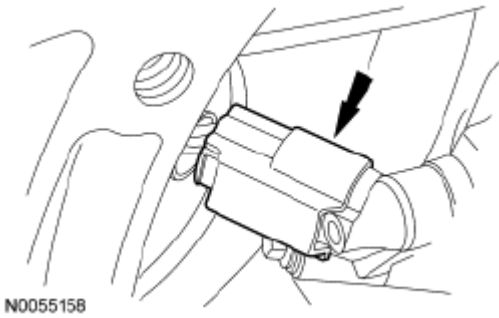


Fig. 409: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

35. Disconnect the A/C compressor electrical connector.

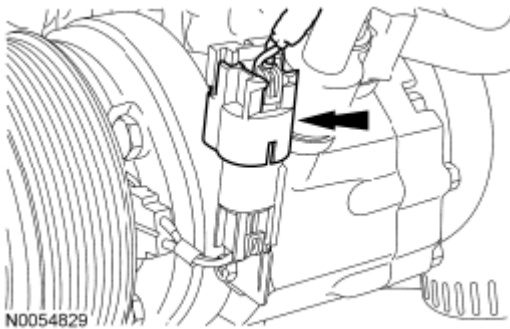


Fig. 410: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

36. Remove the nut and disconnect the generator B+ cable.

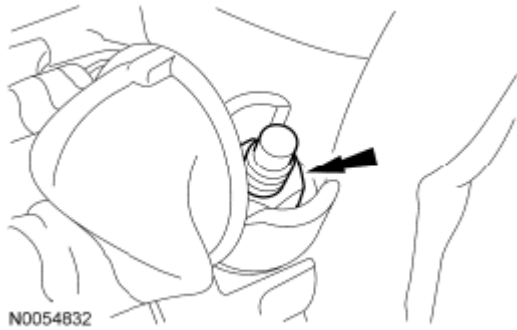


Fig. 411: Locating Generator B+ Cable Nut
Courtesy of FORD MOTOR CO.

37. Disconnect the generator electrical connector.

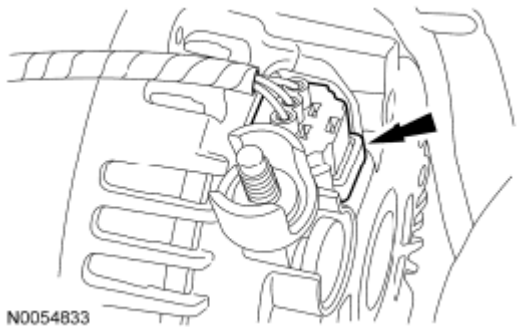


Fig. 412: Locating Electronic Automatic Temperature Control Hose
Courtesy of FORD MOTOR CO.

38. Detach the wiring harness retainer from the generator.

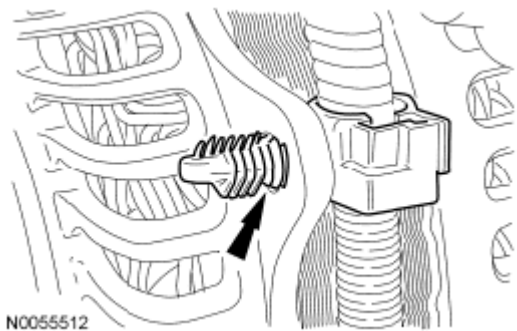


Fig. 413: Locating Wiring Harness Retainer To Generator
Courtesy of FORD MOTOR CO.

39. Disconnect the Engine Oil Pressure (EOP) switch electrical connector and the wiring harness pin-type retainer.
 - Remove the wiring harness from the engine.

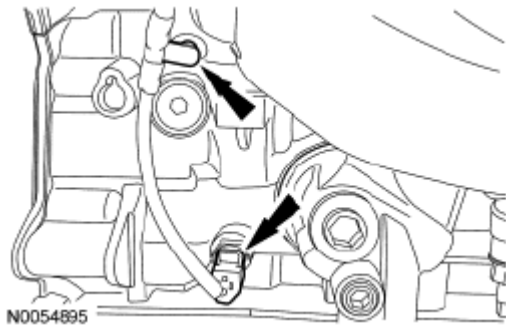


Fig. 414: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
 Courtesy of FORD MOTOR CO.

40. Remove the bolt and the A/C manifold.
 - Discard the O-ring seals.

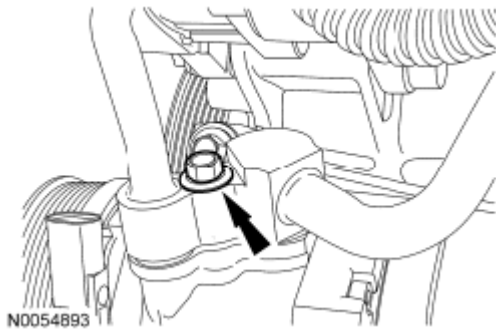


Fig. 415: Locating O-Ring Seals
 Courtesy of FORD MOTOR CO.

41. Remove the nut, 2 bolts and the A/C compressor.

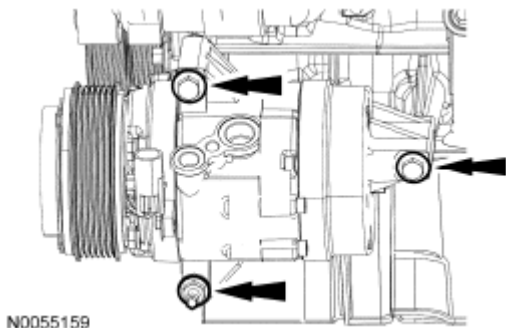


Fig. 416: Locating A/C Compressor, Bolt & Nut
 Courtesy of FORD MOTOR CO.

42. Remove the A/C compressor mounting stud from the oil pan.

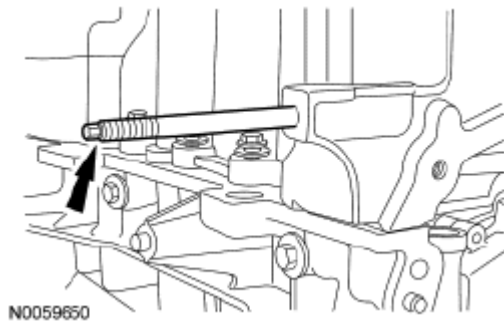


Fig. 417: Locating A/C Compressor Mounting Stud
Courtesy of FORD MOTOR CO.

43. Remove the bolt, nut and the generator.

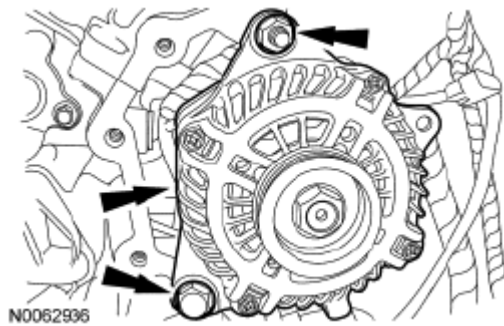


Fig. 418: Locating Nut, Bolt & Generator
Courtesy of FORD MOTOR CO.

44. Detach the PSP hose retainer from the engine lifting eye.

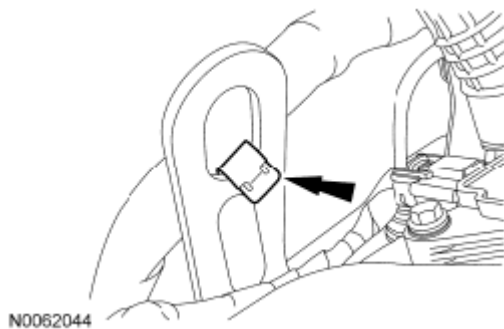


Fig. 419: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

45. Remove the PSP hose bracket nut.

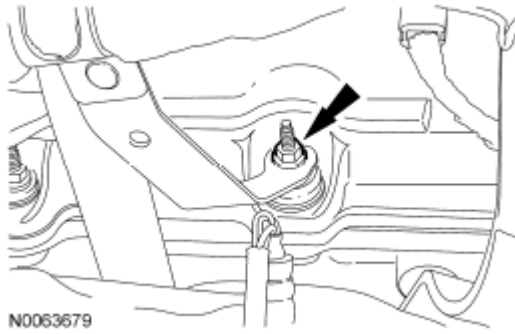


Fig. 420: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

46. Remove the PSP tube bracket bolt from the RH cylinder head.

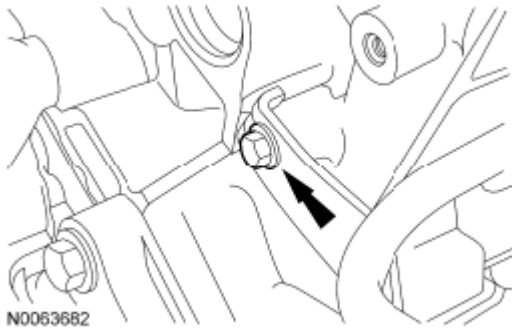


Fig. 421: Locating Power Steering Pressure Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

47. Remove the 3 bolts and the power steering pump.

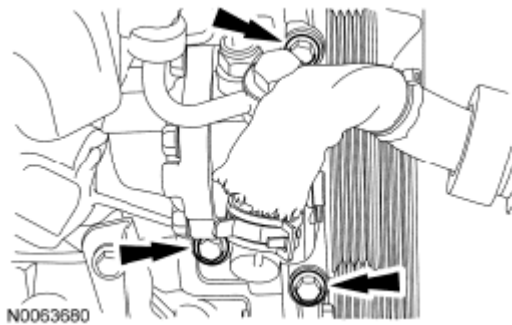


Fig. 422: Locating Power Steering Pump & Bolts
Courtesy of FORD MOTOR CO.

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

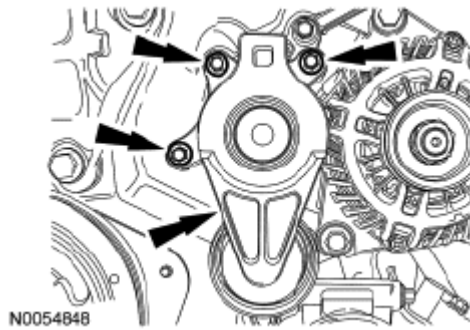


Fig. 423: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

49. Remove the 4 nuts (3 shown in illustration) and the LH catalytic converter.
- Discard the nuts and the gasket.

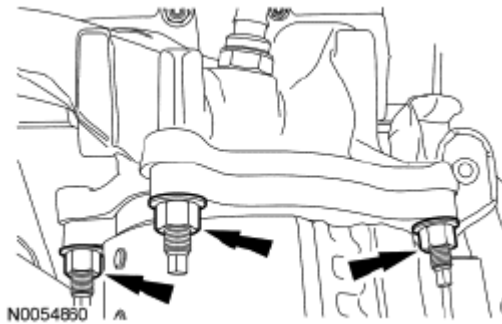


Fig. 424: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

50. Remove the 3 bolts and the LH exhaust manifold heat shield.

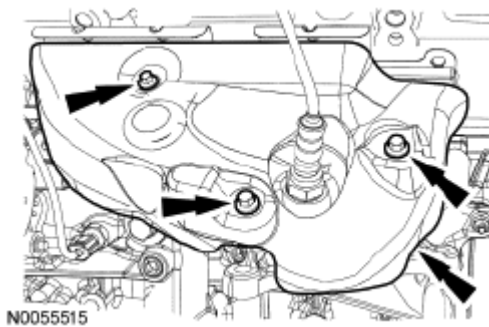


Fig. 425: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

51. Remove the 6 nuts and the LH exhaust manifold.
- Discard the nuts and the exhaust manifold gasket.

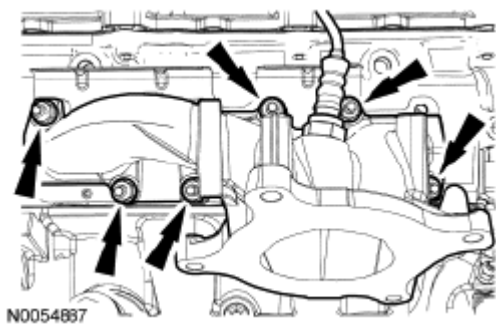


Fig. 426: Locating Exhaust Manifold Gasket Nuts
 Courtesy of FORD MOTOR CO.

52. Clean and inspect the LH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
53. Remove and discard the 6 LH exhaust manifold studs.

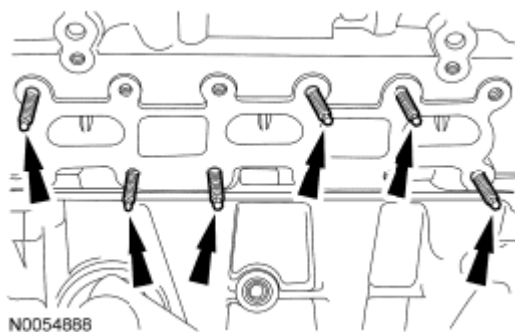


Fig. 427: Locating LH Exhaust Manifold Studs
 Courtesy of FORD MOTOR CO.

FWD vehicles

54. Remove the 4 nuts and the RH catalytic converter.
 - Discard the nuts and the gasket.

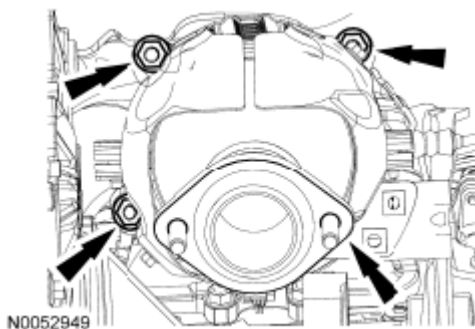


Fig. 428: Locating RH Catalytic Converter & Nuts
 Courtesy of FORD MOTOR CO.

All vehicles

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

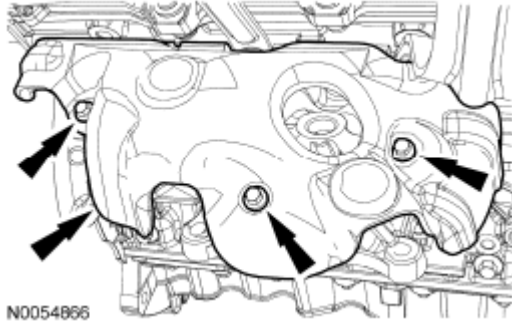


Fig. 429: Locating RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

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

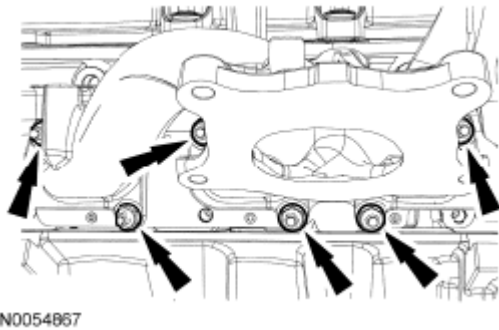


Fig. 430: Locating RH Exhaust Manifold & Nuts
Courtesy of FORD MOTOR CO.

57. Clean and inspect the RH exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
58. Remove and discard the 6 RH exhaust manifold studs.

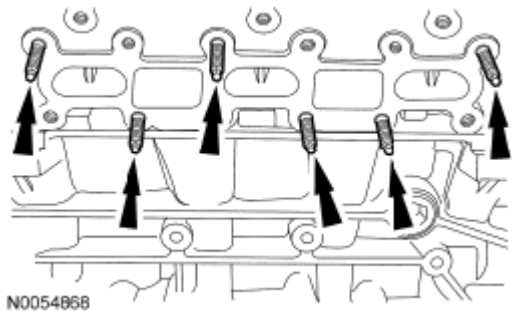


Fig. 431: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

59. Remove the RH cylinder block drain plug or, if equipped, the block heater.
- Allow coolant to drain from the cylinder block.

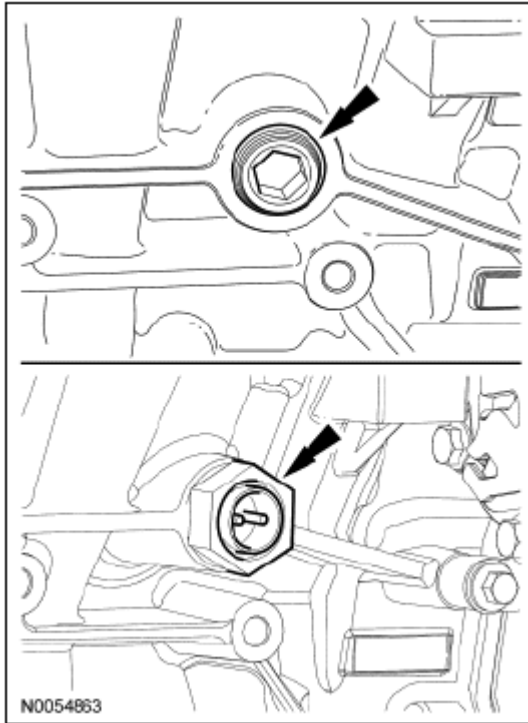


Fig. 432: Locating RH Cylinder Block Drain Plug & Block Heater
Courtesy of FORD MOTOR CO.

60. Remove the LH cylinder block drain plug.
- Allow coolant to drain from the cylinder block.

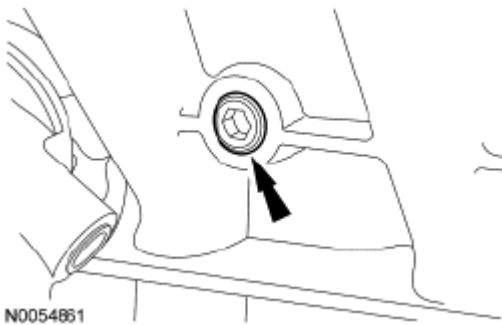


Fig. 433: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

61. Remove the pin-type retainer and the cover.

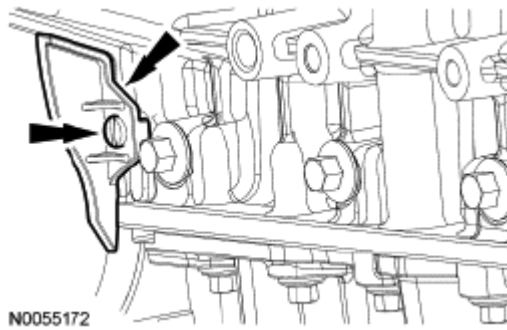


Fig. 434: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

62. Remove the 2 bolts and the engine lifting eye.

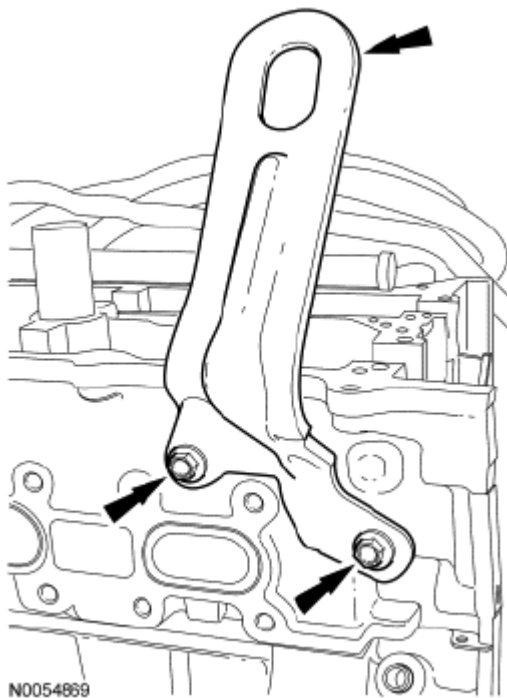


Fig. 435: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

63. Remove the bolt and the upper intake manifold support bracket.

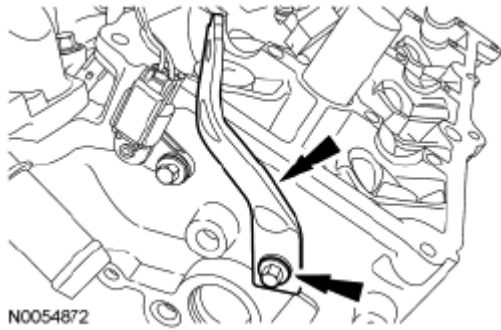


Fig. 436: Locating Upper Intake Manifold Support Bracket & Bolt
Courtesy of FORD MOTOR CO.

64. Remove the bolt and the RH CMP sensor.

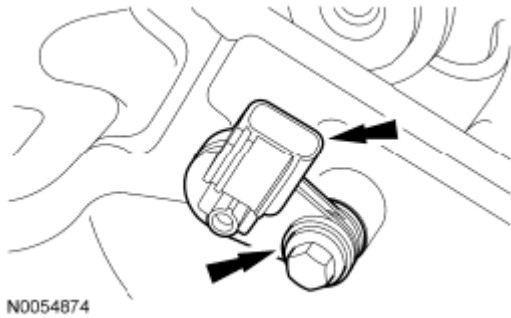


Fig. 437: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

65. Remove the 2 bolts and the catalytic converter bracket.

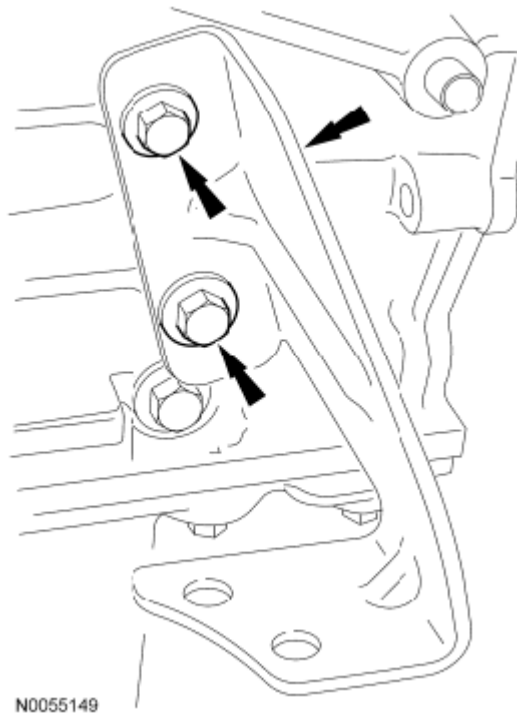


Fig. 438: Locating Catalytic Converter Bracket & Bolt
Courtesy of FORD MOTOR CO.

All vehicles

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

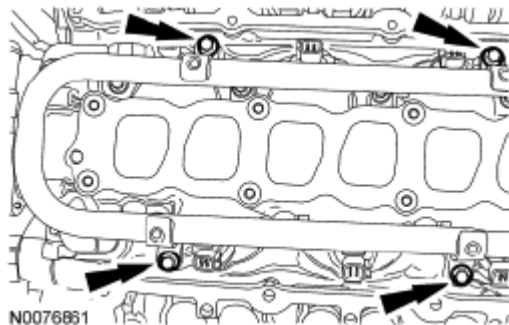


Fig. 439: Locating Fuel Rail & Injectors Assembly Bolts
Courtesy of FORD MOTOR CO.

67. Remove the 2 thermostat housing-to-lower intake manifold bolts.
- Remove the thermostat housing and discard the gasket.

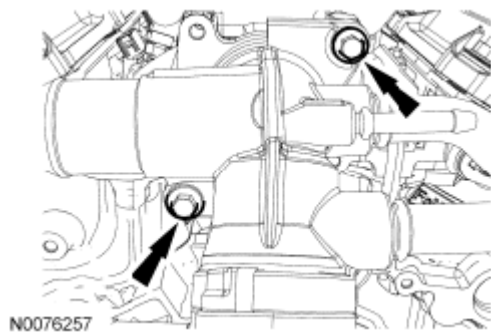


Fig. 440: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

68. Remove the 10 bolts and the lower intake manifold.
 - Discard the gaskets.

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

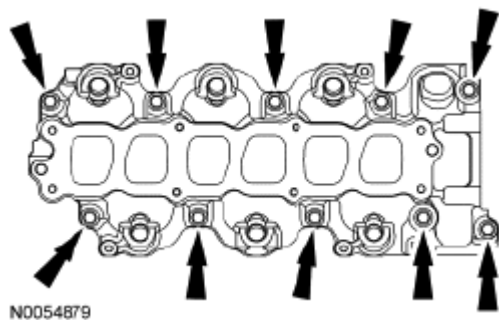


Fig. 441: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

69. Disconnect and remove the CHT sensor jumper harness.

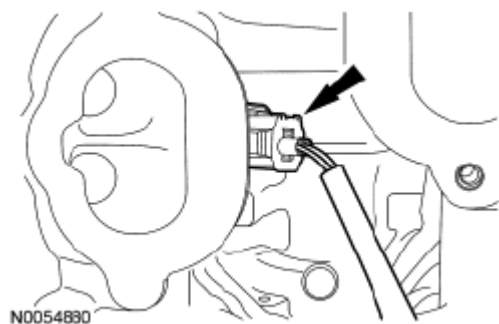


Fig. 442: Locating CHT Sensor Jumper Harness

Courtesy of FORD MOTOR CO.

70. Remove the bolt and the LH CMP sensor.

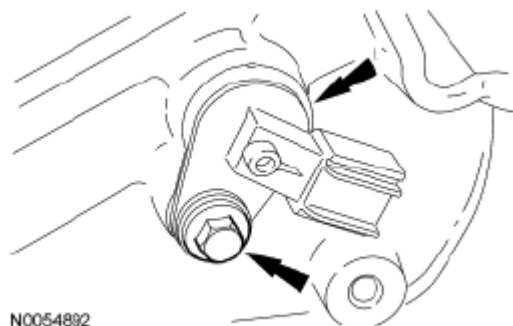


Fig. 443: Locating LH CMP Sensor And Bolt
Courtesy of FORD MOTOR CO.

71. Remove the bolt and the CKP sensor.

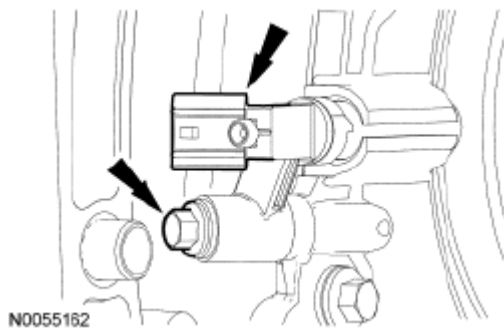


Fig. 444: Locating CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

72. Remove the EOP switch.

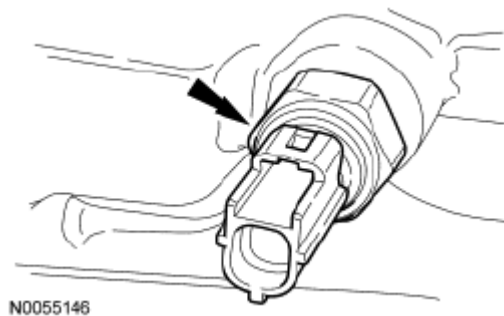


Fig. 445: Locating EOP Switch
Courtesy of FORD MOTOR CO.

Early build vehicles

73. Remove the 2 bolts and the oil filter adapter.
- Discard the gasket and the O-ring seal.

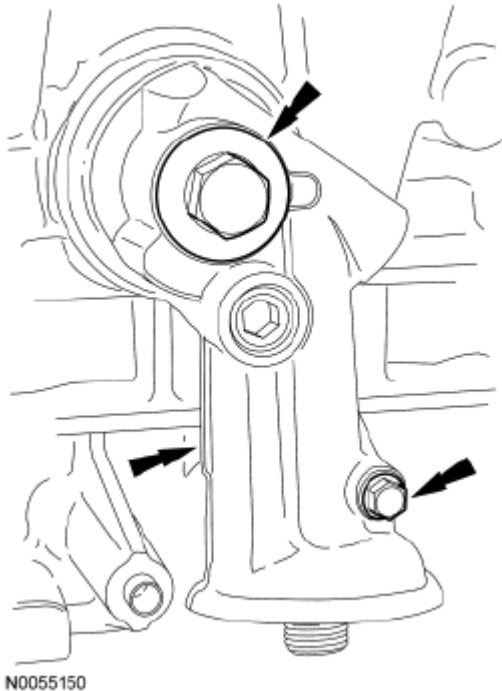
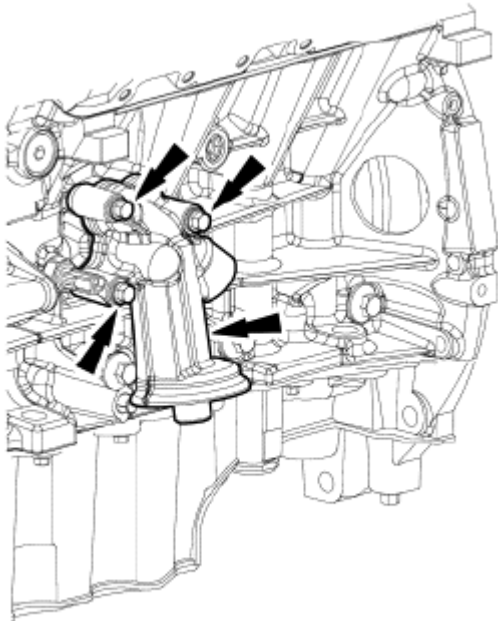


Fig. 446: Locating Oil Filter Adapter, O-Ring Seal & Bolts
Courtesy of FORD MOTOR CO.

Late build vehicles

74. Remove the 3 bolts and the oil filter adapter.
- Discard the gasket.



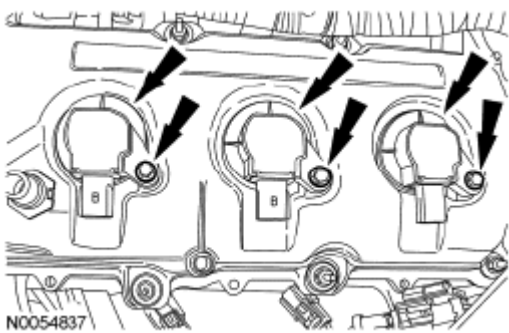
N0097838

Fig. 447: Locating Oil Filter Adapter & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

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

NOTE: LH shown in illustration, RH similar.



N0054837

Fig. 448: Locating Bolts And Coil-On-Plug Assemblies
Courtesy of FORD MOTOR CO.

76. Remove the 2 nuts and the wiring harness retaining bracket.

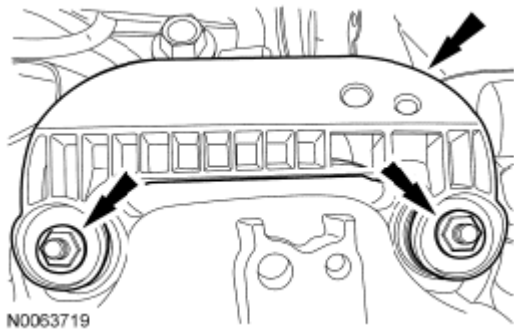


Fig. 449: Locating Wiring Harness Retaining Bracket & Bolt
 Courtesy of FORD MOTOR CO.

Early build vehicles

77. Loosen the 11 stud bolts and remove the LH valve cover.
 - Discard the gasket.

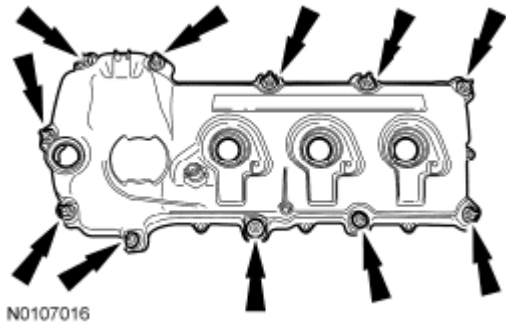


Fig. 450: Locating Stud Bolts & Valve Cover
 Courtesy of FORD MOTOR CO.

78. Loosen the bolt, the 10 stud bolts and remove the RH valve cover.
 - Discard the gasket.

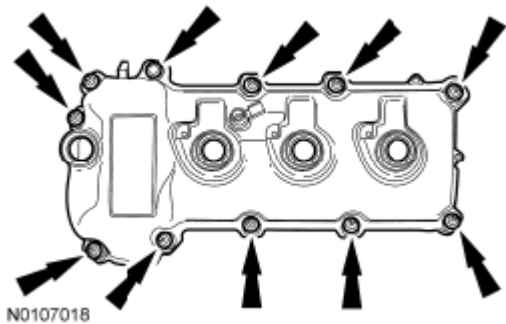


Fig. 451: Locating Stud Bolts & Valve Cover
 Courtesy of FORD MOTOR CO.

Late build vehicles

79. Loosen the 9 stud bolts and remove the LH valve cover.
- Discard the gasket.

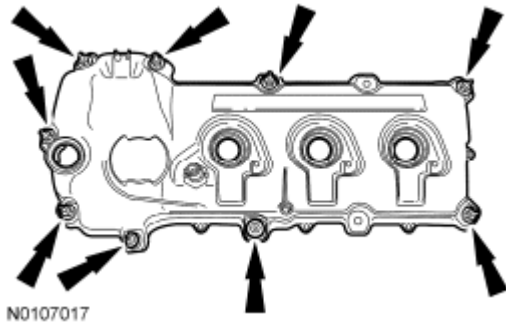


Fig. 452: Locating Stud Bolts & Valve Cover
Courtesy of FORD MOTOR CO.

80. Loosen the 9 stud bolts and remove the RH valve cover.
- Discard the gasket.

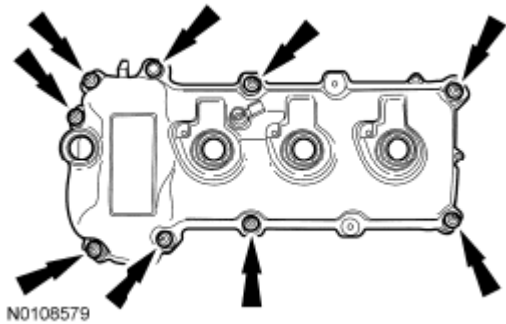


Fig. 453: Locating Stud Bolts & RH Valve Cover
Courtesy of FORD MOTOR CO.

All vehicles

81. Inspect the VCT solenoid seals and the spark plug tube seals. Remove any damaged seals.
- Using the VCT Spark Plug Tube Seal Remover and Handle, remove the seal(s).

NOTE: VCT solenoid seal removal shown in illustration, spark plug tube seal removal similar.

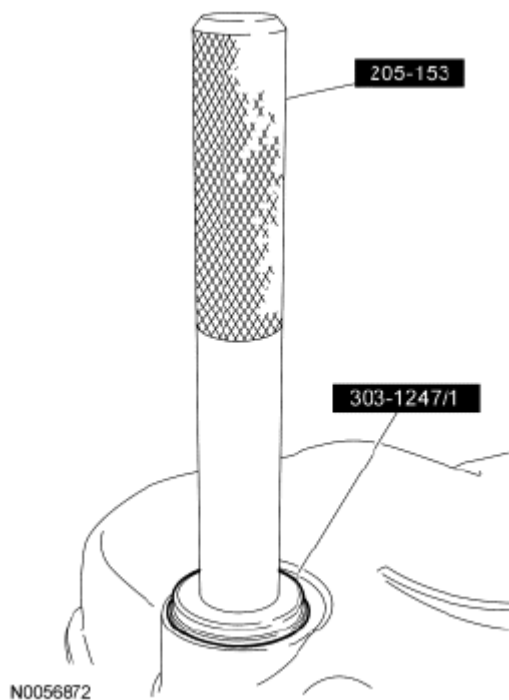


Fig. 454: Identifying VCT Spark Plug Tube Seal Remover And Handle
Courtesy of FORD MOTOR CO.

82. Using the Strap Wrench, remove the crankshaft pulley bolt and washer.
- Discard the bolt.

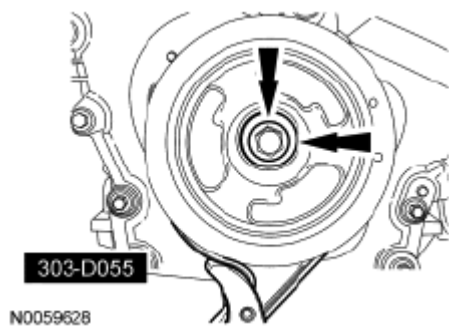


Fig. 455: Locating Crankshaft Pulley Bolt & Washer
Courtesy of FORD MOTOR CO.

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

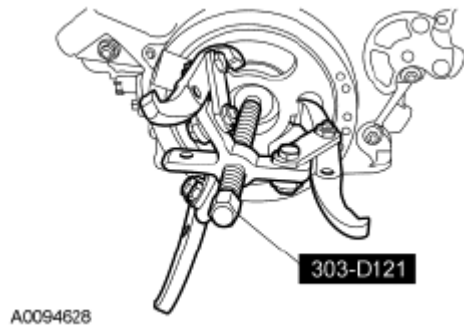


Fig. 456: Identifying Jaw Puller
Courtesy of FORD MOTOR CO.

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

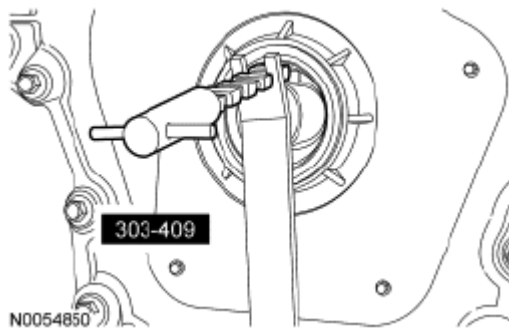


Fig. 457: Identifying Oil Seal Remover
Courtesy of FORD MOTOR CO.

85. Remove the 2 bolts and the engine mount bracket.

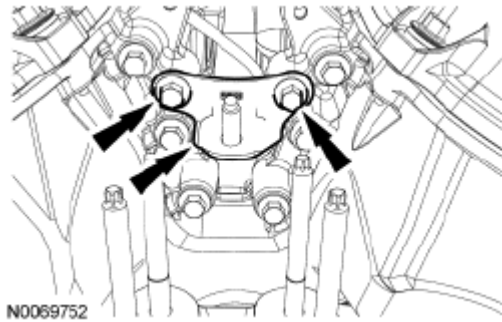


Fig. 458: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

86. Remove the 2 engine mount studs.

NOTE: Only use hand tools to remove the studs.

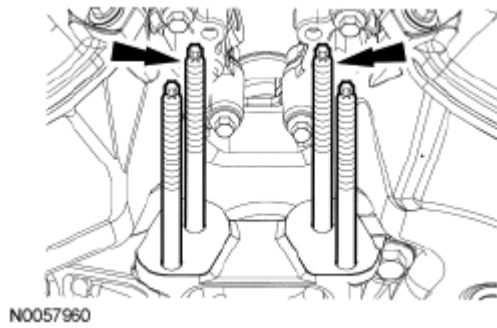


Fig. 459: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

87. Remove the 3 bolts and the engine mount bracket.

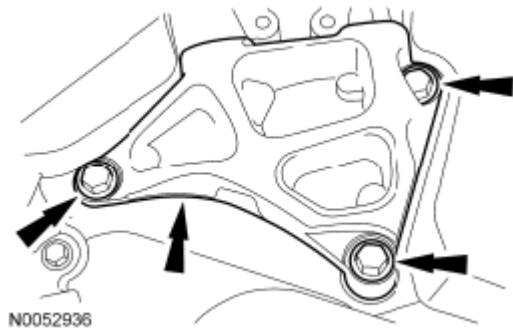
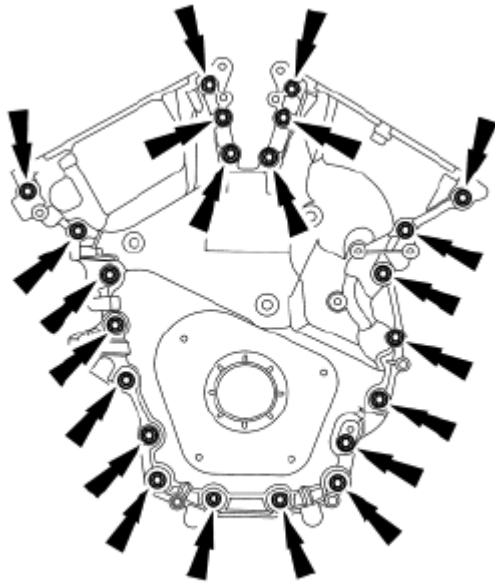


Fig. 460: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

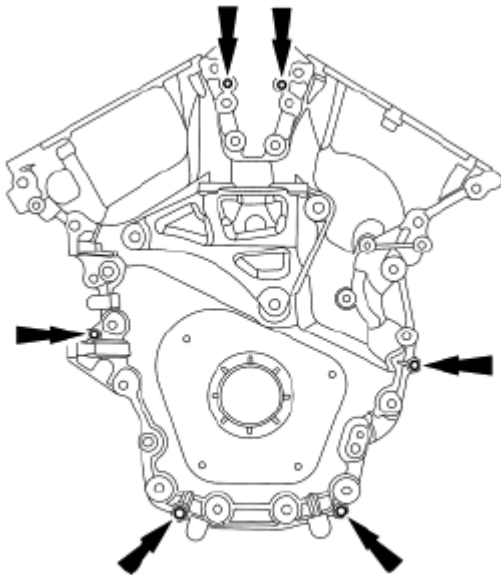
88. Remove the 22 engine front cover bolts.



N0054851

Fig. 461: Locating Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

89. Install 6 of the engine front cover bolts (finger-tight) into the 6 threaded holes in the engine front cover in the following sequence.
1. Tighten the bolts one turn at a time in a crisscross pattern until the engine front cover-to-cylinder block seal is released.
 2. Remove the engine front cover.



N0082530

Fig. 462: Identifying Engine Front Cover Bolt
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

90. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown in illustration.

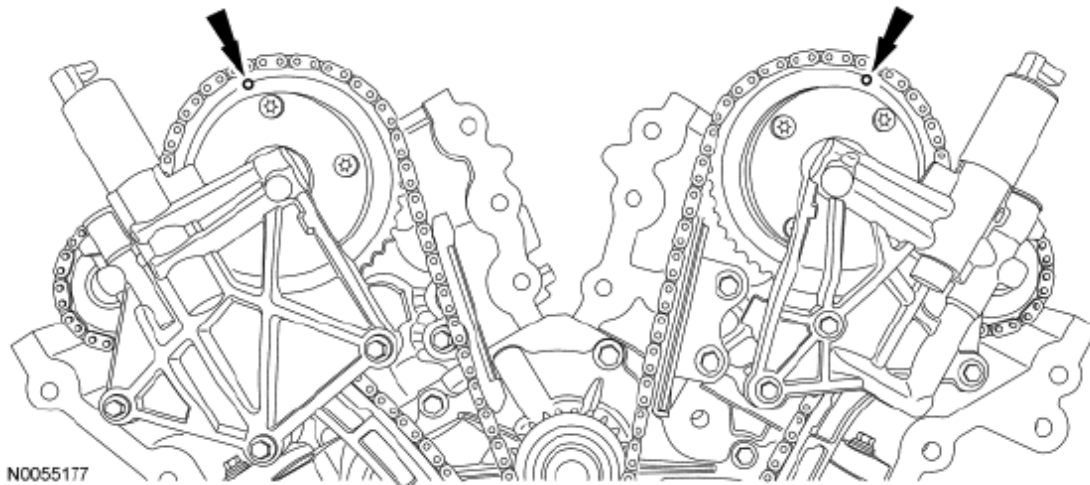


Fig. 463: Locating Timing Marks On Variable Camshaft Timing (VCT)
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

91. Rotate the crankshaft clockwise and align the timing marks on the VCT assemblies as shown in illustration.

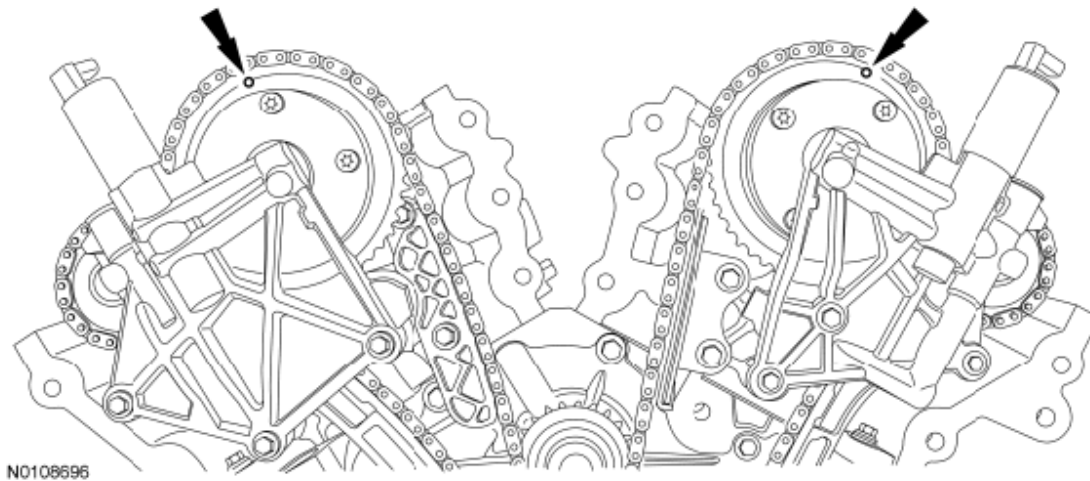


Fig. 464: Locating Timing Marks On VCT Assemblies
Courtesy of FORD MOTOR CO.

All vehicles

92. Install the Camshaft Holding Tool onto the flats of the LH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the Top Dead Center (TDC) position.

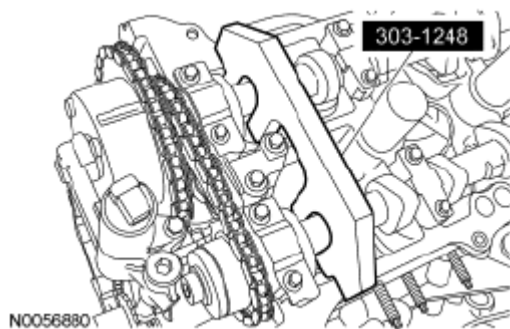


Fig. 465: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

93. Install the Camshaft Holding Tool onto the flats of the RH camshafts.

NOTE: The Camshaft Holding Tool will hold the camshafts in the TDC position.

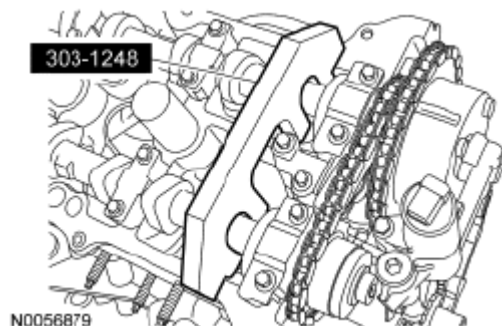


Fig. 466: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

94. Remove the 3 bolts and the RH VCT housing.

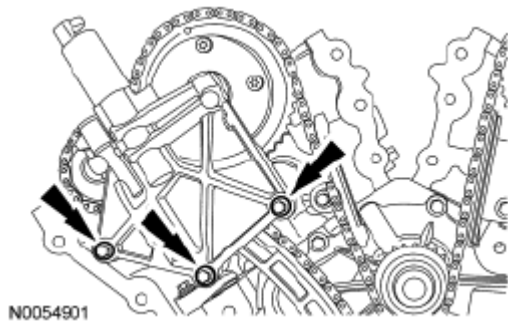


Fig. 467: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

95. Remove the 3 bolts and the LH VCT housing.

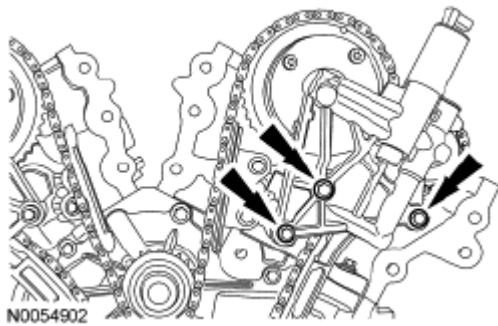


Fig. 468: Locating VCT Housing Bolts
Courtesy of FORD MOTOR CO.

96. Remove the 2 bolts and the primary timing chain tensioner.

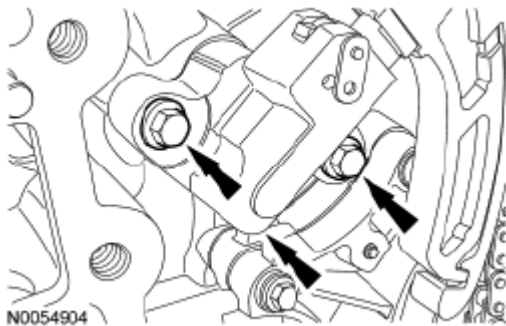


Fig. 469: Locating Primary Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

97. Remove the primary timing chain tensioner arm.

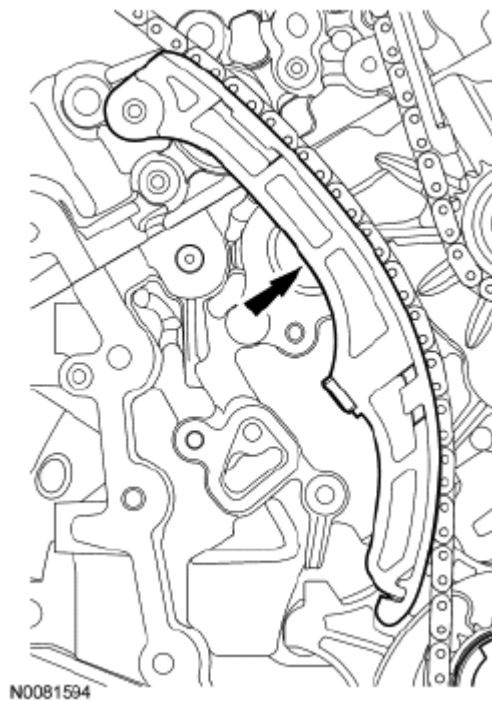


Fig. 470: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

98. Remove the 2 bolts and the lower LH primary timing chain guide.

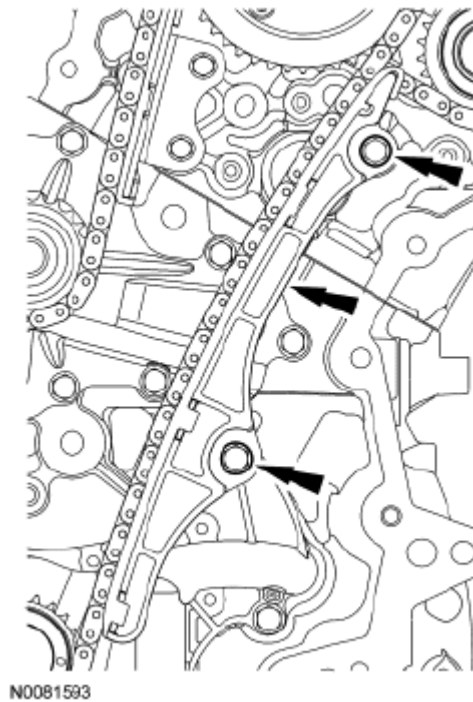
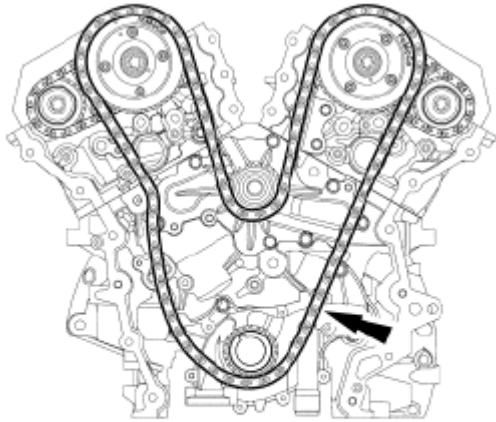


Fig. 471: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

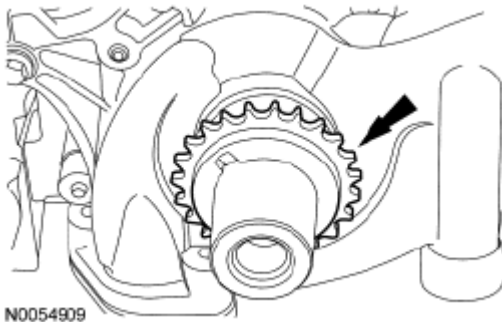
99. Remove the primary timing chain.



N0054908

Fig. 472: Locating Primary Timing Chain
Courtesy of FORD MOTOR CO.

100. Remove the crankshaft timing chain sprocket.



N0054909

Fig. 473: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

101. Remove the 2 bolts and the upper LH primary timing chain guide.

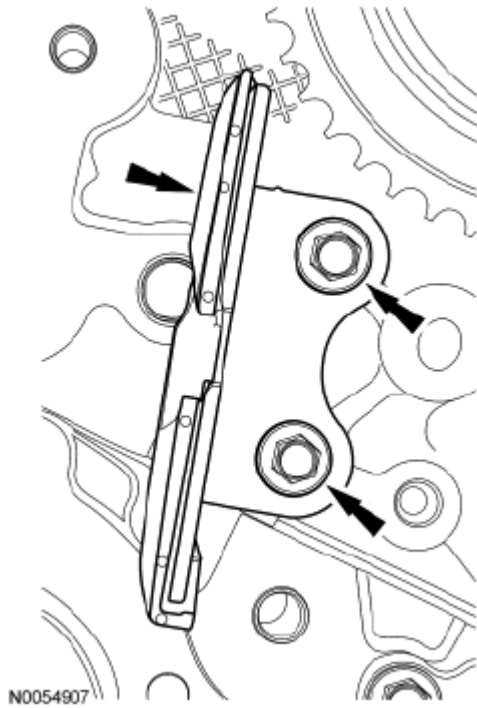


Fig. 474: Locating Upper LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

102. Compress the LH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in the collapsed position.

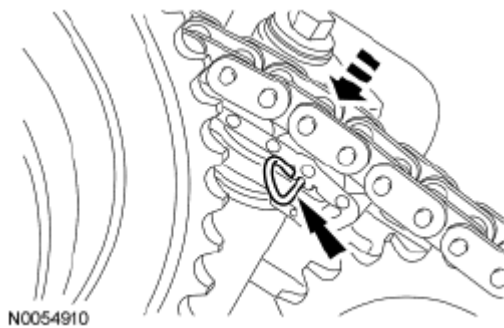


Fig. 475: Compressing LH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

103. Remove and discard the LH VCT assembly bolt and the LH exhaust camshaft sprocket bolt.
 - Remove the LH VCT assembly, secondary timing chain and the LH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

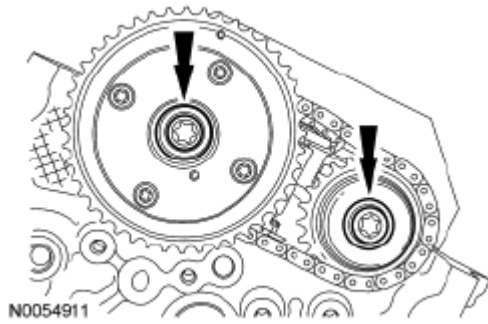


Fig. 476: Locating VCT Bolt & Exhaust Camshaft Bolt
Courtesy of FORD MOTOR CO.

104. Remove the Camshaft Holding Tool from the LH camshafts.

NOTE: When the Camshaft Holding Tool is removed, valve spring pressure will rotate the LH camshafts approximately 3 degrees to a neutral position.

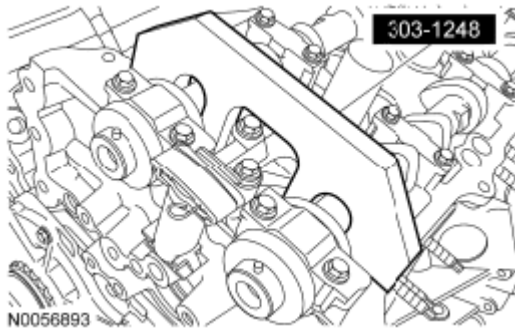


Fig. 477: Identifying Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

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

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

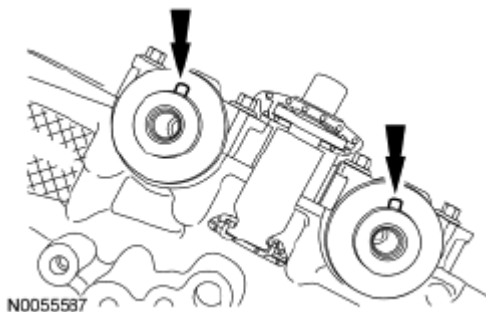


Fig. 478: Positioning Camshafts Onto LH Cylinder Head In Neutral Position

Courtesy of FORD MOTOR CO.

106. Remove the 2 bolts and the LH secondary timing chain tensioner.

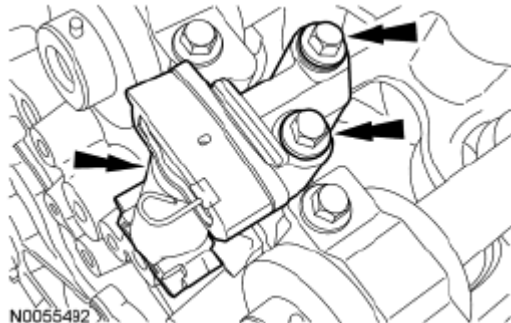


Fig. 479: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

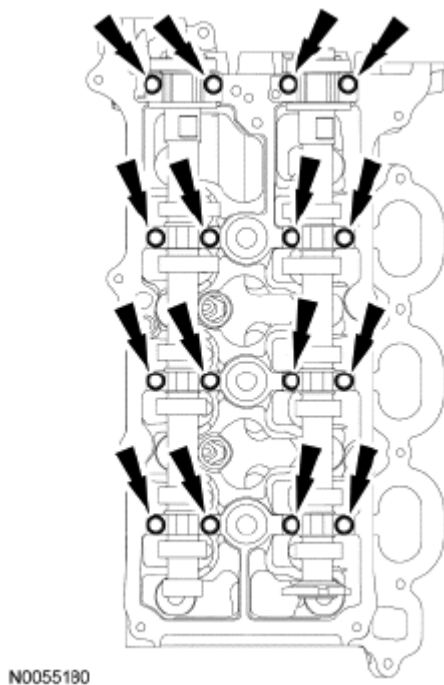


Fig. 480: Locating LH Camshaft Bearing Caps Bolts
Courtesy of FORD MOTOR CO.

108. Compress the RH secondary timing chain tensioner and install a suitable lockpin to retain the tensioner in

the collapsed position.

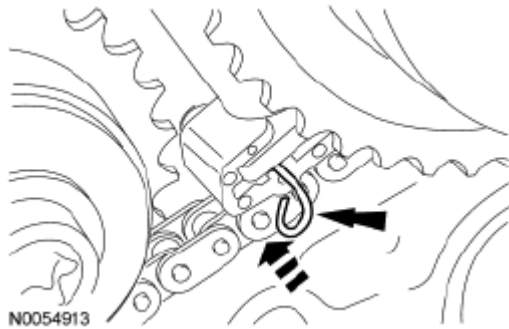


Fig. 481: Compressing RH Secondary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

109. Remove and discard the RH VCT assembly bolt and the RH exhaust camshaft sprocket bolt.
 - Remove the RH VCT assembly, secondary timing chain and the RH exhaust camshaft sprocket as an assembly.

NOTE: The VCT bolt and the exhaust camshaft bolt must be discarded and new ones installed. However, the exhaust camshaft washer is reusable.

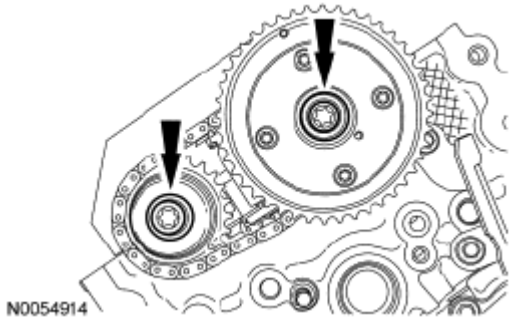


Fig. 482: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

110. Remove the Camshaft Holding Tool from the RH camshafts.

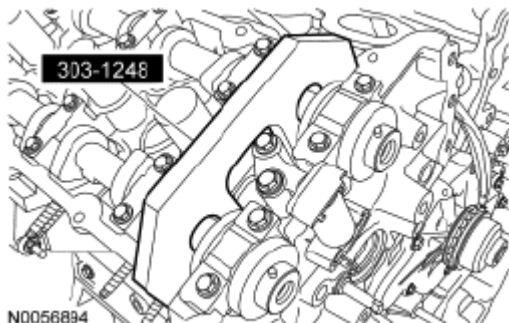
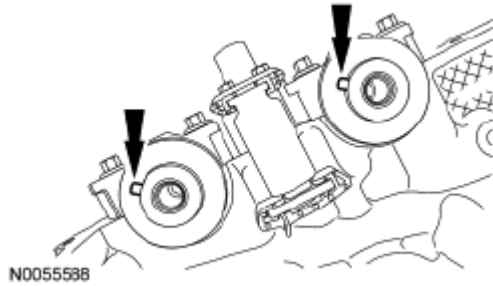


Fig. 483: Identifying Camshaft Holding Tool

Courtesy of FORD MOTOR CO.

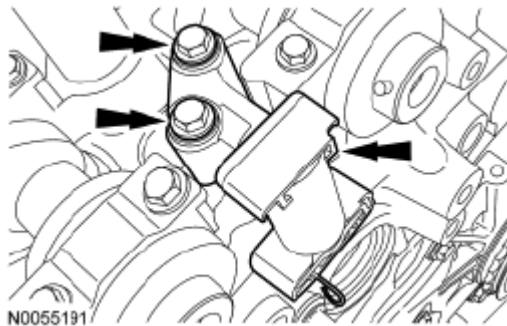
111. Rotate the RH camshafts counterclockwise to the neutral position.

NOTE: The camshafts must remain in the neutral position during removal or engine damage may occur.

**Fig. 484: Positioning Of Camshafts In Neutral Position**

Courtesy of FORD MOTOR CO.

112. Remove the 2 bolts and the RH secondary timing chain tensioner.

**Fig. 485: Locating RH Secondary Timing Chain Tensioner & Bolts**

Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

113. Remove the 2 bolts and the RH primary timing chain guide.

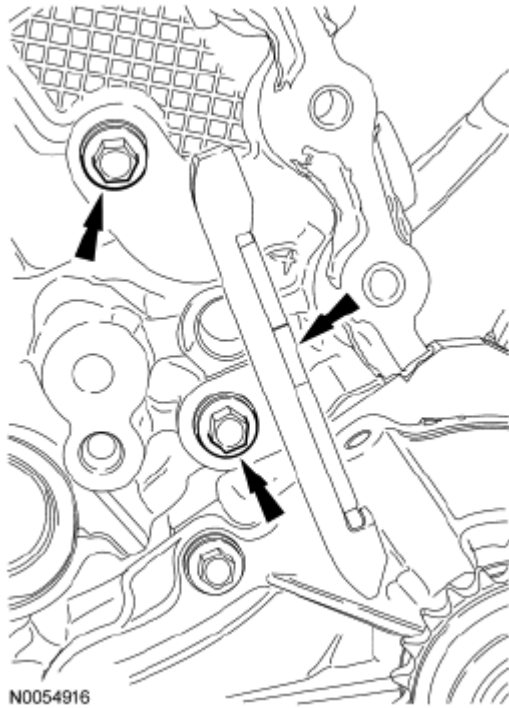


Fig. 486: Locating RH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

114. Remove the 2 bolts and the RH primary timing chain guide.

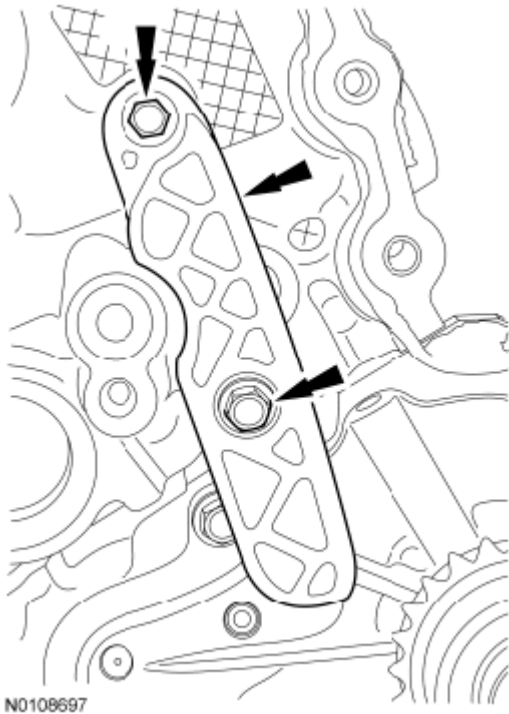
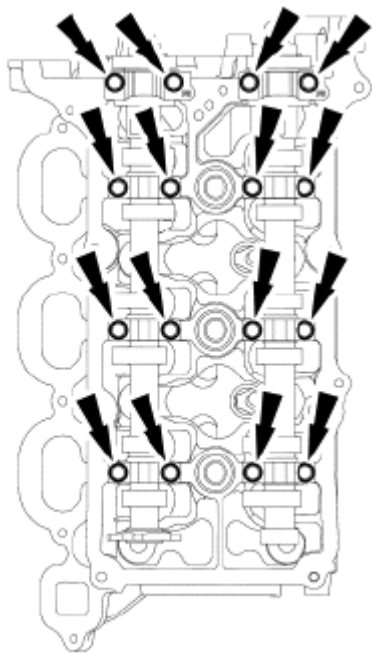


Fig. 487: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

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

NOTE: **Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.**



N0055183

Fig. 488: Locating RH Camshaft Bearing Caps And Bolts
Courtesy of FORD MOTOR CO.

116. Remove the valve tappets from the cylinder heads.

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

NOTE: LH shown in illustration, RH similar.



N0054896

Fig. 489: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

117. Remove and discard the M6 bolt from each cylinder head.

NOTE: LH shown in illustration, RH similar.

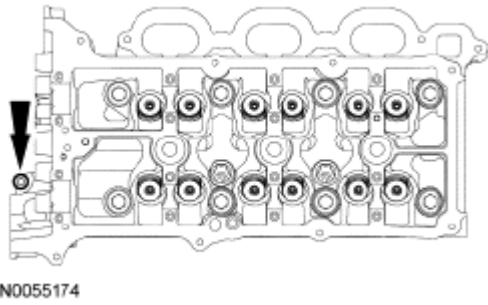


Fig. 490: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

118. Remove and discard the 8 bolts from each cylinder head.

- Remove the cylinder heads.
- Discard the cylinder head gaskets.

NOTE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

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

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

NOTE: LH shown in illustration, RH similar.

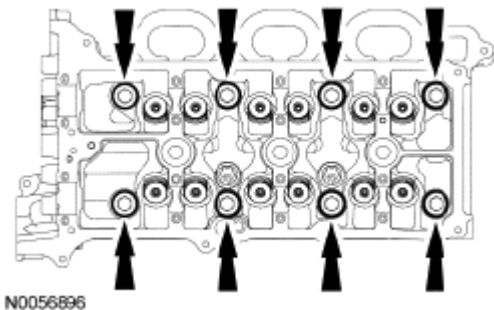


Fig. 491: Installing Valve Spring, Retainer & Key Using Valve Spring Compressors
Courtesy of FORD MOTOR CO.

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

1. Remove any large deposits of silicone or gasket material with a plastic scraper.

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

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

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

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

120. 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 **CYLINDER HEAD DISTORTION** and **CYLINDER BLOCK DISTORTION**.
121. Remove the coolant inlet tube.
 - Remove and discard the O-ring seals.

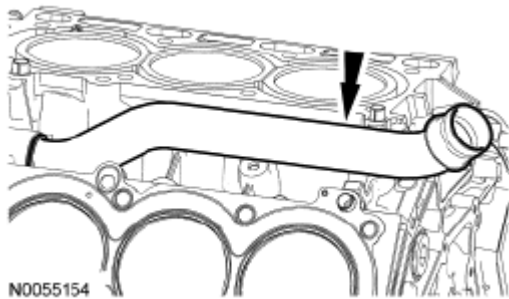


Fig. 492: Locating Coolant Tube
Courtesy of FORD MOTOR CO.

122. Remove the 2 bolts and the Knock Sensor (KS).

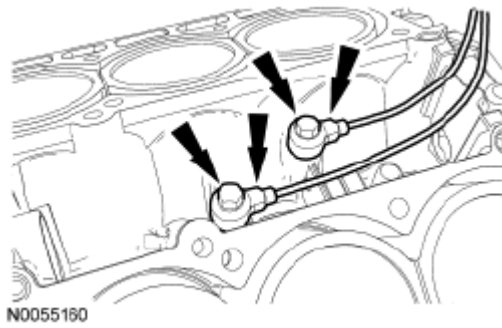


Fig. 493: Locating Knock Sensor Bolts
Courtesy of FORD MOTOR CO.

123. Remove the 8 bolts and the coolant pump.

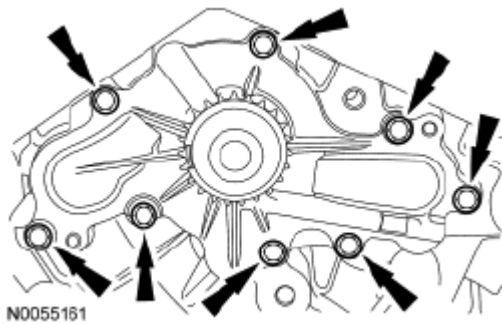
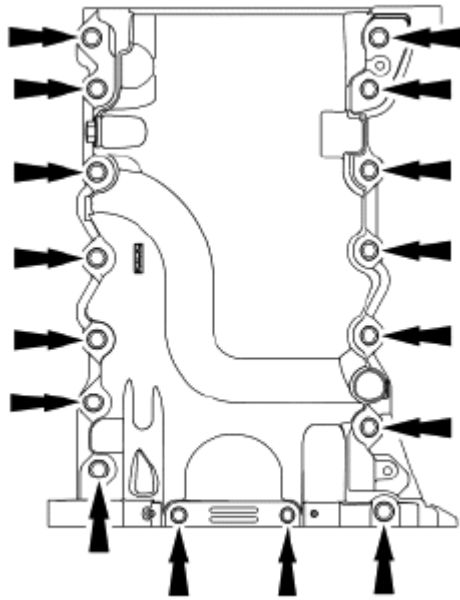


Fig. 494: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

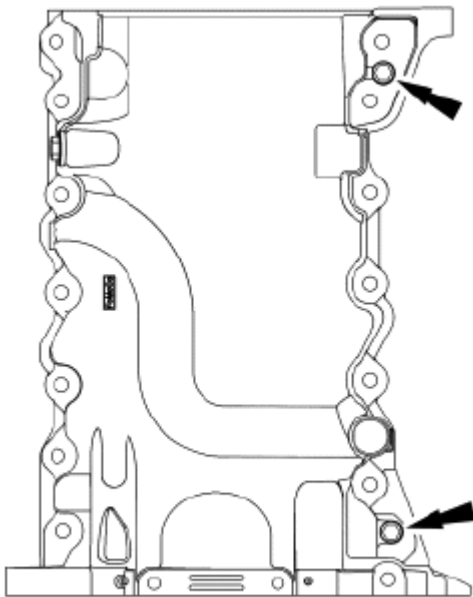
124. Remove the 16 oil pan bolts.



N0055163

Fig. 495: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

125. Install 2 of the oil pan bolts (finger-tight) into the 2 threaded holes in the oil pan in the following sequence.
1. Alternately tighten the 2 bolts one turn at a time until the oil pan-to-cylinder block seal is released.
 2. Remove the oil pan.



N0055164

Fig. 496: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

126. Remove the 2 bolts and the oil pump screen and pickup tube.
- Discard the O-ring seal.

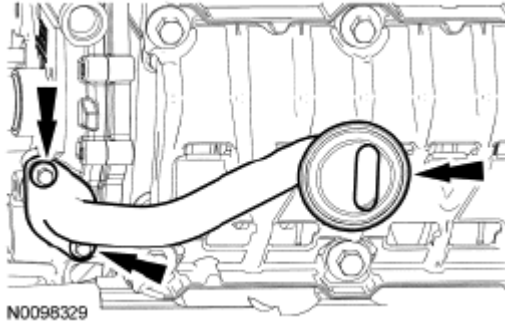


Fig. 497: Locating Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

127. Remove the 3 bolts and the oil pump.

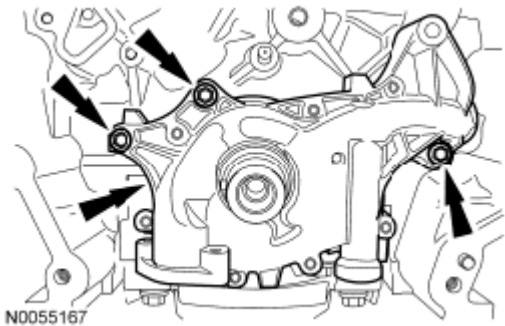


Fig. 498: Locating Oil Pump & Bolts
Courtesy of FORD MOTOR CO.

128. Remove the 8 crankshaft rear seal retainer bolts.

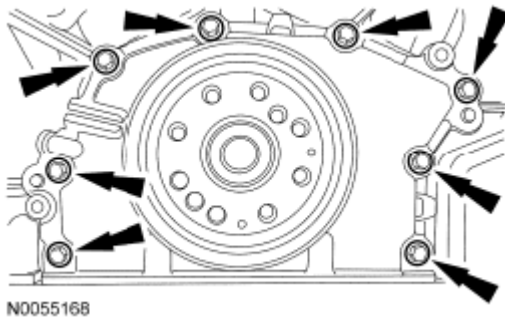


Fig. 499: Locating Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

129. Install the 2 M6 oil pan bolts (finger-tight) into the 2 threaded holes in the crankshaft rear seal retainer in

the following sequence.

1. Alternately tighten the 2 bolts one turn at a time until the crankshaft rear seal retainer-to-cylinder block seal is released.
2. Remove the crankshaft rear seal retainer.

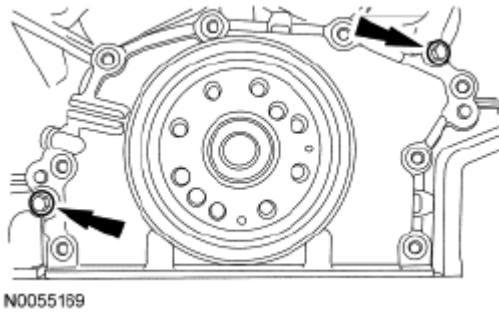


Fig. 500: Locating M6 Oil Pan Bolts
Courtesy of FORD MOTOR CO.

130. Clean the engine front cover, oil pan and crankshaft rear seal retainer plate using a 3M Roloc® Bristle Disk (2-in white, part number 07528) in a suitable tool turning at the recommended speed of 15,000 rpm.
 - Thoroughly wash the engine front cover, oil pan and crankshaft rear seal retainer plate to remove any foreign material, including any abrasive particles created during the cleaning process.

NOTE: Only use a 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. Do not use metal scrapers, wire brushes or any other power abrasive disk to clean the engine front cover, oil pan and crankshaft rear seal retainer plate. These tools cause scratches and gouges that make leak paths.

131. 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.
132. Remove the bolts in the sequence shown in illustration below.
 - Remove the main bearing cap support brace.
 - Discard the bolts.

NOTE: The main bearing cap support brace bolts must be discarded and new bolts must be installed. They are a tighten-to-yield design and cannot be reused.

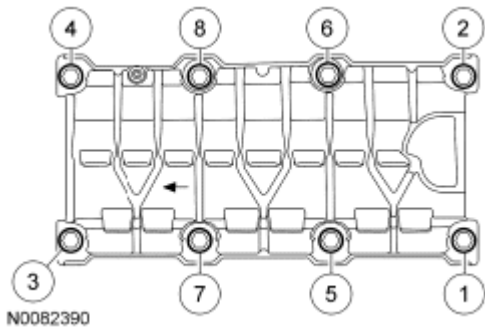


Fig. 501: Identifying Main Bearing Cap Support Brace Bolt Tighten Sequence
Courtesy of FORD MOTOR CO.

133. Remove the connecting rod cap bolts and cap.

NOTE: The connecting rod cap bolts are torque to yield. The original connecting rod cap bolts will be used when measuring the connecting rod large end bore during assembly. The connecting rod cap bolts will be discarded after measurement.

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

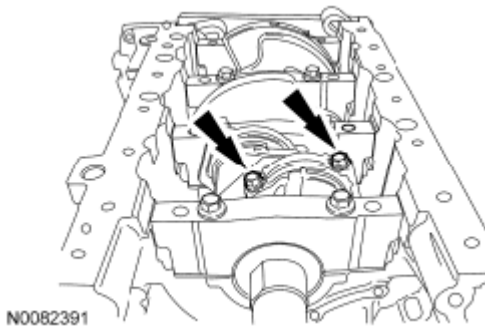


Fig. 502: Locating Connecting Rod Cap Bolts & Cap
Courtesy of FORD MOTOR CO.

134. Remove the piston/rod assembly from the engine block.

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



Fig. 503: Removing Piston & Rod Assembly
Courtesy of FORD MOTOR CO.

135. Repeat the previous 2 steps until all the piston/rod assemblies are removed from the engine block.
136. Remove the 8 main bearing cap side bolts and the 8 main bearing cap bolts in the sequence shown in illustration below.
 - Discard the bolts.

NOTE: The 8 main bearing cap side bolts and the 8 main bearing cap bolts must be discarded and new bolts must be installed. They are a tighten-to-yield design and cannot be reused.

NOTE: Clearly mark the position and orientation of the main bearing caps for reassembly.

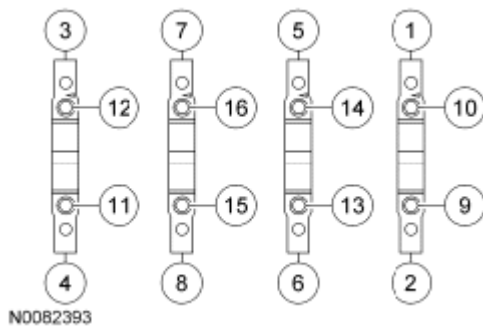


Fig. 504: Identifying Main Bearing Cap Side Bolt Remove Sequence
Courtesy of FORD MOTOR CO.

137. Remove the 4 main bearing caps.

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

NOTE: Note the position of the thrust washer on the outside of the No. 4 rear main bearing cap.

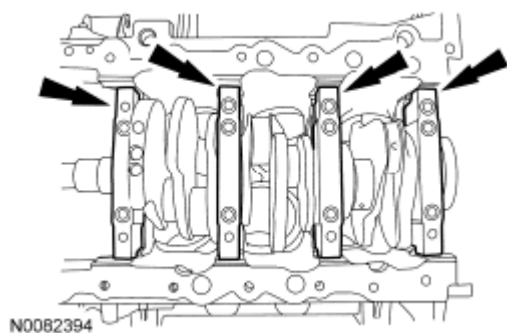


Fig. 505: Locating Main Bearing Caps
Courtesy of FORD MOTOR CO.

138. Remove the crankshaft.

NOTE: Note the position of the 2 thrust washers on the inside and outside of the rear main bearing bulkhead.

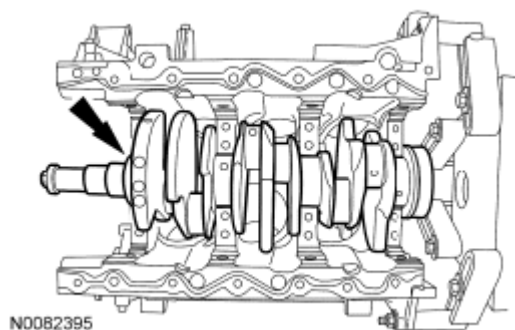


Fig. 506: Locating Crankshaft
Courtesy of FORD MOTOR CO.

139. Remove the 2 crankshaft thrust bearings from the rear main bearing bulkhead.

NOTE: Inside shown in illustration, outside similar.

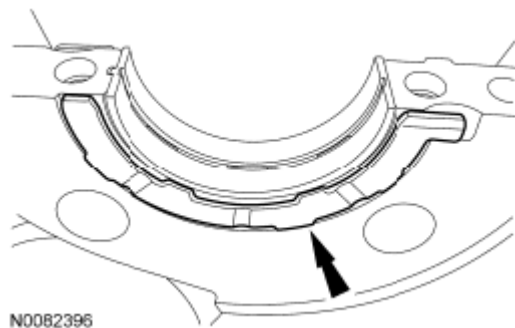


Fig. 507: Locating Heater Coolant Hose

Courtesy of FORD MOTOR CO.

140. Remove the 4 crankshaft main bearings from the cylinder block.

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

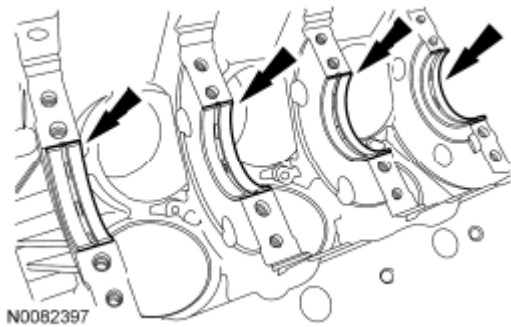


Fig. 508: Locating Crankshaft Main Bearings To Cylinder Block
Courtesy of FORD MOTOR CO.

141. Remove the 4 crankshaft main bearings from the main bearing caps.

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

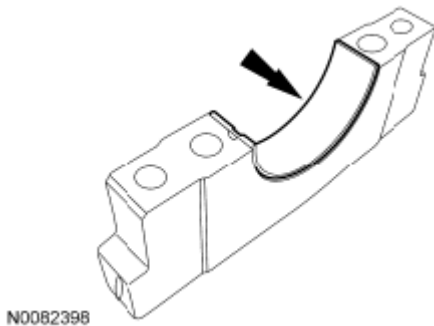


Fig. 509: Locating Main Bearings
Courtesy of FORD MOTOR CO.

142. Inspect the cylinder block, bearing cap support brace, pistons and connecting rods. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION**.
143. Clean all engine sealing surfaces of the cylinder block in the following sequence.
1. Remove any large deposits of silicone or gasket material.
 2. Apply silicone gasket remover and allow to set for several minutes.
 3. Remove the silicone gasket remover. A second application of silicone gasket remover may be required if residual traces of silicone or gasket material remain.

4. Apply metal surface prep to remove any remaining traces of oil or coolant and to prepare the surfaces to bond. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.
5. Make sure the 2 engine front cover locating dowel pins are seated correctly in the cylinder block.

NOTE: Place clean, lint-free shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Any foreign material (including any material created while cleaning gasket surfaces) that enters the oil passages or the oil pan, may cause engine failure.

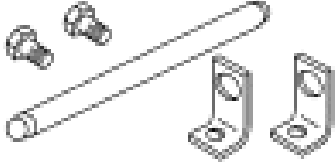
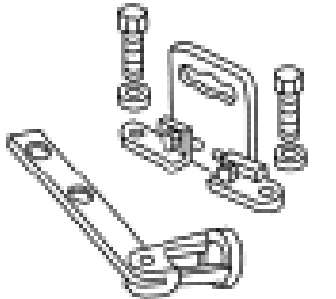
NOTE: Do not use wire brushes, power abrasive discs or 3M Roloc® Bristle Disk (2-in white, part number 07528) to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. They also cause contamination that will cause premature engine failure. Remove all traces of the gasket.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

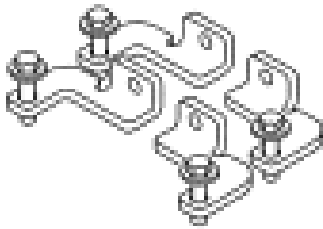
Special Tool(s)

SPECIAL TOOL TABLE

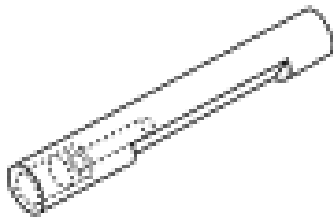
 <p>ST1981-A</p>	Compressor, Valve Spring 303-300 (T87C-6565-A)
 <p>ST1907-A</p>	Compressor, Valve Spring 303-350 (T89P-6565-A)
	Compressor, Valve Spring 303-1249

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ



ST3026-A



ST1906-A

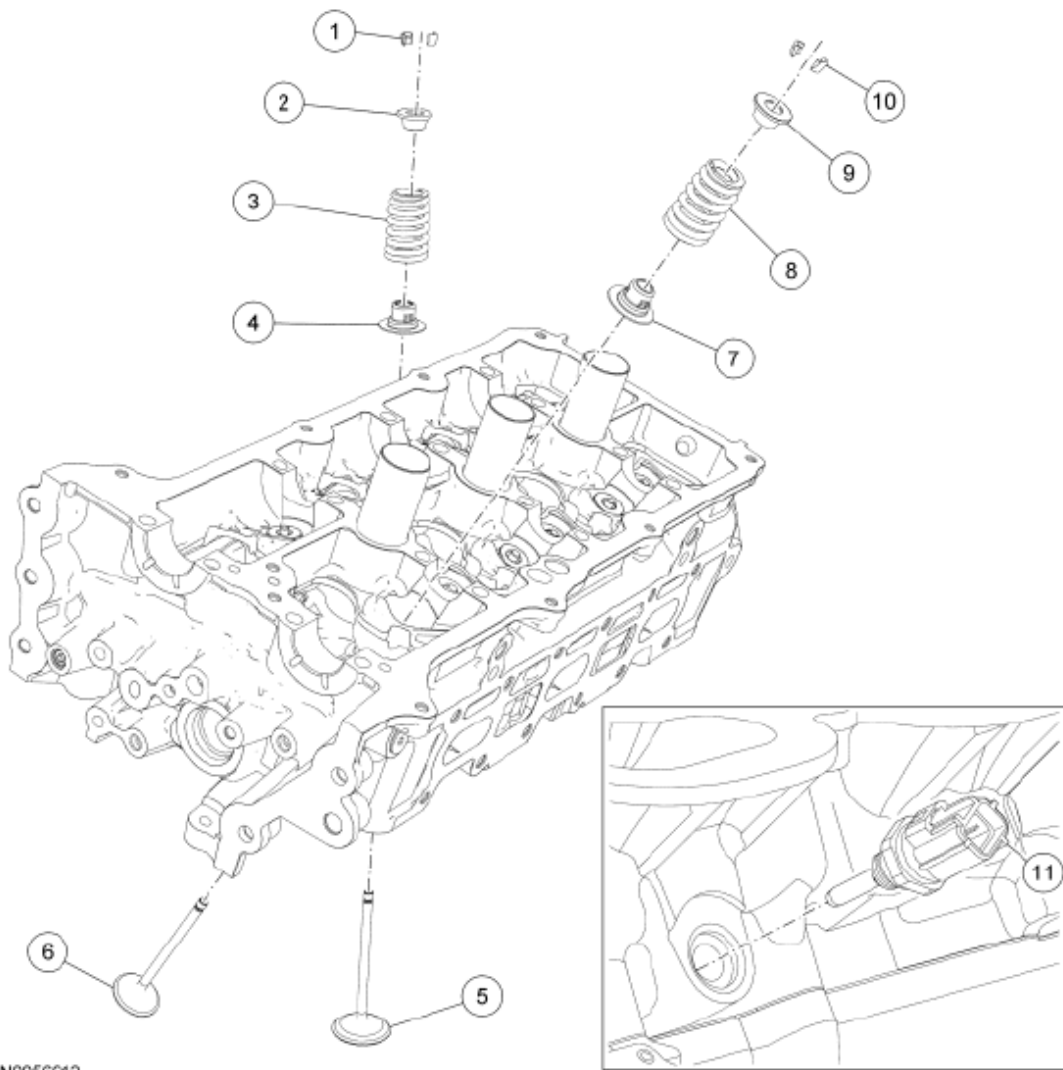
Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)

Material

ITEM SPECIFICATION TABLE

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

Cylinder Head



N0056912

Fig. 510: Identifying Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6518	Intake valve spring retainer key (12 required)
2	6514	Intake valve spring retainer (6 required)
3	6513	Intake valve spring (6 required)
4	6A517	Intake valve stem seal (6 required)
5	6505	Intake valve (6 required)
6	6507	Exhaust valve (6 required)
7	6A517	Exhaust valve stem seal (6 required)
8	6513	Exhaust valve spring (6 required)
9	6514	Exhaust valve spring retainer (6 required)
10	6518	Exhaust valve spring retainer key (12 required)

11	6G004	Cylinder Head Temperature (CHT) sensor
----	-------	--

Disassembly

All cylinder heads

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

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

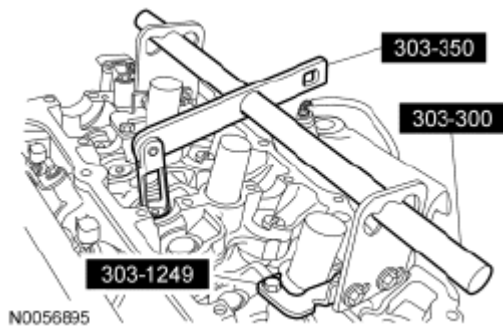


Fig. 511: Identifying Valve Springs Compressors
Courtesy of FORD MOTOR CO.

2. Remove the valve from the cylinder head.
3. Remove and discard the valve stem seal.
4. Repeat the above steps for each valve.

RH cylinder head

5. Remove and discard the Cylinder Head Temperature (CHT) sensor.

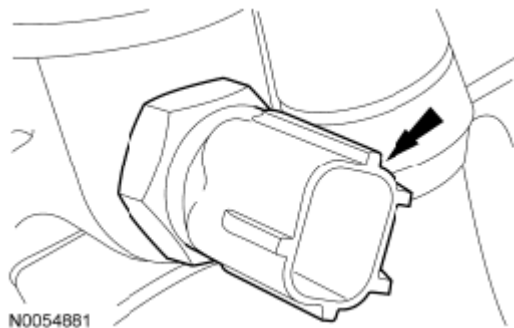


Fig. 512: Locating Cylinder Head Temperature Sensor
Courtesy of FORD MOTOR CO.

Assembly

All cylinder heads

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

NOTE: Lubricate the valve stem seal with clean engine oil prior to installation.

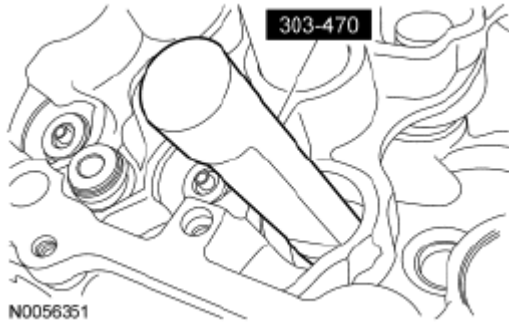


Fig. 513: Identifying Valve Stem Oil Seal Installer
Courtesy of FORD MOTOR CO.

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

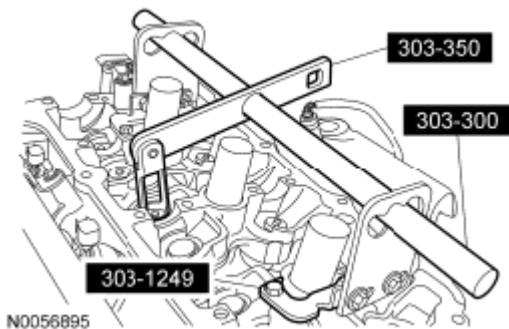


Fig. 514: Identifying Valve Spring Compressors
Courtesy of FORD MOTOR CO.

4. Repeat the above steps for each valve.

RH cylinder head

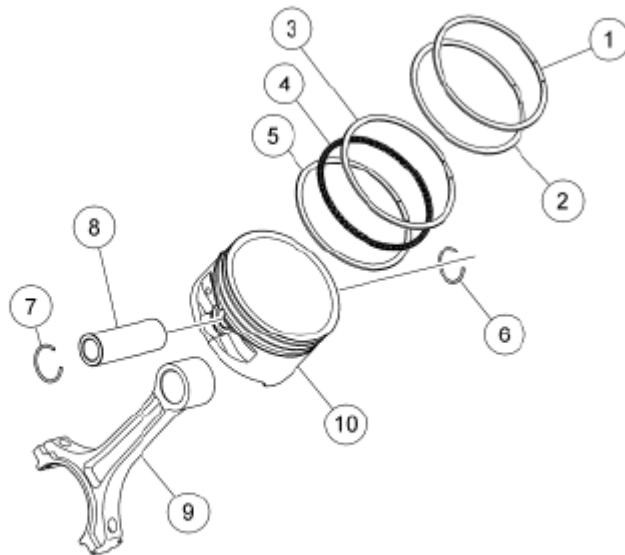
5. Install a new CHT sensor.
 - Tighten to 10 Nm (89 lb-in).

PISTON

Material

ITEM SPECIFICATION TABLE

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



N0010114

Fig. 515: Exploded View Of Piston
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

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 clip
7	6140	Piston pin retainer clip
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.
 - Discard the 2 piston pin retainer clips.
 3. Separate the piston from the connecting rod.

NOTE: If the piston and/or connecting rod are being installed new, the piston rod orientation marks and the arrow on the top of the dome of the piston should be facing toward the front of the engine block.

NOTE: If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.

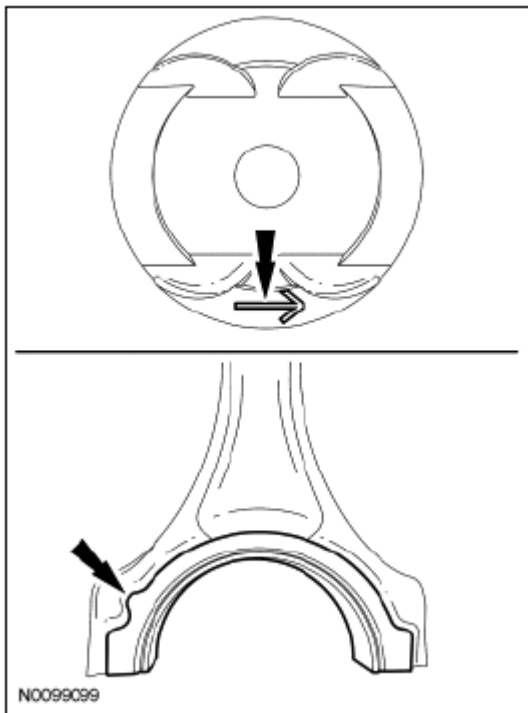


Fig. 516: Locating Piston Rod Orientation Marks
Courtesy of FORD MOTOR CO.

4. Clean and inspect the piston and connecting rod. For additional information, refer to **PISTON INSPECTION** and **CONNECTING ROD CLEANING**.

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 new piston pin retaining clips in the piston.
 - The piston pin retaining clip gap orientation must be toward the top or dome of piston.
5. Lubricate the piston and the new piston rings with clean engine oil.
6. Install the piston rings onto the piston as shown in illustration.
 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

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

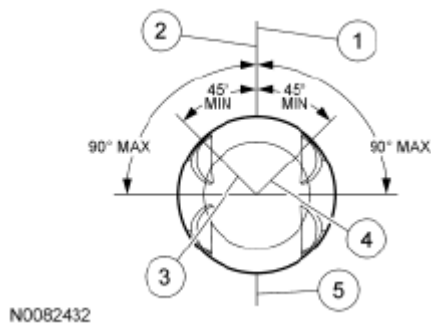


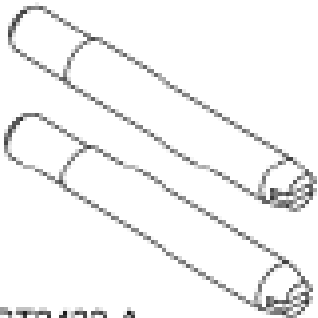
Fig. 517: Identifying Piston Rings Installation Position Onto Piston
Courtesy of FORD MOTOR CO.

ASSEMBLY

ENGINE

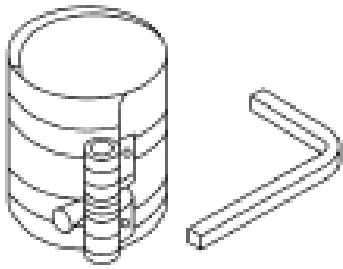
Special Tool(s)

SPECIAL TOOL TABLE

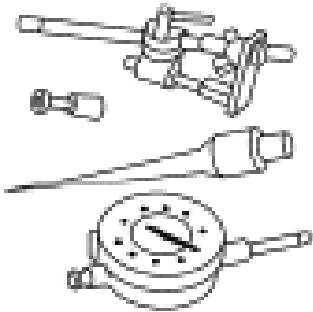
 <p>ST2433-A</p>	<p>Alignment Pins 307-399</p>
---	-------------------------------

2010 Ford Fusion SE

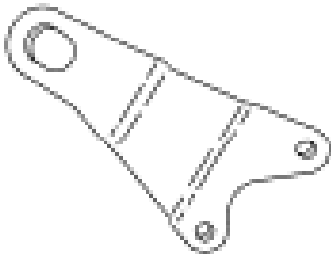
2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST1376-A**

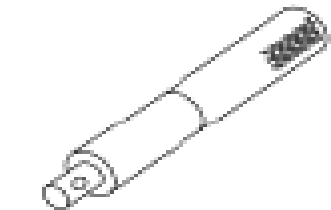
Compressor, Piston Ring 303-D032 (D81L-6002-C)

**ST1214-A**

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

**ST2976A**

Eye, Engine Lift 303-1245

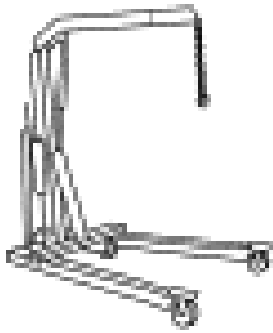
**ST4576 A**

Handle 205-153 (T80T-4000-W)

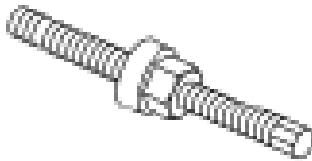
Heavy Duty Floor Crane 014-00071 or equivalent

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

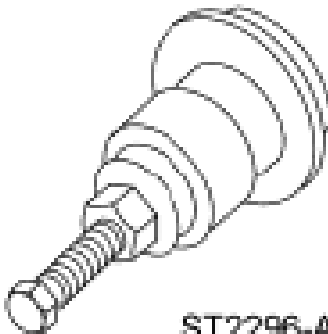


ST1341-A



ST1287-A

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



ST2296-A

Installer, Front Cover Oil Seal 303-335



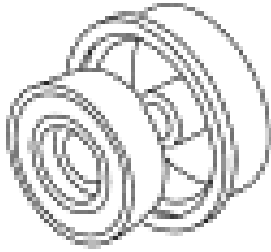
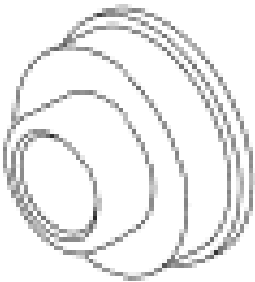
ST2981-A

Installer, Front Crankshaft Seal 303-1251

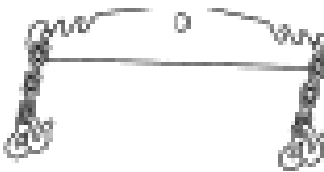
Installer, Rear Main Seal 303-1250

2010 Ford Fusion SE

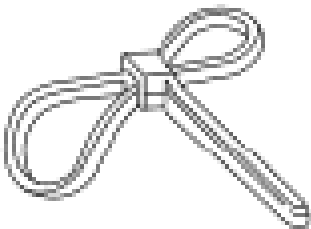
2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST2980-A****ST2983-A**

Installer, VCT Spark Plug Tube Seal 303-1247/2

**ST1432-A**

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

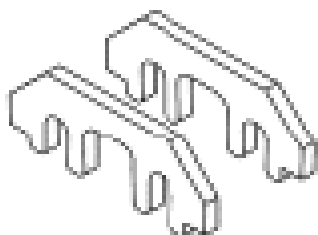
**ST1438-A**

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

Tool, Camshaft Holding 303-1248

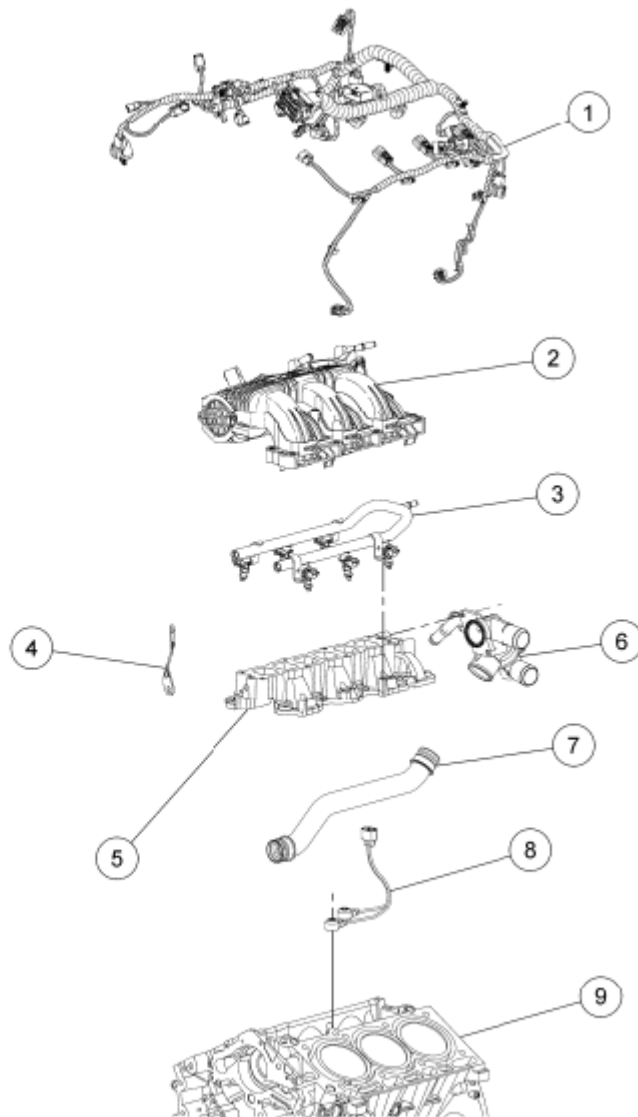
2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST2979-A****Material****ITEM SPECIFICATION TABLE**

Item	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (US); Motorcraft® Premium Gold Engine Coolant (Canada) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® Specialty Green Engine Coolant with Bittering Agent (US); Motorcraft® Specialty Green Engine Coolant (Canada) VC-10-A (US); CVC-10-A (Canada)	WSS-M97B55-A
Silicone Gasket Remover ZC-30	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2
Threadlock and Sealer TA-25	WSK-M2G351-A5

Engine Upper



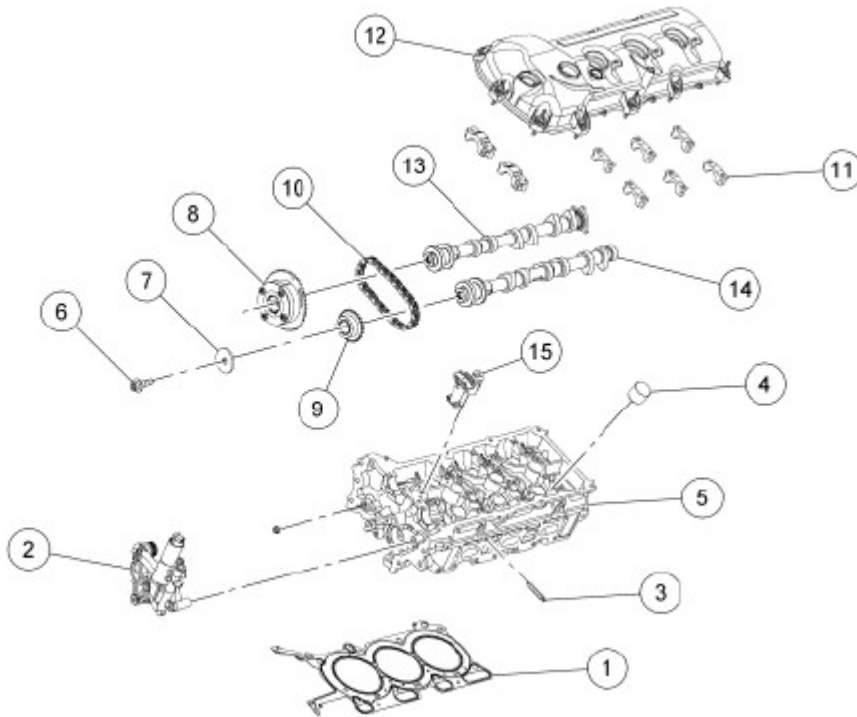
N0082513

Fig. 518: Identifying Engine Upper Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	12C508	Engine control harness
2	9S455	Upper intake manifold
3	9F797	Fuel rail
4	9J444	Upper intake manifold support bracket
5	9K461	Lower intake manifold
6	8A856	Thermostat housing
7	9N271	Coolant tube
8	9N271	Knock Sensor (KS)
9	6010	Cylinder block

Engine Upper - LH Cylinder Head



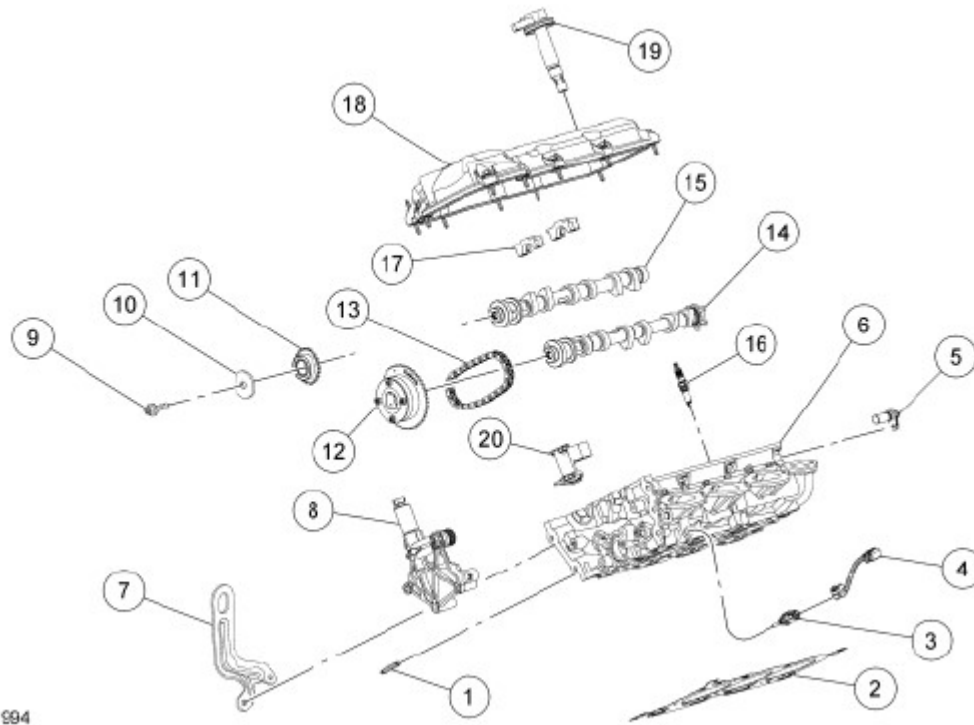
N0055580

Fig. 519: Identifying LH Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6083	LH cylinder head gasket
2	6C261	LH Variable Camshaft Timing (VCT) housing
3	W12244	LH exhaust manifold stud (6 required)
4	6500	Valve tappet (32 required)
5	6050	LH cylinder head
6	6279	LH camshaft bolt (2 required)
7	W710738	LH exhaust camshaft sprocket washer
8	6C524	LH VCT assembly
9	6256	LH exhaust camshaft sprocket
10	6C256	LH secondary timing chain
11	6A258	LH camshaft cap (8 required)
12	6A505	LH valve cover
13	6A267	LH intake camshaft
14	6A269	LH exhaust camshaft
15	6C271	LH secondary timing chain tensioner

Engine Upper - RH Cylinder Head



N0071994

Fig. 520: Identifying RH Cylinder Head Components

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W712244	RH exhaust manifold stud (6 required)
2	6051	RH cylinder head gasket
3	6G004	Cylinder Head Temperature (CHT) sensor
4	14B485	CHT sensor jumper harness
5	6B288	Camshaft Position (CMP) sensor (2 required)
6	6049	RH cylinder head
7	17A084	Engine lift eye
8	6C260	RH Variable Camshaft Timing (VCT) housing
9	6279	RH camshaft bolt (2 required)
10	W710738	RH exhaust camshaft sprocket washer
11	6256	RH exhaust camshaft sprocket
12	6C524	RH VCT assembly
13	6C256	RH secondary timing chain
14	6A266	RH intake camshaft
15	6A268	RH exhaust camshaft
16	12405	Spark plug (6 required)
17	6A258	RH camshaft cap (8 required)
18	6582	RH valve cover

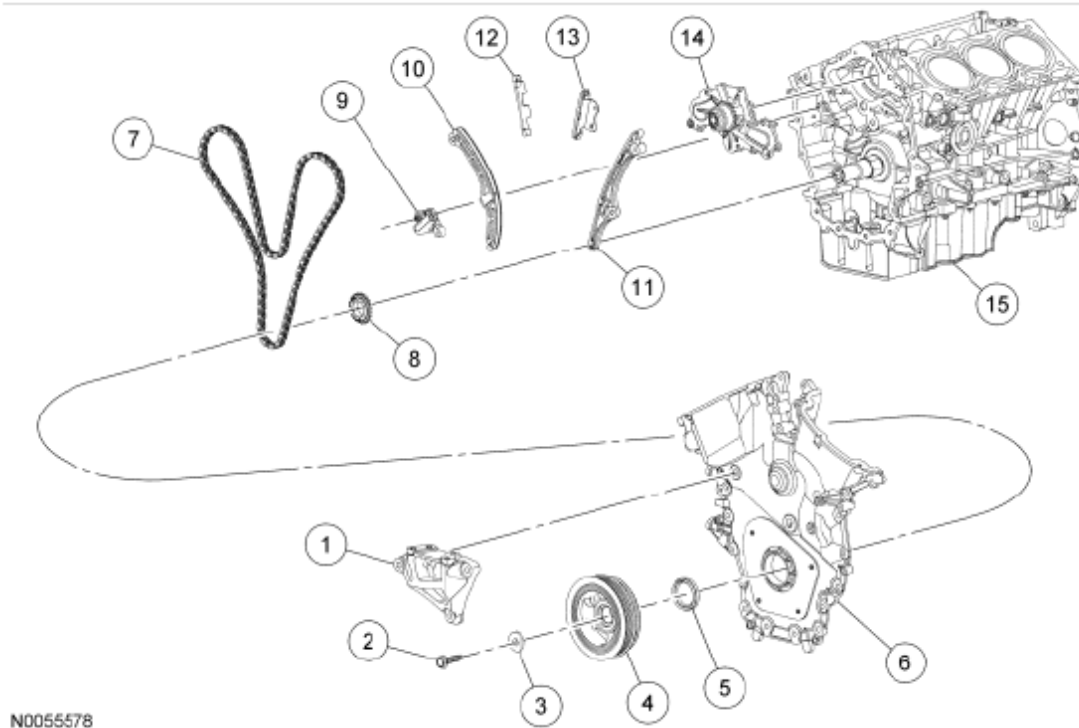
2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

19	12A375	Coil-on-plug (6 required)
20	6C270	RH secondary timing chain tensioner

Engine Front

NOTE: Early build engine shown in illustration, late build similar.



N0055578

Fig. 521: Identifying Engine Components - Front
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

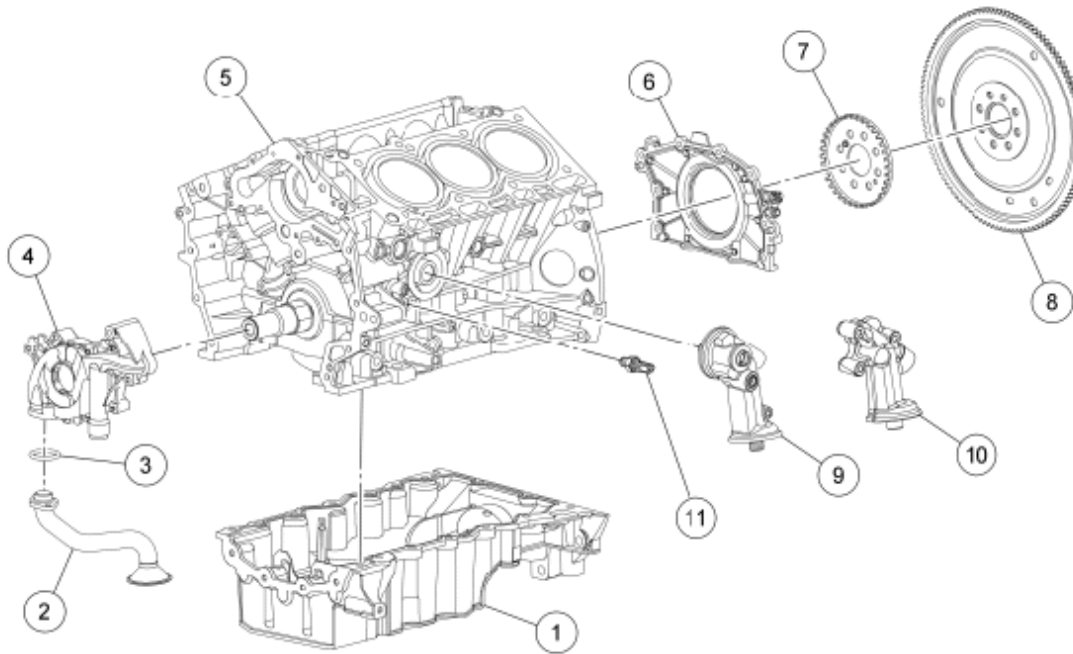
Item	Part Number	Description
1	6A0003	Engine mount bracket
2	W701512	Crankshaft pulley bolt
3	N806165	Crankshaft pulley washer
4	6316	Crankshaft pulley
5	6700	Crankshaft front seal
6	6C086	Engine front cover
7	6268	Timing chain
8	6306	Crankshaft timing sprocket
9	6K254	Primary timing chain tensioner
10	6K255	Primary timing chain tensioner arm
11	6B274	LH lower primary timing chain guide

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

12	6M256	RH primary timing chain guide (early build engines)
13	6K297	LH upper primary timing chain guide
14	8501	Coolant pump
15	6010	Cylinder block

Engine Lower (View 1)



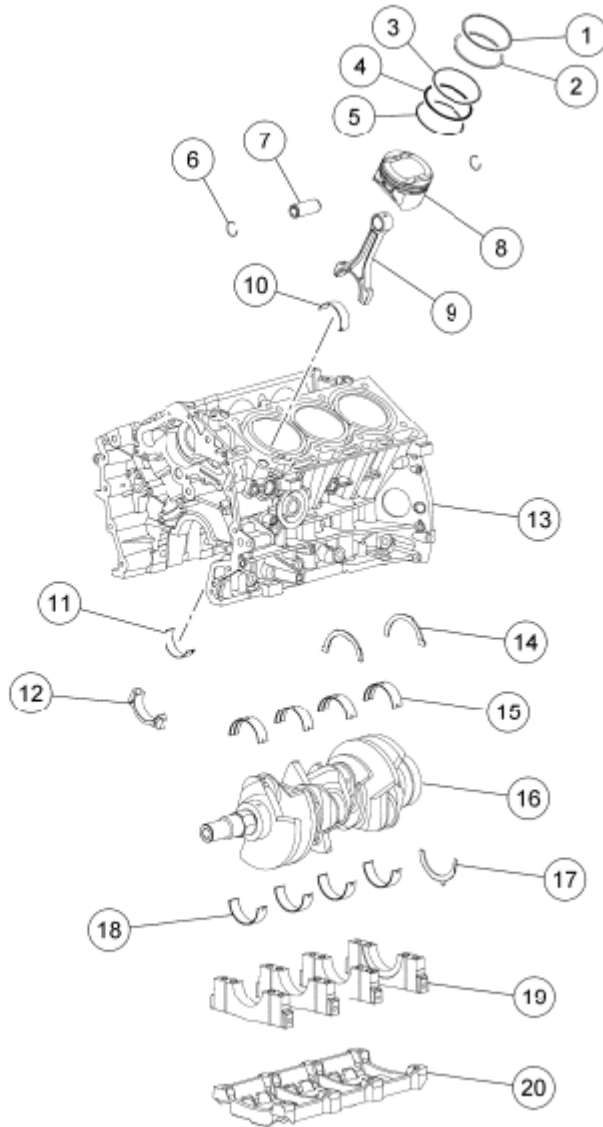
N0109984

Fig. 522: Identifying Engine Lower Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6675	Oil pan
2	6622	Oil pump screen and pickup tube
3	6625	Oil pump screen and pickup tube O-ring seal
4	6621	Oil pump
5	6010	Cylinder block
6	6D327	Crankshaft rear seal retainer
7	12A227	Crankshaft sensor ring
8	6375	Flexplate
9	6881	Oil filter adapter (early build vehicles)
10	6881	Oil filter adapter (late build vehicles)
11	9278	Engine Oil Pressure (EOP) switch

Lower Engine Block (View 2)



N0105730

Fig. 523: Identifying Lower Engine Block Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

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)
7	6135	Piston pin (6 required)

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

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	6A341	Crankshaft upper thrust washer (2 required)
15	6333	Cylinder block crankshaft main bearing (4 required)
16	6303	Crankshaft
17	6K302	Crankshaft lower thrust washer
18	6333	Lower crankshaft main bearings (4 required)
19	6325	Lower crankshaft main bearing caps (4 required)
20	6C364	Main bearing cap support brace

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: Early build vehicle (built before July 6, 2009) cooling systems are filled with Motorcraft® Premium Gold Engine Coolant. Late build vehicle (built on or after July 6, 2009) cooling systems are filled with Motorcraft® Specialty Green Engine Coolant. Mixing coolant types degrades the corrosion protection of the coolant. Do not mix coolant types. Failure to follow these instructions may result in engine or cooling system damage.

NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

NOTE: Assembly of the engine requires various inspections/measurements of the engine components (engine block, crankshaft, connecting rods, pistons and piston rings). These inspections/measurements will aid in determining if the engine components will require replacement. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** .

All vehicles

1. Select the crankshaft main bearings for each crankshaft journal.
 - Read the code on the crankshaft flange.
 - Read the code on the cylinder block face.
 - The first letter after the first asterisk makes up the code for main No. 1 and the next letter for main No. 2. The first letter after the second asterisk makes up the code for main No. 3 and the last letter for main No. 4.

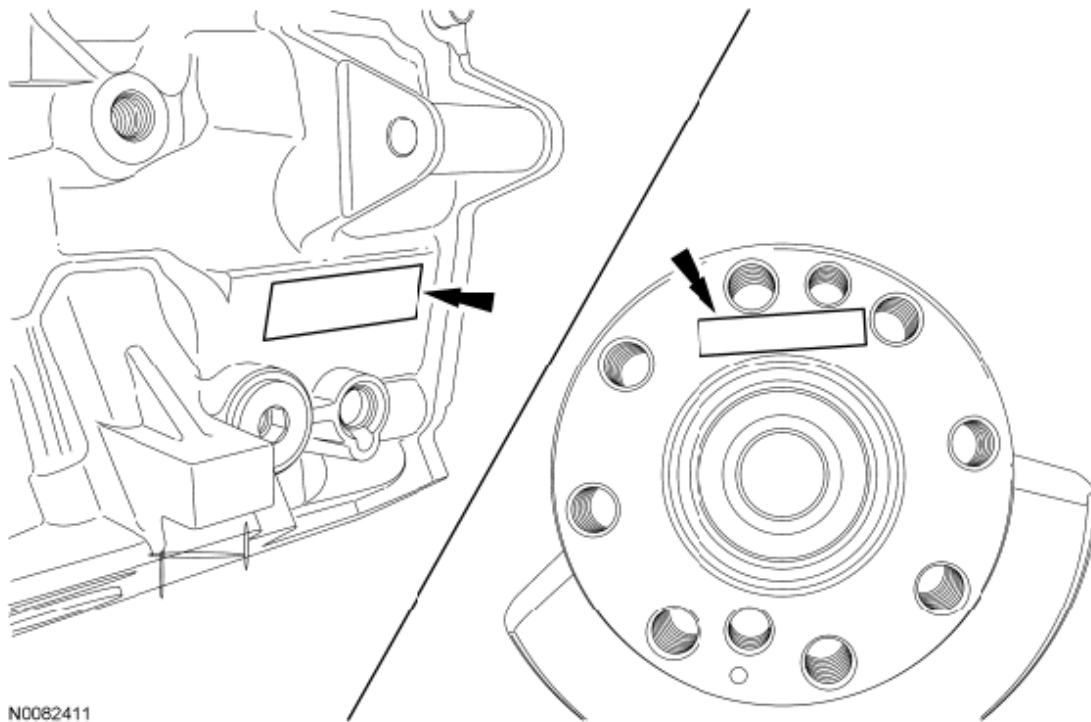


Fig. 524: Locating Cylinder Block Face And Crankshaft Flange Codes
Courtesy of FORD MOTOR CO.

NOTE: This procedure is for selecting bearings using a new crankshaft.

2. Using the table below, 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.
 - If the block code is *BM*QS* and the crankshaft code is *OL*PO*, Main No. 1 should be built with grade 1 bearings, as determined by the intersection of the B block column and the O crankshaft row on the table. Mains No. 2, No. 3 and No. 4 should all be grade 2.

		BLOCK CODE																											
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y			
CRANKSHAFT CODE	U	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	
	T	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	
	S	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	
	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	
	Q	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
	P	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	O	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	N	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	M	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	L	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	
	K	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	
	J	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	
	I	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	
	H	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	
	G	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	
	F	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	
E	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3		
D	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3		
C	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3		
B	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3		
A	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3		

N0082412

Fig. 525: Identifying Crankshaft And Block Code Chart
 Courtesy of FORD MOTOR CO.

- Using the original connecting rod cap bolts, install the connecting rod caps and bolts.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

- Tighten the bolts in 3 stages.
 - Stage 1: Tighten to 23 Nm (17 lb-ft).
 - Stage 2: Tighten to 43 Nm (32 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.
- Measure the connecting rod large end bore in 2 directions.
 - Remove the bolts and the rod cap.
 - Discard the connecting rod cap bolts.

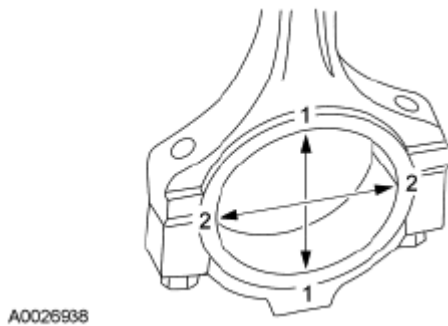


Fig. 526: Directions Of Measuring Connecting Rod Large End Bore
Courtesy of FORD MOTOR CO.

5. Measure each of the crankshaft connecting rod bearing journal diameters in at least 2 directions.

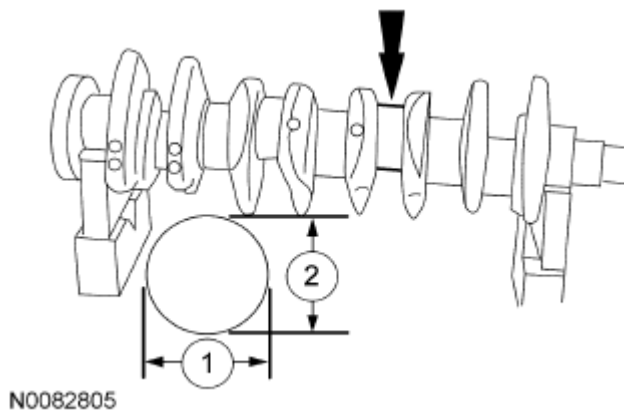


Fig. 527: Exploded View Of Rear Heated Seat Switch
Courtesy of FORD MOTOR CO.

6. Using the table below, select the correct connecting rod bearings for each crankshaft connecting rod journal.

		CONNECTING ROD LARGE END BORE (59.XXX)																			
		1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
		.986	.987	.988	.989	.971	.971	.972	.873	.874	.875	.876	.877	.878	.879	.880	.881	.882	.883	.884	.885
CRANK JOURNAL	56.003	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	56.002	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	56.001	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	56.000	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.999	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.998	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.998	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.998	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.995	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.994	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.993	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.992	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.991	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.990	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.989	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.988	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.987	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.986	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.985	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.984	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
	55.983	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3

		MINIMUM	MAXIMUM	NOMINAL
WALL GRADES	1	1.918 mm	1.924 mm	1.921 mm
	2	1.921 mm	1.927 mm	1.924 mm
	3	1.925 mm	1.931 mm	1.928 mm

N0082806

Fig. 528: Connecting Rod Large End Bore Table
Courtesy of FORD MOTOR CO.

- Lubricate the upper crankshaft main bearings with clean engine oil and install the 4 crankshaft main bearings in the cylinder block.

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.

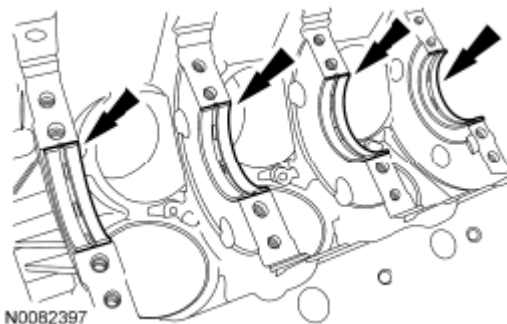


Fig. 529: Locating Upper Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

- Install the crankshaft onto the upper main bearings.

NOTE: Do not install the upper thrust bearings until the crankshaft is installed.

NOTE: Lubricate the thrust surfaces of the crankshaft with clean engine oil.

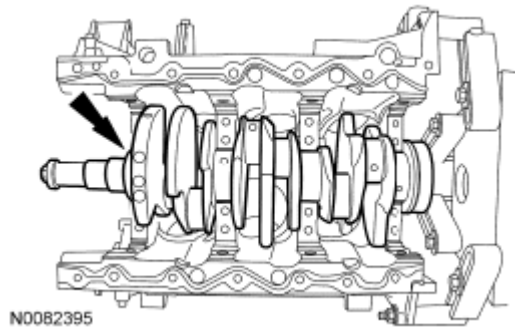


Fig. 530: Installing Crankshaft Onto Upper Main Bearings
Courtesy of FORD MOTOR CO.

9. Push the crankshaft rearward and install the rear crankshaft upper thrust washer at the back of the No. 4 rear bulkhead.

NOTE: Make sure the side of the thrust washer, with the wide oil grooves, faces the crankshaft thrust surface.

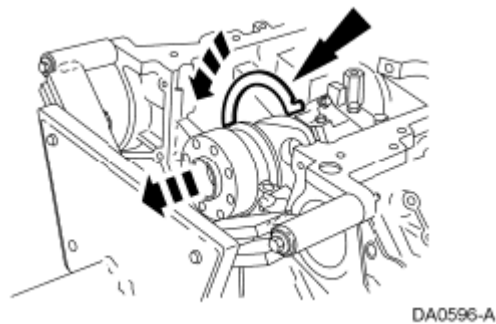


Fig. 531: Installing Rear Crankshaft Upper Thrust Washer At Back Of No. 4 Rear Bulkhead
Courtesy of FORD MOTOR CO.

10. Push the crankshaft forward and install the front crankshaft upper thrust washer at the front of the No. 4 rear bulkhead.

NOTE: Make sure the side of the thrust washer, with the wide oil grooves, faces the crankshaft thrust surface.

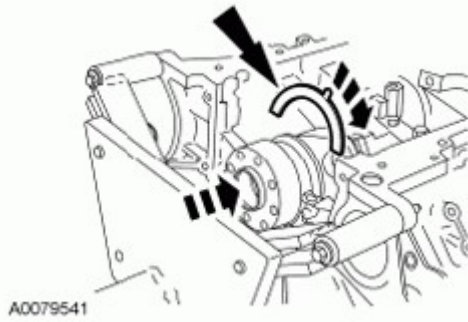


Fig. 532: Installing Front Crankshaft Upper Thrust Washer At Front Of No. 4 Rear Bulkhead
 Courtesy of FORD MOTOR CO.

11. Lubricate the crankshaft lower main bearings with clean engine oil and install them into the main bearing caps. Visually check seating and squareness of the bearings to make sure of proper seating in caps.

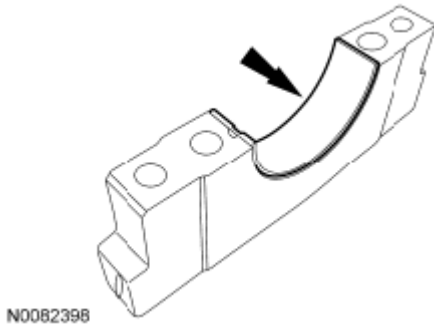


Fig. 533: Identifying Crankshaft Lower Main Bearing
 Courtesy of FORD MOTOR CO.

12. Position the No. 1, No. 2 and No. 3 main bearing caps on the cylinder block and, keeping the caps as square as possible, alternately draw the caps down evenly using the new bolts until the main bearing caps are seated.

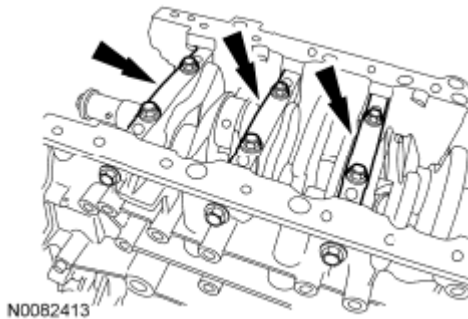


Fig. 534: Identifying No. 1, No. 2 & No. 3 Main Bearing Caps On Cylinder Block
 Courtesy of FORD MOTOR CO.

13. Install the lower crankshaft thrust washer to the back side of the No. 4 rear main bearing cap, with the tab aligned with the cutout in the main bearing cap.

NOTE: Make sure the side of the thrust washer, with the wide oil grooves, faces the crankshaft thrust surface.

NOTE: To aid in assembly, apply petroleum jelly to the back of the crankshaft thrust washer.

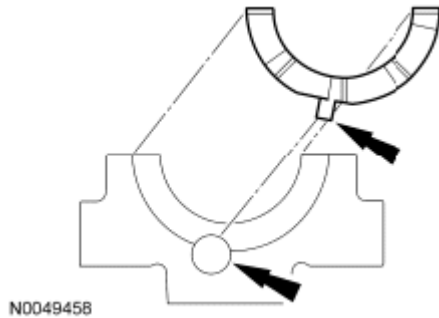


Fig. 535: Locating No. 4 Rear Main Bearing Cap
Courtesy of FORD MOTOR CO.

14. Position main bearing cap No. 4 on the cylinder block and keeping the cap as square as possible, alternately draw the cap down evenly using the new bolts until the main bearing cap is seated.

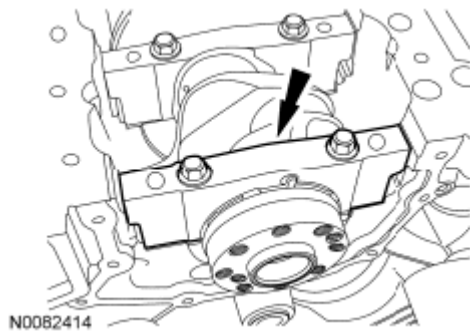
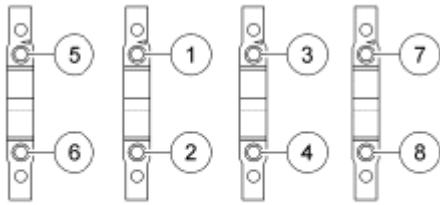


Fig. 536: Locating Main Bearing Cap No. 4 On Cylinder Block
Courtesy of FORD MOTOR CO.

15. Loosen the No. 4 main bearing cap bolts.
16. Tighten the main bearing bolts in the sequence shown in illustration below in 2 stages.
 - Stage 1: Tighten fasteners 1 through 8 to 60 Nm (44 lb-ft).
 - Stage 2: Tighten fasteners 1 through 8 an additional 90 degrees.

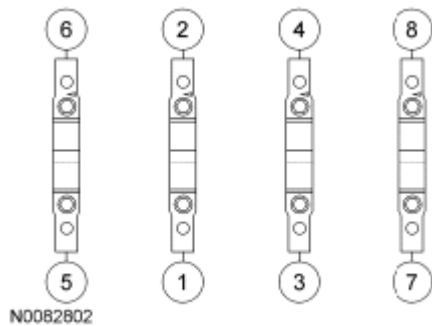
NOTE: While tightening the main bearing vertical bolts, push the crankshaft forward and the No. 4 main bearing cap rearward to seat the crankshaft thrust washers.



N0082801

Fig. 537: Identifying Main Bearing Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

17. Install the new 8 main bearing cap side bolts. Tighten in the sequence shown in illustration below in 2 stages.
- Stage 1: Tighten fasteners 1 through 8 to 45 Nm (33 lb-ft).
 - Stage 2: Tighten fasteners 1 through 8 an additional 90 degrees.



N0082802

Fig. 538: Identifying Main Bearing Cap Side Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

18. 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.
 - Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.

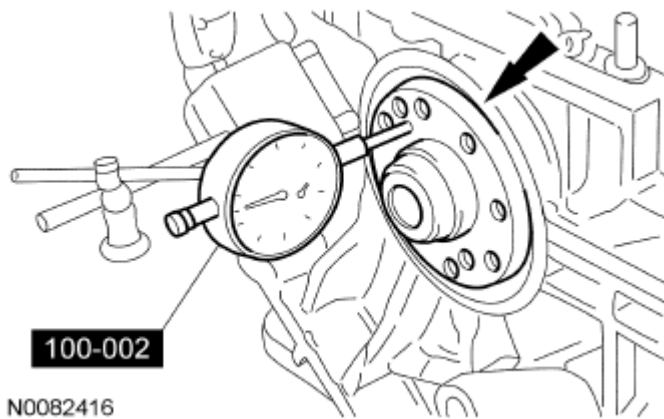


Fig. 539: Measuring Crankshaft End Play
Courtesy of FORD MOTOR CO.

19. Prepare the connecting rod and cap.
 - Insert the new bolts in the rod cap.
 - Insert the upper and lower rod bearings into the rod and cap.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

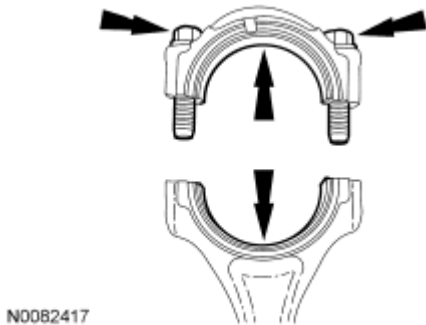
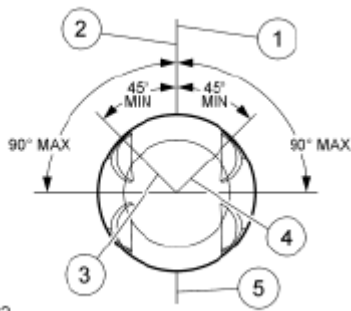


Fig. 540: Preparing Connecting Rod And Cap
Courtesy of FORD MOTOR CO.

20. Before installing the pistons into the cylinder block, verify proper ring gap location.
 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

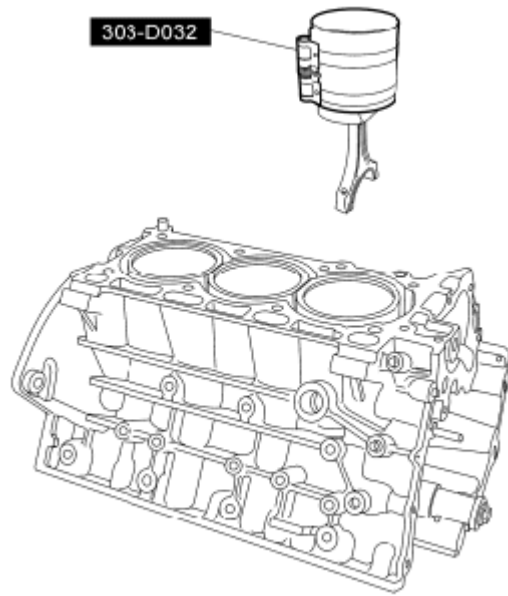


N0082432

Fig. 541: Identifying Piston Rings Installation Position Onto Piston
 Courtesy of FORD MOTOR CO.

21. Using the Piston Ring Compressor, install the piston and connecting rod assemblies.

- 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:** The next 3 steps are for all 6 connecting rods, rod caps and pistons. Only 1 connecting rod, rod cap and piston is shown in illustration.
- NOTE:** Lubricate the pistons, piston rings, connecting rod bearings and the entire cylinder bores with clean engine oil.
- NOTE:** Make sure the piston rings are positioned to specifications for installation. For additional information, refer to PISTON .
- NOTE:** If the piston and or connecting rod are being installed new, the piston rod orientation marks and the arrow on the top of the dome of the piston should be facing toward the front of the engine block.
- NOTE:** If the piston and connecting rod are to be reinstalled, they must be installed in the same orientation as disassembled.



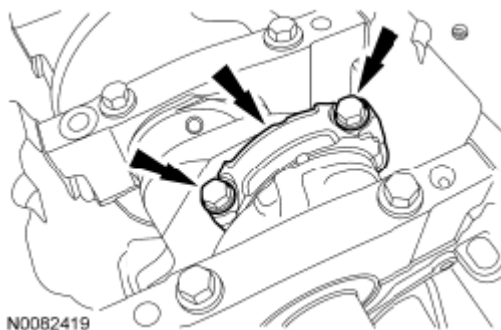
N0082418

Fig. 542: Installing Piston & Connecting Rod Assemblies
 Courtesy of FORD MOTOR CO.

22. Seat the connecting rod on the crankshaft journal.
23. Install the connecting rod cap and bolts.
 - Tighten the bolts in 3 stages.
 - Stage 1: Tighten to 23 Nm (17 lb-ft).
 - Stage 2: Tighten to 43 Nm (32 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

NOTE: After installation of each piston, connecting rod, rod cap and bolts, rotate the crankshaft to verify smooth operation.



N0082419

Fig. 543: Locating Connecting Rod Cap & Bolts

Courtesy of FORD MOTOR CO.

24. Repeat the previous 3 steps until all 6 piston, connecting rod and connecting rod cap assemblies are installed.
25. Install the main bearing cap support brace and the new bolts. Tighten in the sequence shown in illustration in 2 steps.
 - Stage 1: Tighten fasteners to 20 Nm (177 lb-in).
 - Stage 2: Tighten fasteners an additional 180 degrees.

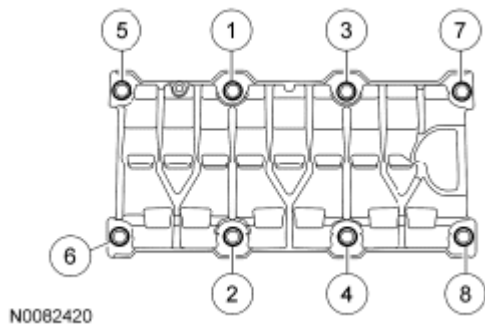


Fig. 544: Identifying Main Bearing Cap Support Brace Tightening Sequence
 Courtesy of FORD MOTOR CO.

26. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.

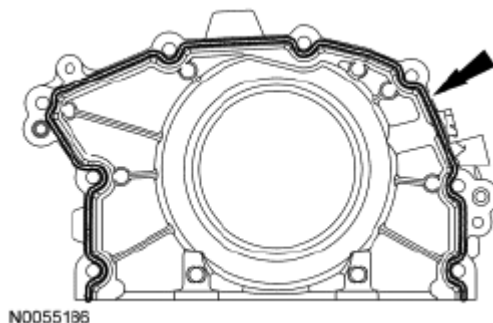


Fig. 545: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Sealing Surface Of Crankshaft Rear Seal Retainer
 Courtesy of FORD MOTOR CO.

27. Install the rear seal retainer and the 8 bolts.

- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

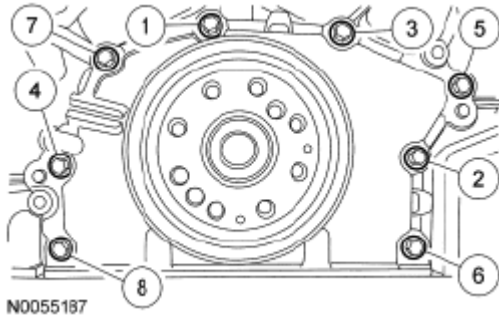


Fig. 546: Identifying Crankshaft Rear Seal Retainer & Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

28. Install the oil pump and the 3 bolts.

- Tighten to 10 Nm (89 lb-in).

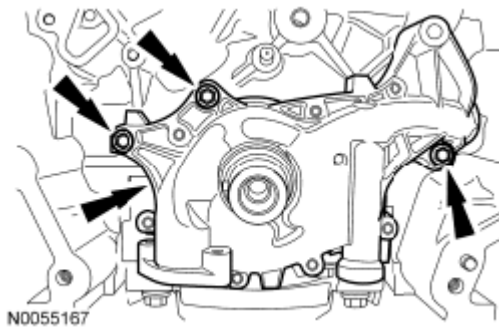


Fig. 547: Locating Oil Pump & Bolts
 Courtesy of FORD MOTOR CO.

29. Using a new O-ring seal, install the oil pump screen and pickup tube and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).

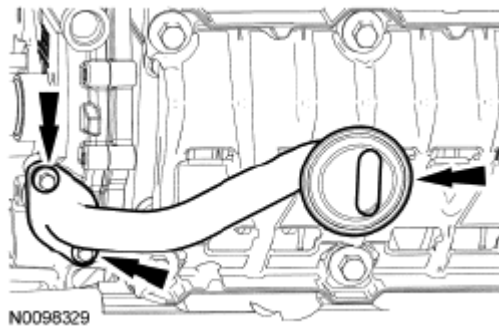


Fig. 548: Locating Oil Pump Screen, Pickup Tube & Bolts

Courtesy of FORD MOTOR CO.

30. Install the A/C compressor and the 2 bolts.

- Tighten to 25 Nm (18 lb-ft).

NOTE: The A/C compressor must be installed on the cylinder block and the 2 bolts tightened prior to installing the oil pan.

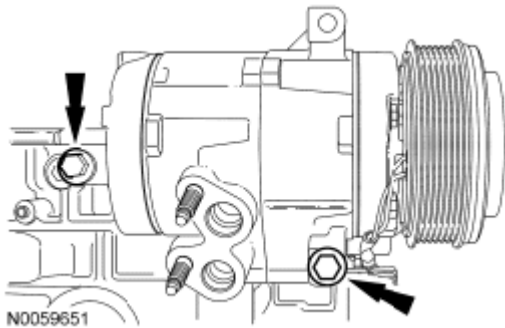


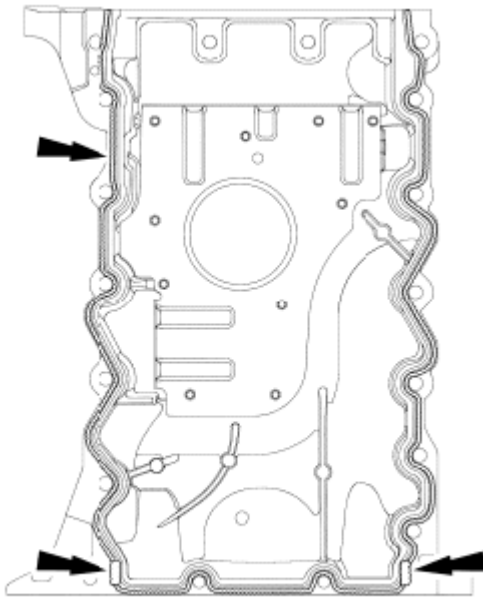
Fig. 549: Locating A/C Compressor & Bolts
Courtesy of FORD MOTOR CO.

31. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.

- Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

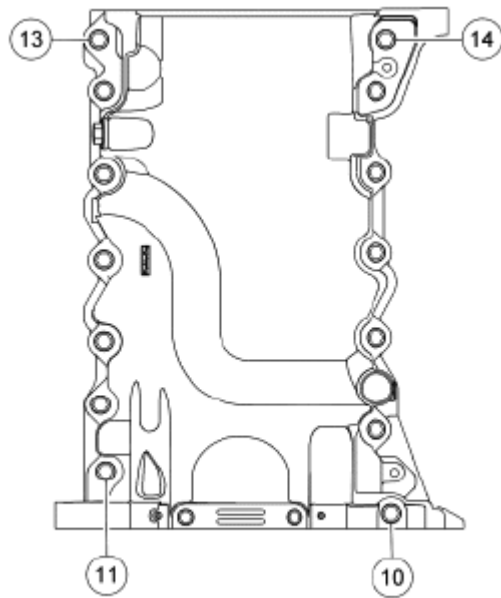


N0055188

Fig. 550: Locating Oil Pump Screen, Pickup Tube And Bolts
Courtesy of FORD MOTOR CO.

32. Install the oil pan and bolts 10, 11, 13 and 14.
- Tighten the bolts in the sequence shown in illustration below to 3 Nm (27 lb-in).
 - Loosen the bolts 180 degrees.

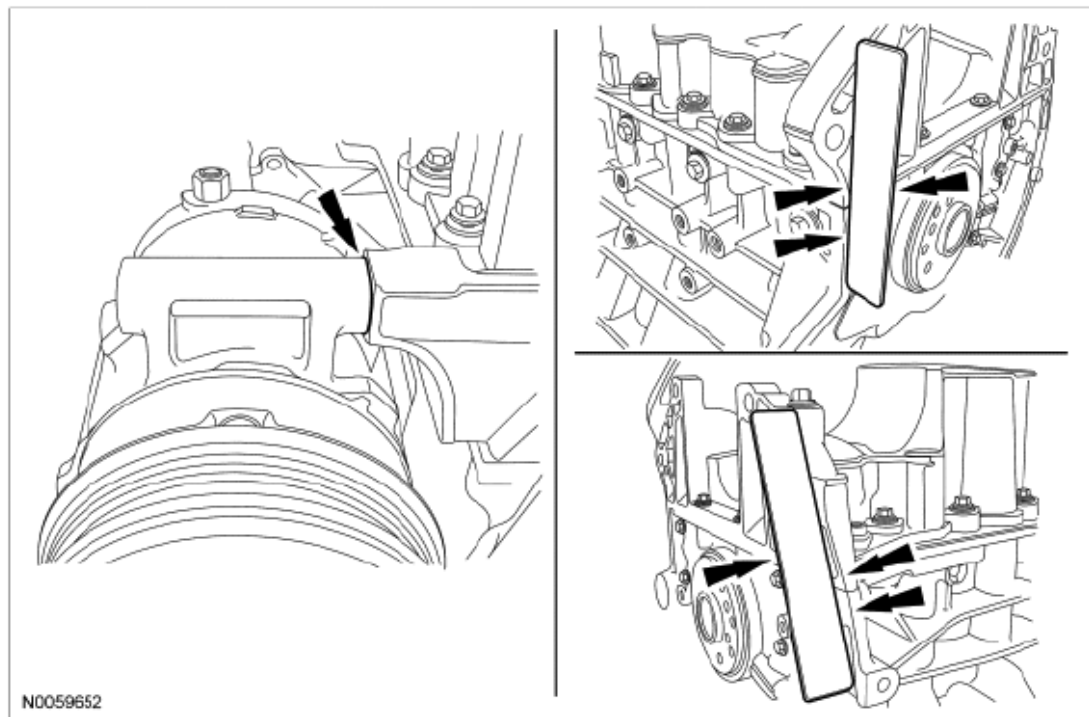
NOTE: The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.



N0069773

Fig. 551: Identifying Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

33. Align the oil pan to the cylinder block and A/C compressor.
- Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown in illustration below.



N0059652

Fig. 552: Locating Oil Pan Alignment Areas

Courtesy of FORD MOTOR CO.

34. Tighten bolts 10, 11, 13 and 14 in the sequence shown in illustration below, to 3 Nm (27 lb-in).

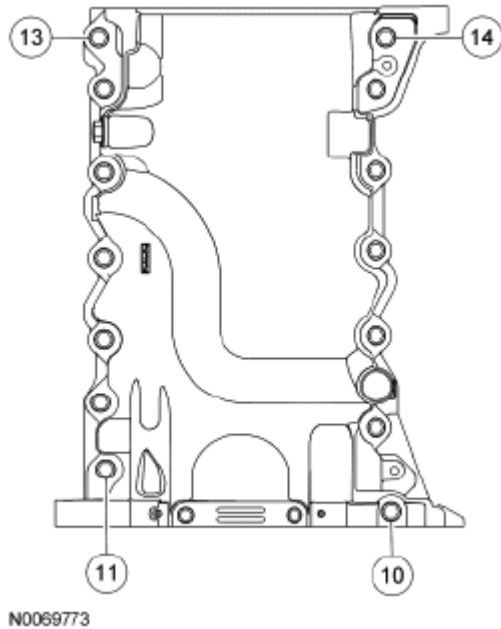


Fig. 553: Identifying Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

35. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown in illustration.
- Tighten the large bolts (1-14) to 24 Nm (18 lb-ft).
 - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).

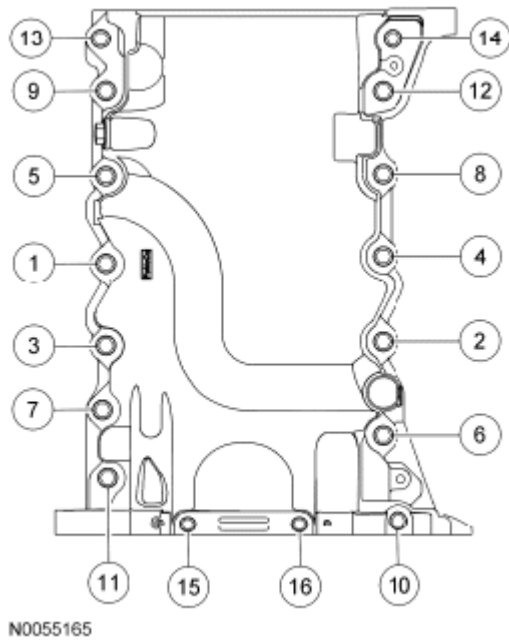


Fig. 554: Locating Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

36. Install the A/C compressor mounting stud and nut.
 - Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).

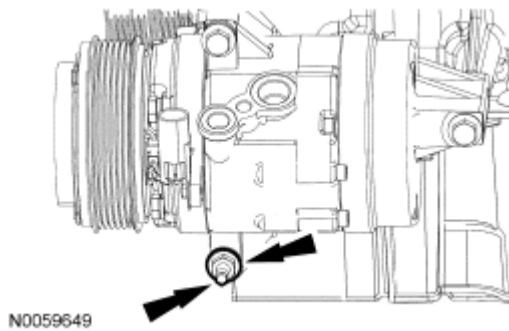


Fig. 555: Locating A/C Compressor Mounting Stud & Nut
Courtesy of FORD MOTOR CO.

37. Install the coolant pump and the 8 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

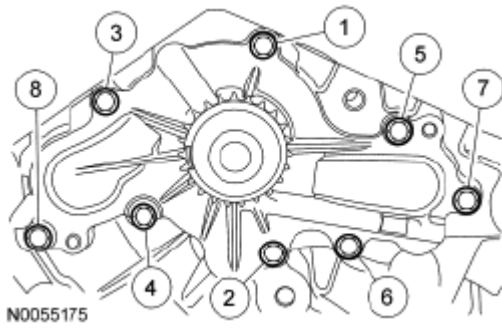


Fig. 556: Identifying Coolant Pump Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

38. Install the Knock Sensor (KS) and the 2 bolts.
 - Tighten to 20 Nm (177 lb-in).

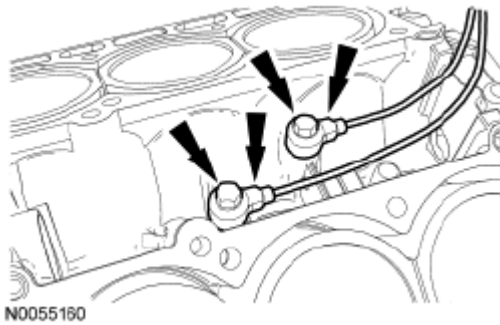


Fig. 557: Locating Knock Sensor Bolts
Courtesy of FORD MOTOR CO.

39. Using new O-ring seals, install the coolant inlet tube.

NOTE: Apply clean engine coolant to the O-ring seals prior to installation.

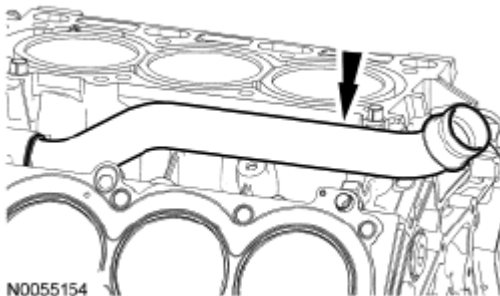
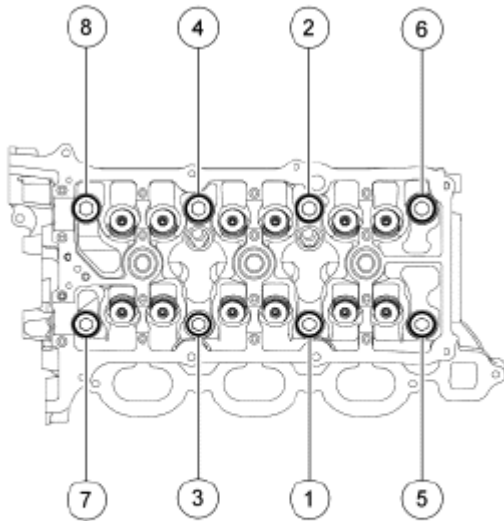


Fig. 558: Locating Coolant Tube
Courtesy of FORD MOTOR CO.

40. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in illustration in 5 stages:

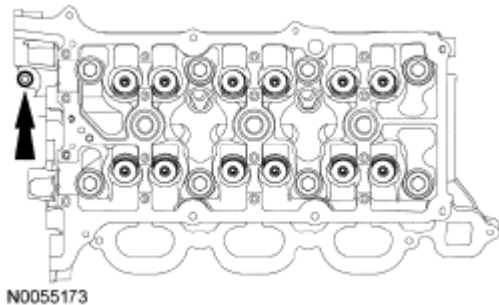
- Stage 1: Tighten to 20 Nm (177 lb-in).
- Stage 2: Tighten to 35 Nm (26 lb-ft).
- Stage 3: Tighten 90 degrees.
- Stage 4: Tighten 90 degrees.
- Stage 5: Tighten 90 degrees.



N0054884

Fig. 559: Identifying RH Cylinder Head Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

41. Install the new M6 bolt.
 - Tighten to 10 Nm (89 lb-in).

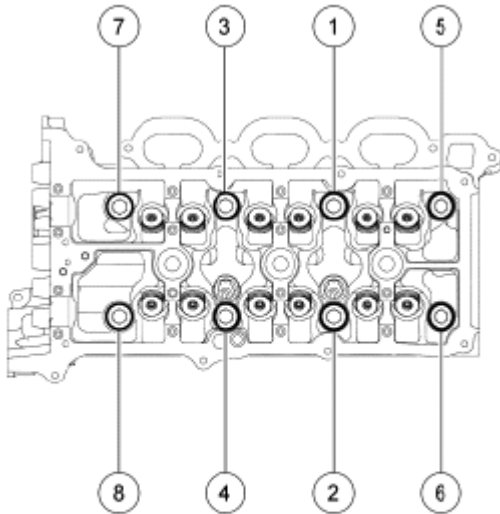


N0055173

Fig. 560: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

42. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in illustration below in 5 stages:
 - Stage 1: Tighten to 20 Nm (177 lb-in).

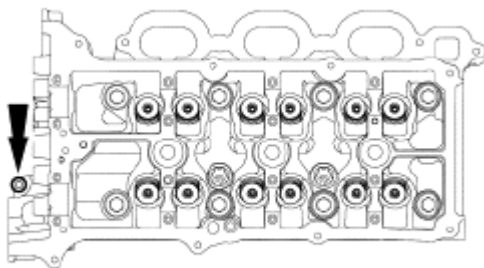
- Stage 2: Tighten to 35 Nm (26 lb-ft).
- Stage 3: Tighten 90 degrees.
- Stage 4: Tighten 90 degrees.
- Stage 5: Tighten 90 degrees.



N0054898

Fig. 561: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

43. Install the new M6 bolt.
 - Tighten to 10 Nm (89 lb-in).



N0055174

Fig. 562: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

44. Position the crankshaft dowel pin in the 9 o'clock position.

NOTE: The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve

clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.

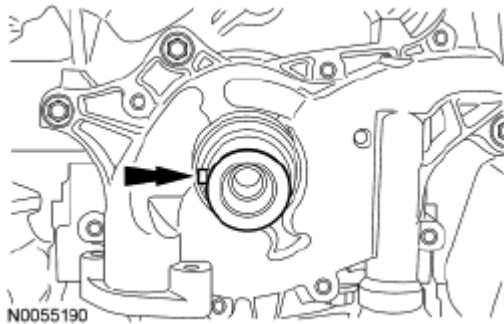


Fig. 563: Locating LH Camshaft Bearing Caps Bolts
Courtesy of FORD MOTOR CO.

45. Install the valve tappets.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

NOTE: LH shown in illustration, RH similar.



Fig. 564: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

46. Position the camshafts onto the RH cylinder head in the neutral position as shown in illustration.

NOTE: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

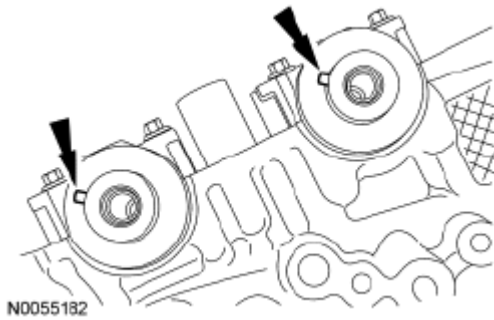


Fig. 565: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

47. Install the 8 camshaft caps and the 16 bolts.

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

- Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

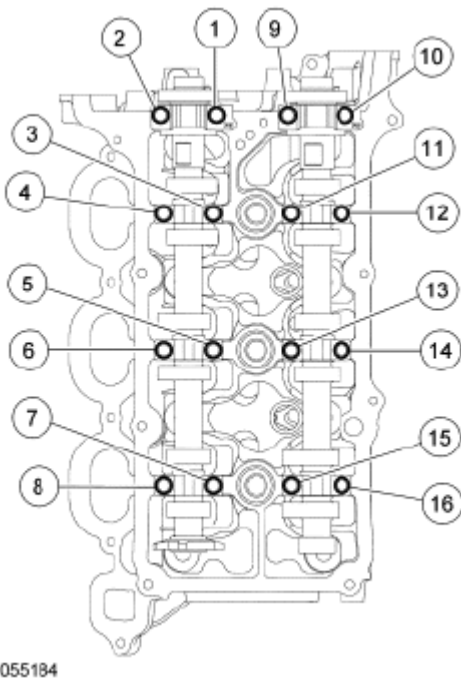


Fig. 566: Identifying Camshaft Caps Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

48. Position the camshafts onto the LH cylinder head in the neutral position as shown in illustration.

NOTE: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

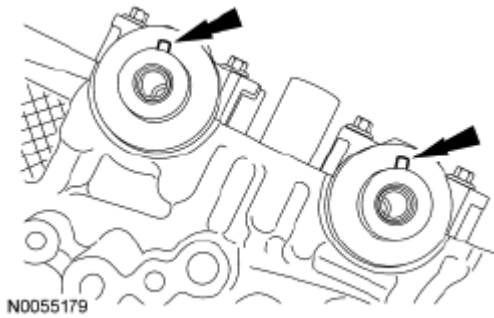


Fig. 567: Positioning Camshafts Onto LH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

49. Install the 8 camshaft caps and the 16 bolts.
- Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.

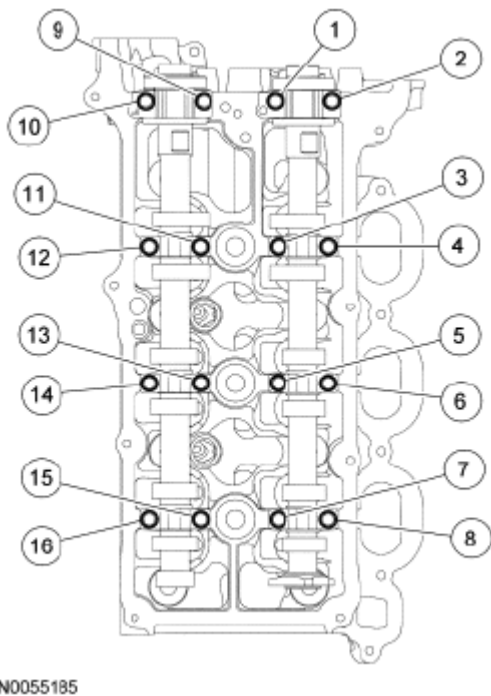


Fig. 568: Identifying Camshaft Caps Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

50. Using a feeler gauge, confirm that the valve tappet clearances are within specification. If valve tappet clearances are not within specification, the clearance must be adjusted by installing new valve tappet(s) of the correct size. For additional information, refer to **VALVE CLEARANCE CHECK**.

NOTE: If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage may occur.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

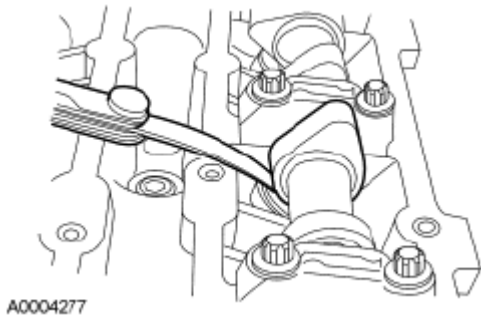


Fig. 569: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

51. Install the RH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

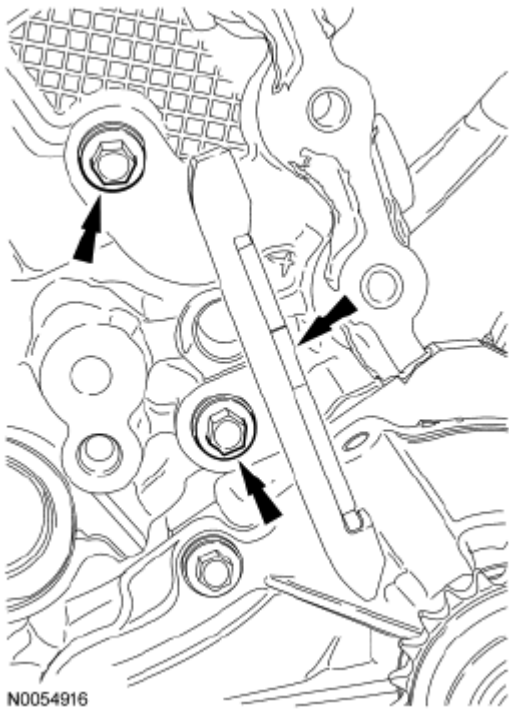


Fig. 570: Locating RH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

52. Install the RH primary timing chain guide and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).

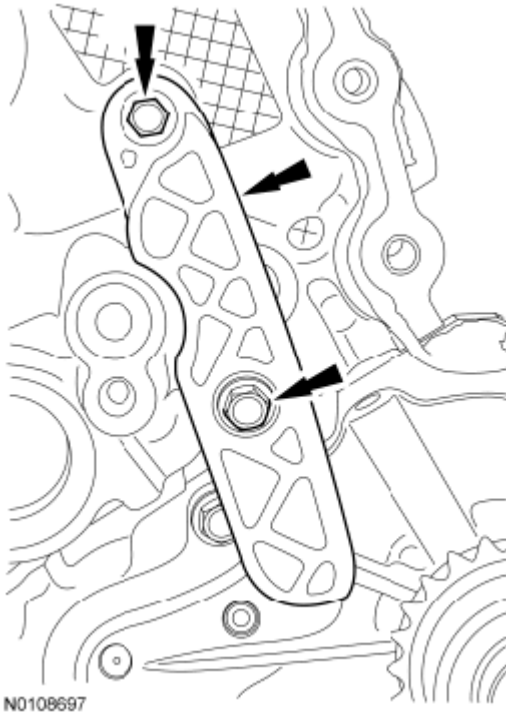


Fig. 571: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

53. Install the RH secondary timing chain tensioner and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).

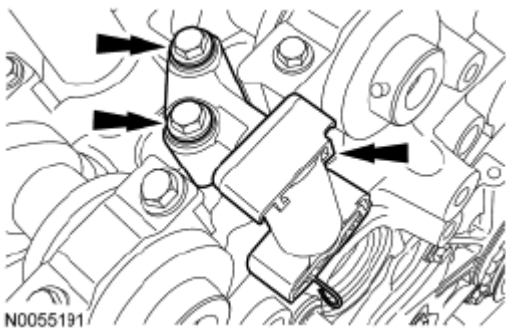


Fig. 572: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

54. Rotate the RH camshafts to the Top Dead Center (TDC) position and install the Camshaft Holding Tool on the flats of the camshafts.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

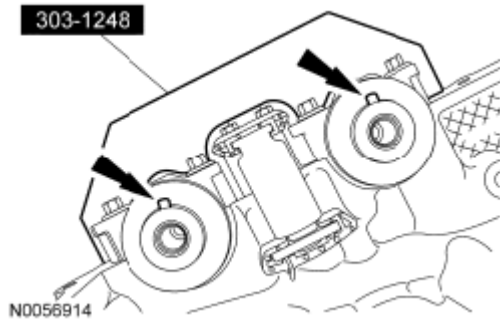


Fig. 573: Identifying Camshaft Holding Tool On Flats Of Camshafts
Courtesy of FORD MOTOR CO.

55. Assemble the RH Variable Camshaft Timing (VCT) assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
 - Align the colored links with the timing marks.

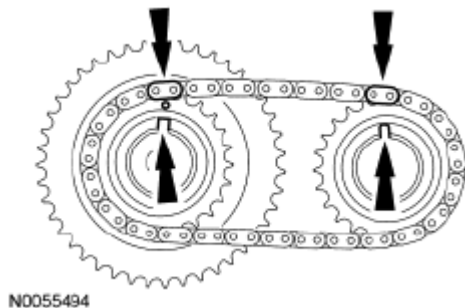


Fig. 574: Aligning Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

56. Position the RH secondary timing assembly onto the camshafts.

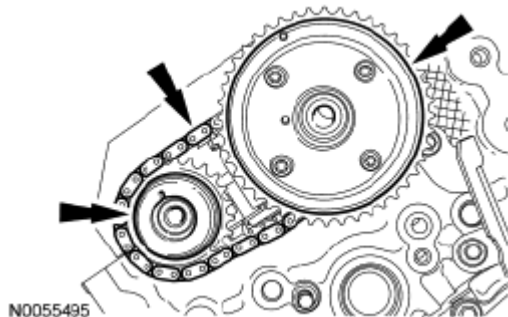


Fig. 575: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

57. Install 2 new bolts and the original washer. Tighten in 4 stages.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 10 Nm (89 lb-in).
 - Stage 4: Tighten 90 degrees.

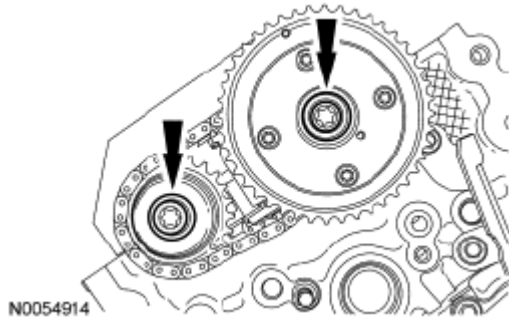


Fig. 576: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

58. Remove the lockpin from the RH secondary timing chain tensioner.

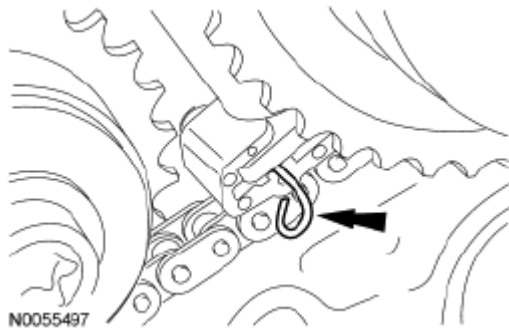


Fig. 577: Locating RH Secondary Timing Chain Tensioner Lockpin
Courtesy of FORD MOTOR CO.

59. Install the LH secondary timing chain tensioner and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).

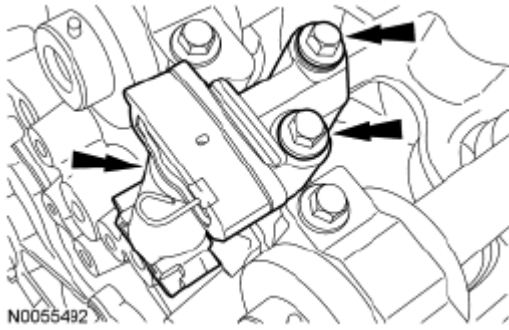


Fig. 578: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

60. Rotate the LH camshafts to the Top Dead Center (TDC) position and install the Camshaft Holding Tool on the flats of the camshafts.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

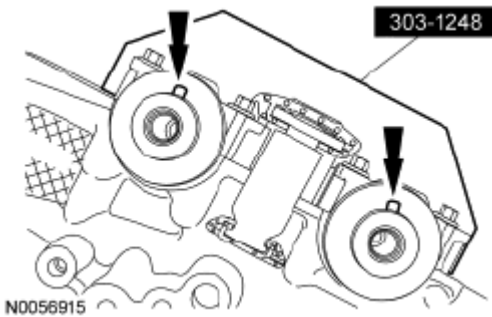


Fig. 579: Identifying Camshaft Holding Tool Onto Flats Of Camshafts
Courtesy of FORD MOTOR CO.

61. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
 - Align the colored links with the timing marks.

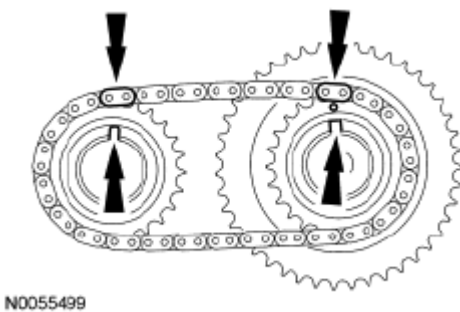


Fig. 580: Aligning Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

62. Position the LH secondary timing assembly onto the camshafts.

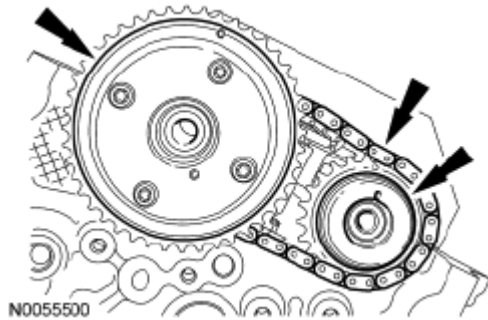


Fig. 581: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

63. Install 2 new bolts and the original washer. Tighten in 4 stages.

- Stage 1: Tighten to 40 Nm (30 lb-ft).
- Stage 2: Loosen one full turn.
- Stage 3: Tighten to 10 Nm (89 lb-in).
- Stage 4: Tighten 90 degrees.

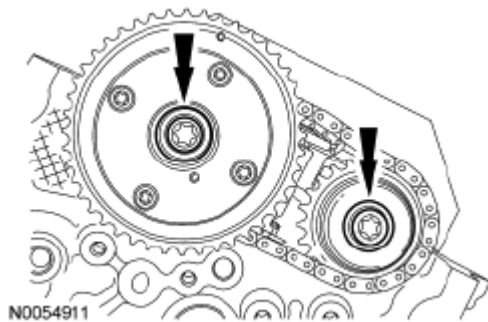


Fig. 582: Locating VCT Bolt & Exhaust Camshaft Bolt
Courtesy of FORD MOTOR CO.

64. Remove the lockpin from the LH secondary timing chain tensioner.

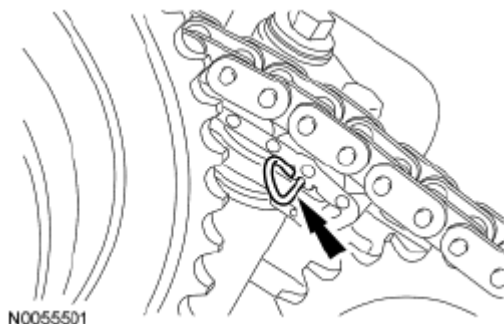


Fig. 583: Locating LH Secondary Timing Chain Tensioner Lockpin
Courtesy of FORD MOTOR CO.

65. Rotate the crankshaft clockwise 60 degrees to the TDC position (crankshaft dowel pin at 11 o'clock).

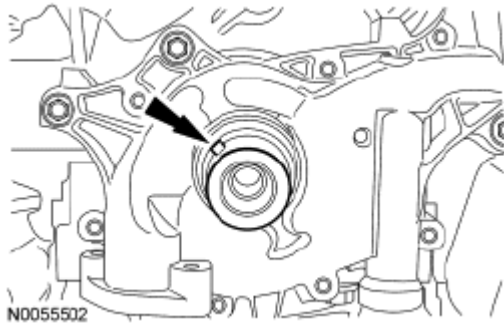


Fig. 584: Locating Crankshaft Dowel Pin
Courtesy of FORD MOTOR CO.

66. Install the crankshaft timing chain sprocket.

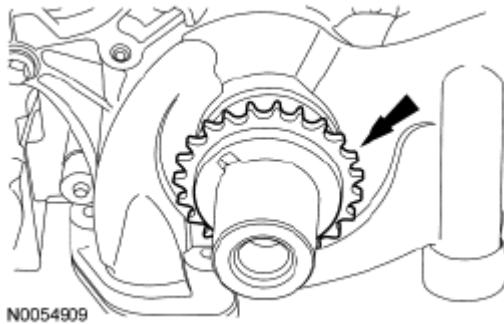
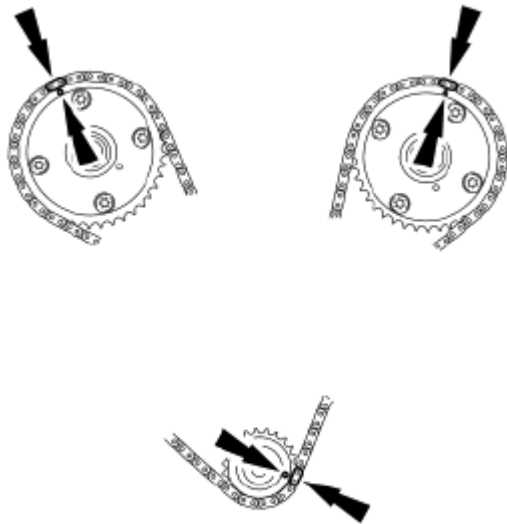


Fig. 585: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

67. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.



N0055503

Fig. 586: Aligning With Timing Marks On VCT Assemblies & Crankshaft Sprocket
 Courtesy of FORD MOTOR CO.

68. Install the upper LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

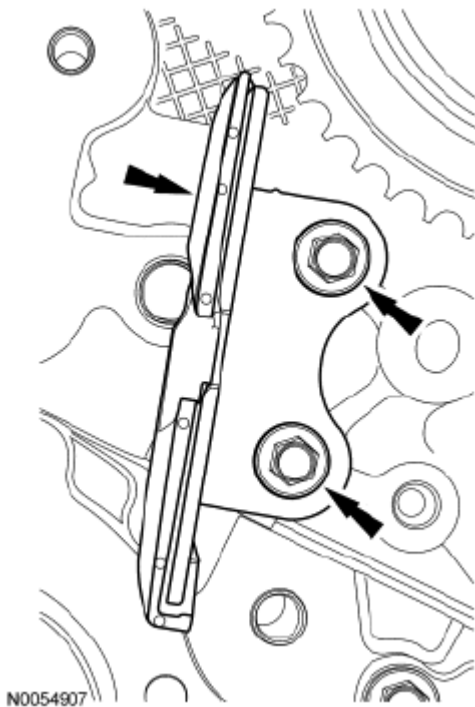
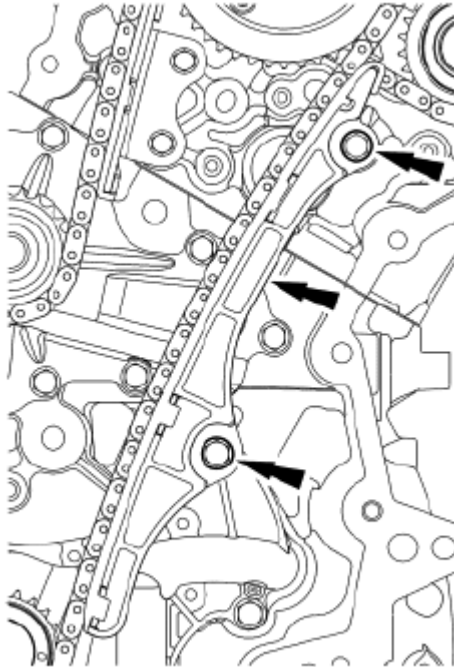


Fig. 587: Locating Upper LH Primary Timing Chain Guide & Bolts
 Courtesy of FORD MOTOR CO.

69. Install the lower LH primary timing chain guide and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).



N0081593

Fig. 588: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

70. Install the primary timing chain tensioner arm.

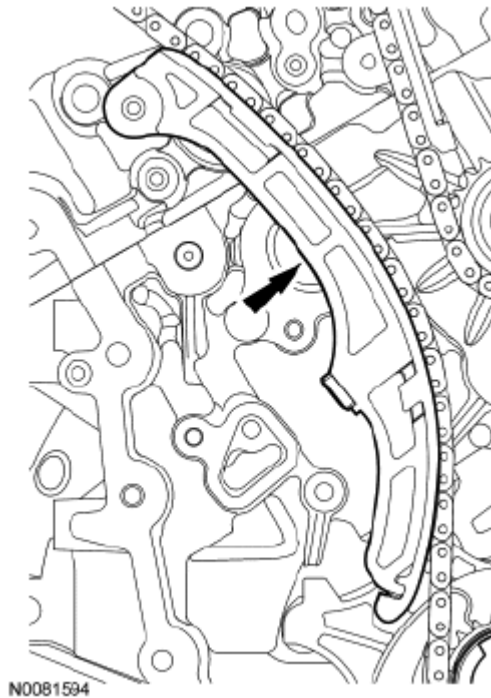


Fig. 589: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

71. Reset the primary timing chain tensioner.
- Rotate the lever counterclockwise.
 - Using a soft-jawed vise, compress the plunger.
 - Align the hole in the lever with the hole in the tensioner housing.
 - Install a suitable lockpin.

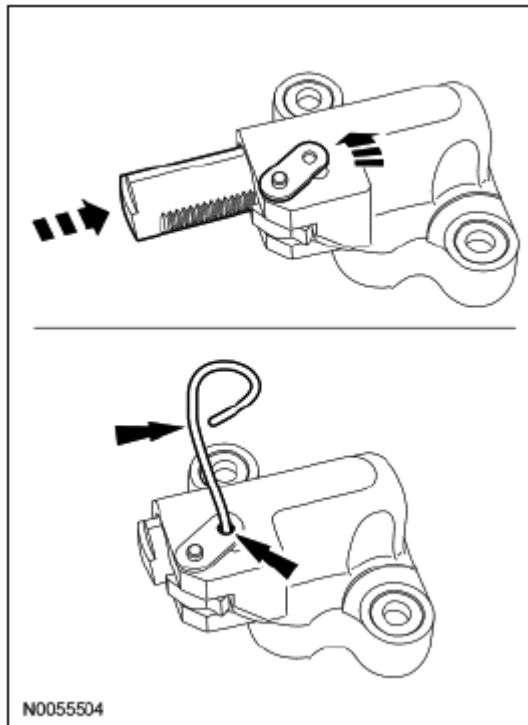


Fig. 590: Resetting Primary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

72. Install the primary tensioner and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).
 - Remove the lockpin.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

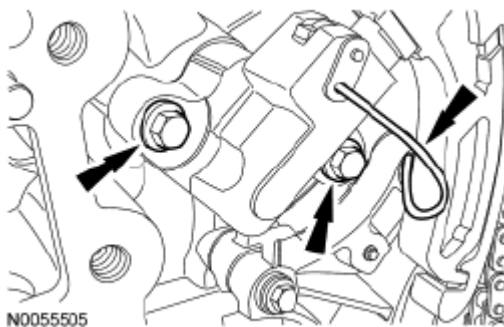


Fig. 591: Locating Primary Tensioner Bolts & Lockpin
Courtesy of FORD MOTOR CO.

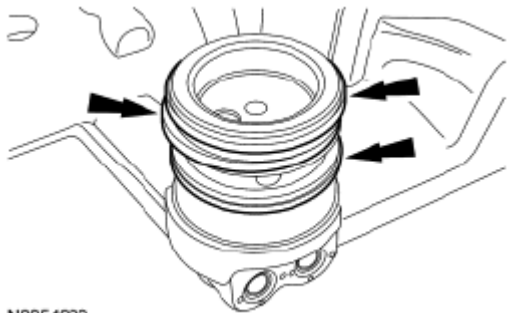
73. As a post-check, verify correct alignment of all timing marks.



N0055496

Fig. 592: Aligning Timing Marks
Courtesy of FORD MOTOR CO.

74. Inspect the VCT housing seals for damage and replace as necessary.



N0054903

Fig. 593: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

75. Install the LH VCT housing and the 3 bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

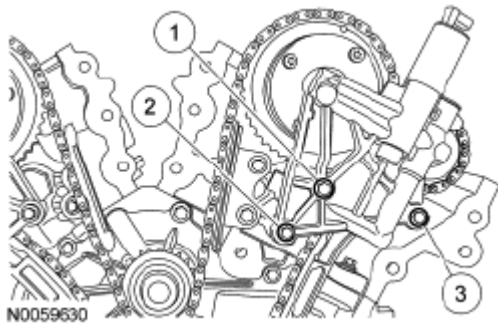


Fig. 594: Identifying VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

76. Install the RH VCT housing and the 3 bolts.
- Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

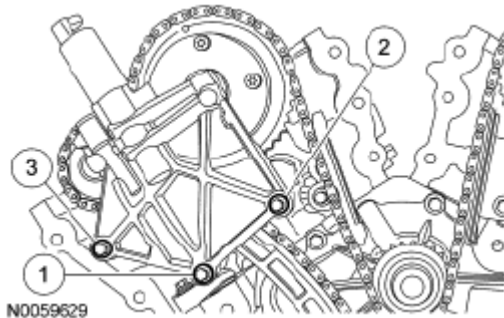


Fig. 595: Identifying RH VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

77. Install the Alignment Pins.

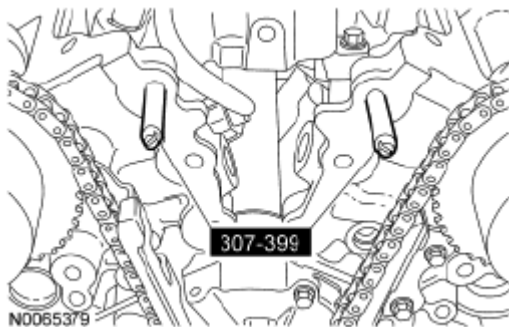


Fig. 596: Locating Alignment Pins
Courtesy of FORD MOTOR CO.

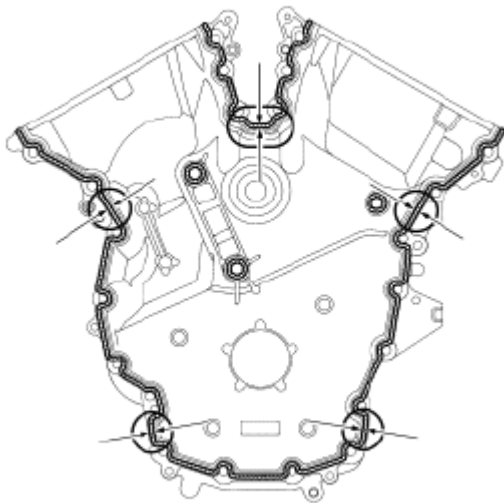
78. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.

- Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

5.5 mm
(0.21 in)



N0068283

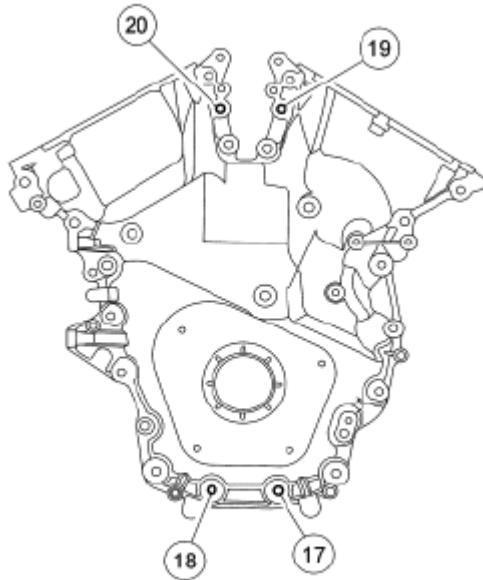
Fig. 597: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Oil Pan-To-Cylinder Block Joint

Courtesy of FORD MOTOR CO.

79. Install the engine front cover and bolts 17, 18, 19 and 20.

- Tighten in sequence to 3 Nm (27 lb-in).

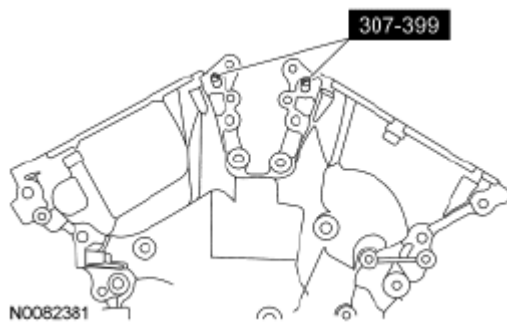
NOTE: Make sure the 2 locating dowel pins are seated correctly in the cylinder block.



N0068108

Fig. 598: Identifying Engine Front Cover Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

80. Remove the Alignment Pins.



N0082381

Fig. 599: Identifying Alignment Pins
Courtesy of FORD MOTOR CO.

81. Install the engine mount bracket and the 3 bolts.

NOTE: Do not tighten the bolts at this time.

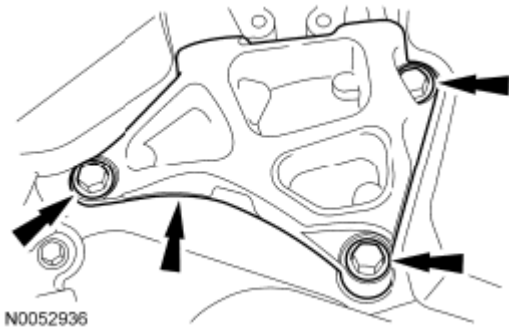


Fig. 600: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

82. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in illustration in 2 stages:
- Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (133 lb-in).
 - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

NOTE: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

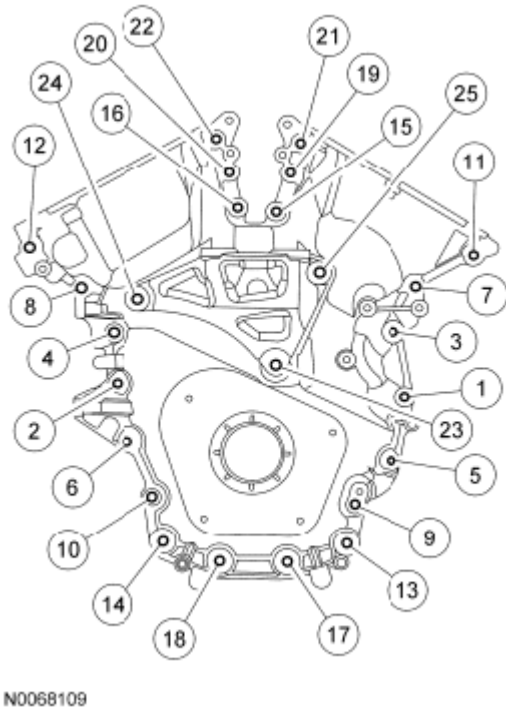


Fig. 601: Identifying Engine Mount Bracket Bolt Tighten Sequence
Courtesy of FORD MOTOR CO.

83. Install the engine mount studs in the following sequence.

1. Clean the front cover engine mount stud holes with pressurized air to remove any foreign material.
2. Clean all the thread sealer from the engine mount studs (old and new studs).
3. Apply new Threadlock and Sealer to the engine mount stud threads.
4. Install the 2 engine mount studs.
 - Tighten to 20 Nm (177 lb-in).

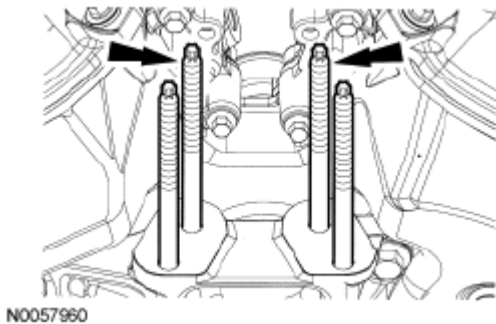


Fig. 602: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

NOTE: The thread sealer on the engine mount studs (including new engine mount studs if applicable) must be cleaned off with a wire brush and new Threadlock and Sealer applied prior to installing the engine mount studs. Failure to follow this procedure may result in damage to the engine mount studs or engine.

84. Install the engine mount bracket and the 2 bolts.
 - Tighten to 24 Nm (18 lb-ft).

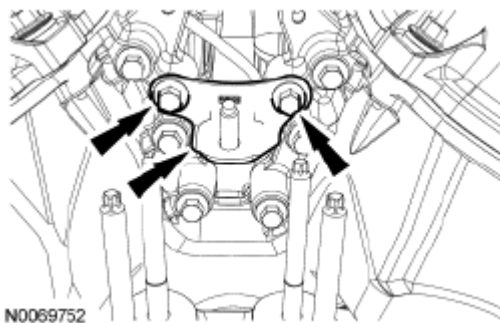


Fig. 603: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

85. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front

cover.

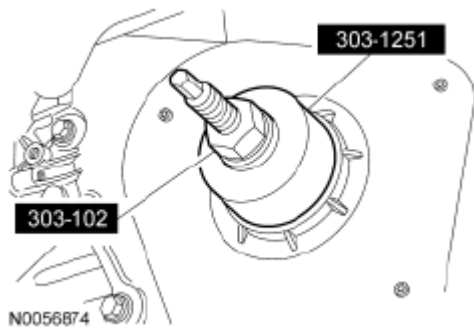


Fig. 604: Identifying Crankshaft Vibration Damper Installer And Front Crankshaft Installer
Courtesy of FORD MOTOR CO.

86. Using the Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the crankshaft pulley.

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

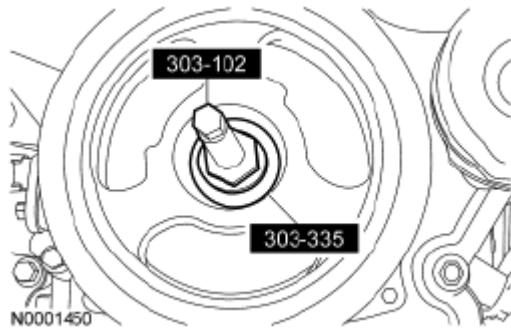


Fig. 605: Identifying Front Cover Oil Seal Installer & Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

87. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten 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.

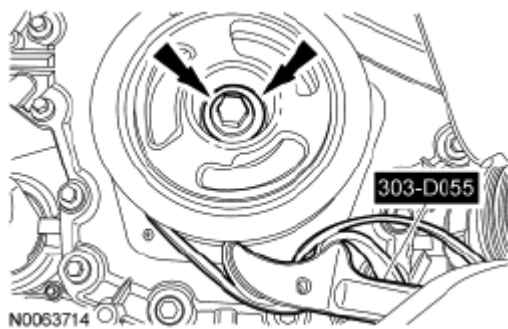


Fig. 606: Locating Crankshaft Pulley Washer & Bolt
Courtesy of FORD MOTOR CO.

88. Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown in illustration, VCT solenoid seal installation similar.

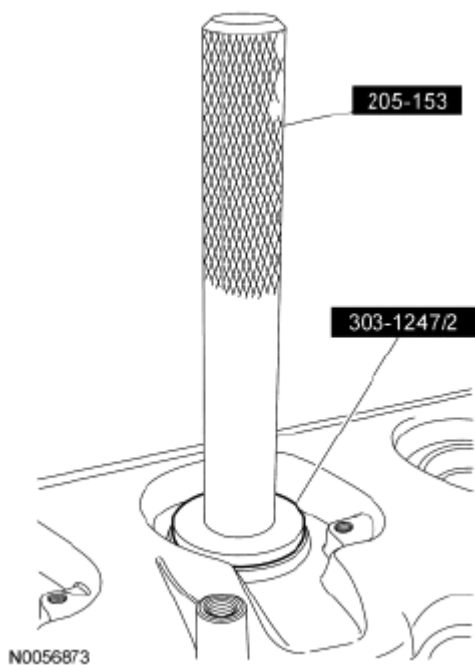


Fig. 607: Identifying VCT Spark Plug Tube Seal Installer And Handle
Courtesy of FORD MOTOR CO.

89. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

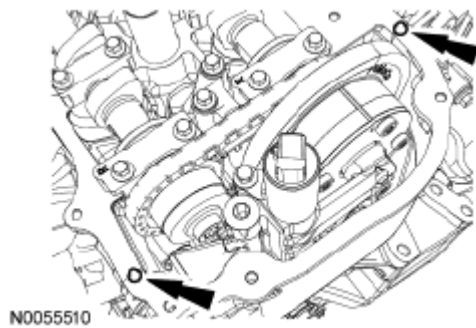


Fig. 608: Locating Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

90. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

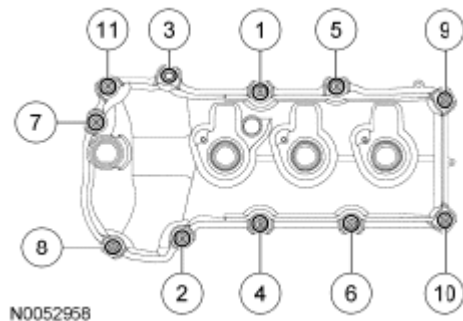


Fig. 609: Identifying Valve Cover Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

91. Using a new gasket, install the RH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

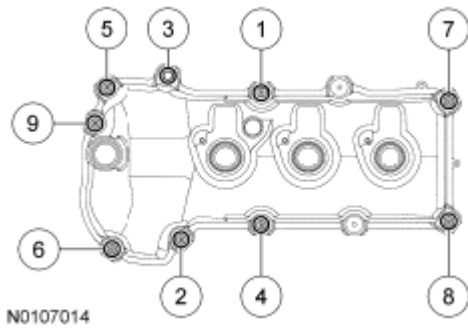


Fig. 610: Identifying RH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

All vehicles

92. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

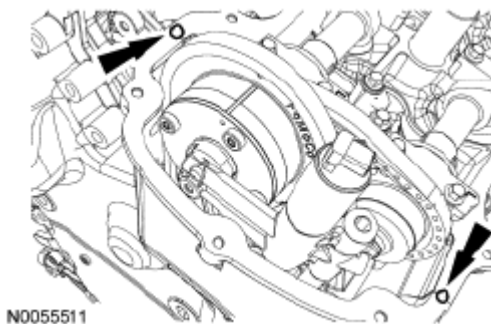


Fig. 611: Identifying Engine RTV Silicone Applying Area To Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

93. Using a new gasket, install the LH valve cover and 11 stud bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

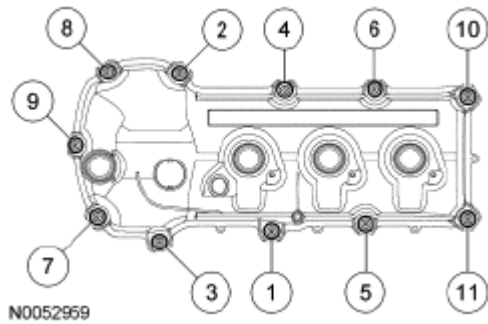


Fig. 612: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

94. Using a new gasket, install the LH valve cover and tighten the 9 stud bolts.
- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

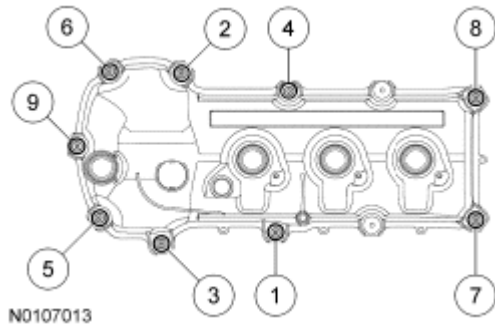


Fig. 613: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

All vehicles

95. Install the wiring harness retaining bracket and the 2 nuts.
- Tighten to 4 Nm (35 lb-in).

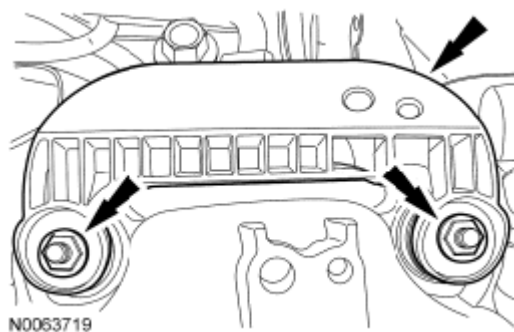


Fig. 614: Locating Wiring Harness Retaining Bracket & Nuts

Courtesy of FORD MOTOR CO.

96. Install the 6 coil-on-plug assemblies and the 6 bolts.
- Tighten to 7 Nm (62 lb-in).

NOTE: LH shown in illustration, RH similar.

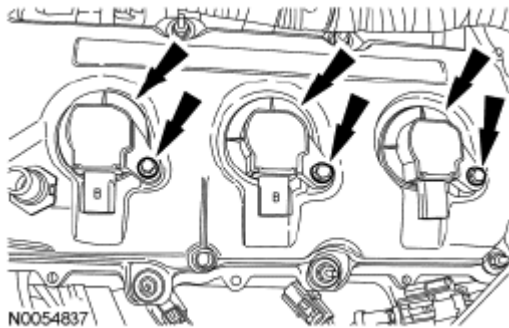


Fig. 615: Locating Bolts And Coil-On-Plug Assemblies
Courtesy of FORD MOTOR CO.

Late build vehicles

97. Using a new gasket, install the oil filter adapter and 3 bolts.
- Tighten to 10 Nm (89 lb-in).

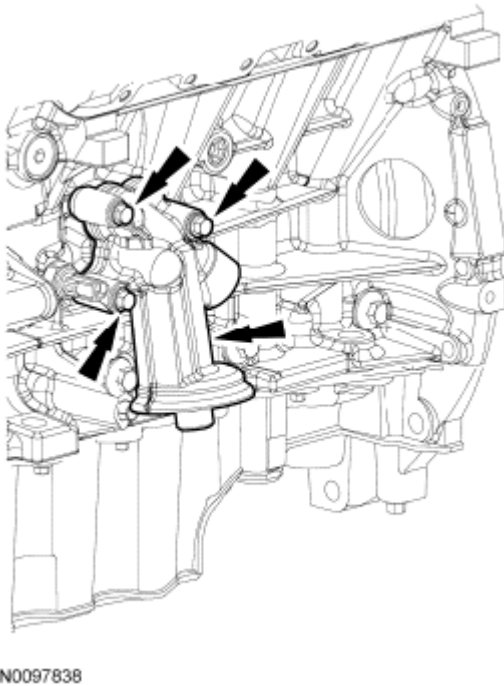


Fig. 616: Locating Oil Filter Adapter Bolts

Courtesy of FORD MOTOR CO.

Early build vehicles

98. Using a new gasket and O-ring seal, install the oil filter adapter and the 2 bolts.
- Tighten the large bolt to 57 Nm (42 lb-ft).
 - Tighten the small bolt to 10 Nm (89 lb-in).

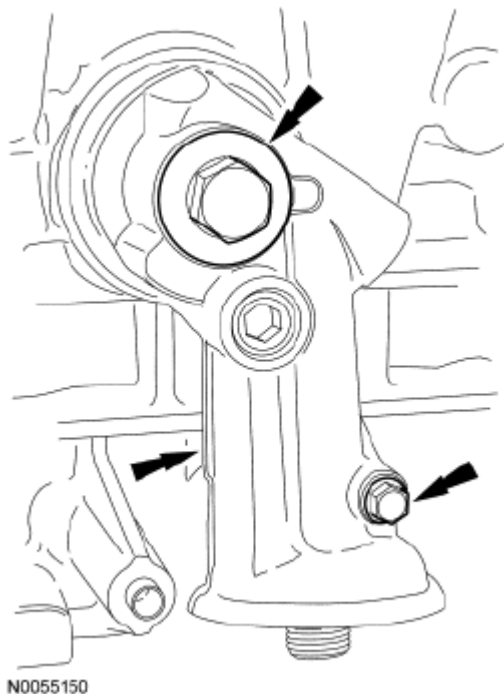


Fig. 617: Locating Oil Filter Adapter, O-Ring Seal & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

99. Install the **EOP** switch.

NOTE: Apply thread sealant with PTFE to the Engine Oil Pressure (EOP) switch threads.

- Tighten to 18 Nm (159 lb-in).

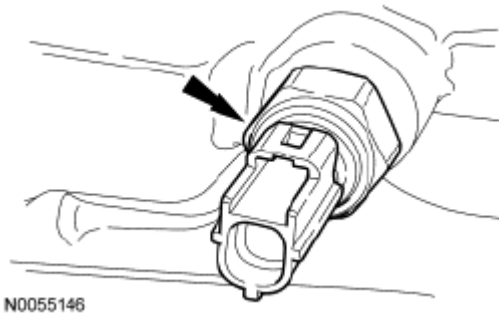


Fig. 618: Locating EOP Switch
Courtesy of FORD MOTOR CO.

100. Install the Crankshaft Position (CKP) sensor and install the bolt.
- Tighten to 10 Nm (89 lb-in).

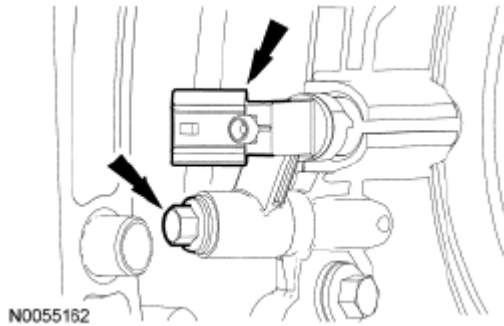


Fig. 619: Locating CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

101. Install LH Camshaft Position (CMP) sensor and the bolt.
- Tighten to 10 Nm (89 lb-in).

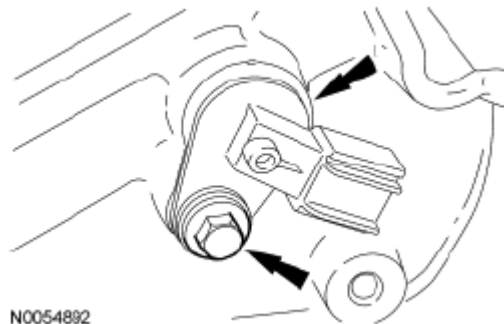


Fig. 620: Locating LH CMP Sensor And Bolt
Courtesy of FORD MOTOR CO.

102. Install and connect the Cylinder Head Temperature (CHT) sensor jumper harness.

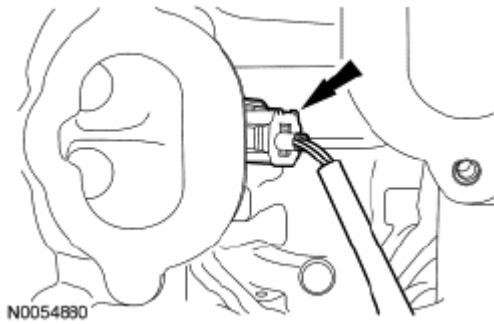


Fig. 621: Locating CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

103. Using new gaskets, install the lower intake manifold and the 10 bolts.

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.

- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

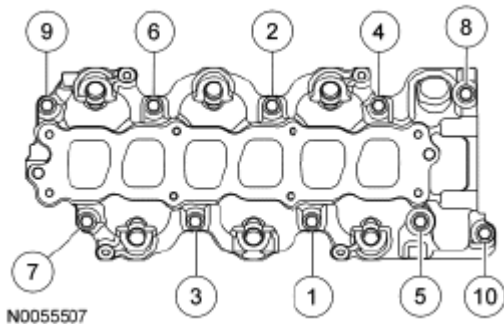


Fig. 622: Identifying Lower Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

104. Using a new gasket, install the thermostat housing and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).

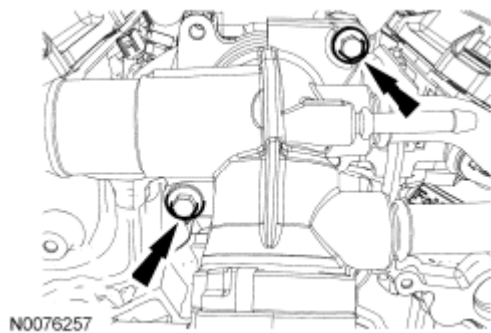


Fig. 623: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

105. Install new fuel injector O-ring seals.

- Remove the retaining clips and separate the fuel injectors from the fuel rail.
- Remove and discard the O-ring seals.
- Install new O-ring seals and lubricate with clean engine oil.
- Install the fuel injectors and the retaining clips onto the fuel rail.

NOTE: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings may cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

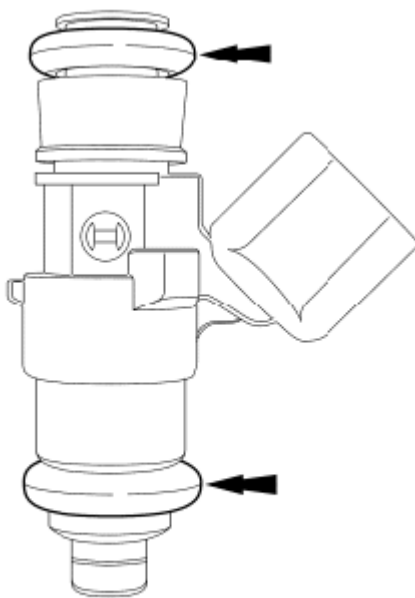


Fig. 624: Locating Fuel Injector O-Ring Seals

Courtesy of FORD MOTOR CO.

106. Install the fuel rail and injectors as an assembly and install the 4 bolts.
- Tighten to 10 Nm (89 lb-in).

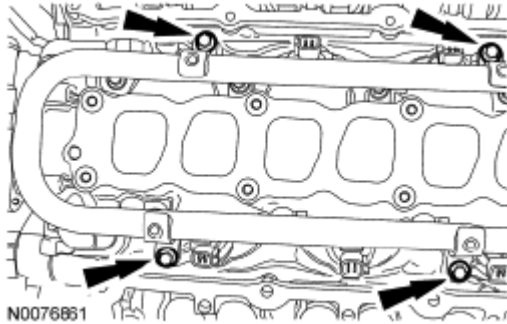


Fig. 625: Locating Fuel Rail & Injectors Assembly Bolts
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

107. Install the catalytic converter bracket and the 2 bolts.
- Tighten to 40 Nm (30 lb-ft).

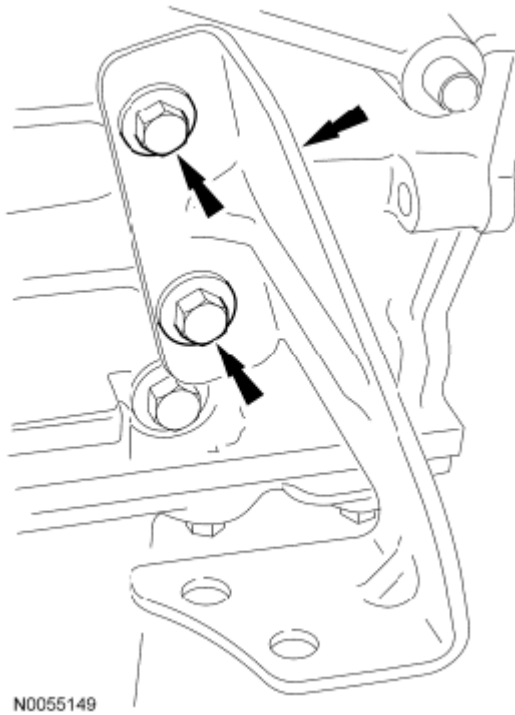


Fig. 626: Locating Catalytic Converter Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

108. Install the RH CMP sensor and the bolt.

- Tighten to 10 Nm (89 lb-in).

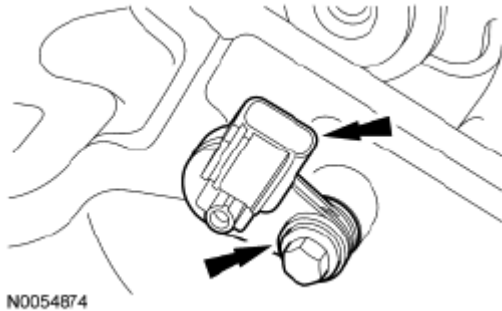


Fig. 627: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

109. Install the engine lifting eye and the 2 bolts.

- Tighten to 24 Nm (18 lb-ft).

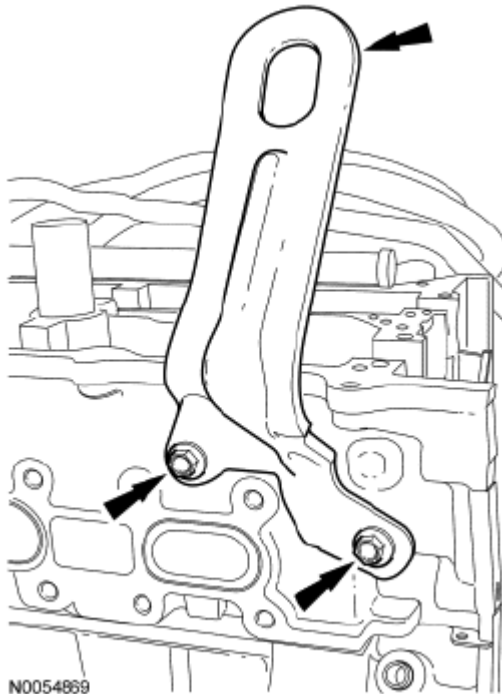


Fig. 628: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

110. Install the cover and the pin-type retainer.

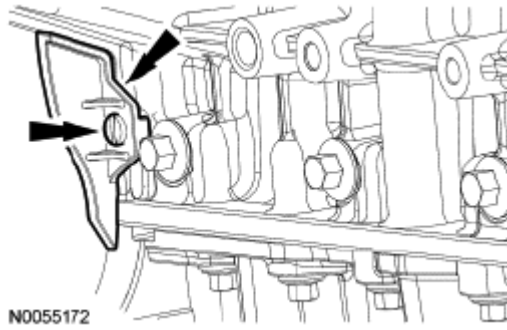


Fig. 629: Locating Pin-Type Retainer & Cover
Courtesy of FORD MOTOR CO.

111. Install the LH cylinder block drain plug.
 - Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

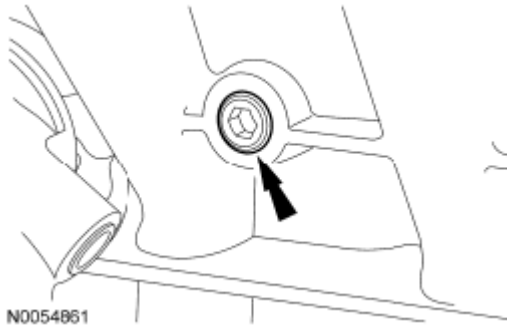


Fig. 630: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

112. Install the RH cylinder block drain plug or, if equipped, the block heater.
 - Tighten to 40 Nm (30 lb-ft).

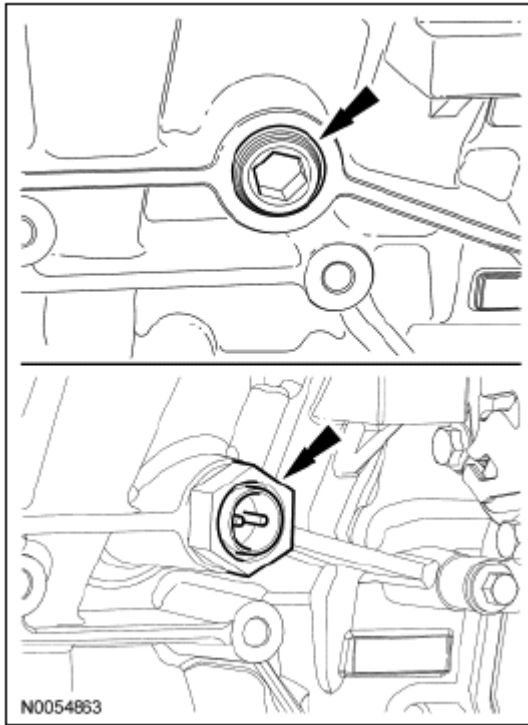


Fig. 631: Locating RH Cylinder Block Drain Plug & Block Heater
Courtesy of FORD MOTOR CO.

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

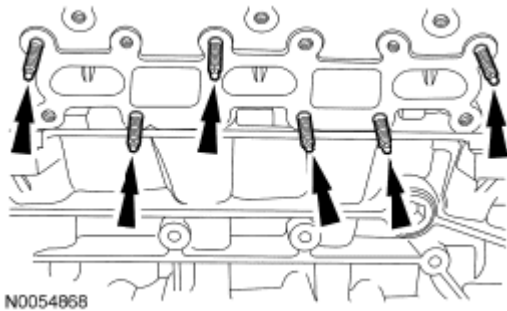


Fig. 632: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

114. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration below:
- Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

NOTE: Failure to tighten the exhaust manifold nuts to specification a second time

will cause the exhaust manifold to develop an exhaust leak.

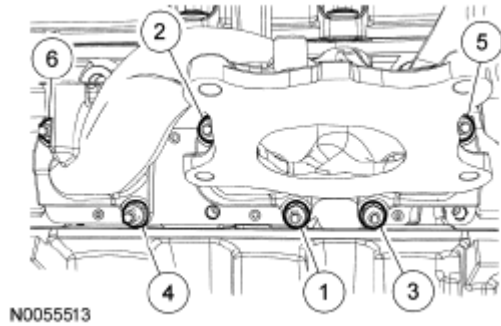


Fig. 633: Identifying RH Exhaust Manifold Nut Tightening Sequence
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

115. Using a new gasket, install the RH catalytic converter and the 4 new nuts.
 - Tighten to 40 Nm (30 lb-ft).

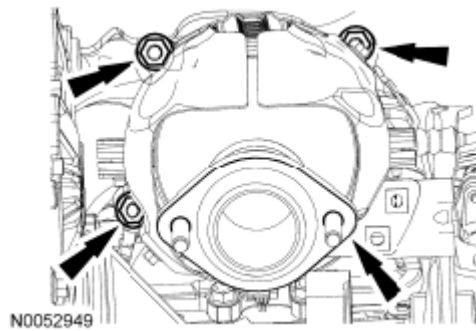


Fig. 634: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

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

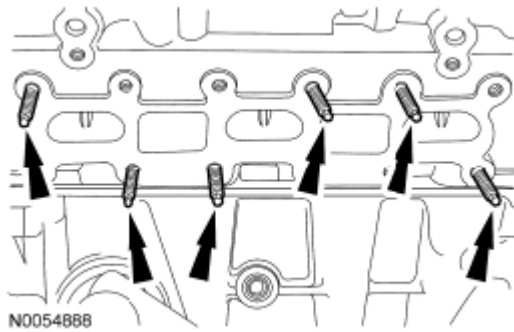


Fig. 635: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

117. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration below:
- Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

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

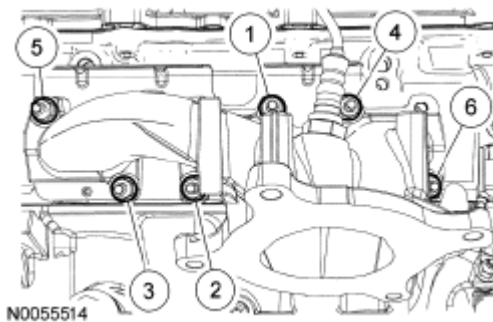


Fig. 636: Identifying LH Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

118. Install the LH exhaust manifold heat shield and the 3 bolts.
- Tighten to 10 Nm (89 lb-in).

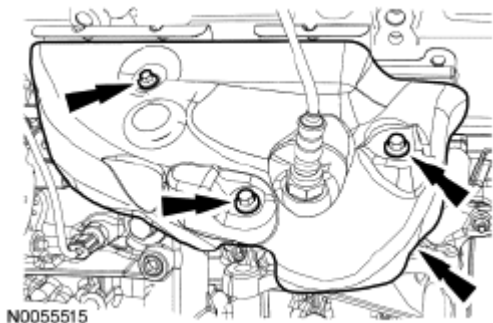


Fig. 637: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

119. Using a new gasket, install the LH catalytic converter and the 4 new nuts (3 shown in illustration).
- Tighten to 40 Nm (30 lb-ft).

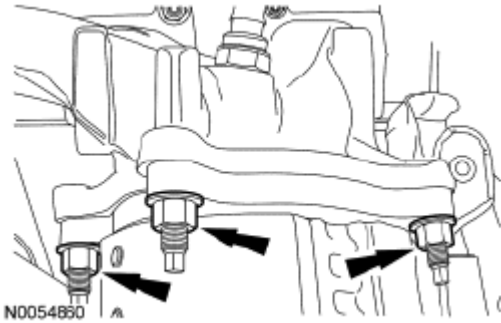


Fig. 638: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

120. Install the accessory drive belt tensioner and the 3 bolts.
- Tighten to 11 Nm (97 lb-in).

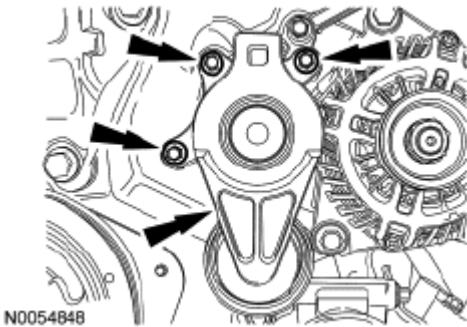


Fig. 639: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

121. Install the power steering pump and the 3 bolts.
- Tighten to 25 Nm (18 lb-ft).

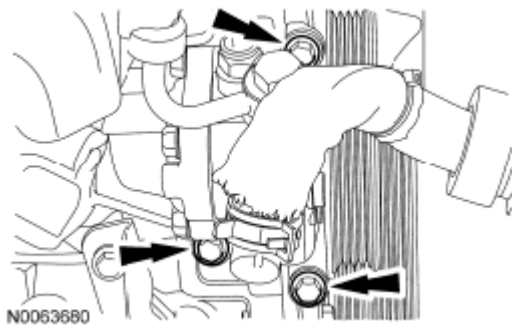


Fig. 640: Locating Power Steering Pump & Bolts
Courtesy of FORD MOTOR CO.

122. Install the Power Steering Pressure (PSP) tube bracket and bolt to the RH cylinder head.
- Tighten to 10 Nm (89 lb-in).

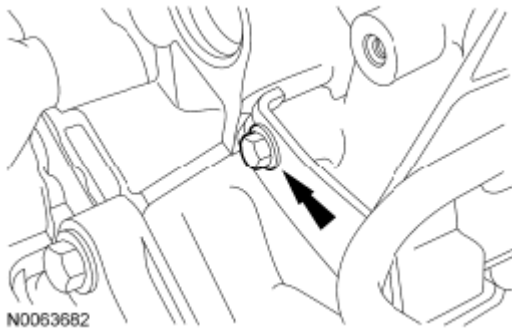


Fig. 641: Locating Power Steering Pressure Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

123. Install the **PSP** hose bracket nut.
- Tighten to 9 Nm (80 lb-in).

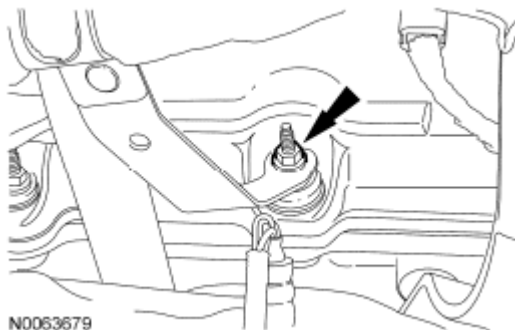


Fig. 642: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

124. Attach the **PSP** hose retainer to the engine lifting eye.

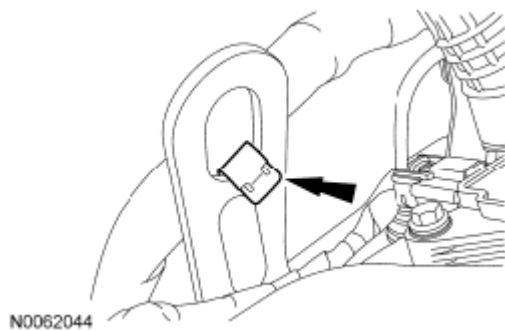


Fig. 643: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

125. Install the generator, the nut and the bolt.
 - Tighten to 48 Nm (35 lb-ft).

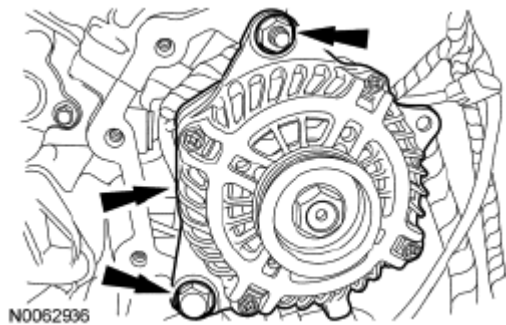


Fig. 644: Locating Nut, Bolt & Generator
Courtesy of FORD MOTOR CO.

126. Using new O-ring seals, install the A/C manifold and the bolt.
 - Tighten to 25 Nm (18 lb-ft).

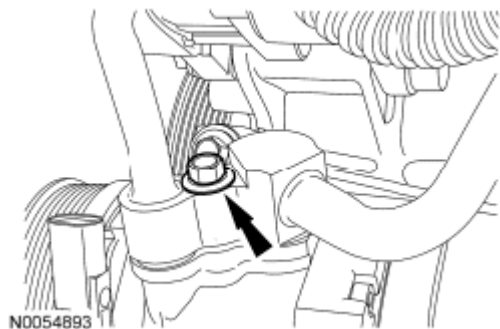


Fig. 645: Locating O-Ring Seals
Courtesy of FORD MOTOR CO.

127. Position the wiring harness onto the engine.
128. Connect the **EOP** switch electrical connector and the wiring harness pin-type retainer.

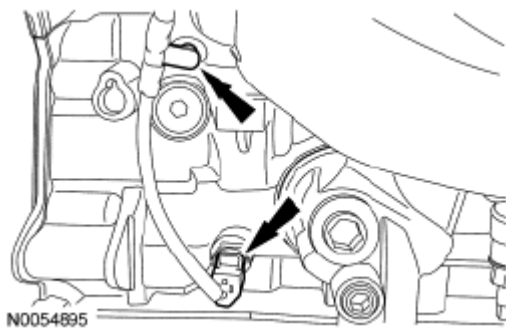


Fig. 646: Locating Engine Oil Pressure (EOP) Switch Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

129. Attach the wiring harness retainer to the generator.

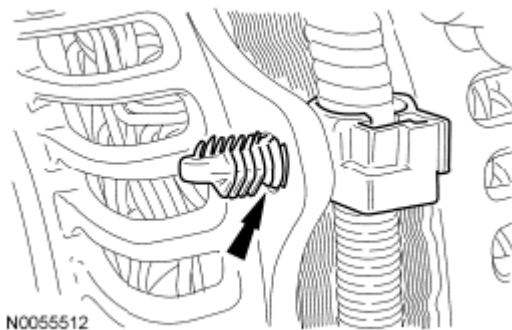


Fig. 647: Locating Wiring Harness Retainer To Generator
Courtesy of FORD MOTOR CO.

130. Connect the generator electrical connector.

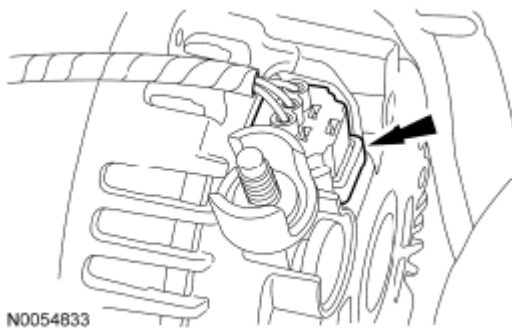


Fig. 648: Locating Electronic Automatic Temperature Control Hose
Courtesy of FORD MOTOR CO.

131. Connect the generator B+ cable and install the nut.
- Tighten to 12 Nm (106 lb-in).

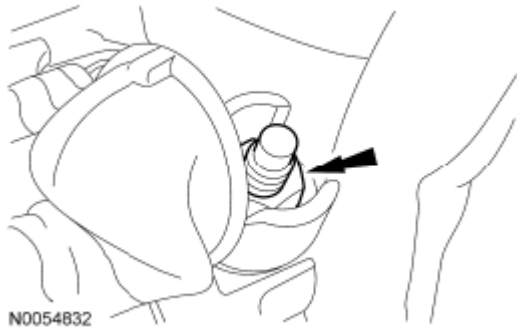


Fig. 649: Locating Generator B+ Cable Nut
Courtesy of FORD MOTOR CO.

132. Connect the A/C compressor electrical connector.

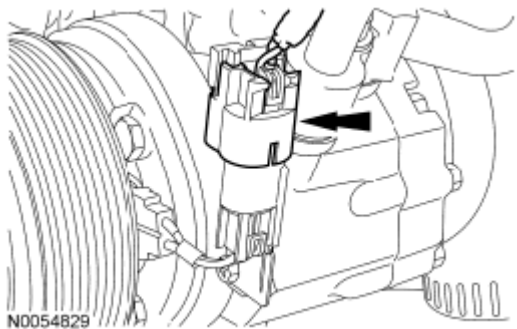


Fig. 650: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

133. Connect the CKP sensor electrical connector.

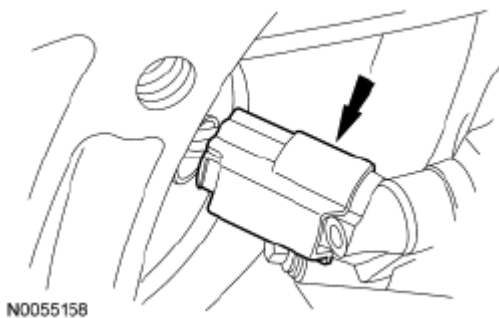


Fig. 651: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

134. Install the wiring harness grommet.

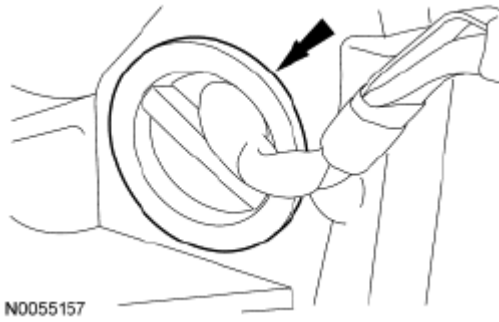


Fig. 652: Locating Wiring Harness Grommet
Courtesy of FORD MOTOR CO.

135. Install the wiring harness retainer stud bolt.
- Tighten to 10 Nm (89 lb-in).

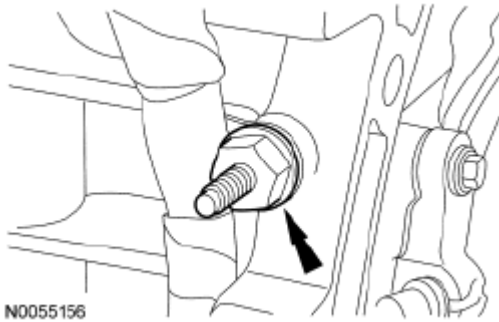


Fig. 653: Locating Wiring Harness Retainer Stud Bolt
Courtesy of FORD MOTOR CO.

136. Install the heat shield, the nut and the bolt.
- Tighten to 10 Nm (89 lb-in).

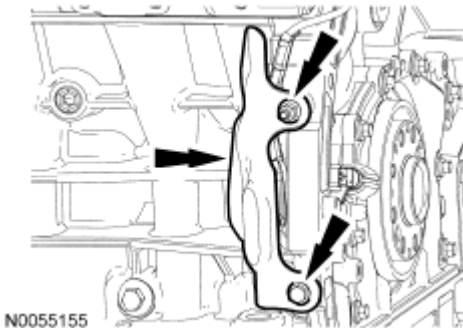


Fig. 654: Locating Heat Shield, Nut & Bolt
Courtesy of FORD MOTOR CO.

137. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
- Tighten to 10 Nm (89 lb-in).

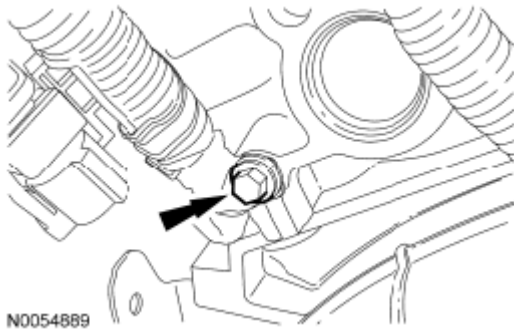


Fig. 655: Locating Wiring Harness Retainer Bolt
Courtesy of FORD MOTOR CO.

138. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
139. Connect the LH camshaft VCT solenoid electrical connector.

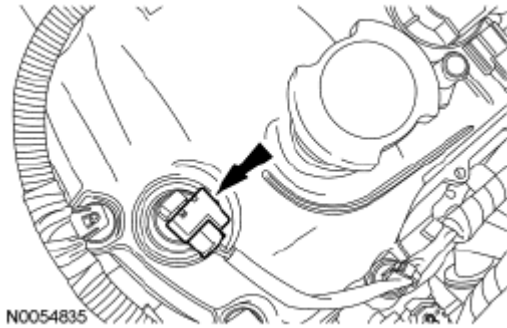


Fig. 656: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

140. Connect the 3 LH coil-on-plug electrical connectors.

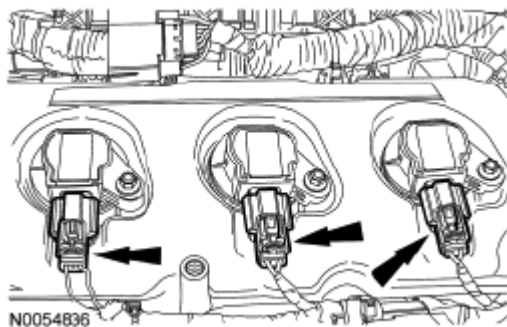


Fig. 657: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

141. Connect the LH HO2S electrical connector.

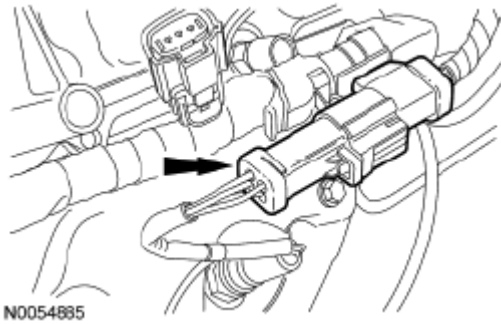


Fig. 658: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

142. Connect the LH Catalyst Monitor Sensor (CMS) electrical connector.

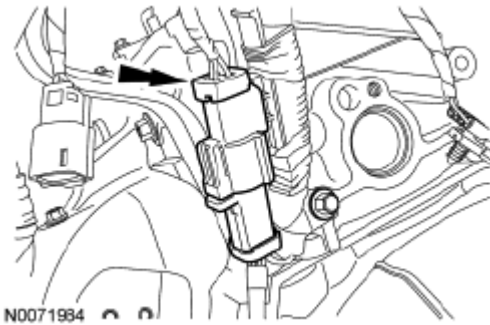


Fig. 659: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

143. Connect the LH **CMP** sensor electrical connector.

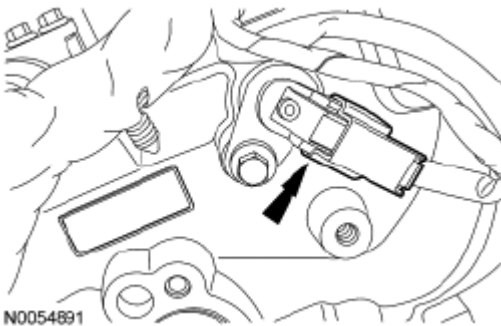


Fig. 660: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

144. Connect the **CHT** sensor electrical connector.

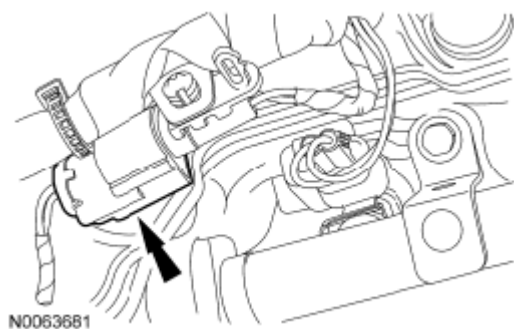


Fig. 661: Locating CHT Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

145. Connect the 6 fuel injector electrical connectors (3 shown in illustration).

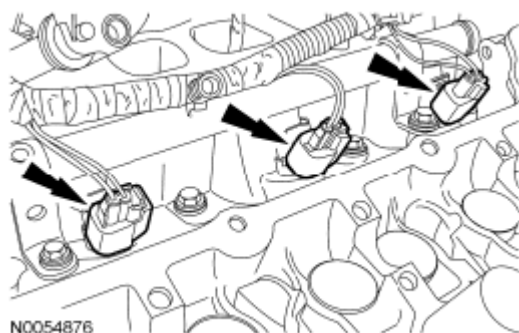


Fig. 662: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

146. Connect the **KS** electrical connector.

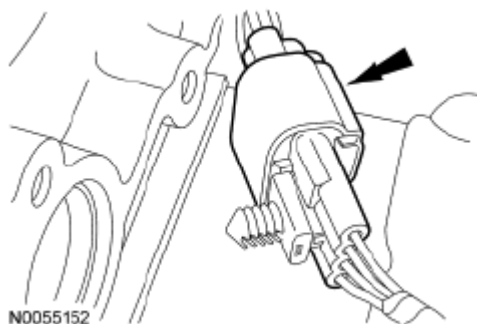


Fig. 663: Locating Knock Sensor (KS) Electrical Connector
Courtesy of FORD MOTOR CO.

147. Connect the RH **CMP** sensor electrical connector.

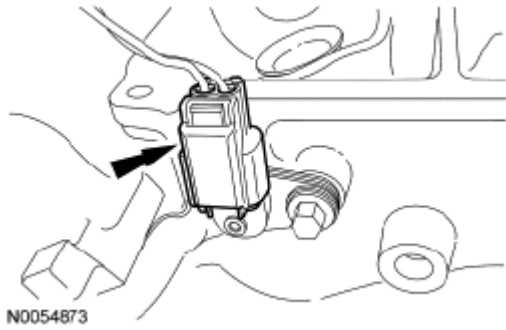


Fig. 664: Locating RH Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

148. Connect the coolant bypass hose to the thermostat housing.

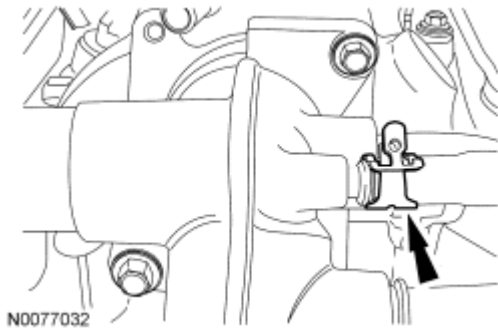


Fig. 665: Locating Coolant Bypass Hose To Thermostat Housing
Courtesy of FORD MOTOR CO.

149. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
150. Connect the 3 RH coil-on-plug electrical connectors.

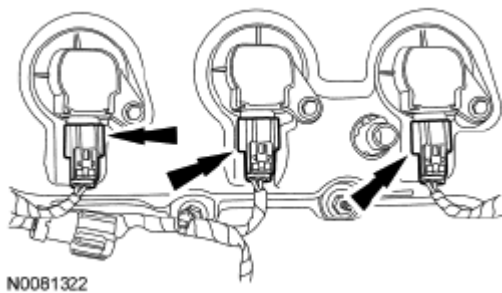


Fig. 666: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

151. Connect the RH VCT solenoid electrical connector.

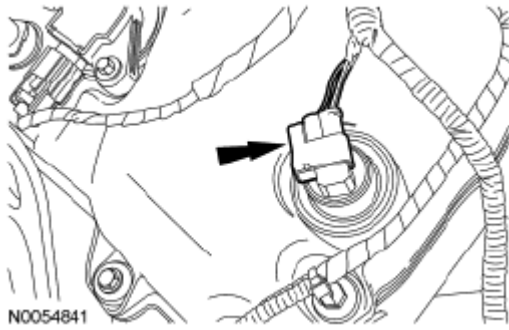


Fig. 667: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

152. Connect the RH **CMS** electrical connector.

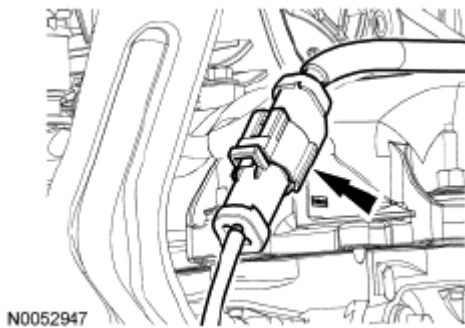


Fig. 668: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

153. Connect the **PSP** switch electrical connector.

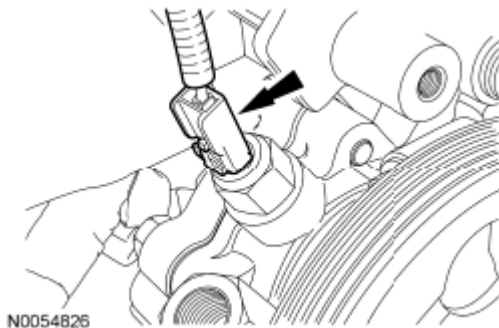
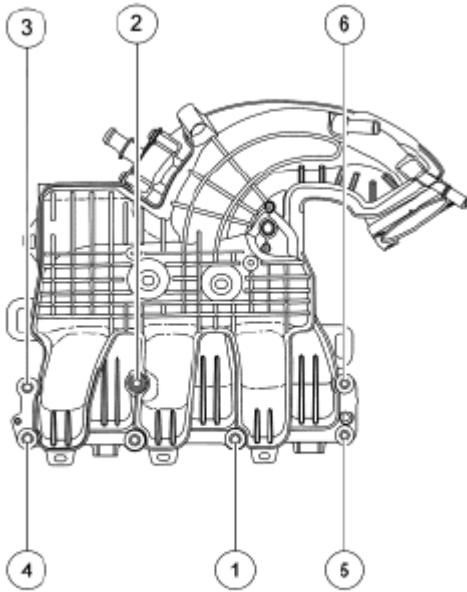


Fig. 669: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

154. Using new gaskets, install the upper intake manifold and the 6 bolts.

- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

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.

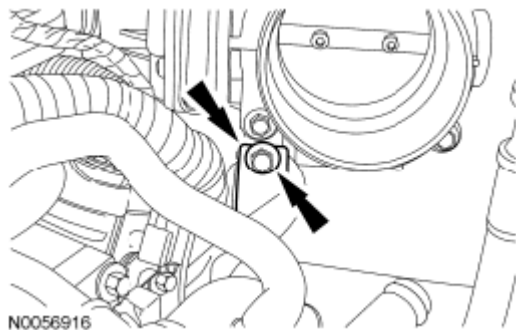


N0081211

Fig. 670: Identifying Upper Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

155. Install the upper intake manifold support bracket and the 2 bolts (one shown in illustration).

- Tighten to 10 Nm (89 lb-in).



N0056916

Fig. 671: Locating Upper Intake Manifold Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

156. Install the RH exhaust manifold heat shield and the 3 bolts.

- Tighten to 10 Nm (89 lb-in).

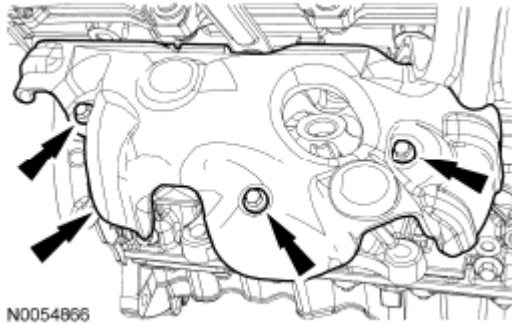


Fig. 672: Locating RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

157. Connect the RH HO2S electrical connector.

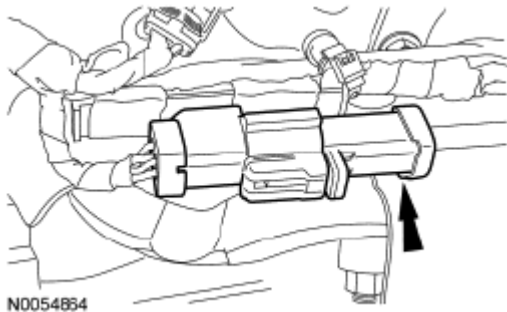


Fig. 673: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

158. Attach the wiring harness retainers to the upper intake manifold.

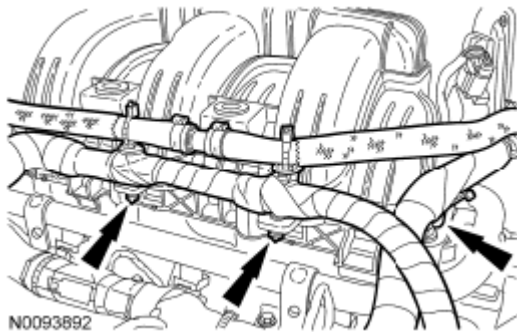


Fig. 674: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

159. Connect the Throttle Body (TB) electrical connector.

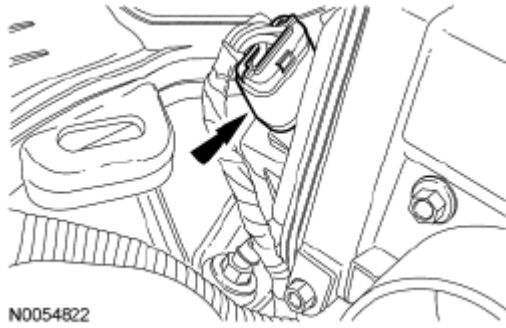


Fig. 675: Locating Throttle Body (TB) Electrical Connector
Courtesy of FORD MOTOR CO.

160. Connect the PCV hose to the PCV valve.

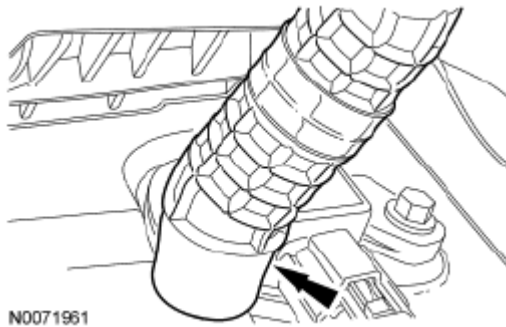


Fig. 676: Locating PCV Hose
Courtesy of FORD MOTOR CO.

161. If equipped, position the block heater wiring harness onto the engine.

- Attach the block heater wiring harness retainer to the power steering reservoir hose and the PSP hose.

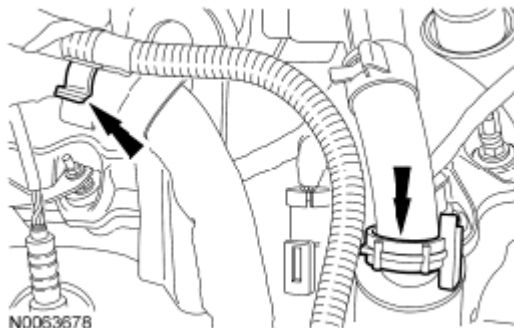


Fig. 677: Locating Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

162. If equipped, connect the block heater electrical connector and install the heat shield.

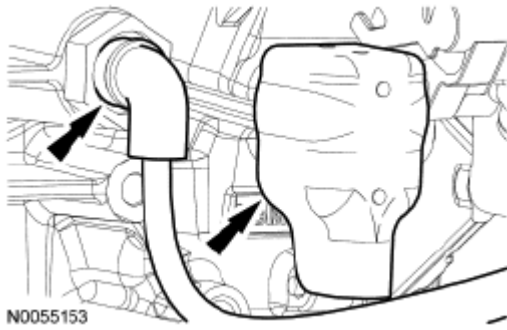


Fig. 678: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

163. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.

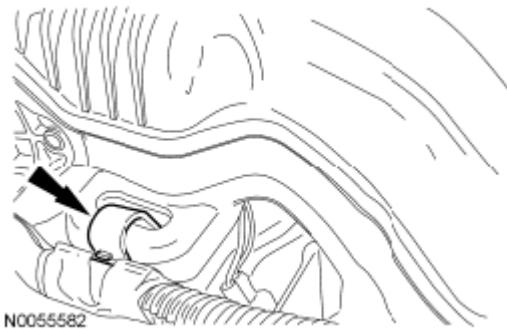


Fig. 679: Locating Block Heater Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

164. Install the Engine Lift Eye on the LH cylinder head.

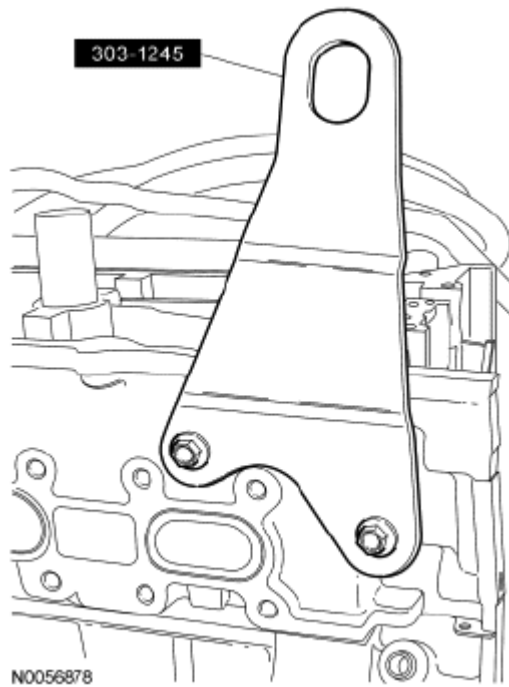


Fig. 680: Installing Engine Lift Eye On LH Cylinder Head
Courtesy of FORD MOTOR CO.

165. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the stand.

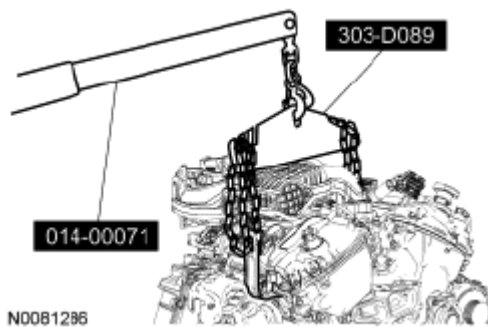


Fig. 681: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

166. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

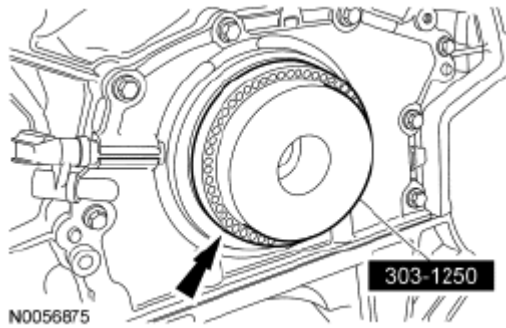


Fig. 682: Identifying Rear Main Seal Installer
Courtesy of FORD MOTOR CO.

167. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

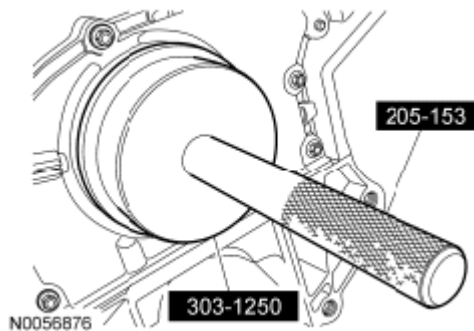


Fig. 683: Identifying Rear Main Seal Installer And Handle
Courtesy of FORD MOTOR CO.

168. Install the crankshaft sensor ring.

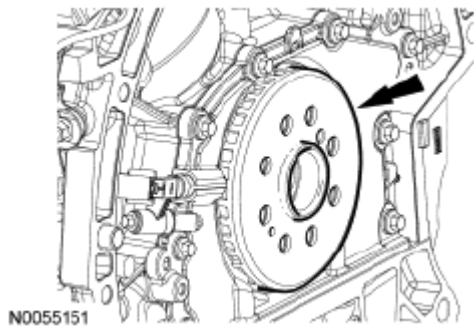


Fig. 684: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

169. Install the flexplate and the 8 bolts.
- Tighten to 80 Nm (59 lb-ft).

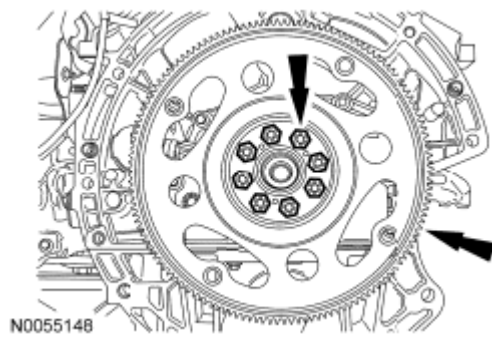


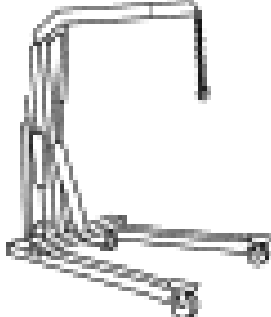
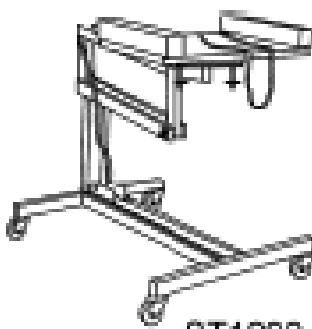
Fig. 685: Locating Flexplate & Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

ENGINE

Special Tool(s)

SPECIAL TOOL TABLE

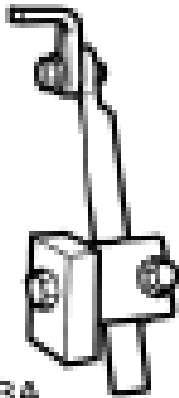
 ST1341-A	Heavy Duty Floor Crane 014-00071 or equivalent
 ST1293-A	Powertrain Lift 014-00765 or equivalent
	Spreader Bar 303-D089 (D93P-6001-A3) or equivalent

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

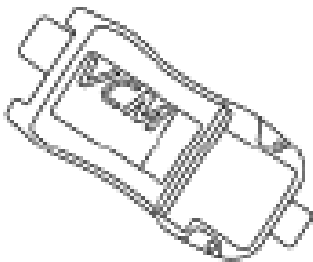


ST1602-A



ST2743A

Universal Adapter Brackets 014-00001 or equivalent



ST2834-A

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

Material

ITEM SPECIFICATION TABLE

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

All vehicles

1. Align the transaxle to the engine.

2. Install the 4 transaxle-to-engine bolts and the transaxle-to-engine stud bolt.
 - Tighten to 48 Nm (35 lb-ft).

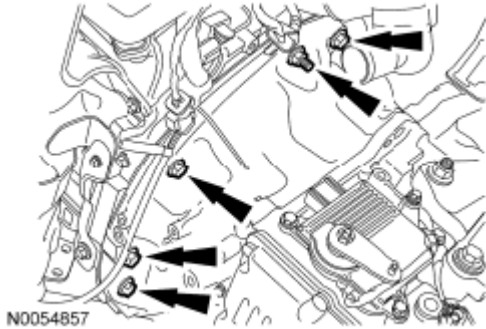


Fig. 686: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Install the 2 engine-to-transaxle bolts.
 - Tighten to 48 Nm (35 lb-ft).

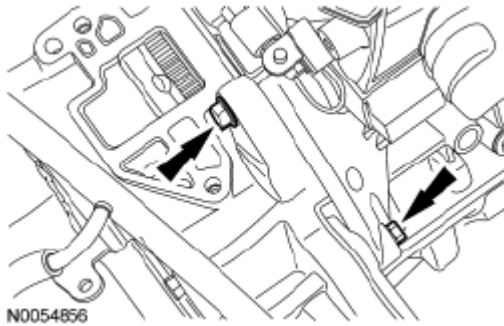


Fig. 687: Locating Engine-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

4. Using the Heavy Duty Floor Crane and the Spreader Bar, position the engine and transaxle onto the lift table.

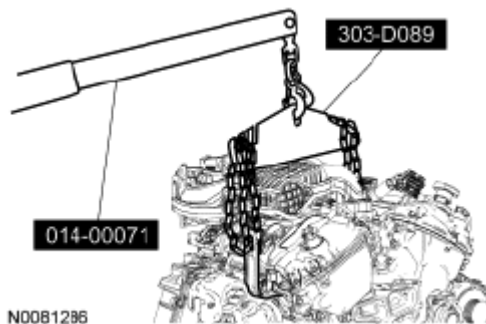


Fig. 688: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

5. Install the Powertrain Lift and Universal Adapter Brackets.

NOTE: Position a block of wood under the transaxle.

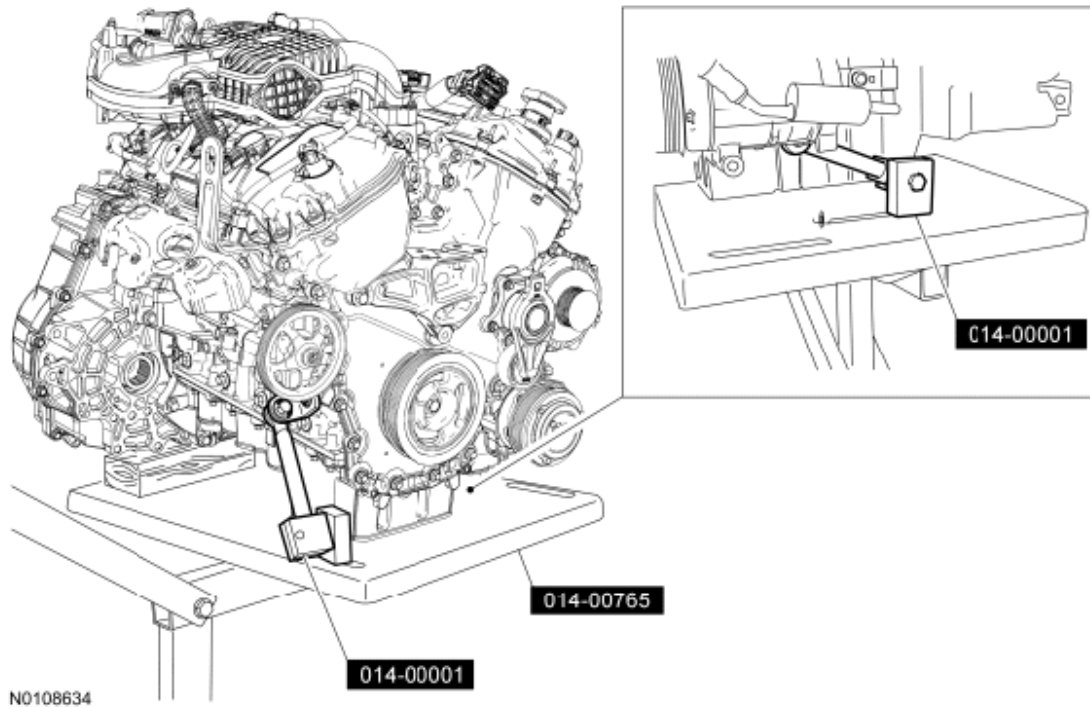


Fig. 689: Identifying Powertrain Lift & Universal Adapter Brackets
Courtesy of FORD MOTOR CO.

6. Install the starter and the 2 bolts.
 - Tighten to 26 Nm (19 lb-ft).

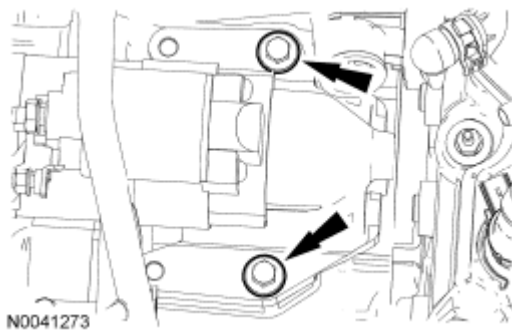


Fig. 690: Locating Starter & Bolts
Courtesy of FORD MOTOR CO.

7. Attach the starter wire terminals and install the 2 nuts.
 1. Tighten to 12 Nm (106 lb-in).

2. Tighten to 5 Nm (44 lb-in).
 - Position the starter terminal boot over the starter terminal.

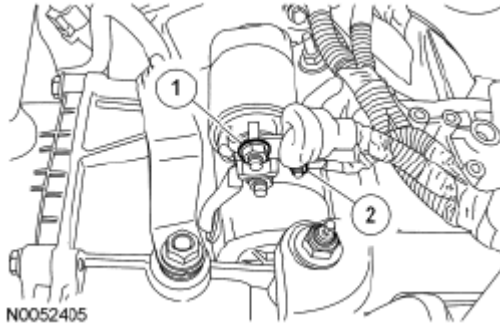


Fig. 691: Identifying Starter Motor Electrical Connectors
Courtesy of FORD MOTOR CO.

8. Connect the Transmission Control Module (TCM) electrical connector.

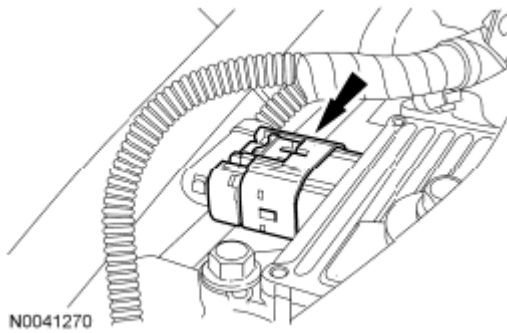


Fig. 692: Locating Transmission Control Module Electrical Connector
Courtesy of FORD MOTOR CO.

9. Install the ground wire and bolt.
 - Tighten to 12 Nm (106 lb-in).

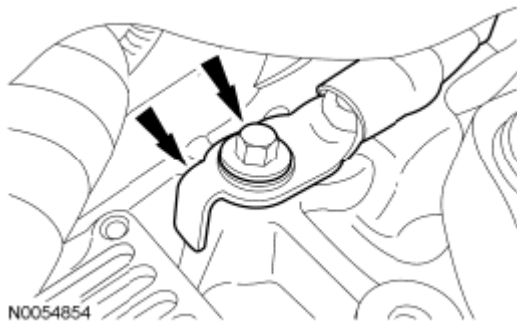


Fig. 693: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

10. Connect the wiring harness fasteners to the transaxle-to-engine stud bolt and the starter.

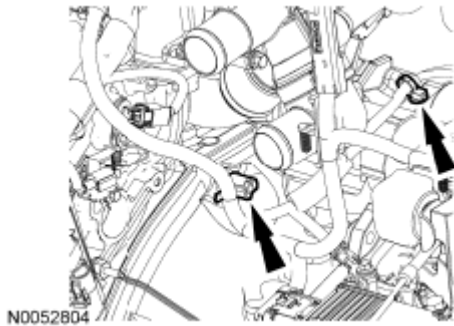


Fig. 694: Locating Transaxle-To-Engine Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

11. Raise the engine and transaxle assembly into the vehicle.
12. Install the engine mount, the nut and the 2 bolts.
 - Tighten the bolts to 55 Nm (41 lb-ft).
 - Tighten the nut to 63 Nm (46 lb-ft).

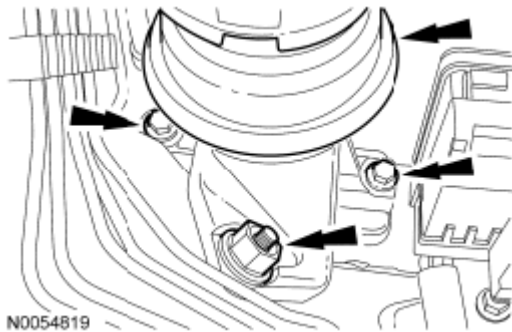


Fig. 695: Locating RH Instrument Panel Floor Brace Bolts
Courtesy of FORD MOTOR CO.

13. Install the 2 engine mount spacers and the 4 engine mount nuts.
 - Tighten in the sequence shown in illustration below to 70 Nm (52 lb-ft).

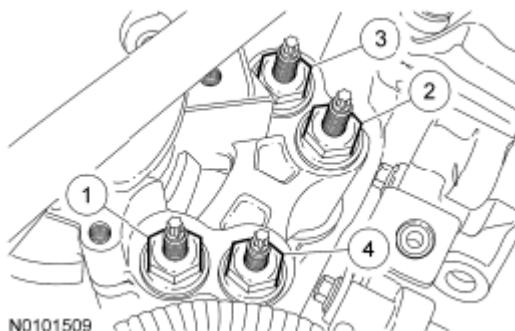


Fig. 696: Identifying Engine Mount Nut Tightening Sequence
Courtesy of FORD MOTOR CO.

14. Install the 2 transaxle support insulator bracket nuts and the bolt.
 - Tighten to 80 Nm (59 lb-ft).

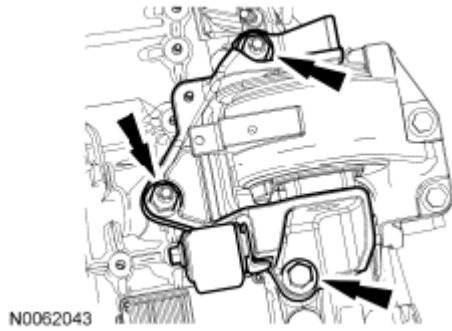


Fig. 697: Locating Transaxle Support Insulator Bracket Bolt & Nuts
Courtesy of FORD MOTOR CO.

15. Install the transaxle support insulator through bolt and nut.
 - Tighten to 90 Nm (66 lb-ft).



Fig. 698: Locating Transaxle Support Insulator Through Bolt & Nut
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

16. Using a small screwdriver, remove the compression seal and discard.

NOTE: A new compression seal must be installed whenever the Power Transfer Unit (PTU) is moved from the vehicle.

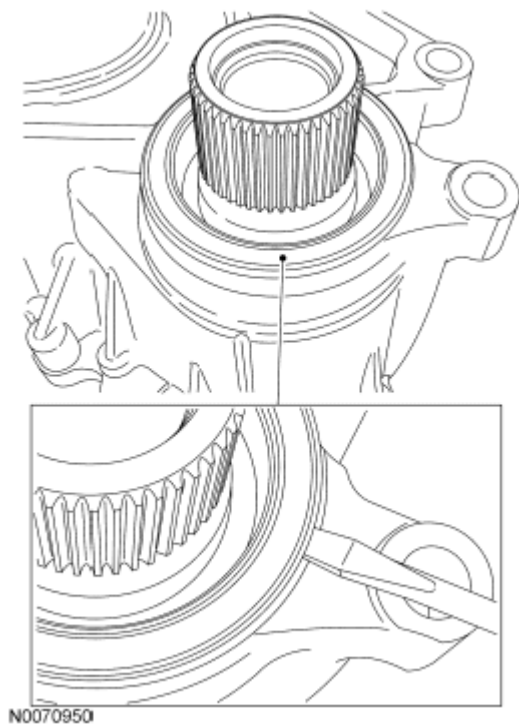


Fig. 699: Removing Compression Seal Using Small Screwdriver
Courtesy of FORD MOTOR CO.

17. Using a soft face hammer, install the new compression seal.

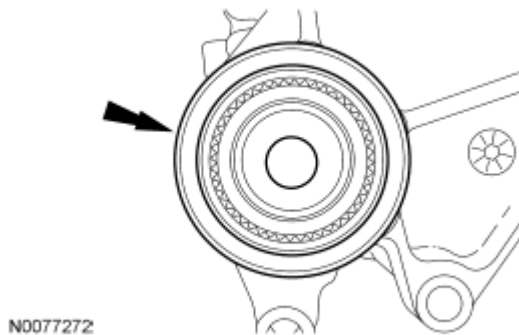


Fig. 700: Locating Compression Seal
Courtesy of FORD MOTOR CO.

18. Position the PTU in place and install the 5 bolts.
- Tighten to 90 Nm (66 lb-ft).

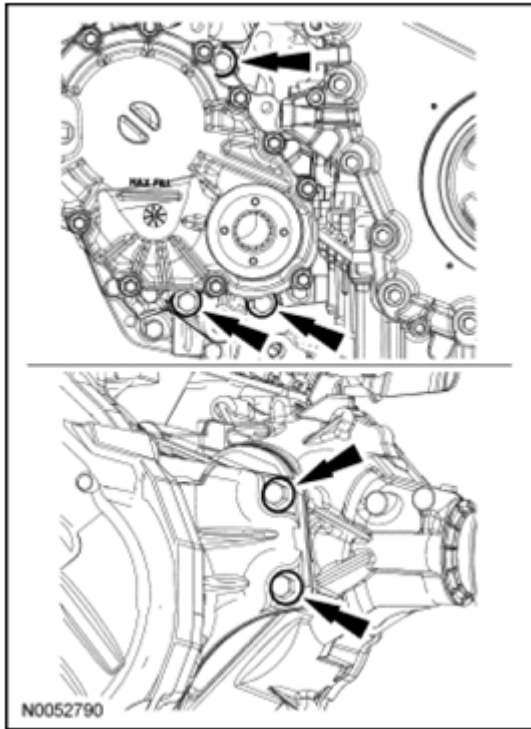


Fig. 701: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

19. Position the PTU support bracket in place and install the 5 bolts.
 - Tighten to 70 Nm (52 lb-ft).

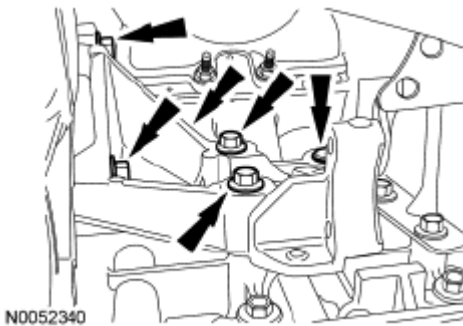


Fig. 702: Locating Bolts & Power Transfer Unit (PTU) Support Bracket
Courtesy of FORD MOTOR CO.

20. Using a new gasket, install the RH catalytic converter and 4 new nuts.

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

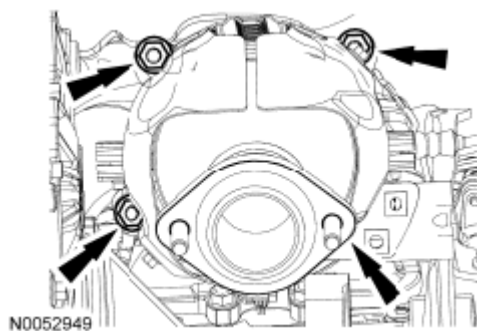


Fig. 703: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 catalytic converter-to-bracket bolts.
- Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
 - Tighten the 2 catalytic converter-to-bracket bolts to 20 Nm (177 lb-in).

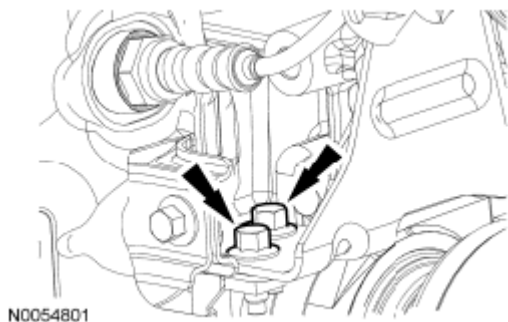


Fig. 704: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

22. Connect the RH Catalyst Monitor Sensor (CMS) electrical connector.

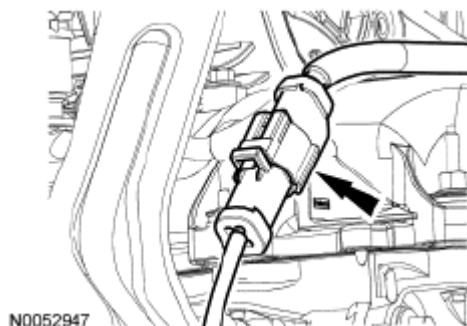


Fig. 705: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

23. Install the RH catalytic converter support bracket and the 2 bolts.

NOTE: Do not tighten the 2 catalytic converter support bracket bolts at this time.

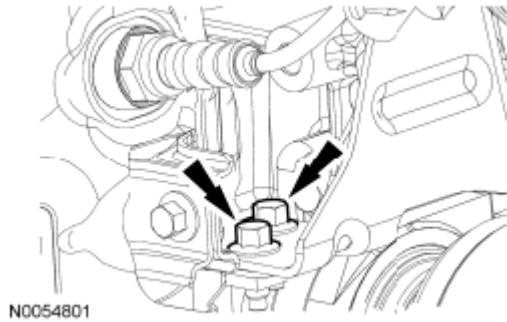


Fig. 706: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

24. Install the 2 catalytic converter support bracket nuts.
- Tighten to 40 Nm (30 lb-ft).
 - Tighten the 2 catalytic converter support bracket bolts to 20 Nm (177 lb-in).

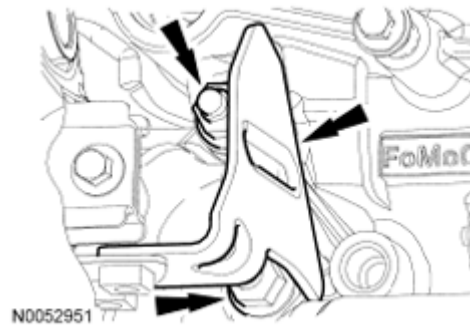


Fig. 707: Locating RH Catalytic Converter Bracket & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

25. Using the Powertrain Lift, raise the subframe into the installed position.

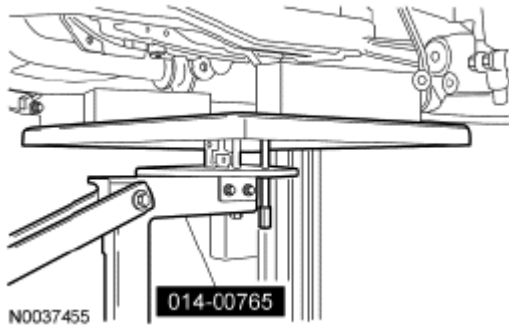


Fig. 708: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

26. Install the 2 front subframe nuts.
- Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown in illustration, RH similar.

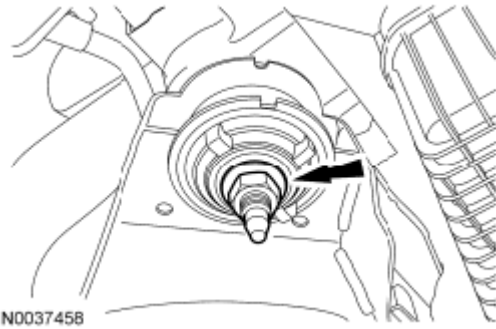


Fig. 709: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

27. Position the subframe brackets and install the 4 bolts finger-tight.

NOTE: LH shown in illustration, RH similar.

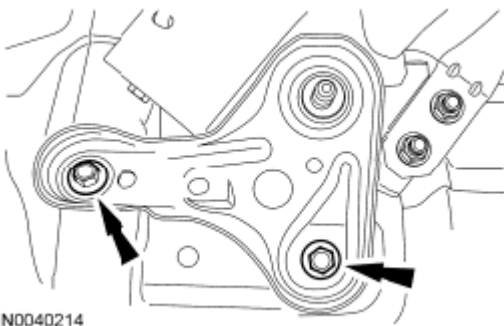
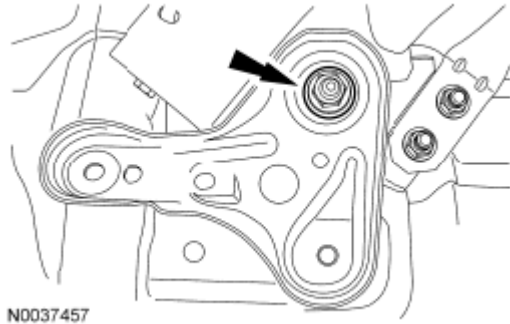


Fig. 710: Locating Subframe Brackets & Bolts

Courtesy of FORD MOTOR CO.

28. Install the 2 rear subframe nuts.
- Tighten to 150 Nm (111 lb-ft).

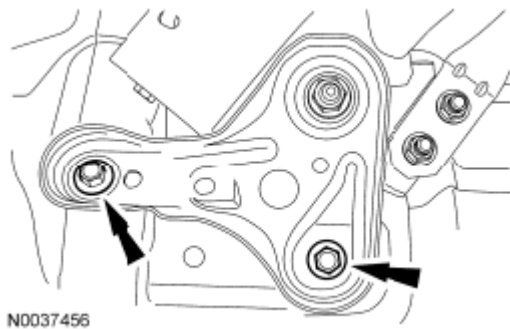
NOTE: LH shown in illustration, RH similar.

**Fig. 711: Locating Rear Subframe Nuts & Subframe Brackets**

Courtesy of FORD MOTOR CO.

29. Tighten the 4 subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

NOTE: LH shown in illustration, RH similar.

**Fig. 712: Locating Subframe Bracket-To-Body Bolts**

Courtesy of FORD MOTOR CO.

30. Install the stabilizer bar links and nuts to the struts.
- Tighten to 40 Nm (30 lb-ft).

NOTE: LH shown in illustration, RH similar.

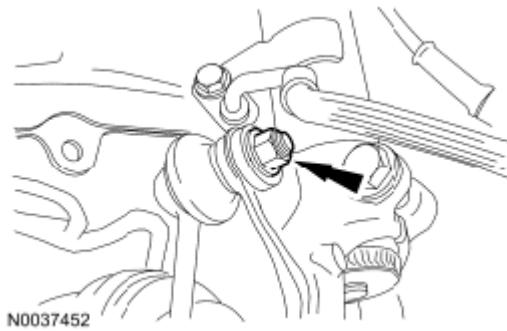


Fig. 713: Locating Stabilizer Bar Links & Nuts
Courtesy of FORD MOTOR CO.

31. Install the tie-rod ends and nuts.
 - Tighten to 48 Nm (35 lb-ft).
 - Install new cotter pins.

NOTE: LH shown in illustration, RH similar.

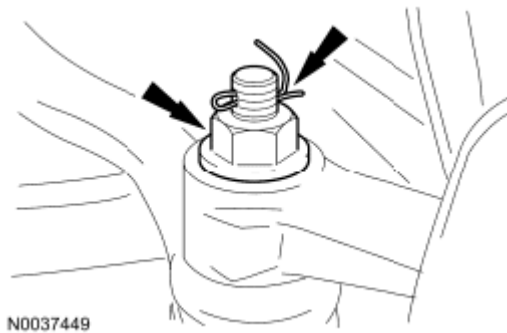


Fig. 714: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

32. Install the engine roll restrictor-to-subframe through bolt.
 - Tighten to 90 Nm (66 lb-ft).

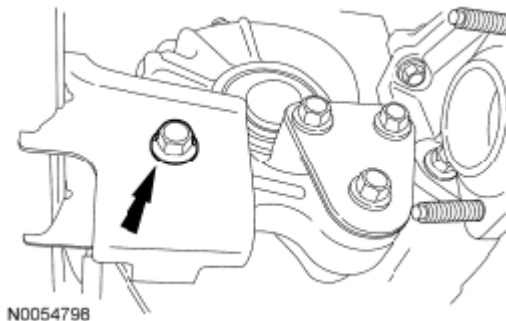


Fig. 715: Locating Engine Roll Restrictor-To-Subframe Through Bolt
Courtesy of FORD MOTOR CO.

AWD vehicles

33. Line up the index marks on the rear driveshaft to the index marks on the **PTU** flange made during removal and install the 4 new bolts.
 - Tighten to 70 Nm (52 lb-ft).

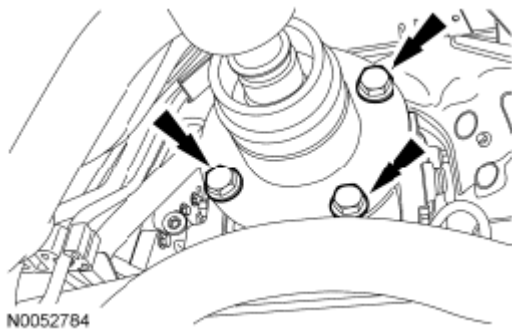


Fig. 716: Locating PTU Flange & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

34. Install 4 new torque converter nuts.
 - Tighten to 36 Nm (27 lb-ft).

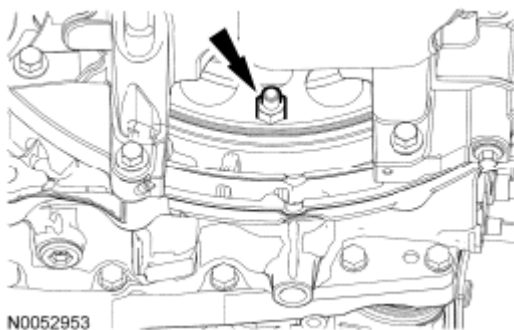


Fig. 717: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

35. Install the inspection cover and the 2 fasteners.

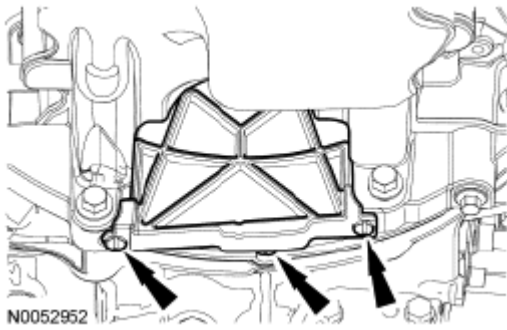


Fig. 718: Locating Inspection Cover & Fasteners
Courtesy of FORD MOTOR CO.

36. Install the 4 oil pan-to-transaxle bolts.
- Tighten to 48 Nm (35 lb-ft).

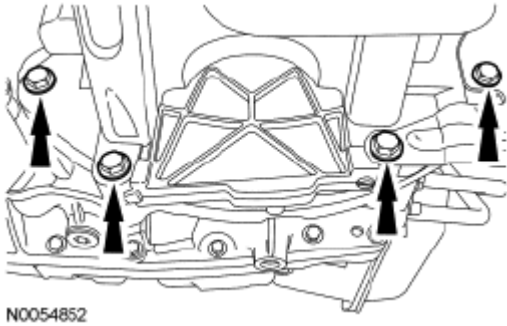


Fig. 719: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

37. Using new gaskets, install the Y-pipe assembly and 6 new nuts.
- Tighten to 40 Nm (30 lb-ft).

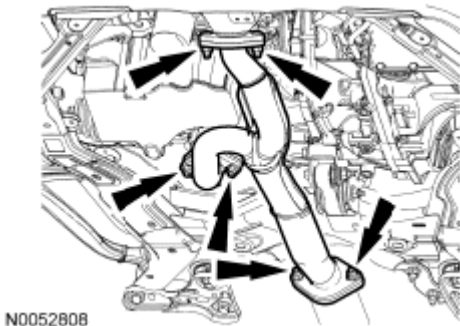


Fig. 720: Locating Transaxle Support Insulator Through Bolt & Nut
Courtesy of FORD MOTOR CO.

38. Install a new engine oil filter.

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

- Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

39. Connect the 2 transmission fluid cooler hoses.

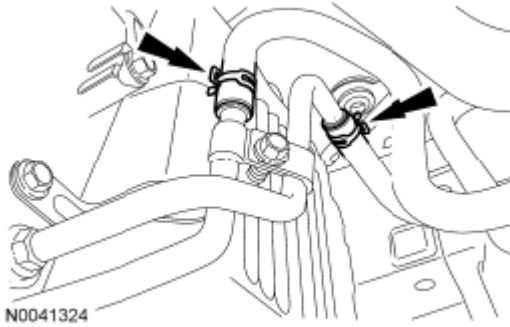


Fig. 721: Locating Transaxle Cooler Hoses
Courtesy of FORD MOTOR CO.

40. Connect the power steering cooler tube.

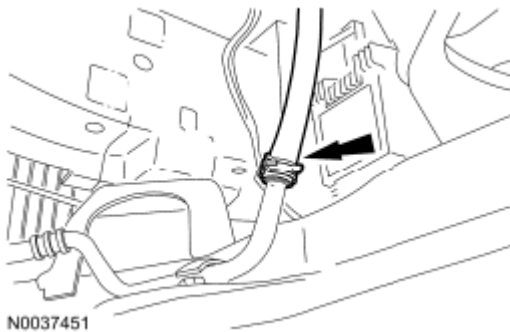


Fig. 722: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

41. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips into the body.
- From under the vehicle, verify that the seal is properly installed on the steering gear and the retaining clips are fully engaged into the body.

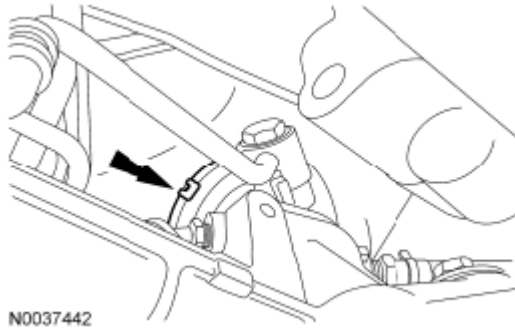


Fig. 723: Locating Steering Gear Clips
Courtesy of FORD MOTOR CO.

42. If equipped, install the underbody shield and the 6 screws.

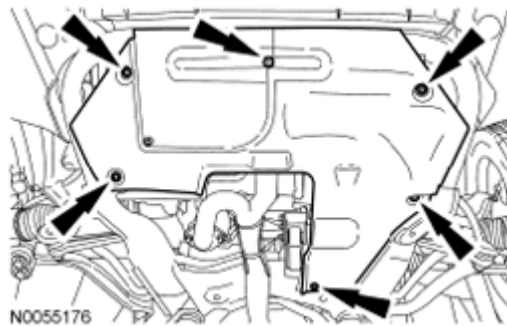


Fig. 724: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

43. Install the LH splash shield and the 6 pin-type retainers (4 shown in illustration).

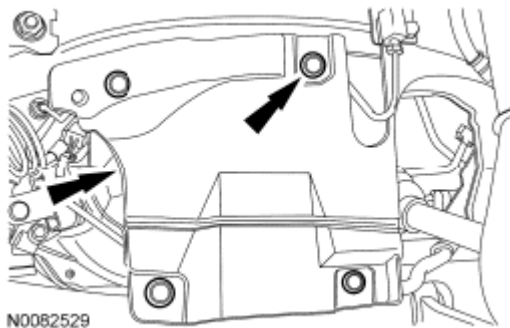


Fig. 725: Identifying Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

44. Position the LH fender splash shield and install the 4 screws.

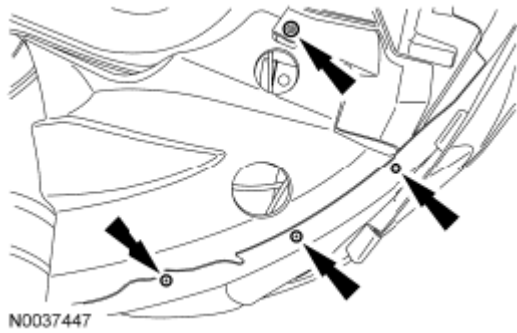


Fig. 726: Locating LH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

45. Install the steering intermediate shaft onto the steering gear and install a new bolt.
- Tighten to 25 Nm (18 lb-ft).

NOTE: **Align the index marks made during removal.**

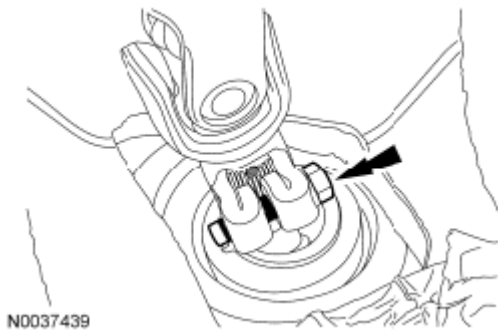


Fig. 727: Locating Steering Intermediate Shaft Onto Steering Gear
Courtesy of FORD MOTOR CO.

46. Install the steering joint cover and the 2 nuts.

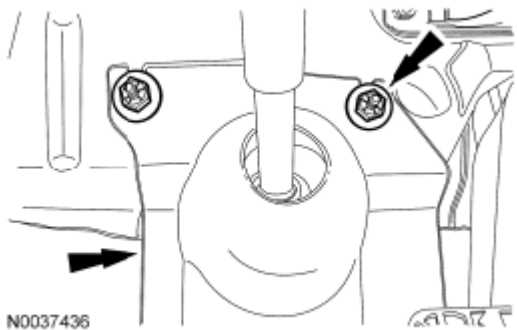


Fig. 728: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

47. Using a new banjo bolt and 2 new seals, install the Power Steering Pressure (PSP) tube onto the steering gear.
- Tighten to 37 Nm (27 lb-ft).

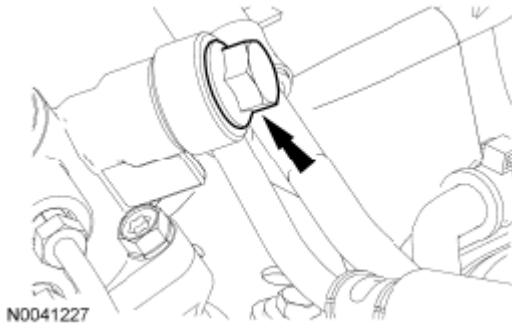


Fig. 729: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

48. Install the PSP tube bracket and bolt.
- Tighten to 10 Nm (89 lb-in).

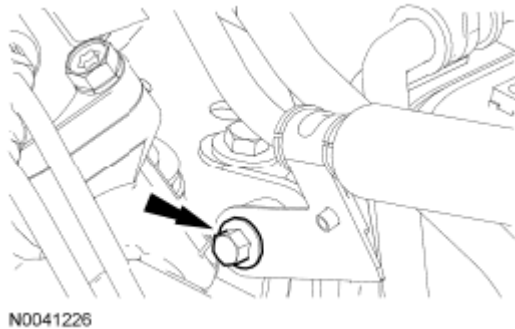


Fig. 730: Locating Power Steering Pressure Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

49. Connect the PCM electrical connectors and pin-type retainers.

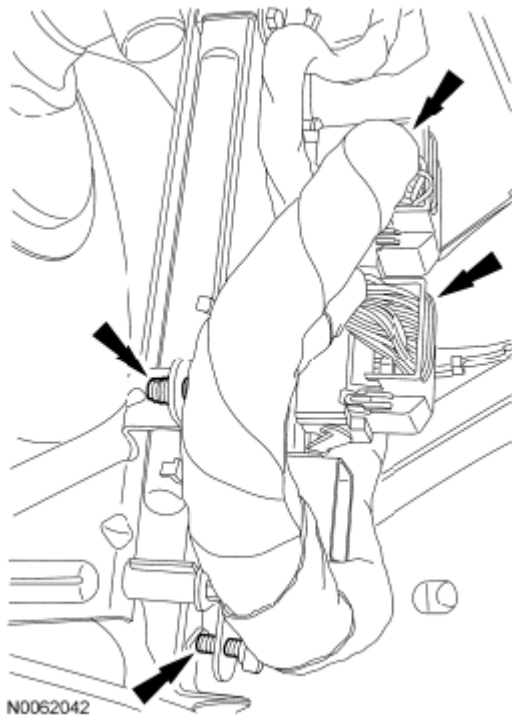


Fig. 731: Locating PCM Electrical Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

50. Install the engine mount brace and the 3 bolts.
- Tighten to 25 Nm (18 lb-ft).

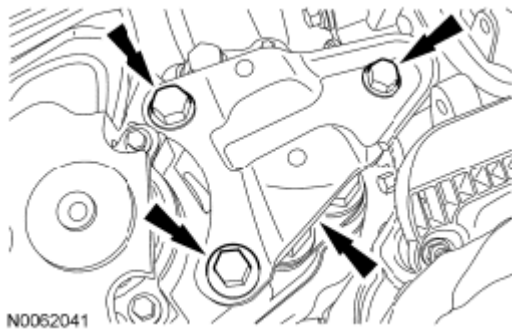


Fig. 732: Locating Engine Mount Brace & Bolt
Courtesy of FORD MOTOR CO.

51. Install the ground wire and the bolt.
- Tighten to 10 Nm (89 lb-in).

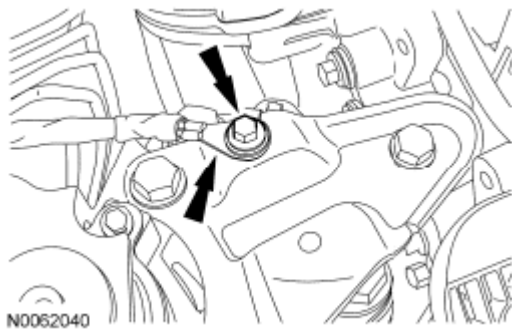


Fig. 733: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

52. Connect the fuel supply tube from the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION**.

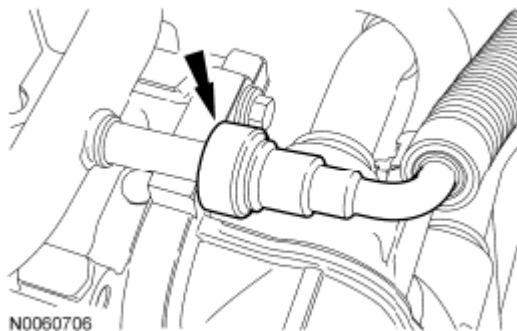


Fig. 734: Locating Fuel Supply Tube From Fuel Rail
Courtesy of FORD MOTOR CO.

53. Attach the power steering reservoir onto the cowl.



Fig. 735: Attaching Power Steering Reservoir Onto Cowl
Courtesy of FORD MOTOR CO.

54. Connect the hose to the power steering reservoir.
 - Attach the pin-type retainer to the engine mount brace.

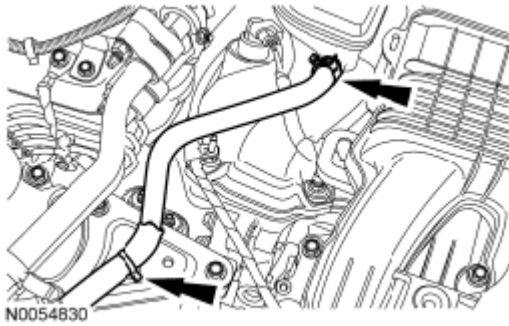


Fig. 736: Locating Hose
Courtesy of FORD MOTOR CO.

55. Install the oil level indicator.

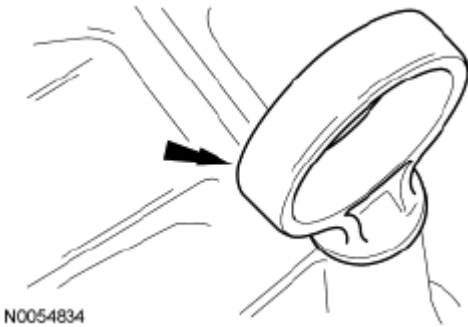


Fig. 737: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

56. Attach the 2 wiring harness retainers to the LH valve cover stud bolts.

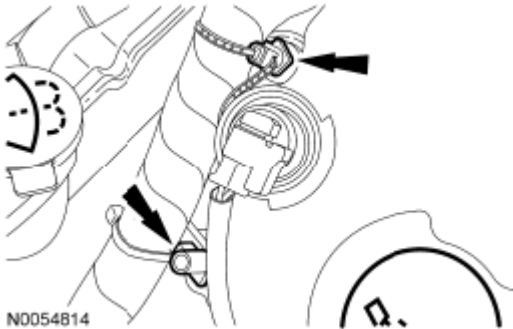


Fig. 738: Locating LH Valve Cover Stud Bolts & Wiring Harness
Courtesy of FORD MOTOR CO.

57. Connect the 2 engine wiring harness electrical connectors.

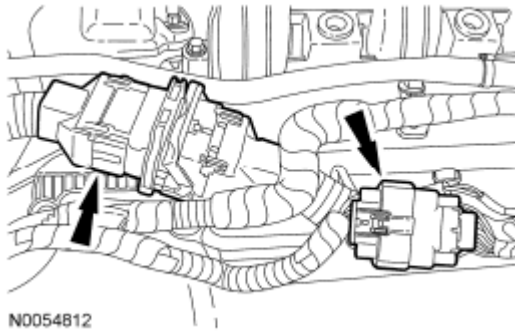


Fig. 739: Locating Engine Control Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

58. Attach the 2 wiring harness retainers.

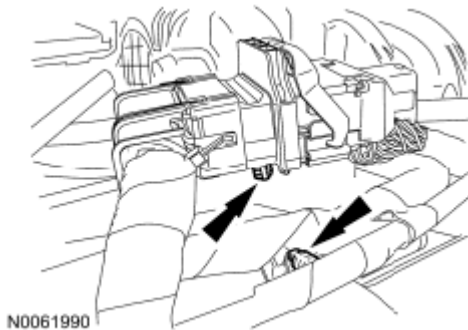


Fig. 740: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

59. Using new O-ring seals, connect the A/C tubes and install the 2 nuts.
- Tighten to 8 Nm (71 lb-in).

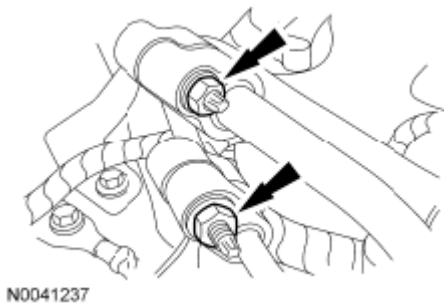


Fig. 741: Locating A/C Tubes & Nuts
Courtesy of FORD MOTOR CO.

60. Install the A/C tube bracket bolt.
- Tighten to 8 Nm (71 lb-in).

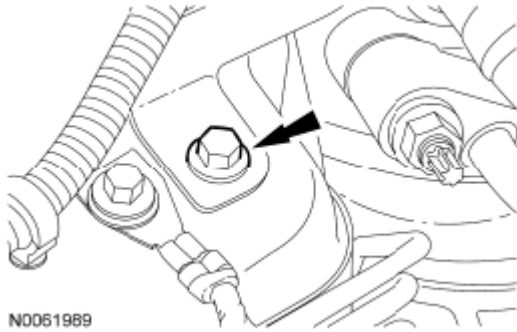


Fig. 742: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

61. Install the 2 A/C tube bracket bolts.
 - Tighten to 10 Nm (89 lb-in).

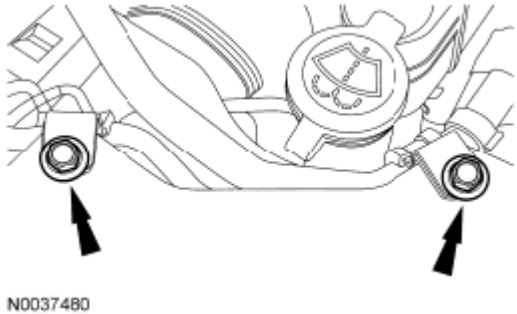


Fig. 743: Locating A/C Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

62. Using a new O-ring seal, connect the A/C tube to the condenser and install the nut.
 - Tighten to 8 Nm (71 lb-in).

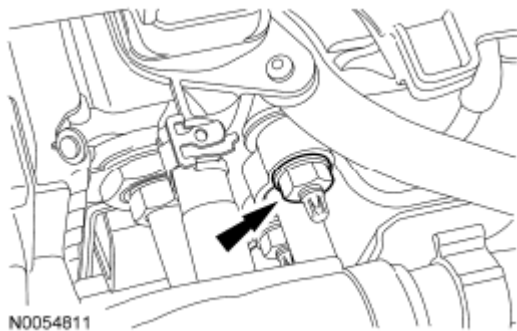


Fig. 744: Locating A/C Tube & Nut
Courtesy of FORD MOTOR CO.

63. Attach the coolant tube retainer clips to the A/C tube.



Fig. 745: Locating Coolant Tube Retainer Clips & A/C Tube
Courtesy of FORD MOTOR CO.

64. If equipped, attach the engine block heater harness to the radiator support, power steering hose, A/C tube and the engine wiring harness.
65. Install the ground wire and bolt.
 - Tighten to 12 Nm (106 lb-in).

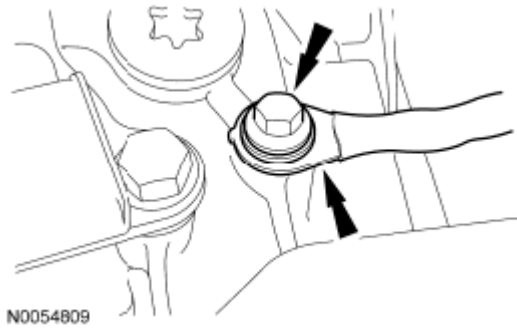


Fig. 746: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

66. Position the transaxle control cable bracket in place and install the 3 nuts.
 - Tighten to 12 Nm (106 lb-in).

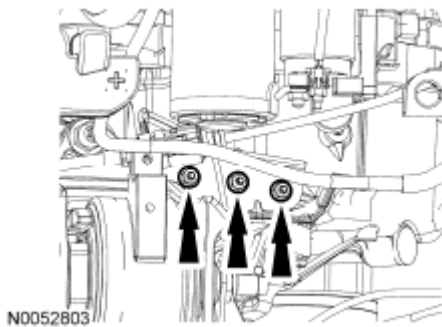


Fig. 747: Locating Transaxle Control Cable Bracket
Courtesy of FORD MOTOR CO.

67. Connect the transaxle control cable to the control lever.

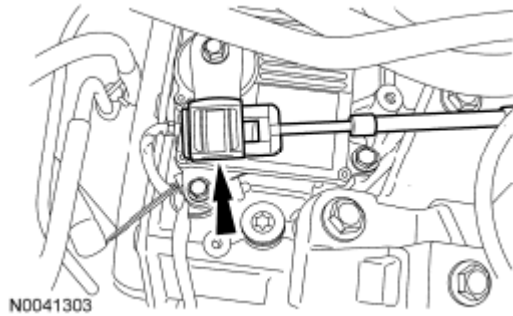


Fig. 748: Locating Transaxle Control Cable
Courtesy of FORD MOTOR CO.

68. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

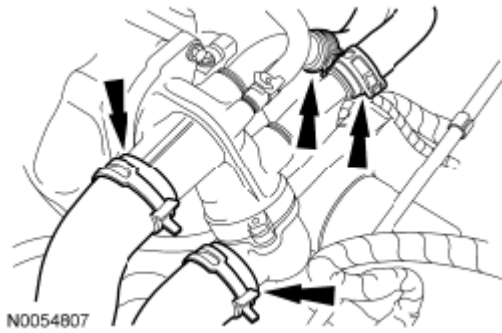


Fig. 749: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

69. Connect the vacuum hose and the Evaporative Emission (EVAP) tube to the upper intake manifold.

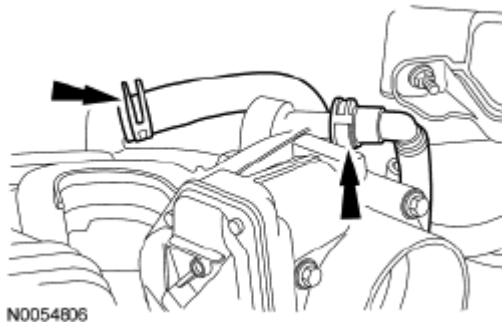


Fig. 750: Locating Vacuum Hose & Evaporative Emission (EVAP) Tube
Courtesy of FORD MOTOR CO.

70. Install the ground wire and the bolt.
- Tighten to 12 Nm (106 lb-in).

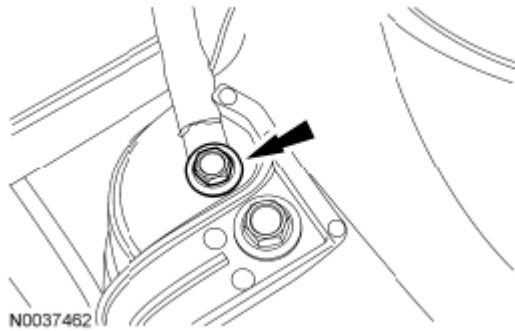


Fig. 751: Locating Ground Wire Bolt
Courtesy of FORD MOTOR CO.

71. Install the 2 battery cables to the positive battery cable and the 2 nuts.
 - Tighten to 9 Nm (80 lb-in).

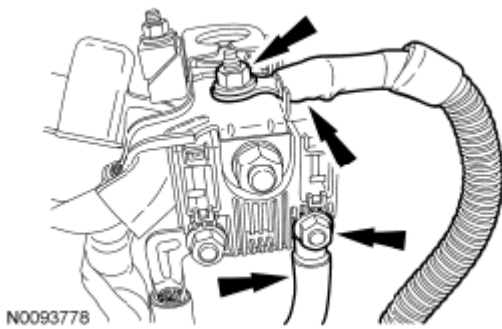


Fig. 752: Locating Battery Cables & Nuts
Courtesy of FORD MOTOR CO.

72. Attach the 2 wiring harness retainers to the transmission mount and the battery tray bracket.

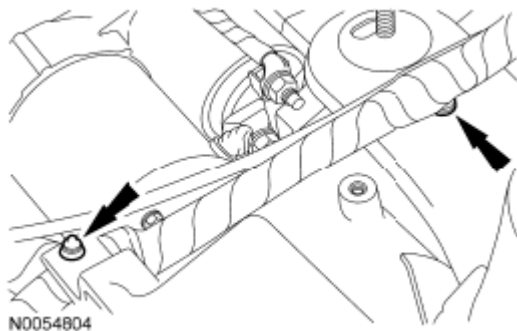


Fig. 753: Locating Transmission Mount & Battery Tray Bracket
Courtesy of FORD MOTOR CO.

73. Connect the 2 engine wiring harness electrical connectors.

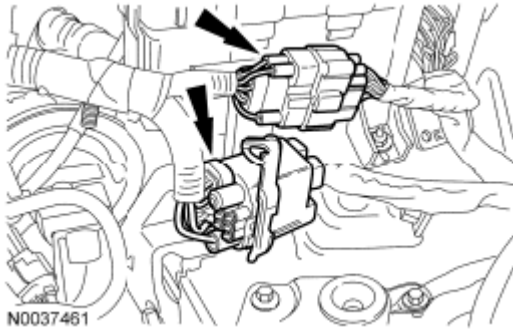


Fig. 754: Locating Engine Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

74. Install the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
75. Install the engine Air Cleaner (ACL) and the ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
76. Install the degas bottle. For additional information, refer to **REMOVAL AND INSTALLATION** .
77. Install the LH halfshaft and the intermediate shaft. For additional information, refer to **INSTALLATION** .
78. Install the accessory drive belt and the power steering belt. For additional information, refer to **INSTALLATION** .
79. Fill the engine with clean engine oil.
80. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** .
81. Fill the power steering system. For additional information, refer to **POWER STEERING SYSTEM FILLING** .
82. Check the transaxle fluid and add fluid if necessary. For additional information, refer to the **TRANSMISSION FLUID DRAIN AND REFILL** .
83. Recharge the A/C system. For additional information, refer to **AIR CONDITIONING (A/C) SYSTEM RECOVERY, EVACUATION AND CHARGING** .
84. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions

ENGINE FRONT COVER

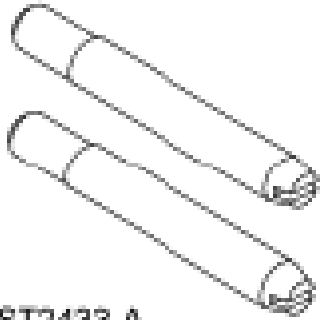
Special Tool(s)

SPECIAL TOOL TABLE

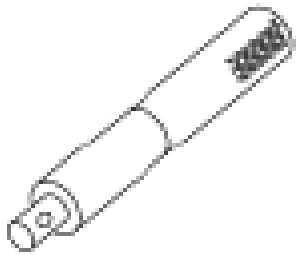
	Alignment Pins 307-399
--	------------------------

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

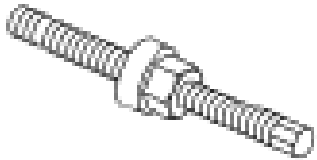


ST2433-A



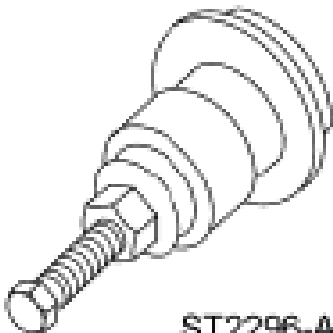
ST1326-A

Handle 205-153 (T80T-4000-W)



ST1287-A

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



ST2296-A

Installer, Front Cover Oil Seal 303-335

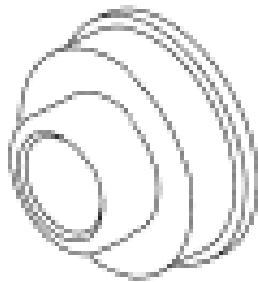
Installer, Front Crankshaft Seal 303-1251

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

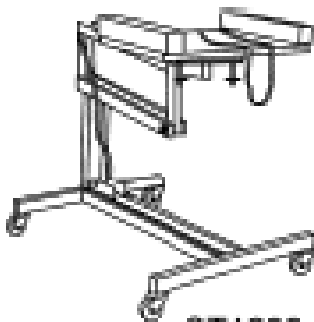


ST2981-A



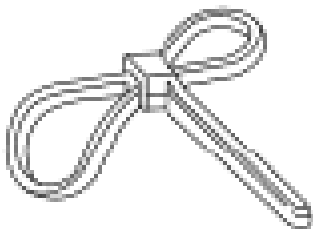
ST2983-A

Installer, VCT Spark Plug Tube Seal 303-1247/2



ST1293-A

Powertrain Lift 014-00765 or equivalent



ST1438-A

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

Material

ITEM SPECIFICATION TABLE

Item	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
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 Remover ZC-30	-
Threadlock and Sealer TA-25	WSK-M2G351-A5

All vehicles

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: Early build engines have 11 fastener valve covers, late build engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

1. Install the Alignment Pins.



Fig. 755: Identifying Alignment Pins
Courtesy of FORD MOTOR CO.

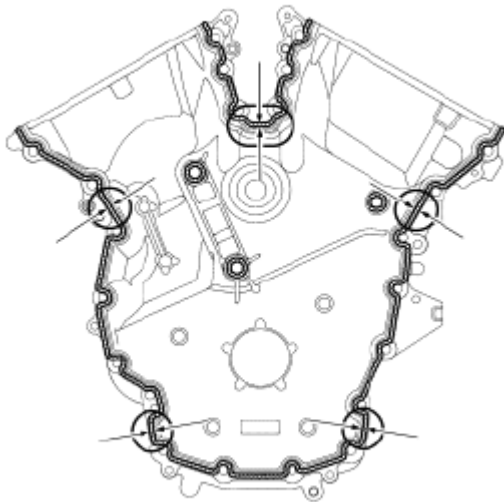
2. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
 - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may

cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

5.5 mm
(0.21 in)



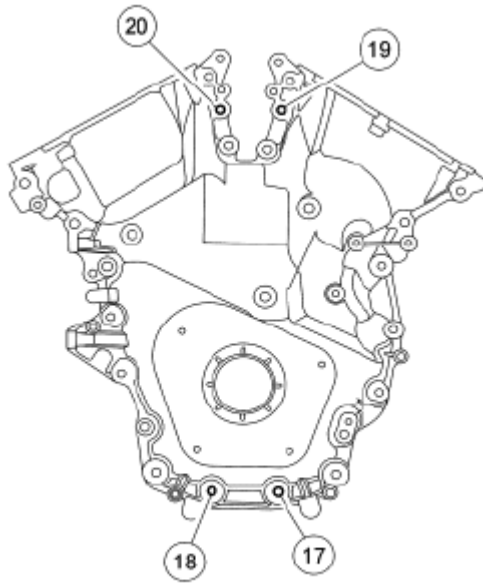
N0068283

Fig. 756: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Oil Pan-To-Cylinder Block Joint

Courtesy of FORD MOTOR CO.

3. Install the engine front cover and bolts 17, 18, 19 and 20.
 - Tighten in sequence to 3 Nm (27 lb-in).

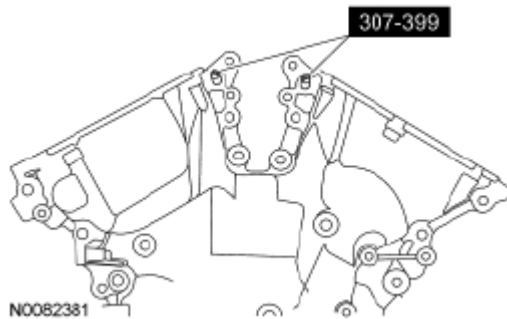
NOTE: Make sure the 2 locating dowel pins are seated correctly in the cylinder block.



N0068108

Fig. 757: Identifying Engine Front Cover Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

4. Remove the Alignment Pins.



N0062381

Fig. 758: Identifying Alignment Pins
 Courtesy of FORD MOTOR CO.

5. Install the engine mount bracket and the 3 bolts.

NOTE: Do not tighten the bolts at this time.

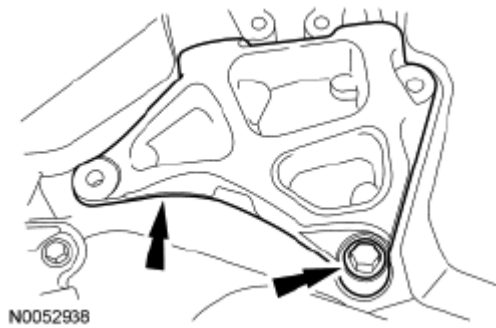


Fig. 759: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

6. Install the remaining engine front cover bolts. Tighten all of the engine front cover bolts and engine mount bracket bolts in the sequence shown in illustration in 2 stages:
 - Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (133 lb-in).
 - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

NOTE: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

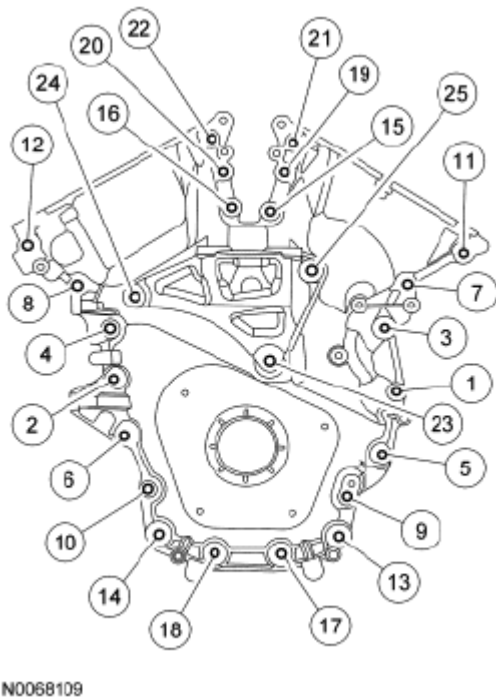


Fig. 760: Identifying Engine Front Cover Bolts & Engine Mount Bracket Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

7. Install the engine mount studs in the following sequence.

1. Clean the front cover engine mount stud holes with pressurized air to remove any foreign material.
2. Clean all the thread sealer from the engine mount studs (old and new studs).
3. Apply new Threadlock and Sealer to the engine mount stud threads.
4. Install the 2 engine mount studs.
 - Tighten to 20 Nm (177 lb-in).

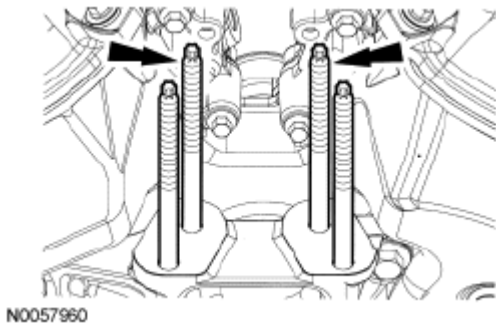


Fig. 761: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

NOTE: The thread sealer on the engine mount studs (including new engine mount studs if applicable) must be cleaned off with a wire brush and new Threadlock and Sealer applied prior to installing the engine mount studs. Failure to follow this procedure may result in damage to the engine mount studs or engine.

8. Install the engine mount bracket and the 2 bolts.
 - Tighten to 24 Nm (18 lb-ft).

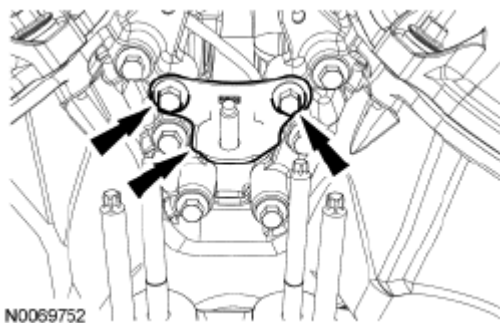


Fig. 762: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

9. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front

cover.

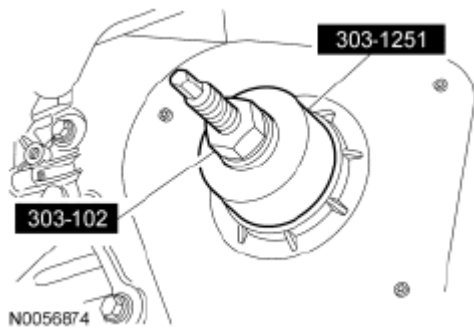


Fig. 763: Identifying Crankshaft Vibration Damper Installer And Front Crankshaft Installer
Courtesy of FORD MOTOR CO.

10. Using the Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the crankshaft pulley.

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

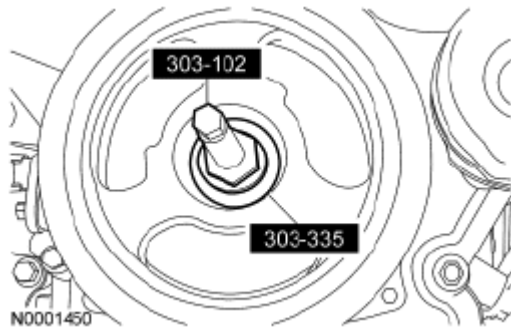


Fig. 764: Identifying Front Cover Oil Seal Installer & Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

11. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten 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.

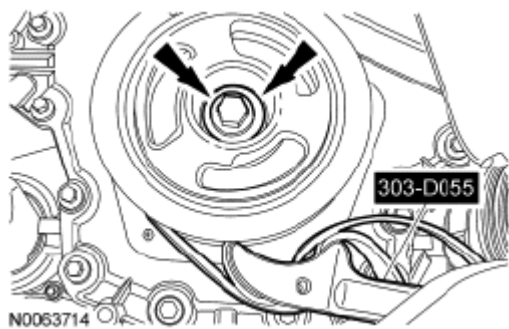


Fig. 765: Locating Crankshaft Pulley Washer & Bolt
Courtesy of FORD MOTOR CO.

12. Install the accessory drive belt tensioner and the 3 bolts.
 - Tighten to 11 Nm (97 lb-in).

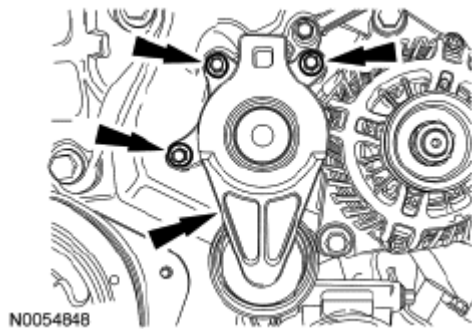


Fig. 766: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

13. Install the power steering pump and the 3 bolts.
 - Tighten to 25 Nm (18 lb-ft).

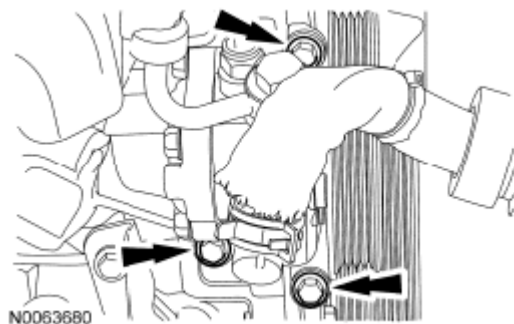


Fig. 767: Locating Power Steering Pump & Bolts
Courtesy of FORD MOTOR CO.

14. Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown in illustration, Variable Camshaft Timing (VCT) solenoid seal installation similar.

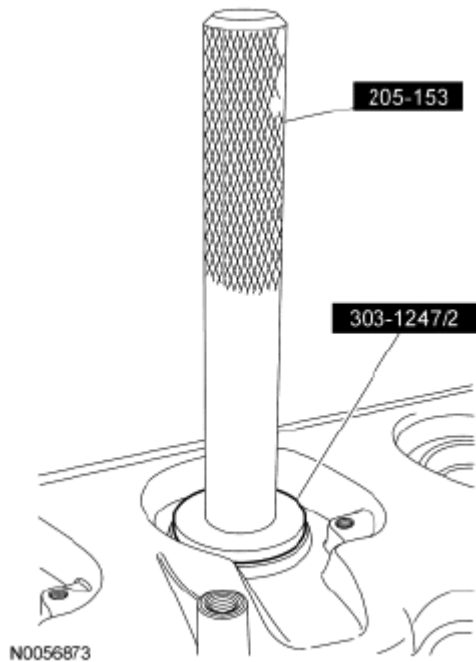


Fig. 768: Identifying VCT Spark Plug Tube Seal Installer And Handle
Courtesy of FORD MOTOR CO.

15. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

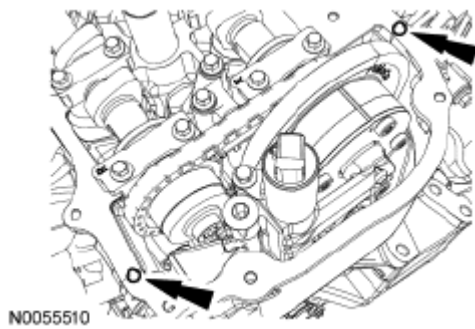


Fig. 769: Locating Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

16. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

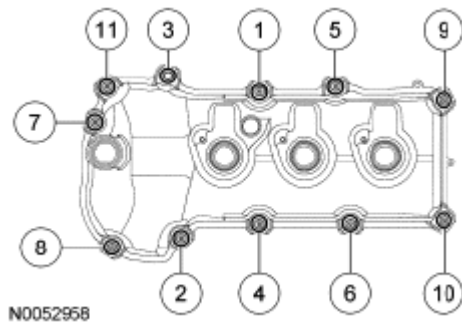


Fig. 770: Identifying RH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

17. Using a new gasket, install the RH valve cover, bolt and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

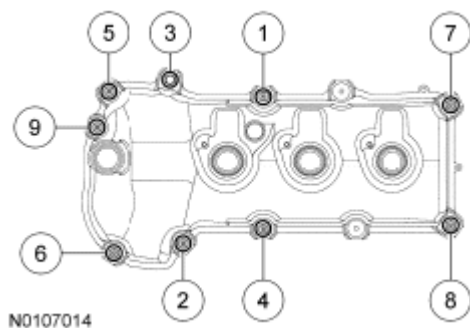


Fig. 771: Identifying RH Valve Cover Stud Bolt Tightening Sequence

Courtesy of FORD MOTOR CO.

All vehicles

18. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

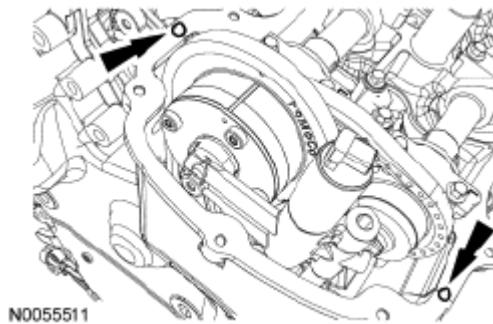


Fig. 772: Identifying Engine RTV Silicone Applying Area To Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

19. Using a new gasket, install the LH valve cover and 11 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

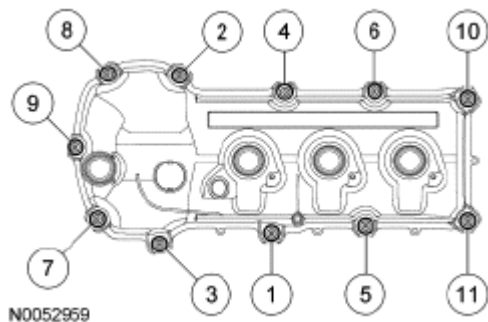


Fig. 773: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

20. Using a new gasket, install the RH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

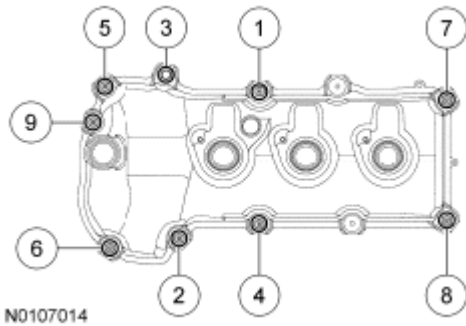


Fig. 774: Identifying RH Valve Cover Stud Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

All vehicles

21. Install the wiring harness retaining bracket and the 2 nuts.
 - Tighten to 4 Nm (35 lb-in).

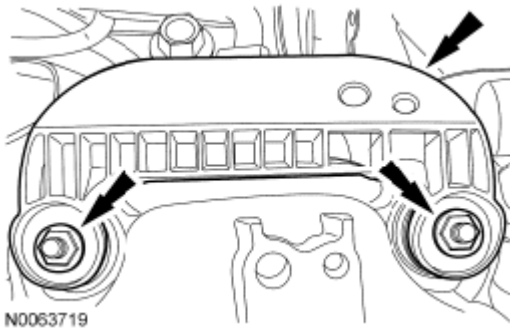


Fig. 775: Locating Wiring Harness Retaining Bracket & Nuts
 Courtesy of FORD MOTOR CO.

22. Install the Power Steering Pressure (PSP) hose bracket and nut.
 - Tighten to 9 Nm (80 lb-in).

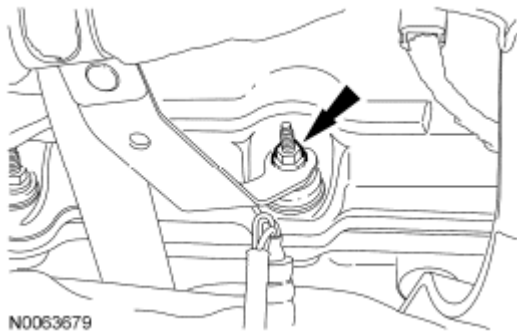


Fig. 776: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

23. Attach the PSP hose retainer to the engine lifting eye.

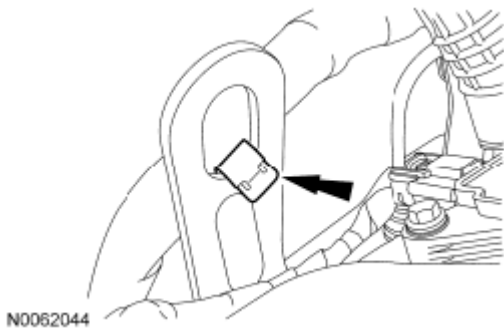


Fig. 777: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

24. Install the 6 coil-on-plug assemblies and the 6 bolts.
 - Tighten to 7 Nm (62 lb-in).

NOTE: LH shown in illustration, RH similar.

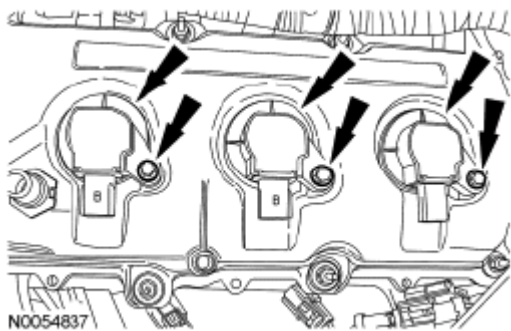


Fig. 778: Locating Bolts And Coil-On-Plug Assemblies
Courtesy of FORD MOTOR CO.

25. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.

26. Connect the 3 LH coil-on-plug electrical connectors.

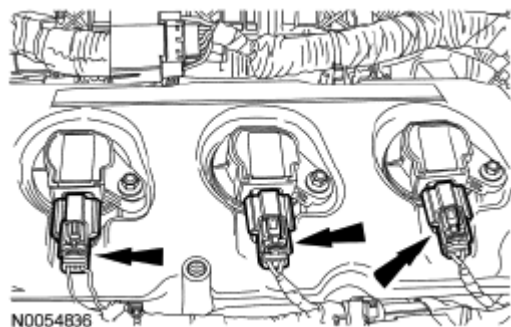


Fig. 779: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

27. Connect the LH camshaft VCT solenoid electrical connector.

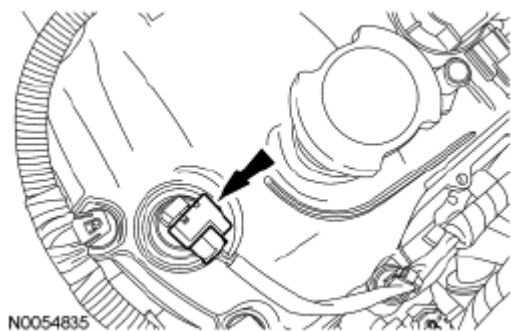


Fig. 780: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

28. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
29. Connect the 3 RH coil-on-plug electrical connectors.

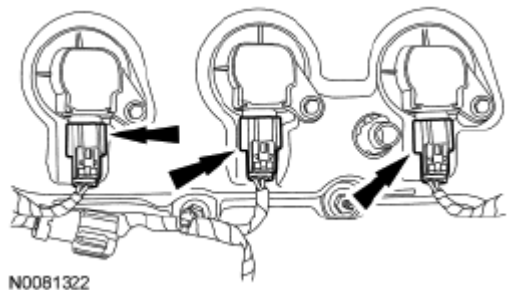


Fig. 781: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

30. Connect the RH VCT solenoid electrical connector.

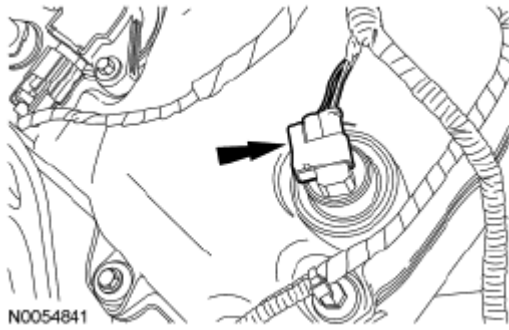


Fig. 782: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

31. Connect the **PSP** switch electrical connector.

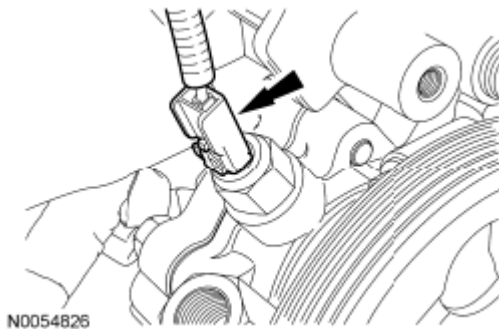


Fig. 783: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

32. Connect the RH Catalyst Monitor Sensor (CMS) sensor electrical connector.

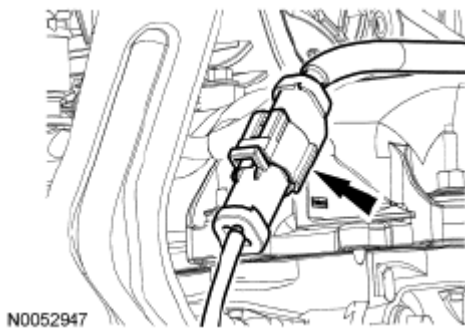
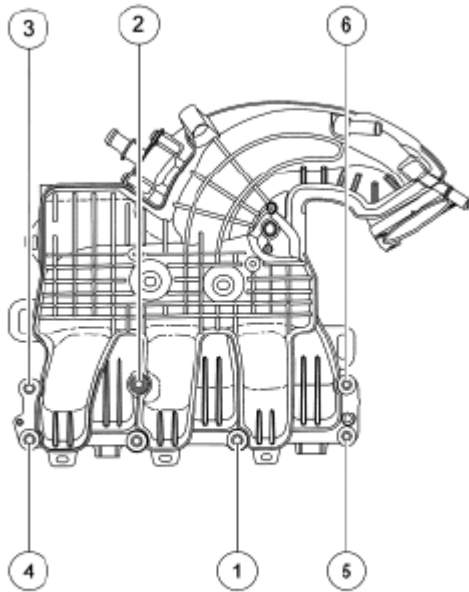


Fig. 784: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

33. Using new gaskets, install the upper intake manifold and the 6 bolts.
- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: If the engine is repaired or replaced because of upper engine failure,

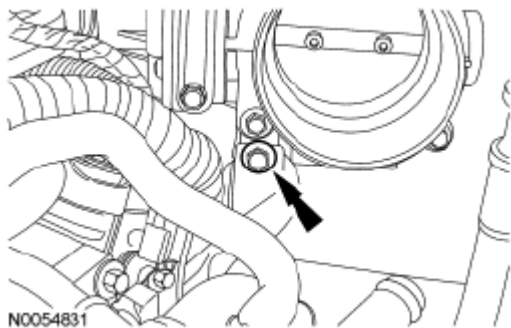
typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.



N0081211

Fig. 785: Identifying Upper Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

34. Install the upper intake manifold support bracket bolt.
 - Tighten to 10 Nm (89 lb-in).



N0054831

Fig. 786: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

35. Attach the wiring harness retainers to the upper intake manifold.

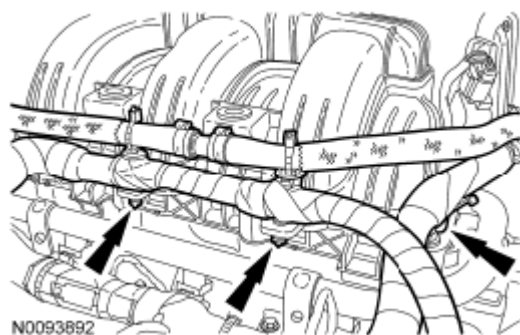


Fig. 787: Locating Wiring Harness Retainers To Upper Intake Manifold
Courtesy of FORD MOTOR CO.

36. Connect the Throttle Body (TB) electrical connector.

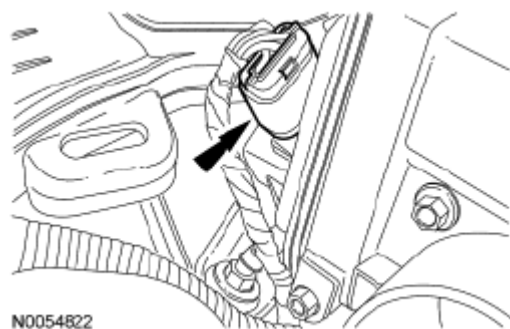


Fig. 788: Locating Throttle Body (TB) Electrical Connector
Courtesy of FORD MOTOR CO.

37. Connect the PCV hose to the PCV valve.

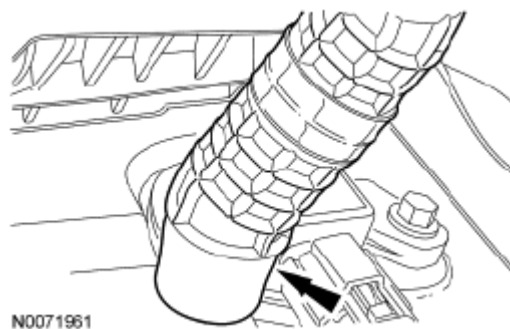


Fig. 789: Locating PCV Hose
Courtesy of FORD MOTOR CO.

38. If equipped, attach the block heater wiring harness retainer to the **PSP** tube and the power steering reservoir hose.

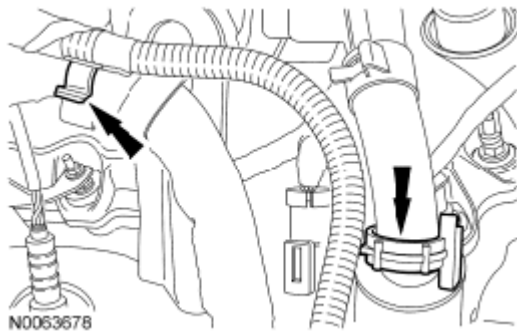


Fig. 790: Locating Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

39. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.



Fig. 791: Locating Block Heater Wiring Harness Retainer To Upper Intake Manifold
Courtesy of FORD MOTOR CO.

40. Raise the engine and transaxle assembly into the vehicle.
41. Install the engine mount, the nut and the 2 bolts.
- Tighten the bolts to 55 Nm (41 lb-ft).
 - Tighten the nut to 63 Nm (46 lb-ft).

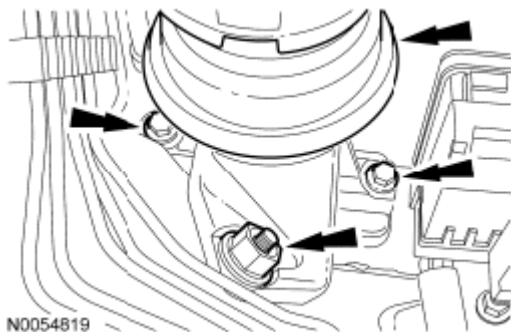


Fig. 792: Locating Engine Mount Bolts & Nut
Courtesy of FORD MOTOR CO.

42. Install the 2 engine mount spacers and the 4 engine mount nuts.
- Tighten in the sequence shown in illustration below to 70 Nm (52 lb-ft).

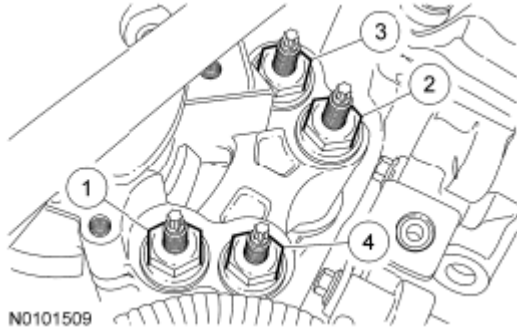


Fig. 793: Locating Engine Mount Spacers & Engine Mount Nuts
Courtesy of FORD MOTOR CO.

43. Install the transaxle support insulator bracket, bolt and the 2 nuts.
- Tighten to 80 Nm (59 lb-ft).

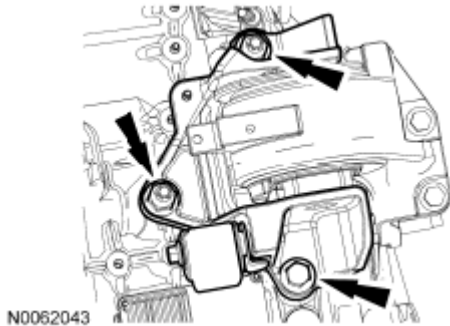


Fig. 794: Locating Transaxle Support Insulator Bracket, Bolt & Nuts
Courtesy of FORD MOTOR CO.

44. Install the transaxle support insulator through bolt and nut.
- Tighten to 90 Nm (66 lb-ft).

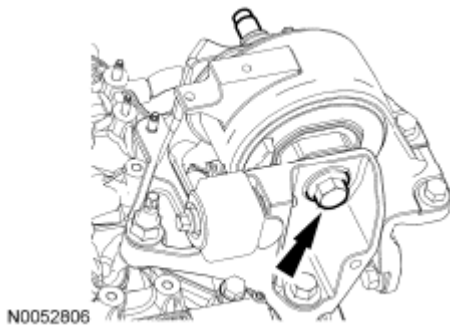


Fig. 795: Locating Transaxle Support Insulator Through Bolt & Nut

Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

45. Install the RH catalytic converter support bracket and the 2 bolts.

NOTE: Do not tighten the 2 catalytic converter support bracket bolts at this time.

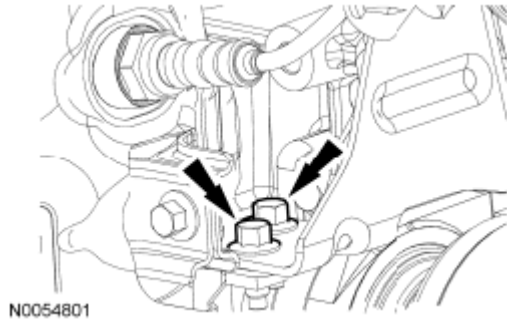


Fig. 796: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

46. Install the 2 catalytic converter support bracket nuts.
- Tighten to 40 Nm (30 lb-ft).
 - Tighten the 2 catalytic converter support bracket bolts to 20 Nm (177 lb-in).

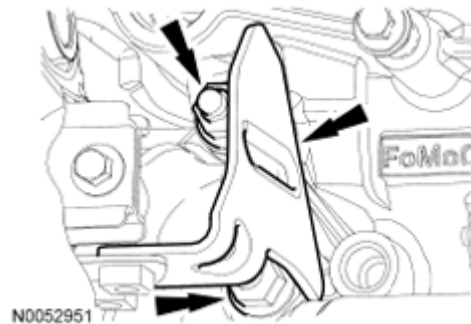


Fig. 797: Locating RH Catalytic Converter Bracket & Nuts
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

47. Install a new **PTU** seal. For additional information, refer to **POWER TRANSFER UNIT (PTU)** .

NOTE: A new Power Transfer Unit (PTU) seal must be installed whenever the intermediate shaft is removed.

All vehicles

48. Using the Powertrain Lift, raise the subframe into the installed position.

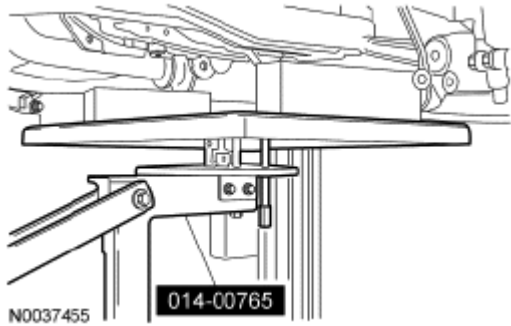


Fig. 798: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

49. Install the 2 front subframe nuts.
- Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown in illustration, RH similar.

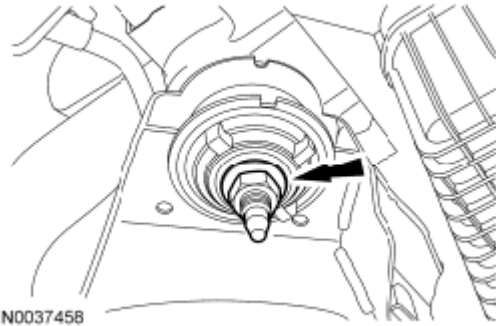


Fig. 799: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

50. Position the subframe brackets and install the 4 bolts finger-tight.

NOTE: LH shown in illustration, RH similar.

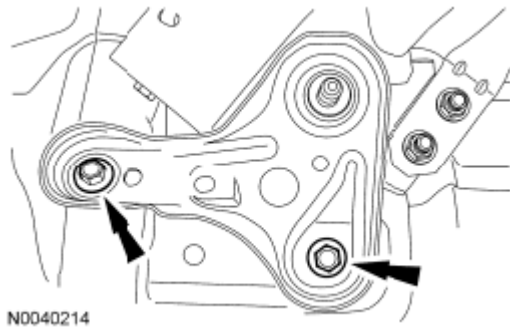


Fig. 800: Locating Subframe Brackets Bolts
Courtesy of FORD MOTOR CO.

51. Install the 2 rear subframe nuts.
 - Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown in illustration, RH similar.

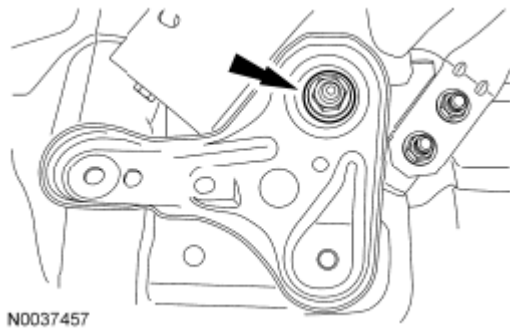


Fig. 801: Locating Rear Subframe Nuts & Subframe Brackets
Courtesy of FORD MOTOR CO.

52. Tighten the 2 subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

NOTE: LH shown in illustration, RH similar.

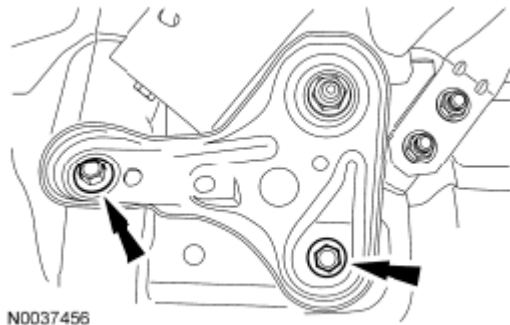


Fig. 802: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

53. Install the stabilizer bar links and nuts to the struts.

NOTE: LH shown in illustration, RH similar.



Fig. 803: Locating Stabilizer Bar Links & Nuts
Courtesy of FORD MOTOR CO.

54. Install the tie-rod ends and nuts.
- Tighten to 48 Nm (35 lb-ft).

NOTE: LH shown in illustration, RH similar.

- Install new cotter pins.

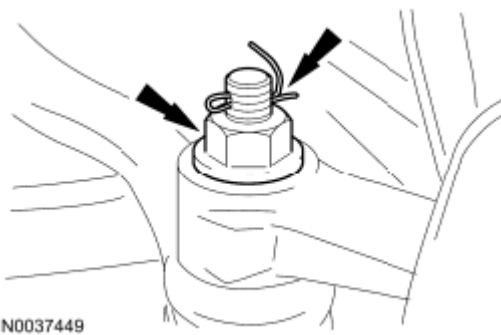


Fig. 804: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

55. Install the engine roll restrictor-to-subframe through bolt.
- Tighten to 90 Nm (66 lb-ft).

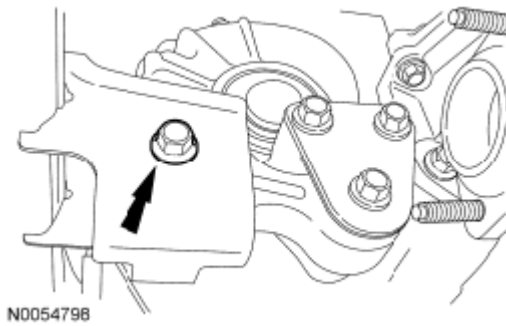


Fig. 805: Locating Engine Roll Restrictor-To-Subframe Through Bolt
Courtesy of FORD MOTOR CO.

AWD vehicles

56. Line up the index marks on the rear driveshaft to the index marks on the PTU flange made during removal and install the 4 new bolts (3 shown in illustration).
 - Tighten to 70 Nm (52 lb-ft).

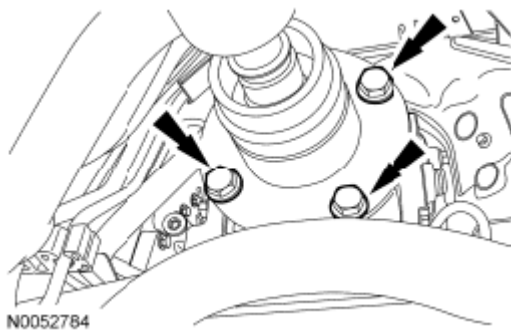


Fig. 806: Locating PTU Flange & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

57. Using new gaskets, install the Y-pipe assembly and the 6 new nuts.
 - Tighten to 40 Nm (30 lb-ft).

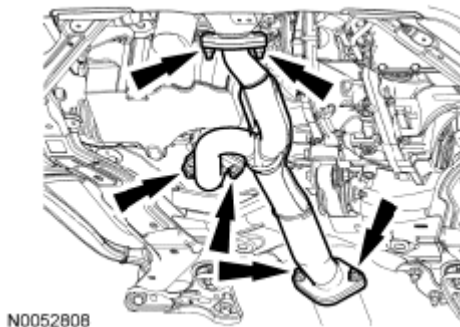


Fig. 807: Locating Y-Pipe Assembly & Nuts
Courtesy of FORD MOTOR CO.

58. Install a new engine oil filter.
- Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

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

59. Connect the 2 transmission fluid cooler hoses.

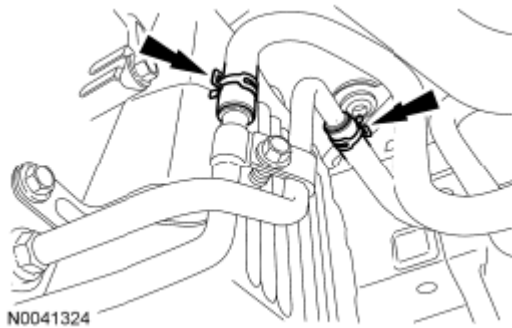


Fig. 808: Locating Transaxle Cooler Hoses
Courtesy of FORD MOTOR CO.

60. Connect the power steering cooler tube.

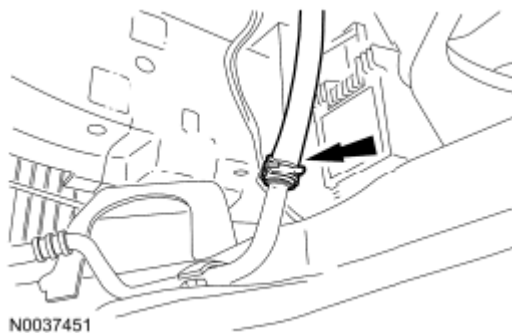


Fig. 809: Locating Power Steering Cooler Tube
Courtesy of FORD MOTOR CO.

61. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips into the body.
- From under the vehicle, verify that the seal is correctly installed on the steering gear and the retaining clips are fully engaged into the body.

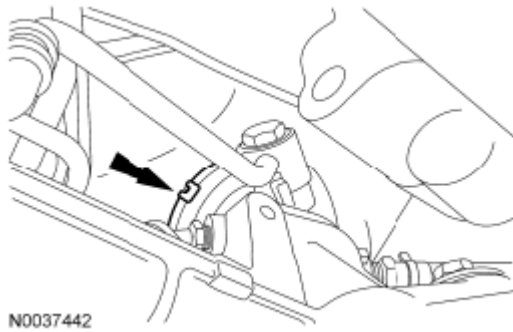


Fig. 810: Locating Steering Gear Clips
Courtesy of FORD MOTOR CO.

62. If equipped, install the underbody shield and the 6 screws.

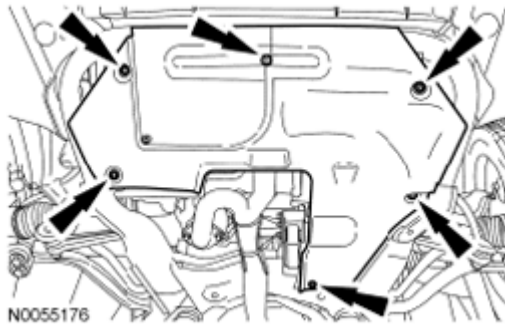


Fig. 811: Locating Underbody Shield Screws
Courtesy of FORD MOTOR CO.

63. Install the LH splash shield and the 6 pin-type retainers (4 shown in illustration).

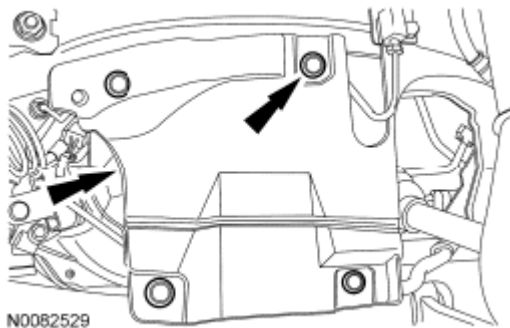


Fig. 812: Locating Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

64. Position the LH fender splash shield and install the 4 screws.

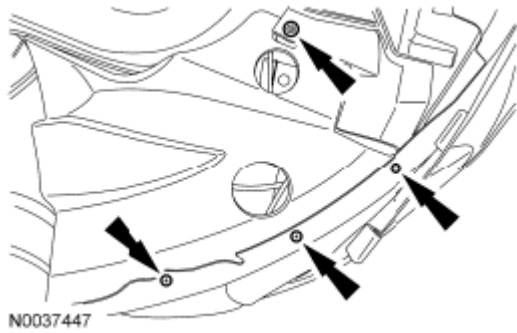


Fig. 813: Locating LH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

65. Install the steering intermediate shaft onto the steering gear and install a new bolt.
 - Tighten to 25 Nm (18 lb-ft).

NOTE: Align the index marks made during removal.

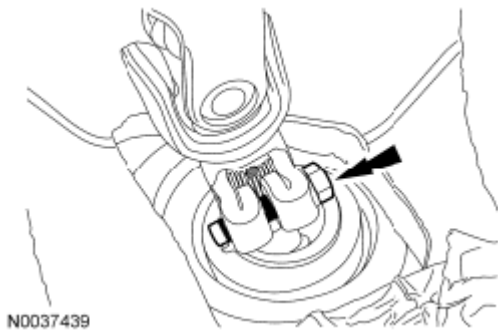


Fig. 814: Locating Steering Intermediate Shaft Onto Steering Gear
Courtesy of FORD MOTOR CO.

66. Install the steering joint cover and the 2 nuts.

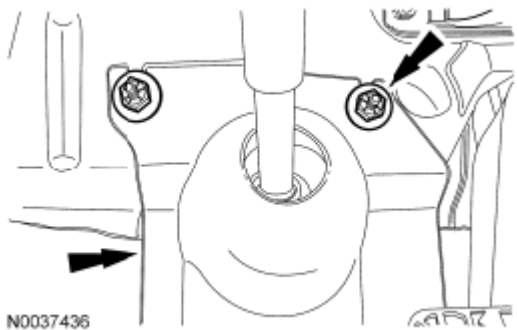


Fig. 815: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

67. Using a new banjo bolt and 2 new seals, install the **PSP** tube onto the steering gear.
- Tighten to 37 Nm (27 lb-ft).

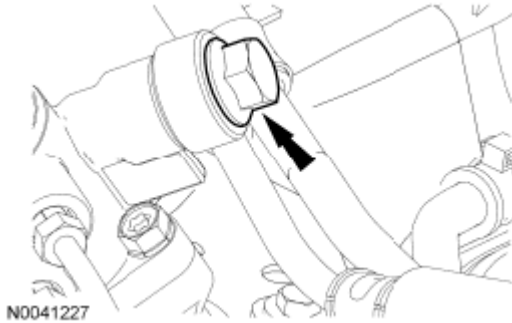


Fig. 816: Locating PSP Hose Banjo Bolt
Courtesy of FORD MOTOR CO.

68. Install the **PSP** tube bracket and bolt.
- Tighten to 10 Nm (89 lb-in).

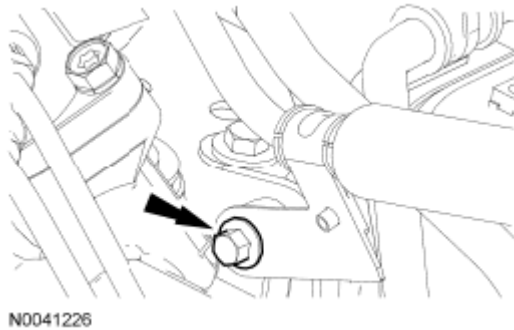


Fig. 817: Locating Power Steering Pressure Hose Bracket Bolt
Courtesy of FORD MOTOR CO.

69. Connect the PCM connectors and pin-type retainers.

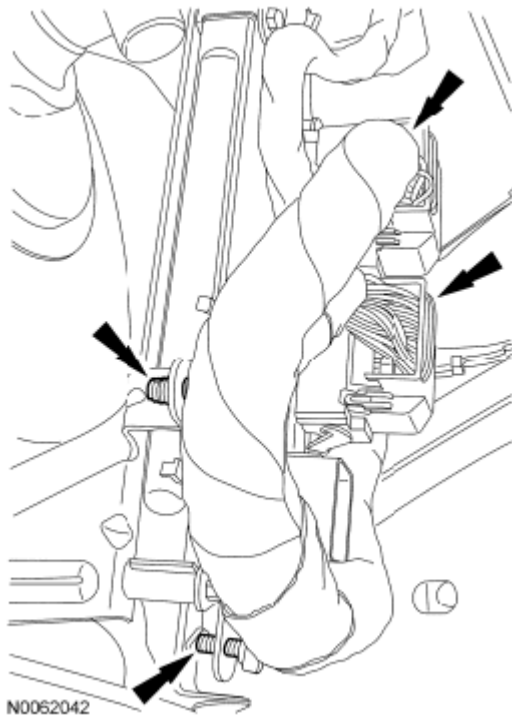


Fig. 818: Locating PCM Connectors & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

70. Install the engine mount brace and the 3 bolts.
 - Tighten to 25 Nm (18 lb-ft).

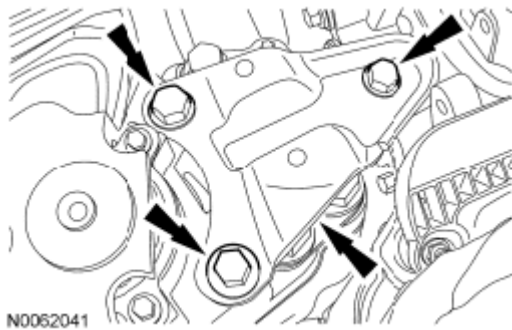


Fig. 819: Locating Engine Mount Brace & Bolt
Courtesy of FORD MOTOR CO.

71. Install the ground wire and the bolt.
 - Tighten to 10 Nm (89 lb-in).

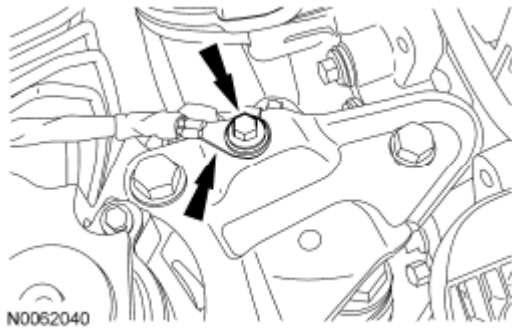


Fig. 820: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

72. Connect the fuel supply tube to the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION**.

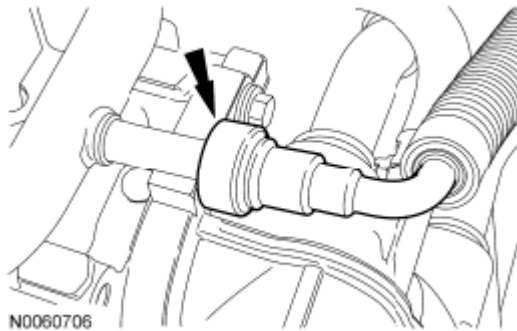


Fig. 821: Locating Fuel Supply Tube
Courtesy of FORD MOTOR CO.

73. Attach the power steering reservoir onto the cowl.



Fig. 822: Attaching Power Steering Reservoir Onto Cowl
Courtesy of FORD MOTOR CO.

74. Connect the hose to the power steering reservoir.
- Attach the pin-type retainer to the engine mount brace.

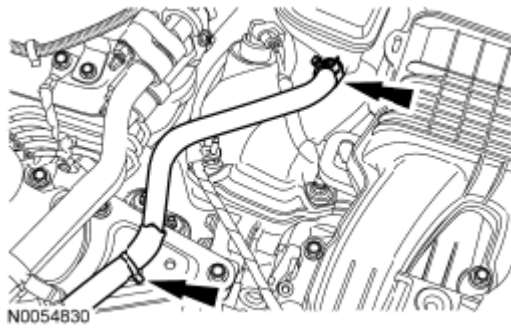


Fig. 823: Locating Hose
Courtesy of FORD MOTOR CO.

75. Install the oil level indicator.

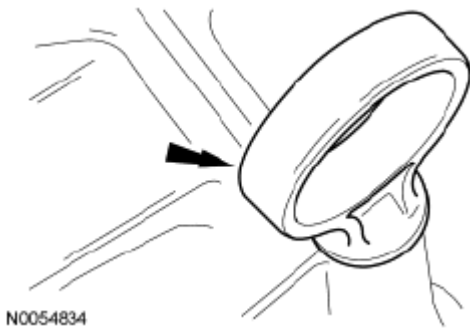


Fig. 824: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

76. Attach the 2 wiring harness retainers to the LH valve cover stud bolts.

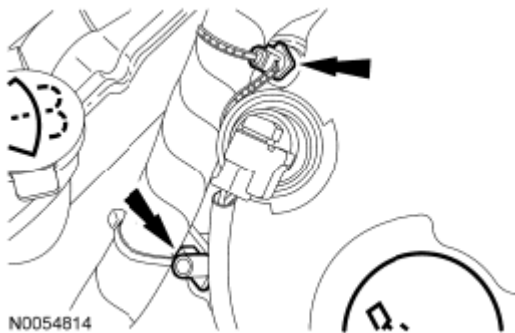


Fig. 825: Locating LH Valve Cover Stud Bolts & Wiring Harness
Courtesy of FORD MOTOR CO.

77. Connect the 2 engine wiring harness electrical connectors.

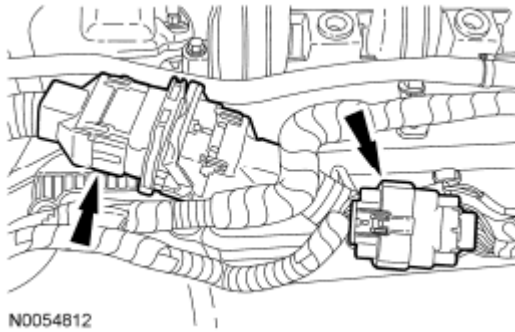


Fig. 826: Locating Engine Control Wiring Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

78. Attach the 2 wiring harness retainers.

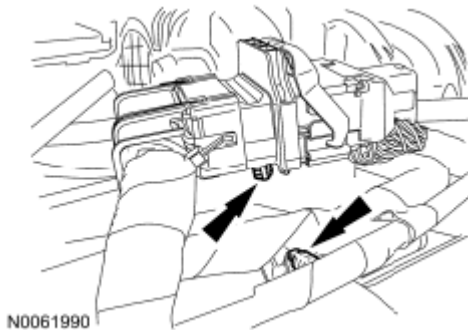


Fig. 827: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

79. Using new O-ring seals, connect the A/C tubes and install the 2 nuts.
- Tighten to 8 Nm (71 lb-in).

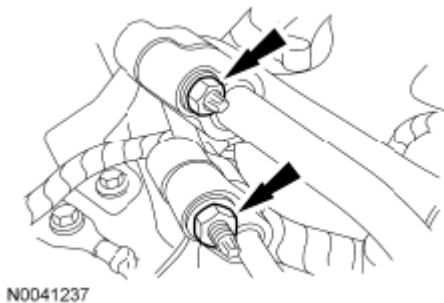


Fig. 828: Locating A/C Tubes & Nuts
Courtesy of FORD MOTOR CO.

80. Install the A/C tube bracket bolt.
- Tighten to 8 Nm (71 lb-in).

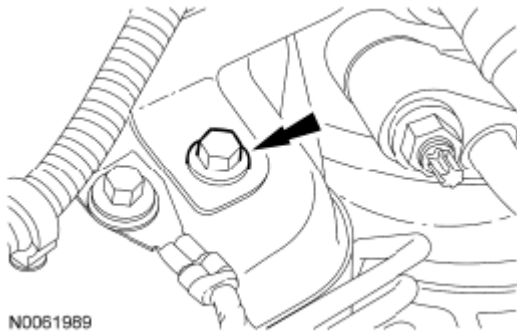


Fig. 829: Locating A/C Tube Bracket Bolt
Courtesy of FORD MOTOR CO.

81. Install the 2 A/C tube retaining clamp bolts.
 - Tighten to 10 Nm (89 lb-in).

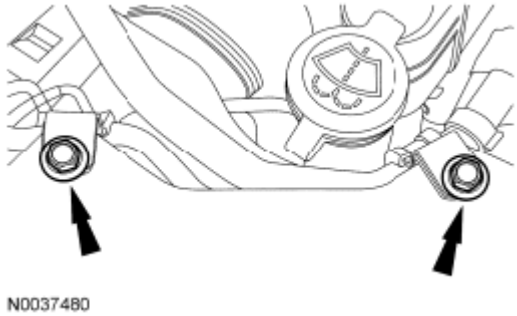


Fig. 830: Locating A/C Tube Retaining Clamp Bolts
Courtesy of FORD MOTOR CO.

82. Using a new O-ring seal, connect the A/C tube to the condenser and install the nut.
 - Tighten to 8 Nm (71 lb-in).

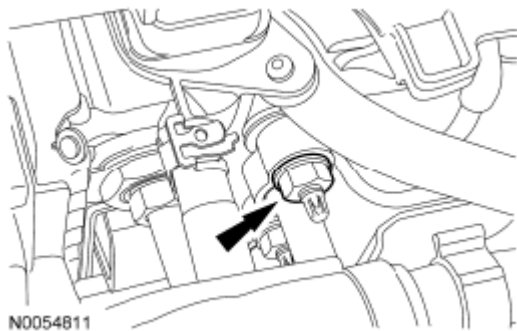


Fig. 831: Locating A/C Tube & Nut
Courtesy of FORD MOTOR CO.

83. Attach the coolant tube retainer clips to the A/C tube.



Fig. 832: Locating Coolant Tube Retainer Clips & A/C Tube
Courtesy of FORD MOTOR CO.

84. If equipped, attach the engine block heater harness to the radiator support, power steering hose, A/C tube and the engine wiring harness.
85. Install the ground wire and bolt.
 - Tighten to 12 Nm (106 lb-in).

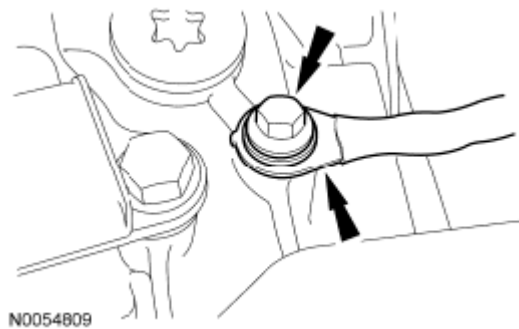


Fig. 833: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

86. Position the transaxle control cable bracket in place and install the 3 nuts.
 - Tighten to 12 Nm (106 lb-in).

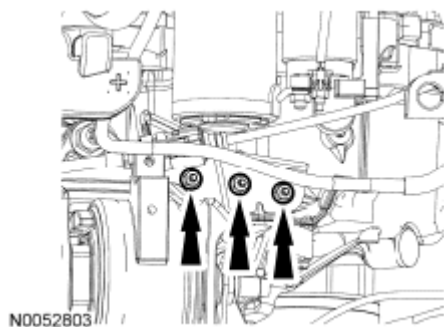


Fig. 834: Locating Transaxle Control Cable Bracket & Nuts
Courtesy of FORD MOTOR CO.

87. Connect the transaxle control cable to the control lever.

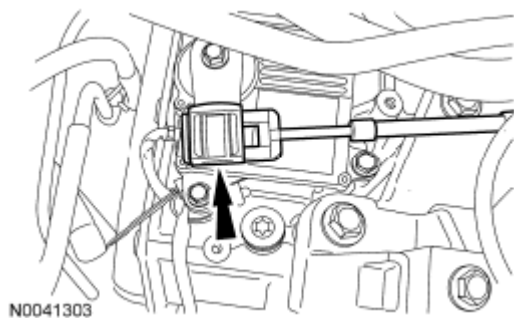


Fig. 835: Locating Transaxle Control Cable
Courtesy of FORD MOTOR CO.

88. Connect the upper radiator hose, lower radiator hose and 2 heater hoses to the thermostat housing.

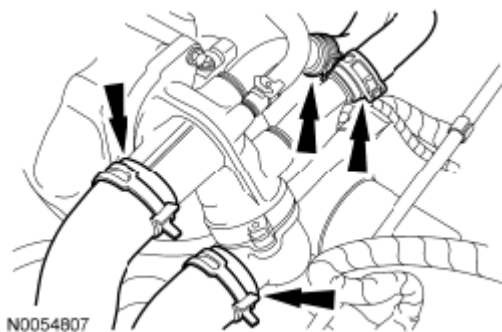


Fig. 836: Locating Upper Radiator Hose, Lower Radiator Hose & Heater Hoses
Courtesy of FORD MOTOR CO.

89. Connect the vacuum hose and the Evaporative Emission (EVAP) tube to the upper intake manifold.

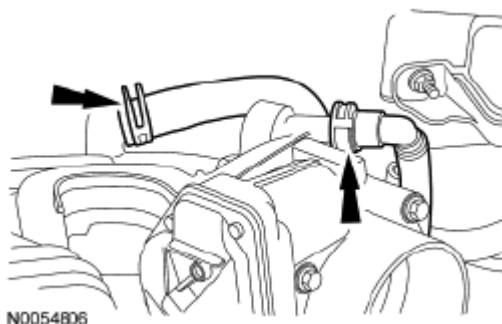


Fig. 837: Locating Vacuum Hose & Evaporative Emission (EVAP) Tube
Courtesy of FORD MOTOR CO.

90. Install the ground wire and the bolt.
- Tighten to 12 Nm (106 lb-in).

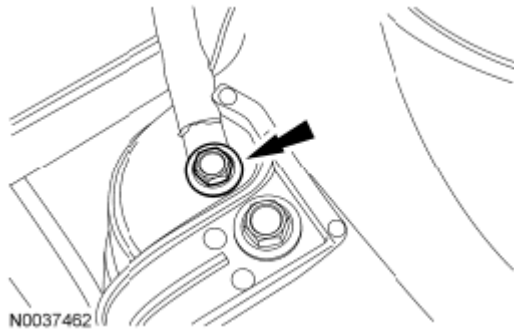


Fig. 838: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

91. Install the 2 battery cables to the positive battery cable and the 2 nuts.
 - Tighten to 9 Nm (80 lb-in).

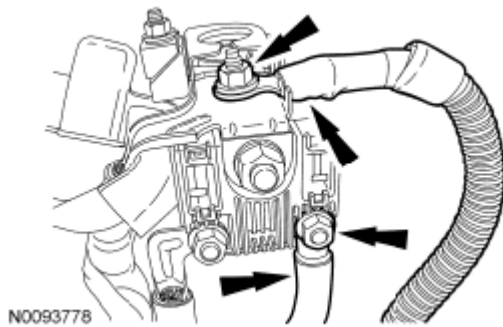


Fig. 839: Locating Battery Cables & Nuts
Courtesy of FORD MOTOR CO.

92. Attach the 2 wiring harness retainers to the transmission mount and the battery tray bracket.

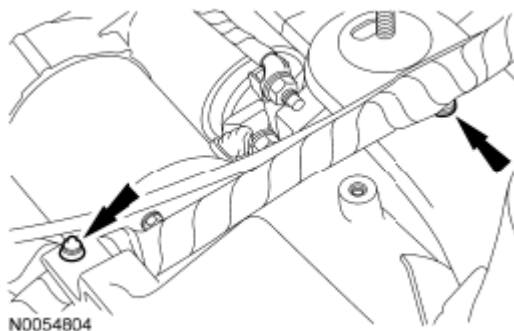


Fig. 840: Locating Wiring Harness Retainers To Transmission Mount
Courtesy of FORD MOTOR CO.

93. Connect the 2 engine wiring harness electrical connectors.

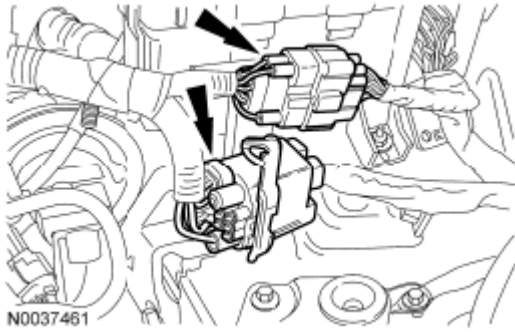


Fig. 841: Locating Engine Wiring Harness Electrical Connectors
 Courtesy of FORD MOTOR CO.

94. Install the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION**.
95. Install the engine Air Cleaner (ACL) and the ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION**.
96. Install the degas bottle. For additional information, refer to **REMOVAL AND INSTALLATION**.
97. Install the LH halfshaft and the intermediate shaft. For additional information, refer to **INSTALLATION**.
98. Install the accessory drive belt and the power steering belt. For additional information, refer to **INSTALLATION**.
99. Fill the engine with clean engine oil.

NOTE: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

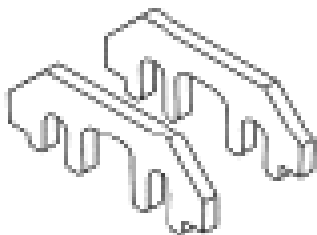
100. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.
101. Fill the power steering system. For additional information, refer to **POWER STEERING SYSTEM FILLING**.
102. Check the transaxle fluid and add fluid if necessary. For additional information, refer to **TRANSMISSION FLUID DRAIN AND REFILL** procedure.
103. Recharge the A/C system. For additional information, refer to **AIR CONDITIONING (A/C) SYSTEM RECOVERY, EVACUATION AND CHARGING**.

TIMING DRIVE COMPONENTS

Special Tool(s)

SPECIAL TOOL TABLE

	Tool, Camshaft Holding 303-1248
--	---------------------------------



ST2979-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 can cause engine failure.

Engines equipped with late build/replacement RH timing chain guides

1. Install the RH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

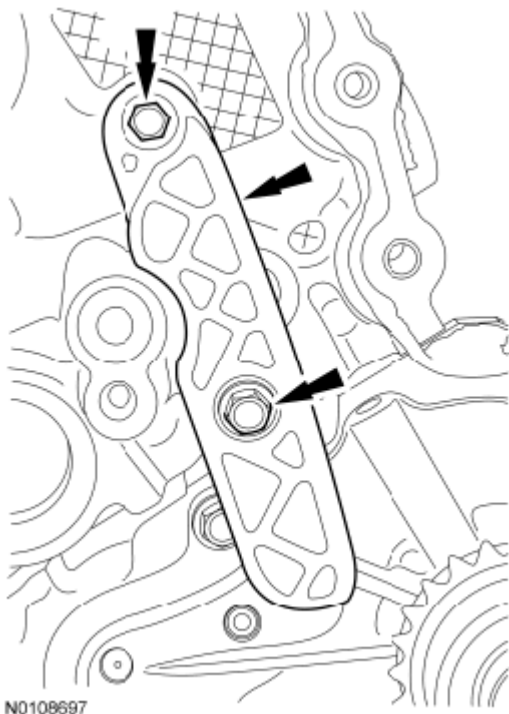


Fig. 842: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

2. Install the RH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

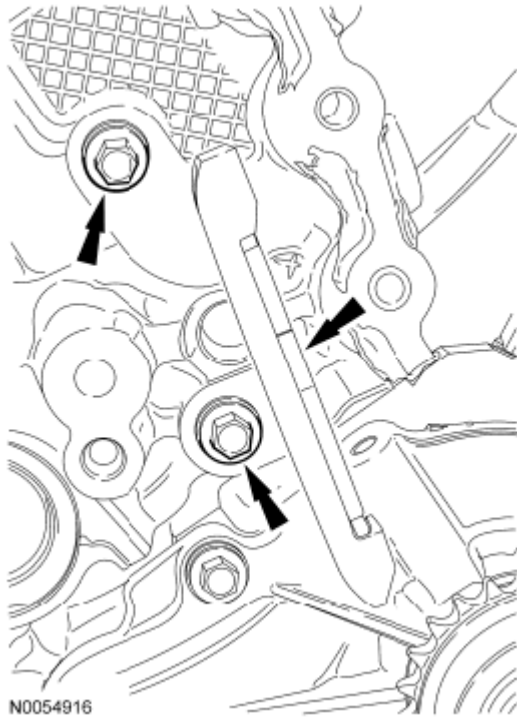


Fig. 843: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

3. Install the RH secondary timing chain tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

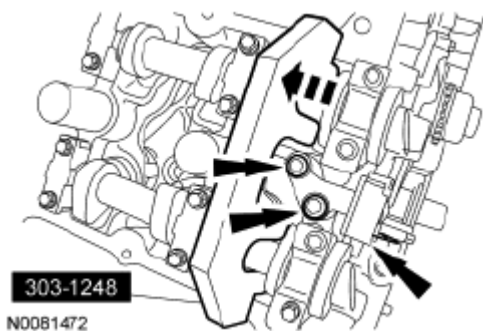


Fig. 844: Locating RH Secondary Timing Chain Tensioner Bolts

Courtesy of FORD MOTOR CO.

4. Assemble the RH Variable Camshaft Timing (VCT) assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
 - Align the colored links with the timing marks.

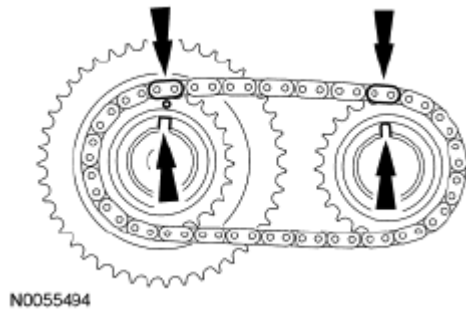


Fig. 845: Aligning Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

5. Position the RH secondary timing assembly onto the camshafts.

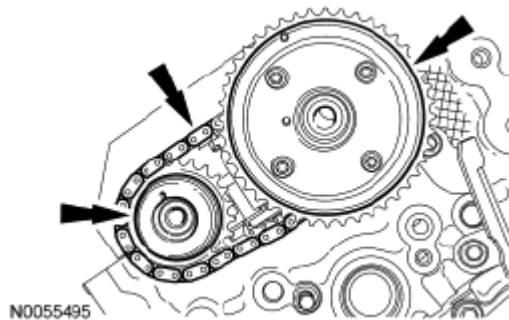


Fig. 846: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

6. Install 2 new bolts and the original washer. Tighten in 4 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 10 Nm (89 lb-in).
 - Stage 4: Tighten 90 degrees.

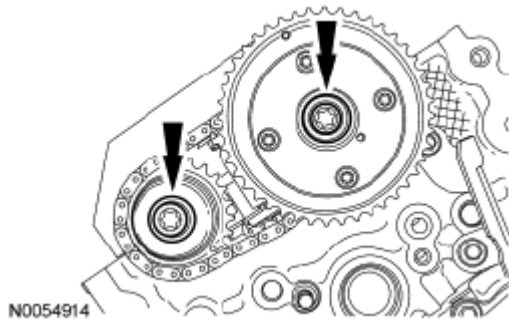


Fig. 847: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
 Courtesy of FORD MOTOR CO.

7. Remove the lockpin from the RH secondary timing chain tensioner.

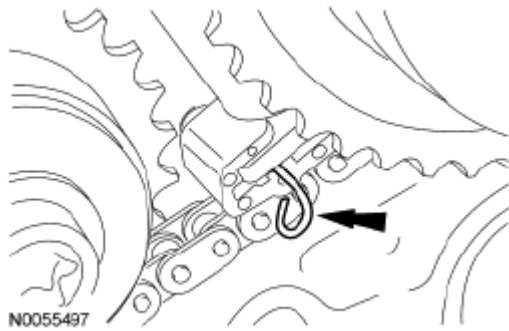


Fig. 848: Locating RH Secondary Timing Chain Tensioner Lockpin
 Courtesy of FORD MOTOR CO.

8. Install the LH secondary timing chain tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

NOTE: It is necessary to tilt the Camshaft Holding Tool toward the rear of the engine to access the rearmost secondary timing chain tensioner bolt.

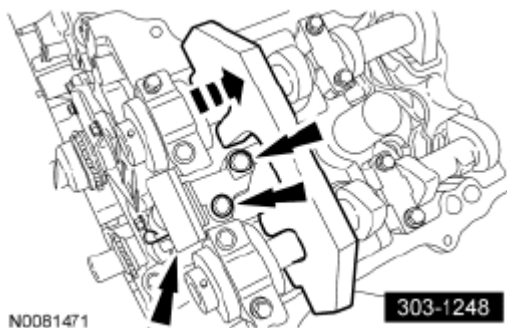
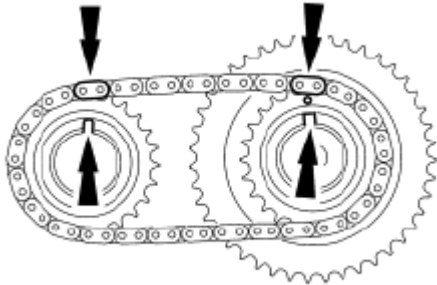


Fig. 849: Identifying Camshaft Holding Tool
 Courtesy of FORD MOTOR CO.

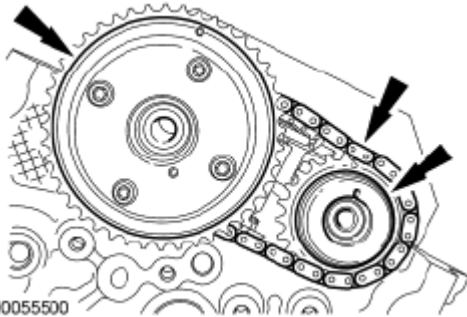
9. Assemble the LH VCT assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
 - Align the colored links with the timing marks.



N0055499

Fig. 850: Aligning Colored Links With Timing Marks
Courtesy of FORD MOTOR CO.

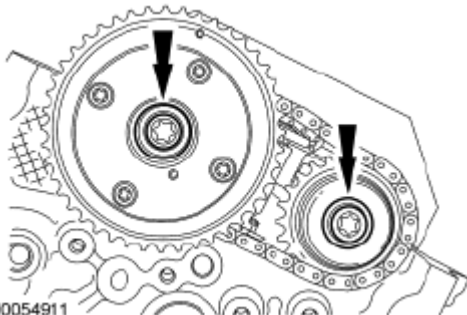
10. Position the LH secondary timing assembly onto the camshafts.



N0055500

Fig. 851: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

11. Install 2 new bolts and the original washer. Tighten in 4 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 10 Nm (89 lb-in).
 - Stage 4: Tighten 90 degrees.



N0054911

Fig. 852: Locating VCT Bolt & Exhaust Camshaft Bolt
Courtesy of FORD MOTOR CO.

12. Remove the lockpin from the LH secondary timing chain tensioner.

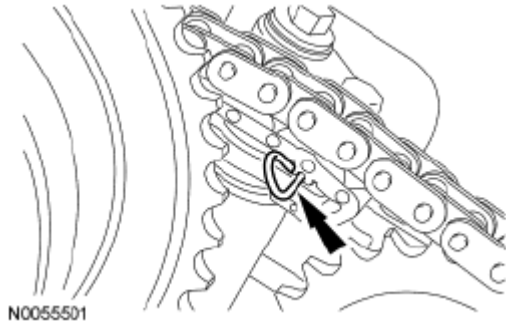


Fig. 853: Locating LH Secondary Timing Chain Tensioner Lockpin
Courtesy of FORD MOTOR CO.

13. Install the crankshaft timing chain sprocket.

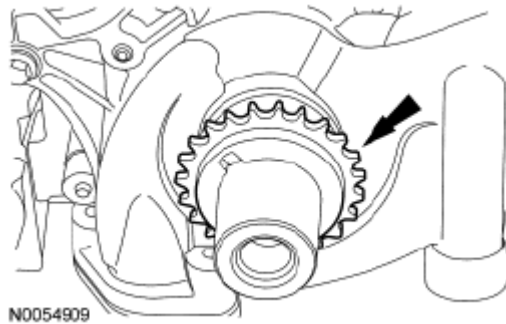
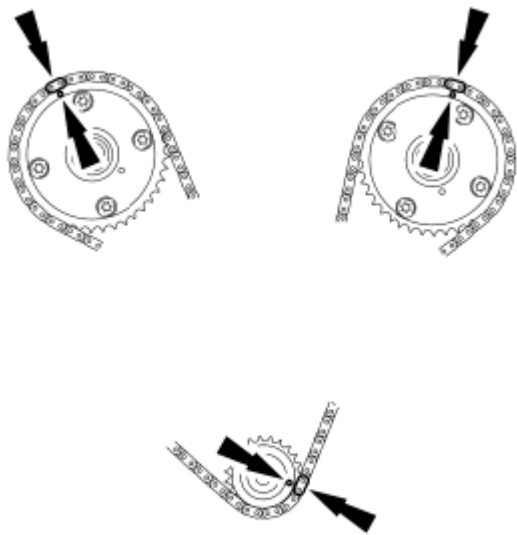


Fig. 854: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

14. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.



N0055503

Fig. 855: Locating Timing Marks On VCT Assemblies & Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

15. Install the upper LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

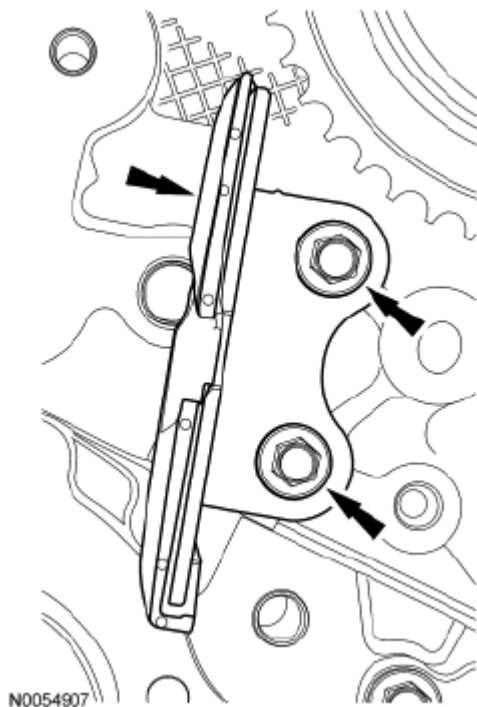
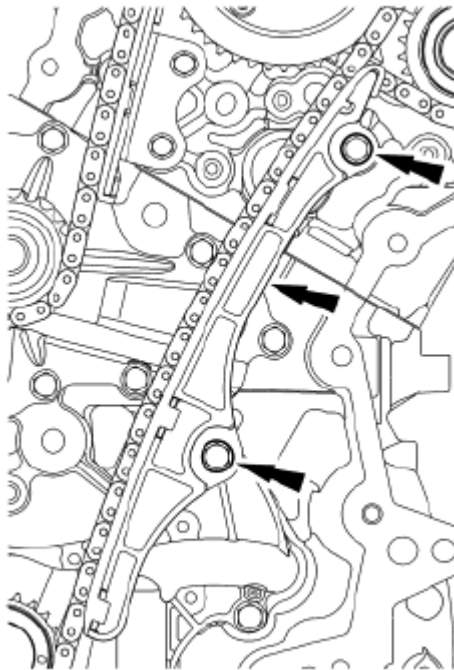


Fig. 856: Locating Upper LH Primary Timing Chain Guide & Bolts

Courtesy of FORD MOTOR CO.

16. Install the lower LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).



N0081593

Fig. 857: Locating Lower LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

17. Install the primary timing chain tensioner arm.

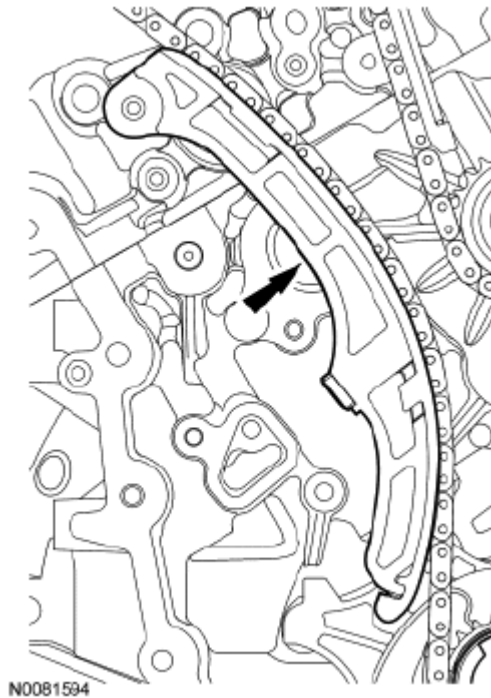


Fig. 858: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

18. Reset the primary timing chain tensioner.
 - Rotate the lever counterclockwise.
 - Using a soft-jawed vise, compress the plunger.
 - Align the hole in the lever with the hole in the tensioner housing.
 - Install a suitable lockpin.

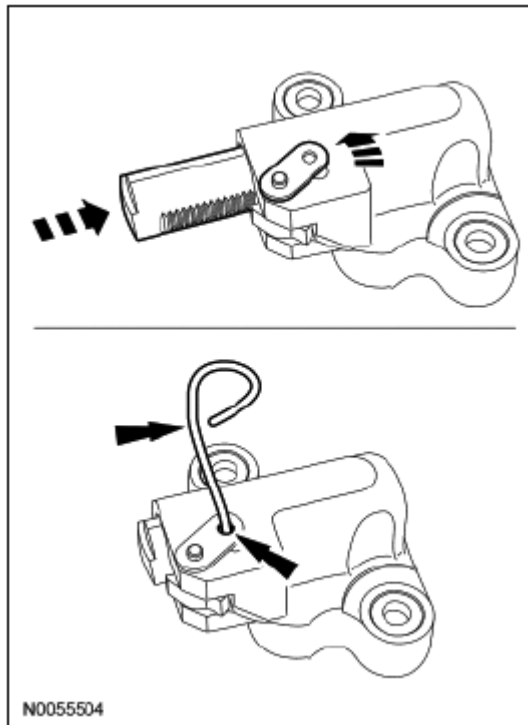


Fig. 859: Resetting Primary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

19. Install the primary tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).
 - Remove the lockpin.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

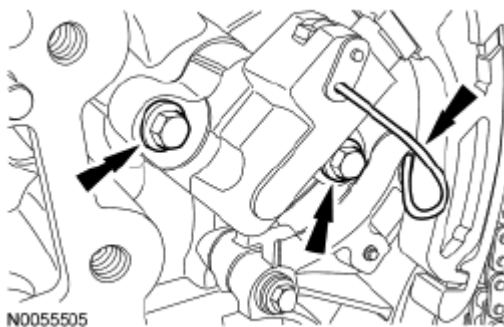


Fig. 860: Locating Primary Tensioner Bolts & Lockpin
Courtesy of FORD MOTOR CO.

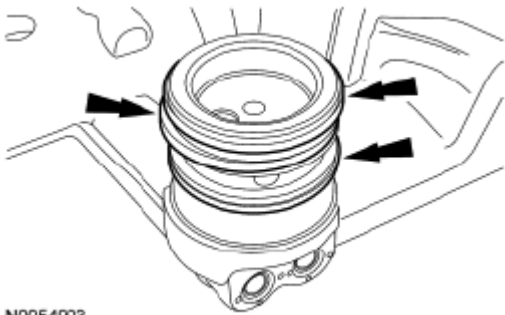
20. As a post-check, verify correct alignment of all timing marks.



N0055496

Fig. 861: Aligning Timing Marks
Courtesy of FORD MOTOR CO.

21. Inspect the VCT housing seals for damage and replace as necessary.



N0054903

Fig. 862: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

22. Install the LH VCT housing and the 3 bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

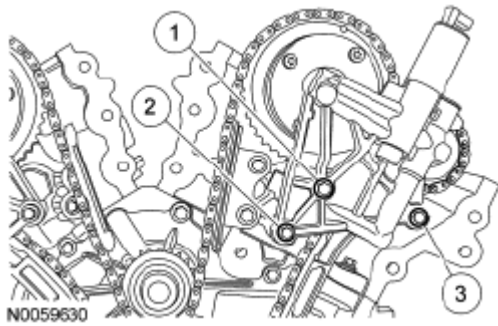


Fig. 863: Identifying VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

23. Install the RH VCT housing and the 3 bolts.

- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

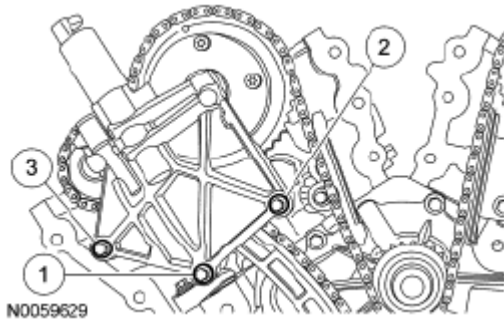


Fig. 864: Identifying RH VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

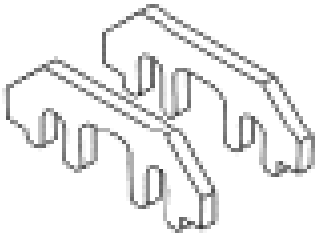
24. Install the engine front cover. For additional information, refer to **Removal and Installation**.

CAMSHAFT

Special Tool(s)

SPECIAL TOOL TABLE

	Tool, Camshaft Holding 303-1248
--	---------------------------------



ST2979-A

Material

ITEM SPECIFICATION TABLE

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

Removal and Installation

All camshafts

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

1. Rotate the crankshaft counterclockwise until the crankshaft dowel pin is in the 9 o'clock position.

NOTE: The crankshaft must remain in the freewheeling position (crankshaft dowel pin at 9 o'clock) until after the camshafts are installed and the valve clearance is checked/adjusted. Do not turn the crankshaft until instructed to do so. Failure to follow this process will result in severe engine damage.

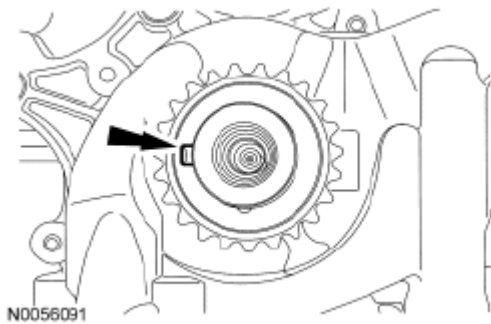


Fig. 865: Locating Dowel Pin
Courtesy of FORD MOTOR CO.

LH camshafts

2. Position the camshafts onto the LH cylinder head in the neutral position as shown in illustration.

NOTE: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.

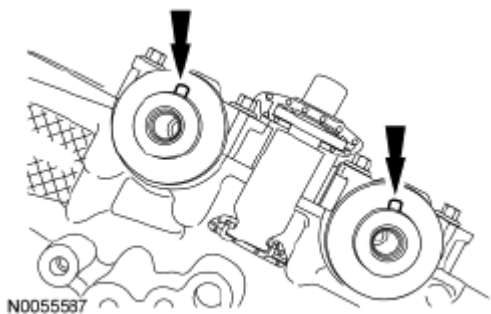
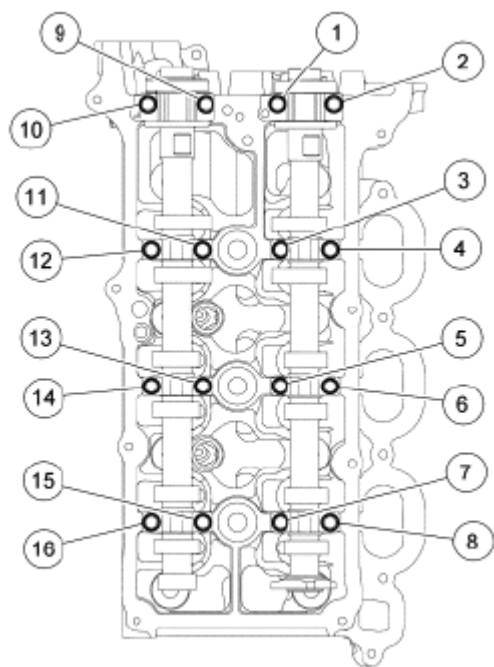


Fig. 866: Positioning Camshafts Onto LH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

3. Install the 8 camshaft caps and the 16 bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.



N0055185

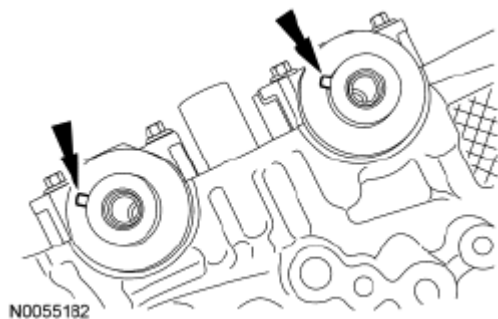
Fig. 867: Identifying Camshaft Caps Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

RH camshafts

4. Position the camshafts onto the RH cylinder head in the neutral position as shown in illustration.

NOTE: The camshafts must remain in the neutral position during installation or engine damage may occur.

NOTE: Coat the camshafts with clean engine oil prior to installation.



N0055182

Fig. 868: Positioning Camshafts Onto RH Cylinder Head In Neutral Position
Courtesy of FORD MOTOR CO.

5. Install the 8 camshaft caps and the 16 bolts.

- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: **Cylinder head camshaft bearing caps are numbered to verify that they are assembled in their original positions.**

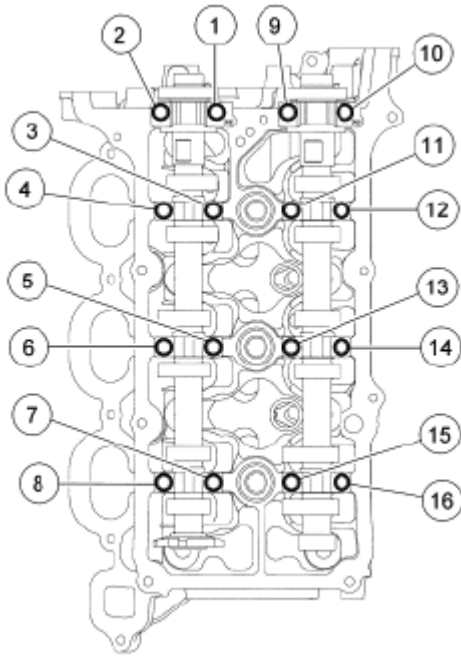


Fig. 869: Identifying Camshaft Caps Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

All camshafts

6. Using a feeler gauge, confirm that the valve tappet clearances are within specification. If valve tappet clearances are not within specification, the clearance must be adjusted by installing new valve tappet(s) of the correct size. For additional information, refer to **VALVE CLEARANCE CHECK**.

NOTE: **If any components are installed new, the engine valve clearance must be checked/adjusted or engine damage can occur.**

NOTE: **Use a camshaft sprocket bolt to turn the camshafts.**

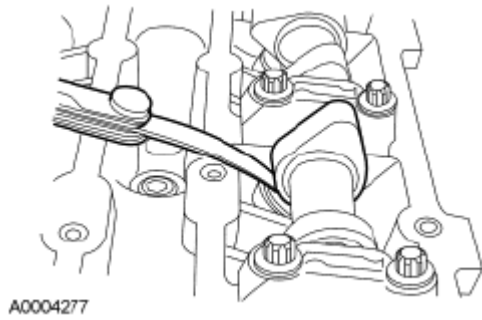


Fig. 870: Measuring Valve Clearance
Courtesy of FORD MOTOR CO.

LH camshafts

7. Rotate the LH camshafts to the Top Dead Center (TDC) position and install the Camshaft Holding Tool on the flats of the camshafts.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

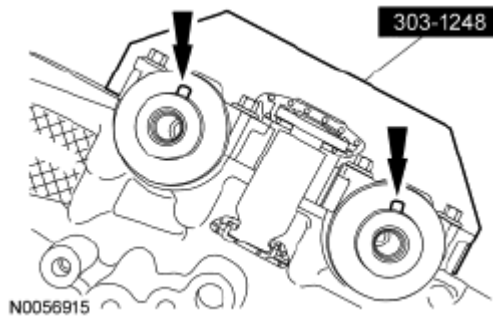


Fig. 871: Identifying Camshaft Holding Tool Onto Flats Of Camshafts
Courtesy of FORD MOTOR CO.

8. Assemble the LH Variable Camshaft Timing (VCT) assembly, the LH exhaust camshaft sprocket and the LH secondary timing chain.
 - Align the colored links with the timing marks.

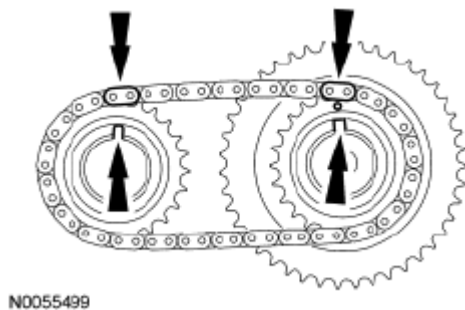


Fig. 872: Aligning Colored Links With Timing Marks

Courtesy of FORD MOTOR CO.

9. Position the LH secondary timing assembly onto the camshafts.

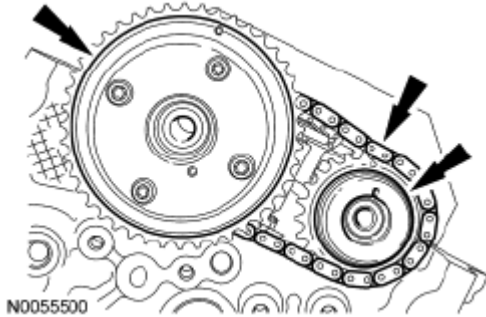


Fig. 873: Positioning LH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

10. Install 2 new bolts and the original washer. Tighten in 4 stages.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 10 Nm (89 lb-in).
 - Stage 4: Tighten 90 degrees.

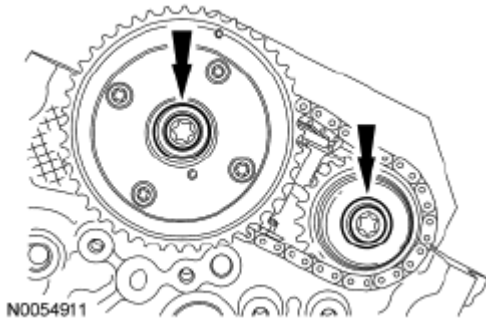


Fig. 874: Locating VCT Bolt & Exhaust Camshaft Bolt
Courtesy of FORD MOTOR CO.

11. Remove the lockpin from the LH secondary timing chain tensioner.

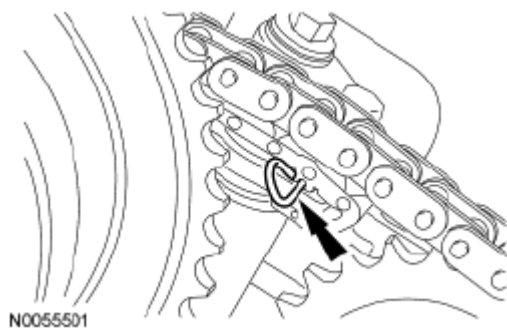


Fig. 875: Locating LH Secondary Timing Chain Tensioner Lockpin
Courtesy of FORD MOTOR CO.

RH camshafts

12. Rotate the RH camshafts to the TDC position and install the Camshaft Holding Tool on the flats of the camshafts.

NOTE: Use a camshaft sprocket bolt to turn the camshafts.

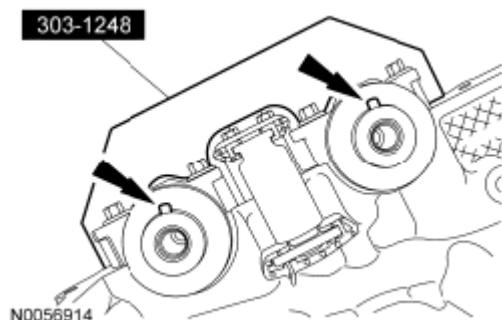


Fig. 876: Installing Camshaft Holding Tool
Courtesy of FORD MOTOR CO.

13. Assemble the RH VCT assembly, the RH exhaust camshaft sprocket and the RH secondary timing chain.
 - Align the colored links with the timing marks.

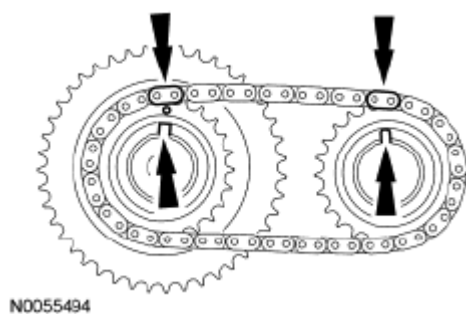


Fig. 877: Aligning Colored Links With Timing Marks

Courtesy of FORD MOTOR CO.

14. Position the RH secondary timing assembly onto the camshafts.

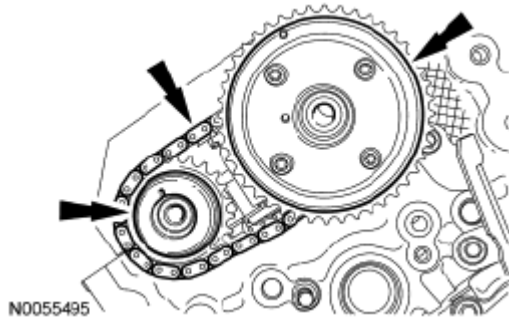


Fig. 878: Positioning RH Secondary Timing Assembly Onto Camshafts
Courtesy of FORD MOTOR CO.

15. Install 2 new bolts and the original washer. Tighten in 4 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Loosen one full turn.
 - Stage 3: Tighten to 10 Nm (89 lb-in).
 - Stage 4: Tighten 90 degrees.

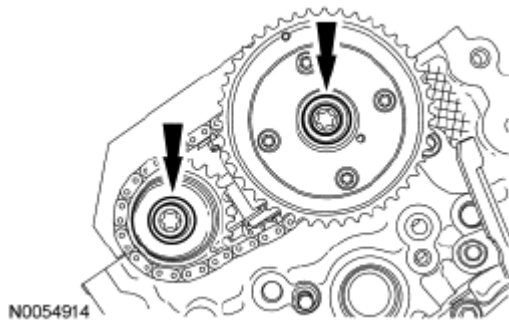


Fig. 879: Locating VCT Assembly Bolt & RH Exhaust Camshaft Sprocket Bolt
Courtesy of FORD MOTOR CO.

16. Remove the lockpin from the RH secondary timing chain tensioner.

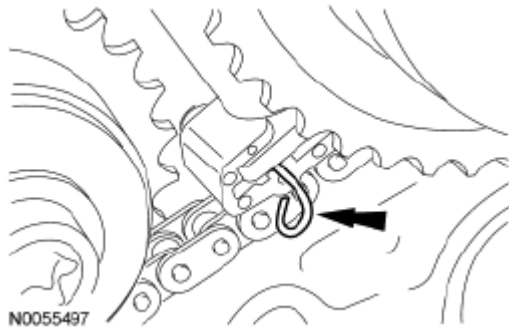


Fig. 880: Locating RH Secondary Timing Chain Tensioner Lockpin
Courtesy of FORD MOTOR CO.

All camshafts

17. Rotate the crankshaft clockwise 60 degrees to the **TDC** position (crankshaft dowel pin at 11 o'clock).

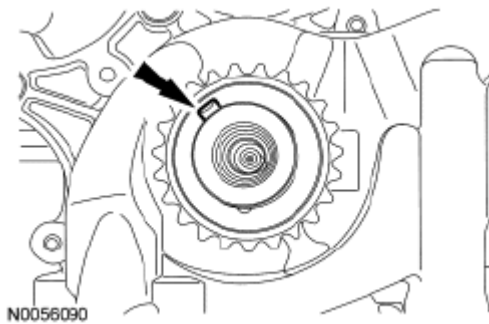
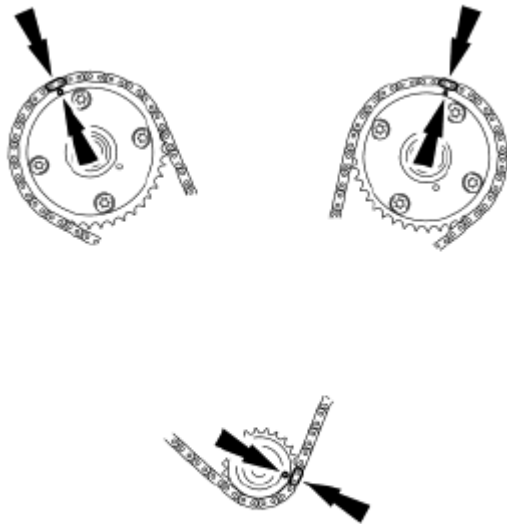


Fig. 881: Locating Dowel Pin
Courtesy of FORD MOTOR CO.

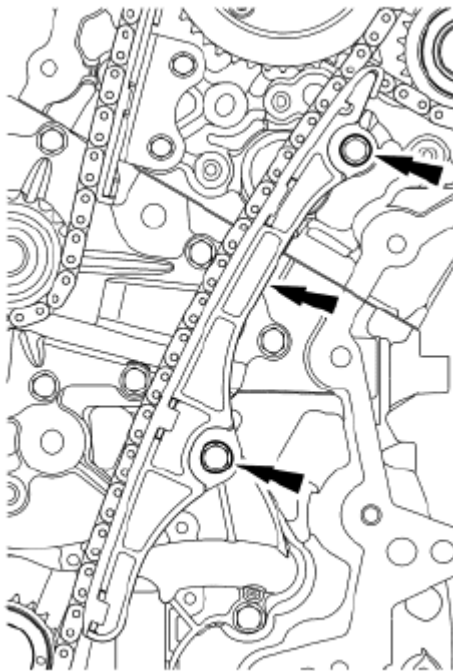
18. Install the primary timing chain with the colored links aligned with the timing marks on the **VCT** assemblies and the crankshaft sprocket.



N0055503

Fig. 882: Aligning With Timing Marks On VCT Assemblies & Crankshaft Sprocket
 Courtesy of FORD MOTOR CO.

19. Install the lower LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).



N0081593

Fig. 883: Locating Lower LH Primary Timing Chain Guide & Bolts
 Courtesy of FORD MOTOR CO.

20. Install the primary timing chain tensioner arm.

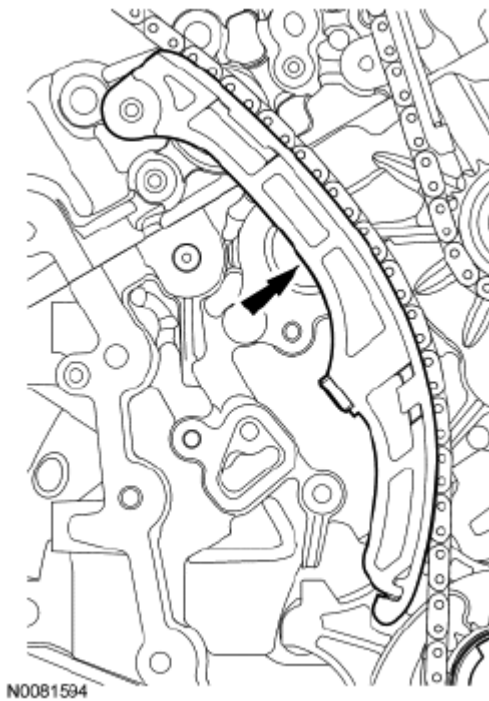


Fig. 884: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

21. Reset the primary timing chain tensioner.

- Rotate the lever counterclockwise.
- Using a soft-jawed vise, compress the plunger.
- Align the hole in the lever with the hole in the tensioner housing.
- Install a suitable lockpin.

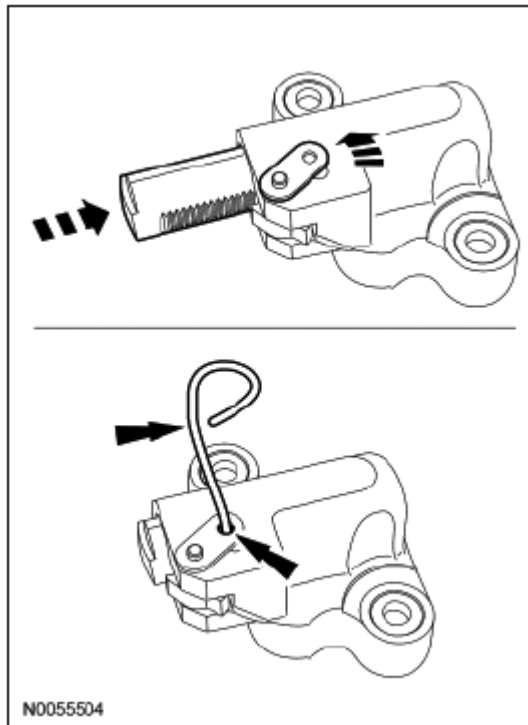


Fig. 885: Resetting Primary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

22. Install the primary tensioner and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).
 - Remove the lockpin.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

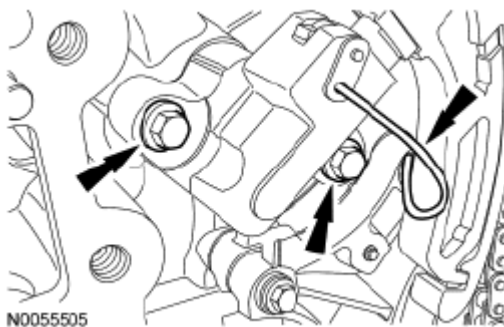


Fig. 886: Locating Primary Tensioner Bolts & Lockpin
Courtesy of FORD MOTOR CO.

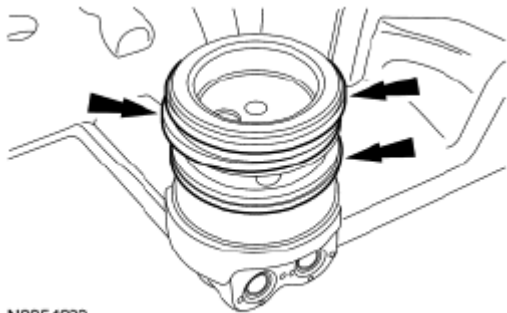
23. As a post-check, verify correct alignment of all timing marks.



N0055496

Fig. 887: Aligning Timing Marks
Courtesy of FORD MOTOR CO.

24. Inspect the VCT housing seals for damage and replace as necessary.



N0054903

Fig. 888: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

25. Install the LH VCT housing and the 3 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

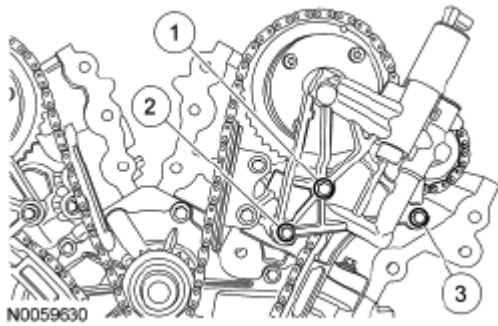


Fig. 889: Identifying VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

26. Install the RH VCT housing and the 3 bolts.
- Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

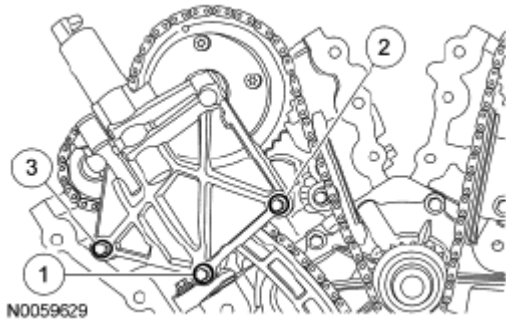


Fig. 890: Identifying RH VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

27. Install the engine front cover. For additional information, refer to **Removal and Installation**.

VALVE TAPPETS

Material

ITEM SPECIFICATION TABLE

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

Removal and Installation

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

1. Install the valve tappets.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

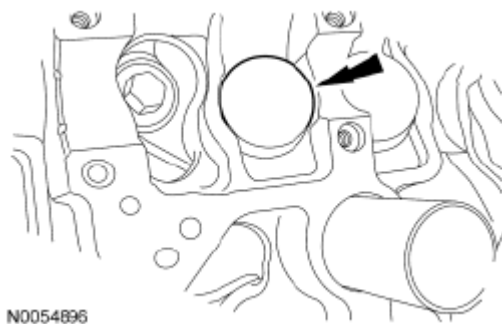


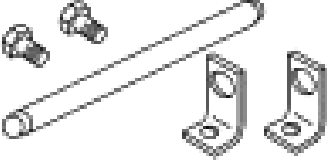
Fig. 891: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

2. Depending on the valve tappets being serviced, install the LH and/or the RH camshafts. For additional information, refer to **Removal and Installation**.

VALVE SPRING, RETAINER AND SEAL

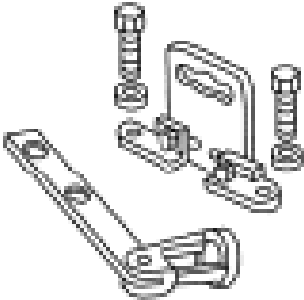
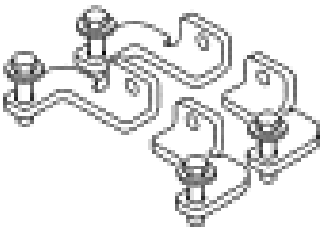
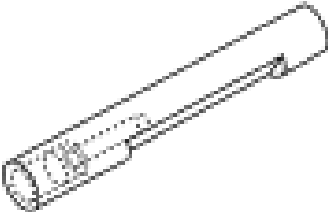
Special Tool(s)

SPECIAL TOOL TABLE

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

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

 ST1907-A	
 ST3026-A	Compressor, Valve Spring 303-1249
 ST1906-A	Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)

Material

ITEM SPECIFICATION TABLE

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

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

NOTE: Lubricate the valve stem seal with clean engine oil prior to installation.

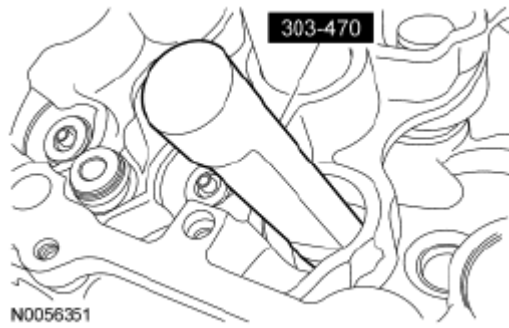


Fig. 892: Identifying Valve Stem Oil Seal Installer
Courtesy of FORD MOTOR CO.

2. Using the Valve Spring Compressors, install the valve spring, retainer and key.

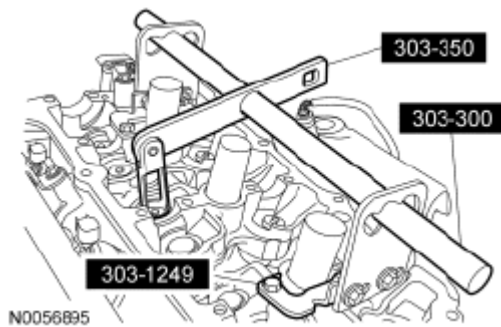


Fig. 893: Identifying Valve Springs Compressors
Courtesy of FORD MOTOR CO.

3. Install the valve tappets. For additional information, refer to **Removal and Installation**.

CYLINDER HEAD - RH

Material

ITEM SPECIFICATION TABLE

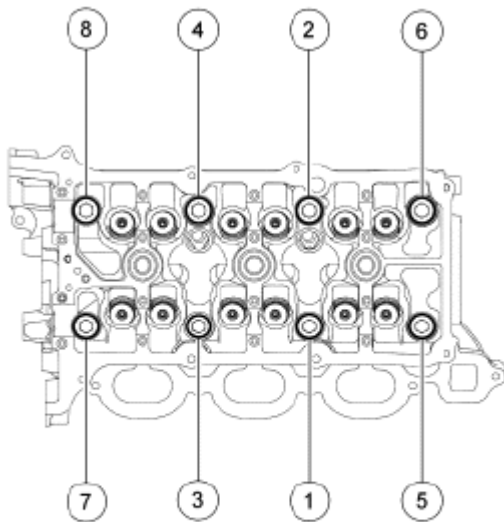
Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

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

NOTE: On early build engines, the timing chain rides on the inner side of the RH timing chain guide. Late build engines are equipped with a different design RH timing chain guide that requires the timing chain to ride on the outer side of the RH timing chain guide. For service, all replacement RH timing chain guides will be the late build design.

All vehicles

1. Install a new gasket, the RH cylinder head and 8 new bolts. Tighten in the sequence shown in illustration below in 5 stages:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 35 Nm (26 lb-ft).
 - Stage 3: Tighten 90 degrees.
 - Stage 4: Tighten 90 degrees.
 - Stage 5: Tighten 90 degrees.



N0054884

Fig. 894: Identifying RH Cylinder Head Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the new M6 bolt.
 - Tighten to 10 Nm (89 lb-in).

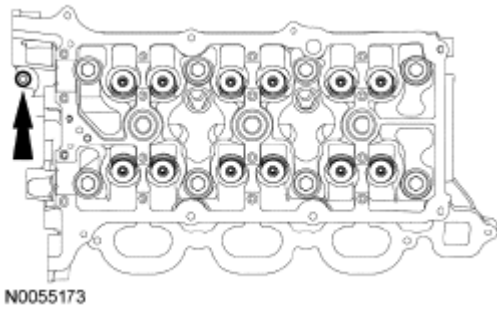


Fig. 895: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

3. Install the valve tappets.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

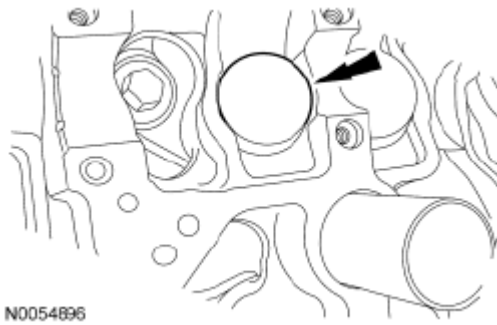


Fig. 896: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

4. Install and connect the Cylinder Head Temperature (CHT) sensor jumper harness.

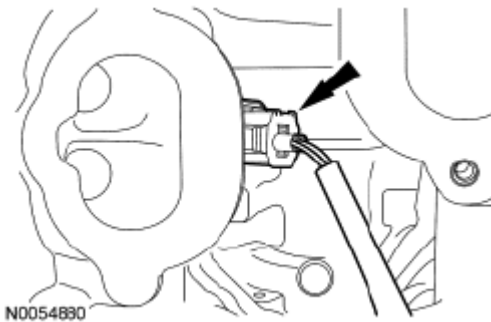


Fig. 897: Locating CHT Sensor Jumper Harness
Courtesy of FORD MOTOR CO.

5. Using new gaskets, install the lower intake manifold and the 10 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

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

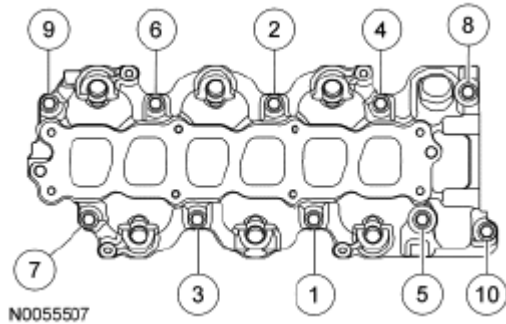


Fig. 898: Identifying Lower Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Using a new gasket and O-ring seal, install the thermostat housing and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

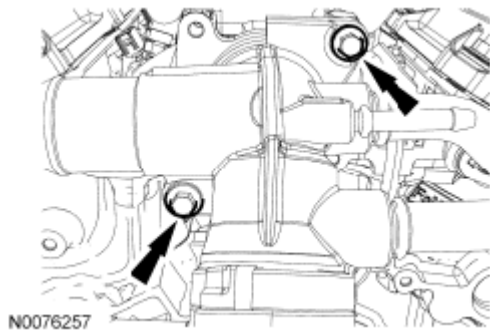


Fig. 899: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

7. Connect the coolant bypass hose to the thermostat housing.

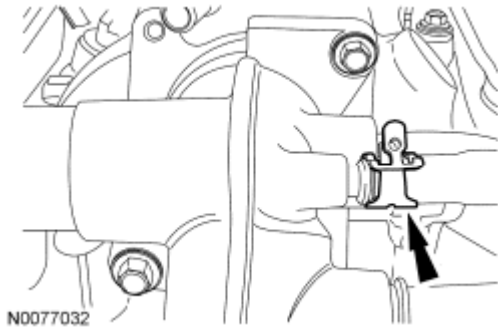


Fig. 900: Locating Coolant Bypass Hose To Thermostat Housing
Courtesy of FORD MOTOR CO.

8. Install new fuel injector O-ring seals.
 - Remove the retaining clips and separate the fuel injectors from the fuel rail.
 - Remove and discard the O-ring seals.
 - Install new O-ring seals and lubricate with clean engine oil.
 - Install the fuel injectors and the retaining clips onto the fuel rail.

NOTE: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

NOTE: The upper and lower O-ring seals are not interchangeable.

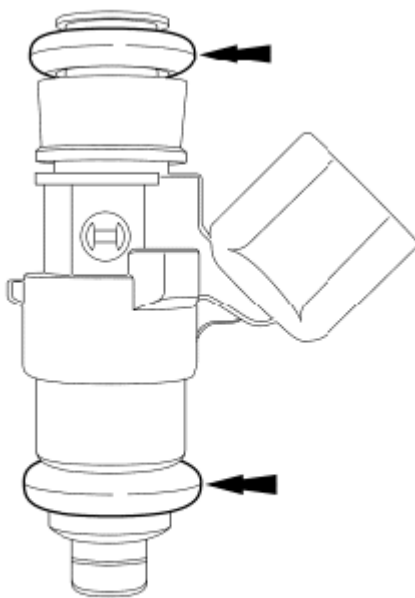


Fig. 901: Identifying Fuel Injector O-Ring Seals

Courtesy of FORD MOTOR CO.

9. Install the fuel rail and injectors as an assembly and install the 4 bolts.
 - Tighten to 10 Nm (89 lb-in).

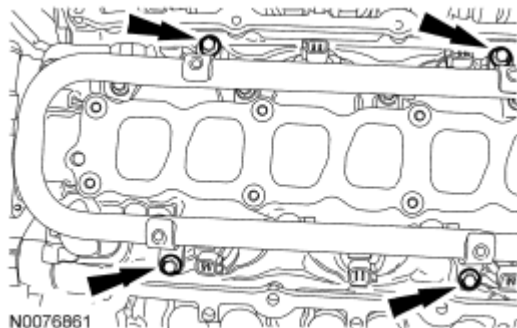


Fig. 902: Locating Fuel Rail & Injectors Assembly Bolts
Courtesy of FORD MOTOR CO.

10. Install the RH Camshaft Position (CMP) sensor and the bolt.
 - Tighten to 10 Nm (89 lb-in).

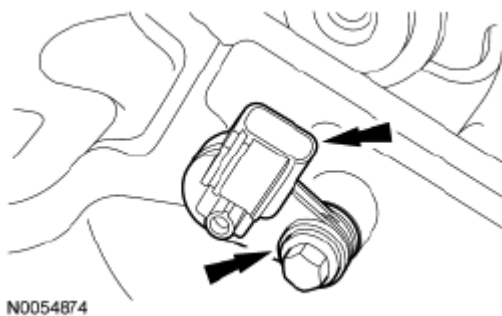


Fig. 903: Locating RH CMP Sensor & Bolt
Courtesy of FORD MOTOR CO.

11. Install the upper intake manifold support bracket and the bolt.
 - Tighten to 10 Nm (89 lb-in).

NOTE: **Align the bracket with the index mark made during removal.**

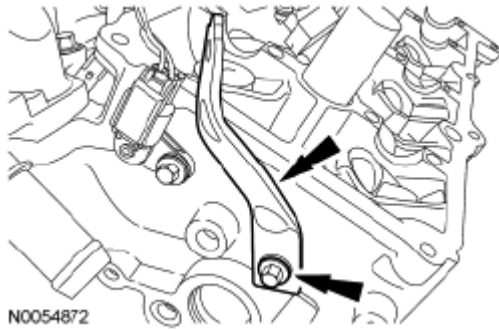


Fig. 904: Locating Upper Intake Manifold Support Bracket & Bolt
Courtesy of FORD MOTOR CO.

12. Install the engine lifting eye and the 2 bolts.
 - Tighten to 24 Nm (18 lb-ft).

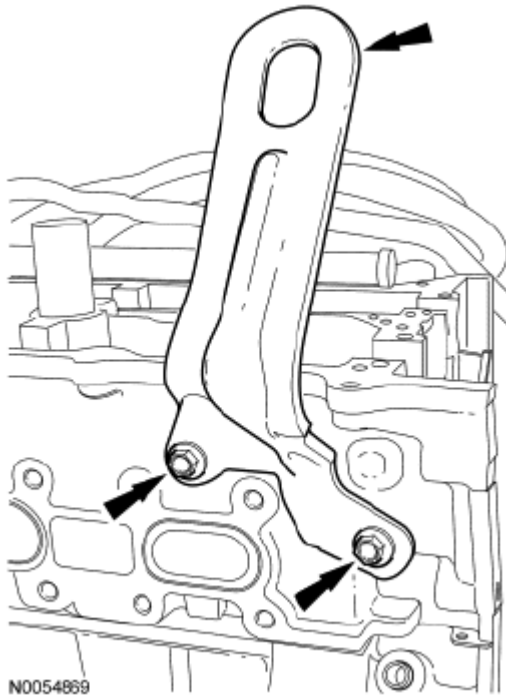


Fig. 905: Locating Engine Lifting Eye & Bolts
Courtesy of FORD MOTOR CO.

13. Install the RH secondary timing chain tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

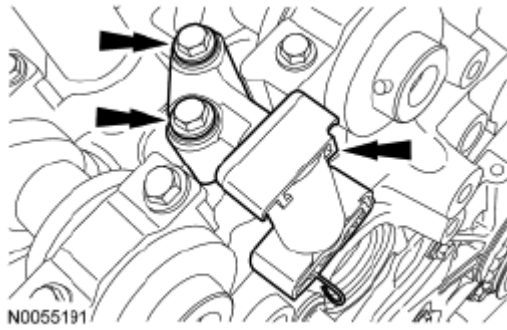


Fig. 906: Locating RH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with late build/replacement RH timing chain guides

14. Install the RH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

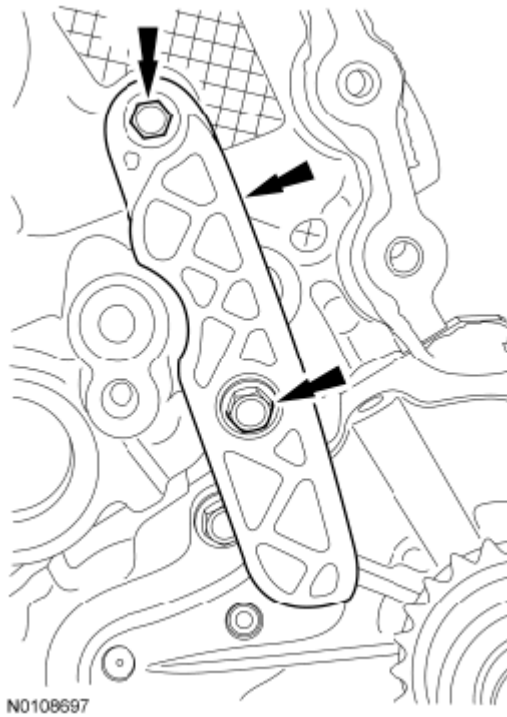


Fig. 907: Locating RH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

Engines equipped with early build RH timing chain guides

15. Install the RH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

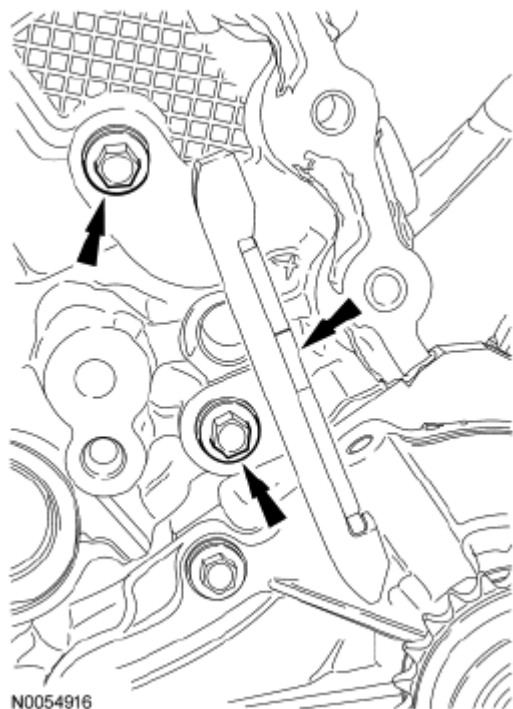


Fig. 908: Locating RH Primary Timing Chain Guide Bolts
Courtesy of FORD MOTOR CO.

All vehicles

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

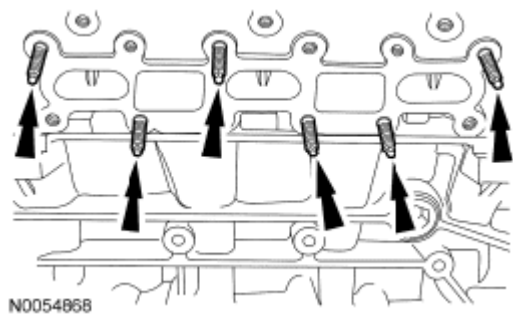


Fig. 909: Locating RH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

17. Using a new gasket, install the RH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration below:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

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

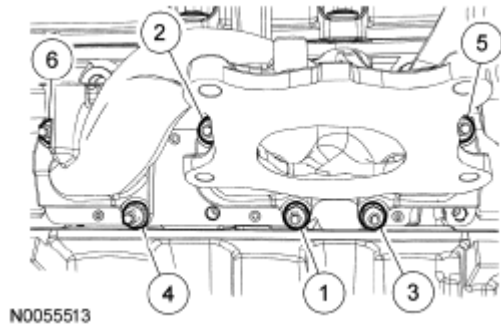


Fig. 910: Identifying RH Exhaust Manifold Nut Tightening Sequence
Courtesy of FORD MOTOR CO.

18. Install the RH exhaust manifold heat shield and the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).

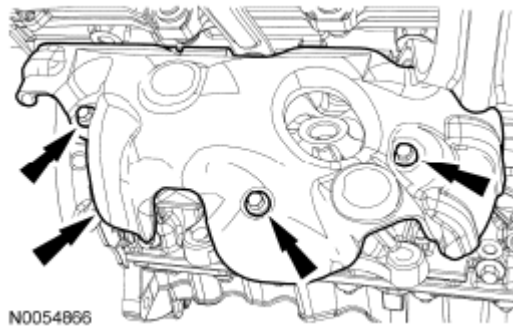


Fig. 911: Locating RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

19. Install the RH cylinder block drain plug or, if equipped, the block heater.
 - Tighten to 40 Nm (30 lb-ft).

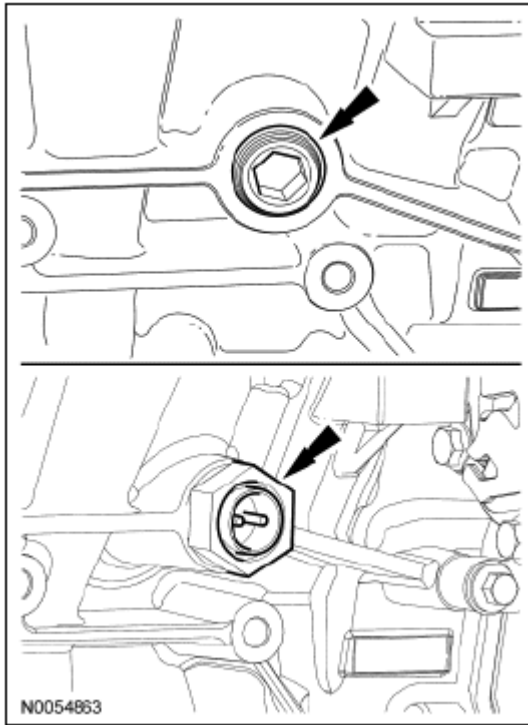


Fig. 912: Locating RH Cylinder Block Drain Plug & Block Heater
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

20. Using a new gasket, install the RH catalytic converter and 4 new nuts.

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

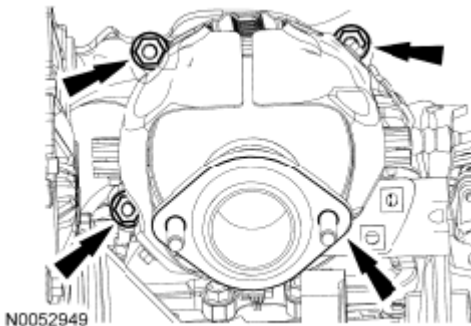


Fig. 913: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 RH catalytic converter bracket bolts.
 - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
 - Tighten the 2 catalytic converter brackets to 20 Nm (177 lb-in).

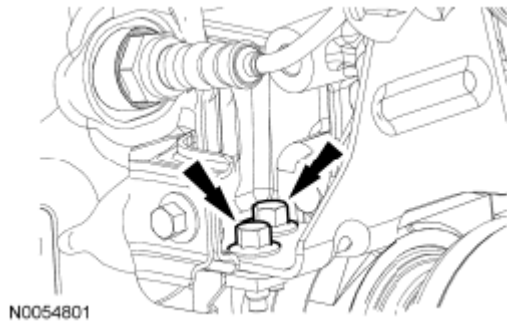


Fig. 914: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

22. Using a new gasket, install the RH catalytic converter and 4 new nuts.
 - Tighten to 40 Nm (30 lb-ft).

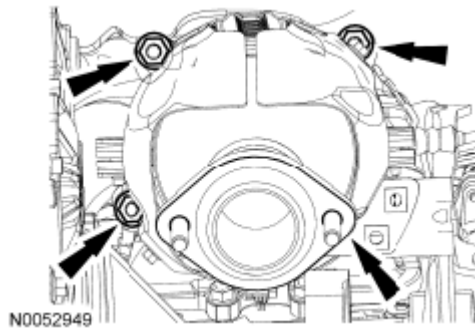


Fig. 915: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

23. Install the LH cylinder block drain plug.
 - Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

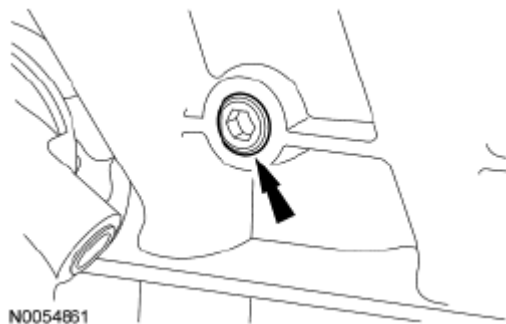


Fig. 916: Locating LH Cylinder Block Drain Plug

Courtesy of FORD MOTOR CO.

24. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown in illustration).
- Tighten to 40 Nm (30 lb-ft).

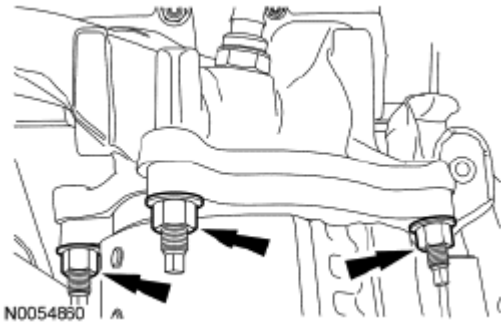


Fig. 917: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

25. Install the 2 LH catalytic converter bracket bolts.
- Tighten to 20 Nm (177 lb-in).

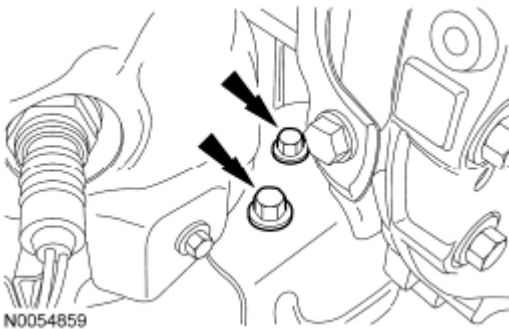


Fig. 918: Locating LH Catalytic Converter Bolts
Courtesy of FORD MOTOR CO.

26. Connect the LH Catalyst Monitor Sensor (CMS) sensor electrical connector.

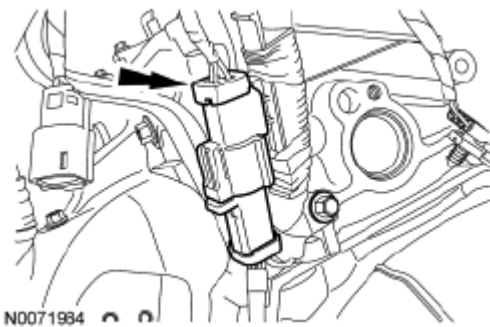


Fig. 919: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector

Courtesy of FORD MOTOR CO.

27. Connect the **CHT** sensor electrical connector.

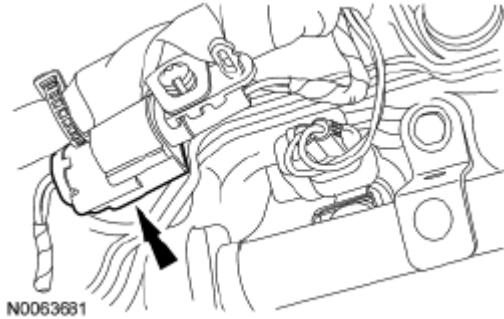


Fig. 920: Identifying Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

28. Connect the 6 fuel injector electrical connectors (3 shown in illustration).

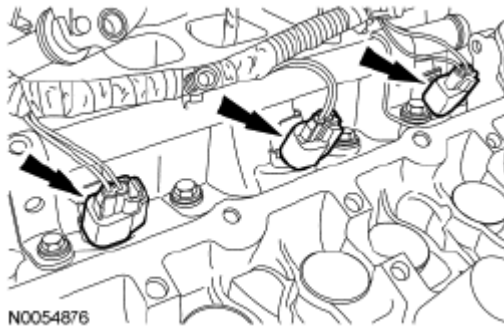


Fig. 921: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

29. Install the Power Steering Pressure (PSP) tube bracket and bolt.
- Tighten to 10 Nm (89 lb-in).

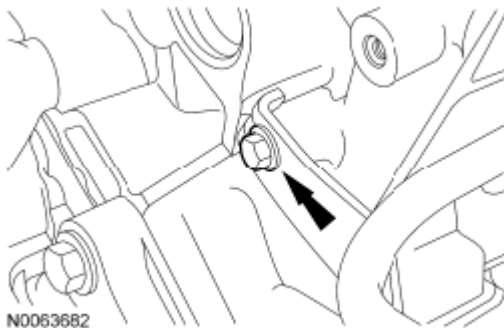


Fig. 922: Locating Power Steering Pressure Tube & Bracket Assembly
Courtesy of FORD MOTOR CO.

30. Connect the RH **CMP** sensor electrical connector.

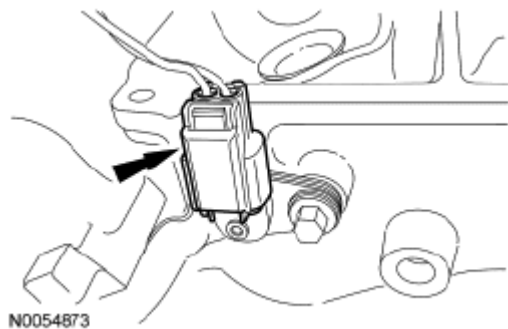


Fig. 923: Locating RH Camshaft Position Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

31. Connect the RH **HO2S** electrical connector.

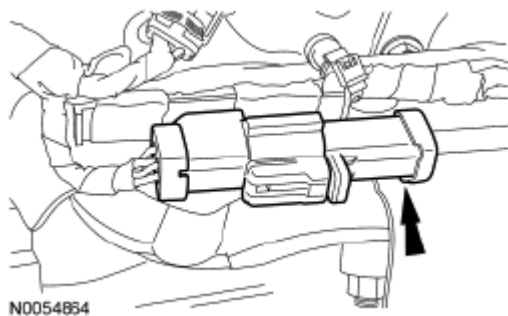


Fig. 924: Locating RH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

32. If equipped, install the block heater wiring harness onto the engine.
- Connect the block heater electrical connector and install the heat shield.

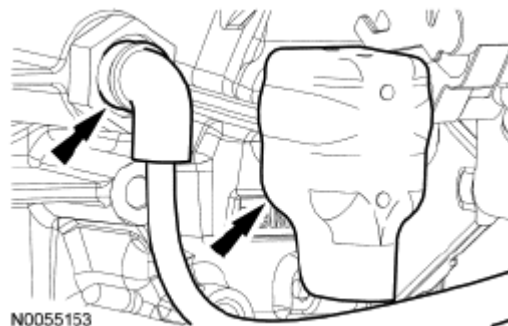


Fig. 925: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

33. Install the RH camshafts. For additional information, refer to **Removal and Installation**.

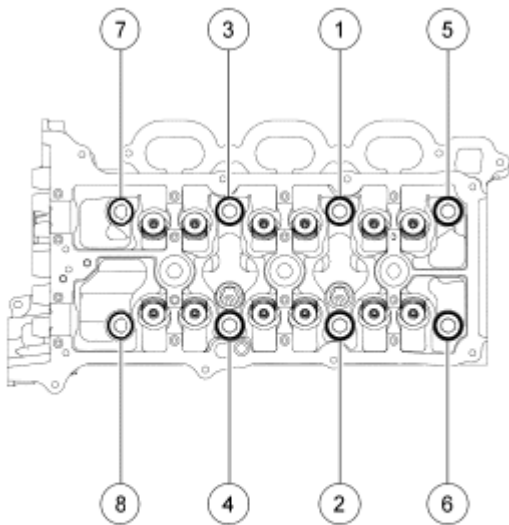
CYLINDER HEAD - LH**Material****ITEM SPECIFICATION TABLE**

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

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.

All vehicles

1. Install a new gasket, the LH cylinder head and 8 new bolts. Tighten in the sequence shown in illustration in 5 stages:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 35 Nm (26 lb-ft).
 - Stage 3: Tighten 90 degrees.
 - Stage 4: Tighten 90 degrees.
 - Stage 5: Tighten 90 degrees.



N0054898

Fig. 926: Identifying LH Cylinder Head Bolt Tightening Sequence

Courtesy of FORD MOTOR CO.

2. Install the new M6 bolt.
 - Tighten to 10 Nm (89 lb-in).

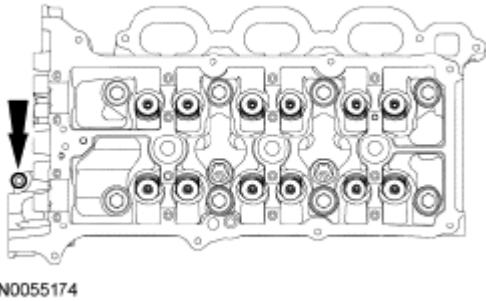


Fig. 927: Locating M6 Bolt
Courtesy of FORD MOTOR CO.

3. Install the valve tappets.

NOTE: The valve tappets must be installed in their original positions.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

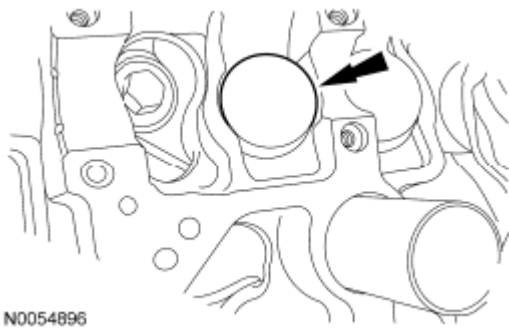


Fig. 928: Locating Valve Tappets
Courtesy of FORD MOTOR CO.

4. Install the LH secondary timing chain tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

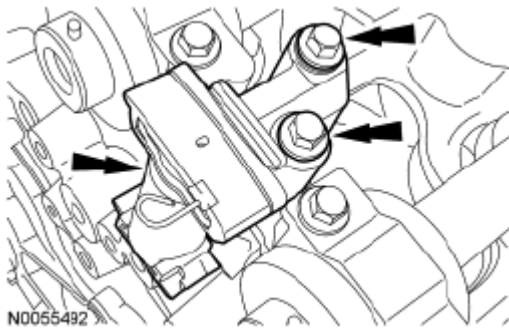


Fig. 929: Locating LH Secondary Timing Chain Tensioner & Bolts
Courtesy of FORD MOTOR CO.

5. Install the upper LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

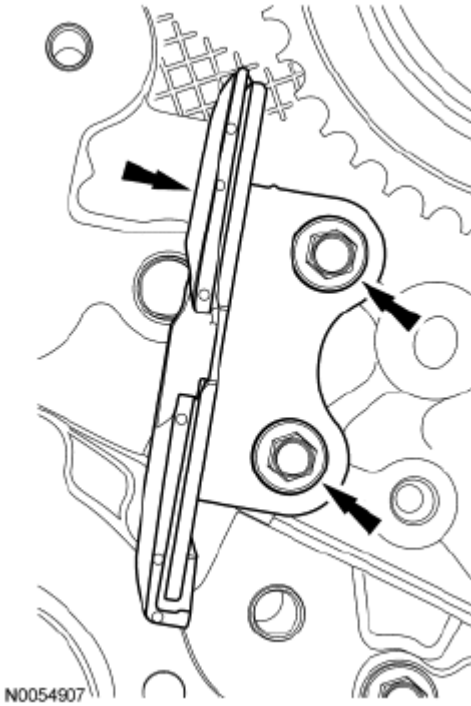


Fig. 930: Locating Upper LH Primary Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

6. Install LH Camshaft Position (CMP) sensor and the bolt.
 - Tighten to 10 Nm (89 lb-in).

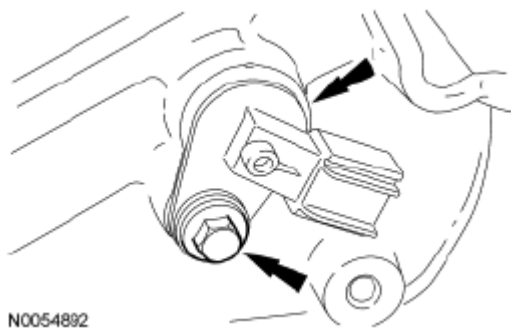


Fig. 931: Locating LH CMP Sensor And Bolt
Courtesy of FORD MOTOR CO.

7. Using new gaskets, install the lower intake manifold and the 10 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

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

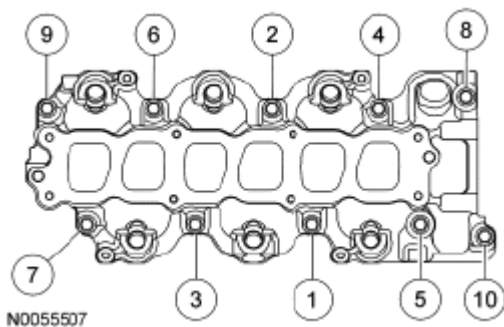


Fig. 932: Identifying Lower Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

8. Using a new gasket and O-ring seal, install the thermostat housing and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

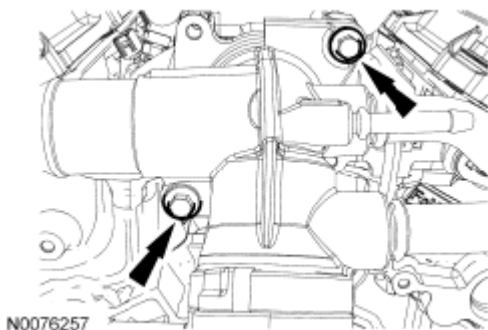


Fig. 933: Locating Thermostat Housing-To-Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

9. Connect the coolant bypass hose to the thermostat housing.

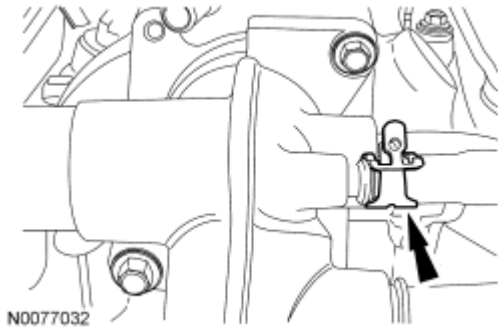
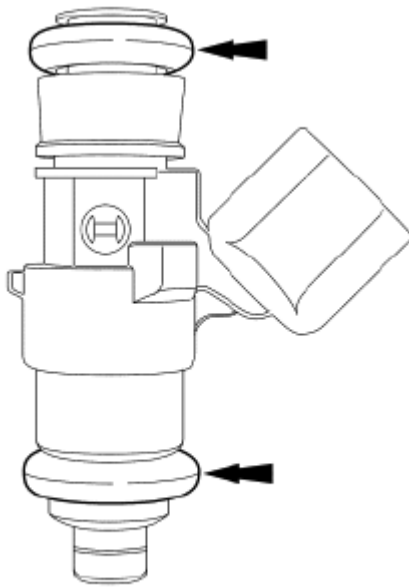


Fig. 934: Locating Coolant Bypass Hose To Thermostat Housing
Courtesy of FORD MOTOR CO.

10. Install new fuel injector O-ring seals.
- Remove the retaining clips and separate the fuel injectors from the fuel rail.
 - Remove and discard the O-ring seals.
 - Install new O-ring seals and lubricate with clean engine oil.
 - Install the fuel injectors and the retaining clips onto the fuel rail.

NOTE: Use O-ring seals that are made of special fuel-resistant material. The use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

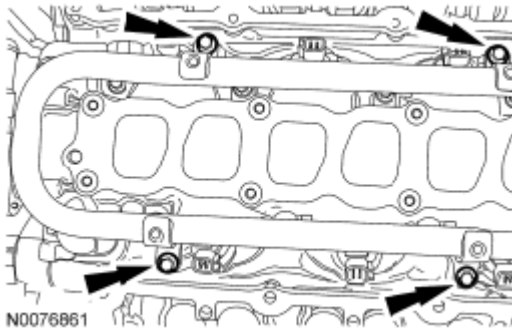
NOTE: The upper and lower O-ring seals are not interchangeable.



N0055508

Fig. 935: Locating Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

11. Install the fuel rail and injectors as an assembly and install the 4 bolts.
 - Tighten to 10 Nm (89 lb-in).



N0076861

Fig. 936: Locating Fuel Rail & Injectors Assembly Bolts
Courtesy of FORD MOTOR CO.

12. Install the RH cylinder block drain plug or, if equipped, the block heater.
 - Tighten to 40 Nm (30 lb-ft).

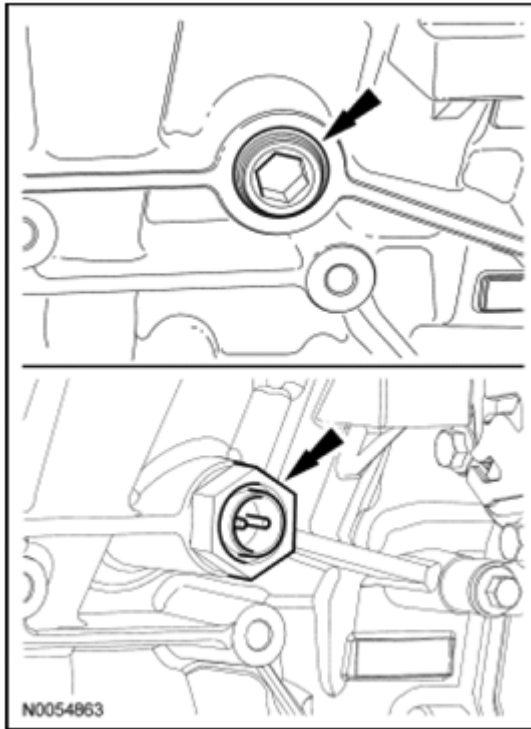


Fig. 937: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

All-Wheel Drive (AWD) vehicles

13. Using a new gasket, install the RH catalytic converter and 4 new nuts.

NOTE: Do not tighten the 4 catalytic converter nuts at this time.

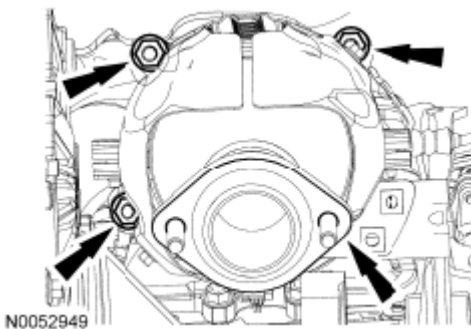


Fig. 938: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

14. Install the 2 RH catalytic converter bracket bolts.
 - Tighten the 4 catalytic converter nuts to 40 Nm (30 lb-ft).
 - Tighten the 2 catalytic converter brackets to 20 Nm (177 lb-in).

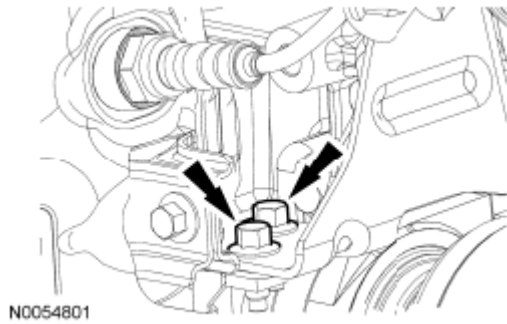


Fig. 939: Locating RH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

15. Using a new gasket, install the RH catalytic converter and 4 new nuts.
 - Tighten to 40 Nm (30 lb-ft).

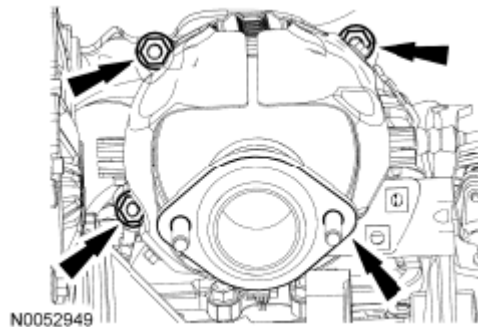


Fig. 940: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

16. Install the LH cylinder block drain plug.
 - Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

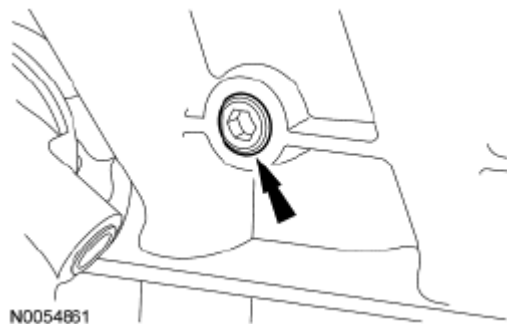


Fig. 941: Locating LH Cylinder Block Drain Plug

Courtesy of FORD MOTOR CO.

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

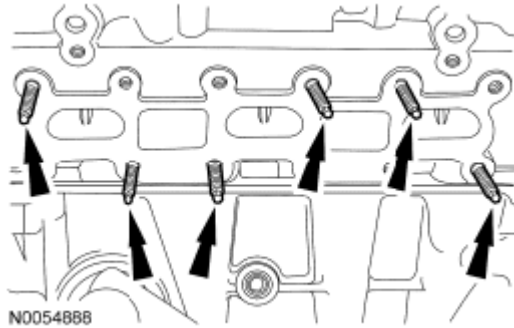


Fig. 942: Locating LH Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

18. Using a new gasket, install the LH exhaust manifold and 6 new nuts. Tighten in 2 stages in the sequence shown in illustration below:
 - Stage 1: Tighten to 20 Nm (177 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).

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

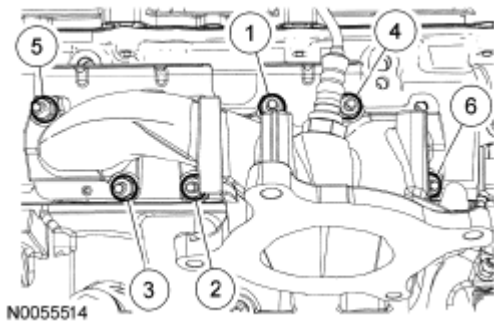


Fig. 943: Identifying LH Exhaust Manifold Nut Tightening Sequence
Courtesy of FORD MOTOR CO.

19. Install the LH exhaust manifold heat shield and the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).

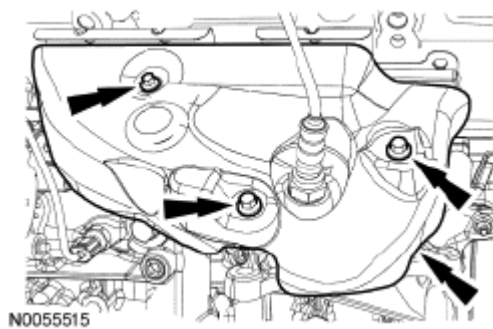


Fig. 944: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

20. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown in illustration).
 - Tighten to 40 Nm (30 lb-ft).

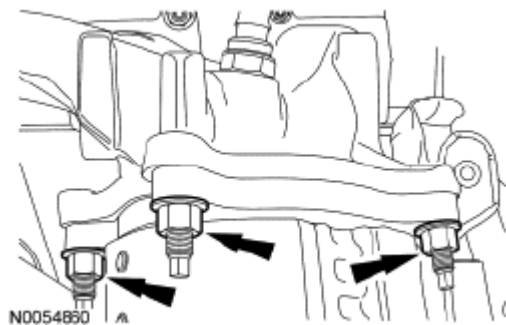


Fig. 945: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

21. Install the 2 LH catalytic converter bracket bolts.
 - Tighten to 20 Nm (177 lb-in).

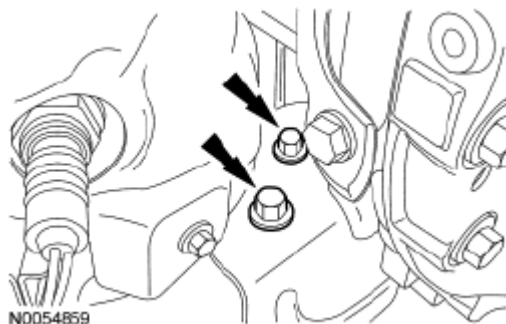


Fig. 946: Locating LH Catalytic Converter Bracket Bolts
Courtesy of FORD MOTOR CO.

22. Install the wiring harness retainer bolt on the rear of the LH cylinder head.
 - Tighten to 10 Nm (89 lb-in).

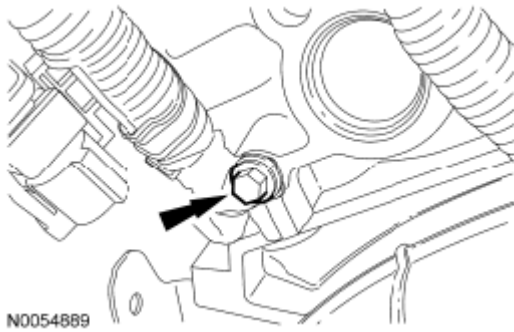


Fig. 947: Locating Wiring Harness Retainer Bolt
Courtesy of FORD MOTOR CO.

23. Connect the LH Catalyst Monitor Sensor (CMS) sensor electrical connector.

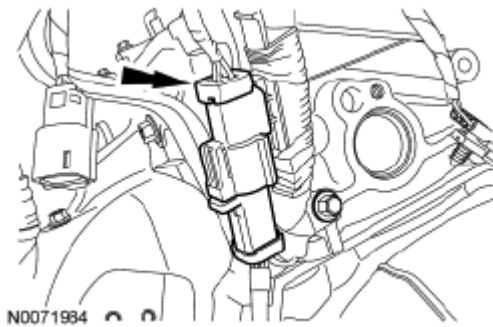


Fig. 948: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

24. Connect the LH Heated Oxygen Sensor (HO2S) electrical connector.

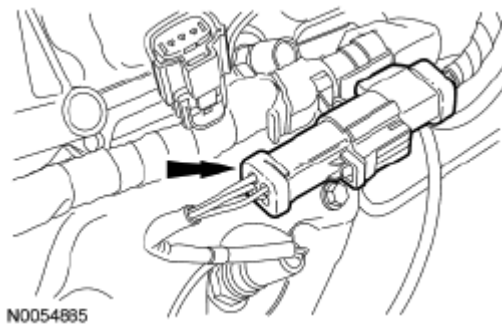


Fig. 949: Locating LH Heated Oxygen Sensor (HO2S) Electrical Connector
Courtesy of FORD MOTOR CO.

25. Connect the LH **CMP** sensor electrical connector.

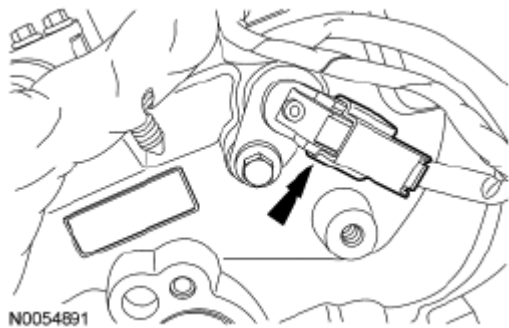


Fig. 950: Locating LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

26. Connect the Cylinder Head Temperature (CHT) sensor electrical connector.

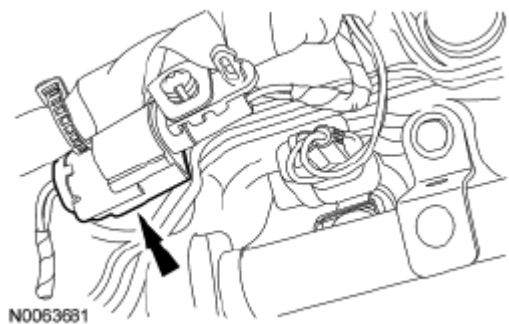


Fig. 951: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

27. Connect the 6 fuel injector electrical connectors (3 shown in illustration).

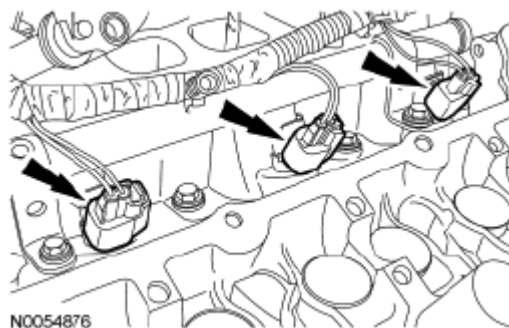


Fig. 952: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

28. Attach the wiring harness pin-type retainer.

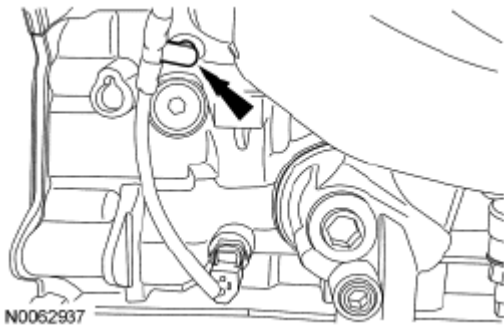


Fig. 953: Locating Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

29. Install the generator, the bolt and the nut.
- Tighten to 48 Nm (35 lb-ft).

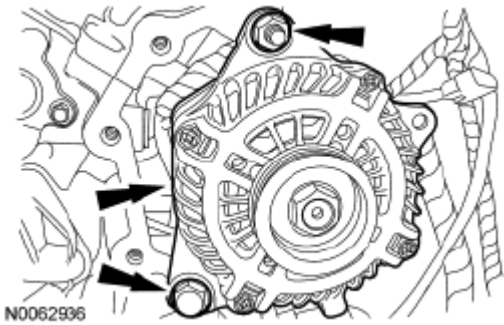


Fig. 954: Locating Nut, Bolt & Generator
Courtesy of FORD MOTOR CO.

30. Attach the wiring harness retainer to the generator.

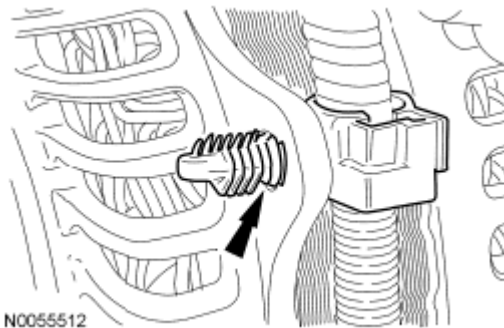


Fig. 955: Locating Wiring Harness Retainer To Generator
Courtesy of FORD MOTOR CO.

31. Connect the generator electrical connector.

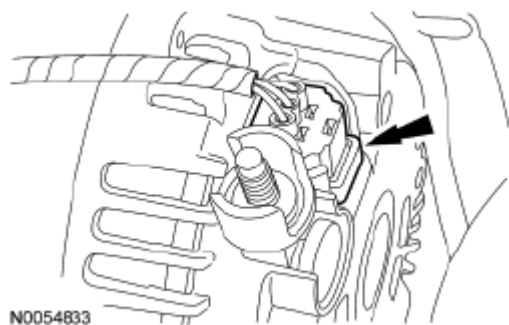


Fig. 956: Locating Generator Electrical Connector
Courtesy of FORD MOTOR CO.

32. Connect the generator B+ cable and install the nut.
 - Tighten to 12 Nm (106 lb-in).

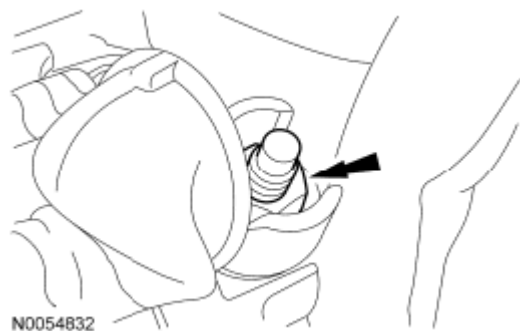


Fig. 957: Locating Generator B+ Cable Nut
Courtesy of FORD MOTOR CO.

33. Connect the A/C compressor electrical connector.

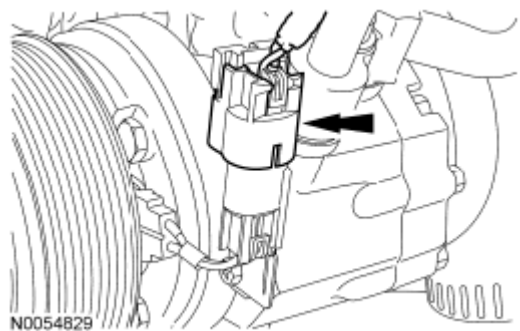


Fig. 958: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

34. If equipped, install the block heater wiring harness onto the engine.
 - Connect the block heater electrical connector and install the heat shield.

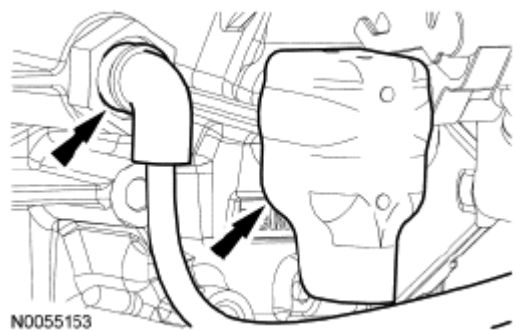


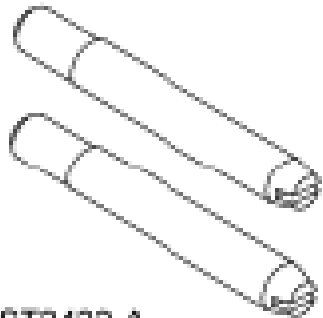
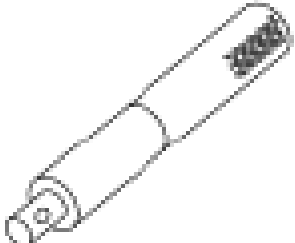
Fig. 959: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

35. Install the LH camshafts. For additional information, refer to **Removal and Installation**.

OIL PAN

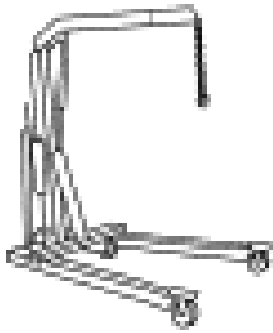
Special Tool(s)

SPECIAL TOOL TABLE

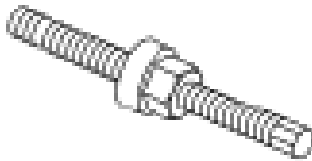
 ST2433-A	Alignment Pins 307-399
 ST1326-A	Handle 205-153 (T80T-4000-W)
	Heavy Duty Floor Crane 014-00071 or equivalent

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

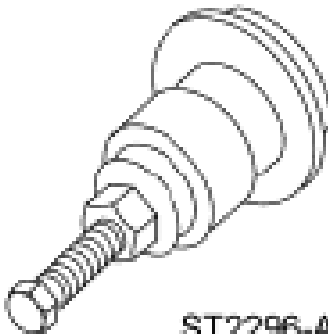


ST1341-A



ST1287-A

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



ST2296-A

Installer, Front Cover Oil Seal 303-335



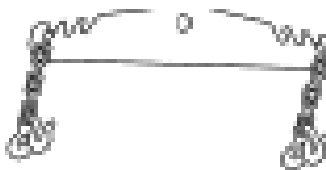
ST2981-A

Installer, Front Crankshaft Seal 303-1251

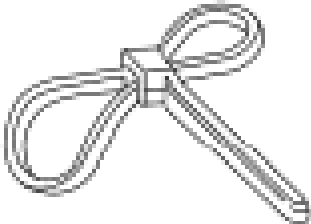
Installer, VCT Spark Plug Tube Seal 303-1247/2

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

**ST2983-A****ST1438-A**

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

**ST1438-A**

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

Material**ITEM SPECIFICATION TABLE**

Item	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
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 Remover ZC-30	-

Threadlock and Sealer TA-25

WSK-M2G351-A5

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

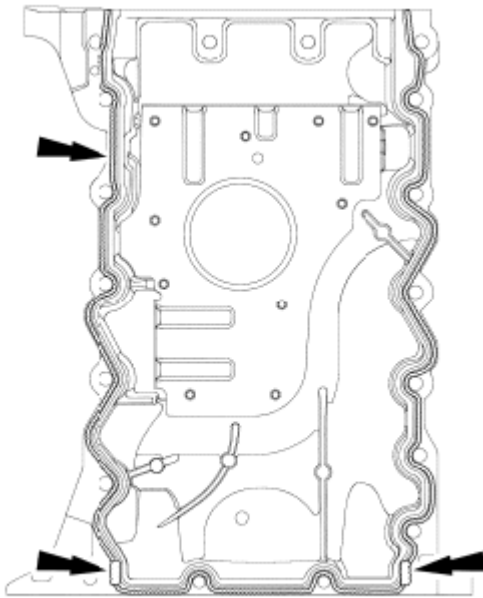
NOTE: Early build engines have 11 fastener valve covers, late built engines have 9 fastener valve covers. Do not attempt to install bolts in the 2 empty late build valve cover holes or damage to the valve cover will occur.

All vehicles

1. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the oil pan.
 - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the 2 crankshaft seal retainer plate-to-cylinder block joint areas on the sealing surface of the oil pan.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The oil pan and the 4 specified bolts must be installed and the oil pan aligned to the cylinder block and A/C compressor within 4 minutes of sealant application. Final tightening of the oil pan bolts must be carried out within 60 minutes of sealant application.

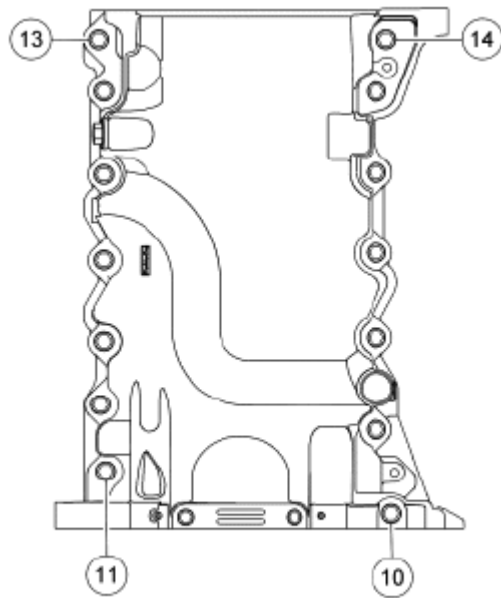


N0055188

Fig. 960: Locating Motorcraft High Performance Engine RTV Silicone Applying Area
Courtesy of FORD MOTOR CO.

2. Install the oil pan and bolts 10, 11, 13 and 14.
 - Tighten the bolts in the sequence shown in illustration to 3 Nm (27 lb-in).
 - Loosen the bolts 180 degrees.

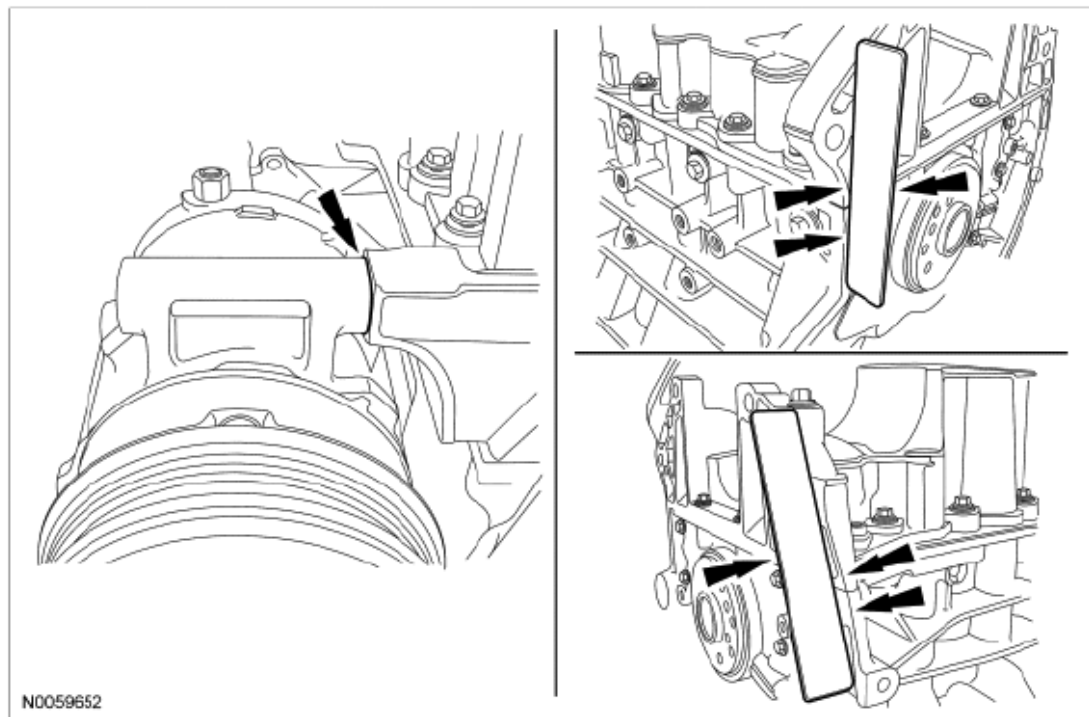
NOTE: **The oil pan and the 4 specified bolts must be installed within 4 minutes of the start of sealant application.**



N0069773

Fig. 961: Identifying Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Align the oil pan to the cylinder block and A/C compressor.
 - Position the oil pan so the mounting boss is against the A/C compressor and using a straightedge, align the oil pan flush with the rear of the cylinder block at the 2 areas shown in illustration below.



N0059652

Fig. 962: Locating Oil Pan Alignment Areas

Courtesy of FORD MOTOR CO.

4. Tighten bolts 10, 11, 13 and 14 in the sequence shown in illustration below, to 3 Nm (27 lb-in).

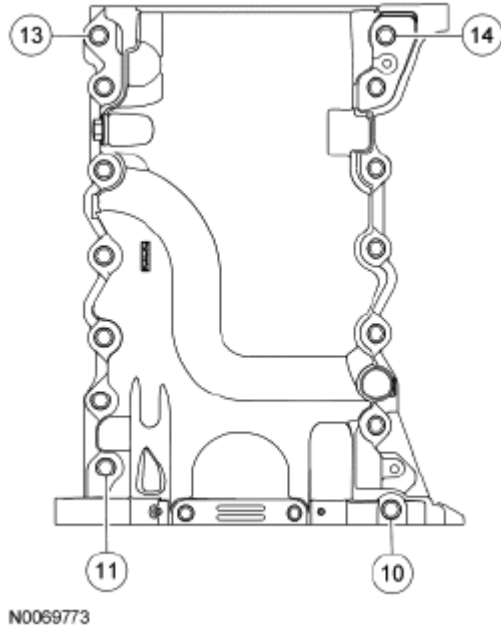
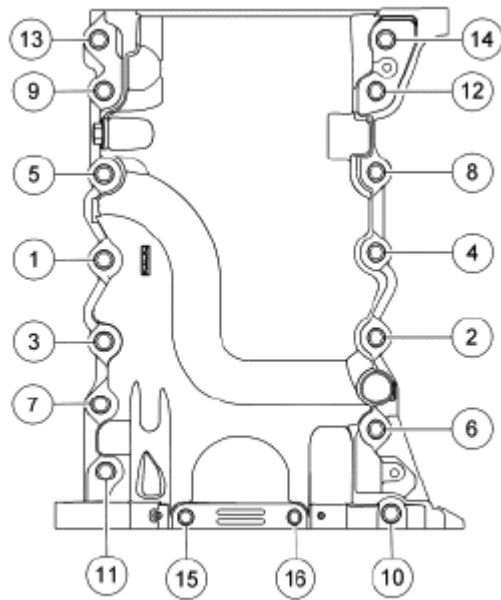


Fig. 963: Identifying Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

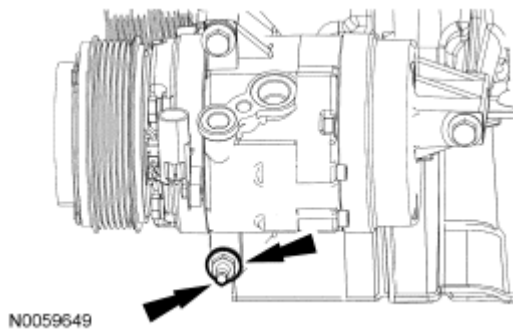
5. Install the remaining oil pan bolts. Tighten all the oil pan bolts in the sequence shown in illustration.
- Tighten the large bolts (1-14) to 24 Nm (18 lb-ft).
 - Tighten the small bolts (15 and 16) to 10 Nm (89 lb-in).



N0055165

Fig. 964: Identifying Oil Pan Bolts In Tightening Sequence
Courtesy of FORD MOTOR CO.

6. Install the A/C compressor mounting stud and nut.
 - Tighten the stud to 9 Nm (80 lb-in) and the nut to 25 Nm (18 lb-ft).



N0059649

Fig. 965: Locating A/C Compressor Mounting Stud & Nut
Courtesy of FORD MOTOR CO.

7. Install the Alignment Pins.

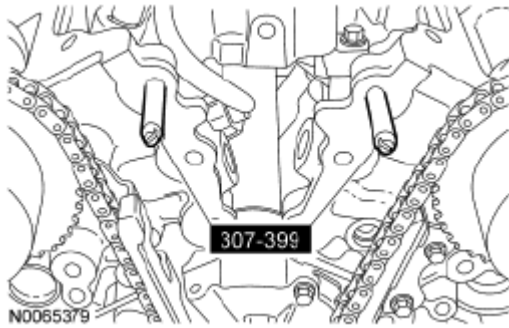


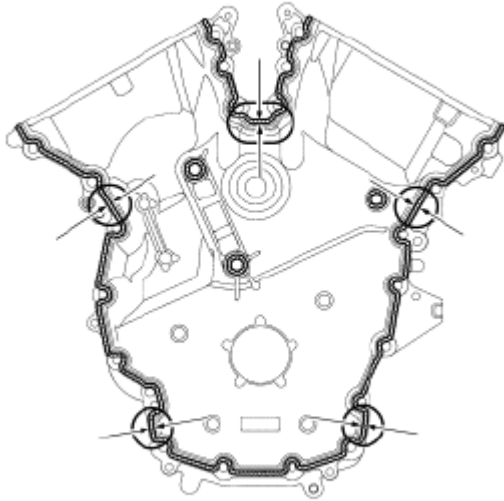
Fig. 966: Locating Alignment Pins
Courtesy of FORD MOTOR CO.

8. Apply a 3.0 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover sealing surfaces including the 3 engine mount bracket bosses.
 - Apply a 5.5 mm (0.21 in) bead of Motorcraft High Performance Engine RTV Silicone to the oil pan-to-cylinder block joint and the cylinder head-to-cylinder block joint areas of the engine front cover in 5 places as indicated.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The engine front cover and bolts 17, 18, 19 and 20 must be installed within 4 minutes of the initial sealant application. The remainder of the engine front cover bolts and the engine mount bracket bolts must be installed and tightened within 35 minutes of the initial sealant application. If the time limits are exceeded, the sealant must be removed, the sealing area cleaned and sealant reapplied. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

5.5 mm
(0.21 in)



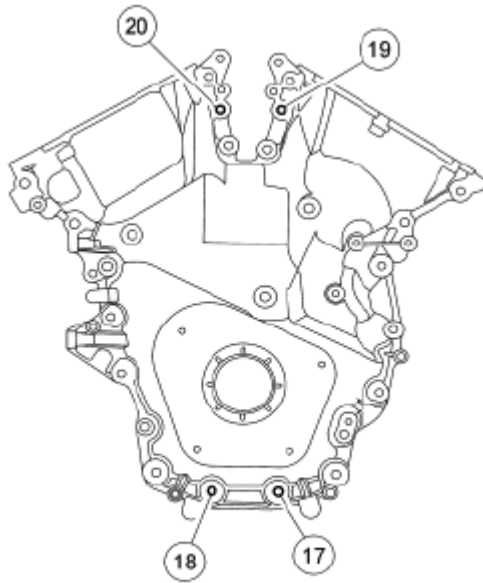
N0068283

Fig. 967: Applying Bead Of Motorcraft High Performance Engine RTV Silicone To Oil Pan-To-Cylinder Block Joint

Courtesy of FORD MOTOR CO.

9. Install the engine front cover and bolts 17, 18, 19 and 20.
 - Tighten in sequence to 3 Nm (27 lb-in).

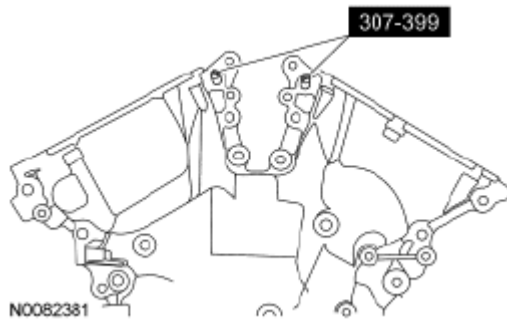
NOTE: **Make sure the 2 locating dowel pins are seated correctly in the cylinder block.**



N0068108

Fig. 968: Identifying Engine Front Cover Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

10. Remove the Alignment Pins.



N0062381

Fig. 969: Identifying Alignment Pins
 Courtesy of FORD MOTOR CO.

11. Install the engine mount bracket and the 3 bolts.

NOTE: Do not tighten the bolt at this time.

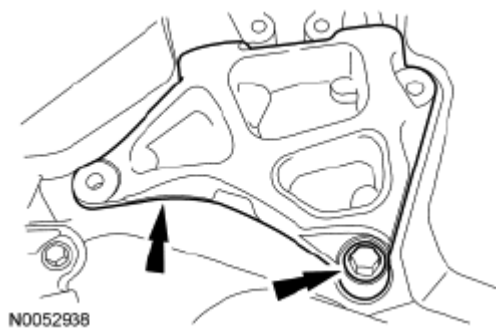


Fig. 970: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

12. Install the remaining engine front cover bolts. Tighten all the engine front cover bolts and engine mount bracket bolts in the sequence shown in illustration below in 2 stages:
- Stage 1: Tighten bolts 1 thru 22 to 10 Nm (89 lb-in) and bolts 23, 24 and 25 to 15 Nm (133 lb-in).
 - Stage 2: Tighten bolts 1 thru 22 to 24 Nm (18 lb-ft) and bolts 23, 24 and 25 to 75 Nm (55 lb-ft).

NOTE: Do not expose the Motorcraft High Performance Engine RTV Silicone to engine oil for at least 90 minutes after installing the engine front cover. Failure to follow this instruction may cause oil leakage.

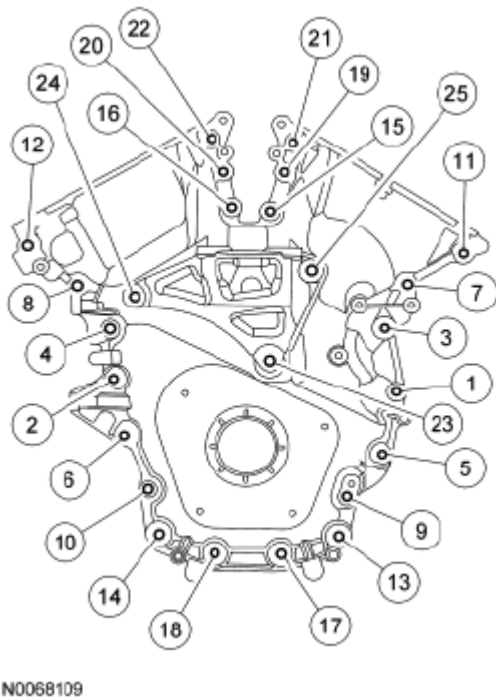


Fig. 971: Identifying Engine Front Cover Bolts & Engine Mount Bracket Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

13. Install the engine mount studs in the following sequence.
 1. Clean the front cover engine mount stud holes with pressurized air to remove any foreign material.
 2. Clean all the thread sealer from the engine mount studs (old and new studs).
 3. Apply new Threadlock and Sealer to the engine mount stud threads.
 4. Install the 2 engine mount studs.
 - Tighten to 20 Nm (177 lb-in).

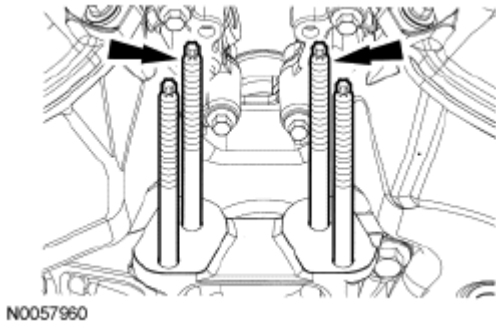


Fig. 972: Locating Engine Mount Studs
Courtesy of FORD MOTOR CO.

NOTE: The thread sealer on the engine mount studs (including new engine mount studs if applicable) must be cleaned off with a wire brush and new Threadlock and Sealer applied prior to installing the engine mount studs. Failure to follow this procedure may result in damage to the engine mount studs or engine.

14. Install the engine mount bracket and the 2 bolts.
 - Tighten to 24 Nm (18 lb-ft).

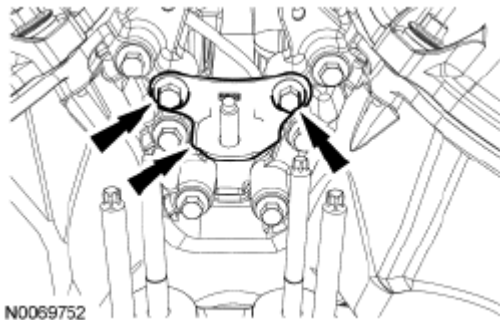


Fig. 973: Locating Engine Mount Bracket & Bolts
Courtesy of FORD MOTOR CO.

15. Using the Front Crankshaft Seal Installer and Crankshaft Vibration Damper Installer, install a new crankshaft front seal.

NOTE: Apply clean engine oil to the crankshaft front seal bore in the engine front cover.

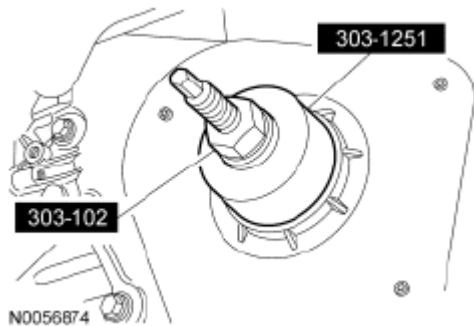


Fig. 974: Identifying Crankshaft Vibration Damper Installer & Front Crankshaft Installer
Courtesy of FORD MOTOR CO.

16. Using the Front Cover Oil Seal Installer and Crankshaft Vibration Damper Installer, install the crankshaft pulley.

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

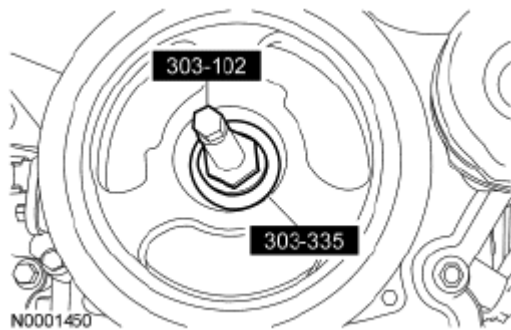


Fig. 975: Identifying Front Cover Oil Seal Installer & Crankshaft Vibration Damper Installer
Courtesy of FORD MOTOR CO.

17. Using the Strap Wrench, install the crankshaft pulley washer and new bolt and tighten 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.

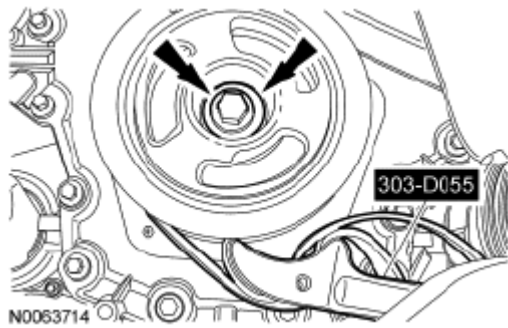


Fig. 976: Locating Crankshaft Pulley Washer & Bolt
Courtesy of FORD MOTOR CO.

18. Using the VCT Spark Plug Tube Seal Installer and Handle, install new VCT solenoid and/or spark plug tube seals.

NOTE: Installation of new seals is only required if damaged seals were removed during disassembly of the engine.

NOTE: Spark plug tube seal installation shown in illustration, Variable Camshaft Timing (VCT) solenoid seal installation similar.

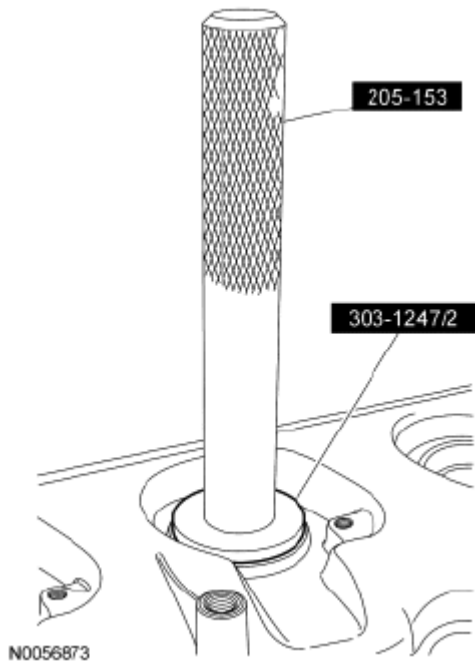


Fig. 977: Identifying VCT Spark Plug Tube Seal Installer And Handle
Courtesy of FORD MOTOR CO.

19. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-RH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

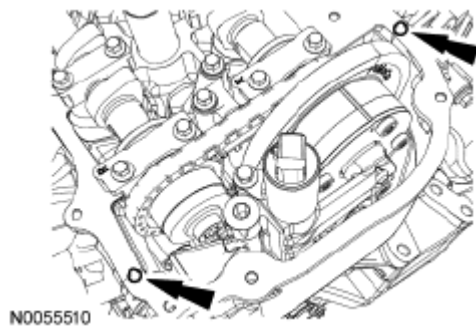


Fig. 978: Locating Engine Front Cover-To-RH Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

20. Using a new gasket, install the RH valve cover, bolt and the 10 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

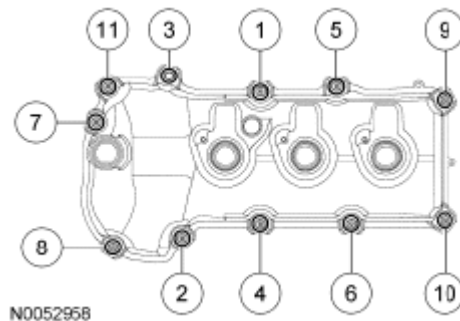


Fig. 979: Identifying Valve Cover Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

21. Using a new gasket, install the RH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

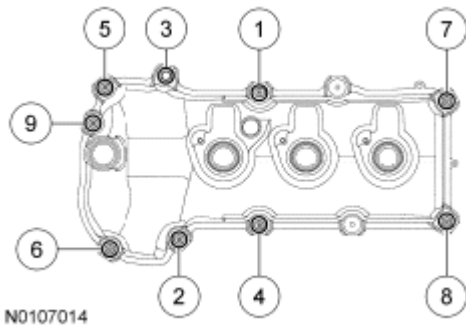


Fig. 980: Identifying RH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

All vehicles

22. Apply an 8 mm (0.31 in) bead of Motorcraft High Performance Engine RTV Silicone to the engine front cover-to-LH cylinder head joints.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: If the valve cover is not installed and the fasteners tightened within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage.

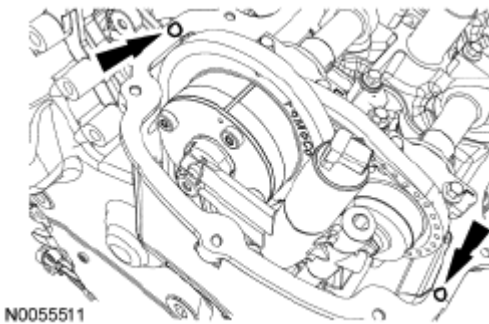


Fig. 981: Identifying Engine RTV Silicone Applying Area To Cylinder Head Joints
Courtesy of FORD MOTOR CO.

Early build vehicles

23. Using a new gasket, install the LH valve cover and 11 stud bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

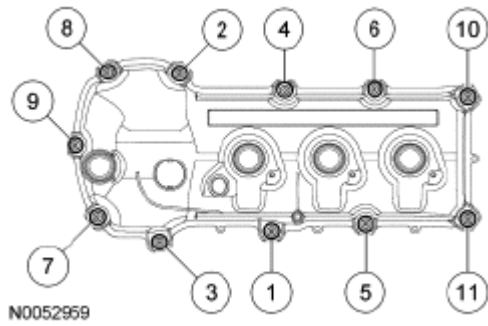


Fig. 982: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Late build vehicles

24. Using a new gasket, install the LH valve cover and tighten the 9 stud bolts.
 - Tighten in the sequence shown in illustration to 10 Nm (89 lb-in).

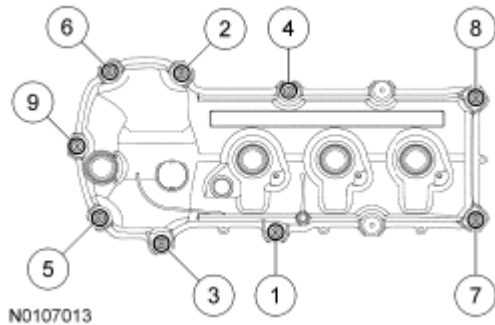


Fig. 983: Identifying LH Valve Cover Stud Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

All vehicles

25. Install the wiring harness retaining bracket and the 2 nuts.
 - Tighten to 4 Nm (35 lb-in).

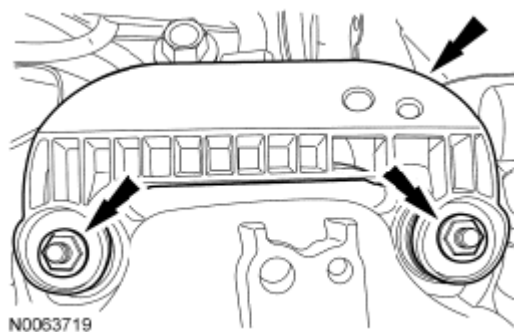


Fig. 984: Locating Wiring Harness Retaining Bracket & Nuts

Courtesy of FORD MOTOR CO.

26. Install the 6 coil-on-plug assemblies and the 6 bolts.
- Tighten to 7 Nm (62 lb-in).

NOTE: LH shown in illustration, RH similar.

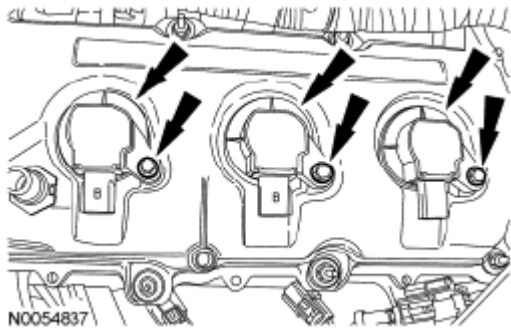


Fig. 985: Locating Bolts And Coil-On-Plug Assemblies
Courtesy of FORD MOTOR CO.

27. Install the LH cylinder block drain plug.
- Tighten to 20 Nm (177 lb-in) plus an additional 180 degrees.

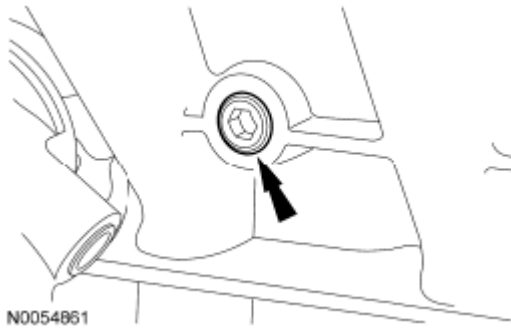


Fig. 986: Locating LH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

28. Install the RH cylinder block drain plug or, if equipped, the block heater.
- Tighten to 40 Nm (30 lb-ft).

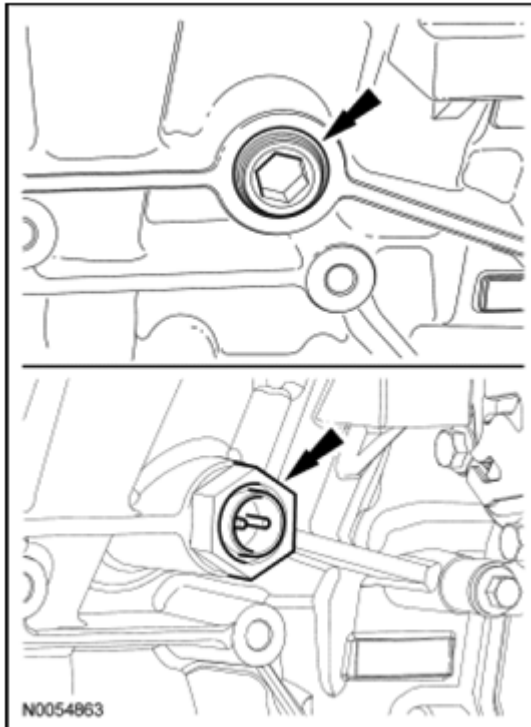


Fig. 987: Locating RH Cylinder Block Drain Plug
Courtesy of FORD MOTOR CO.

Front Wheel Drive (FWD) vehicles

29. Using a new gasket, install the RH catalytic converter and 4 new nuts.
 - Tighten to 40 Nm (30 lb-ft).

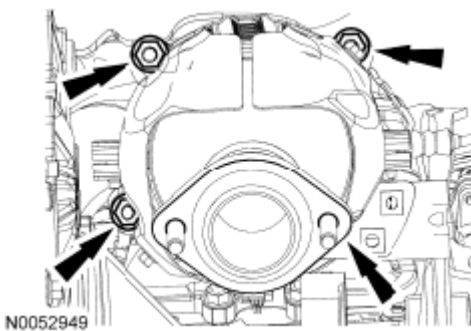


Fig. 988: Locating RH Catalytic Converter & Nuts
Courtesy of FORD MOTOR CO.

All vehicles

30. Using a new gasket, install the LH catalytic converter and 4 new nuts (3 shown in illustration).
 - Tighten to 40 Nm (30 lb-ft).

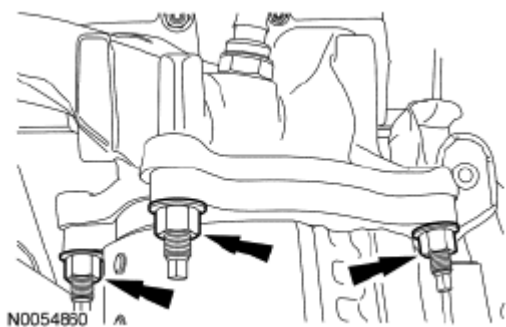


Fig. 989: Locating LH Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

31. Install the accessory drive belt tensioner and the 3 bolts.
- Tighten to 11 Nm (97 lb-in).

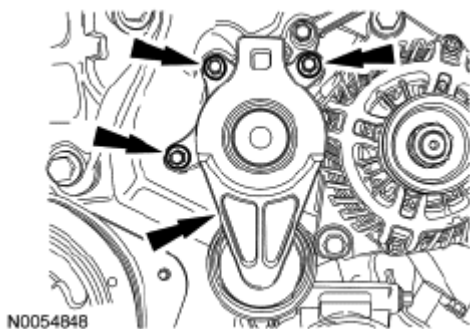


Fig. 990: Locating Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

32. Install the power steering pump and the 3 bolts.
- Tighten to 25 Nm (18 lb-ft).

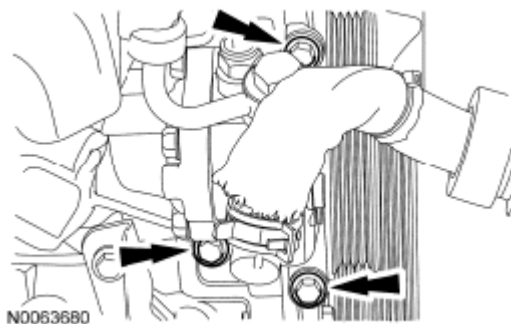


Fig. 991: Locating Power Steering Pump & Bolts
Courtesy of FORD MOTOR CO.

33. Install the Power Steering Pressure (PSP) hose bracket and nut.
- Tighten to 9 Nm (80 lb-in).

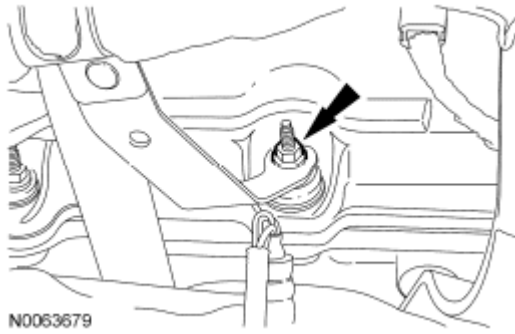


Fig. 992: Locating PSP Hose Bracket Nut
Courtesy of FORD MOTOR CO.

34. Attach the PSP hose retainer to the engine lifting eye.

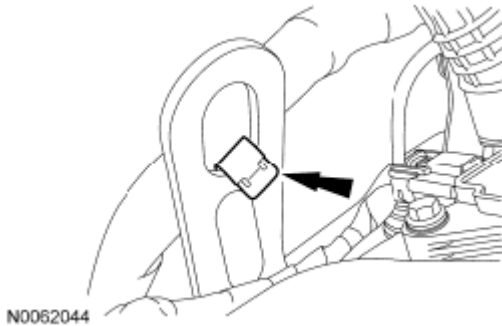


Fig. 993: Locating PSP Hose Retainer
Courtesy of FORD MOTOR CO.

35. Attach all of the wiring harness retainers to the LH valve cover and stud bolts.
36. Connect the LH camshaft VCT solenoid electrical connector.

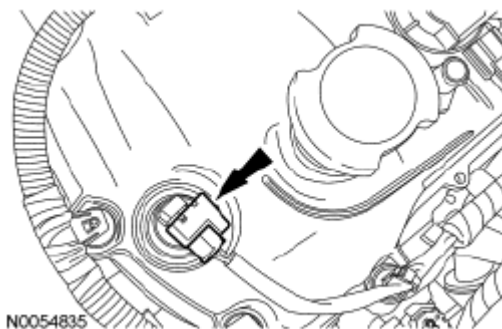


Fig. 994: Locating LH VCT Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

37. Connect the 3 LH coil-on-plug electrical connectors.

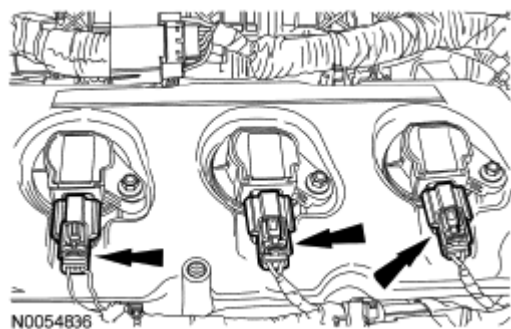


Fig. 995: Locating LH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

38. Connect the LH Catalyst Monitor Sensor (CMS) electrical connector.

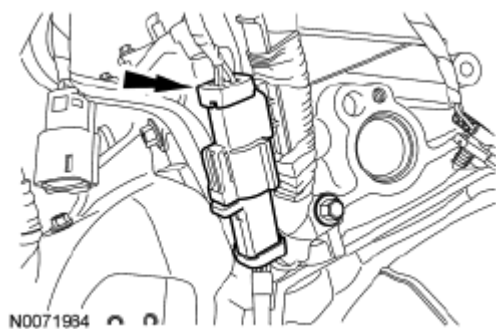


Fig. 996: Locating LH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

39. Attach all of the wiring harness retainers to the RH valve cover and stud bolts.
40. Connect the 3 RH coil-on-plug electrical connectors.

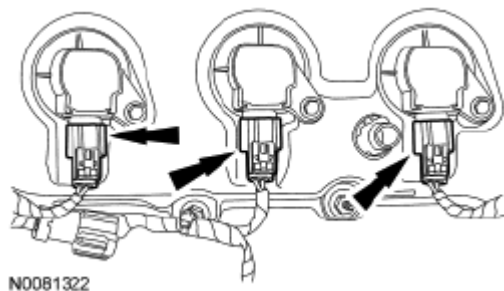


Fig. 997: Locating RH Coil-On-Plug Electrical Connectors
Courtesy of FORD MOTOR CO.

41. Connect the RH VCT solenoid electrical connector.

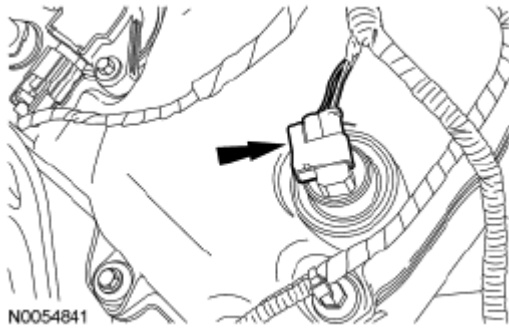


Fig. 998: Locating RH Variable Camshaft Timing (VCT) Solenoid Electrical Connector
Courtesy of FORD MOTOR CO.

FWD vehicles

42. Connect the RH **CMS** electrical connector.

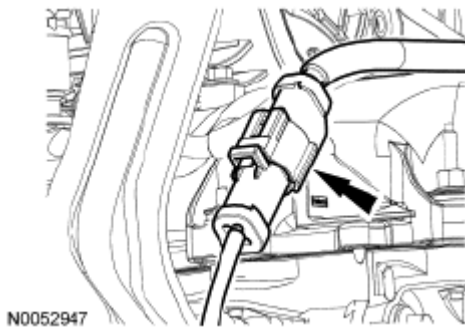


Fig. 999: Locating RH Catalyst Monitor Sensor (CMS) Electrical Connector
Courtesy of FORD MOTOR CO.

All vehicles

43. Connect the **PSP** switch electrical connector.

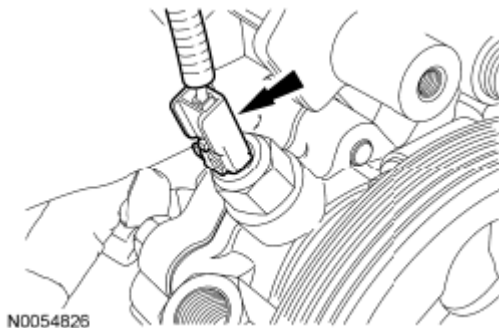
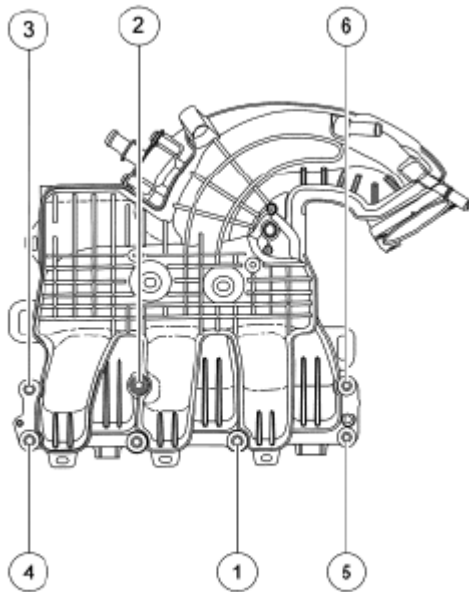


Fig. 1000: Locating PSP Switch Electrical Connector
Courtesy of FORD MOTOR CO.

44. Using new gaskets, install the upper intake manifold and the 6 bolts.
- Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

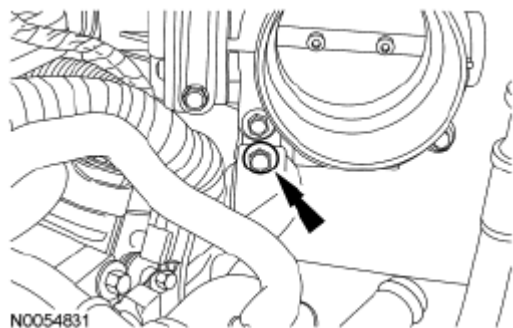
NOTE: If the engine is repaired or replaced because of upper engine failure, typically including valve or piston damage, check the intake manifold for metal debris. If metal debris is found, install a new intake manifold. Failure to follow these instructions can result in engine damage.



N0081211

Fig. 1001: Identifying Upper Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

45. Install the upper intake manifold support bracket bolt.
- Tighten to 10 Nm (89 lb-in).



N0054831

Fig. 1002: Locating Upper Intake Manifold Support Bracket Bolt
Courtesy of FORD MOTOR CO.

46. Attach the wiring harness retainers to the upper intake manifold.

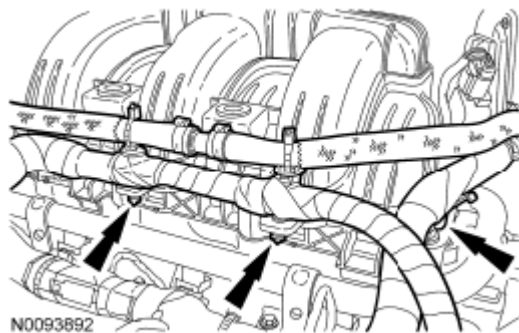


Fig. 1003: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

47. Connect the Throttle Body (TB) electrical connector.

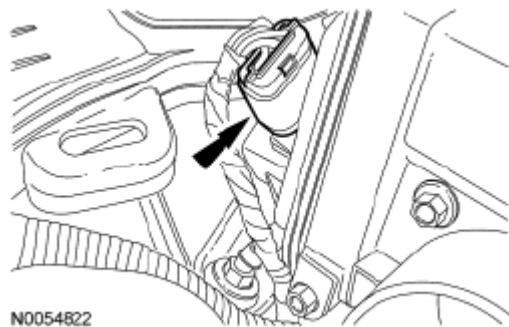


Fig. 1004: Locating Throttle Body (TB) Electrical Connector
Courtesy of FORD MOTOR CO.

48. Connect the PCV hose to the PCV valve.

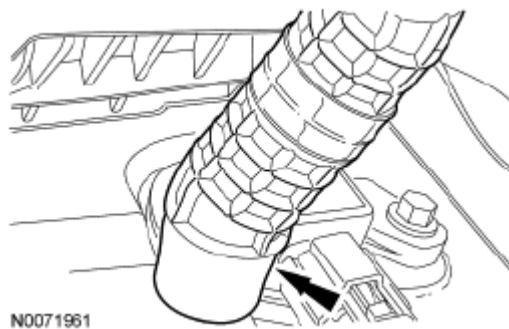


Fig. 1005: Locating PCV Hose
Courtesy of FORD MOTOR CO.

49. If equipped, position the block heater wiring harness onto the engine.
- Attach the block heater wiring harness retainer to the power steering reservoir hose and the **PSP**

hose.

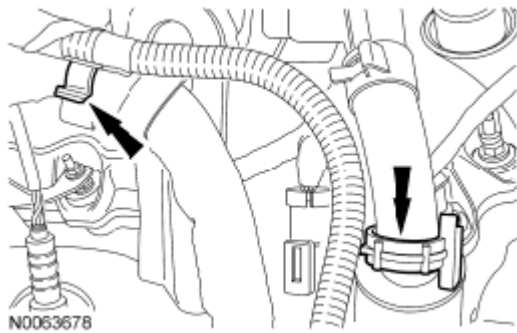


Fig. 1006: Locating Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

50. If equipped, connect the block heater electrical connector and install the heat shield.

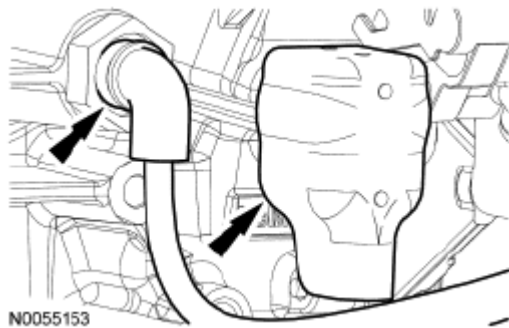


Fig. 1007: Locating Block Heater Electrical Connector & Heat Shield
Courtesy of FORD MOTOR CO.

51. If equipped, attach the block heater wiring harness retainer to the upper intake manifold.



Fig. 1008: Locating Block Heater Wiring Harness Retainer To Upper Intake Manifold
Courtesy of FORD MOTOR CO.

52. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the stand.

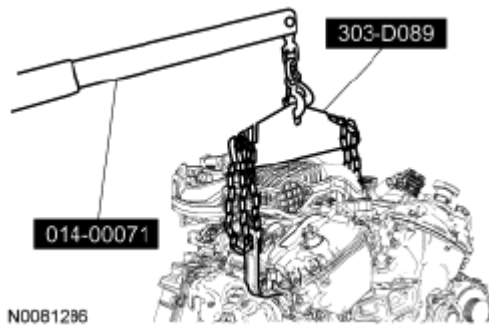


Fig. 1009: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

53. Install the crankshaft sensor ring.

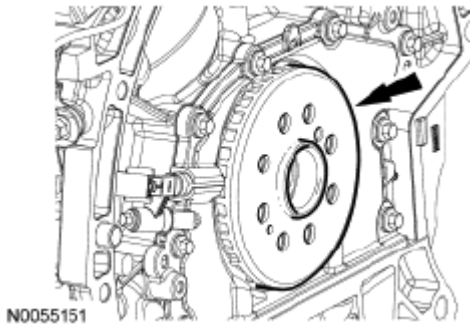


Fig. 1010: Locating Crankshaft Sensor Ring
Courtesy of FORD MOTOR CO.

54. Install the flexplate and the 8 bolts.
- Tighten to 80 Nm (59 lb-ft).

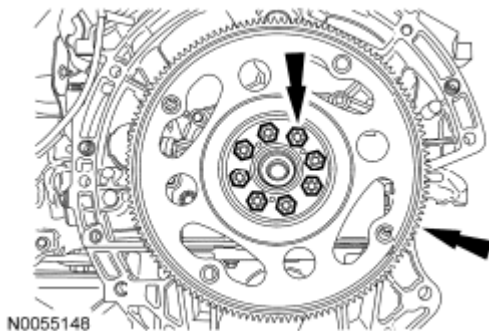


Fig. 1011: Locating Flexplate & Bolts
Courtesy of FORD MOTOR CO.

55. Install the engine in the vehicle. For additional information, refer to **ENGINE**.

OIL PUMP SCREEN AND PICKUP TUBE

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. Using a new O-ring seal, install the oil pump screen and pickup tube and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

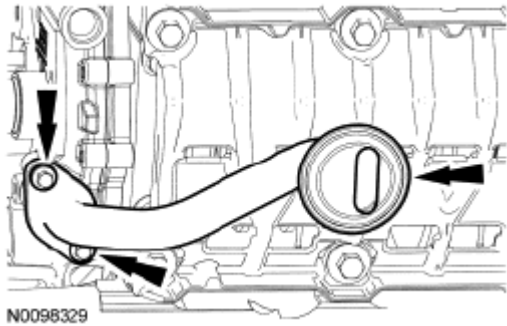


Fig. 1012: Locating Oil Pump Screen & Bolts
Courtesy of FORD MOTOR CO.

2. Install the oil pan. For additional information, refer to **Removal and Installation**.

OIL PUMP

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. Position the oil pump onto the crankshaft and rotate counterclockwise to position the pump onto the oil pump screen and pickup tube.
 - Install the 3 bolts and tighten to 10 Nm (89 lb-in).

NOTE: Install a new oil pump screen and pickup tube O-ring seal prior to installing the oil pump.

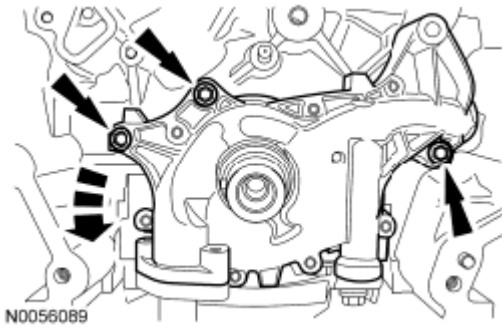


Fig. 1013: Installing Oil Pump Screen & Pickup Tube O-Ring Seal Prior
Courtesy of FORD MOTOR CO.

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

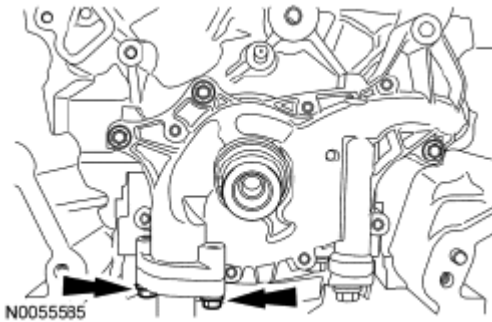


Fig. 1014: Locating Oil Pump Screen & Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

3. Install the crankshaft timing chain sprocket.

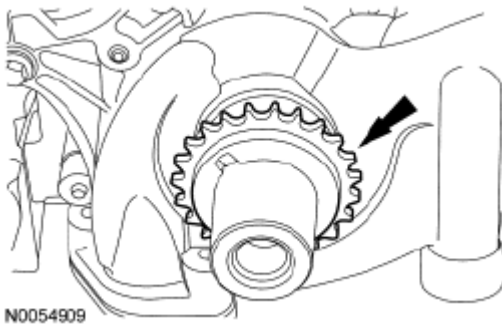
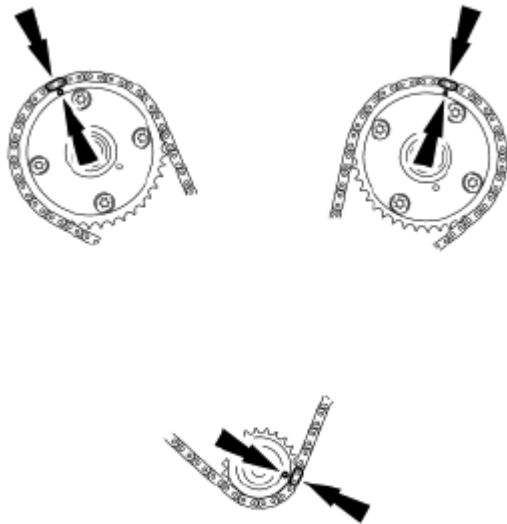


Fig. 1015: Locating Crankshaft Timing Chain Sprocket
Courtesy of FORD MOTOR CO.

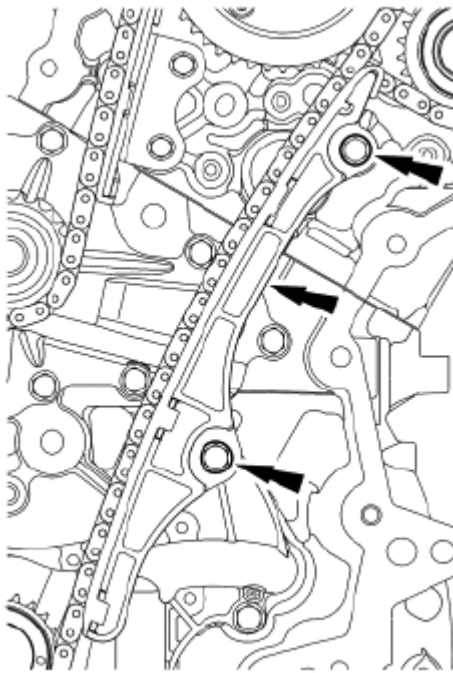
4. Install the primary timing chain with the colored links aligned with the timing marks on the VCT assemblies and the crankshaft sprocket.



N0055503

Fig. 1016: Aligning With Timing Marks On VCT Assemblies & Crankshaft Sprocket
 Courtesy of FORD MOTOR CO.

5. Install the LH primary timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).



N0081593

Fig. 1017: Locating Lower LH Primary Timing Chain Guide & Bolts
 Courtesy of FORD MOTOR CO.

6. Install the primary timing chain tensioner arm.

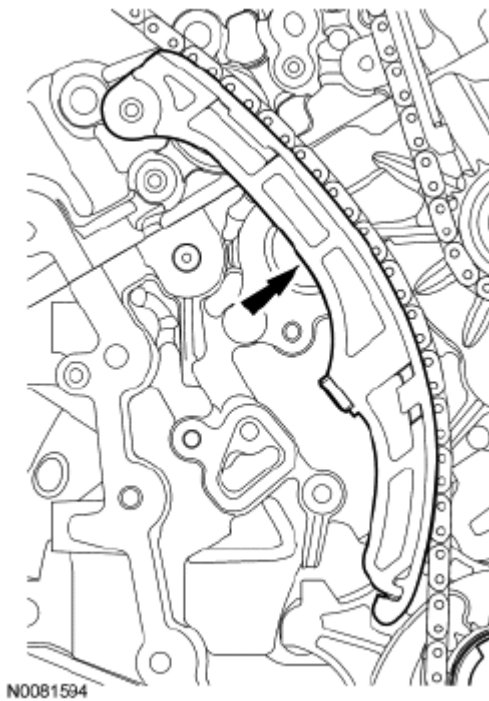


Fig. 1018: Locating Primary Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

7. Reset the primary timing chain tensioner.
- Rotate the lever counterclockwise.
 - Using a soft-jawed vise, compress the plunger.
 - Align the hole in the lever with the hole in the tensioner housing.
 - Install a suitable lockpin.

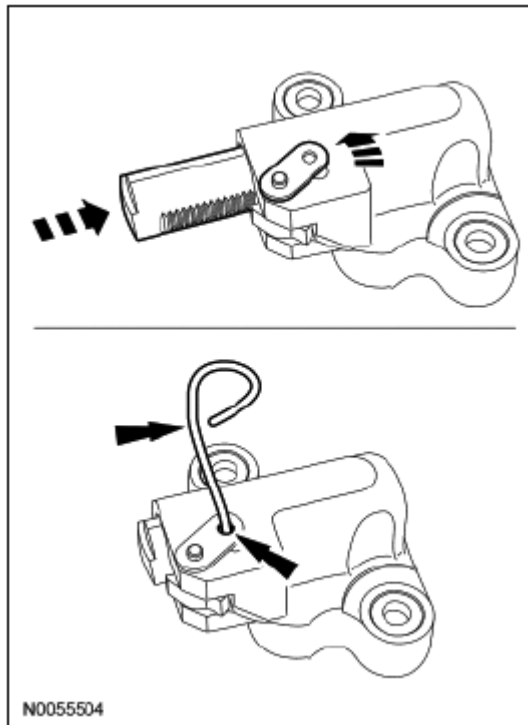


Fig. 1019: Resetting Primary Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

8. Install the primary tensioner and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).
 - Remove the lockpin.

NOTE: It may be necessary to rotate the crankshaft slightly to remove slack from the timing chain and install the tensioner.

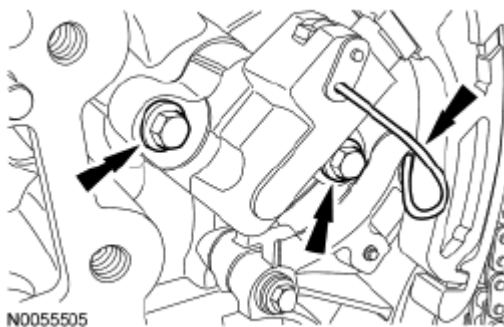


Fig. 1020: Locating Primary Tensioner Bolts & Lockpin
Courtesy of FORD MOTOR CO.

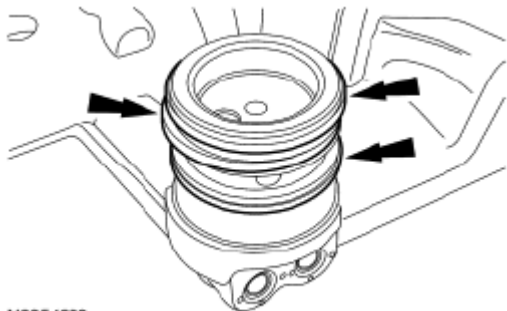
9. As a post-check, verify correct alignment of all timing marks.



N0055496

Fig. 1021: Aligning Timing Marks
Courtesy of FORD MOTOR CO.

10. Install new VCT housing seals.



N0054903

Fig. 1022: Locating VCT Housing Seals
Courtesy of FORD MOTOR CO.

11. Install the LH VCT housing and the 3 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

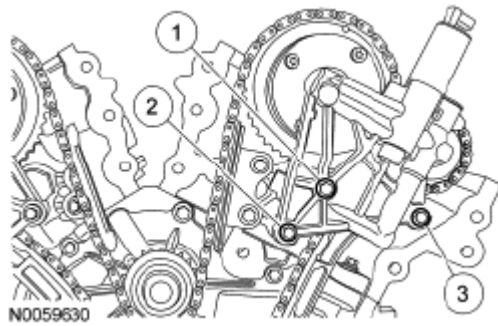


Fig. 1023: Identifying VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

12. Install the RH VCT housing and the 3 bolts.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

NOTE: Make sure the dowels on the Variable Camshaft Timing (VCT) housing are fully engaged in the cylinder head prior to tightening the bolts. Failure to follow this process will result in severe engine damage.

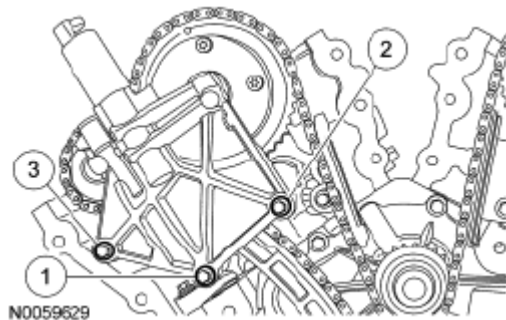


Fig. 1024: Identifying RH VCT Housing Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

13. Install the engine front cover. For additional information, refer to **Removal and Installation**.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

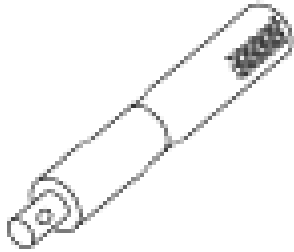
Special Tool(s)

SPECIAL TOOL TABLE

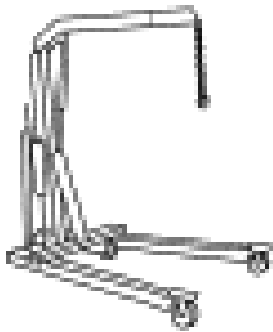
	Handle 205-153 (T80T-4000-W)
--	------------------------------

2010 Ford Fusion SE

2010 ENGINE Engine Mechanical - 3.5L - Fusion & MKZ

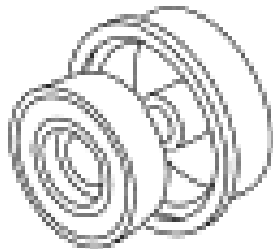


ST1326-A



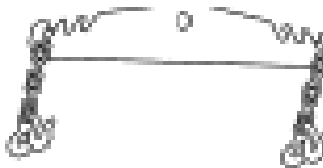
ST1341-A

Heavy Duty Floor Crane 014-00071 or equivalent



ST2980-A

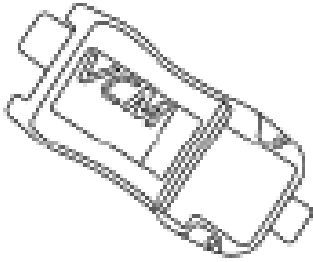
Installer, Rear Main Seal 303-1250



ST1602-A

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

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



ST2834-A

or equivalent diagnostic tool

Material**ITEM SPECIFICATION TABLE**

Item	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
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

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. Apply a 3 mm (0.11 in) bead of Motorcraft High Performance Engine RTV Silicone to the sealing surface of the crankshaft rear seal retainer.

NOTE: Failure to use Motorcraft High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

NOTE: The crankshaft rear seal retainer must be installed and the bolts tightened within 4 minutes of sealant application.

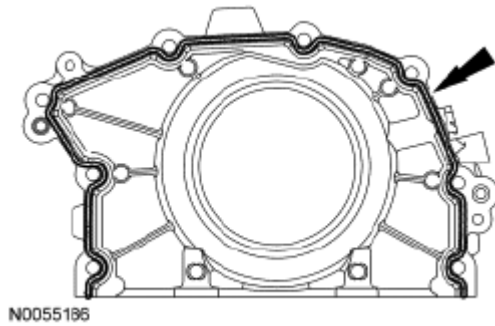


Fig. 1025: Identifying RTV Silicone Applying Area
Courtesy of FORD MOTOR CO.

2. Install the rear seal retainer and the 8 bolts in the sequence shown in illustration below.
 - Tighten in the sequence shown in illustration below to 10 Nm (89 lb-in).

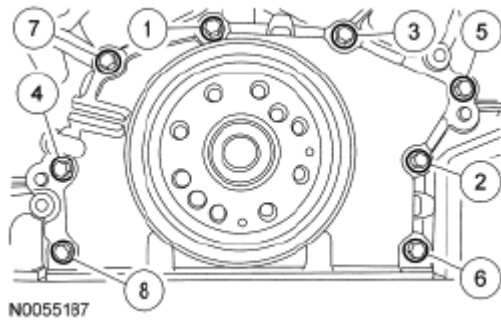


Fig. 1026: Identifying Rear Seal Retainer With Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Position the Rear Main Seal Installer onto the end of the crankshaft and slide a new crankshaft rear seal onto the tool.

NOTE: Lubricate the seal lips and bore with clean engine oil prior to installation.

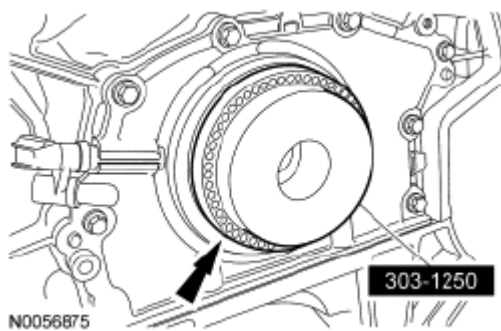


Fig. 1027: Identifying Rear Main Seal Installer
Courtesy of FORD MOTOR CO.

4. Using the Rear Main Seal Installer and Handle, install the new crankshaft rear seal.

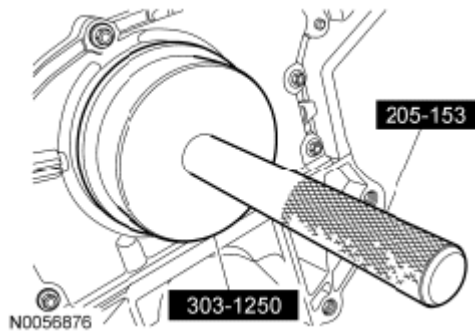


Fig. 1028: Identifying Rear Main Seal Installer And Handle
Courtesy of FORD MOTOR CO.

5. Install the Crankshaft Position (CKP) sensor and install the bolt.
 - Tighten to 10 Nm (89 lb-in).

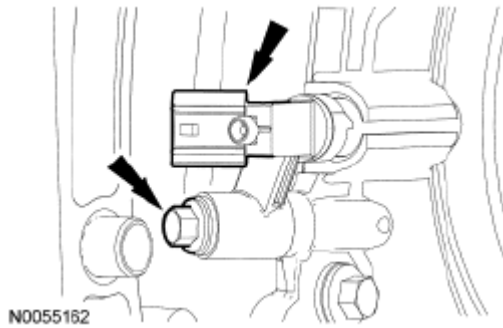


Fig. 1029: Locating CKP Sensor & Bolt
Courtesy of FORD MOTOR CO.

6. Connect the CKP sensor electrical connector.

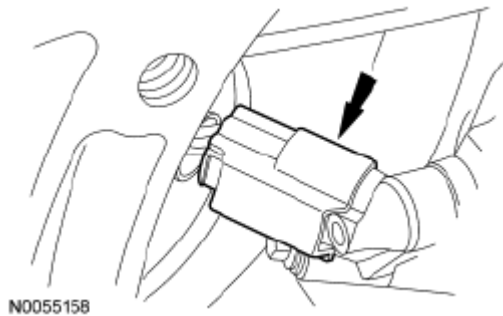


Fig. 1030: Identifying Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

7. Using the Heavy Duty Floor Crane and Spreader Bar, install the engine onto the stand.

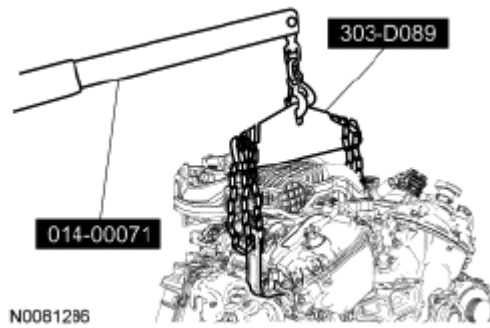


Fig. 1031: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

8. Install the oil pan. For additional information, refer to **Removal and Installation**.
9. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.