

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

2009 ENGINE**Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer****SPECIFICATIONS****MATERIAL****MATERIAL**

Item	Specification	Fill Capacity
Gasket Maker TA-16	WSK-M2G348-A5	-
Motorcraft Metal Surface Prep ZC-31	-	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A	6.0L (6.5 qt)
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Silicone Gasket Remover ZC-30	-	-

GENERAL SPECIFICATIONS**GENERAL SPECIFICATIONS**

Item	Specification
Engine	
Displacement	4.6L (281 CID)
Number of cylinders	8
Bore	90.2 mm (3.55 in)
Stroke	90.0 mm (3.54 in)
Firing order	1-3-7-2-6-5-4-8
Spark plugs (early build - black coil boot)	PZT-14F
Spark plugs (late build - brown coil boot)	HJFS-24FP
Oil pressure minimum at 2,000 RPM (engine at normal operating temperature)	517 kPa (75 psi)
Compression ratio	9.8:1
Engine weight (without accessory drive components)	220 Kg (485 lb)

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or flexplate)

Cylinder Head and Valve Train

Combustion chamber volume	48.1-51.1 cc (2.94-3.12 cu in)
Valve arrangement (front to rear) - LH	I-E-I-I-E-I-I-E-I
Valve arrangement (front to rear) - RH	I-E-I-I-E-I-I-E-I
Valve guide bore diameter	6.015-6.044 mm (0.237-0.238 in)
Valve stem diameter - intake	5.975-5.995 mm (0.235-0.236 in)
Valve stem diameter - exhaust	5.95-5.97 mm (0.234-0.235 in)
Valve stem-to-guide clearance - intake	0.020-0.069 mm (0.001-0.003 in)
Valve stem-to-guide clearance - exhaust	0.045-0.094 mm (0.002-0.004 in)
Valve head diameter - intake	33.62-33.98 mm (1.324-1.338 in)
Valve head diameter - exhaust	37.32-37.68 mm (1.469-1.483 in)
Valve face runout	0.05 mm (0.002 in)
Valve face angle	45.5 degrees
Valve seat width - intake	1.2-1.4 mm (0.047-0.055 in)
Valve seat width - exhaust	1.4-1.6 mm (0.055-0.063 in)
Valve seat angle	44.5-45.0 degrees
Valve spring free length	56.5 mm (2.22 in)
Valve spring compression pressure (maximum lift)	760 N (171 lbs) ± 39.0 N (8.8 lb) @ 31.04 mm (1.22 in)
Valve spring installed height	42.04 mm (1.66 in)
Valve spring installed pressure	350 N (79 lbs) ± 17.5 N (4 lb) @ 42.04 mm (1.66 in)

Hydraulic Lash Adjuster

Diameter	15.988-16.000 mm (0.6294-0.6299 in)
Clearance-to-bore	0.018-0.069 mm (0.0007-0.0027 in)
Service limit	-
Collapsed lash adjuster gap	0.45-0.85 (0.018-0.033)

Camshaft

Theoretical valve lift @ 0 lash - intake	11.166 mm (0.439 in)
Theoretical valve lift @ 0 lash - exhaust	11.066 mm (0.436 in)
Lobe lift - intake	5.520 mm (0.217 in)
Lobe lift - exhaust	5.506 mm (0.217 in)
Allowable lobe lift loss	0.00127 mm (0.00005 in)
Journal diameter	28.607-28.633 mm (1.126-1.127 in)
Camshaft journal bore inside diameter	28.657-28.682 mm (1.128-1.129 in)
Camshaft journal-to-bearing clearance	0.024-0.075 mm (0.001-0.003 in)
Runout	0.03 mm (0.001 in)
End play	0.0050-0.250 mm (0.0002-0.009 in)

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Cylinder Block

Cylinder bore diameter - grade 1	90.200-90.210 mm (3.5512-3.5516 in)
Cylinder bore diameter - grade 2	90.210-90.220 mm (3.5516-3.5520 in)
Cylinder bore diameter - grade 3	90.220-90.230 mm (3.5520-3.5524 in)
Cylinder bore maximum taper	0.006 mm (0.0002 in)
Cylinder bore maximum out-of-round	0.020 mm (0.0008 in)
Main bearing bore inside diameter	72.400-72.424 mm (2.850-2.851 in)

Crankshaft

Main bearing journal diameter	67.481-67.505 mm (2.6567-2.6576 in)
Main bearing journal maximum taper	0.004 mm (0.0002 in)
Main bearing journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Main bearing journal-to-cylinder block clearance	0.048-0.024 mm (0.0019-0.0009 in)
Connecting rod journal diameter	53.003-52.983 mm (2.0867-2.0859 in)
Connecting rod journal maximum taper	0.004 mm (0.0002 in)
Connecting rod journal maximum out-of-round	0.0075 mm (0.0003 in) between cross sections
Crankshaft maximum end play	0.075-0.377 mm (0.0030-0.0148 in)

Piston and Connecting Rod

Piston diameter - grade 1 (at right angle to pin bore) (uncoated)	90.182-90.167 mm (3.5504-3.5499 in)
Piston diameter - grade 2 (at right angle to pin bore) (uncoated)	90.196-90.179 mm (3.551-3.5503 in)
Piston diameter - grade 3 (at right angle to pin bore) (uncoated)	90.208-90.193 mm (3.5515-3.551 in)
Piston-to-cylinder bore clearance (at grade size)	0.017-0.047 mm (0.0007-0.0019 in)
Piston ring end gap - top	0.15-0.30 mm (0.006-0.012 in)
Piston ring end gap - intermediate	0.25-0.50 mm (0.0098-0.0197 in)
Piston ring end gap - oil control	0.15-0.65 mm (0.0059-0.0256 in)
Piston ring groove width - top	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width - intermediate	1.52-1.54 mm (0.0598-0.0606 in)
Piston ring groove width - oil control	3.030-3.056 mm (0.1193-0.1203 in)
Piston ring width - top and intermediate	1.50-1.48 mm (0.0590-0.0582 in)
Piston ring-to-groove clearance - top	0.020-0.060 mm (0.0008-0.0020 in)
Piston ring-to-groove clearance - intermediate	0.020-0.060 mm (0.0008-0.0020 in)
Piston pin bore diameter	22.0125-22.0175 mm (0.8666-0.8668 in)
Piston pin diameter	22.0010-22.0030 mm (0.8662-0.8663 in)
Piston pin length	61.8 mm (2.433 in)
Piston pin-to-piston fit	0.0095-0.023 mm (0.0004-0.0009 in)
Connecting rod-to-pin clearance	0.009-0.023 mm (0.0004-0.0009 in)
Connecting rod pin bore diameter	22.012-22.024 mm (0.8666-0.8671 in)
Connecting rod length (center-to-center)	150.7 mm (5.933 in)
Connecting rod maximum allowed bend	± 0.038 mm (0.0015 in)
	± 0.05 mm (0.0020 in)

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Connecting rod maximum allowed twist ^a	
Connecting rod bearing bore diameter (with assembled liners)	53.049-53.027 mm (2.0885-2.0877 in)
Connecting rod bearing-to-crankshaft clearance	0.024-0.066 mm (0.0009-0.0026 in)
Connecting rod side clearance	0.5-0.15 mm (0.02-0.006 in)

^a The pin bore and crank bearing bore must be parallel and in the same vertical plane within the specified total difference when measured at the ends of a 203 mm bar, 105.5 mm on each side of rod centerline.

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Description	Nm	lb-ft	lb-in
A/C compressor stud bolt	25	18	-
A/C compressor nuts	25	18	-
A/C hose bracket-to-A/C compressor nut	20	-	177
Accessory drive belt idler pulley bolts	25	18	-
Accessory drive belt tensioner bolts	25	18	-
Alternator lower mounting nuts	25	18	-
Alternator mounting bracket bolts	10	-	89
Battery cable bracket-to-engine front cover nut	10	-	89
Battery cable bracket-to-engine support insulator bracket bolt	15	-	133
Battery cable bracket-to-power steering pump nuts	10	-	89
Camshaft bearing cap bolts ^a	-	-	-
Camshaft phaser sprocket assembly bolts ^a	-	-	-
Camshaft position (CMP) sensor bolt	10	-	89
Connecting rod cap bolts ^a	-	-	-
Coolant crossover bolts	10	-	89
Coolant pump bolts	25	18	-
Coolant pump pulley bolts	25	18	-
Cooling fan wiring harness bracket nut	25	18	-
Crankshaft main bearing cap bolts ^a	-	-	-
Crankshaft main bearing cap side bolts ^a	-	-	-
Crankshaft main bearing cap jack screws ^a	-	-	-
Crankshaft main bearing cap stud bolt ^a	-	-	-
Crankshaft position (CKP) sensor bolt	10	-	89
Crankshaft pulley bolt ^a	-	-	-
Crankshaft rear seal retainer bolts ^a	-	-	-
Cylinder heads bolts ^a	-	-	-

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Cylinder head temperature sensor (CHT)	10	-	89
Differential housing bolts	66	49	-
Dual converter Y-pipe-to-exhaust manifold nuts	40	30	-
Engine front cover bolts ^a	-	-	-
Engine support insulator bracket bolts	72	53	-
Engine support insulator nuts	90	66	-
Engine support insulator through bolt	103	76	-
Exhaust manifold heat shield bolts	10	-	89
Exhaust manifold nuts ^a	-	-	-
Exhaust manifold studs	12	-	106
Flexplate bolts ^a	-	-	-
Ground strap-to-heater supply tube nut	10	-	89
Ground strap-to-cowl nut	12	-	106
Heated PCV fitting bolts	10	-	89
Heater supply tube stud bolt	10	-	89
Hood hinge bolts	12	-	106
Ignition coil bolts	6	-	53
Intake manifold bolts ^a	-	-	-
Knock Sensor (KS) bolts	20	-	177
Oil drain splash shield	12	-	106
Oil filter adapter bolts	25	18	-
Oil level indicator tube bolt	10	-	89
Oil pan bolts ^a	-	-	-
Oil pan drain plug	23	17	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube spacer	25	18	-
Oil pump screen and pickup tube-to-oil pump bolts	10	-	89
Oil pump screen and pickup tube-to-spacer bolt	25	18	-
Power steering pressure (PSP) hose-to-battery cable bracket nut	10	-	89
Power steering pump stud bolts	25	18	-
Radio interference capacitor nuts	25	18	-
Spark plugs	12	-	106
Stabilizer bar bracket bolts	55	41	-
Steering intermediate shaft coupling bolt	48	35	-
Throttle body bolts	10	-	89
Timing chain guide bolts	10	-	89
Timing chain hydraulic tensioner bolts	25	18	-
Transmission cooler tube bracket-to-engine front cover nut	12	-	106
Valve cover bolts ^a	-	-	-
Variable camshaft timing (VCT) housing bolts	10	-	89

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Wiring harness bracket nuts	10	-	89
Wiring harness terminals-to-power distribution box nuts	12	-	106

DESCRIPTION AND OPERATION

ENGINE

NOTE: Refer to the exploded view under Engine.

The 4.6L (3V) is a V-8 engine with the following features:

- Single overhead camshafts
- Three valves per cylinder
- Sequential multi-port fuel injection (SFI)
- Aluminum cylinder heads
- Cast iron cylinder block
- Variable camshaft timing (VCT)
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Distributorless ignition system
- Electronic returnless fuel system

Identification

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

Code Information

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

- Engine build date
- Engine plant code
- Engine code

Induction System

The sequential multi-port fuel injection (SFI) provides the fuel/air mixture needed for combustion in the cylinders. The 8 solenoid-operated fuel injectors:

- are mounted in the intake manifold.

- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.
- are connected in series with the fuel rail pressure and temperature sensor.
- supply fuel from the fuel tank with a fuel pump mounted in the fuel tank.

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

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

Valve Train

The valve train operates as follows:

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

PCV System

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

Lubrication System

The engine lubrication system operates as follows:

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

Oil Pump

The lubrication system of the 4.6L (3V) engine is designed to provide optimum oil flow to critical components of the engine through its entire operating range. The heart of the system is a positive displacement internal gear oil pump using top seal rotors. Generically this design is known as a gerotor pump, which operates as follows:

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

Engine Cylinder Identification

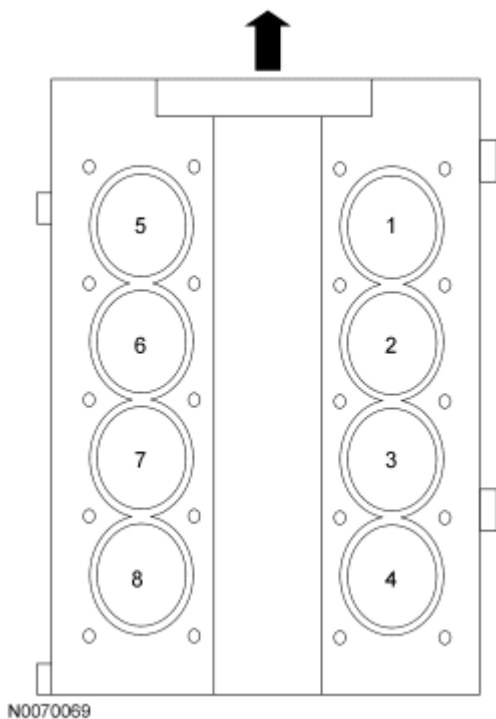


Fig. 1: Engine Cylinder Identification
Courtesy of FORD MOTOR CO.

DIAGNOSTIC TESTS

ENGINE

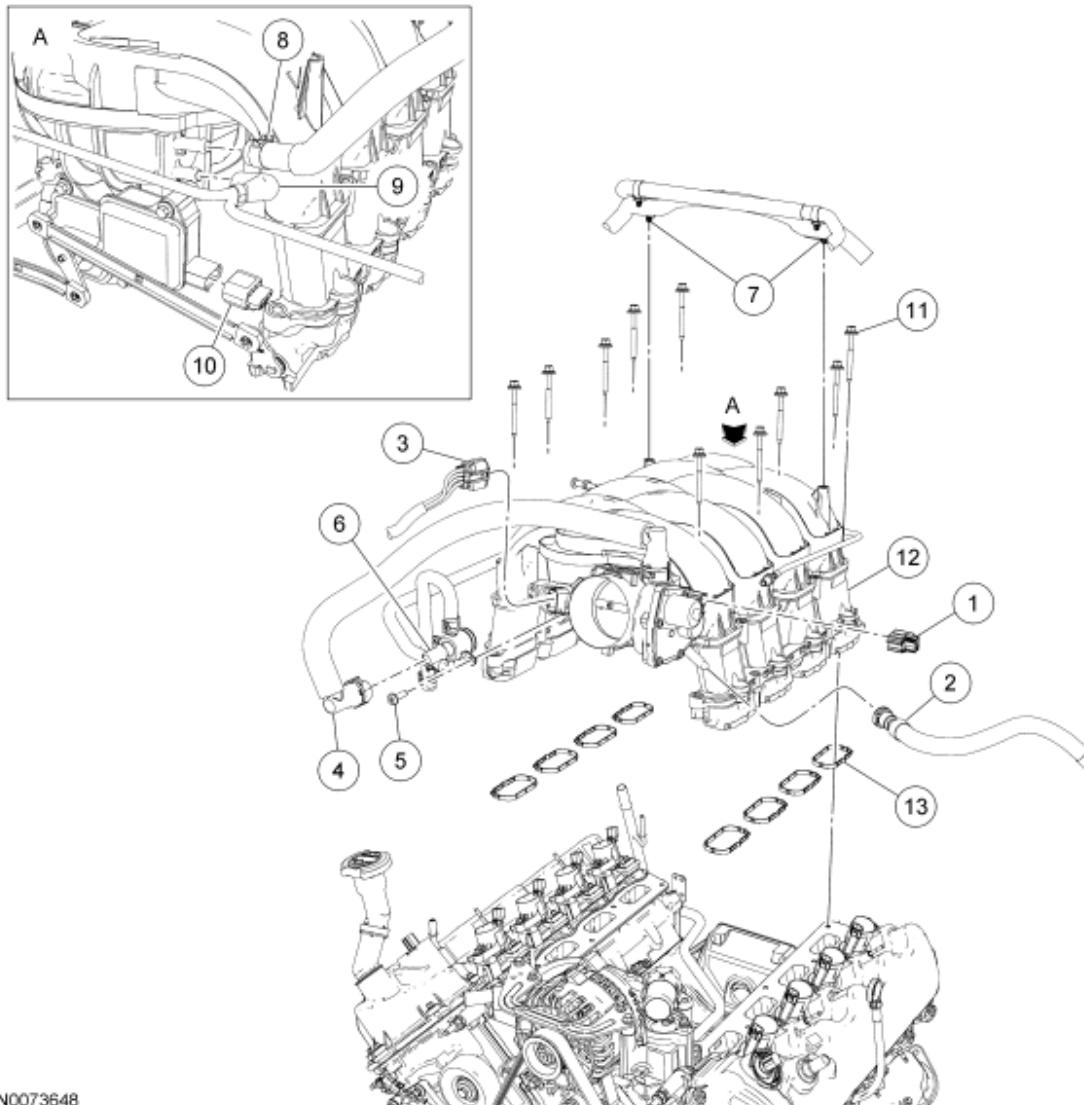
For basic engine mechanical concerns, refer to [**ENGINE SYSTEM - GENERAL INFORMATION**](#) article.
For driveability concerns, refer to the [**Introduction - Gasoline Engines**](#) article.

IN-VEHICLE SERVICING

INTAKE MANIFOLD

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-



N0073648

Fig. 2: Intake Manifold Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Electronic throttle body (TB) electrical connector (part of 12B637)

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2	9D289	Evaporative emissions (EVAP) hose
3	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
4	6K817	PCV hose
5	W706975	Heated PCV fitting bolt (2 required)
6	9A474	Heated PCV fitting
7	13A506	Wiring harness retainers (part of 12B637)
8	9C482	Brake booster vacuum hose
9	4E498	Vacuum hose
10	14A464	Charge motion control valve (CMCV) electrical connector (part of 12B637)
11	W709552	Intake manifold bolt (10 required)
12	9425	Intake manifold
13	9439	Intake manifold gasket (8 required)

REMOVAL

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

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

1. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
2. Remove the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
3. Remove the fuel rail and injectors. For additional information, refer to **FUEL CHARGING AND CONTROLS - 4.6L (3V)** article.
4. Disconnect the electronic throttle body (TB) electrical connector.
5. Disconnect the evaporative emissions (EVAP) tube from the intake manifold.
6. Disconnect the throttle position (TP) sensor electrical connector.
7. Disconnect the PCV hose from the heated PCV fitting on the intake manifold.
8. Remove the bolts and position the heated PCV fitting aside.
 - Remove and discard the O-ring seal.
9. Detach the wiring harness retainers from the intake manifold.
10. Disconnect the charge motion control valve (CMCV) electrical connector.

11. Remove the bolts and position the intake manifold forward.
12. Disconnect the brake booster vacuum hose from the rear of the intake manifold.
13. Disconnect the vacuum hose from the rear of the intake manifold.
14. Remove the intake manifold and the gaskets.
 - Discard the gaskets.

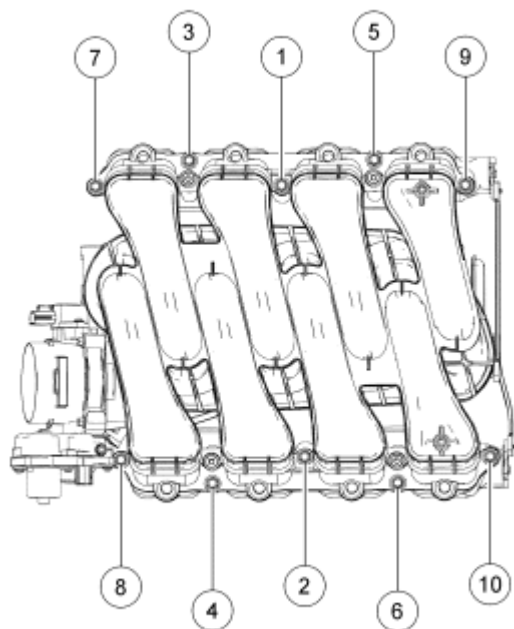
INSTALLATION

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

NOTE: Clean and inspect the sealing surfaces with metal surface prep. Follow the directions on the packaging.

NOTE: Electrical and vacuum harnesses must not restrict movement of the CMCV control rods at the rear of the intake manifold. Use extreme care during the installation of the intake manifold to prevent any pinching of electrical and vacuum harnesses.

1. Using new intake manifold gaskets, position the intake manifold.
2. Connect the vacuum hose to the rear of the intake manifold.
3. Connect the brake booster hose to the rear of the intake manifold.
4. Install the intake manifold bolts and tighten the bolts in the sequence shown in 2 stages.
 - Stage 1: Tighten to 2 Nm (18 lb-in).
 - Stage 2: Tighten to 10 Nm (89 lb-in).



N0038995

Fig. 3: Identifying Tightening Sequence Of Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

5. Connect the CMCV electrical connector.
6. Attach the wiring harness retainers to the intake manifold.
7. Install a new O-ring seal, position the heated PCV fitting and install the bolts.
8. Connect the PCV hose to the heated PCV fitting on the intake manifold.
9. Connect the TP sensor electrical connector.
10. Connect the EVAP hose to the intake manifold.
11. Connect the electronic TB electrical connector.
12. Install the fuel rail and injectors. For additional information, refer to **FUEL CHARGING AND CONTROLS - 4.6L (3V)** article.
13. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

VALVE COVER - LH

Material

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

ZC-30

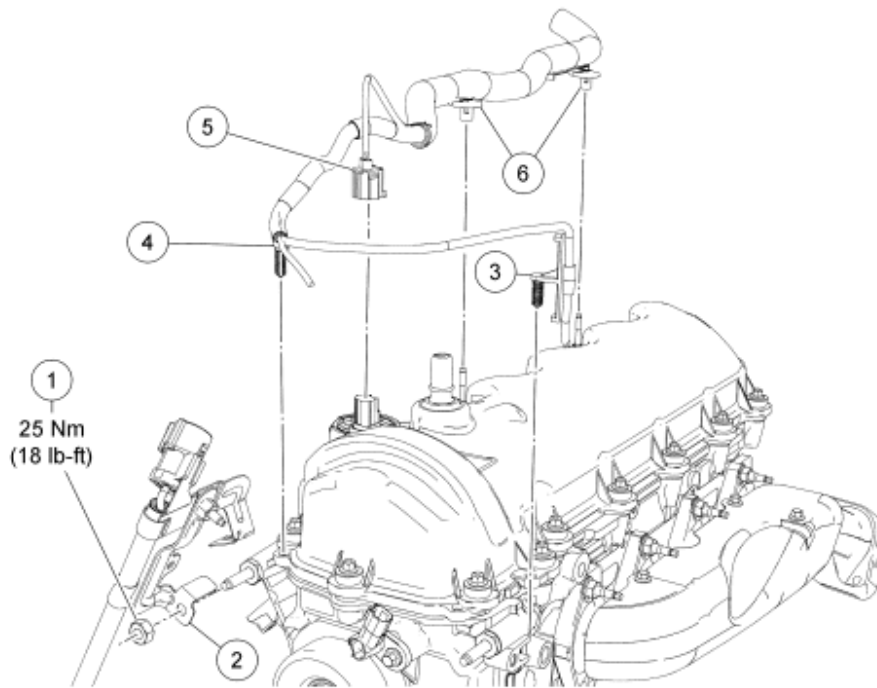
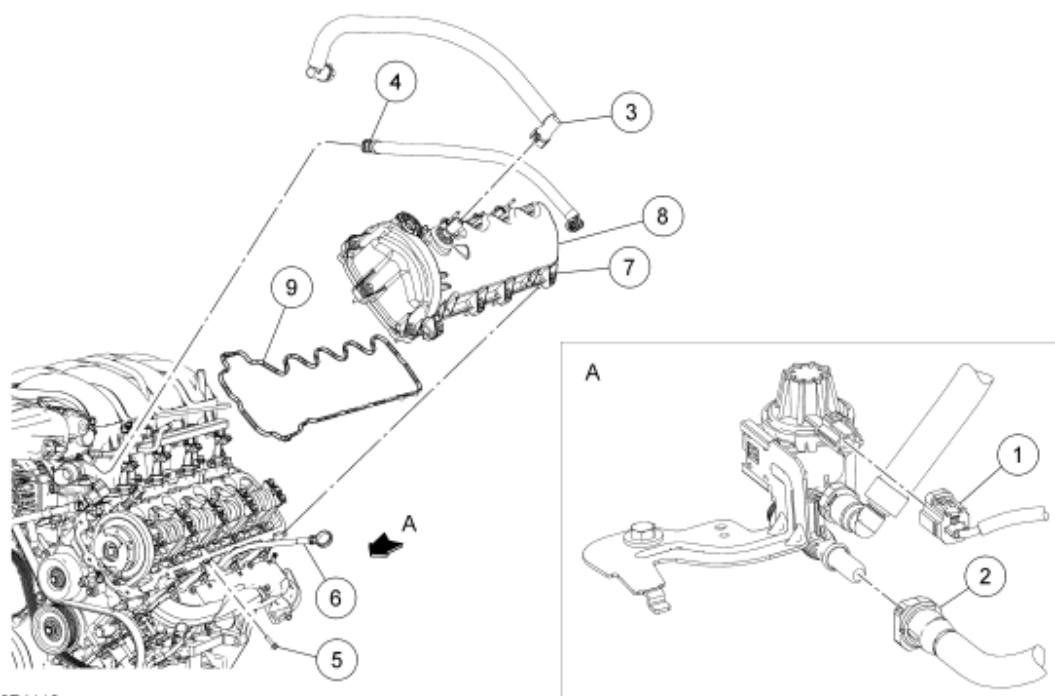


Fig. 4: Electrical Connectors and Wiring Harnesses With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N804758	Electric cooling fan clutch wiring harness bracket nut
2	14W163	Electric cooling fan clutch wiring harness bracket
3	13A506	Wiring harness retainer (part of 12B637)
4	13A506	Wiring harness retainer (part of 12B637)
5	14A464	LH variable camshaft timing (VCT) solenoid electrical connector (part of 12B637)
6	14A163	Wiring harness retainers (2 required) (part of 12B637)



N0074118

Fig. 5: LH Valve Cover
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Evaporative emission (EVAP) canister purge valve electrical connector
2	9D676	EVAP canister-to-EVAP canister purge valve hose
3	6K817	PCV hose
4	9D289	EVAP tube
5	N806155	Oil level indicator tube bracket bolt
6	-	Oil level indicator tube (part of 6754)
7	6C519	LH valve cover bolt (10 required)
8	6A513	LH valve cover
9	6A559	LH valve cover gasket

REMOVAL

1. Remove the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.
2. Remove the bolt and position the oil level indicator and tube aside.
3. Disconnect the evaporative emissions (EVAP) tube from the intake manifold.
4. Disconnect the PCV hose from the valve cover.
5. Remove the nut and position the cooling fan wiring harness bracket aside.

6. Disconnect the 2 pin-type retainers from the valve cover.
7. Disconnect the variable camshaft timing (VCT) solenoid electrical connector.
8. Detach the wiring harness retainers from the valve cover studs.
9. Disconnect the EVAP canister purge valve electrical connector.
10. Disconnect the EVAP canister-to-EVAP canister purge valve EVAP hose from the EVAP canister purge valve.
11. Loosen the 10 bolts and remove the LH valve cover and gasket.
 - Discard the gasket.

INSTALLATION

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

1. Clean the gasket mating surfaces.
 - Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
 - Clean the valve cover gasket groove in the valve cover with soap and water or a suitable solvent.
2. Install a new gasket on the LH valve cover.

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

3. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

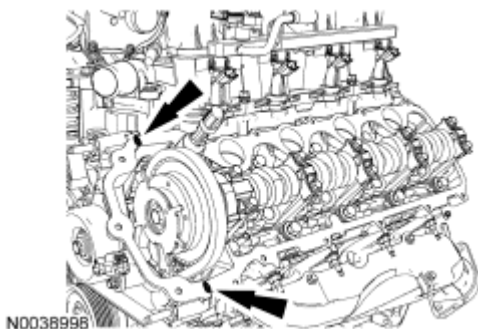


Fig. 6: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

4. Position the LH valve cover with a new gasket and tighten the bolts in the sequence shown.
 - Tighten to 10 Nm (89 lb-in).

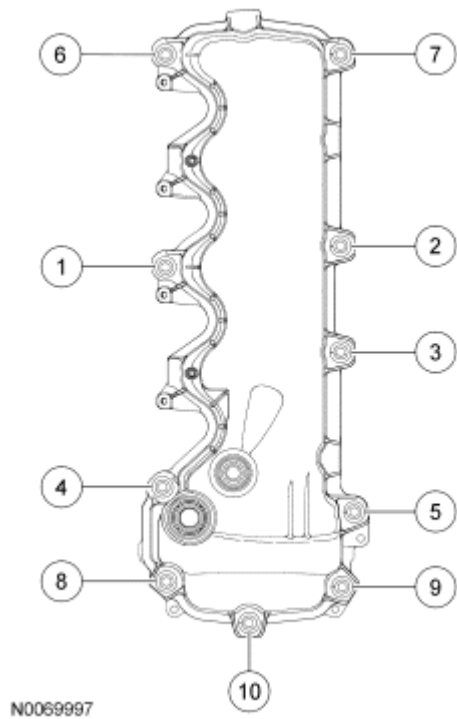


Fig. 7: Tightening LH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

5. Connect the EVAP canister-to-EVAP canister purge valve EVAP hose to the EVAP canister purge valve.
6. Connect the EVAP canister purge valve electrical connector.
7. Attach the wiring harness retainers to the valve cover studs.
8. Connect the VCT solenoid electrical connector.
9. Connect the 2 pin-type retainers to the valve cover.
10. Position the cooling fan wiring harness bracket and install the nut.
 - Tighten to 25 Nm (18 lb-ft).
11. Connect the PCV hose to the valve cover.
12. Connect the EVAP tube to the intake manifold.
13. Position the oil level indicator tube and install the bolt.
 - Tighten to 10 Nm (89 lb-in).
14. Install the LH ignition coils. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.

VALVE COVER - RH

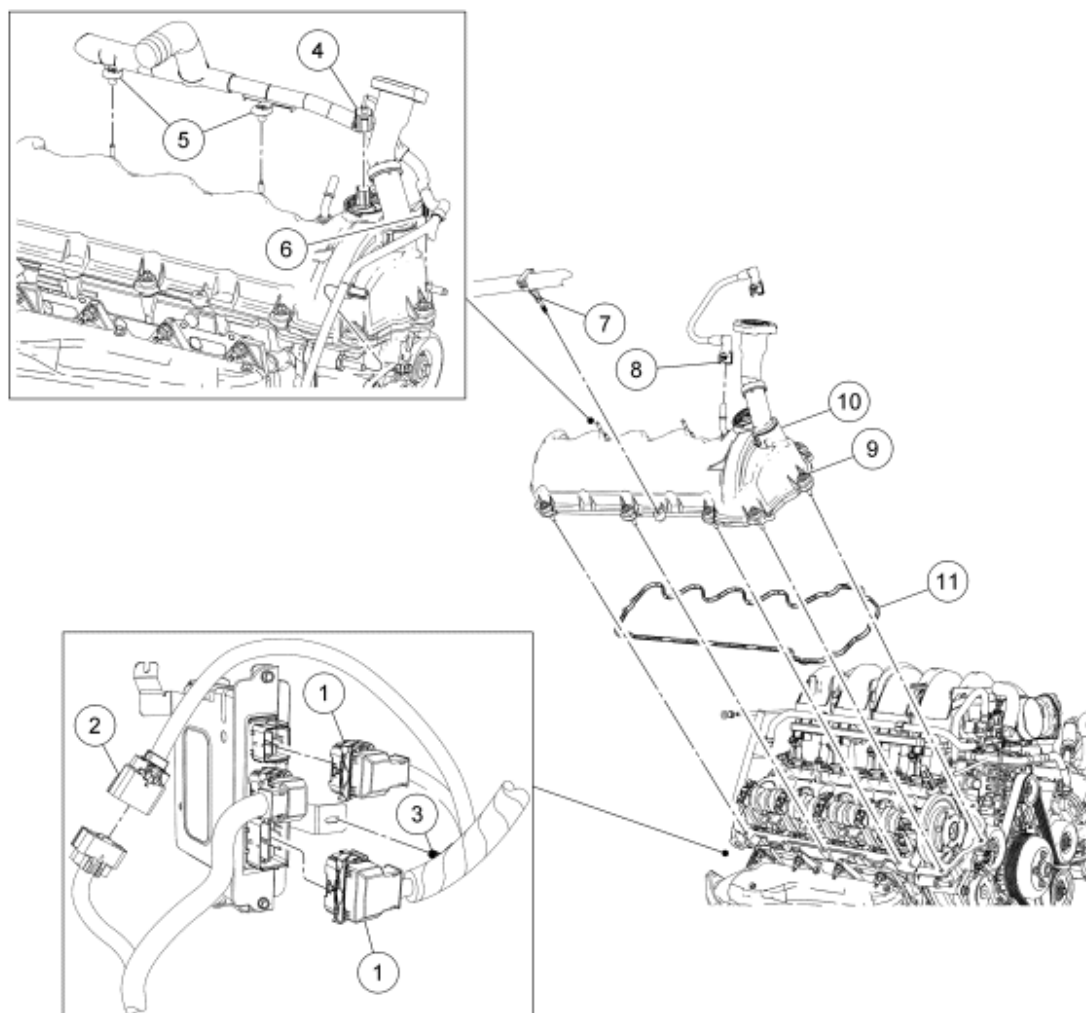
Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-

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



N0074119

Fig. 8: Valve Cover - RH
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	Engine wiring harness-to-PCM electrical connectors (2 required) (part of 12B637)
2	14A624	Engine wiring harness inline electrical connector (part of 12B637)
3	13A506	Wiring harness pin-type retainer (part of 12B637)

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2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

4	14A464	RH variable camshaft timing (VCT) oil control solenoid electrical connector (part of 12B637)
5	14A163	Wiring harness retainers (3 required) (part of 12B637)
6	13A506	Wiring harness pin-type retainer (part of 12B637)
7	8W287	Heater hose retainer
8	6758	Crankcase breather tube
9	6C519	RH valve cover bolt (9 required)
10	6583	RH valve cover
11	6584	RH valve cover gasket

REMOVAL

1. Remove the air cleaner (ACL) and the ACL outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.
2. Remove the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.
3. Disconnect the engine wiring harness from the PCM.
 - Disconnect the 2 PCM electrical connectors.
 - Disconnect the inline electrical connector.
 - Detach the wiring harness retainer from the PCM bracket and position the wiring harness aside.
4. Disconnect the RH variable camshaft timing (VCT) oil control solenoid electrical connector.
5. Detach the 2 wiring harness retainers from the RH valve cover studs.
6. Detach the wiring harness pin-type retainer from the front of the RH valve cover.
7. Detach the heater hose retainer from the RH valve cover.
8. Disconnect the crankcase breather tube from the RH valve cover.
9. Loosen the 9 RH valve cover bolts and remove the RH valve cover and the RH valve cover gasket.
 - Discard the gasket.

INSTALLATION

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

1. Clean the gasket mating surfaces.
 - Clean the valve cover mating surface of the RH cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
 - Clean the RH valve cover gasket groove with soap and water or a suitable solvent.

2. Install a new gasket on the RH valve cover.

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

3. Apply a bead of silicone gasket and sealant in 2 places where the engine front cover meets the RH cylinder head.

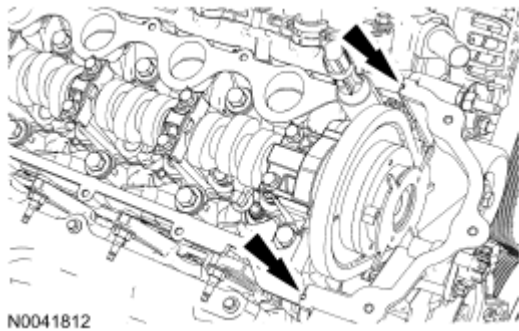


Fig. 9: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

4. Position the RH valve cover with a new gasket on the cylinder head and tighten the bolts in the sequence shown.
 - Tighten to 10 Nm (89 lb-in).

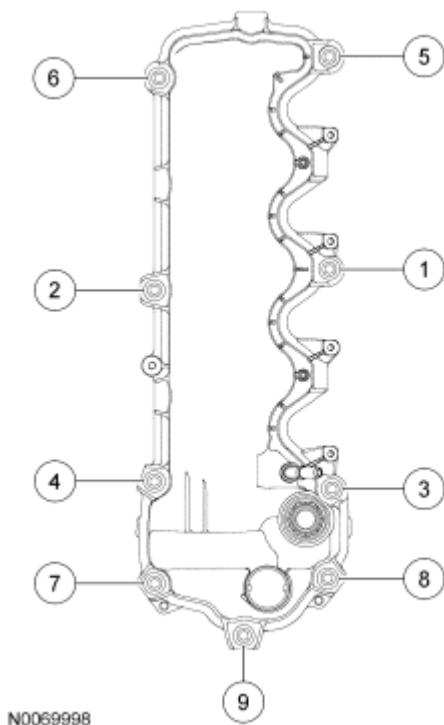


Fig. 10: Tightening RH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

5. Connect the crankcase breather tube to the RH valve cover.
6. Attach the heater hose retainer to the RH valve cover.
7. Attach the wiring harness pin-type retainer to the front of the RH valve cover.
8. Attach the wiring harness retainers to the RH valve cover studs.
9. Connect the RH VCT oil control solenoid electrical connector.
10. Connect the engine wiring harness to the PCM.
 - Position the wiring harness and attach the wiring harness pin-type retainer to the PCM bracket.
 - Connect the inline electrical connector.
 - Connect the 2 PCM electrical connectors.
11. Install the RH ignition coils. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.
12. Install the air cleaner and the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING** article.

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

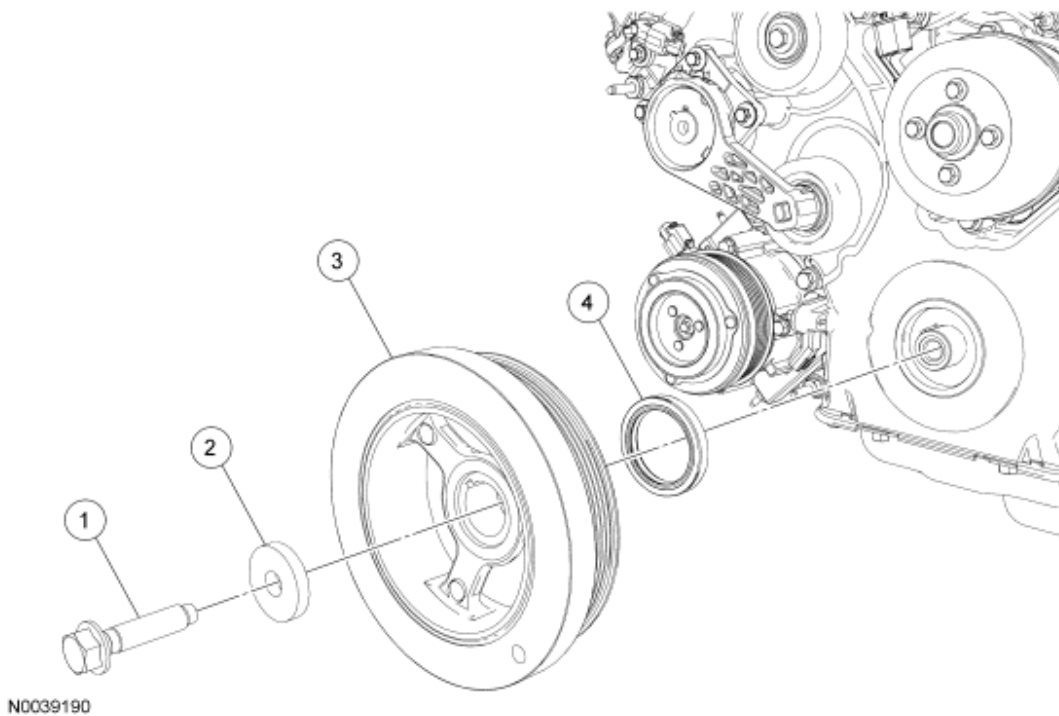


Fig. 11: Exploded View Of Crankshaft Pulley & Crankshaft Front Seal - Lower End Components
Courtesy of FORD MOTOR CO.

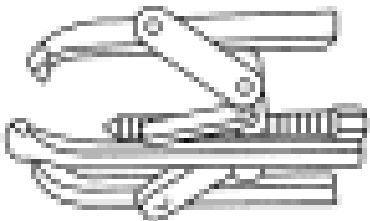
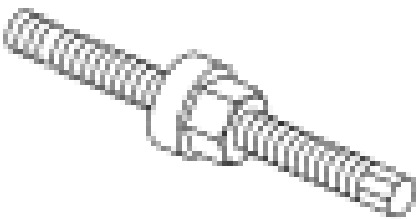
Item	Part Number	Description
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2009 Mercury Mountaineer

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1	W701512	Crankshaft pulley bolt
2	N806165	Crankshaft pulley bolt washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front oil seal

CRANKSHAFT PULLEY**Special Tools**

Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)

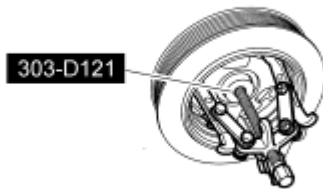
Material

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

ZC-30

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the cooling fan shroud. For additional information, refer to **ENGINE COOLING** article.
3. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE** article.
4. Remove and discard the crankshaft pulley bolt and washer.
5. Using the special tool, remove the crankshaft pulley.



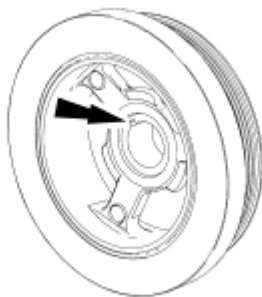
N0010528

Fig. 12: Removing Crankshaft Pulley Using Special Tool (303-D121)
Courtesy of FORD MOTOR CO.

INSTALLATION

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

1. Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



N0010530

Fig. 13: Applying Silicone Gasket And Sealant To Woodruff Key Slot In Crankshaft Pulley
Courtesy of FORD MOTOR CO.

2. Using the special tool, install the crankshaft pulley.

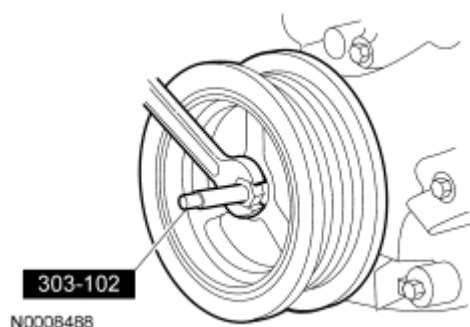


Fig. 14: Installing Crankshaft Pulley Using Special Tool
Courtesy of FORD MOTOR CO.

3. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
 - Stage 1: Tighten to 90 N.m (66 lb-ft).
 - Stage 2: Loosen 360 degrees.
 - Stage 3: Tighten to 50 N.m (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.
4. Install the accessory drive belt. For additional information, refer to [ACCESSORY DRIVE](#) article.
5. Install the cooling fan shroud. For additional information, refer to [ENGINE COOLING](#) article.

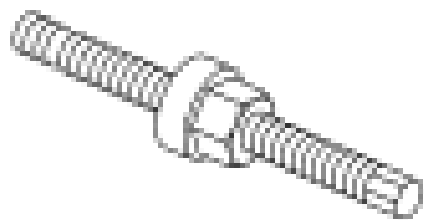
CRANKSHAFT FRONT SEAL

Special Tools

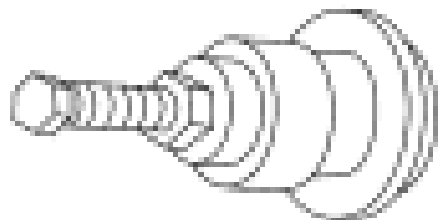
Illustration	Tool Name	Tool Number
ST2197-A	Installer, Crankshaft Front Seal	303-635
	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)

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ST1287-A



ST132B-A

Installer, Front Cover Seal

303-335 (T88T-6701-A)



ST128B-A

Remover, Crankshaft Front Seal

303-107 (T74P-6700-A)

Material

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

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

REMOVAL

1. Remove the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.
2. Using the special tool, remove the crankshaft front seal.

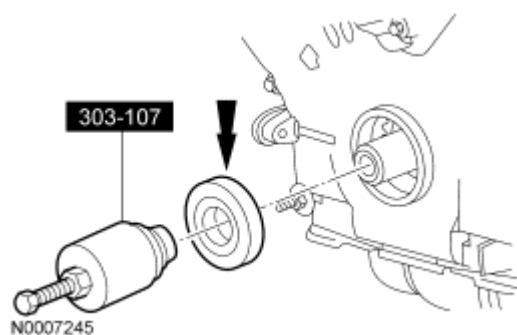


Fig. 15: Removing Crankshaft Front Seal Using Special Tool
Courtesy of FORD MOTOR CO.

INSTALLATION

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

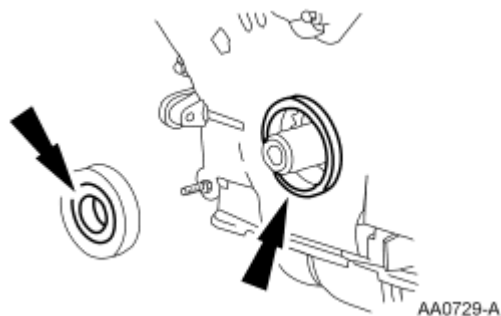


Fig. 16: Lubricating Engine Front Cover And Crankshaft Front Seal Inner Lip
Courtesy of FORD MOTOR CO.

2. Using the special tools, install the crankshaft front seal.

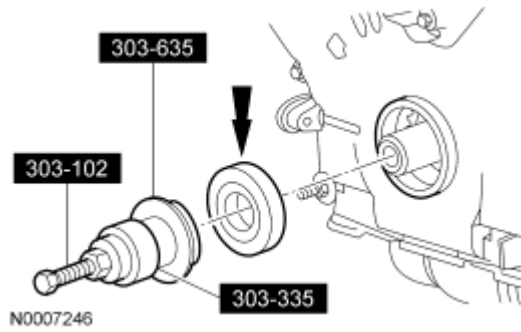


Fig. 17: Installing Crankshaft Front Seal Using Special Tools
Courtesy of FORD MOTOR CO.

3. Install the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#).

FLEXPLATE OR FLYWHEEL AND CRANKSHAFT REAR SEAL - EXPLODED VIEW

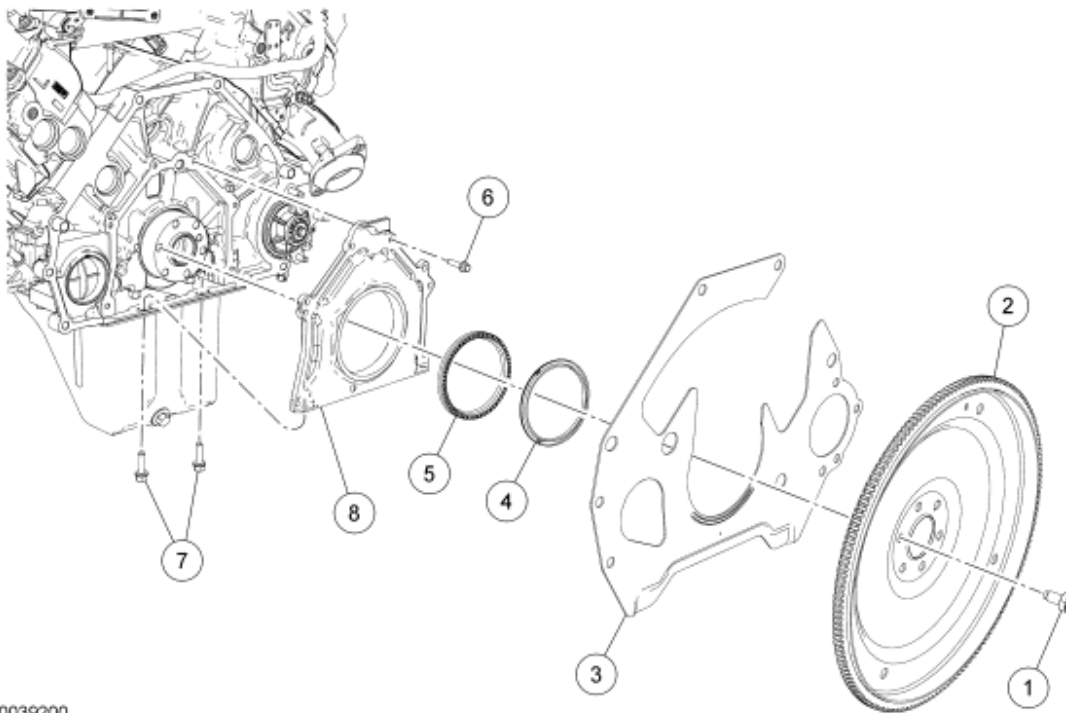


Fig. 18: Exploded View Of Flexplate Or Flywheel & Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N806168	Flexplate bolt (6 required)
2	6375	Flexplate
3	6A373	Engine-to-transmission spacer plate
4	6701	Crankshaft oil slinger
5	6310	Crankshaft rear seal

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6	N806155	Crankshaft rear seal retainer plate bolt (6 required)
7	W701605	Oil pan bolts (2 required)
8	6K318	Crankshaft rear seal retainer plate

FLEXPLATE

REMOVAL AND INSTALLATION

1. Remove the transmission. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** article.
2. Remove the 6 bolts and the flexplate.
 - To install, tighten to 80 Nm (59 lb-ft) in the sequence shown.

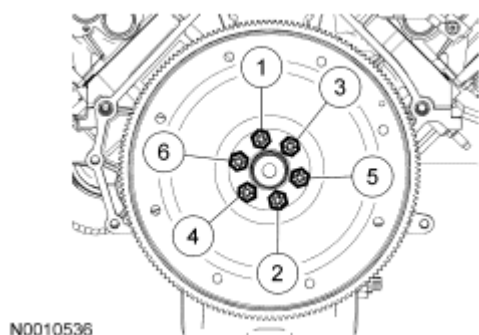


Fig. 19: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL

Special Tools

Illustration	Tool Name	Tool Number
	Impact Slide Hammer	100-001 (T50T-100-A)

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ST1185-A



ST1482-A

Installer, Crankshaft Rear Oil Slinger

303-517 (T95P-6701-CH)



ST1479-A

Installer, Crankshaft Rear Seal

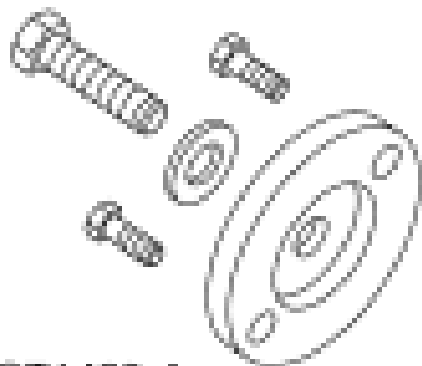
303-516 (T95P-6701-BH)

Installer, Crankshaft Rear Seal

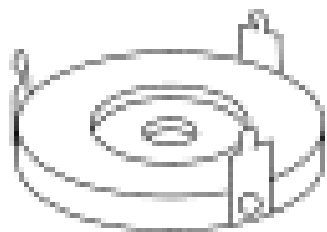
303-518 (T95P-6701-DH)

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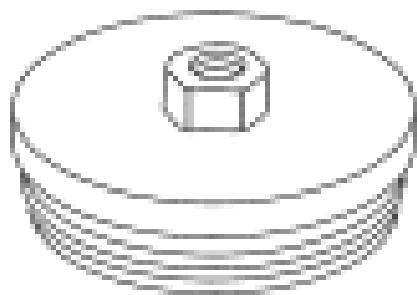
ST1480-A



ST1481-A

Remover, Crankshaft Rear Oil Slinger

303-514 (T95P-6701-AH)



ST1382-A

Remover, Crankshaft Rear Seal

303-519 (T95P-6701-EH)

Material

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

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

REMOVAL

1. Remove the flexplate. For additional information, refer to **Flexplate**.
2. Remove the engine-to-transmission spacer plate.
3. Using the special tools, remove the crankshaft oil slinger.
 - Discard the crankshaft oil slinger.

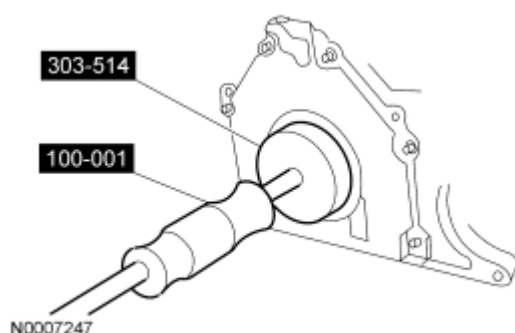


Fig. 20: Removing Crankshaft Rear Oil Seal Slinger
Courtesy of FORD MOTOR CO.

4. Using the special tools, remove the crankshaft rear seal.
 - Discard the crankshaft rear seal.

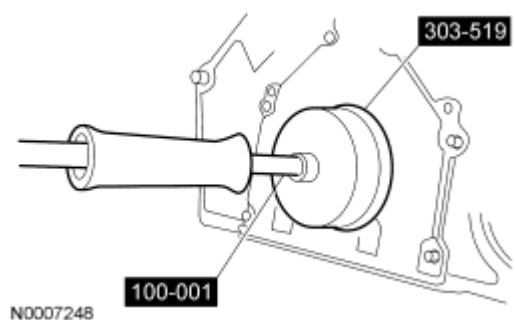


Fig. 21: Removing Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

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

1. Using the special tools, install the crankshaft rear seal.

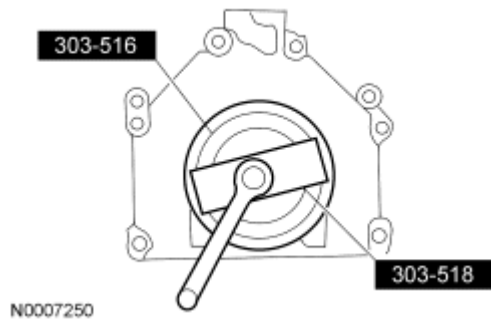


Fig. 22: Using Special Tools To Install New Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

2. Using the special tools, install the crankshaft rear oil slinger.

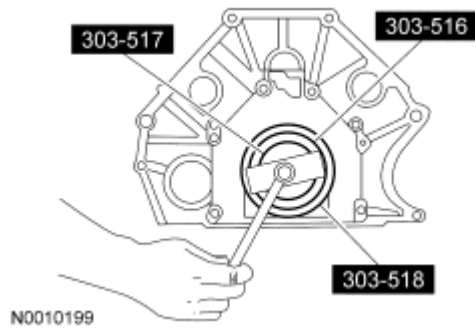


Fig. 23: Installing Crankshaft Rear Oil Slinger Using Special Tools
Courtesy of FORD MOTOR CO.

3. Install the engine-to-transmission spacer plate.
4. Install the flexplate. For additional information, refer to **Flexplate**.

CRANKSHAFT REAR SEAL WITH RETAINER PLATE

Special Tools

Illustration	Tool Name	Tool Number
	Impact Slide Hammer	100-001 (T50T-100-A)

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ST1185-A



ST1482-A

Installer, Crankshaft Rear Oil Slinger

303-517 (T95P-6701-CH)



ST1479-A

Installer, Crankshaft Rear Seal

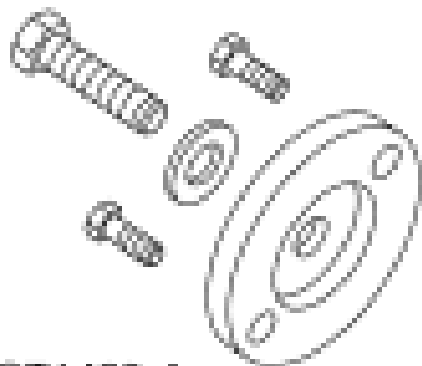
303-516 (T95P-6701-BH)

Installer, Crankshaft Rear Seal

303-518 (T95P-6701-DH)

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2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



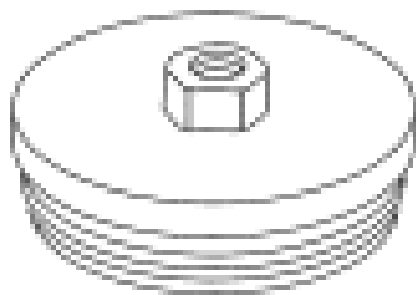
ST1480-A



ST1481-A

Remover, Crankshaft Rear Oil Slinger

303-514 (T95P-6701-AH)



ST1382-A

Remover, Crankshaft Rear Seal

303-519 (T95P-6701-EH)

Material

Item	Specification
Gasket Maker	WSK-M2G348-A5

TA-16	
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-

REMOVAL

1. Remove the flexplate. For additional information, refer to **Flexplate**.
2. Remove the engine-to-transmission spacer plate.
3. Remove the oil pan. For additional information, refer to **Oil Pan**.
4. Using the special tools, remove the crankshaft oil slinger.
 - Discard the crankshaft oil slinger.

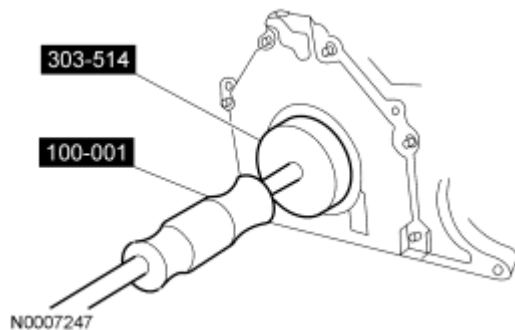


Fig. 24: Removing Crankshaft Rear Oil Seal Slinger
Courtesy of FORD MOTOR CO.

5. Using the special tools, remove the crankshaft rear seal.
 - Discard the crankshaft rear seal.

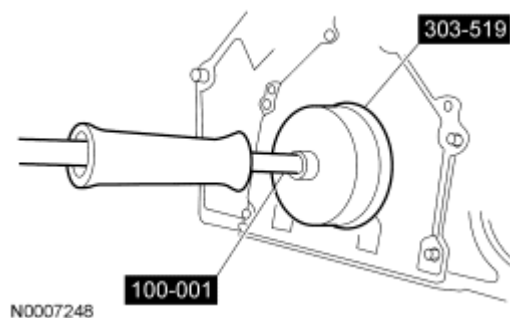


Fig. 25: Removing Crankshaft Rear Seal

Courtesy of FORD MOTOR CO.

6. Remove the 6 bolts and the crankshaft rear seal retainer plate.

INSTALLATION

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

NOTE: Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

1. Clean and inspect the mating surfaces.

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

2. Apply a bead of gasket maker to the crankshaft rear seal retainer plate mating surface on the engine block.

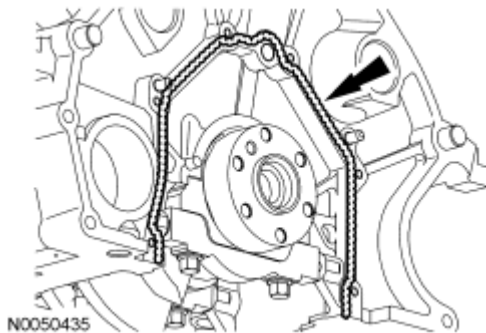


Fig. 26: Applying Bead Of Gasket Maker To Rear Crankshaft Seal Retainer
Courtesy of FORD MOTOR CO.

3. Install the crankshaft rear seal retainer plate and the 6 bolts in the sequence shown.
 - Tighten to 10 Nm (89 lb-in).

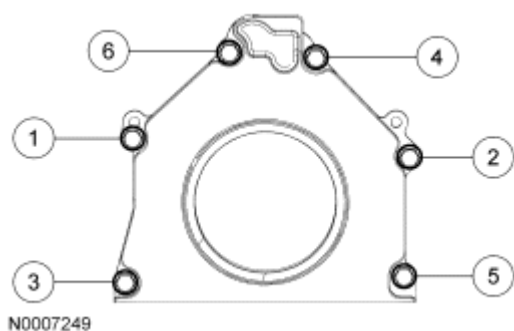


Fig. 27: Tightening Sequence Of Crankshaft Rear Seal Retainer Plate Bolts
Courtesy of FORD MOTOR CO.

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

4. Using the special tools, install the crankshaft rear seal.

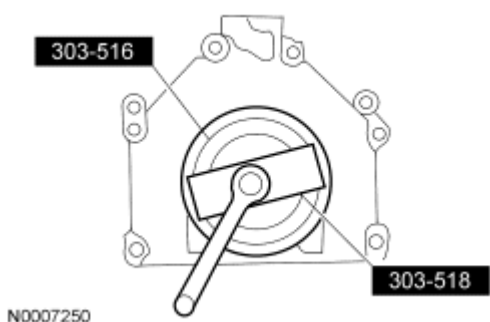


Fig. 28: Using Special Tools To Install New Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

5. Using the special tools, install the crankshaft rear oil slinger.

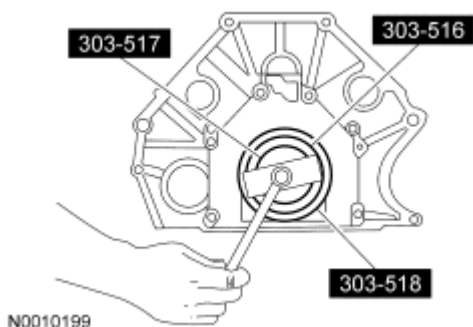


Fig. 29: Installing Crankshaft Rear Oil Slinger Using Special Tools
Courtesy of FORD MOTOR CO.

6. Install the oil pan. For additional information, refer to **Oil Pan**.
7. Install the engine-to-transmission spacer plate.

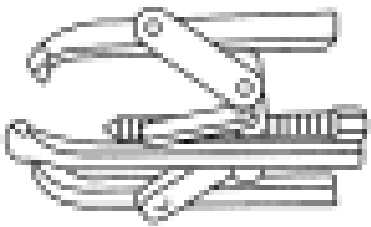
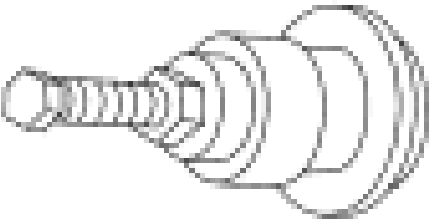
2009 Mercury Mountaineer

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8. Install the flexplate. For additional information, refer to **Flexplate**.

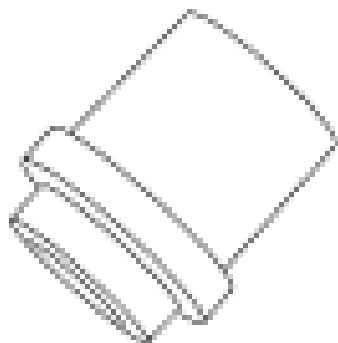
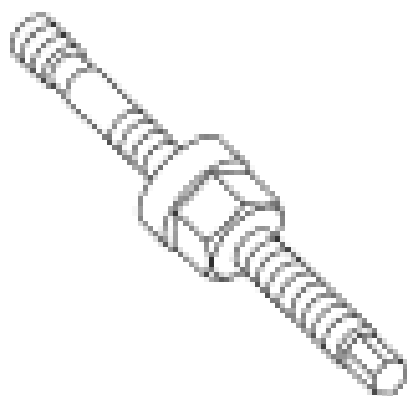
ENGINE FRONT COVER

Special Tools

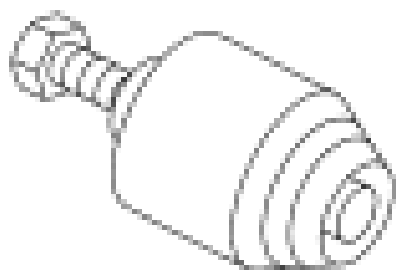
Illustration	Tool Name	Tool Number
 ST1184-A	3-Jaw Puller	303-D121
 ST1328-A	Installer, Crankshaft Front Seal	303-335 (T88T-6701-A)
	Installer, Crankshaft Front Seal	303-635

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**ST2197-A****ST2428-A**Installer, Crankshaft Vibration
Damper

303-102 (T74P-6316-B)

**ST1288-A**

Remover, Crankshaft Front Seal

303-107 (T74P-6700-A)

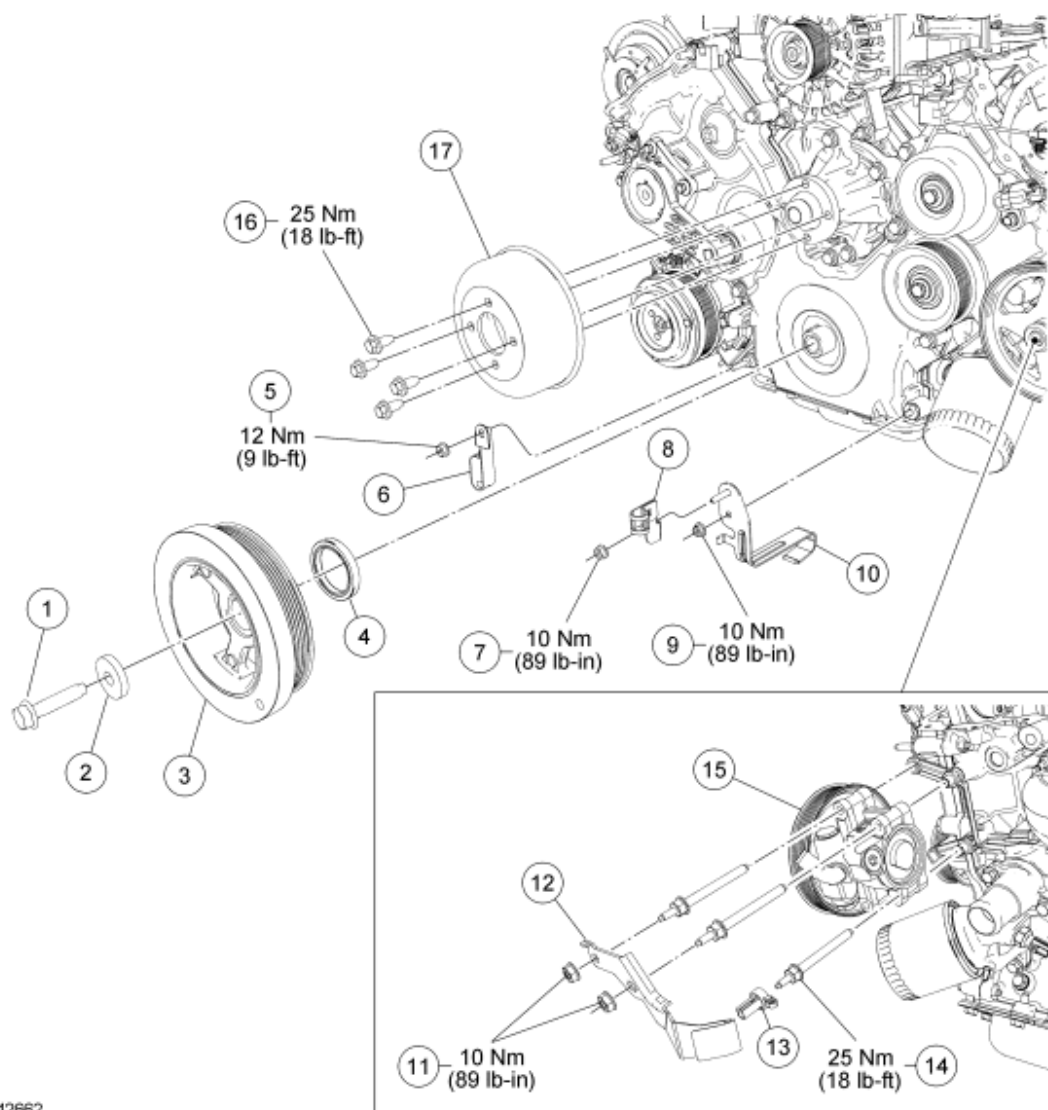
Material

Item	Specification
Motorcraft Metal Surface Prep	-

2009 Mercury Mountaineer

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ZC-31	
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-



N0042662

Fig. 30: Accessory Drive Components and Wiring Harness Brackets With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
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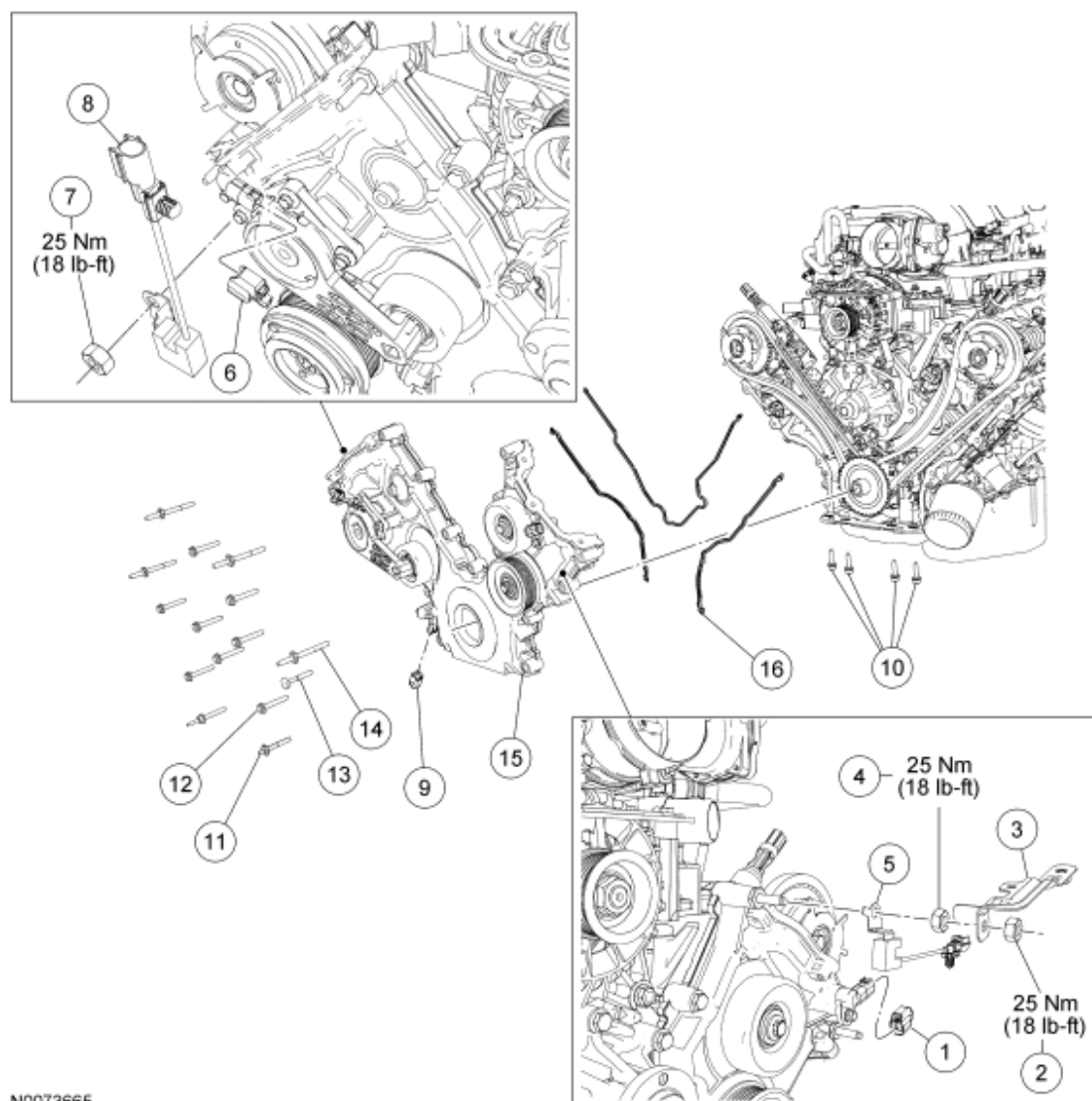
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1	W701512	Crankshaft pulley bolt
2	N806165	Crankshaft pulley washer
3	8316	Crankshaft pulley
4	6700	Crankshaft front seal
5	7R081	Transmission cooler tube bracket nut
6	BK0001728	Transmission cooler tube bracket (part of 7H420)
7	N805320	Power steering pressure (PSP) hose bracket nut
8	81396	PSP hose bracket (part of 3A719)
9	W520101	Battery cable bracket nut
10	10A779	Battery cable bracket (part of 14A280)
11	N805403	Battery cable bracket nuts (2 required)
12	10W652	Battery cable bracket (part of 14A280)
13	14A163	Wiring harness retainer (part of 12B637)
14	W707225	Power steering pump bolt (3 required)
15	3A696	Power steering pump
16	N806282	Coolant pump pulley bolt (4 required)
17	8A528	Coolant pump pulley

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N0073665

Fig. 31: Engine Front Cover Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	14A464	LH camshaft position (CMP) sensor electrical connector (part of 12B637)
2	N804758	Cooling fan wiring harness bracket nut
3	14W163	Cooling fan wiring harness bracket
4	N804758	LH radio interference capacitor nut
5	18801	LH radio interference capacitor
6	14A464	RH CMP sensor electrical connector (part of 12B637)
7	N804758	RH radio interference capacitor nut
8	18801	RH radio interference capacitor

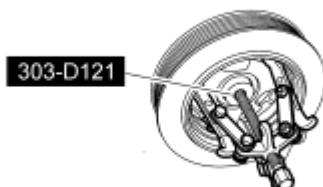
2009 Mercury Mountaineer

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9	14A464	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
10	W701605	Oil pan-to-engine front cover bolts (4 required)
11	W706508	Engine front cover stud bolt
12	N806177	Engine front cover bolt (8 required)
13	N808294	Engine front cover bolt
14	N806300	Engine front cover stud bolt (5 required)
15	6D080	Engine front cover
16	6D081	Engine front cover gasket (3 required)

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the drain plug and drain the engine oil.
 - To install, tighten to 23 Nm (17 lb-ft).
3. Remove the cooling fan shroud. For additional information, refer to **ENGINE COOLING** article.
4. Remove the RH side idler pulley. For additional information, refer to **ACCESSORY DRIVE** article.
5. Remove the RH valve cover. For additional information, refer to **Valve Cover - RH**.
6. Remove the LH valve cover. For additional information, refer to **Valve Cover - LH**.
7. Remove the nut and position the RH radio interference capacitor aside.
8. Disconnect the RH camshaft position (CMP) sensor electrical connector.
9. Remove the nut and the cooling fan wiring harness bracket.
10. Remove the nut and position the LH radio interference capacitor aside.
11. Disconnect the LH CMP sensor electrical connector.
12. Remove the bolts and the coolant pump pulley.
13. Remove the nuts and detach the battery cable bracket from the power steering pump stud bolts.
14. Detach the wiring harness retainer from the power steering pump stud bolt.
15. Remove the stud bolts and position the power steering pump aside.
 - Support the power steering pump with a length of mechanic's wire.
16. Remove the nut and detach the power steering pressure (PSP) hose bracket from the battery cable bracket.
17. Remove the nut and detach the battery cable bracket from the engine front cover.
18. Remove the nut and detach the transmission cooler tube bracket from the engine front cover.
19. Disconnect the crankshaft position (CKP) sensor electrical connector.
20. Remove the crankshaft pulley bolt and washer.
 - Discard the crankshaft pulley bolt.
21. Using the special tool, remove the crankshaft pulley.



N0010528

Fig. 32: Removing Crankshaft Pulley Using Special Tool (303-D121)
Courtesy of FORD MOTOR CO.

22. Using the special tool, remove the crankshaft front seal.
 - Discard the crankshaft front seal.

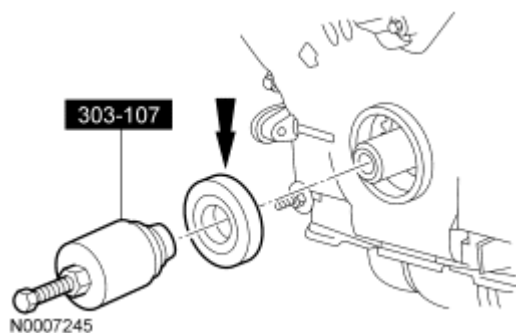


Fig. 33: Removing Crankshaft Front Seal Using Special Tool
Courtesy of FORD MOTOR CO.

23. Remove the oil pan-to-engine front cover bolts.
24. Remove the engine front cover bolts and stud bolts.
25. Remove the engine front cover from the engine front cover-to-cylinder block dowel.
 - Remove and discard the engine front cover gaskets.

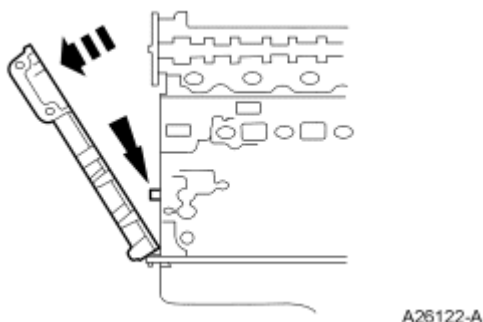


Fig. 34: Removing Engine Front Cover From Front Cover-To-Cylinder Block Dowel
Courtesy of FORD MOTOR CO.

INSTALLATION

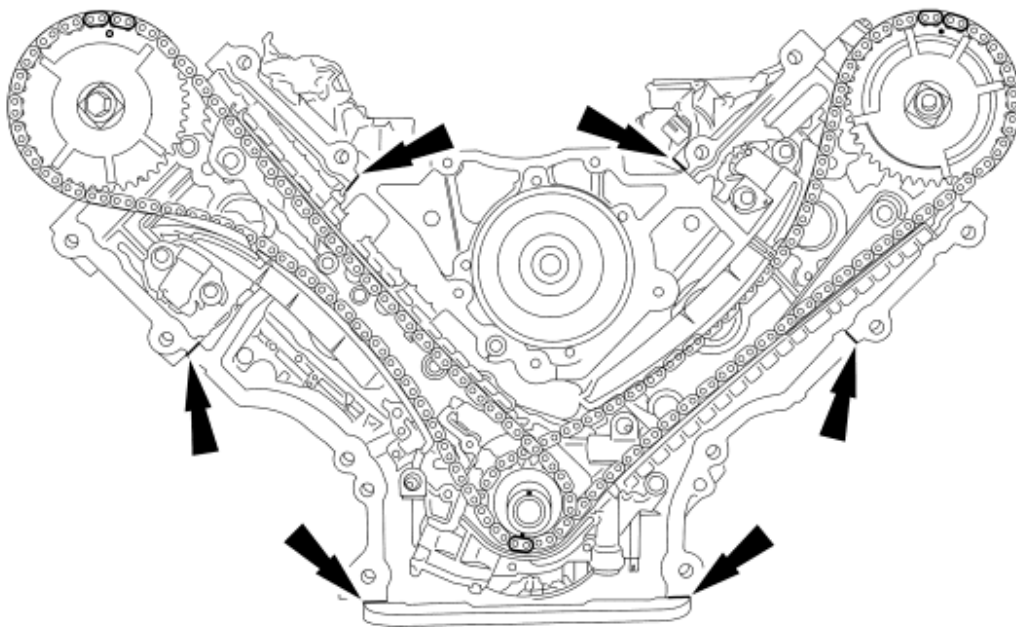
CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

1. Clean the mating surfaces with silicone gasket remover, metal surface prep and a plastic scraping tool. Follow the directions on the packaging.

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

NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

2. Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block mating surface and the oil pan-to-cylinder block mating surface at the locations shown.



A0080776

Fig. 35: Applying A Bead Of Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

3. Install new engine front cover gaskets on the engine front cover. Position the engine front cover onto the dowels. Install the fasteners finger tight.

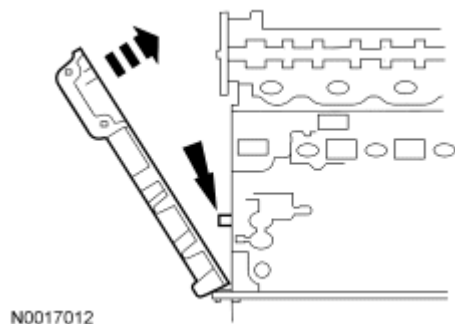


Fig. 36: Installing Engine Front Cover Gasket On Engine Front Cover
Courtesy of FORD MOTOR CO.

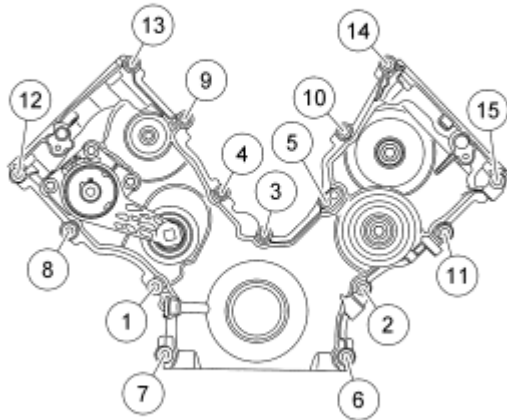
4. Tighten the engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x

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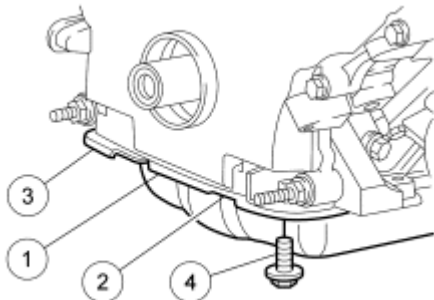
		1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1



N0039598

Fig. 37: Identifying Tightening Sequence Of Engine Front Cover Fasteners
Courtesy of FORD MOTOR CO.

5. Loosely install the oil pan-to-engine front cover bolts, then tighten the bolts in 2 stages in the sequence shown.
 - Stage 1: Tighten to 20 Nm (15 lb-ft).
 - Stage 2: Tighten an additional 60 degrees.



N0008507

Fig. 38: Identifying Tightening Sequence Of Front Oil Pan Bolts
Courtesy of FORD MOTOR CO.

6. Lubricate the engine front cover and a new crankshaft front seal inner lip with clean engine oil.

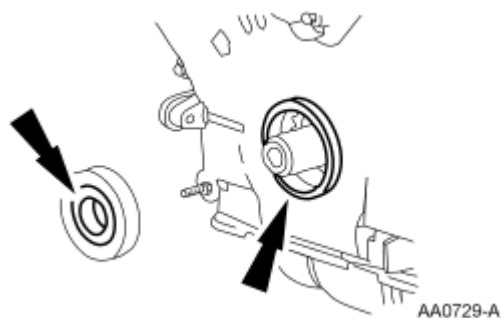


Fig. 39: Lubricating Engine Front Cover And Crankshaft Front Seal Inner Lip
Courtesy of FORD MOTOR CO.

7. Using the special tools, install the crankshaft front seal.

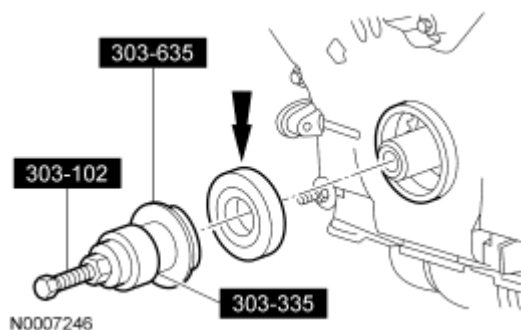


Fig. 40: Installing Crankshaft Front Seal Using Special Tools
Courtesy of FORD MOTOR CO.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

8. Apply silicone gasket sealant to the Woodruff key slot in the crankshaft pulley.

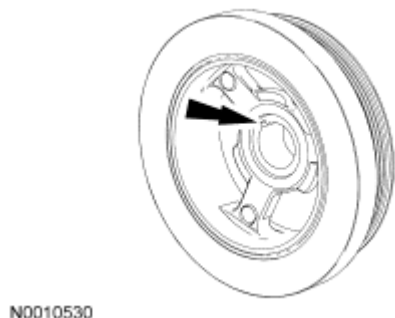


Fig. 41: Applying Silicone Gasket And Sealant To Woodruff Key Slot In Crankshaft Pulley
Courtesy of FORD MOTOR CO.

9. Using the special tool, install the crankshaft pulley.

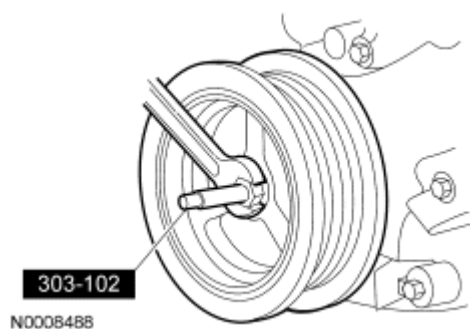


Fig. 42: Installing Crankshaft Pulley Using Special Tool
Courtesy of FORD MOTOR CO.

10. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
- Stage 1: Tighten to 90 Nm (66 lb-ft).
 - Stage 2: Loosen 360 degrees.
 - Stage 3: Tighten to 50 Nm (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.
11. Connect the CKP sensor electrical connector.
12. Attach the transmission cooler tube bracket to the engine front cover and install the nut.
- Tighten to 12 Nm (9 lb-ft).
13. Attach the battery cable bracket to the front cover and install the nut.
- Tighten to 10 Nm (89 lb-in).
14. Attach the PSP hose bracket to the battery cable bracket and install the nut.
- Tighten to 10 Nm (89 lb-in).
15. Position the power steering pump and install the stud bolts.
- Tighten to 25 Nm (18 lb-ft).
16. Attach the wiring harness retainer to the power steering pump stud bolt.
17. Position the battery cable bracket on the power steering pump stud bolts and install the nuts.
- Tighten to 10 Nm (89 lb-in).
18. Position the coolant pump pulley and install the bolts.
- Tighten the bolts to 25 Nm (18 lb-ft).
19. Connect the LH CMP sensor electrical connector.
20. Position the LH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).
21. Position the cooling fan wiring harness bracket and install the nut.
22. Connect the RH CMP sensor electrical connector.
23. Position the RH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

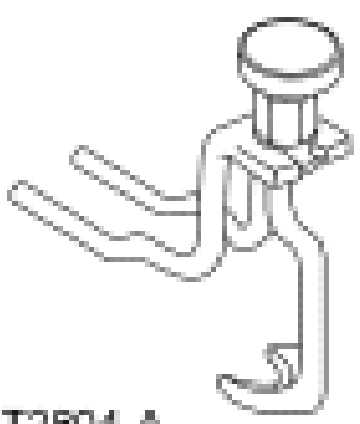
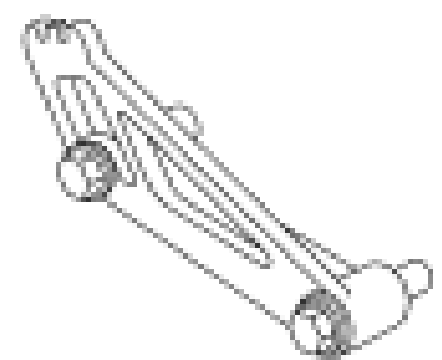
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24. Install the LH valve cover. For additional information, refer to **Valve Cover - LH**.
25. Install the RH valve cover. For additional information, refer to **Valve Cover - RH**.
26. Install the RH side idler pulley. For additional information, refer to **ACCESSORY DRIVE** article.
27. Install the cooling fan shroud. For additional information, refer to **ENGINE COOLING** article.
28. Fill the engine with clean engine oil.

TIMING DRIVE COMPONENTS

Special Tools

Illustration	Tool Name	Tool Number
 ST2604-A	Compressor, Valve Spring	303-1039
 ST2607-A	Locking Tool, Camshaft Phaser Sprocket	303-1046

Material

Item	Specification
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil	WSS-M2C930-A

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

REMOVAL

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.
2. Remove the crankshaft sensor ring from the crankshaft.

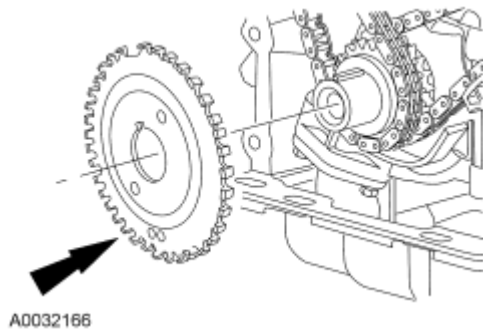


Fig. 43: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

3. Position the crankshaft keyway at the 12 o'clock position.

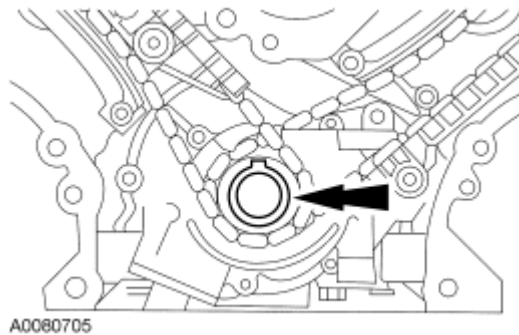


Fig. 44: Positioning Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

4. The No. 1 cylinder must be coming up on the exhaust stroke with the crankshaft keyway at the 12 o'clock position. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.

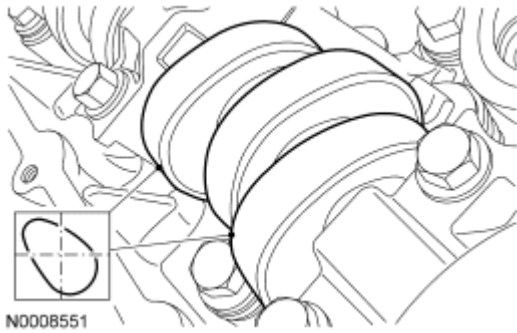
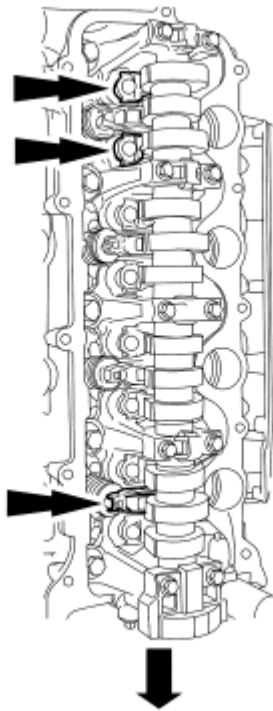


Fig. 45: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

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

5. Remove only the 3 roller followers shown in the **Fig. 46** from the RH cylinder head.



A0083248

Fig. 46: Identifying RH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

6. Using the special tool, remove the 3 roller followers designated in the previous step from the RH cylinder head.



Fig. 47: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

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

7. Remove only the 3 roller followers shown in the 7 from the LH cylinder head.

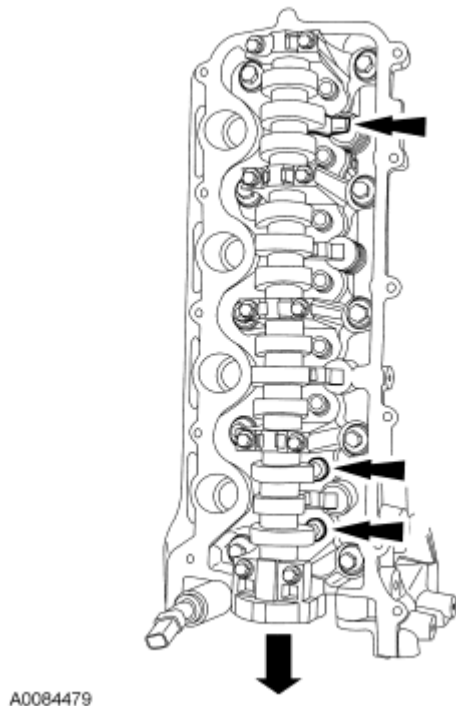


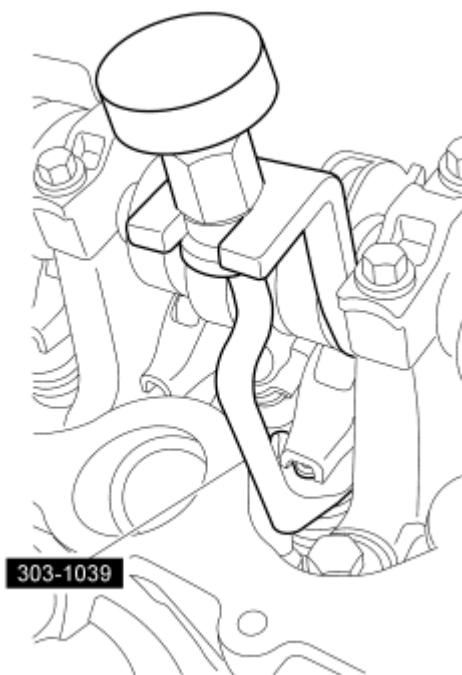
Fig. 48: Locating LH Cylinder Head Camshaft Roller Followers And Bolts

Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

8. Using the special tool, remove the 3 roller followers designated in the previous step from the LH cylinder head.



N0010191

Fig. 49: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

CAUTION: The crankshaft cannot be moved past the 6 o'clock position once set or engine damage may occur.

9. Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.

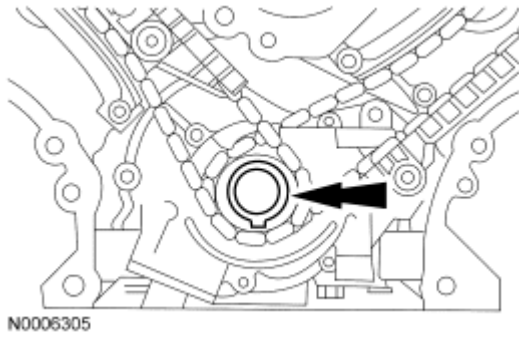


Fig. 50: Crankshaft Positioned With Keyway At 6 O'clock Position
Courtesy of FORD MOTOR CO.

10. Remove the bolts, the LH timing chain tensioner and tensioner arm.

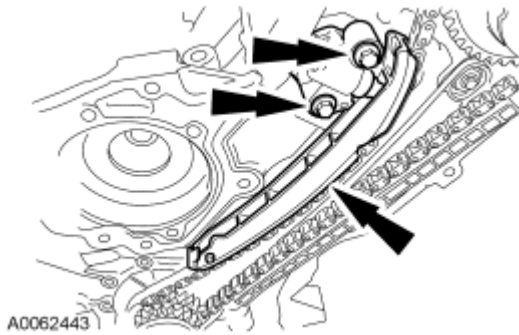


Fig. 51: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

11. Remove the bolts, the RH timing chain tensioner and tensioner arm.

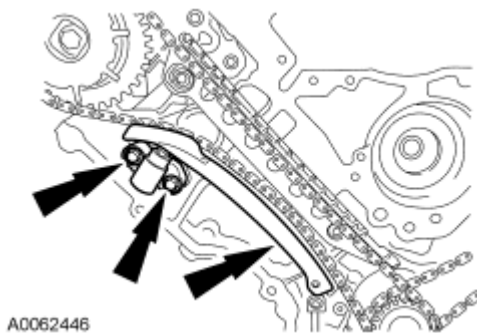


Fig. 52: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

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

- Remove the LH timing chain and crankshaft sprocket.

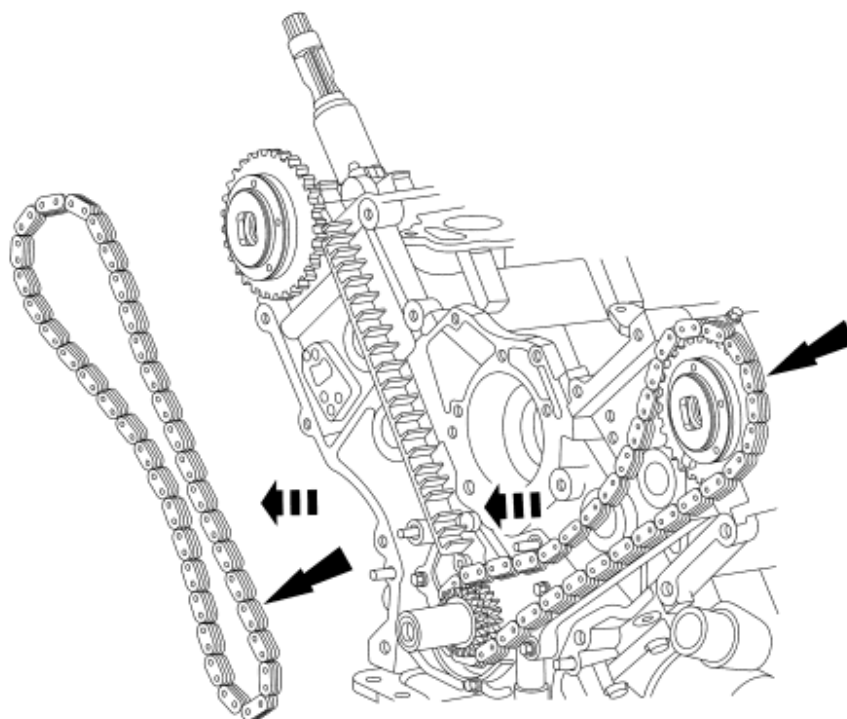


Fig. 53: Identifying RH/LH Timing Chains
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

13. Remove the LH and RH timing chain guides.
 - Remove the bolts.
 - Remove both timing chain guides.

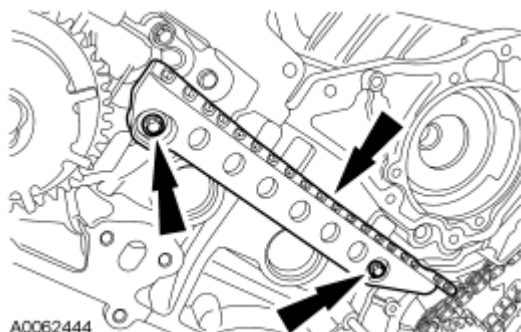


Fig. 54: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if

mishandled or used as a lifting or leveraging device.

CAUTION: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

14. Using the special tool, remove the bolt and the RH camshaft phaser sprocket assembly.
 - Discard the camshaft phaser sprocket bolt.

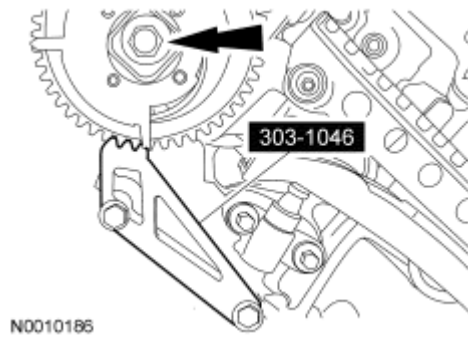


Fig. 55: Identifying VCT Phaser Sprocket Bolt And Holder Tool
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

15. Using the special tool, remove the bolt and the LH camshaft phaser sprocket assembly.
 - Discard the camshaft phaser sprocket bolt.

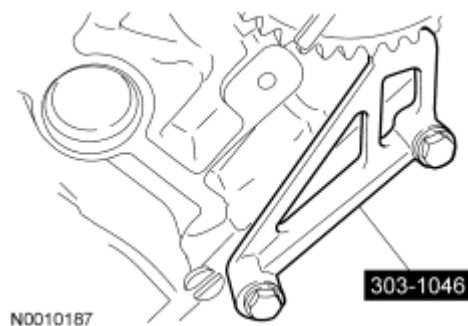
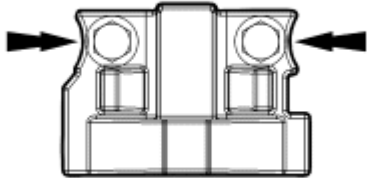


Fig. 56: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

CAUTION: Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.

16. Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

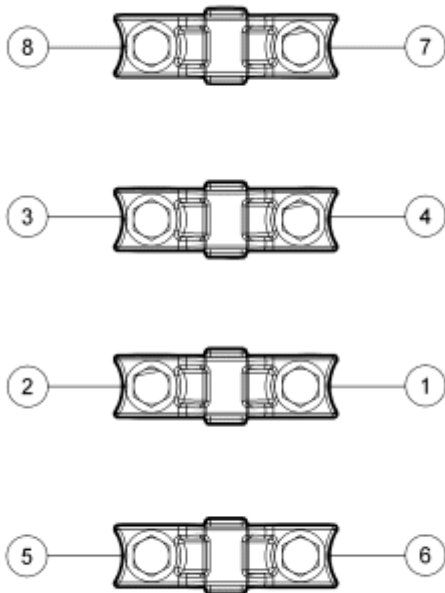


N0070049

Fig. 57: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.

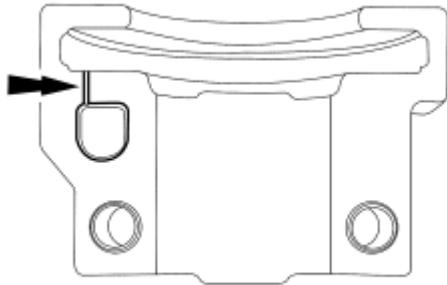
17. Remove the remaining bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.



N0070050

Fig. 58: Removing Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

18. Clean and inspect the RH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



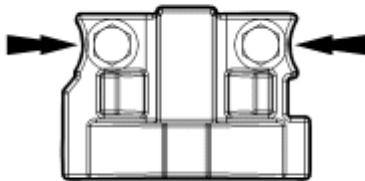
N0010448

Fig. 59: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

19. Remove the RH camshaft.

CAUTION: Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.

20. Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.

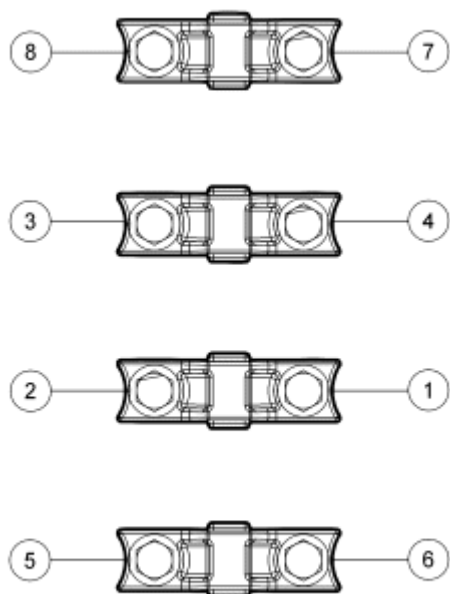


N0070049

Fig. 60: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.

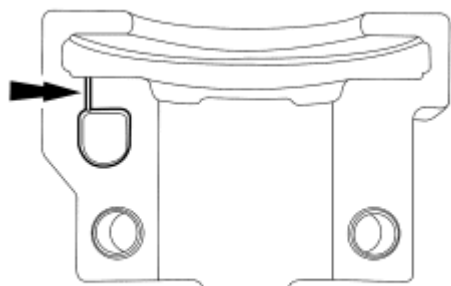
21. Remove the remaining bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



N0070050

Fig. 61: Removing Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

22. Clean and inspect the LH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 62: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

23. Remove the LH camshaft.

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

24. Remove all of the remaining roller followers from the cylinder heads.

INSTALLATION

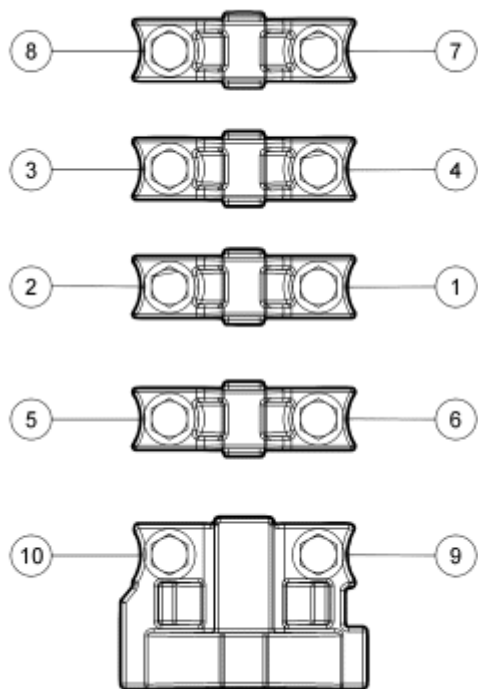
1. Install the LH and RH camshafts.

- Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

NOTE: LH shown, RH similar.

2. Install the LH and RH camshaft bearing caps in their original locations.

- Lubricate the camshaft bearing caps with clean engine oil.
- Position the front camshaft bearing cap.
- Position the remaining camshaft bearing caps.
- Install the bolts loosely.
- Tighten to 10 N.m (89 lb-in) in the sequence shown.



N0011337

Fig. 63: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: LH shown, RH similar.

3. Install the camshaft phaser sprockets and new camshaft phaser bolts finger-tight.

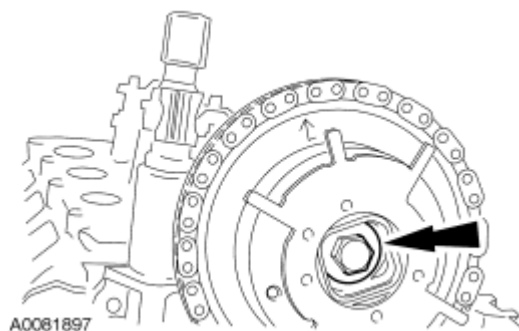


Fig. 64: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: LH shown, RH similar.

4. Using the special tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.
 - Stage 1: Tighten to 40 N.m (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

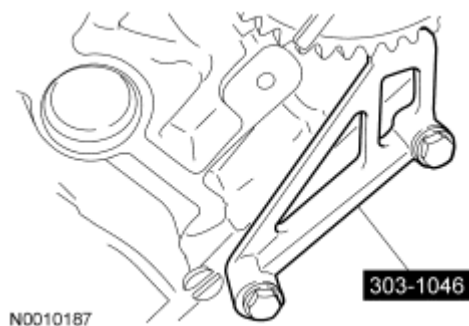


Fig. 65: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

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

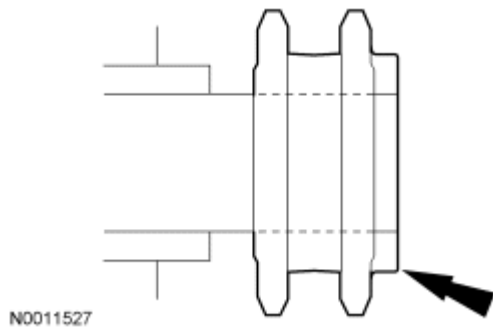


Fig. 66: Identifying Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

6. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.

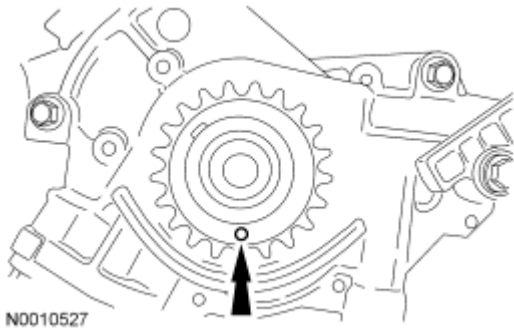


Fig. 67: Locating Crankshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

CAUTION: If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. Any cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead, will require replacement of the tensioner.

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

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

8. Compress the tensioner plunger, using a vise.

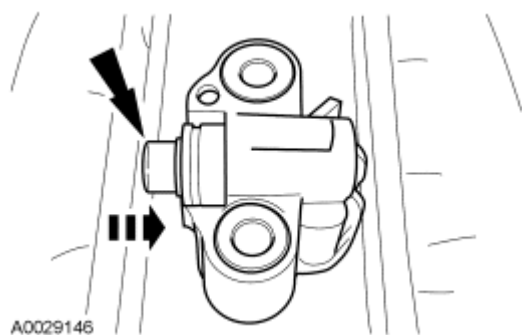


Fig. 68: Compressing Tensioner Plunger
Courtesy of FORD MOTOR CO.

9. Install a retaining clip on the tensioner to hold the plunger in during installation.

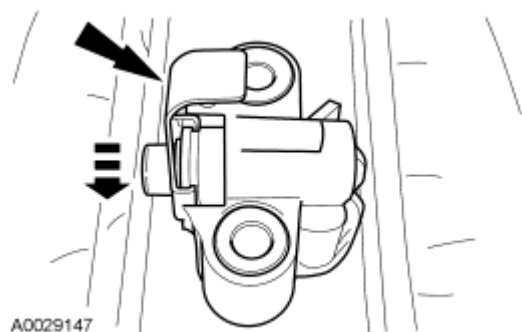


Fig. 69: Identifying Retaining Clip on Tensioner
Courtesy of FORD MOTOR CO.

10. Remove the tensioner from the vise.
11. If the colored links are not visible, mark one link on one end and one link on the other end and use as timing marks.

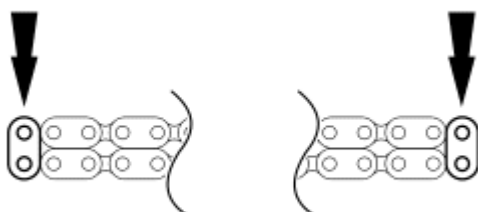
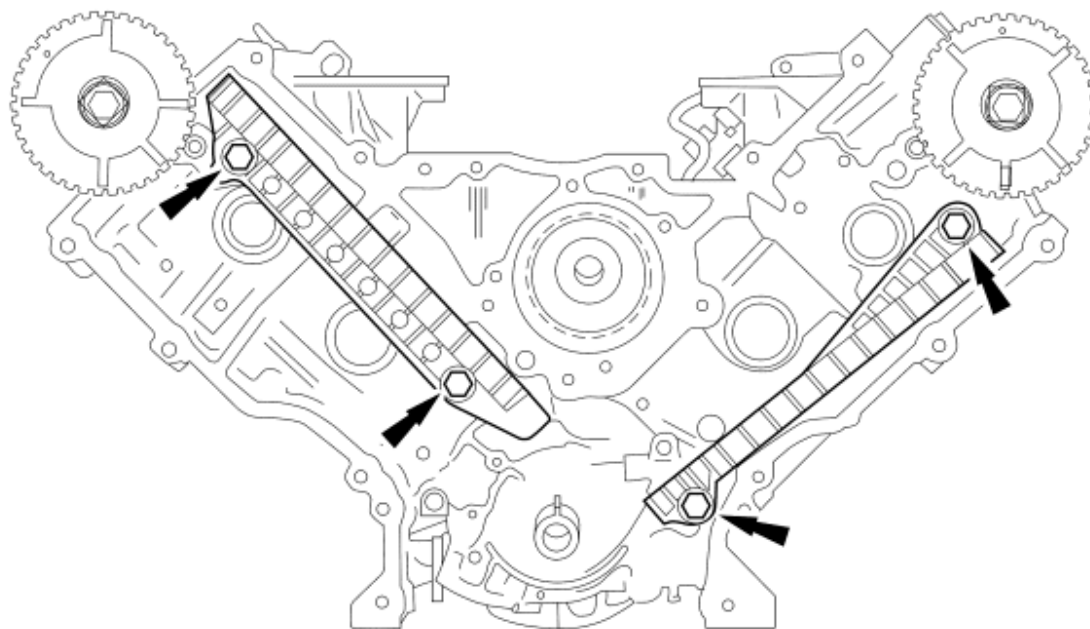


Fig. 70: Identifying Timing Chain Copper Links
Courtesy of FORD MOTOR CO.

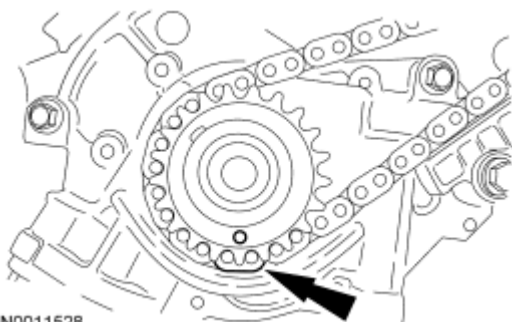
12. Install the 4 bolts and the LH and RH timing chain guides.
 - Tighten to 10 N.m (89 lb-in).



N0006303

Fig. 71: Identifying Timing Chain Guides
Courtesy of FORD MOTOR CO.

13. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single colored (marked) link on the chain.



N0011528

Fig. 72: Aligning Crankshaft Sprocket Timing Mark And LH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: Make sure the upper half of the timing chain is below the tensioner arm dowel.

14. Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the colored (marked) chain link.

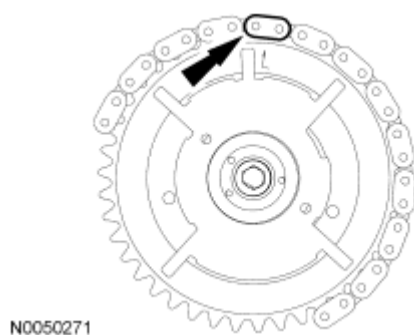


Fig. 73: Locating Camshaft Sprocket Timing Copper Mark
Courtesy of FORD MOTOR CO.

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

15. Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and bolts.
 - Tighten to 25 N.m (18 lb-ft).

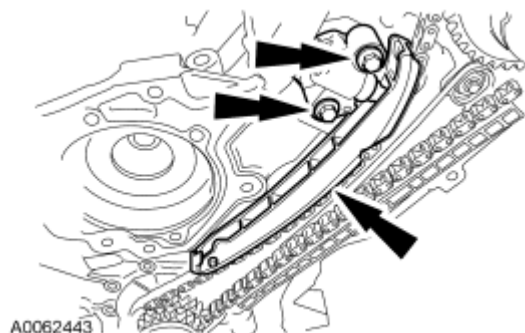


Fig. 74: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

16. Remove the retaining clip from the LH timing chain tensioner.

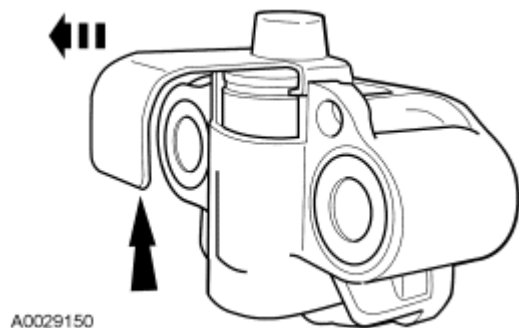


Fig. 75: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

17. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single colored (marked) chain link.

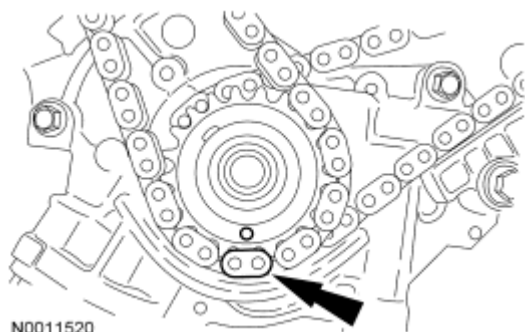


Fig. 76: Aligning Crankshaft Sprocket Timing Mark And RH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

NOTE: The lower half of the timing chain must be positioned above the tensioner arm dowel.

18. Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the colored (marked) chain link.

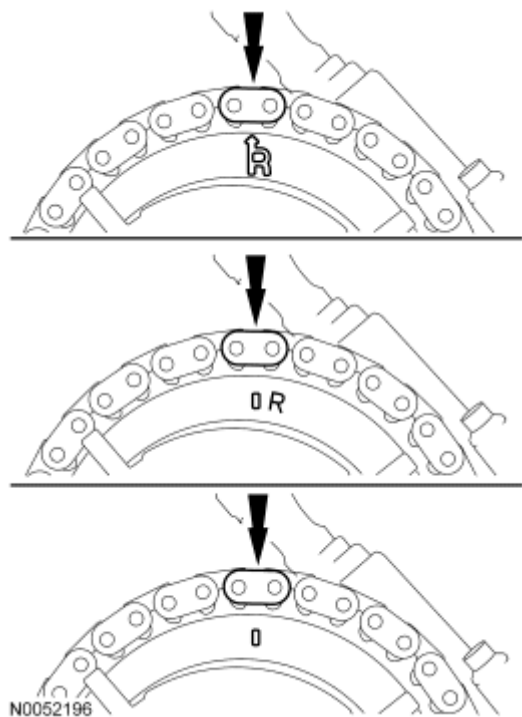


Fig. 77: Locating Camshaft Sprocket Timing Mark Aligned With Copper Chain Link

Courtesy of FORD MOTOR CO.

19. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and bolts.
 - Tighten to 25 N.m (18 lb-ft).

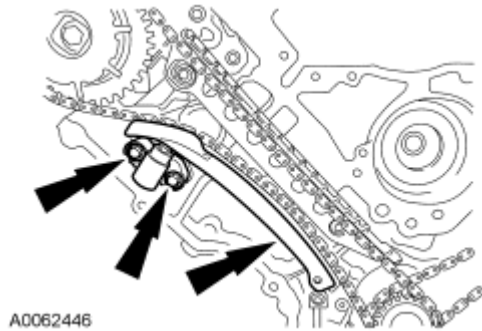


Fig. 78: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

20. Remove the retaining clip from the RH timing chain tensioner.

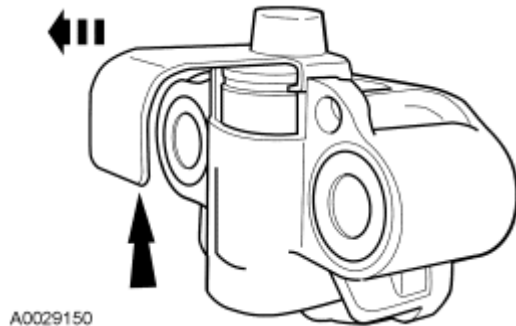


Fig. 79: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

21. As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.

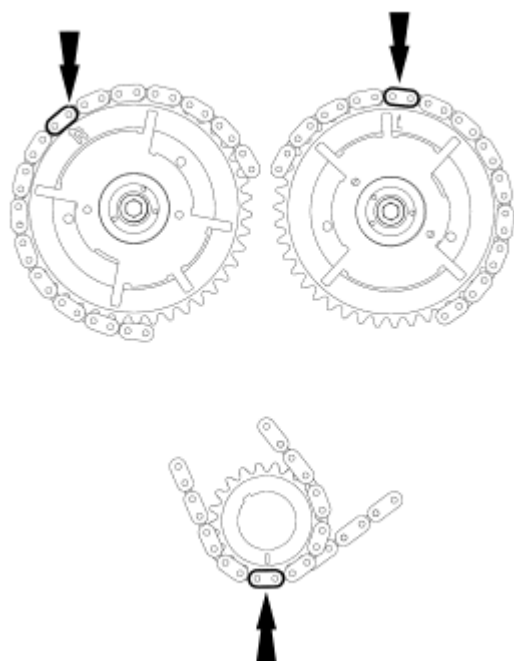


Fig. 80: Verify Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

22. Install the crankshaft sensor ring on the crankshaft.

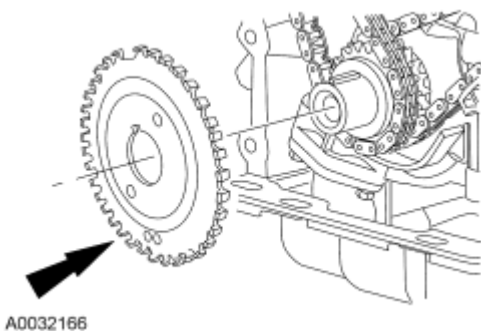
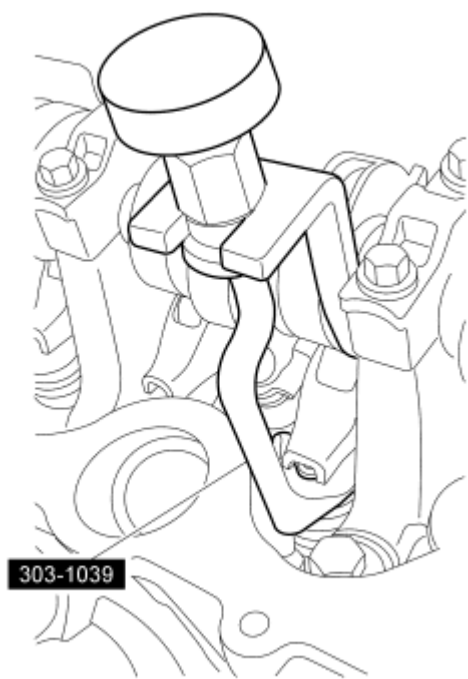


Fig. 81: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

NOTE: It is necessary to rotate the engine to position the camshaft lobes at base circle to install the roller followers.

23. Using the special tool, install all of the camshaft roller followers.
- Lubricate the roller followers with clean engine oil prior to installation.



N0010191

Fig. 82: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

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

VALVE TRAIN COMPONENTS - EXPLODED VIEW

NOTE: LH side.

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

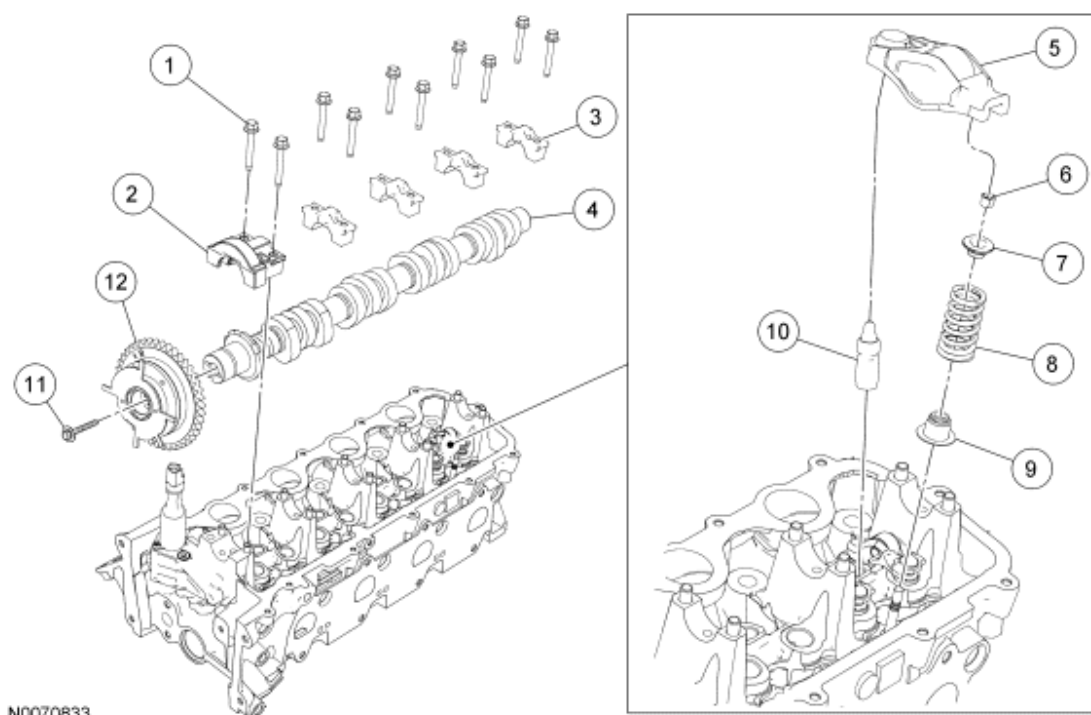


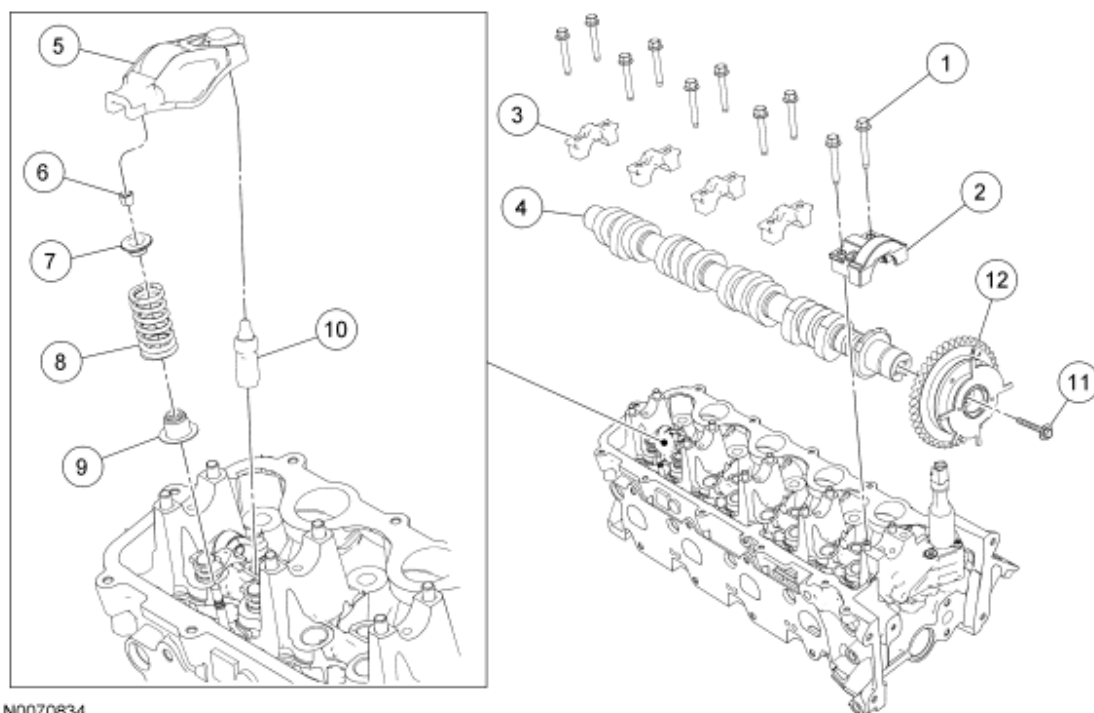
Fig. 83: Valve Train Components - Exploded View
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807834	Camshaft bearing cap bolt (10 required)
2	6B284	Camshaft front bearing cap
3	6B280	Camshaft bearing cap (4 required)
4	6C255	Camshaft
5	6529	Camshaft roller follower (12 required)
6	6518	Valve spring retainer key (24 required)
7	6514	Valve spring retainer (12 required)
8	6513	Valve spring (12 required)
9	6A517	Valve seal (12 required)
10	6C501	Hydraulic lash adjuster (12 required)
11	6279	Camshaft phaser and sprocket bolt
12	6C524	Camshaft phaser and sprocket

NOTE: RH side.

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



N0070834

Fig. 84: Valve Train Components - Exploded View - RH Side
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807834	Camshaft bearing cap bolt (10 required)
2	6B284	Camshaft front bearing cap
3	6B280	Camshaft bearing cap (4 required)
4	6251	Camshaft
5	6529	Camshaft roller follower (12 required)
6	6518	Valve spring retainer key (24 required)
7	6514	Valve spring retainer (12 required)
8	6513	Valve spring (12 required)
9	6A517	Valve seal (12 required)
10	6C501	Hydraulic lash adjuster (12 required)
11	6279	Camshaft phaser and sprocket bolt
12	6C524	Camshaft phaser and sprocket

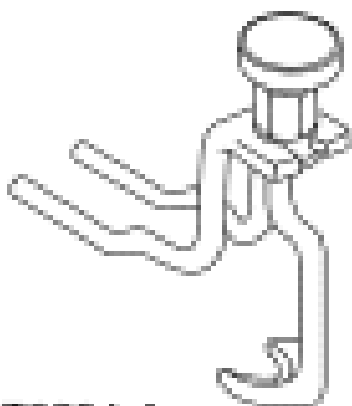
CAMSHAFT - LH

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-1039

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



ST2804-A



ST2869-A

Wedge, Timing Chain

303-1175

Material

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

REMOVAL

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

1. Position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

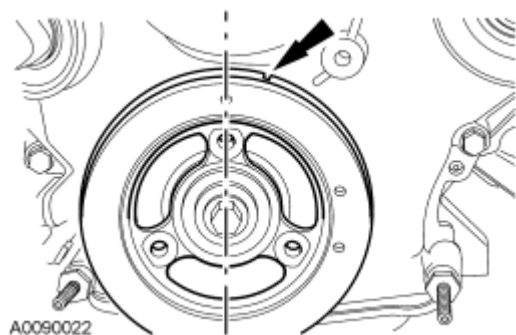


Fig. 85: Locating Crankshaft Damper Spoke Timing Mark
Courtesy of FORD MOTOR CO.

2. Remove the LH valve cover. For additional information, refer to **Valve Cover - LH**.

NOTE: **Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.**

3. Loosen and back off the LH camshaft phaser and sprocket bolt one full turn.
4. Disconnect the LH camshaft position (CMP) sensor electrical connector.

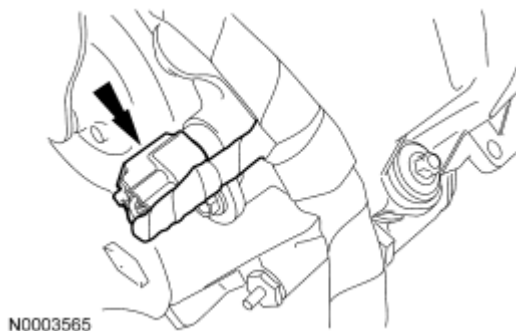


Fig. 86: Identifying LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the LH CMP sensor and the bolt.

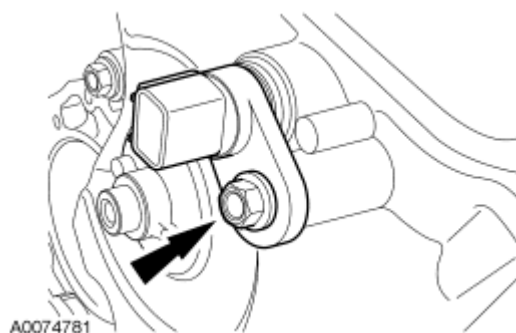


Fig. 87: Locating LH CMP Sensor Bolt

Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown, the crankshaft keyway will require one full additional rotation to 12 o'clock.

6. The No. 5 cylinder camshaft lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 5 cylinder.

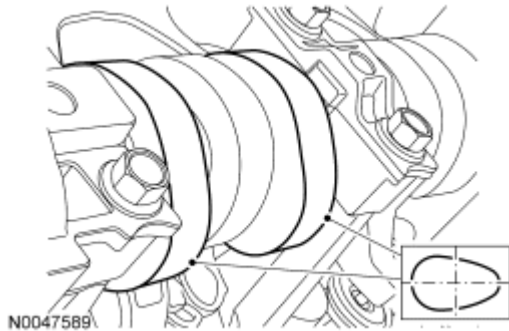


Fig. 88: Checking Position Of No. 5 Cylinder Intake And Exhaust Camshaft Lobes
Courtesy of FORD MOTOR CO.

7. Remove only the 3 camshaft roller followers shown in the **Fig. 89**.

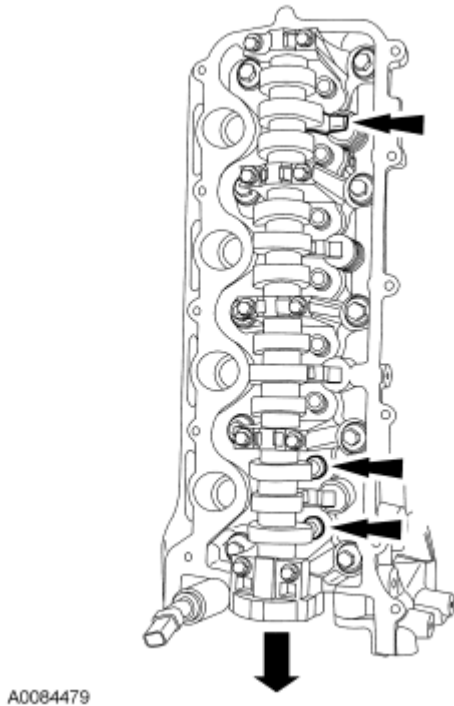


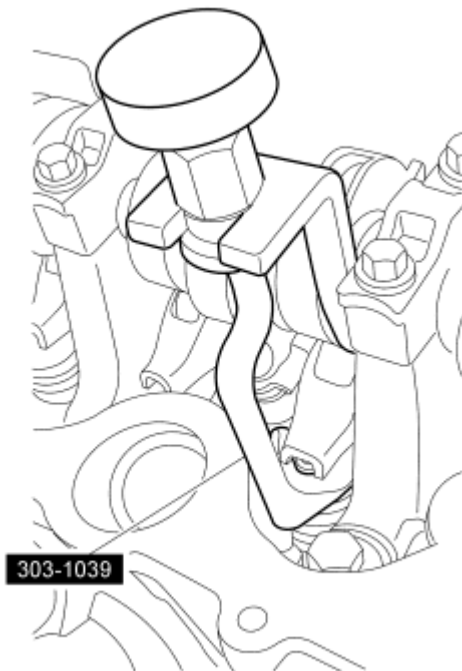
Fig. 89: Locating LH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

8. Using the special tool, remove only the 3 designated camshaft roller followers from the previous step.



N0010191

Fig. 90: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

NOTE: The crankshaft cannot be moved past the 6 o'clock position once set or engine damage may occur.

9. Rotate the crankshaft clockwise, as viewed from the front, positioning the crankshaft damper spoke at the 6 o'clock position and the timing mark indentation at the 7 o'clock position.

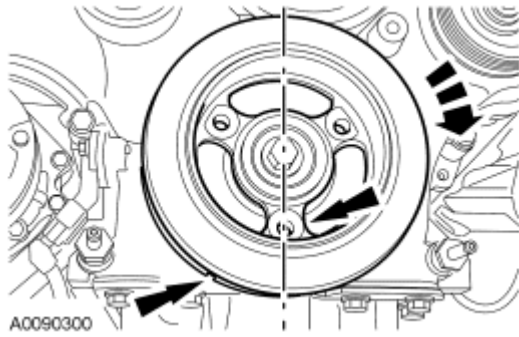


Fig. 91: Positioning Crankshaft Damper Spoke At 6 O'clock Position And Timing Mark Indentation At 7 O'clock Position
Courtesy of FORD MOTOR CO.

NOTE: Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.

NOTE: The Timing Chain Wedge tool must be installed square to the timing chain and the engine block.

NOTE: Engine front cover removed for clarity.

10. Install the special tool in the LH timing chain as shown.

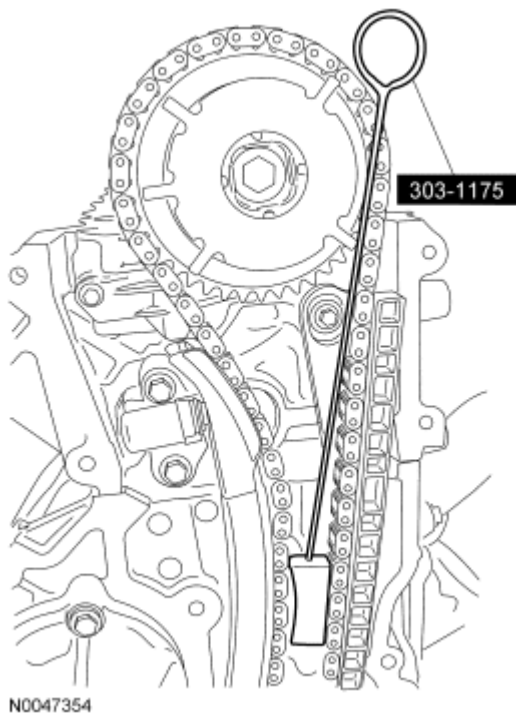


Fig. 92: Identifying Special Tool (303-1175)
Courtesy of FORD MOTOR CO.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

NOTE: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

NOTE: RH shown, LH similar.

11. Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.

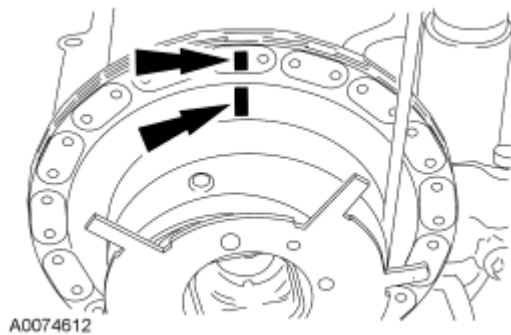


Fig. 93: Identifying Scribe Marks Of Camshaft Phaser And Chain
Courtesy of FORD MOTOR CO.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.

12. Remove the 2 bolts and the LH cylinder head camshaft front bearing cap.

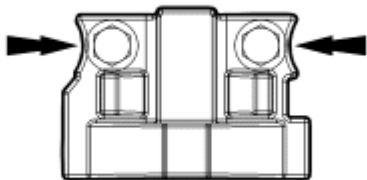
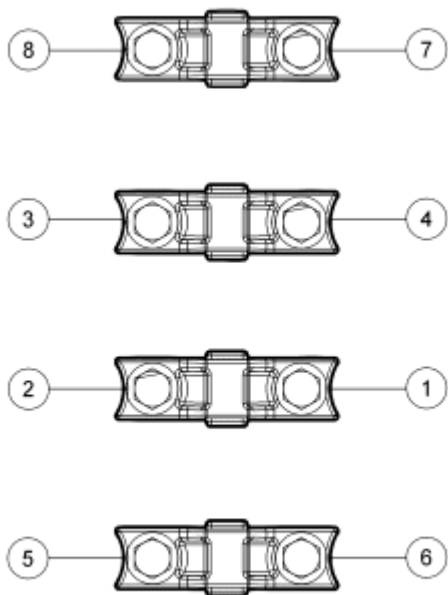


Fig. 94: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these

instructions may result in engine damage.

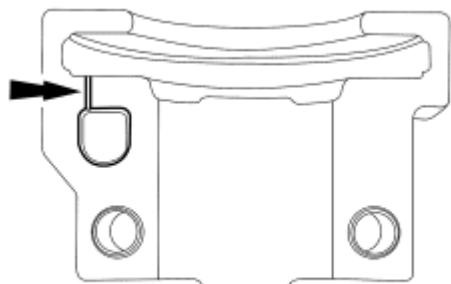
13. Remove the remaining bolts in the sequence shown and remove the LH cylinder head camshaft bearing caps.



N0070050

Fig. 95: Removing Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

14. Clean and inspect the LH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 96: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if

mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

15. Remove the bolt and withdraw the camshaft from the camshaft phaser and sprocket assembly, leaving the camshaft phaser and sprocket assembly in place.
 - Discard the bolt and washer.

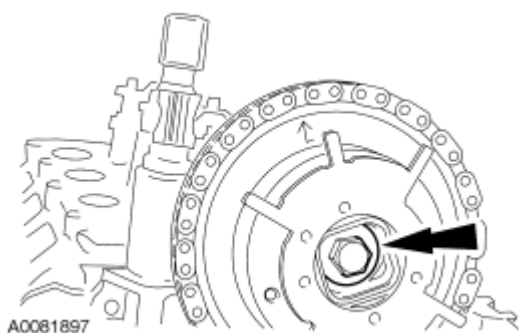


Fig. 97: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

16. Remove the camshaft.
17. Inspect the camshaft phaser and sprocket for damage. For additional information, refer to Camshaft Phaser and Sprocket.

INSTALLATION

1. Lubricate the camshaft and camshaft journals with clean engine oil.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

2. Install the camshaft into the camshaft phaser and sprocket assembly and onto the head. Install a new camshaft phaser and sprocket bolt finger-tight.

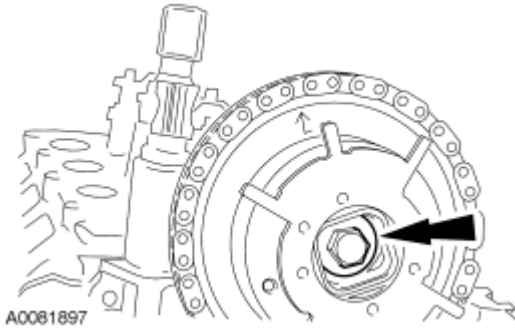


Fig. 98: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

NOTE: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

NOTE: RH shown, LH similar.

3. Verify the camshaft phaser and sprocket and timing chain scribe marks are still in alignment.

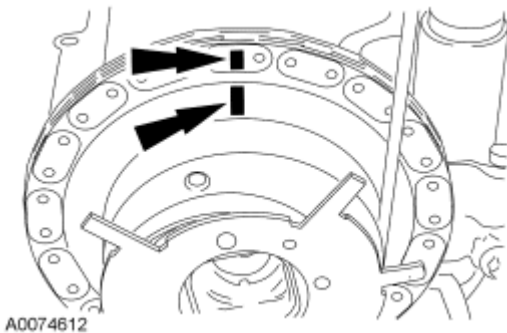


Fig. 99: Identifying Scribe Marks Of Camshaft Phaser And Chain
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

4. Install the camshaft bearing caps in their original locations.

- Lubricate the camshaft bearing caps with clean engine oil.
 - Position the front camshaft bearing cap.
 - Position the remaining camshaft bearing caps.
 - Install the bolts loosely.
5. Tighten the bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

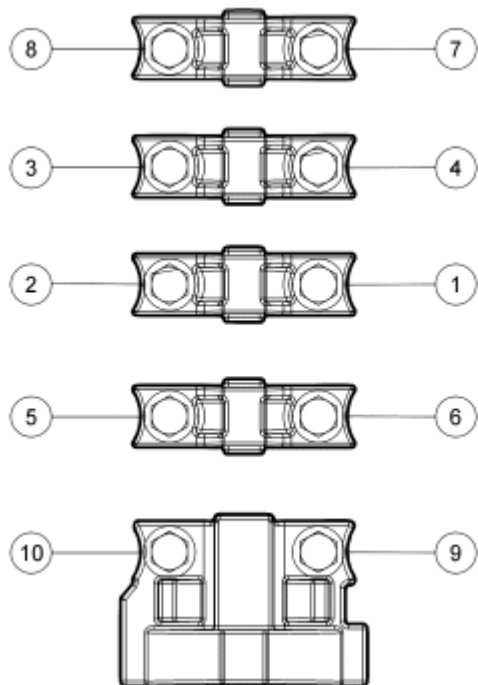


Fig. 100: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Engine front cover removed for clarity.

6. Remove the special tools.

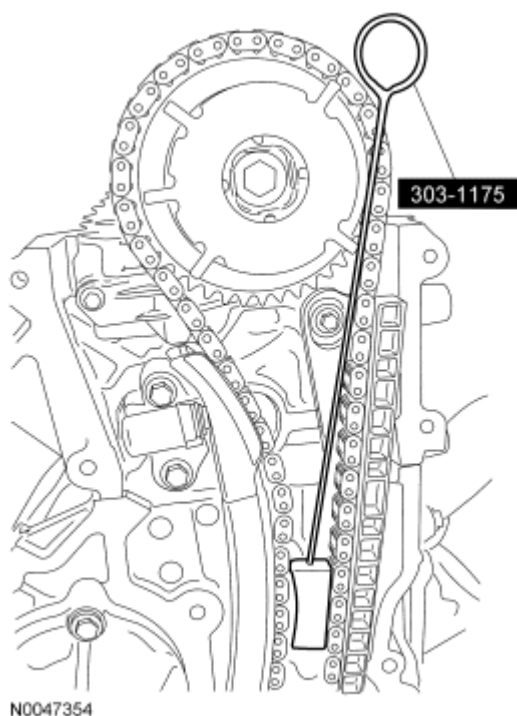


Fig. 101: Identifying Special Tool (303-1175)
Courtesy of FORD MOTOR CO.

7. Rotate the crankshaft a half turn counterclockwise and position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

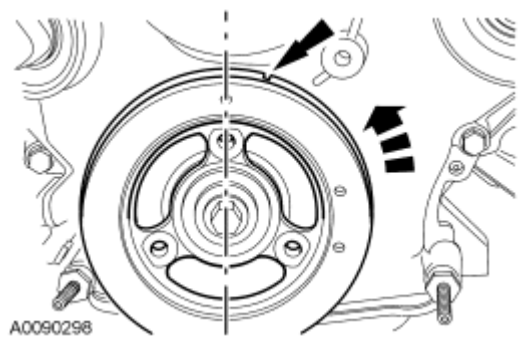


Fig. 102: Positioning Crankshaft Damper Spoke At 12 O'clock Position And Timing Mark Indentation At 1 O'clock Position
Courtesy of FORD MOTOR CO.

8. Verify correct camshaft position by noting the position of the No. 5 cylinder intake and exhaust camshaft lobes.

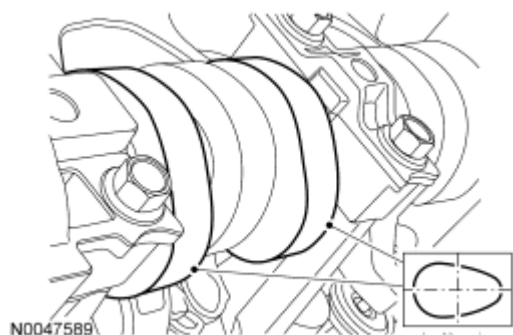


Fig. 103: Checking Position Of No. 5 Cylinder Intake And Exhaust Camshaft Lobes
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

9. Using the special tool, install the 3 originally removed camshaft roller followers.

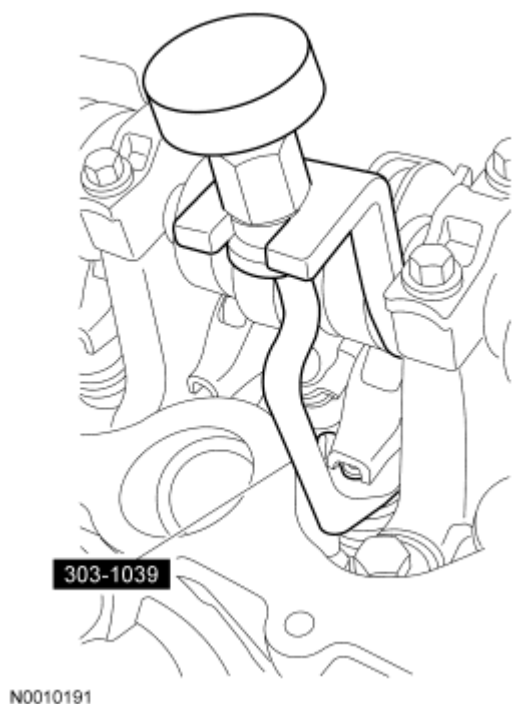


Fig. 104: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

10. Install the CMP sensor and the bolt.

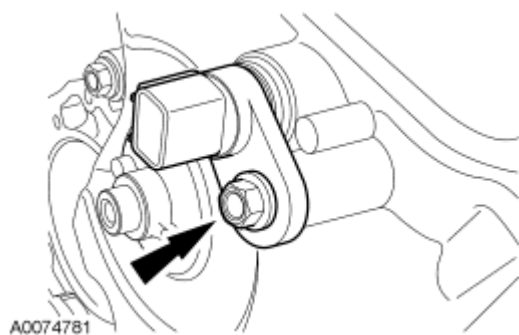


Fig. 105: Locating LH CMP Sensor Bolt
Courtesy of FORD MOTOR CO.

11. Connect the CMP electrical connector.

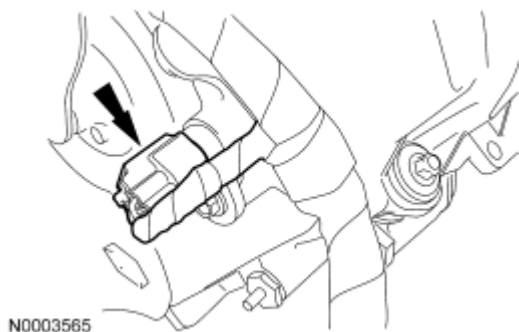


Fig. 106: Identifying LH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

12. Tighten the camshaft phaser and sprocket bolt in 2 stages:
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

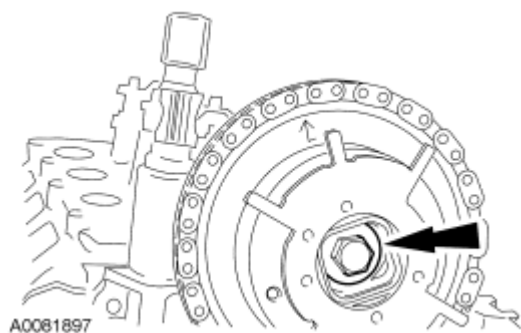


Fig. 107: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

13. Install the LH valve cover. For additional information, refer to **Valve Cover - LH**.

CAMSHAFT - RH

Special Tools

Illustration	Tool Name	Tool Number
ST2604-A	Compressor, Valve Spring	303-1039
ST2969-A	Wedge, Timing Chain	303-1175

Material

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

REMOVAL

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

1. Position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

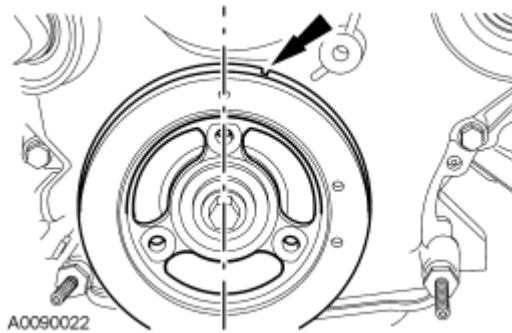


Fig. 108: Locating Crankshaft Damper Spoke Timing Mark
Courtesy of FORD MOTOR CO.

2. Remove the RH valve cover. For additional information, refer to Valve Cover - RH.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

3. Loosen and backoff the RH camshaft phaser and sprocket bolt one full turn.
4. Disconnect the RH camshaft position (CMP) sensor electrical connector.

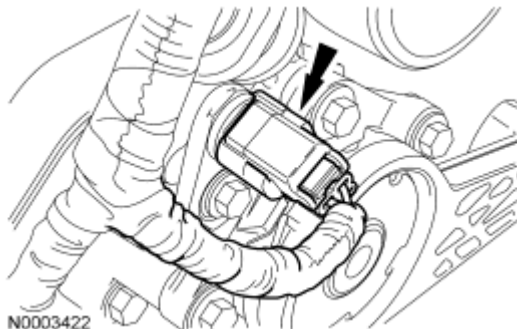


Fig. 109: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

5. Remove the bolt and the RH CMP sensor.

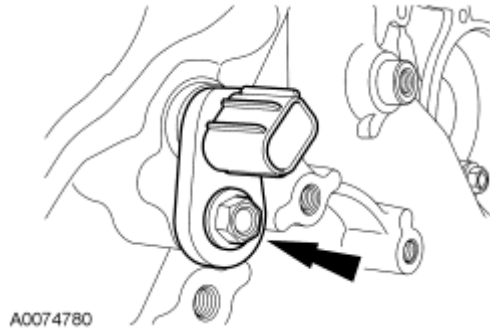


Fig. 110: Locating Camshaft (CMP) Sensor Bolt
Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to 12 o'clock.

6. The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake camshaft lobes and the exhaust lobe on the No. 1 cylinder.



Fig. 111: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

7. Remove only the 3 camshaft roller followers shown in the **Fig. 112**.

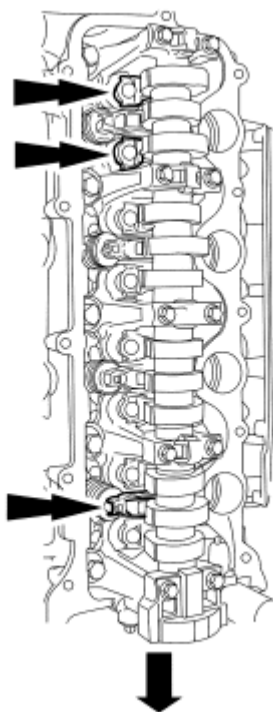


Fig. 112: Identifying RH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: The camshaft roller followers must be installed in their original locations. Record camshaft roller follower locations. Failure to follow these instructions may result in engine damage.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

8. Using the special tool, remove only the 3 designated camshaft roller followers from the previous step.



Fig. 113: Identifying Special Tool For Removing/Installing Camshaft Roller Followers

Courtesy of FORD MOTOR CO.

NOTE: The crankshaft cannot be moved past the 6 o'clock position once set or engine damage may occur.

9. Rotate the crankshaft clockwise, as viewed from the front, positioning the crankshaft damper spoke at the 6 o'clock position and the timing mark indentation at the 7 o'clock position.

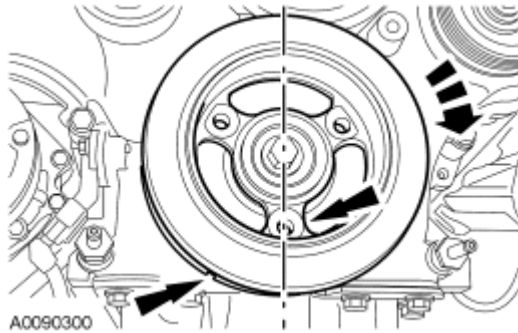


Fig. 114: Positioning Crankshaft Damper Spoke At 6 O'clock Position And Timing Mark Indentation At 7 O'clock Position

Courtesy of FORD MOTOR CO.

NOTE: Engine is not freewheeling. Camshaft procedure must be followed exactly or damage to valves and pistons will result.

NOTE: The Timing Chain Wedge tool must be installed square to the timing chain and the engine block.

NOTE: Engine front cover removed for clarity.

10. Install the special tool in the RH timing chain as shown.

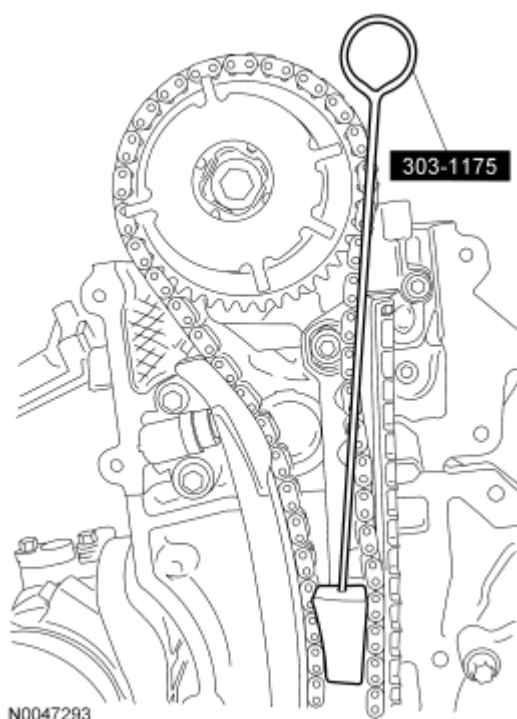


Fig. 115: Identifying Special Tool (303-1175)

Courtesy of FORD MOTOR CO.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

NOTE: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

11. Scribe a location mark on the timing chain and the camshaft phaser and sprocket assembly.

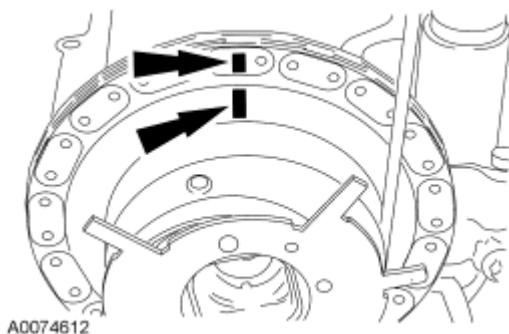
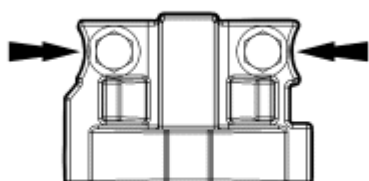


Fig. 116: Identifying Scribe Marks Of Camshaft Phaser And Chain

Courtesy of FORD MOTOR CO.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.

12. Remove the 2 bolts and the RH cylinder head camshaft front bearing cap.

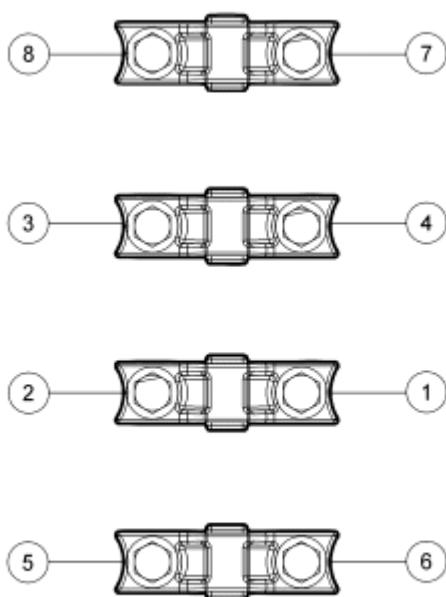


N0070049

Fig. 117: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.

13. Remove the remaining bolts in the sequence shown and remove the RH cylinder head camshaft bearing caps.

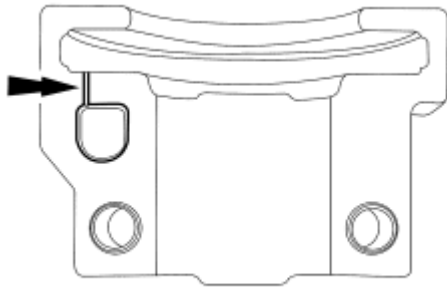


N0070050

Fig. 118: Removing Camshaft Bearing Caps Bolts In Sequence

Courtesy of FORD MOTOR CO.

14. Clean and inspect the RH camshaft bearing caps.
 - The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.

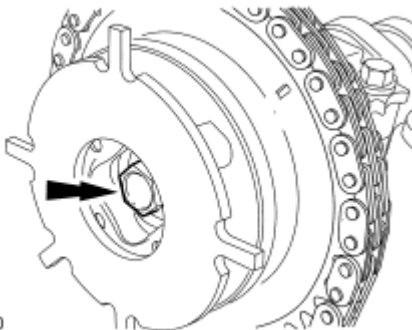


N0010448

Fig. 119: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

- NOTE:** Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.
- NOTE:** Only use hand tools to remove the camshaft phaser and sprocket bolt or damage may occur to the camshaft or camshaft phaser and sprocket.
- NOTE:** Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

15. Remove the bolt and withdraw the camshaft from the camshaft phaser and sprocket assembly, leaving the camshaft phaser and sprocket assembly in place.
 - Discard the bolt and washer.



N0008550

Fig. 120: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

16. Remove the camshaft.
17. Inspect the camshaft phaser and sprocket for damage. For additional information, refer to **Camshaft Phaser and Sprocket**.

INSTALLATION

1. Lubricate the camshaft and camshaft journals with clean engine oil.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to **Timing Drive Components**.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

2. Install the camshaft into the camshaft phaser and sprocket assembly and onto the head. Install a new camshaft phaser and sprocket bolt finger-tight.

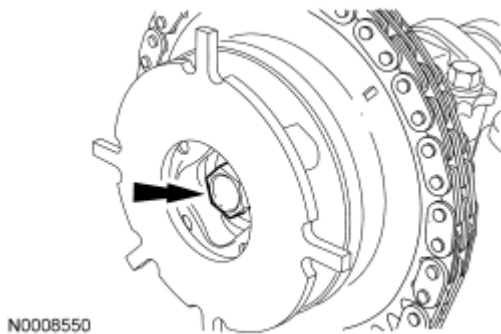


Fig. 121: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

NOTE: Do not remove the Timing Chain Wedge tool at any time during assembly. If the special tool is removed or out of placement, the engine front cover must be removed and the engine must be retimed. For additional information, refer to **Timing Drive Components**.

NOTE: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

3. Verify the camshaft phaser and sprocket and timing chain scribe marks are still in alignment.

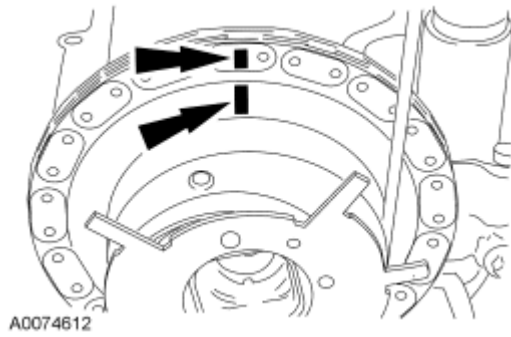


Fig. 122: Identifying Scribe Marks Of Camshaft Phaser And Chain
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the camshaft roller followers to move out of position when installing the camshaft.

4. Install the camshaft bearing caps in their original locations.
 - Lubricate the camshaft bearing caps with clean engine oil.
 - Position the front camshaft bearing cap.
 - Position the remaining camshaft bearing caps.
 - Install the bolts loosely.
5. Tighten the bolts in the sequence shown.
 - Tighten to 10 Nm (89 lb-in).

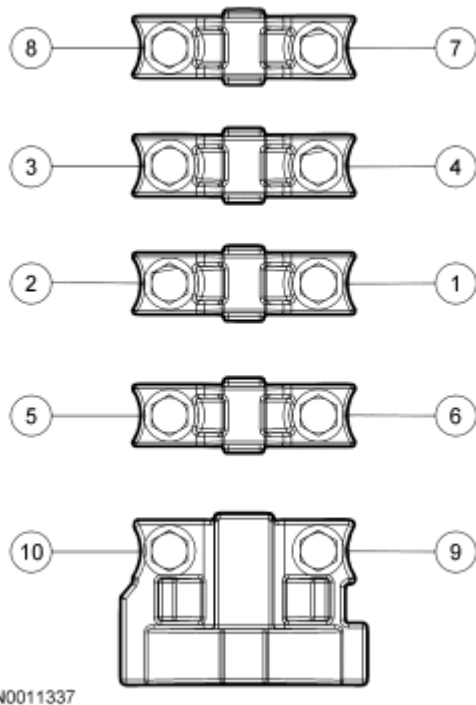


Fig. 123: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence

Courtesy of FORD MOTOR CO.

NOTE: Engine front cover removed for clarity.

6. Remove the special tool.

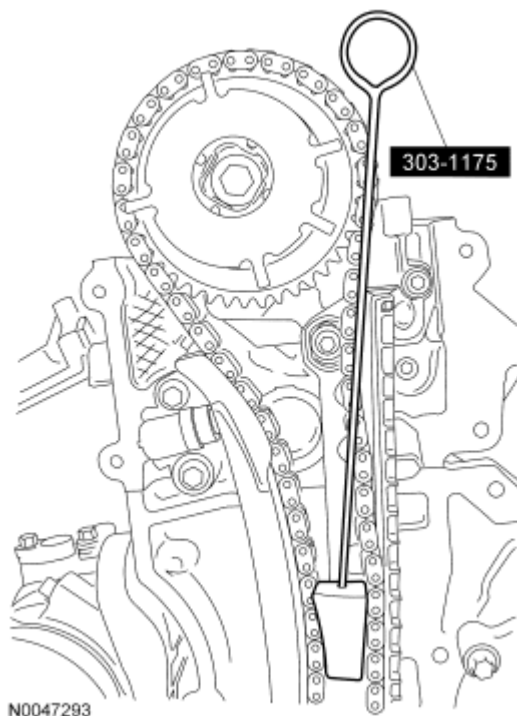


Fig. 124: Identifying Special Tool (303-1175)

Courtesy of FORD MOTOR CO.

7. Rotate the crankshaft a half turn counterclockwise and position the crankshaft damper spoke at the 12 o'clock position and the timing mark indentation at the 1 o'clock position.

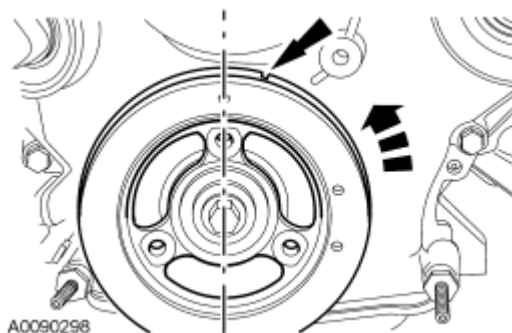


Fig. 125: Positioning Crankshaft Damper Spoke At 12 O'clock Position And Timing Mark Indentation At 1 O'clock Position

Courtesy of FORD MOTOR CO.

8. Verify correct camshaft position by noting the position of the No. 1 cylinder intake and exhaust camshaft

lobes.

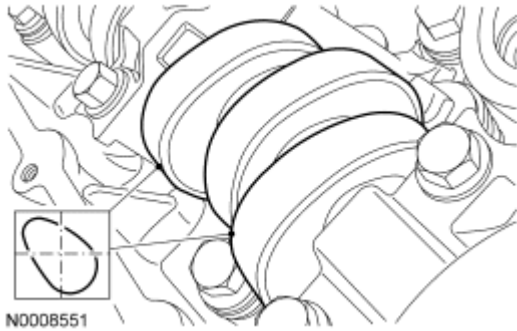


Fig. 126: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

9. Using the special tool, install the 3 originally removed camshaft roller followers.



Fig. 127: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

10. Install the CMP sensor and the bolt.
 - Tighten to 10 Nm (89 lb-in).

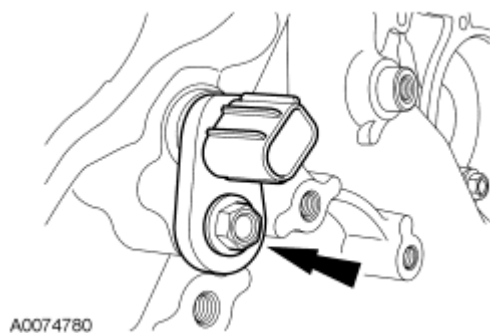


Fig. 128: Locating Camshaft (CMP) Sensor Bolt
Courtesy of FORD MOTOR CO.

11. Connect the CMP electrical connector.

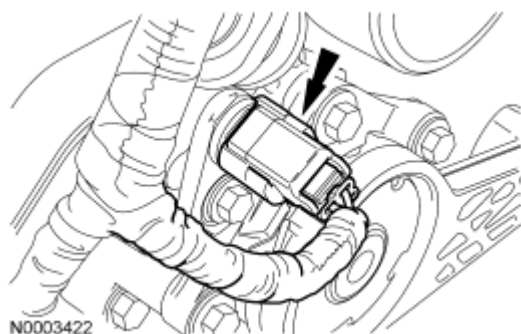


Fig. 129: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Only use hand tools to install the camshaft phaser and sprocket assembly or damage may occur to the camshaft or camshaft phaser and sprocket.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

12. Tighten the new camshaft phaser and sprocket bolt in 2 stages:
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

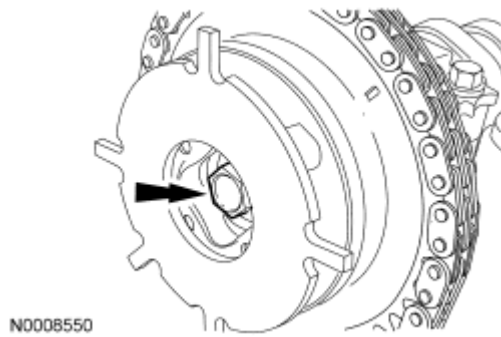


Fig. 130: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

13. Install the RH valve cover. For additional information, refer to **Valve Cover - RH**.

CAMSHAFT PHASER AND SPROCKET

Special Tools

Illustration	Tool Name	Tool Number
 ST2969-A	Locking Tool, Timing Chain	303-1175

REMOVAL

1. If servicing the RH camshaft phaser and sprocket, remove the RH camshaft. For additional information, refer to **Camshaft - RH**.
2. If servicing the LH camshaft phaser and sprocket, remove the LH camshaft. For additional information, refer to **Camshaft - LH**.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Do not remove the Timing Chain Locking Tool at any time during assembly. If the special tool is removed or out of placement, the engine

front cover must be removed and the engine must be retimed. For additional information, refer to Timing Drive Components.

3. Remove the camshaft phaser and sprocket from the timing chain.
4. Inspect the front of the camshaft phaser and sprocket for missing or damaged roll pins.
 - If the roll pins are missing or damaged, a new camshaft phaser and sprocket must be installed.

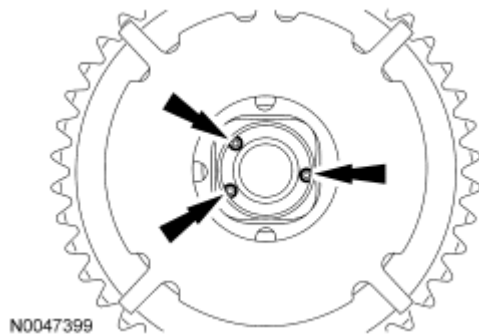


Fig. 131: Inspecting Front Of Camshaft Phase And Sprocket For Missing Or Damaged Roll Pins
Courtesy of FORD MOTOR CO.

5. Inspect the rear of the camshaft phaser and sprocket for a deformed or damaged location pin.
 - If the location pin is deformed or damaged, a new camshaft phaser and sprocket must be installed.

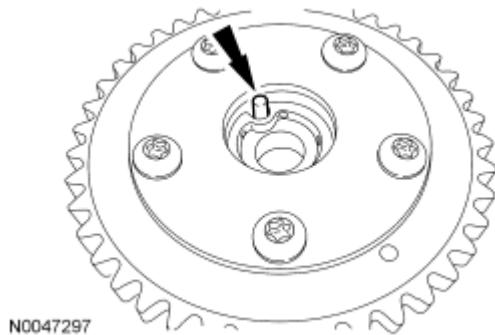
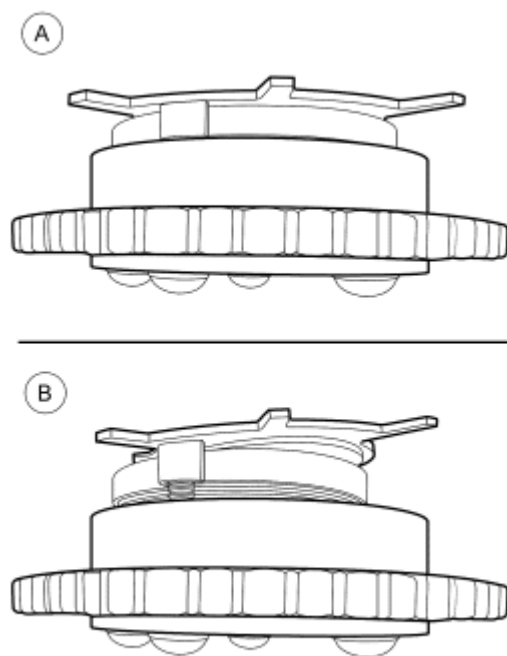


Fig. 132: Inspecting Rear Of Camshaft Phase And Sprocket
Courtesy of FORD MOTOR CO.

6. Visually inspect the camshaft phaser and sprocket for squareness (A). If the trigger wheel or spring is deformed or damaged (B), install a new camshaft phaser and sprocket.



N0047574

Fig. 133: Inspecting Camshaft Phaser And Sprocket For Squareness
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

1. If installing a new camshaft phaser and sprocket, transfer the original scribe mark to the new camshaft phaser and sprocket.

NOTE: The timing chain must be installed in its original position onto the camshaft phaser and sprocket using the scribed marks, or damage to valves and pistons will result.

NOTE: Damage to the camshaft phaser and sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

2. Align the scribe marks and position the camshaft phaser and sprocket into the timing chain.

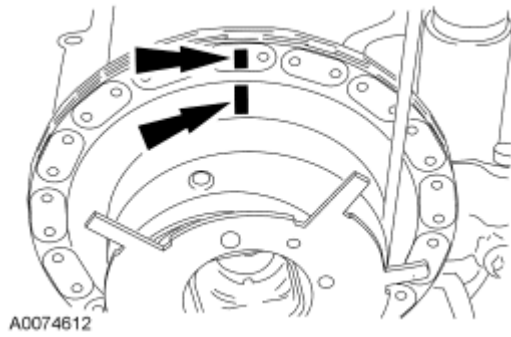


Fig. 134: Identifying Scribe Marks Of Camshaft Phaser And Chain
Courtesy of FORD MOTOR CO.

3. If servicing the RH camshaft phaser and sprocket, install the RH camshaft. For additional information, refer to **Camshaft - RH**.
4. If servicing the LH camshaft phaser and sprocket, install the LH camshaft. For additional information, refer to **Camshaft - LH**.

CAMSHAFT ROLLER FOLLOWER

Special Tools

Illustration	Tool Name	Tool Number
ST2B04-A	Compressor, Valve Spring	303-1039

Material

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

REMOVAL

1. Depending on the roller follower being serviced, remove the LH or RH valve cover. For additional information, refer to **Valve Cover - LH** or **Valve Cover - RH**.
2. Rotate the crankshaft until the piston for the valve being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

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

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to **Cylinder Head**.

NOTE: It may be necessary to push the valve down while compressing the spring.

3. Using the special tool, compress the valve spring and remove the camshaft roller follower.



Fig. 135: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

4. Repeat the previous 2 steps for each roller follower being serviced.
5. Inspect the roller follower. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

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

NOTE: Lubricate the roller follower with clean engine oil.

1. Using the special tool, compress the valve spring and install the camshaft roller follower.



Fig. 136: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

2. Repeat the previous step for each roller follower being serviced.
3. Depending on the valve being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH.

VALVE SPRINGS

Special Tools

Illustration	Tool Name	Tool Number
	Compressor, Valve Spring	303-1039

Material

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

REMOVAL

1. Depending on the valve spring being serviced, remove the LH or RH valve cover. For additional

information, refer to **Valve Cover - LH** or **Valve Cover - RH**.

2. Remove the spark plug. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.
3. Rotate the crankshaft until the piston for the valve spring being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

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

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to **Cylinder Head**.

NOTE: It may be necessary to push the valve down while compressing the spring.

4. Using the special tool, compress the valve spring and remove the camshaft roller follower.



Fig. 137: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

5. Use compressed air in the cylinder to hold both valves in position.
 - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

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

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. If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to **Cylinder Head**.

- Using the special tool, compress the valve spring and remove the valve spring retainer keys.



Fig. 138: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

- Remove the valve spring retainer and the valve spring.
- Inspect the valve spring. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

INSTALLATION

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

- Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.



Fig. 139: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

- Relieve the air pressure from the cylinder.

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

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

NOTE: Lubricate the camshaft roller followers with clean engine oil prior to installation.

- Using the special tool, compress the valve spring and install the camshaft roller follower.



Fig. 140: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

- Install the spark plug. For additional information, refer to ENGINE IGNITION - 4.6L (3V) article.
- Depending on the valve spring being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH.

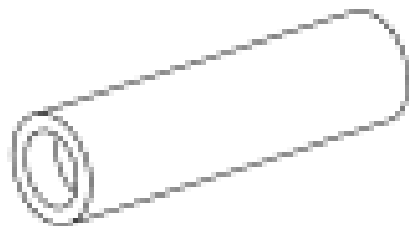
VALVE SEALS

Special Tools

Illustration	Tool Name	Tool Number
ST2804-A	Compressor, Valve Spring	303-1039

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



ST1332-A

Installer, Valve Stem Oil Seal

303-383 (T91P-6571-A)

Material

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

REMOVAL

1. Depending on the valve seal being serviced, remove the LH or RH valve cover. For additional information, refer to **Valve Cover - LH** or **Valve Cover - RH**.
2. Remove the spark plug. For additional information, refer to **ENGINE IGNITION - 4.6L (3V)** article.
3. Rotate the crankshaft until the piston for the valve seal being serviced is at the top of its stroke with the intake valve and the exhaust valves closed.

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

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to **Cylinder Head**.

NOTE: It may be necessary to push the valve down while compressing the spring.

4. Using the special tool, compress the valve spring and remove the camshaft roller follower.



Fig. 141: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

5. Use compressed air in the cylinder to hold both valves in position.
 - Apply a minimum of 965 kPa (140 psi) of compressed air into the cylinder.

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

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. If a valve drops into the cylinder, remove the cylinder head. For additional information, refer to Cylinder Head.

6. Using the special tool, compress the valve spring and remove the valve spring retainer keys.



Fig. 142: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

7. Remove the valve spring retainer, the valve spring and the valve seal.
 - Discard the valve seal.
8. Inspect the components. For additional information, refer to ENGINE SYSTEM - GENERAL INFORMATION article.

INSTALLATION

NOTE: Lubricate the valve seal and valve stem with clean engine oil prior to installation.

1. Position a new valve seal onto the valve stem.
2. Using the special tool, install the new valve seal.

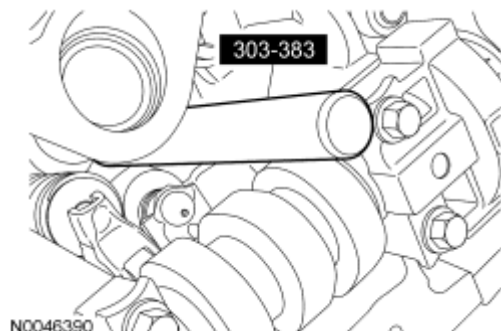


Fig. 143: Installing Valve Seal Using Special Tool
Courtesy of FORD MOTOR CO.

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

3. Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.



Fig. 144: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

4. Relieve the air pressure from the cylinder.

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

engine damage.

NOTE: Do not allow the valve keepers to fall off of the valve or the valve may drop into the cylinder. If a valve drops into the cylinder, the cylinder head must be removed. For additional information, refer to Cylinder Head.

NOTE: It may be necessary to push the valve down while compressing the spring.

NOTE: Lubricate the camshaft roller followers with clean engine oil prior to installation.

- Using the special tool, compress the valve spring and install the camshaft roller follower.



Fig. 145: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

- Install the spark plug. For additional information, refer to ENGINE IGNITION - 4.6L (3V) article.
- Depending on the valve seal being serviced, install the LH or RH valve cover. For additional information, refer to Valve Cover - LH or Valve Cover - RH.

HYDRAULIC LASH ADJUSTER

Material

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

REMOVAL AND INSTALLATION

- Remove the camshafts. For additional information, refer to Valve Train Components - Exploded View and Camshaft - LH and Camshaft - RH.
- Remove the remaining roller followers from the cylinder head being serviced.

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

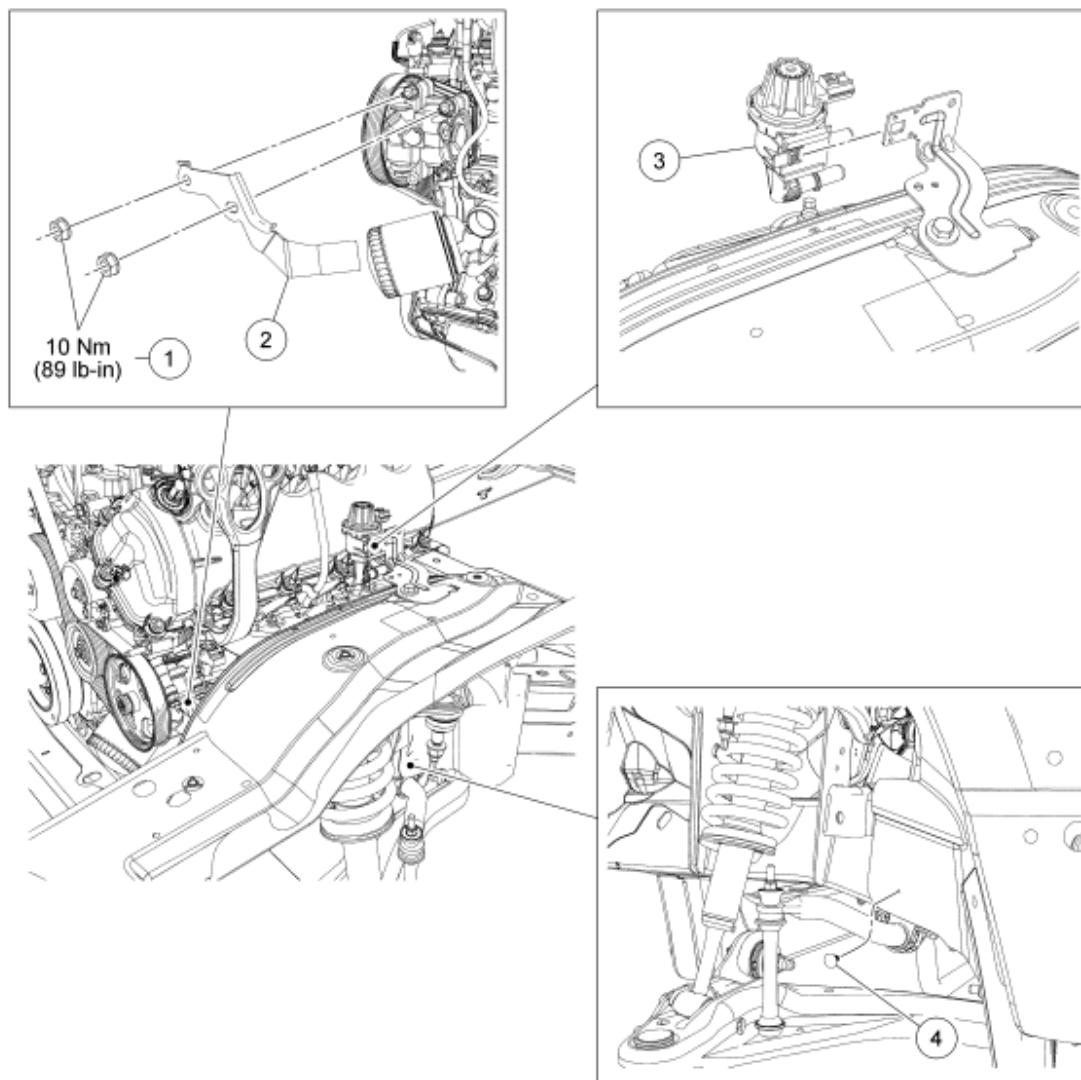
3. Remove the hydraulic lash adjusters that are being serviced.
4. Inspect the hydraulic lash adjusters. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

NOTE: Lubricate each of the hydraulic lash adjusters with clean engine oil prior to installation.

5. To install, reverse the removal procedure.

EXHAUST MANIFOLD - LH

REMOVAL



N0074120

Fig. 146: Wiring Harness Bracket, Evaporative Emissions (EVAP) Canister Purge Valve and Splash Shield Push Pin With Torque Specification
 Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N805403	Battery cable bracket nuts (2 required)
2	10W652	Battery cable bracket (part of 14A280)
3	9G641	Evaporative emissions (EVAP) canister purge valve
4	388577	Splash shield push pin

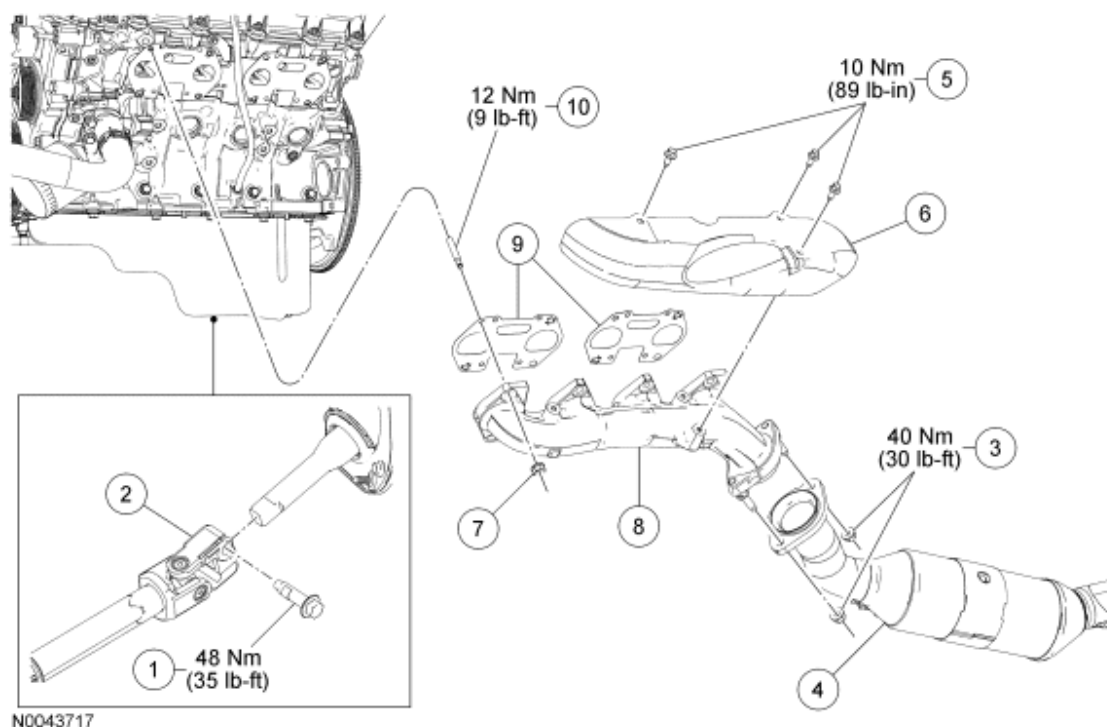


Fig. 147: LH Exhaust Manifold With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W710570	Intermediate steering shaft pinch bolt
2	3C662	Intermediate steering shaft
3	W705443	Dual converter Y-pipe flange nuts (4 required)
4	5F250	Dual converter Y-pipe
5	W707130	LH exhaust manifold heat shield bolts (3 required)
6	9Y427	LH exhaust manifold heat shield
7	W701706	LH exhaust manifold nut (8 required)
8	9431	LH exhaust manifold
9	9Y431	LH exhaust manifold gaskets (2 required)
10	W707747	LH exhaust manifold stud (8 required)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Detach the evaporative emission (EVAP) canister purge valve from the bracket and position the valve aside.

CAUTION: Do not allow the lower steering column shaft to rotate while it is disconnected from the gear or the clockspring may be damaged. If

there is evidence that the lower steering column shaft has rotated, the clockspring must be removed and recentered. For additional information, refer to SUPPLEMENTAL RESTRAINT SYSTEM article.

3. Remove the intermediate steering shaft pinch bolt and disconnect the intermediate steering shaft from the lower steering column shaft.
4. Remove the 4 nuts and disconnect the dual converter Y-pipe from the exhaust manifolds.
5. Remove the nuts and position the battery cable bracket aside.
6. Remove the bolts and the LH exhaust manifold heat shield.
7. Remove and discard the push pin.
8. Remove the 8 nuts, the LH exhaust manifold and the gaskets.
 - Deflect the inner fender splash shield and remove the manifold between the splash shield and the frame rail.
 - Discard the nuts and the gaskets.

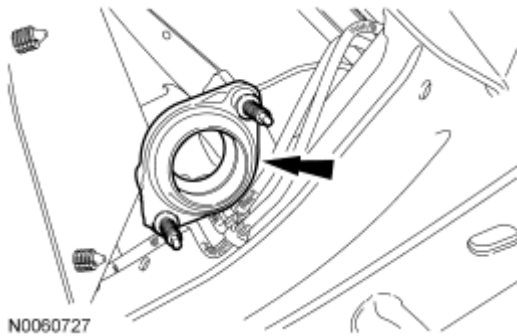


Fig. 148: Locating Exhaust Manifold And Gaskets
Courtesy of FORD MOTOR CO.

9. Remove and discard the 8 LH exhaust manifold studs.

INSTALLATION

1. Inspect the LH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to ENGINE SYSTEM - GENERAL INFORMATION article.
2. Install 8 new LH exhaust manifold studs.
 - Tighten to 12 Nm (9 lb-ft).
3. Position the new gaskets, the LH exhaust manifold and install new nuts finger-tight.
 - Deflect the inner fender splash shield and install the exhaust manifold between the splash shield and the frame rail.

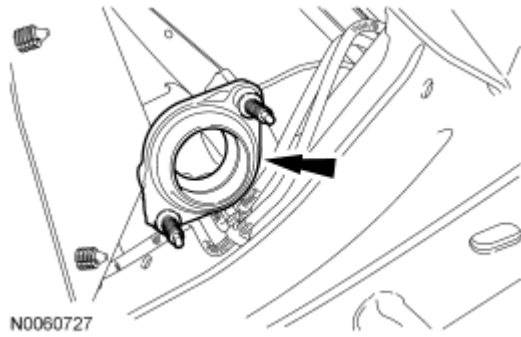


Fig. 149: Locating Exhaust Manifold And Gaskets
Courtesy of FORD MOTOR CO.

4. Tighten the exhaust manifold nuts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).

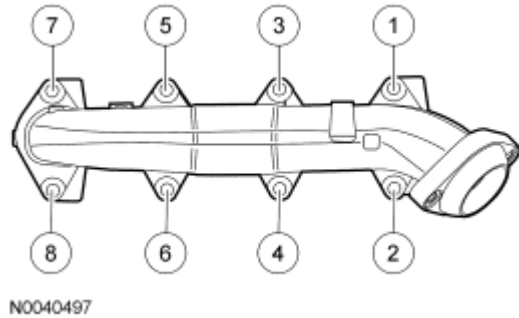


Fig. 150: Identifying Tightening Sequence Of Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

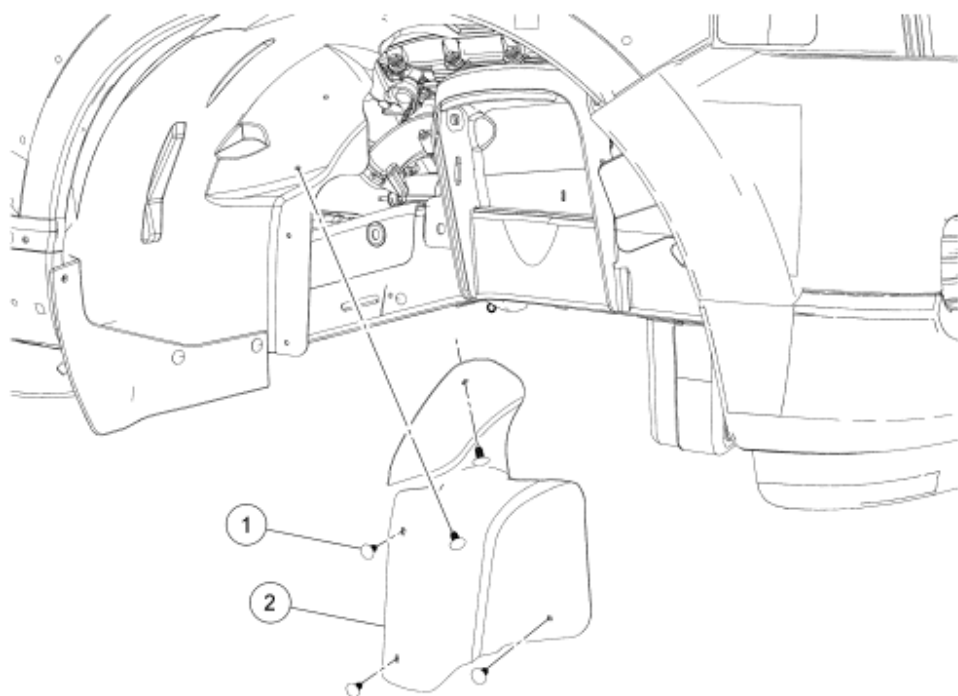
5. Position the inner fender splash shield and install a new push pin.
6. Install the heat shield and the bolts.
 - Tighten to 10 Nm (89 lb-in).
7. Position the battery cable bracket and install the nuts.
 - Tighten to 10 Nm (89 lb-in).
8. Connect the dual converter Y-pipe to the exhaust manifolds and install the 4 nuts.
 - Tighten to 40 Nm (30 lb-ft).
9. Connect the intermediate steering shaft to the lower steering column shaft and install the pinch bolt.
 - Tighten to 48 Nm (35 lb-ft).
10. Attach the EVAP canister purge valve to the bracket.

EXHAUST MANIFOLD - RH

REMOVAL

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N0074139

Fig. 151: RH Splash Shield
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	388577	RH splash shield push pin (5 required)
2	16034	RH splash shield

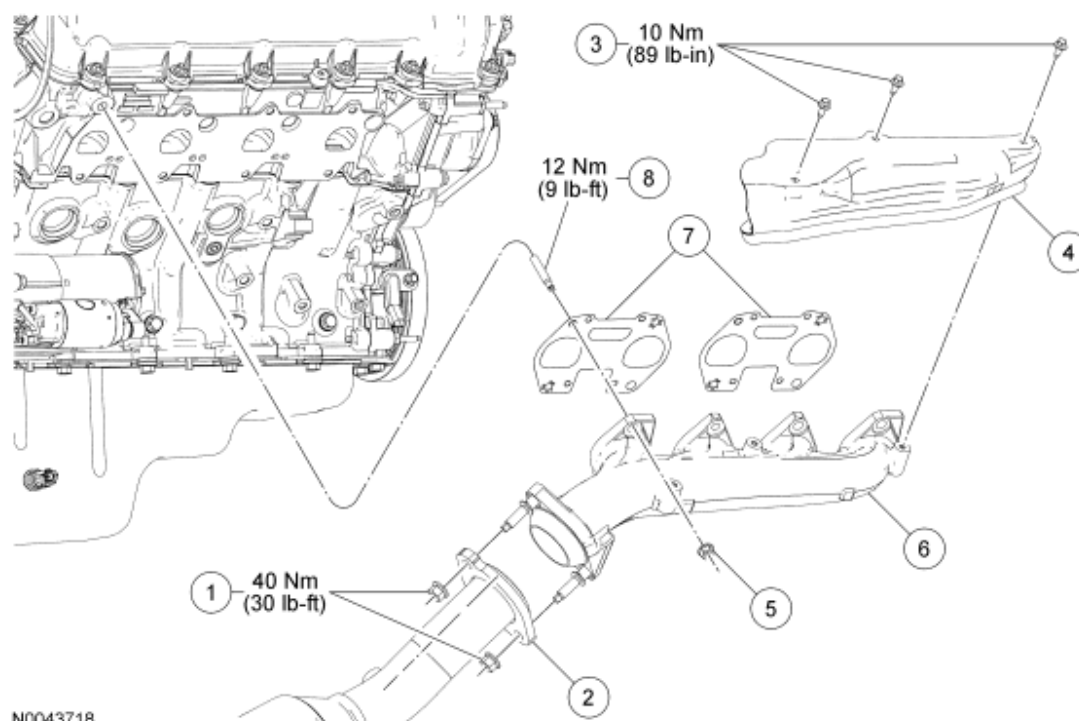


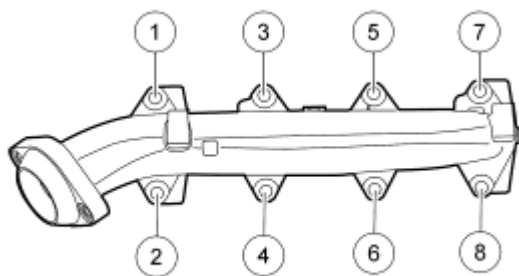
Fig. 152: RH Exhaust Manifold With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W705443	Dual converter Y-pipe flange nuts (4 required)
2	5F250	Dual converter Y-pipe
3	W707130	RH exhaust manifold heat shield bolts (3 required)
4	9A462	RH exhaust manifold heat shield
5	W701706	RH exhaust manifold nut (8 required)
6	9430	RH exhaust manifold
7	9Y431	RH exhaust manifold gaskets (2 required)
8	W707747	RH exhaust manifold stud (8 required)

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the 4 nuts and disconnect the dual converter Y-pipe from the exhaust manifolds.
3. Remove the bolts and the RH exhaust manifold heat shield.
4. Remove the pushpins and the RH splash shield.
5. Remove the 8 nuts, the RH exhaust manifold and the gaskets.
 - Discard the nuts and the gaskets.
6. Remove and discard the 8 RH exhaust manifold studs.

INSTALLATION

1. Inspect the exhaust manifold gasket mating surfaces for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
2. Install 8 new RH exhaust manifold studs.
 - Tighten to 12 Nm (9 lb-ft).
3. Position the new gaskets, the RH exhaust manifold and install new nuts finger-tight.
4. Tighten the nuts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).



N0040498

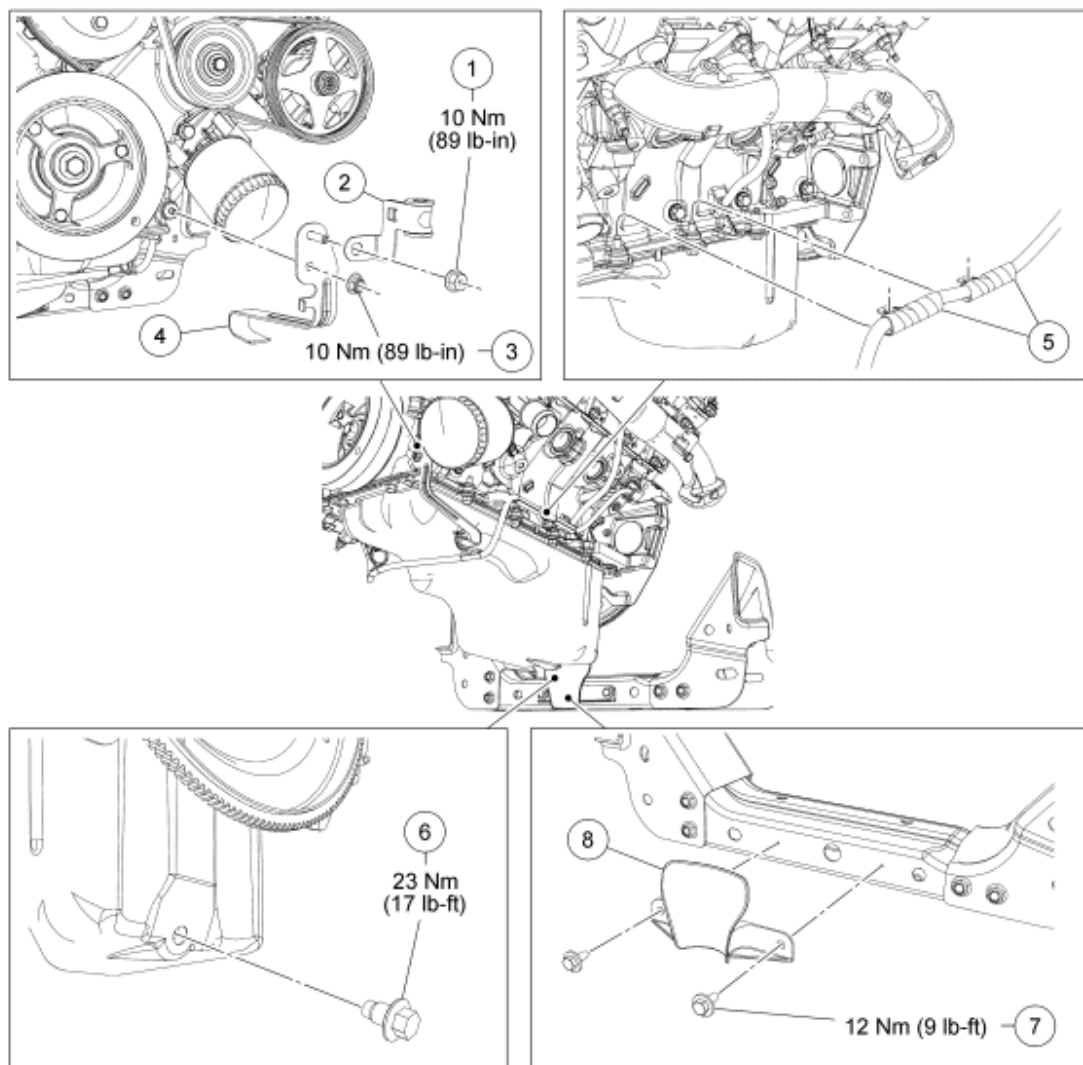
Fig. 153: Identifying Tightening Sequence Of Exhaust Manifold-To-Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

5. Position the RH splash shield and install the pushpins.
6. Position the heat shield and install the bolts.
 - Tighten to 10 Nm (89 lb-in).
7. Connect the dual converter Y-pipe to the exhaust manifolds and install the nuts.
 - Tighten to 40 Nm (30 lb-ft).

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



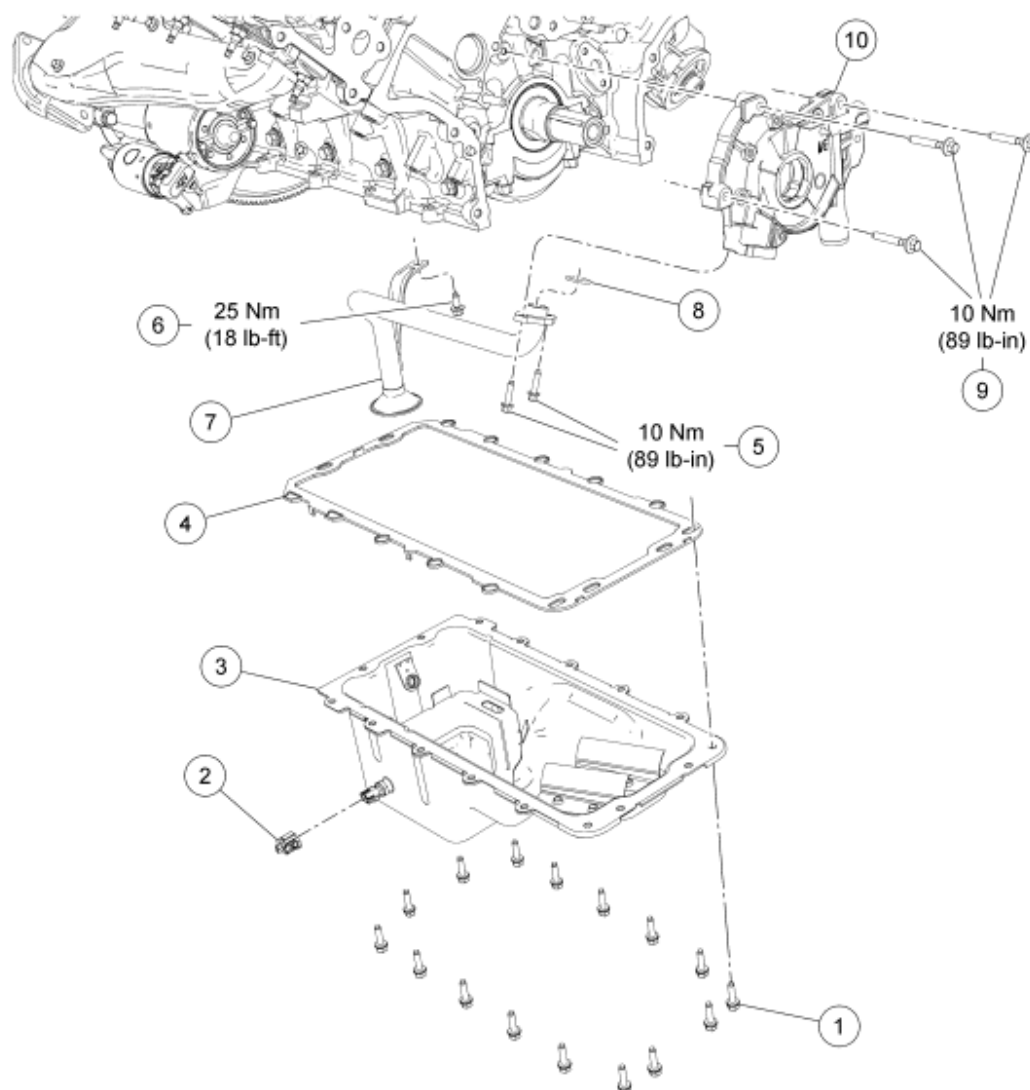
N0074140

Fig. 154: Brackets, Oil Drain Plug and Oil Splash Shield With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W805320	Power steering pressure (PSP) hose bracket nut
2	81396	PSP hose bracket (part of 3A719)
3	W520101	Battery cable bracket nut
4	10A779	Battery cable bracket (part of 14A280)
5	13506	Engine block heater wiring harness retainers (2 required)
6	6730	Oil pan drain plug
7	W710617	Oil splash shield bolt (2 required)
8	5D121	Oil splash shield

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N0040530

Fig. 155: Engine Lubrication Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701605	Oil pan bolt (16 required)
2	14A464	Oil temperature sensor electrical connector (part of 12B637)
3	6676	Oil pan
4	6710	Oil pan gasket
5	N806155	Oil pump screen and pickup tube-to-oil pump bolts (2 required)
6	N605904	Oil pump screen and pickup tube support bracket bolt
7	6622	Oil pump screen and pickup tube

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8	6625	Oil pump screen and pickup tube O-ring seal
9	N806183	Oil pump bolts (3 required)
10	6621	Oil pump

OIL PAN

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the front axle, if equipped. For additional information, refer to **FRONT DRIVE AXLE/DIFFERENTIAL - DANA 30** article.
3. Remove the stabilizer bar. For additional information, refer to **FRONT SUSPENSION - REAR WHEEL DRIVE (RWD)** article.
4. Remove the drain plug and drain the engine oil. Install the drain plug when finished.
 - Tighten to 23 Nm (17 lb-ft).
5. Remove the nut and position the power steering pressure (PSP) hose bracket aside.
6. Remove the nut and position the battery cable bracket aside.
7. Disconnect the oil temperature sensor electrical connector.
8. Remove the bolts and the oil drain splash shield.
9. If equipped with a block heater, detach the block heater wiring harness retainers from the LH side oil pan bolts.
10. Remove the bolts, the oil pan and the gasket.
 - Discard the gasket.

INSTALLATION

CAUTION: 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. Failure to follow these directions can cause future oil leaks.

1. Clean and inspect the sealing surfaces with silicone gasket remover, metal surface prep, and a plastic scraper. Follow the directions on the packaging.

NOTE: If the oil pan and gasket are not secured within 4 minutes of sealer application, the sealant must be removed and the sealing surfaces cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

2. Apply silicone gasket and sealant in 2 places as shown.

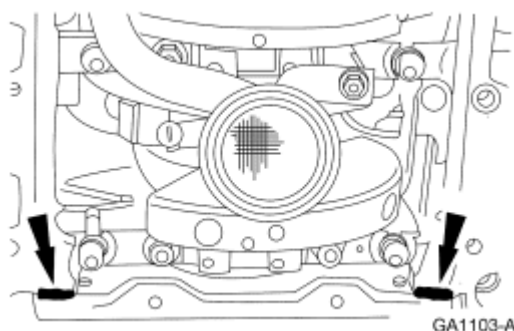
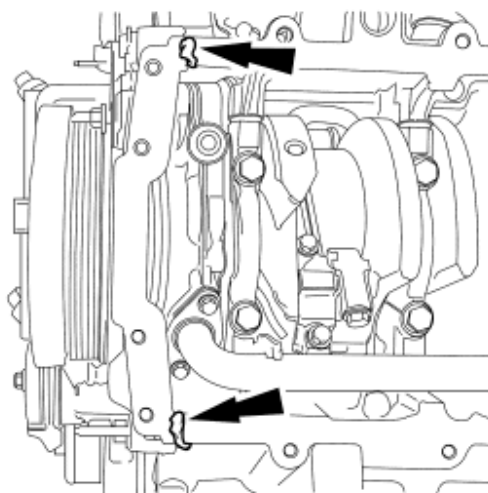


Fig. 156: Applying Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

NOTE: If the oil pan and gasket are not secured within 4 minutes of sealer application, the sealant must be removed and the sealing surfaces cleaned with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

3. Apply silicone gasket and sealant in 2 places as shown.

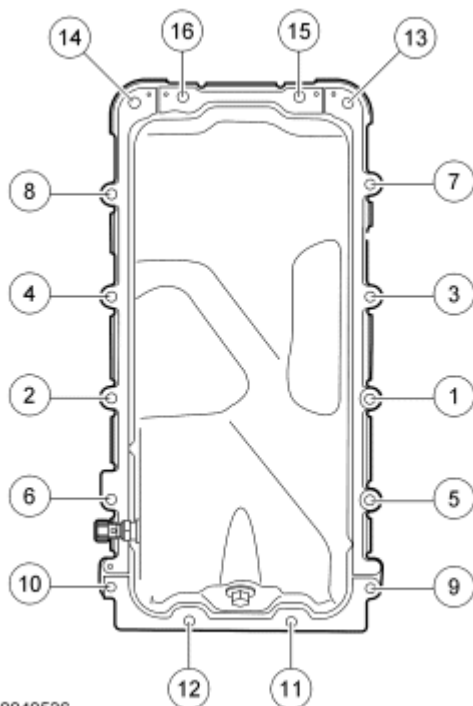


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Fig. 157: Applying Silicone Gasket And Sealant At Engine Front Cover-To-Cylinder Block Sealing Surface

Courtesy of FORD MOTOR CO.

4. Position a new oil pan gasket and the oil pan and install the bolts finger-tight.
5. Tighten the bolt in 3 stages in the sequence shown.
 - Stage 1: Tighten to 2 Nm (18 lb-in).
 - Stage 2: Tighten to 20 Nm (15 lb-ft).
 - Stage 3: Tighten an additional 60 degrees.



N0040536

Fig. 158: Identifying Tightening Sequence Of Bolts

Courtesy of FORD MOTOR CO.

6. If equipped with a block heater, attach the block heater wiring harness retainers to the LH oil pan bolts.
7. Position the oil drain splash shield and install the bolts.
 - Tighten to 12 Nm (9 lb-ft).
8. Connect the oil temperature sensor electrical connector.
9. Attach the battery cable bracket and install the nut.
 - Tighten to 10 Nm (89 lb-in).
10. Attach the PSP hose bracket and install the nut.
 - Tighten to 10 Nm (89 lb-in).
11. Install the stabilizer bar. For additional information, refer to **FRONT SUSPENSION - REAR WHEEL DRIVE (RWD)** article.
12. Install the front axle, if equipped. For additional information, refer to **FRONT DRIVE AXLE/DIFFERENTIAL - DANA 30** article.
13. Fill the engine with clean engine oil.

OIL PUMP SCREEN AND PICKUP TUBE**Material**

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

REMOVAL

1. Remove the oil pan. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pan**.
2. Remove the bolts and the oil pump screen and pickup tube.

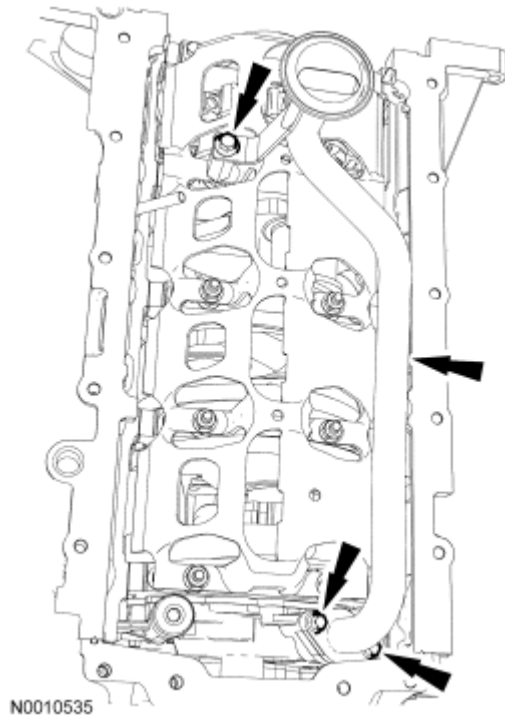


Fig. 159: Locating Oil Pump Screen And Pickup Tube And Bolt
Courtesy of FORD MOTOR CO.

INSTALLATION

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

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

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

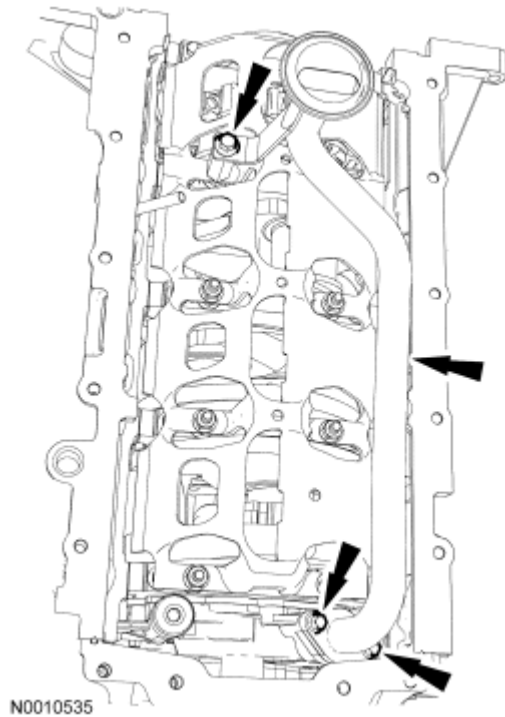


Fig. 160: Locating Oil Pump Screen And Pickup Tube And Bolt
Courtesy of FORD MOTOR CO.

2. Install the oil pan. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pan**.

OIL PUMP

Material

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

REMOVAL

1. Remove the oil pan. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pan**.
2. Remove the timing drive components. For additional information, refer to **Timing Drive Components**.
3. Remove the bolts and the oil pump screen and pickup tube.

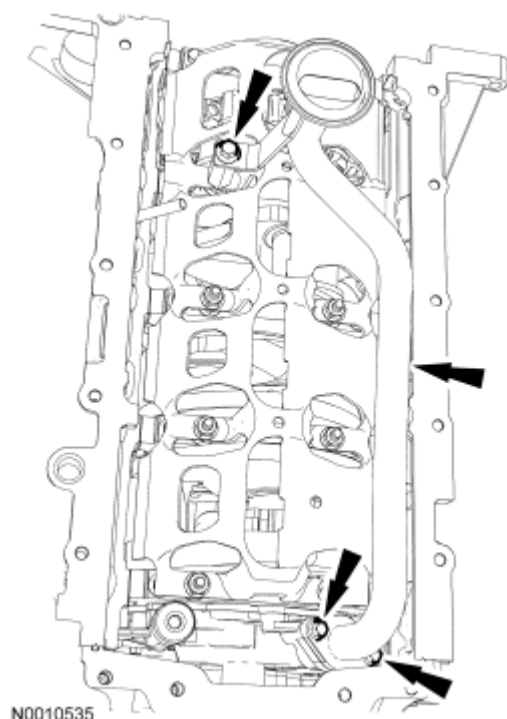


Fig. 161: Locating Oil Pump Screen And Pickup Tube And Bolt
Courtesy of FORD MOTOR CO.

4. Remove the 3 bolts and the oil pump.



Fig. 162: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

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

1. Clean the sealing surfaces with metal surface prep. Follow the directions on the packaging. Inspect the mating surfaces.

2. Position the oil pump and install the bolts.
 - Tighten to 10 N.m (89 lb-in).

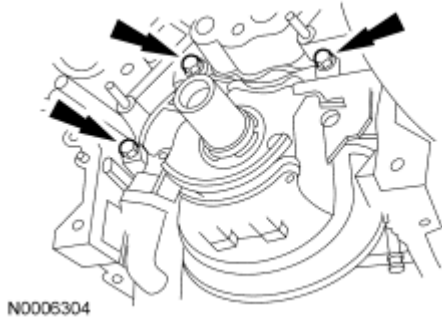


Fig. 163: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

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

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

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

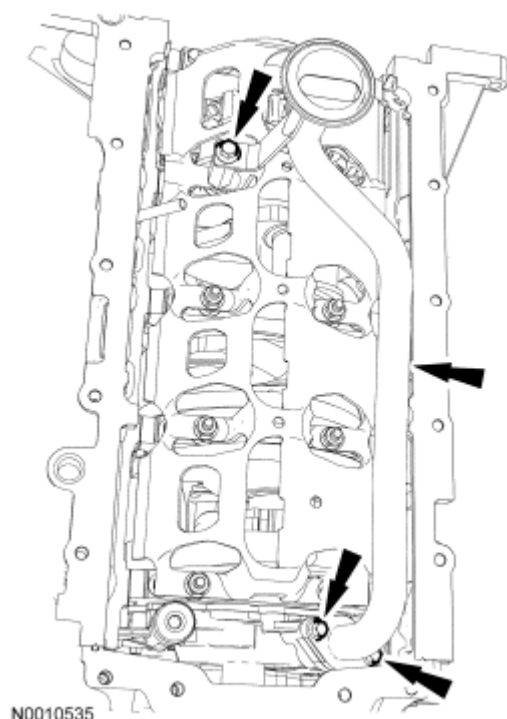


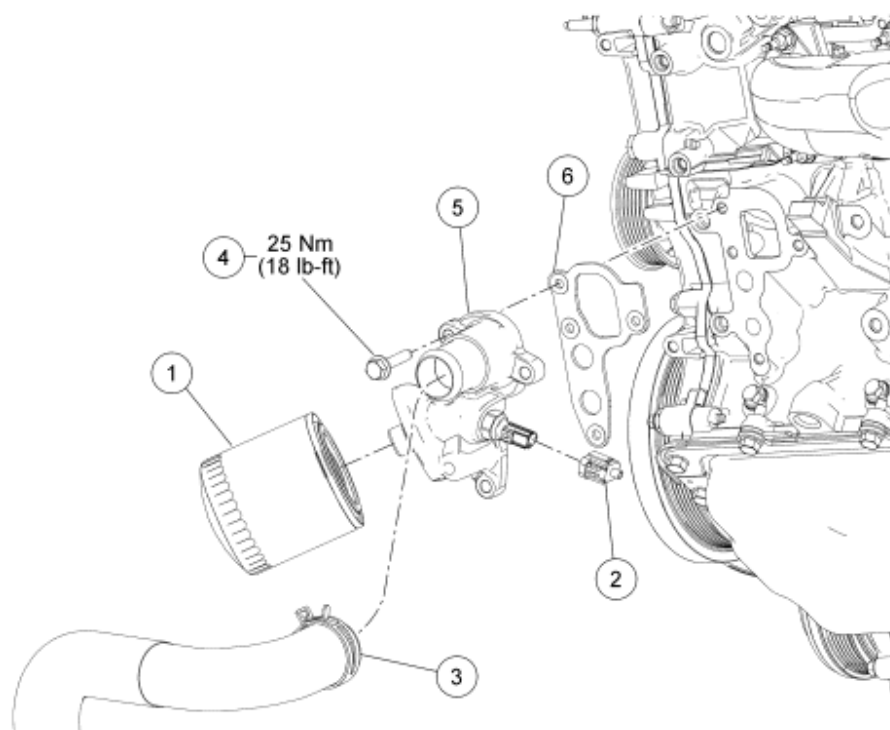
Fig. 164: Locating Oil Pump Screen And Pickup Tube And Bolt
Courtesy of FORD MOTOR CO.

4. Install the timing drive components. For additional information, refer to **Timing Drive Components**.
5. Install the oil pan. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pan**.

OIL FILTER ADAPTER

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket Remover ZC-30	-



N0041566

Fig. 165: Exploded View Of Oil Filter Adapter With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6714	Oil filter
2	14A464	Engine oil pressure switch electrical connector (part of 12B637)
3	8B273	Lower radiator hose
4	W705128	Oil filter adapter bolt (4 required)
5	6881	Oil filter adapter
6	6A636	Oil filter adapter gasket

REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Drain the engine cooling system. For additional information, refer to **ENGINE COOLING** article.
3. Drain the engine oil.
 - Install the drain plug and tighten to 23 Nm (17 lb-ft).
4. Disconnect the engine oil pressure switch electrical connector.
5. Disconnect the lower radiator hose and position it aside.
6. Remove and discard the engine oil filter.
 - To install, lubricate the oil filter gasket with clean engine oil and tighten until the seal makes contact.

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- Using an oil filter strap wrench, tighten the filter an additional 270 degrees.
7. Remove the 4 bolts and the oil filter adapter.
 - To install, tighten to 25 Nm (18 lb-ft).

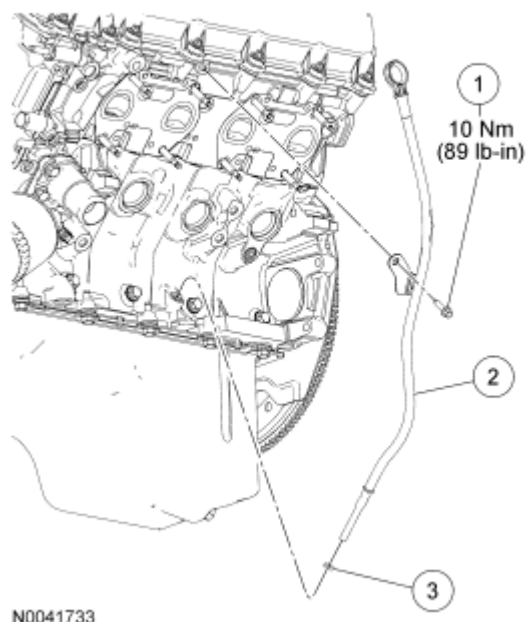
CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These may cause scratches and gouges resulting in leak paths. Use a plastic scraper to clean the sealing surfaces.

8. Remove and discard the oil filter adapter gasket.
 - Clean the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
 - Inspect the mating surfaces.
9. To install, reverse the removal procedure.
 - Fill the engine with clean engine oil.
10. Fill and bleed the engine cooling system. For additional information, refer to **ENGINE COOLING** article.

OIL LEVEL INDICATOR AND TUBE

Material

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



N0041733

Fig. 166: Exploded View Of Oil Level Indicator & Tube With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N806155	Oil level indicator and tube bolt
2	6754	Oil level indicator and tube
3	-	O-ring seal (part of 6754)

REMOVAL AND INSTALLATION

1. Remove the LH exhaust manifold. For additional information, refer to **Exhaust Manifold - LH**.
2. Remove the oil level indicator and tube bolt.
 - To install, tighten to 10 Nm (89 lb-in).
3. Remove the oil level indicator and tube from the cylinder block.
4. Remove and discard the O-ring seal.

NOTE: Install a new oil level indicator tube O-ring seal and lubricate it with clean engine oil prior to installation.

5. To install, reverse the removal procedure.

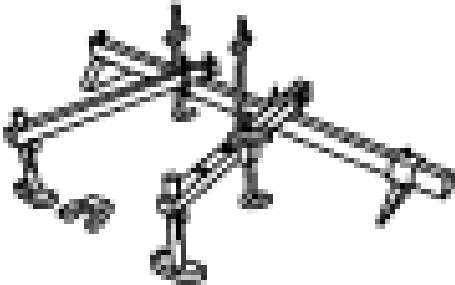
ENGINE SUPPORT INSULATORS

Special Tools

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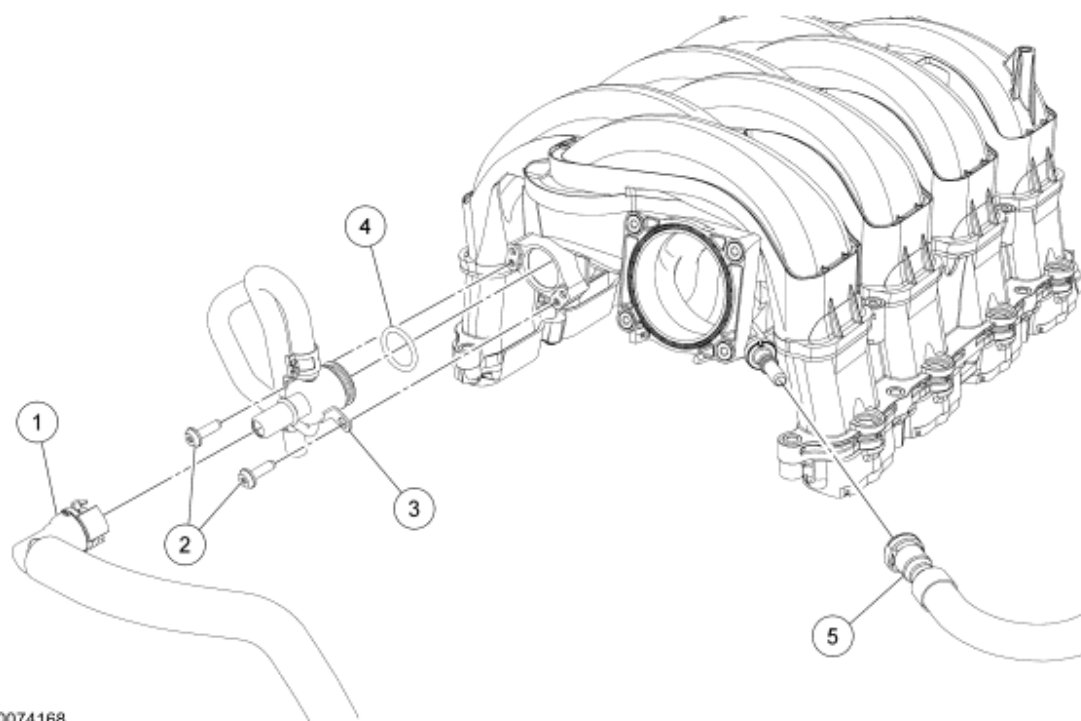
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Illustration	Tool Name	Tool Number
 ST2176-A	3-Bar Engine Support	303-F070
 ST2592-A	Engine Support Bracket	303-639

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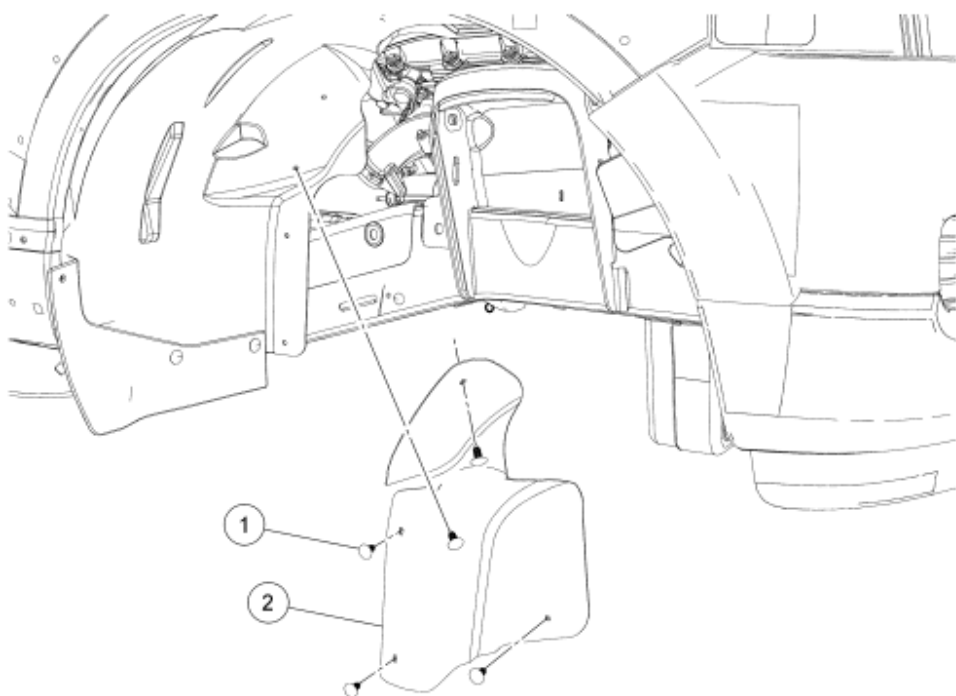
N0074168

Fig. 167: Intake Manifold Connections
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6758	PCV valve hose
2	W506975	Heated PCV fitting bolts (2 required)
3	9A474	Heated PCV fitting
4	-	Heated PCV fitting O-ring seal
5	9D289	Evaporative emission (EVAP) hose

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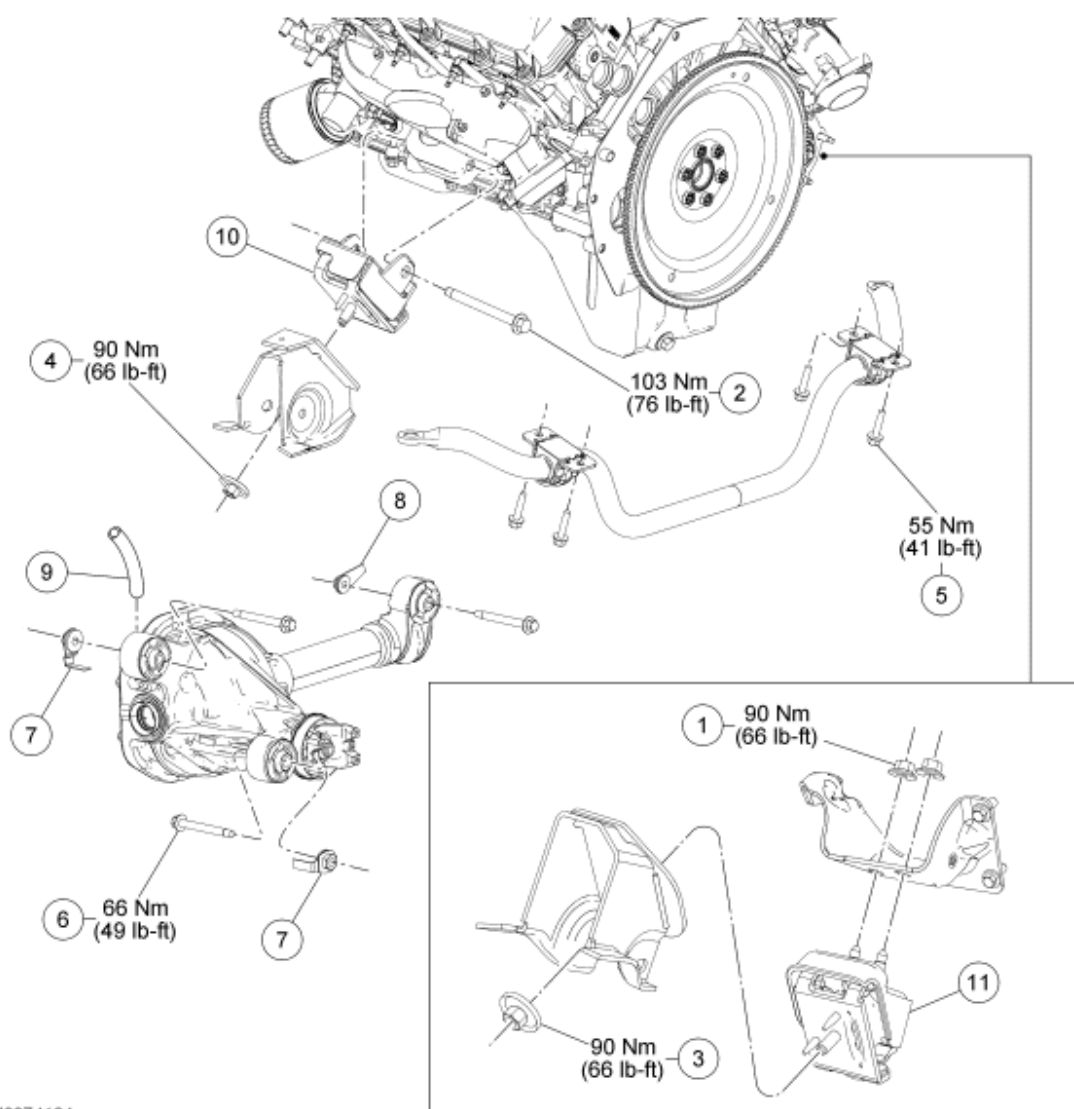
N0074139

Fig. 168: RH Splash Shield
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	388577	RH splash shield push pin (5 required)
2	16034	RH splash shield

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N0074164

Fig. 169: Engine Support Insulators With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N807479	RH engine support insulator nut (2 required)
2	W708103	LH engine support insulator through bolt
3	N802330	RH engine support insulator nut
4	N802330	LH engine support insulator nut
5	W707472	Stabilizer bar bracket bolt (4 required)
6	W506549	Differential housing bolt (3 required) (if equipped)
7	W706348	Differential housing flag nuts (2 required)
8	W708348	Differential housing flag nut

9	3B476	Differential housing vent hose
10	6B032	LH engine support insulator
11	6038	RH engine support insulator

REMOVAL AND INSTALLATION

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the engine cooling fan. For additional information, refer to **ENGINE COOLING** article.
3. Remove the throttle body (TB). For additional information, refer to **FUEL CHARGING AND CONTROLS - 4.6L (3V)** article.
4. Remove the generator. For additional information, refer to **GENERATOR AND REGULATOR** article.
5. Disconnect the PCV valve hose from the heated PCV fitting.
6. Remove the bolts and position the heated PCV fitting aside.
7. Disconnect the evaporative emission (EVAP) hose from the intake manifold.
8. Remove the 5 pushpins and the splash shield.
9. Remove the RH engine support insulator upper nuts.
 - To install, tighten to 90 Nm (66 lb-ft).
10. Remove the LH engine support insulator through bolt.
 - To install, tighten to 103 Nm (76 lb-ft).
11. Install the special tools and raise the engine approximately 70 mm (2.75 in).

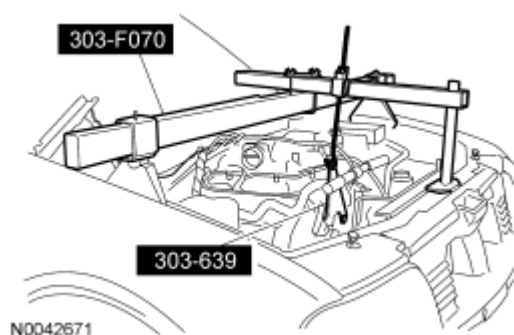


Fig. 170: Identifying Special Tools (303-639) & (303-F070)
Courtesy of FORD MOTOR CO.

RH side

12. Remove the RH engine support insulator lower nut.
 - To install, tighten to 90 Nm (66 lb-ft).
13. Remove the RH engine support insulator.

Four wheel drive (4WD) vehicles

14. Remove the stabilizer bar bracket bolts and allow the stabilizer bar to hang freely.
 - To install, tighten to 55 Nm (41 lb-ft).

WARNING: Secure the assembly to the jack. Avoid any obstructions while lowering and raising the jack. Contact with obstructions may cause the assembly to fall off the jack, which may result in serious personal injury.

15. Support the differential housing with a suitable jack stand.
16. Disconnect the vent hose from the differential housing vent tube.

CAUTION: Any time bolts, washers, spacers or nuts are loosened in the differential support for any reason, install new components to prevent damage.

17. Remove and discard the 3 bolts and 3 flag nuts.
 - To install, tighten to 66 Nm (49 lb-ft).
18. Lower the differential housing approximately 25 mm (1 in).

LH side

19. Remove the LH engine support insulator nut.
 - To install, tighten to 90 Nm (66 lb-ft).
20. Remove the engine support insulator.
21. To install, reverse the removal procedure.
 - If equipped, install new differential housing bolts and flag nuts.

REMOVAL

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
	Modular Engine Lift Bracket	303-F047 (014-00073) or equivalent



ST1377-A

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

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Disconnect the windshield washer hose.

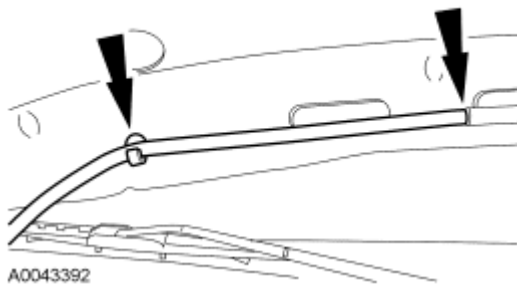


Fig. 171: Locating Windshield Washer Hose And Retainer
Courtesy of FORD MOTOR CO.

NOTE: Index-mark the hood hinge location to aid in hood installation.

3. Remove the 4 bolts and the hood.

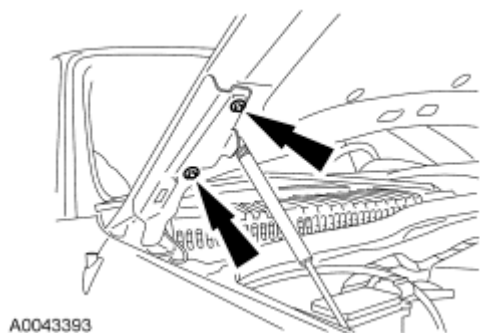


Fig. 172: Locating Hood Hinge Bolts
Courtesy of FORD MOTOR CO.

4. Remove the intake manifold. For additional information, refer to **Intake Manifold**.
5. Open the cover, remove the nuts and disconnect the wiring harness terminals.

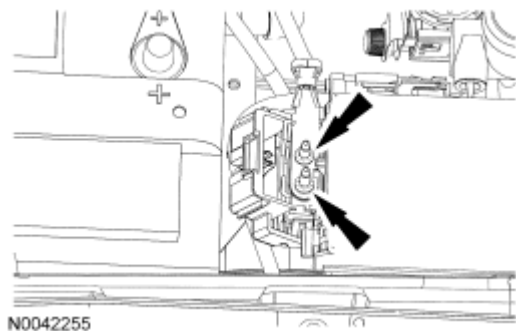


Fig. 173: Locating Wiring Harness Terminals Nuts
Courtesy of FORD MOTOR CO.

6. Remove the cooling fan. For additional information, refer to **ENGINE COOLING** article.
7. Drain the cooling system. For additional information, refer to **ENGINE COOLING** article.
8. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt.

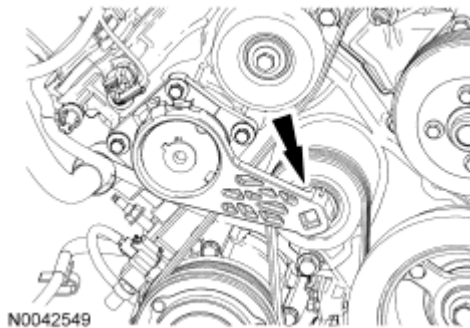


Fig. 174: Locating Accessory Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

9. Disconnect the electrical connector.



Fig. 175: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

10. Disconnect the heated PCV fitting coolant hose.

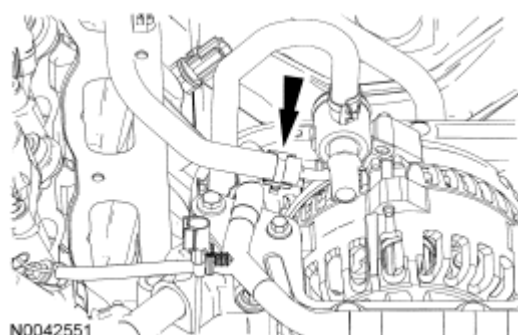


Fig. 176: Locating Heated PCV Fitting Coolant Hose
Courtesy of FORD MOTOR CO.

11. Detach the wiring harness retainer from the cooling fan wiring harness bracket.

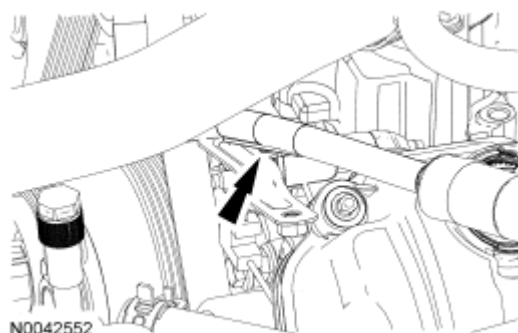


Fig. 177: Locating Wiring Harness Retainer From Cooling Fan Wiring Harness Bracket
Courtesy of FORD MOTOR CO.

12. Loosen the nuts.

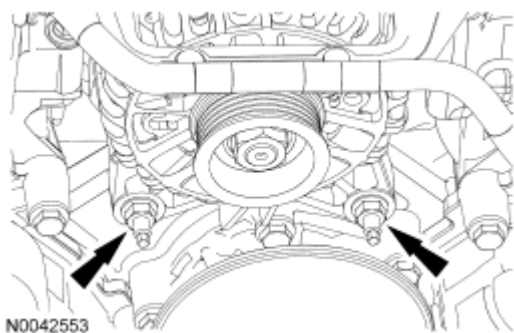


Fig. 178: Locating Nuts
Courtesy of FORD MOTOR CO.

13. Remove the bolts and the alternator, the alternator bracket and the wiring harness as an assembly.

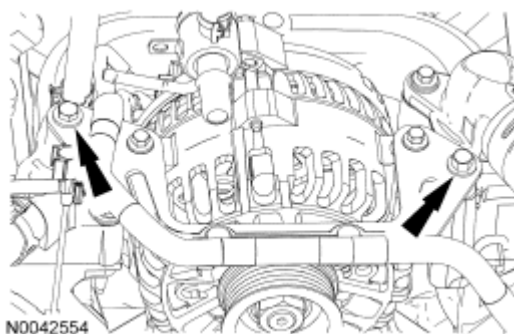


Fig. 179: Locating Alternator Bracket And Wiring Harness Bolts
Courtesy of FORD MOTOR CO.

14. Disconnect the heater hose.

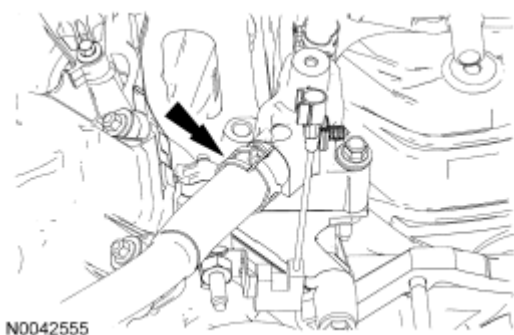


Fig. 180: Locating Heater Hose Clamp
Courtesy of FORD MOTOR CO.

15. Remove the upper radiator hose.

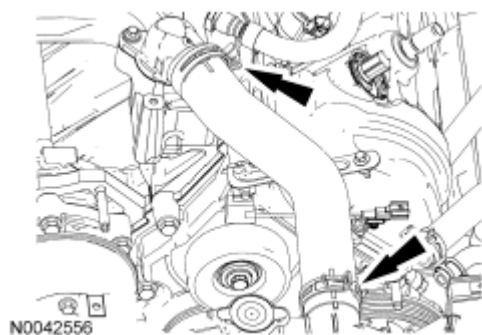


Fig. 181: Locating Upper Radiator Hose Clamps
Courtesy of FORD MOTOR CO.

16. Remove the bolts, the coolant crossover manifold, the gaskets, the heated PCV fitting and the heated PCV fitting coolant hose as an assembly.
 - Discard the gaskets.



Fig. 182: Locating PCV Fitting Hose Assembly Bolts
Courtesy of FORD MOTOR CO.

17. Disconnect the evaporative emission (EVAP) canister purge valve electrical connector.

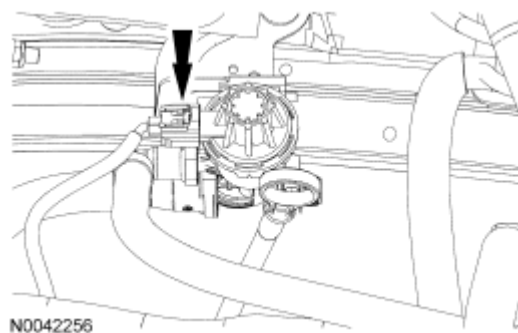


Fig. 183: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

18. Detach the heater hose retainer from the RH valve cover.

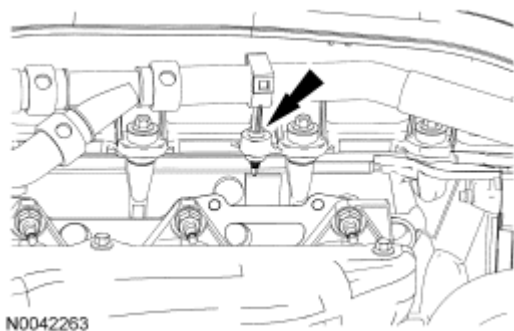


Fig. 184: Locating Heater Hose Retainer
Courtesy of FORD MOTOR CO.

19. Disconnect the inline electrical connector and the 2 PCM electrical connectors, and detach the wiring harness pin-type retainer.

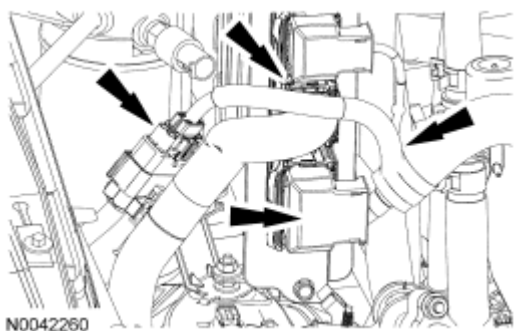


Fig. 185: Locating Wiring Harness Pin-Type Retainer, Powertrain Control Module (PCM) Electrical Connectors & In-Line Electrical Connector
Courtesy of FORD MOTOR CO.

20. Disconnect the heater hose.

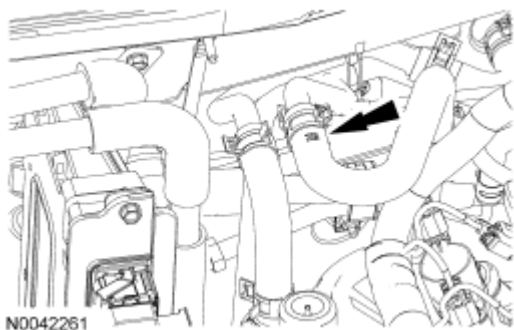


Fig. 186: Locating Heater Hose
Courtesy of FORD MOTOR CO.

21. Remove the nut and disconnect the ground wire.

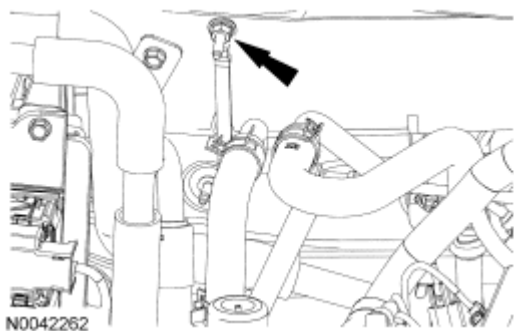


Fig. 187: Locating Ground Wire And Nut
Courtesy of FORD MOTOR CO.

22. Remove the transmission. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** article.
23. Remove the 3 screws, the 3 pushpins and the inner fender splash shield.

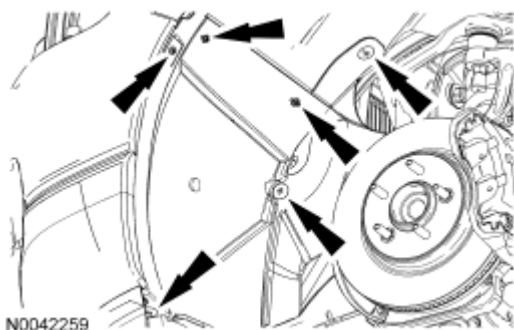


Fig. 188: Locating Inner Fender Splash Shield Pushpins And Screws
Courtesy of FORD MOTOR CO.

24. Remove the nut and detach the power steering pressure (PSP) hose bracket.

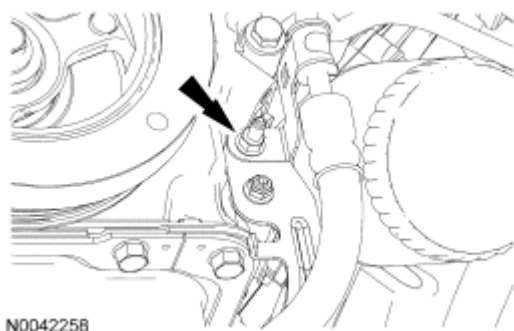


Fig. 189: Locating Power Steering Pressure (PSP) Hose Bracket Nut
Courtesy of FORD MOTOR CO.

25. Remove the nut and detach the wiring harness bracket.

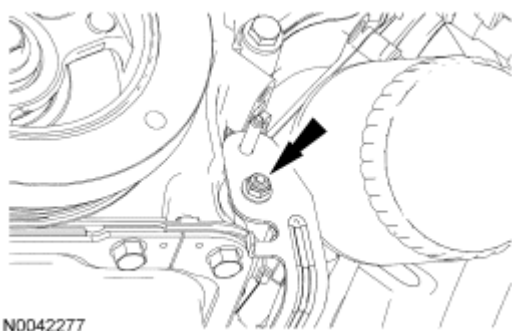


Fig. 190: Locating Battery Cable Bracket Nut
Courtesy of FORD MOTOR CO.

26. Remove the nuts and detach the wiring harness bracket.

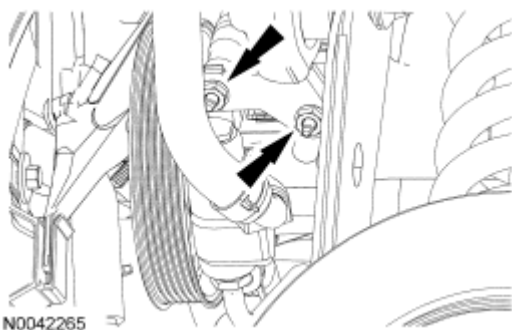


Fig. 191: Locating Wiring Harness Bracket Nuts
Courtesy of FORD MOTOR CO.

27. Detach the wiring harness retainer from the power steering pump stud bolt.

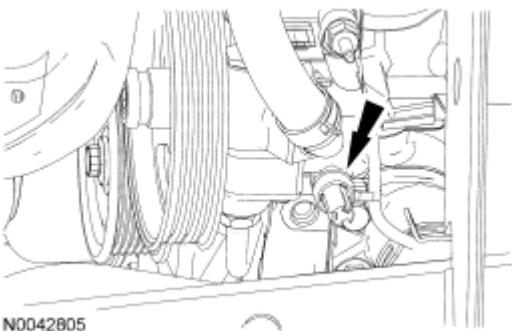


Fig. 192: Locating Power Steering Pump Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

28. Remove the stud bolts and position the power steering pump aside.

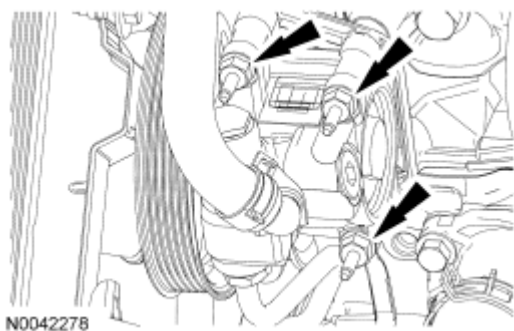


Fig. 193: Locating Power Steering Pump Stud Bolts
Courtesy of FORD MOTOR CO.

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

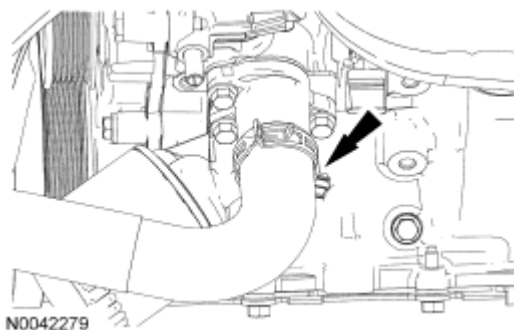


Fig. 194: Locating Lower Radiator Hose Clamp
Courtesy of FORD MOTOR CO.

30. Disconnect the A/C clutch electrical connector and detach the wiring harness retainer. Remove the nut and detach the A/C hose bracket.

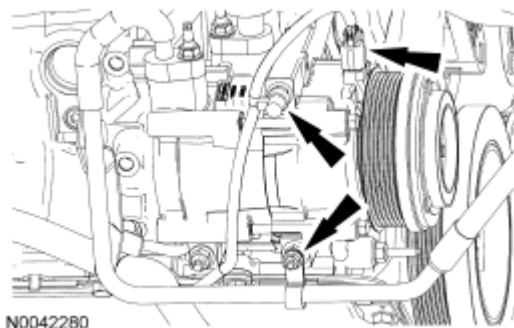


Fig. 195: Locating A/C Hose Bracket And A/C Clutch Electrical Connector
Courtesy of FORD MOTOR CO.

31. Remove the 2 nuts, the stud bolt and position the A/C compressor aside.

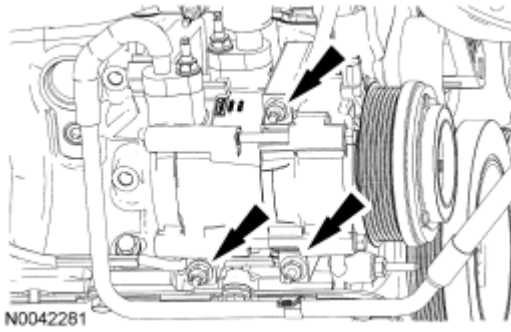


Fig. 196: Locating A/C Compressor Stud Bolt And Nut
Courtesy of FORD MOTOR CO.

32. Remove the oil drain plug and drain the engine oil. Install the drain plug when finished.
 - Tighten to 23 Nm (17 lb-ft).
33. Remove the oil temperature sensor.

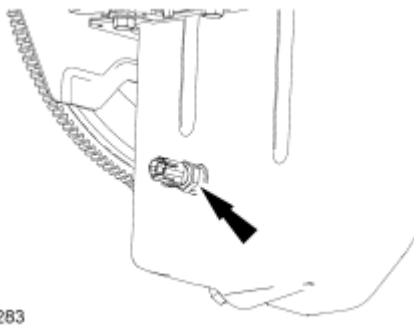


Fig. 197: Locating Oil Temperature Sensor
Courtesy of FORD MOTOR CO.

34. Remove the bolt and detach the wiring harness bracket from the RH engine support insulator bracket.

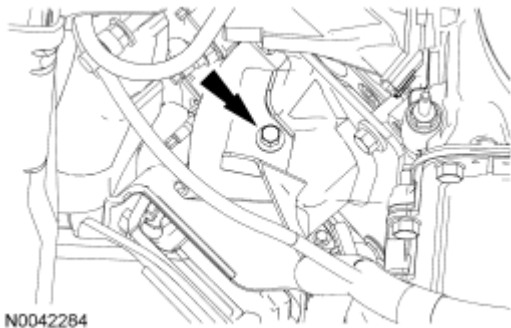


Fig. 198: Locating RH Engine Support Insulator Bracket Bolt
Courtesy of FORD MOTOR CO.

35. Remove the pushpins and the RH splash shield.

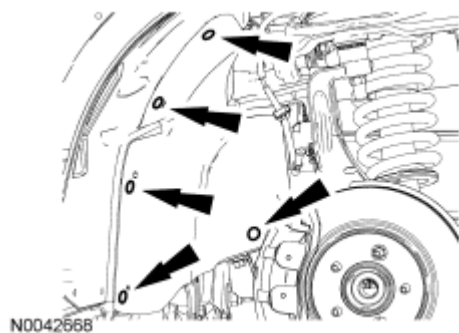


Fig. 199: Locating Pushpins And Splash Shield
Courtesy of FORD MOTOR CO.

36. Remove the RH engine support insulator nuts.



Fig. 200: Locating RH Engine Support Insulator Nuts
Courtesy of FORD MOTOR CO.

37. If equipped, disconnect the block heater electrical connector and detach the wiring harness retainers.

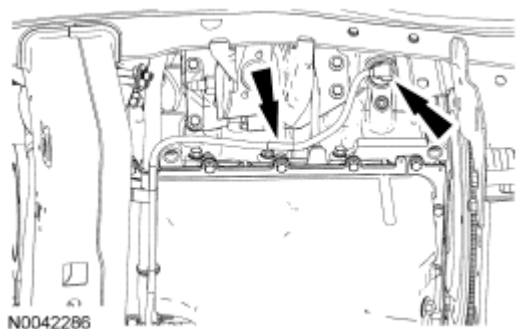


Fig. 201: Locating Block Heater Wiring Harness Retainers And Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

38. Remove the LH engine support insulator through bolt.

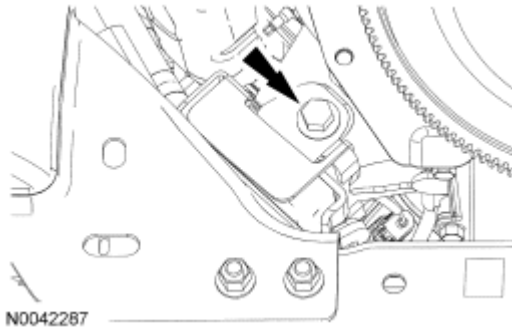


Fig. 202: Locating LH Engine Support Insulator Through-Bolt
Courtesy of FORD MOTOR CO.

39. Install the special tool.

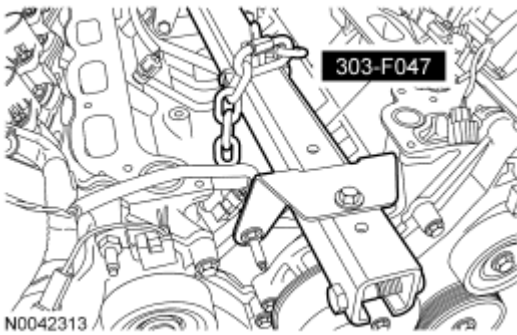


Fig. 203: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

40. Attach a suitable floor crane to the special tool installed in the previous step and remove the engine from the vehicle.

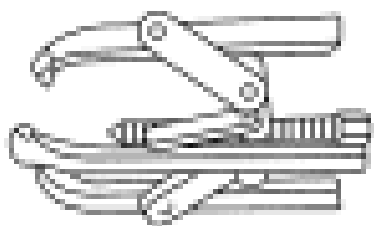
CYLINDER HEAD

Special Tools

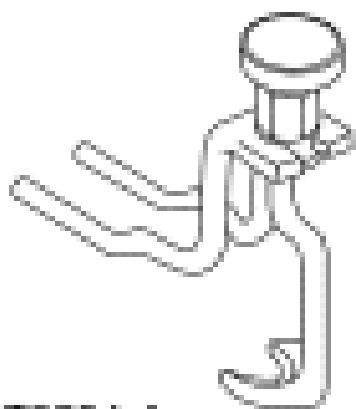
Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121

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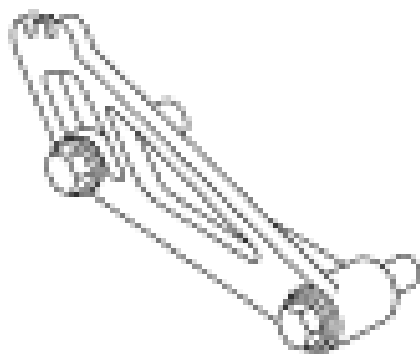
ST1184-A



ST2604-A

Compressor, Valve Spring

303-1039



ST2607-A

Locking Tool, Camshaft Phaser
Sprocket

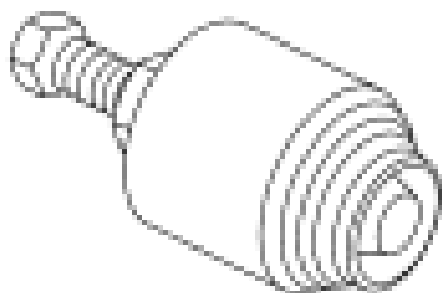
303-1046

Modular Engine Lift Bracket

303-F047 (014-00073) or
equivalent

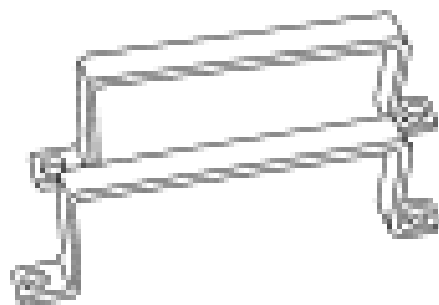
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**ST1377-A****ST1730-A**

Remover, Crankshaft Front Seal

303-107 (T74P-6700-A)

**ST1668-A**

Remover/Installer, Cylinder Head

303-572 (T97T-6000-A)

Material

Item	Specification
Motorcraft Metal Surface Prep	-

ZC-31	
Silicone Gasket Remover	-
ZC-30	

All cylinder heads

1. Remove the engine. For additional information, refer to **Engine**.
2. Mount the engine on a suitable work stand.
3. Remove the special tool.

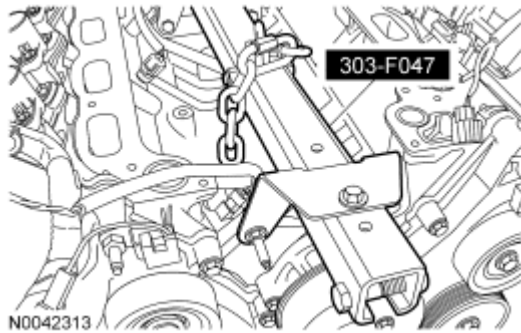


Fig. 204: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

4. Disconnect the crankshaft position sensor electrical connector and detach the wiring harness retainer.



Fig. 205: Locating Crankshaft Position Sensor Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

5. Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

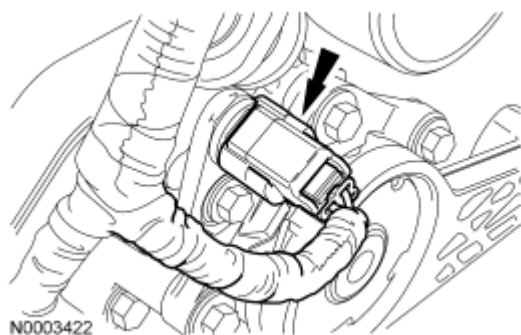


Fig. 206: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

6. Disconnect the RH and LH variable camshaft timing (VCT) solenoid electrical connectors.

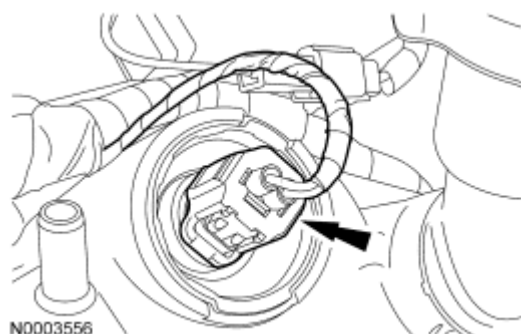


Fig. 207: Locating Camshaft Timing (VCT) Solenoid Electrical Connectors
Courtesy of FORD MOTOR CO.

7. Detach the wiring harness retainers.

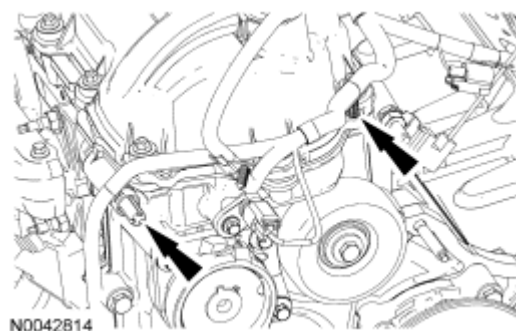


Fig. 208: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

8. Remove the nut and the RH radio ignition interference capacitor.

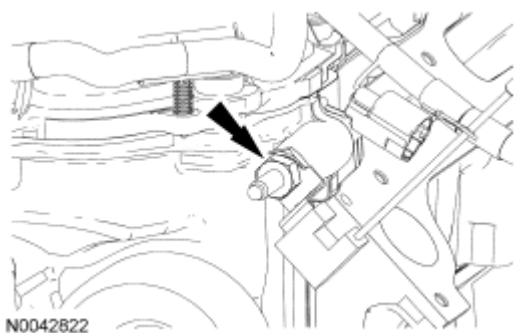


Fig. 209: Locating RH Radio Ignition Interference Capacitor Nut
Courtesy of FORD MOTOR CO.

9. Disconnect the oil pressure sensor electrical connector.

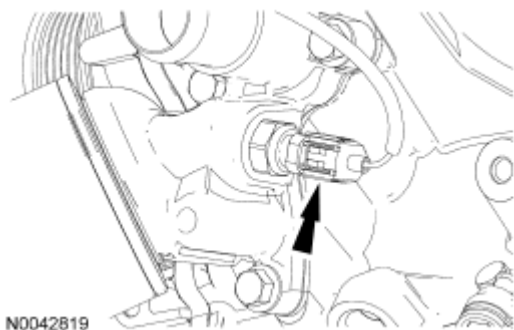


Fig. 210: Locating Oil Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

10. Disconnect the LH CMP sensor electrical connector and detach the wiring harness retainers.

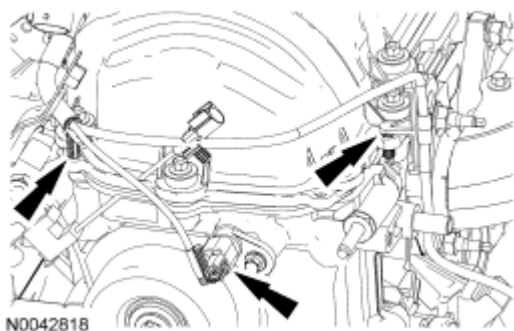


Fig. 211: Locating LH Camshaft Position Sensor And Attach Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

11. Remove the nut and the cooling fan wiring harness bracket.

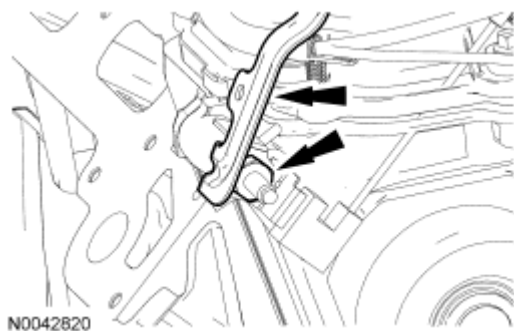


Fig. 212: Locating Cooling Fan Wiring Harness Bracket Nut
Courtesy of FORD MOTOR CO.

12. Remove the nut and detach the LH radio interference capacitor.

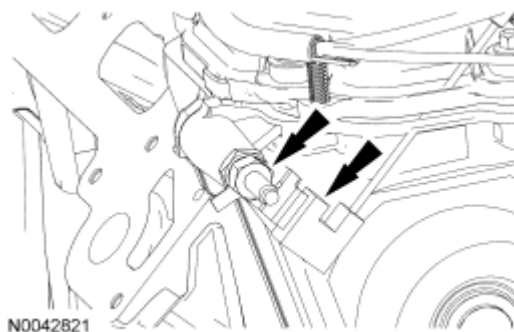


Fig. 213: Locating LH Radio Interference Capacitor And Nuts
Courtesy of FORD MOTOR CO.

13. Detach the wiring harness retainers from the LH valve cover studs.

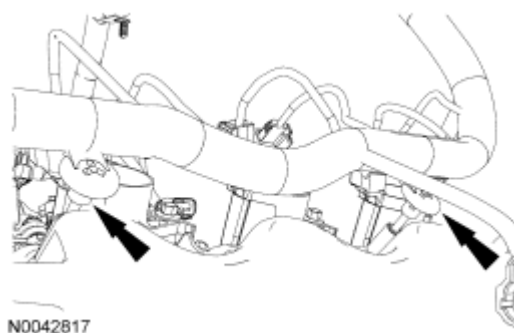


Fig. 214: Locating LH Valve Cover Studs
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

14. Disconnect the 4 RH and 4 LH ignition coil electrical connectors.

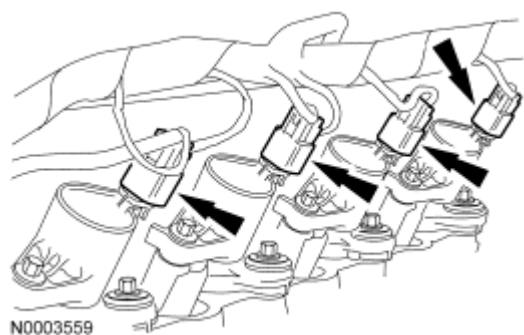


Fig. 215: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

15. Detach the wiring harness retainers from the RH valve cover studs.

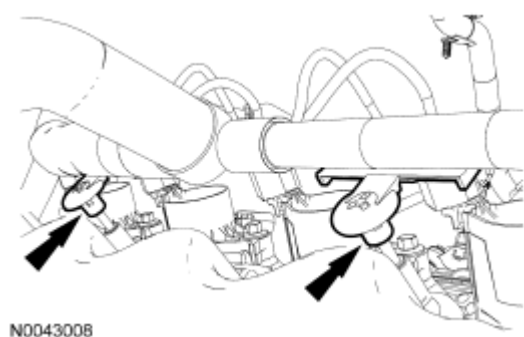


Fig. 216: Locating RH Valve Cover Studs
Courtesy of FORD MOTOR CO.

16. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

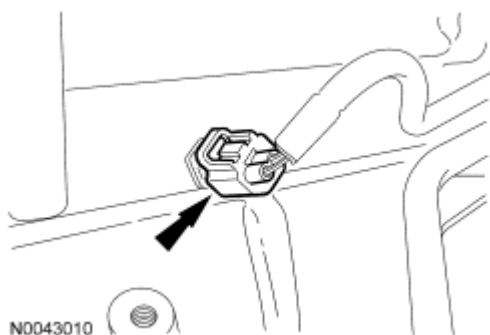


Fig. 217: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

17. Detach the electrical connector retainers and remove the engine wiring harness.

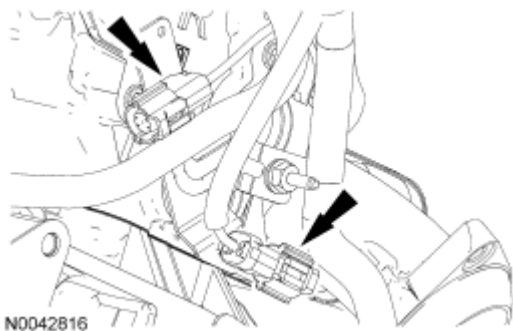


Fig. 218: Locating Electrical Connector Retainers And Engine Wiring Harness
Courtesy of FORD MOTOR CO.

NOTE: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

18. Remove the breather tube from the RH valve cover.
 - Disconnect the quick connect fittings.
 - Push the connector toward the valve cover to release pressure.
 - Push the release tab clockwise.
 - Disconnect the quick connect fitting.

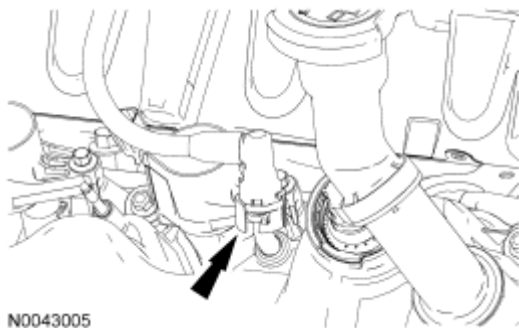


Fig. 219: Locating Breather Tube Connector Retaining Clip
Courtesy of FORD MOTOR CO.

NOTE: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

19. Remove the PCV tube from the LH valve cover.
 - Disconnect the quick connect fittings.
 - Push the connector toward the valve cover to release pressure.
 - Push the release tab clockwise.
 - Disconnect the quick connect fitting.

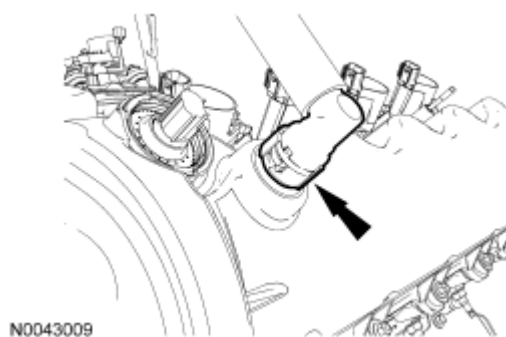


Fig. 220: Locating Positive Crankcase Ventilation (PCV) Hose
Courtesy of FORD MOTOR CO.

20. Remove and discard the oil filter.

NOTE: LH shown, RH similar.

21. Remove the 8 bolts and the 8 ignition coils.

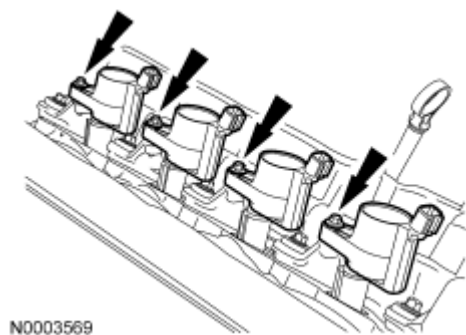


Fig. 221: Identifying Ignition Coils And Bolts
Courtesy of FORD MOTOR CO.

22. Remove the bolt and position the oil level indicator aside.



Fig. 222: Locating Oil Level Indicator Tube Bolt
Courtesy of FORD MOTOR CO.

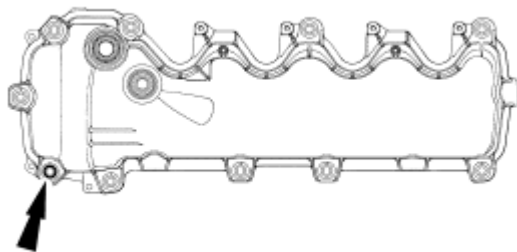
NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: Remove the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

NOTE: The bolts are part of the valve cover and should not be removed.

23. Loosen the 10 bolts and remove the LH valve cover.

- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



N0074177

Fig. 223: Identifying Bolts
Courtesy of FORD MOTOR CO.

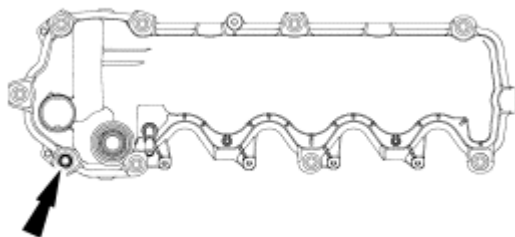
NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: Remove the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

NOTE: The bolts are part of the valve cover and should not be removed.

24. Loosen the 9 bolts and remove the RH valve cover.

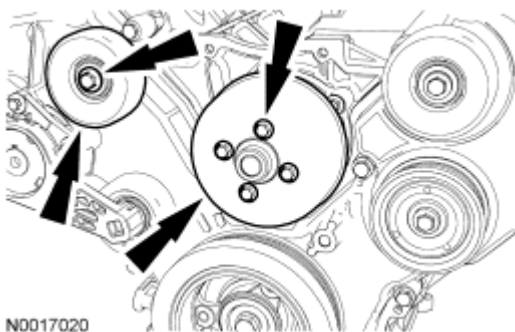
- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



N0074178

Fig. 224: Identifying Bolts
Courtesy of FORD MOTOR CO.

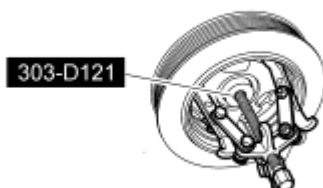
25. Remove the 5 bolts, the coolant pump pulley and the RH side accessory drive belt idler pulley.



N0017020

Fig. 225: Locating Accessory Drive Belt Idler Pulley And Bolts
Courtesy of FORD MOTOR CO.

26. Remove and discard the crankshaft pulley bolt. Using the special tool, remove the crankshaft pulley.



N0010528

Fig. 226: Removing Crankshaft Pulley Using Special Tool (303-D121)
Courtesy of FORD MOTOR CO.

27. Using the special tool, remove the crankshaft seal.

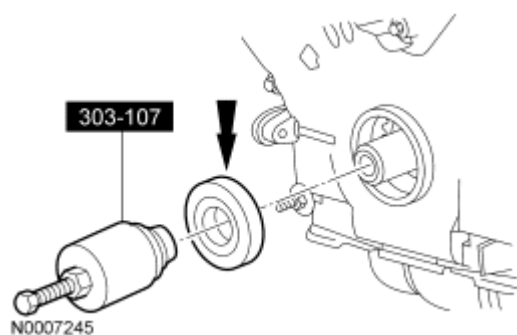
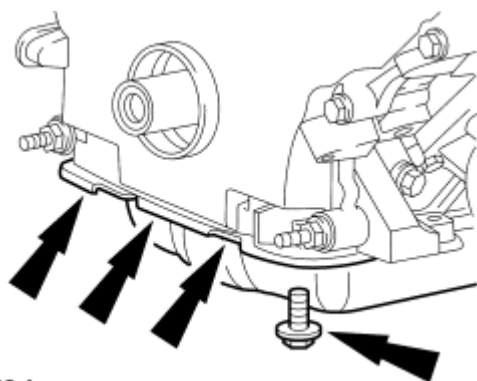


Fig. 227: Removing Crankshaft Front Seal Using Special Tool
Courtesy of FORD MOTOR CO.

28. Remove the 4 oil pan-to-engine front cover bolts.

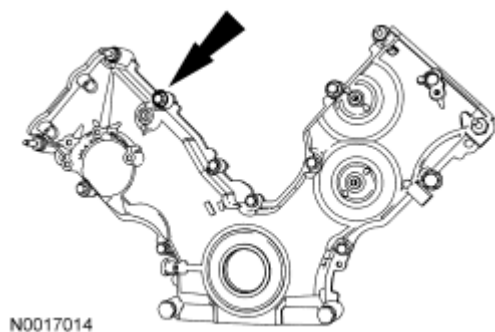


AA4226-A

Fig. 228: Front Oil Pan Bolts
Courtesy of FORD MOTOR CO.

NOTE: Correct fastener location is essential for the assembly procedure. Record fastener location.

29. Remove the engine front cover fasteners.



N0017014

Fig. 229: Locating Engine Front Cover Fasteners
Courtesy of FORD MOTOR CO.

30. Remove the engine front cover from the cylinder block.

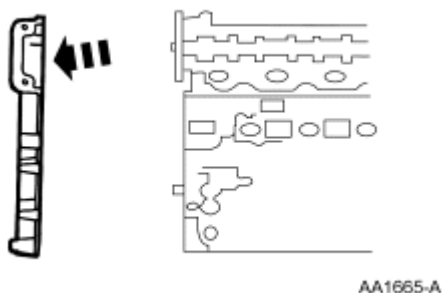


Fig. 230: Removing Engine Front Cover From Cylinder Block
Courtesy of FORD MOTOR CO.

31. Remove the crankshaft sensor ring from the crankshaft.

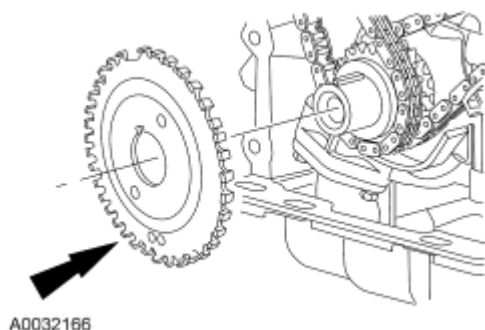


Fig. 231: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

32. Position the crankshaft keyway at the 12 o'clock position.

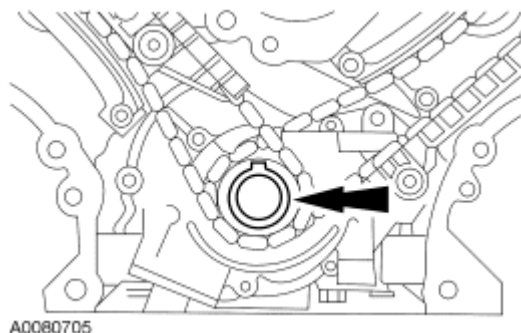


Fig. 232: Positioning Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to the 12 o'clock position.

33. The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.



Fig. 233: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

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

34. Remove only the 3 roller followers shown in the **Fig. 234** from the RH cylinder head.

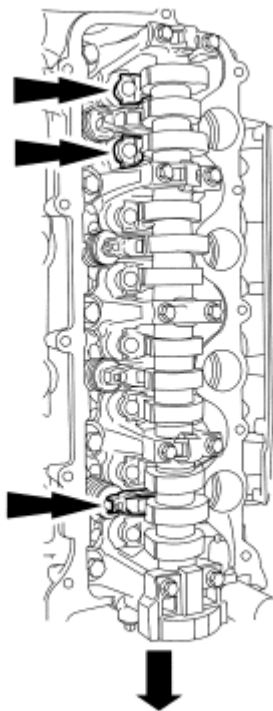


Fig. 234: Identifying RH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop

into the cylinder.

NOTE: It may be necessary to push the valve down while compressing the spring.

35. Using the special tool, remove the 3 roller followers designated in the previous step from the RH cylinder head.



Fig. 235: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

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

36. Remove only the 3 roller followers shown in the **Fig. 236** from the LH cylinder head.

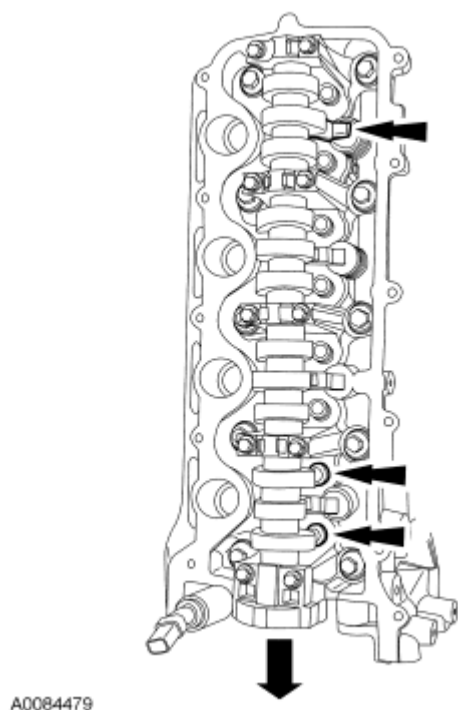
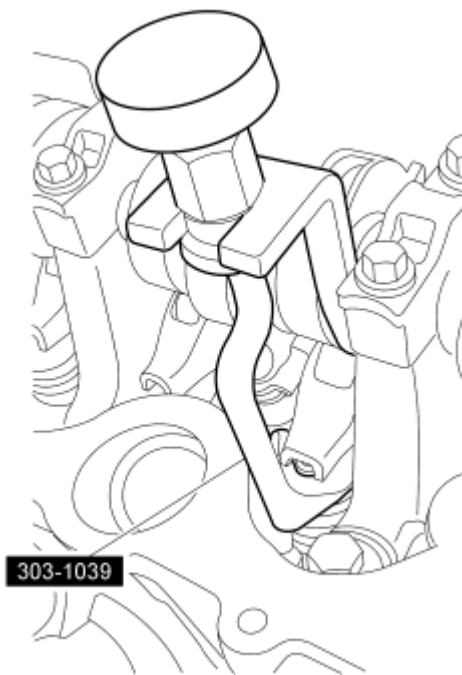


Fig. 236: Locating LH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

- NOTE:** Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.
- NOTE:** It may be necessary to push the valve down while compressing the spring.

37. Using the special tool, remove the 3 roller followers designated in the previous step from the LH cylinder head.



N0010191

Fig. 237: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

- NOTE:** The crankshaft cannot be moved past the 6 o'clock position once set.
38. Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.

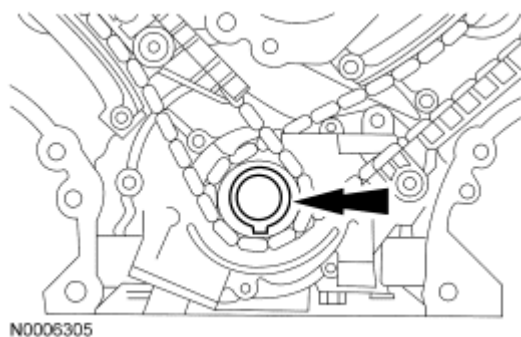


Fig. 238: Crankshaft Positioned With Keyway At 6 O'clock Position
Courtesy of FORD MOTOR CO.

39. Remove the 2 bolts, the LH timing chain tensioner and tensioner arm.

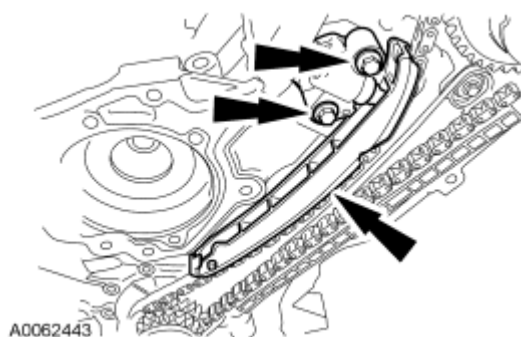


Fig. 239: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

40. Remove the 2 bolts, the RH timing chain tensioner and tensioner arm.

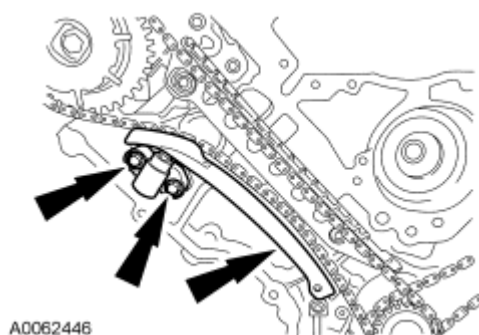


Fig. 240: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

41. Remove the RH and LH timing chains and the crankshaft sprocket.
- Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Remove the LH timing chain from the camshaft sprocket.

- Remove the LH timing chain and crankshaft sprocket.

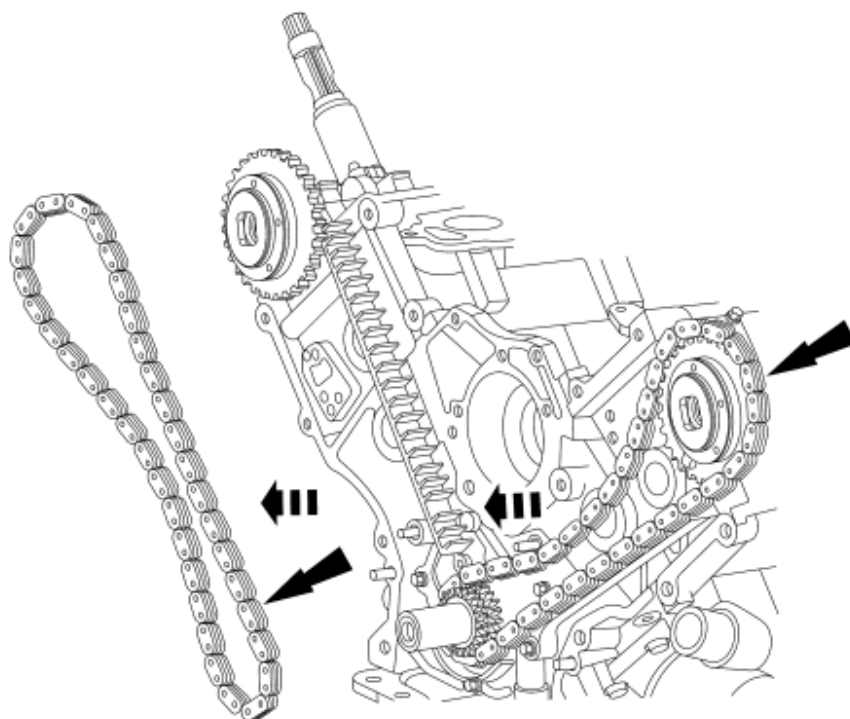


Fig. 241: Identifying RH/LH Timing Chains
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

42. Remove the LH and RH timing chain guides.
- Remove the 2 bolts.
 - Remove both timing chain guides.

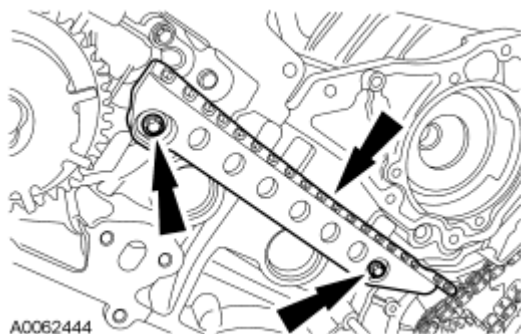


Fig. 242: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if

mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

43. Using the special tool, remove the bolt and the RH camshaft phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

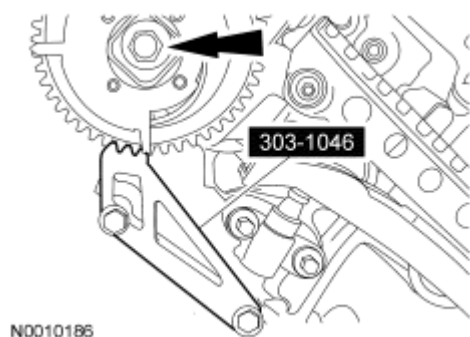


Fig. 243: Identifying VCT Phaser Sprocket Bolt And Holder Tool
Courtesy of FORD MOTOR CO.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

44. Using the special tool, remove the bolt and the LH camshaft phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

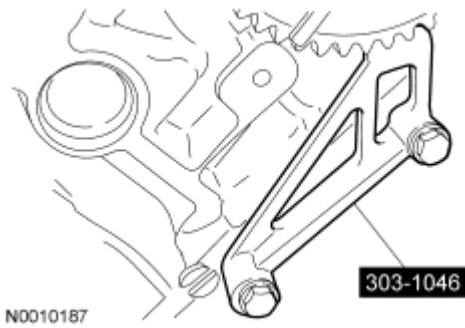


Fig. 244: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers, or the bearing cap may be damaged from side loading.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

45. Remove the bolts in the sequence shown. Remove the RH cylinder head front camshaft bearing cap, then the remaining bearing caps.

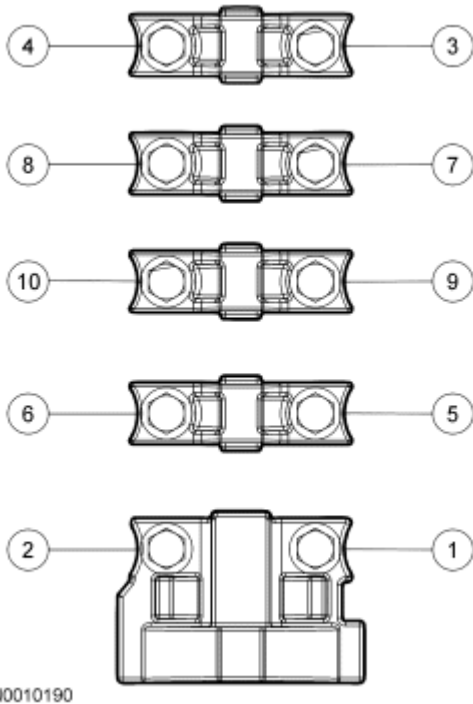
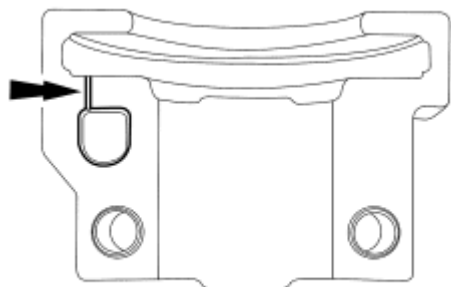


Fig. 245: Identifying Camshaft Bearing Caps Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

46. Clean and inspect the RH camshaft bearing caps.

- The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

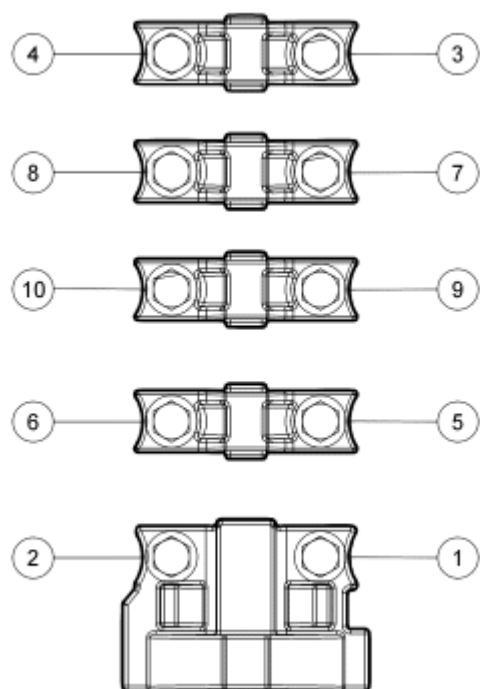
Fig. 246: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

47. Remove the RH camshaft.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers, or the bearing cap may be damaged from side loading.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

48. Remove the bolts in the sequence shown. Remove the LH cylinder head front camshaft bearing cap, then the remaining bearing caps.

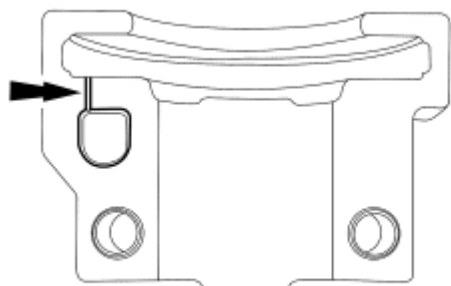


N0010190

Fig. 247: Identifying Camshaft Bearing Caps Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

49. Clean and inspect the LH camshaft bearing caps.

- The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 248: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

50. Remove the LH camshaft.

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.

51. Remove all of the remaining roller followers from the cylinder heads.

LH 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.

52. Remove the hydraulic lash adjusters from the LH cylinder head.
53. Install the special tool onto the LH cylinder head.

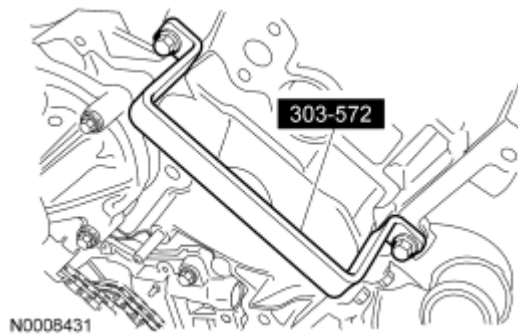


Fig. 249: Identifying Special Tool Onto Cylinder Head
Courtesy of FORD MOTOR CO.

54. Remove the bolts and the LH exhaust manifold heat shield.

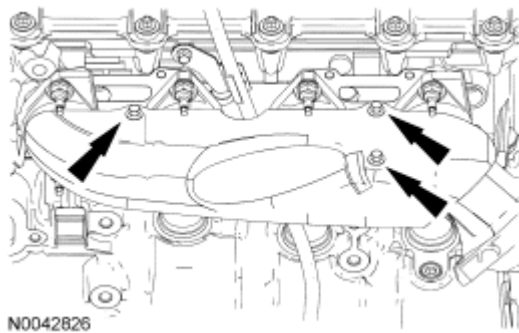


Fig. 250: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

55. Remove the nuts, the LH exhaust manifold and the gaskets.
- Discard the nuts and the gaskets.

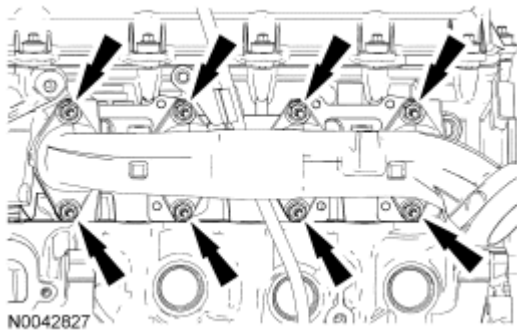


Fig. 251: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

56. Remove and discard the 8 LH exhaust manifold studs.

RH 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.

57. Remove the hydraulic lash adjusters from the RH cylinder heads.
58. Install the special tool onto the RH cylinder head.

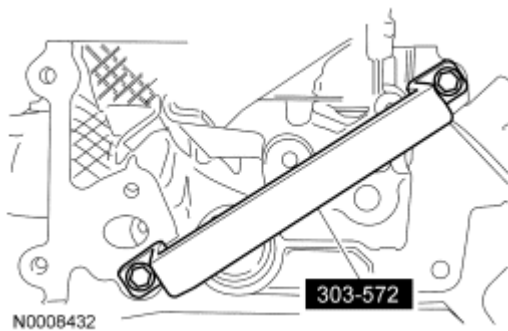


Fig. 252: Identifying Special Tool On Cylinder Head
Courtesy of FORD MOTOR CO.

59. Remove the bolts and the RH exhaust manifold heat shield.

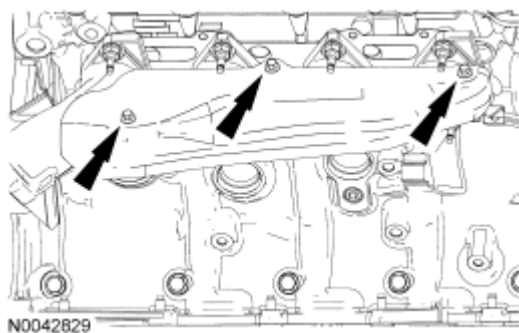


Fig. 253: Identifying RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

60. Remove the nuts, the RH exhaust manifold and the gaskets.
 - Discard the nuts and the gaskets.

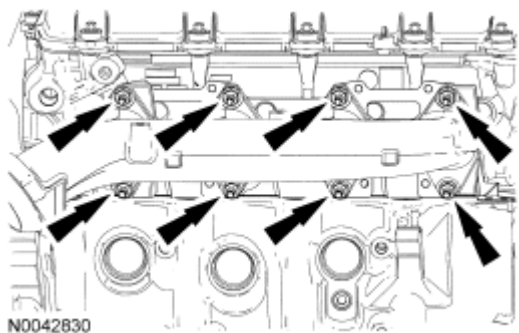


Fig. 254: Locating RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

61. Remove and discard the 8 RH exhaust manifold studs.
62. Remove the nut and the ground strap.

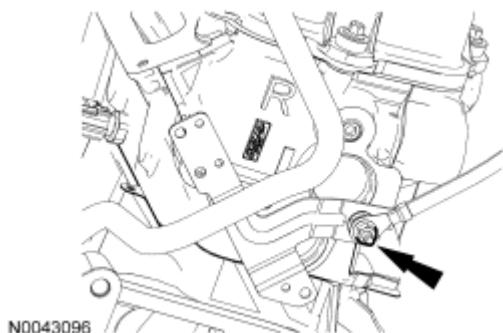


Fig. 255: Locating Ground Strap Nut
Courtesy of FORD MOTOR CO.

63. Remove the stud bolt and the heater supply tube and hoses as an assembly.
 - Discard the O-ring seals.

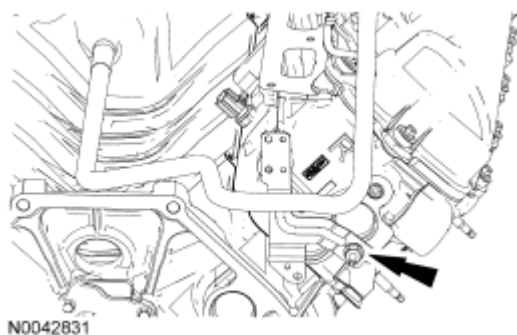


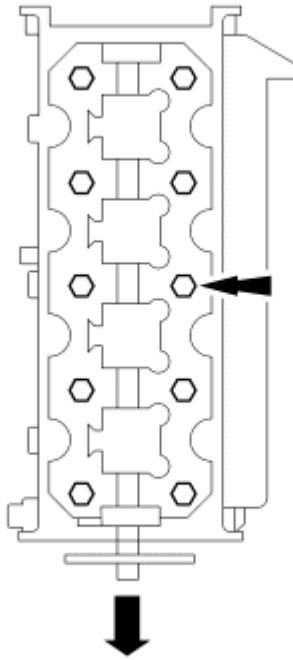
Fig. 256: Locating Heater Supply Tube Stud Bolt
Courtesy of FORD MOTOR CO.

All cylinder heads

- NOTE:** The cylinder head must be cool before removing it from the engine. Cylinder head warpage may result if a warm or hot cylinder head is removed.
- NOTE:** Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.
- 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:** Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface, or the cylinder head may be damaged.
- 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:** RH shown, LH similar.

64. Remove the 20 bolts and the cylinder heads.

- Discard the cylinder head gaskets.
- Discard the cylinder head bolts.



N0067889

Fig. 257: Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

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

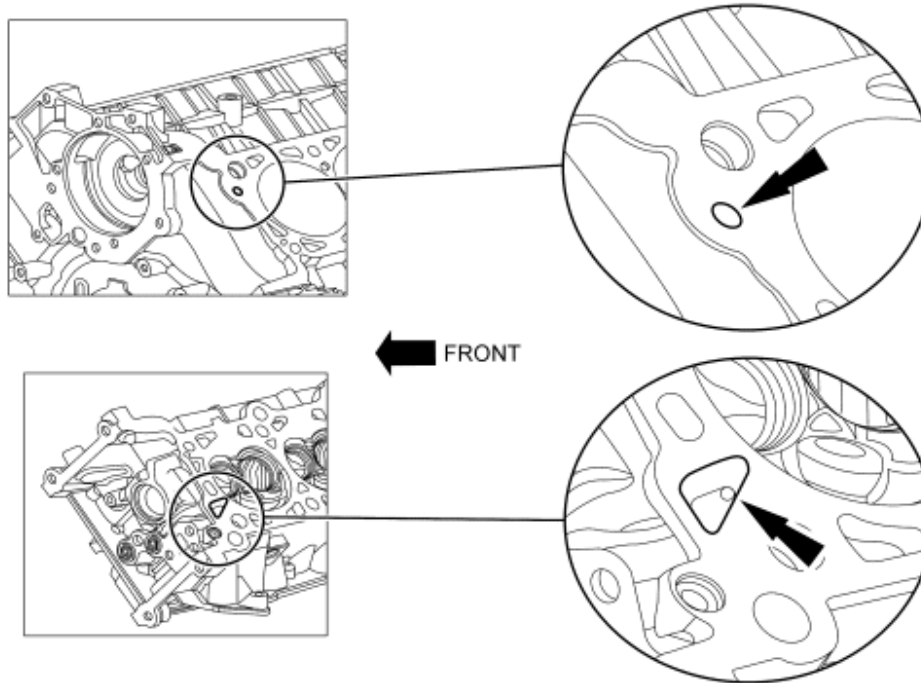
NOTE: Observe all warnings or cautions and follow all application directions contained on the packaging of the silicone gasket remover and the metal surface prep.

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

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

NOTE: LH shown, RH similar.

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



A0079634

Fig. 258: Identifying Cylinder Head/Cylinder Block Oil Pressure Feed Areas
Courtesy of FORD MOTOR CO.

DISASSEMBLY

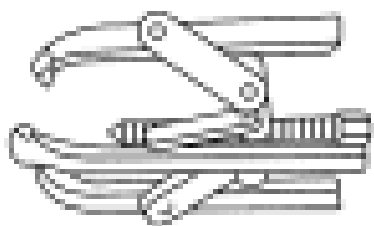
ENGINE

Special Tools

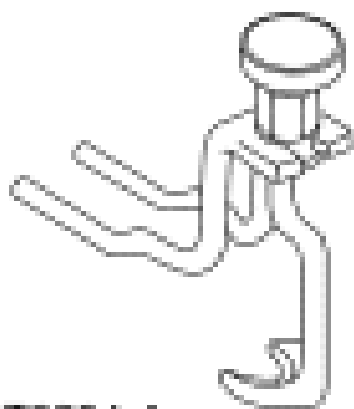
Illustration	Tool Name	Tool Number
	3-Jaw Puller	303-D121

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



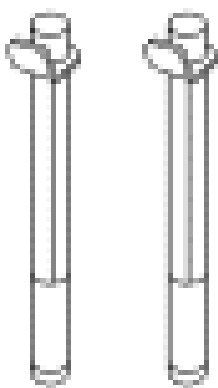
ST1184-A



ST2804-A

Compressor, Valve Spring

303-1039



ST1337-A

Installer, Connecting Rod

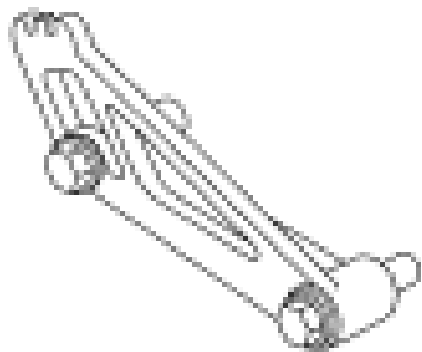
303-442 (T93P-6136-A)

Locking Tool, Camshaft Phaser
Sprocket

303-1046

2009 Mercury Mountaineer

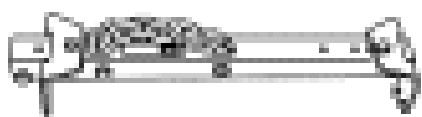
2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



ST2B07-A

Modular Engine Lift Bracket

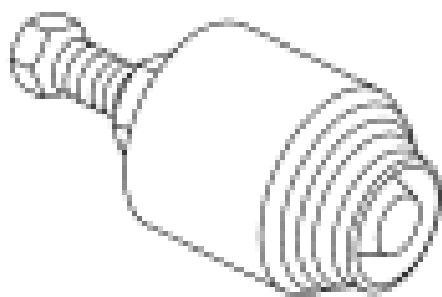
303-F047 (014-00073)



ST1377-A

Remover, Crankshaft Front Seal

303-107 (T74P-6700-A)



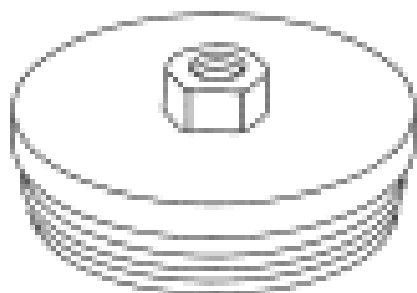
ST1730-A

Remover, Crankshaft Rear Seal

303-519 (T95P-6701-EH)

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

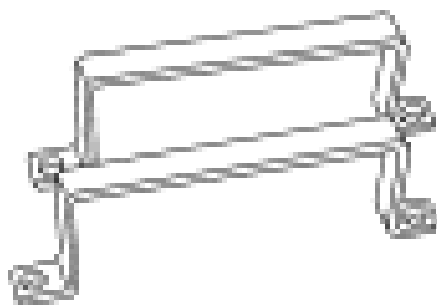
**ST1382-A**Remover, Crankshaft Rear
Slinger

303-514 (T95P-6701-AH)

**ST1481-A**

Remover/Installer, Cylinder Head

303-572 (T97T-6000-A)

**ST1668-A**

Slide Hammer

100-001 (T50T-100-A)

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



ST1185-A

Material

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

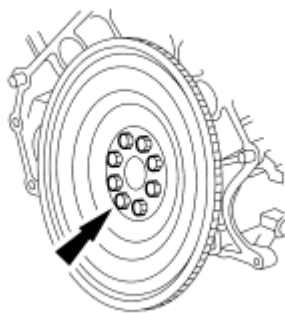
NOTE: Remove the cylinder heads before removing the crankshaft. Failure to do so may result in engine damage.

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

NOTE: The flexplate, the spacer plate, the crankshaft rear seal, the crankshaft rear oil slinger and the rear seal retainer plate must be removed before mounting the engine on the engine stand.

NOTE: For additional information, refer to the exploded view under Engine.

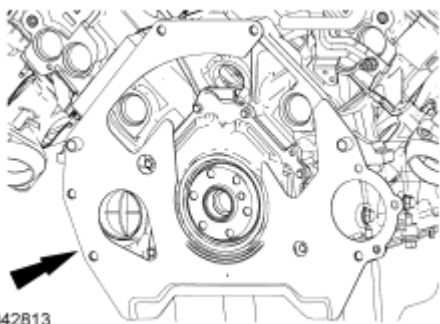
1. Remove the 6 bolts and the flexplate.



A26925-A

Fig. 259: Locating Flexplate Bolts
Courtesy of FORD MOTOR CO.

2. Remove the spacer plate.



N0042813

Fig. 260: Locating Spacer Plate
Courtesy of FORD MOTOR CO.

3. Using the special tools, remove the crankshaft rear oil slinger.

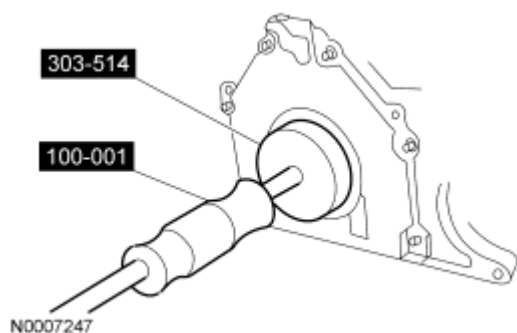


Fig. 261: Removing Crankshaft Rear Oil Seal Slinger
Courtesy of FORD MOTOR CO.

4. Using the special tools, remove the crankshaft rear seal.

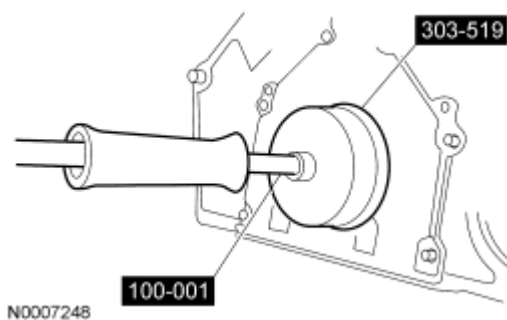


Fig. 262: Removing Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

5. Remove the 8 bolts and the crankshaft rear seal retainer plate.

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

- Clean and inspect the sealing surfaces.

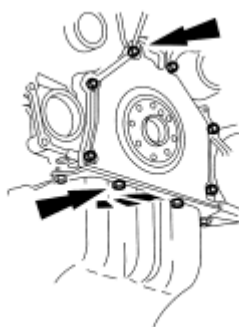


Fig. 263: Identifying Crankshaft Rear Seal Retainer Plate Bolts
Courtesy of FORD MOTOR CO.

6. Mount the engine on a suitable work stand.
7. Remove the special tool.

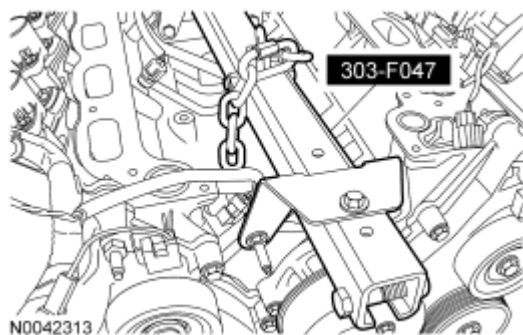


Fig. 264: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

8. Disconnect the crankshaft position sensor electrical connector and detach the wiring harness retainer.

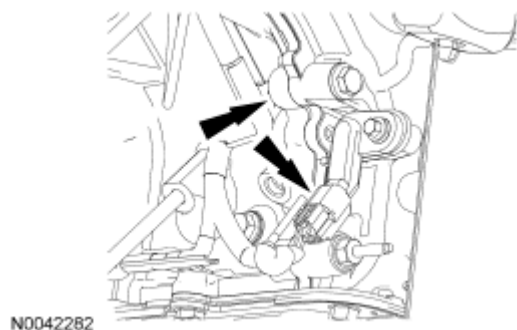


Fig. 265: Locating Crankshaft Position Sensor Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

9. Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

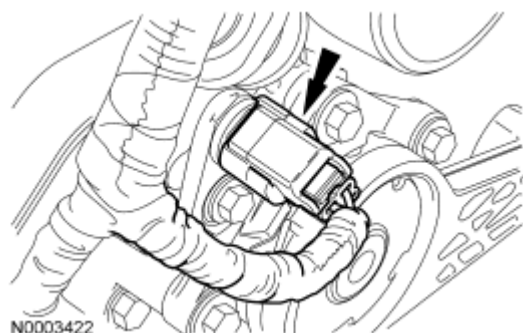


Fig. 266: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

10. Disconnect the RH and LH variable camshaft timing (VCT) solenoid electrical connectors.

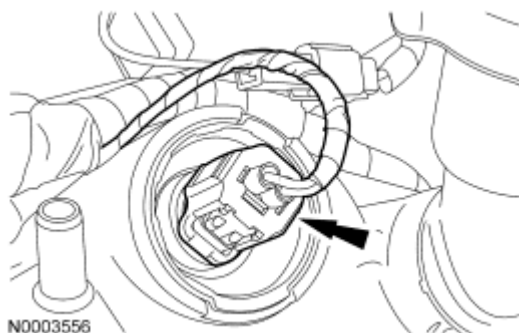


Fig. 267: Locating Camshaft Timing (VCT) Solenoid Electrical Connectors
Courtesy of FORD MOTOR CO.

11. Detach the wiring harness retainers.

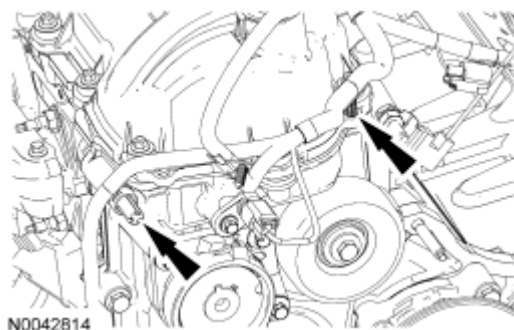


Fig. 268: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

12. Remove the nut and the RH radio ignition interference capacitor.

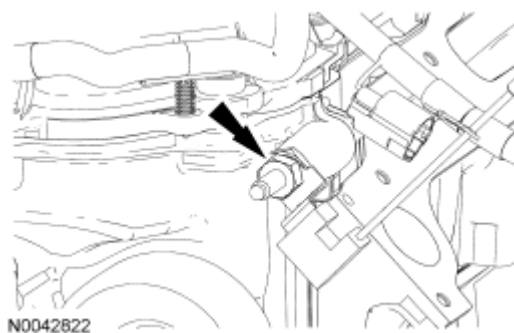


Fig. 269: Locating RH Radio Ignition Interference Capacitor Nut
Courtesy of FORD MOTOR CO.

13. Disconnect the oil pressure sensor electrical connector.

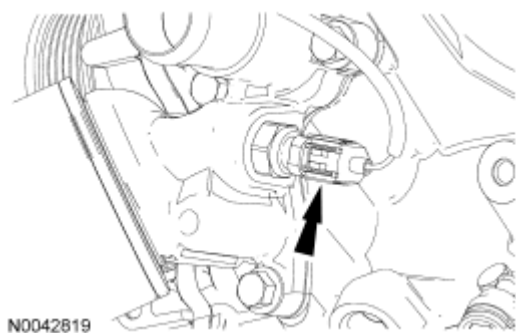


Fig. 270: Locating Oil Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

14. Disconnect the LH CMP sensor electrical connector and detach the wiring harness retainers.

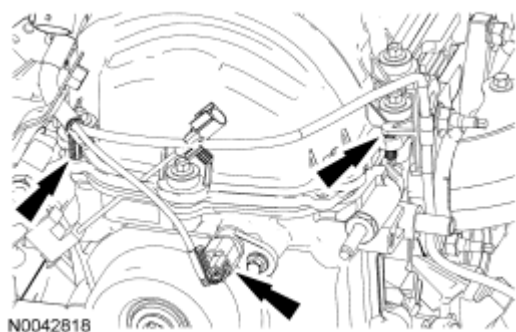


Fig. 271: Locating LH Camshaft Position Sensor And Attach Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

15. Remove the nut and the cooling fan wiring harness bracket.

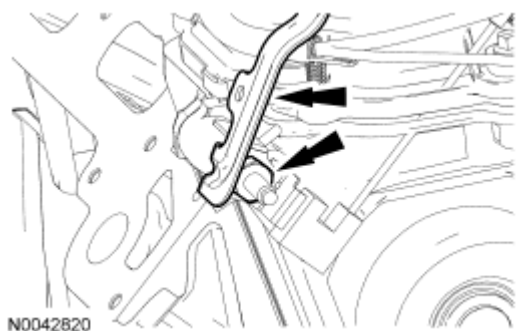


Fig. 272: Locating Cooling Fan Wiring Harness Bracket Nut
Courtesy of FORD MOTOR CO.

16. Remove the nut and detach the LH radio interference capacitor.

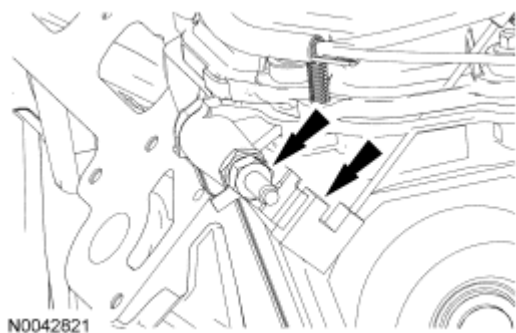


Fig. 273: Locating LH Radio Interference Capacitor And Nuts
Courtesy of FORD MOTOR CO.

17. Detach the wiring harness retainers from the LH valve cover studs.

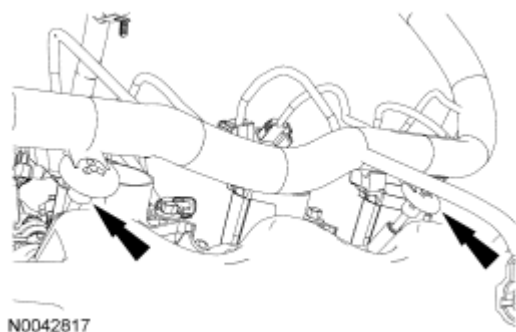


Fig. 274: Locating LH Valve Cover Studs
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

18. Disconnect the 4 RH and 4 LH ignition coil electrical connectors.

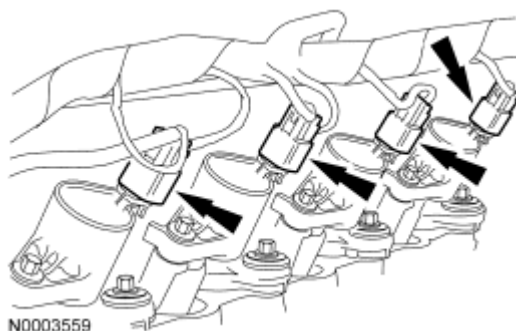


Fig. 275: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

19. Detach the wiring harness retainers from the RH valve cover studs.

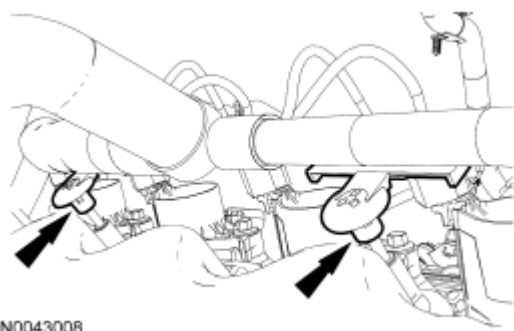


Fig. 276: Locating RH Valve Cover Studs
Courtesy of FORD MOTOR CO.

20. Disconnect the cylinder head temperature (CHT) sensor electrical connector.

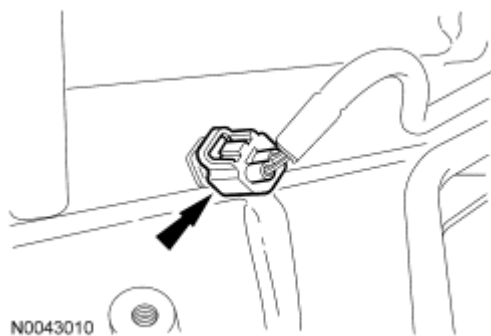


Fig. 277: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

21. Remove the nut and the ground strap.

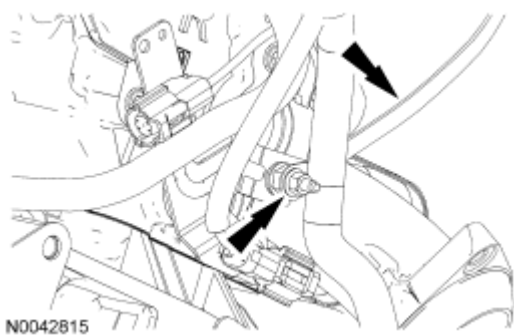


Fig. 278: Locating Ground Strap Nut
Courtesy of FORD MOTOR CO.

22. Detach the electrical connector retainers and remove the engine wiring harness.

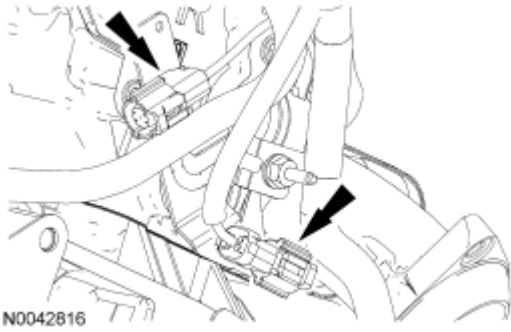


Fig. 279: Locating Electrical Connector Retainers And Engine Wiring Harness
Courtesy of FORD MOTOR CO.

23. Remove the stud bolt and the heater supply tube and hoses as an assembly.
- Discard the O-ring seals.

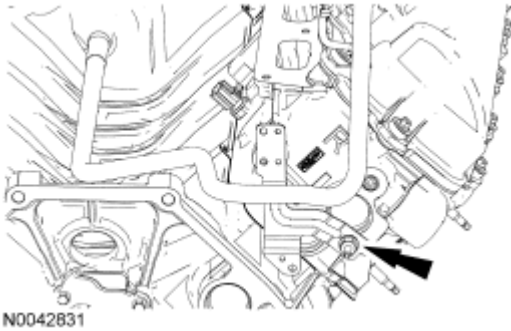


Fig. 280: Locating Heater Supply Tube Stud Bolt
Courtesy of FORD MOTOR CO.

NOTE: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

24. Remove the breather tube from the RH valve cover.
- Disconnect the quick connect fittings.
 - Push the connector toward the valve cover to release pressure.
 - Push the release tab clockwise.
 - Disconnect the quick connect fitting.

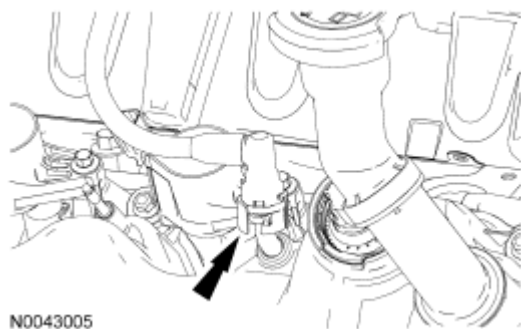


Fig. 281: Locating Breather Tube Connector Retaining Clip
Courtesy of FORD MOTOR CO.

NOTE: When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube.

25. Remove the PCV tube from the LH valve cover.
 - Disconnect the quick connect fittings.
 - Push the connector toward the valve cover to release pressure.
 - Push the release tab clockwise.
 - Disconnect the quick connect fitting.

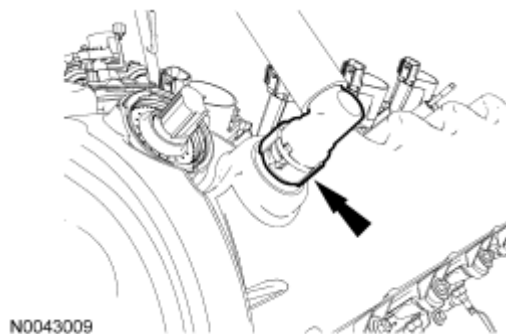


Fig. 282: Locating Positive Crankcase Ventilation (PCV) Hose
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

26. Remove the 8 bolts and the 8 ignition coils.

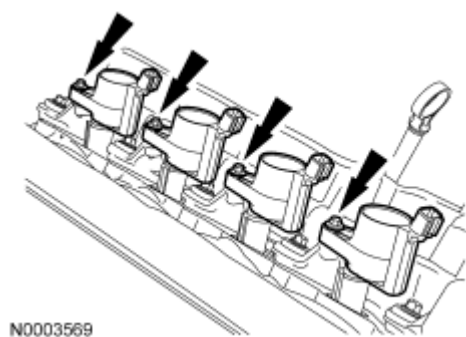


Fig. 283: Identifying Ignition Coils And Bolts
Courtesy of FORD MOTOR CO.

27. Remove the bolts and the LH engine support insulator bracket.

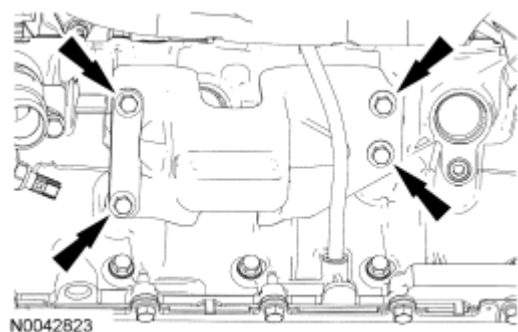


Fig. 284: Locating LH Engine Support Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

28. Remove and discard the oil filter. Remove the bolts and the oil filter adapter.

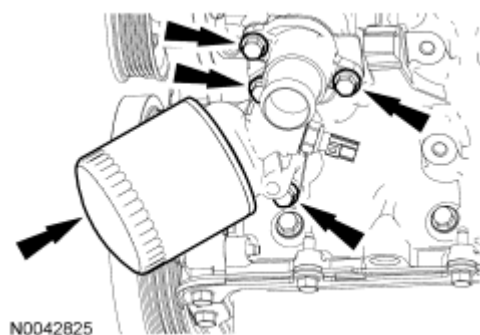


Fig. 285: Locating Bolts And Oil Filter Adapter
Courtesy of FORD MOTOR CO.

29. Remove the bolts and the LH exhaust manifold heat shield.

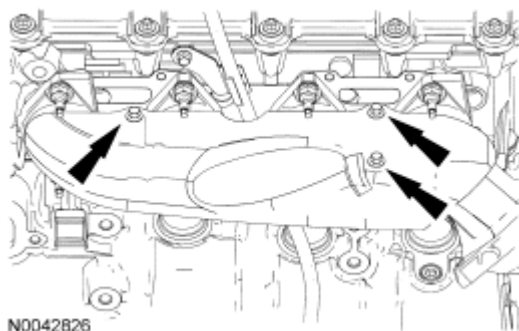


Fig. 286: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

30. Remove the nuts, the LH exhaust manifold and the gaskets.
 - Discard the nuts and the gaskets.

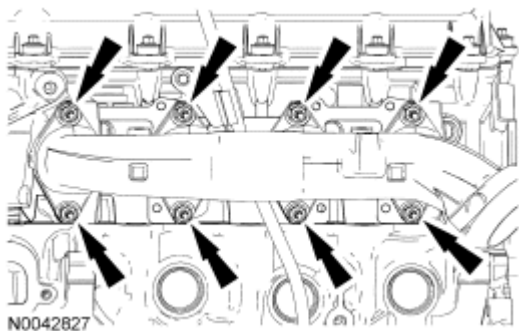


Fig. 287: Locating LH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

31. Remove and discard the 8 LH exhaust manifold studs.
32. Remove the bolt and the oil level indicator tube.

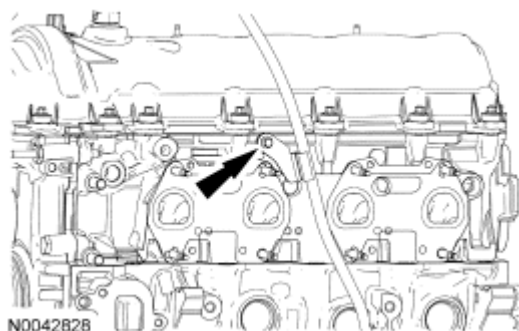


Fig. 288: Locating Oil Level Indicator Tube Bolt
Courtesy of FORD MOTOR CO.

33. Remove the bolts and the RH engine support insulator bracket.

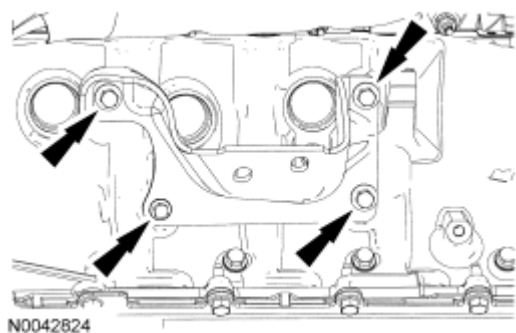


Fig. 289: Locating RH Engine Support Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

34. Remove the bolts and the RH exhaust manifold heat shield.

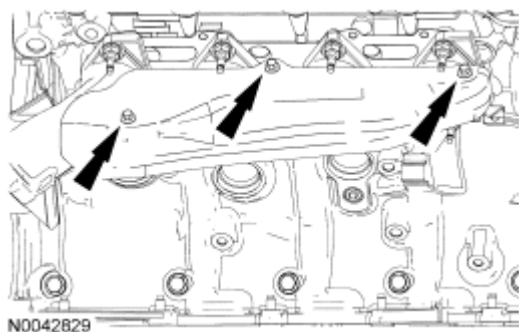


Fig. 290: Identifying RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

35. Remove the nuts, the RH exhaust manifold and the gaskets.
- Discard the nuts and the gaskets.

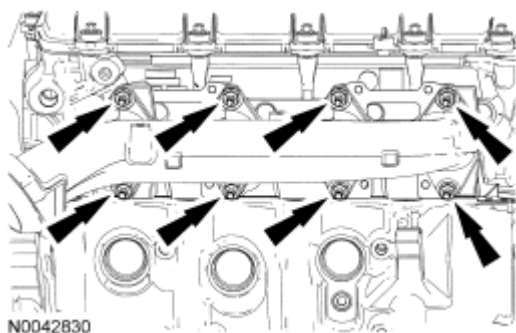


Fig. 291: Locating RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

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

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

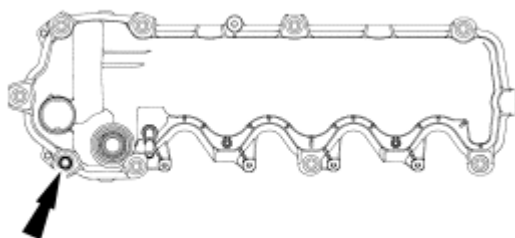
abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: Remove the valve covers carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

NOTE: The bolts are part of the valve cover and should not be removed.

37. Loosen the 9 bolts and remove the RH valve cover.

- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



N0074178

Fig. 292: Identifying Bolts
Courtesy of FORD MOTOR CO.

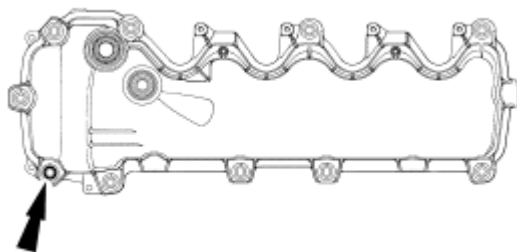
NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: Remove the valve covers carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

NOTE: The bolts are part of the valve cover and should not be removed.

38. Loosen the 10 bolts and remove the LH valve cover.

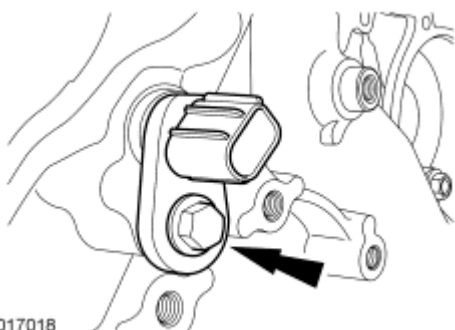
- Clean the valve cover mating surface of the cylinder head with silicone gasket remover and metal surface prep. Follow the directions on the packaging.
- Inspect the valve cover gasket. If the gasket is damaged, remove and discard the gasket. Clean the valve cover gasket groove with soap and water or a suitable solvent.



N0074177

Fig. 293: Identifying Bolts
Courtesy of FORD MOTOR CO.

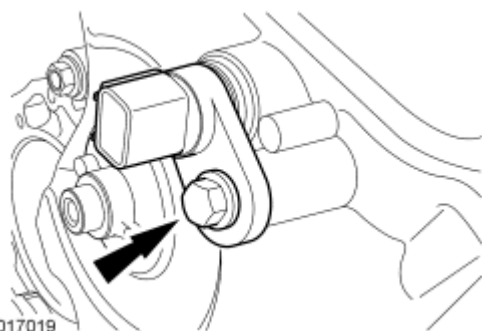
39. Remove the bolt and the RH CMP sensor.



N0017018

Fig. 294: Locating RH CMP Sensor And Bolt
Courtesy of FORD MOTOR CO.

40. Remove the bolt and the LH CMP sensor.



N0017019

Fig. 295: Locating Camshaft Position (CMP) Sensor And Bolt
Courtesy of FORD MOTOR CO.

41. Remove the bolt and the CKP sensor.

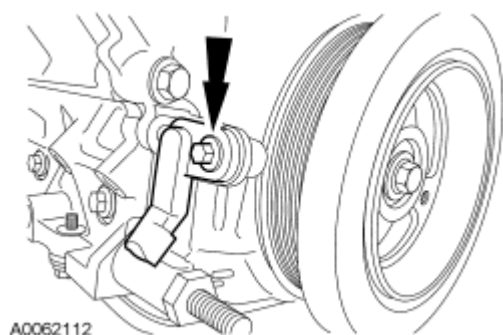


Fig. 296: Locating Crankshaft Position (CKP) Sensor Bolt
Courtesy of FORD MOTOR CO.

42. Remove the 7 bolts, the coolant pump pulley and the 3 accessory drive belt idler pulleys.

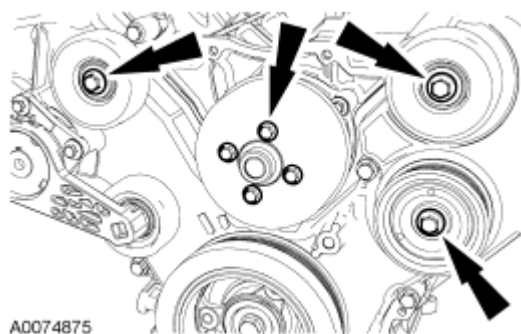


Fig. 297: Locating Coolant Pump Pulley And Accessory Drive Belt Idler Pulley Bolts
Courtesy of FORD MOTOR CO.

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

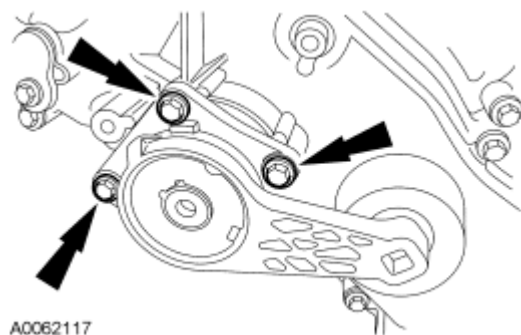
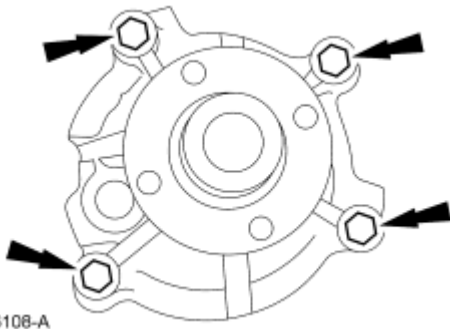


Fig. 298: Identifying Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

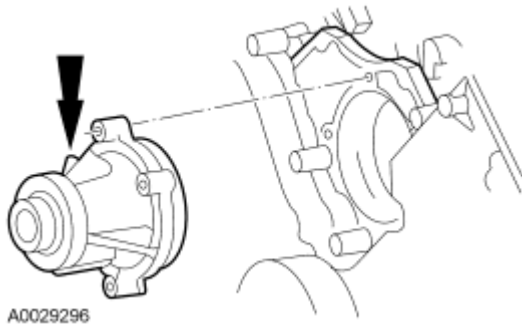
44. Remove the 4 coolant pump bolts.



A26108-A

Fig. 299: Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

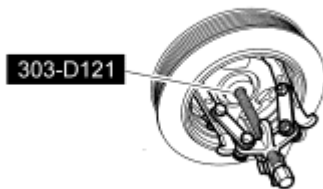
45. Remove the coolant pump from the cylinder block.
- Discard the O-ring seal.



A0029296

Fig. 300: Identifying Coolant Pump
Courtesy of FORD MOTOR CO.

46. Remove and discard the crankshaft pulley bolt. Using the special tool, remove the crankshaft pulley.



N0010528

Fig. 301: Removing Crankshaft Pulley Using Special Tool (303-D121)
Courtesy of FORD MOTOR CO.

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

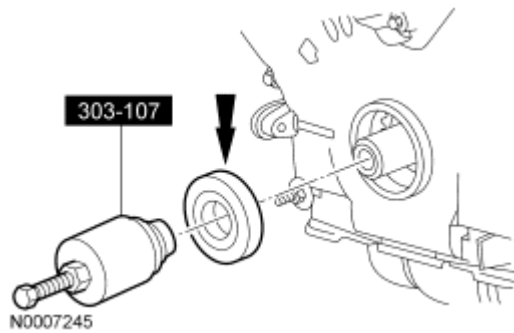


Fig. 302: Removing Crankshaft Front Seal Using Special Tool
Courtesy of FORD MOTOR CO.

48. Remove the bolts, oil pan and oil pan gasket.

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

- Clean and inspect the sealing surfaces with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

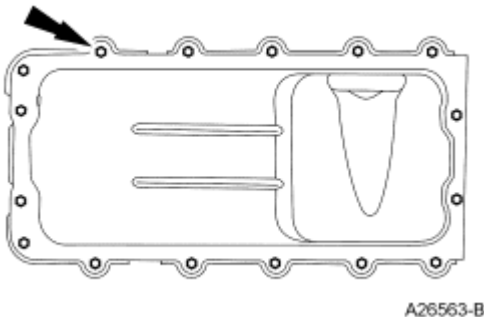


Fig. 303: Locating Oil Pan And Oil Pan Gasket Bolts
Courtesy of FORD MOTOR CO.

NOTE: Correct fastener location is essential for the assembly procedure. Record fastener location.

49. Remove the engine front cover fasteners.

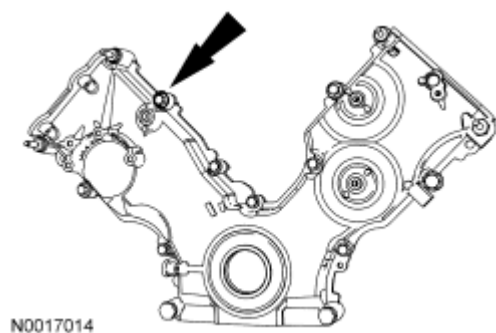


Fig. 304: Locating Engine Front Cover Fasteners
Courtesy of FORD MOTOR CO.

50. Remove the engine front cover from the cylinder block.

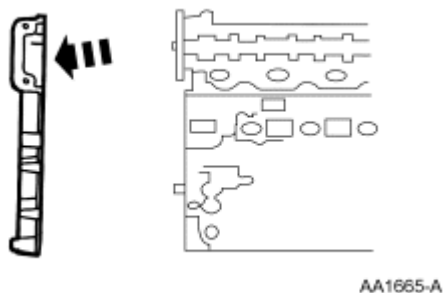


Fig. 305: Removing Engine Front Cover From Cylinder Block
Courtesy of FORD MOTOR CO.

51. Remove the crankshaft sensor ring from the crankshaft.

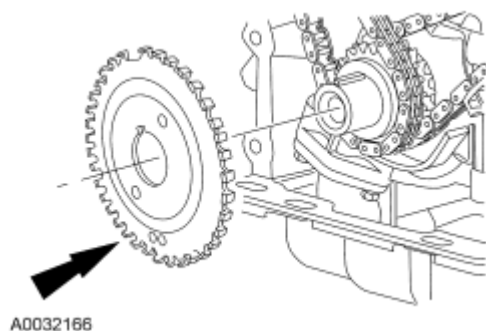


Fig. 306: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

52. Position the crankshaft keyway at the 12 o'clock position.

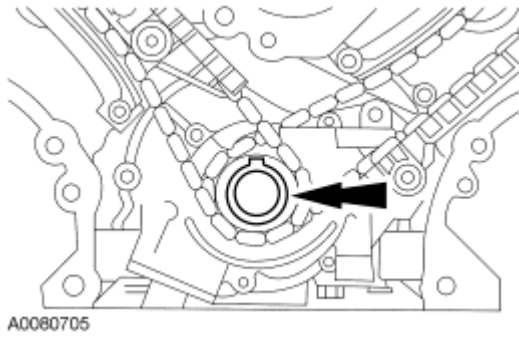


Fig. 307: Positioning Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

NOTE: If the camshaft lobes are not exactly positioned as shown, the crankshaft will require one full additional rotation to the 12 o'clock position.

53. The No. 1 cylinder camshaft exhaust lobe must be coming up on the exhaust stroke. Verify by noting the position of the 2 intake lobes and the exhaust lobe on the No. 1 cylinder.



Fig. 308: Identifying Camshaft Lobe Position
Courtesy of FORD MOTOR CO.

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

54. Remove only the 3 roller followers shown in the **Fig. 309** from the RH cylinder head.

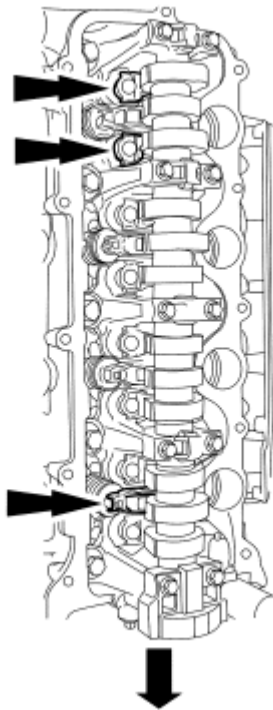


Fig. 309: Identifying RH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.

NOTE: It may be necessary to push the valve down while compressing the spring.

55. Using the special tool, remove the 3 roller followers designated in the previous step from the RH cylinder head.

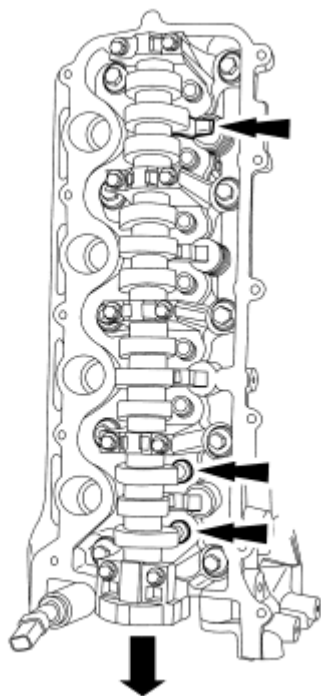


Fig. 310: Identifying Special Tool For Removing/Installing Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

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

locations.

56. Remove only the 3 roller followers shown in the **Fig. 311** from the LH cylinder head.



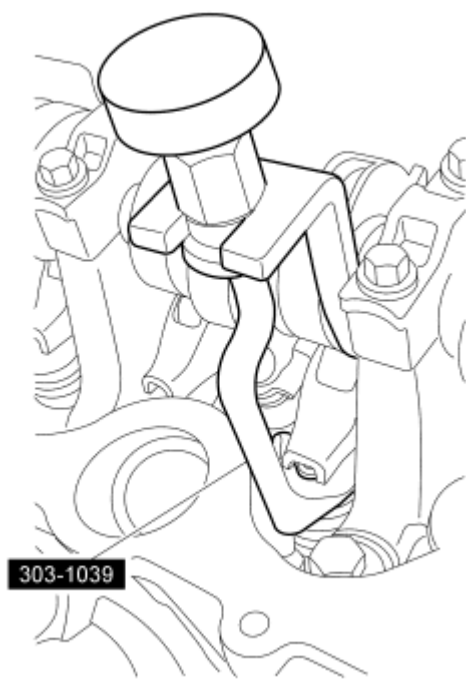
A0084479

Fig. 311: Locating LH Cylinder Head Camshaft Roller Followers And Bolts
Courtesy of FORD MOTOR CO.

NOTE: Do not allow the valve keepers to fall off the valve or the valve may drop into the cylinder.

NOTE: It may be necessary to push the valve down while compressing the spring.

57. Using the special tool, remove the 3 roller followers designated in the previous step from the LH cylinder head.

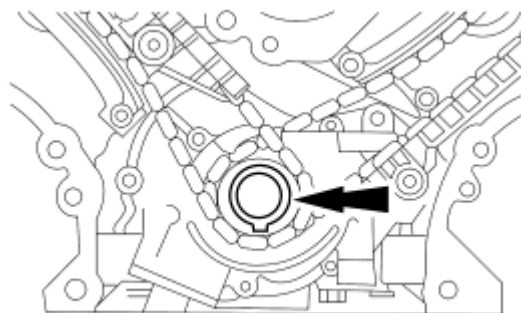


N0010191

Fig. 312: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

NOTE: The crankshaft cannot be moved past the 6 o'clock position once set, or the engine may be damaged.

58. Rotate the crankshaft clockwise and position the crankshaft keyway at the 6 o'clock position.



N0006305

Fig. 313: Crankshaft Positioned With Keyway At 6 O'clock Position
Courtesy of FORD MOTOR CO.

59. Remove the 2 bolts, the LH timing chain tensioner and tensioner arm.

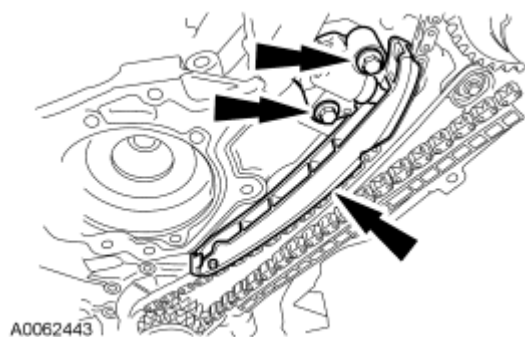


Fig. 314: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

60. Remove the 2 bolts, the RH timing chain tensioner and tensioner arm.

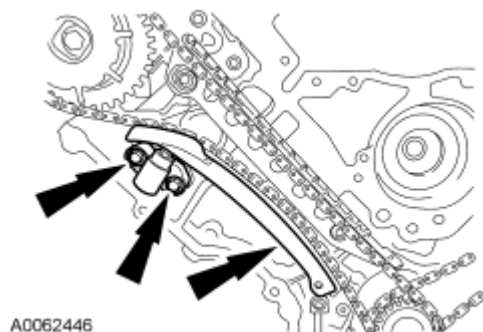
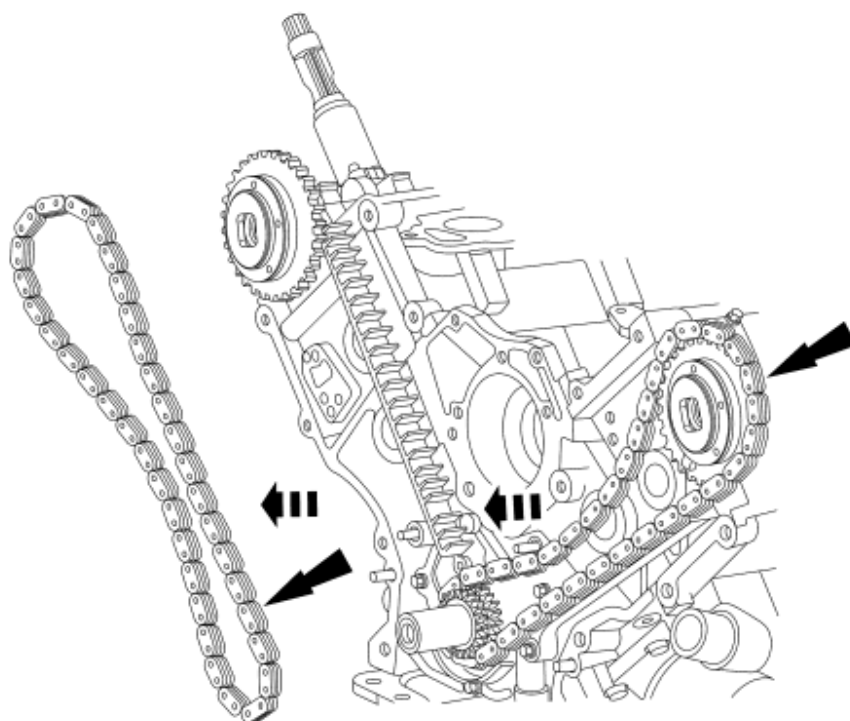


Fig. 315: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

61. Remove the RH and LH timing chains and the crankshaft sprocket.
- Remove the RH timing chain from the camshaft sprocket.
 - Remove the RH timing chain from the crankshaft sprocket.
 - Remove the LH timing chain from the camshaft sprocket.
 - Remove the LH timing chain and crankshaft sprocket.

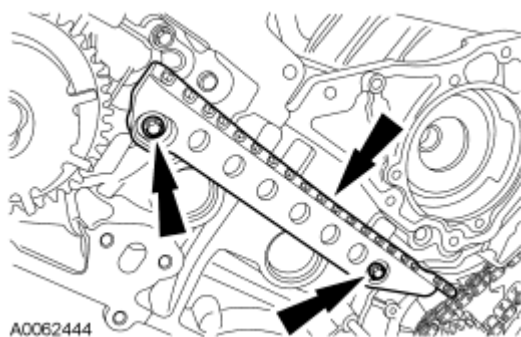


A0068222

Fig. 316: Identifying RH/LH Timing Chains
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

62. Remove the LH and RH timing chain guides.
- Remove the 2 bolts.
 - Remove both timing chain guides.



A0062444

Fig. 317: Identifying Timing Chain Guide And Mounting Bolts
Courtesy of FORD MOTOR CO.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

63. Using the special tool, remove the bolt and the RH camshaft phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

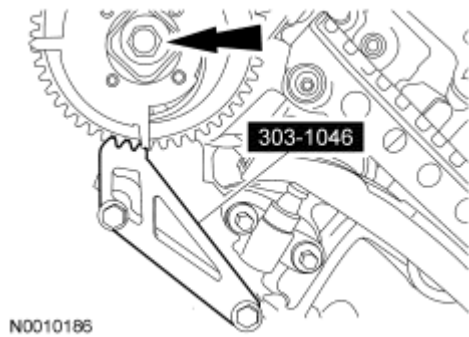


Fig. 318: Identifying VCT Phaser Sprocket Bolt And Holder Tool
Courtesy of FORD MOTOR CO.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

NOTE: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

64. Using the special tool, remove the bolt and the LH camshaft phaser sprocket assembly.
- Discard the camshaft phaser sprocket bolt.

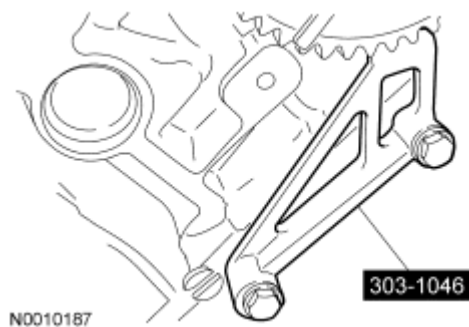


Fig. 319: Identifying Special Sprocket Phaser Tool

Courtesy of FORD MOTOR CO.

65. Install the special tool onto the LH cylinder head.

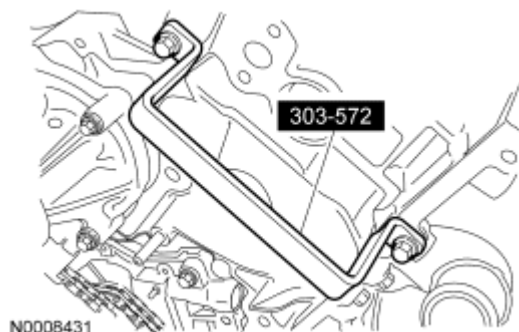


Fig. 320: Identifying Special Tool Onto Cylinder Head
Courtesy of FORD MOTOR CO.

66. Install the special tool onto the RH cylinder head.

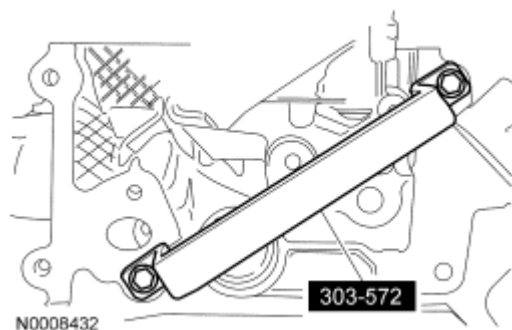
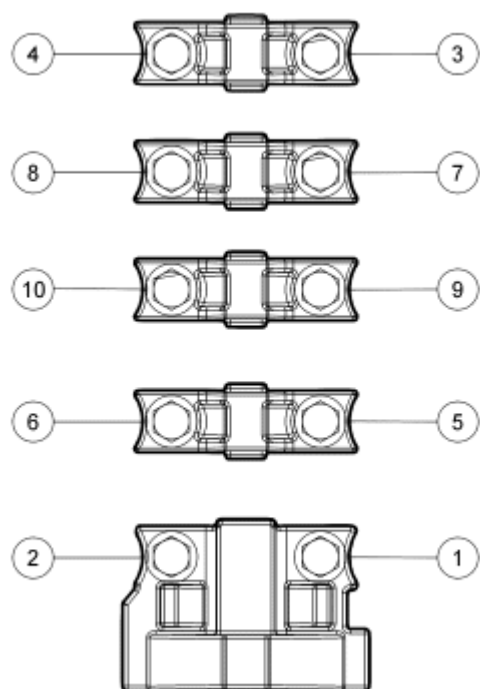


Fig. 321: Identifying Special Tool On Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers, or the bearing cap may be damaged from side loading.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

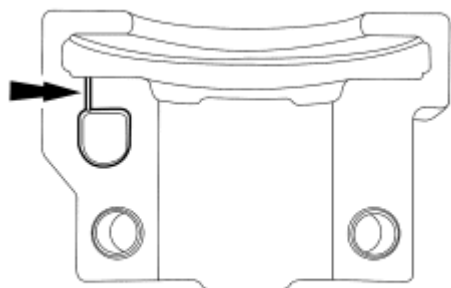
67. Remove the bolts in the sequence shown. Remove the RH cylinder head front camshaft bearing cap, then the remaining bearing caps.



N0010190

Fig. 322: Identifying Camshaft Bearing Caps Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

68. Clean and inspect the RH camshaft bearing caps.
- The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 323: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

69. Remove the RH camshaft.

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.

70. Remove the remaining roller followers from the RH cylinder head.

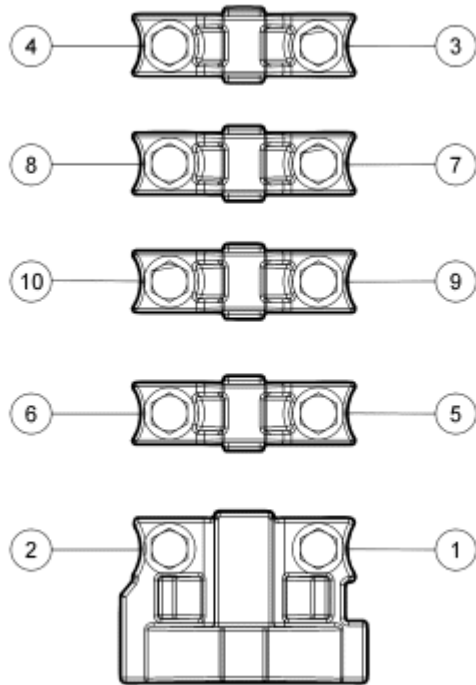
NOTE: If the components are to be reinstalled, they must be installed in the same positions. Mark the components for installation into their original locations.

71. Remove the hydraulic lash adjusters from the RH cylinder head.

NOTE: Remove the front thrust camshaft bearing cap straight upward from the bearing towers, or the bearing cap may be damaged from side loading.

NOTE: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations.

72. Remove the bolts in the sequence shown. Remove the LH cylinder head front camshaft bearing cap, then the remaining bearing caps.

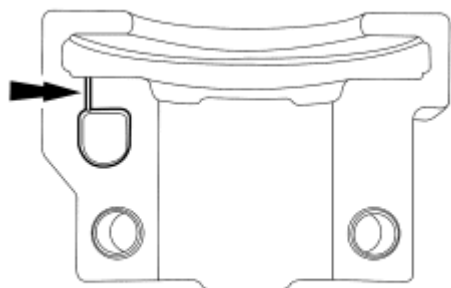


N0010190

Fig. 324: Identifying Camshaft Bearing Caps Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

73. Clean and inspect the LH camshaft bearing caps.

- The camshaft front thrust bearing cap contains an oil metering groove. Make sure the groove is free of foreign material.



N0010448

Fig. 325: Identifying Camshaft Front Thrust Bearing Cap Oil Metering Groove
Courtesy of FORD MOTOR CO.

74. Remove the LH camshaft.

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.

75. Remove the remaining roller followers from the LH 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.

76. Remove the hydraulic lash adjusters from the LH cylinder head.

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

NOTE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine. Failure to follow these instructions may result in engine damage.

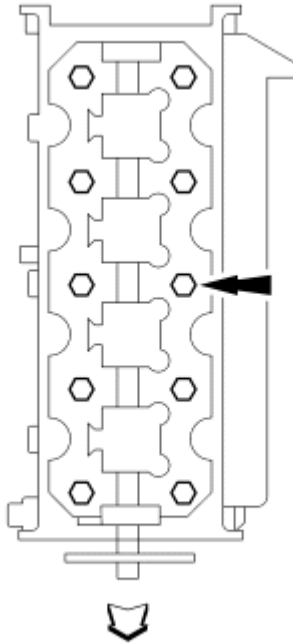
NOTE: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

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

NOTE: RH shown, LH similar.

77. Remove the 20 bolts and the cylinder heads.

- Discard the cylinder head gaskets.
- Discard the cylinder head bolts.



A26253-A

Fig. 326: Identifying Cylinder Head Gasket And Bolts

Courtesy of FORD MOTOR CO.

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

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

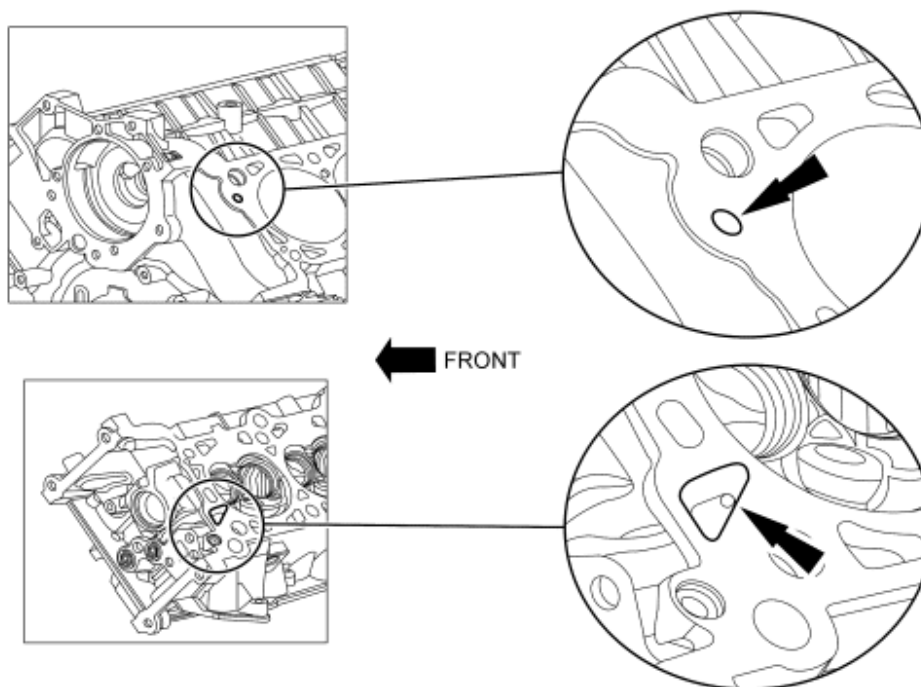
1. Remove any large deposits of silicone or gasket material with a plastic scraper.
2. Apply silicone gasket remover, following package directions and allow to set for several minutes.
3. Remove the silicone gasket remover with a plastic scraper. A second application of silicone gasket

remover may be required if residual traces of silicone or gasket material remain.

4. Apply metal surface prep, following package directions, to remove any remaining traces of oil or coolant and to prepare the surfaces to bond with the new gasket. Do not attempt to make the metal shiny. Some staining of the metal surfaces is normal.

NOTE: LH shown, RH similar.

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



A0079634

Fig. 327: Identifying Cylinder Head/Cylinder Block Oil Pressure Feed Areas
Courtesy of FORD MOTOR CO.

80. Remove the bolts, the oil pump screen and pickup tube and the spacer.

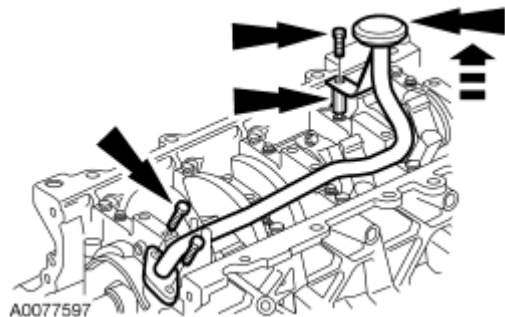


Fig. 328: Locating Oil Pump Screen Bolts, Pickup Tube & Spacer
Courtesy of FORD MOTOR CO.

81. Remove the 3 bolts and the oil pump.

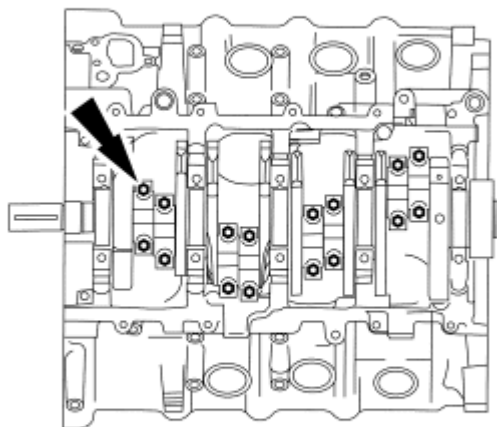


Fig. 329: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

82. 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 the manufacturer's instructions.

NOTE: Verify that the connecting rods and rod caps have orientation numbers cast into them. If not, number the connecting rods and rod caps for correct orientation. If the connecting rods and caps are assembled incorrectly, the engine may be damaged.

83. Remove the bolts and the connecting rod caps. Discard the bolts.

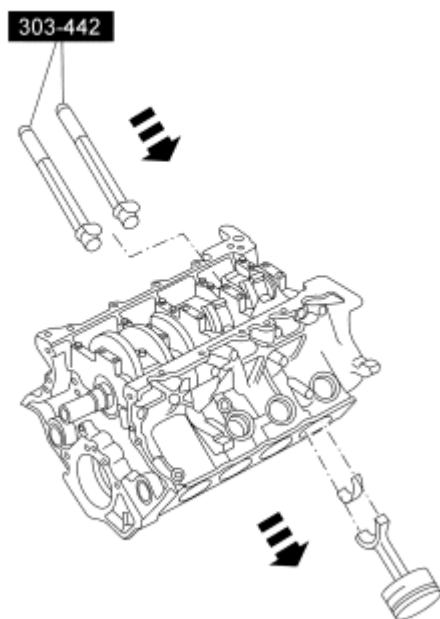


DA0578-A

Fig. 330: Locating Connecting Rod Caps
Courtesy of FORD MOTOR CO.

NOTE: Remove the piston and connecting rod assemblies carefully, or the cylinder walls or crankshaft journals may be damaged.

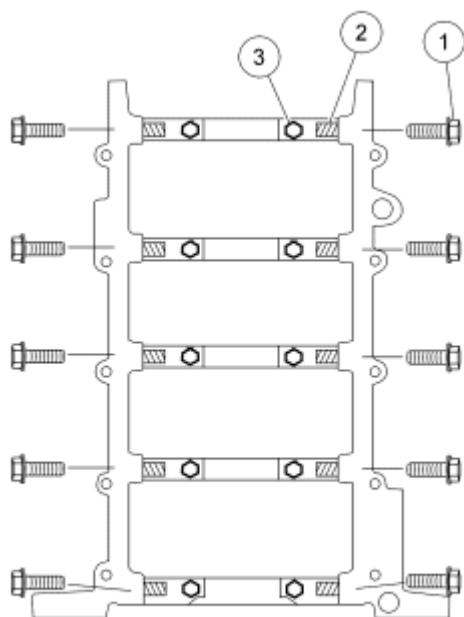
84. Use the special tool to push the piston through the top of the cylinder block.



N0010189

Fig. 331: Pushing Piston Through Top Of Cylinder Block
Courtesy of FORD MOTOR CO.

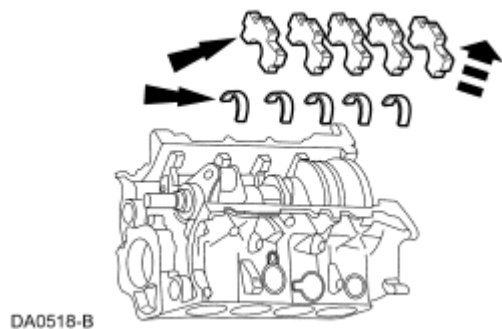
85. Disassemble the 8 pistons. For additional information, refer to **Piston**.
86. Remove the fasteners.
 1. Remove and discard the cross-mounted main cap bolts.
 2. Loosen the jack screws.
 3. Remove and discard the main bearing cap bolts and the stud bolt.



N0015130

Fig. 332: Locating Crankshaft Bearing Cap Fasteners
Courtesy of FORD MOTOR CO.

87. Remove the 5 main bearing caps, the lower crankshaft main bearings and the lower thrust washer.



DA0518-B

Fig. 333: Locating Main Bearing Caps, Lower Crankshaft Main Bearings And Lower Thrust Washer
Courtesy of FORD MOTOR CO.

88. Remove the crankshaft, the upper crankshaft main bearings and the upper thrust washers from the cylinder block.

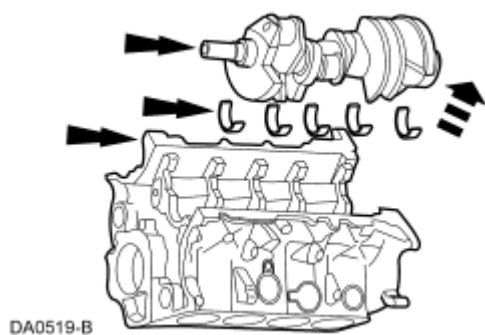


Fig. 334: Removing Crankshaft, Upper Crankshaft Main Bearings And Upper Thrust Washers From Cylinder Block
 Courtesy of FORD MOTOR CO.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

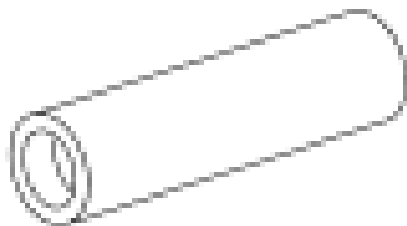
CYLINDER HEAD

Special Tools

Illustration	Tool Name	Tool Number
ST2604-A	Compressor, Valve Spring	303-1039
	Installer, Valve Stem Oil Seal	303-383 (T91T-6571-A)

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



ST1332-A

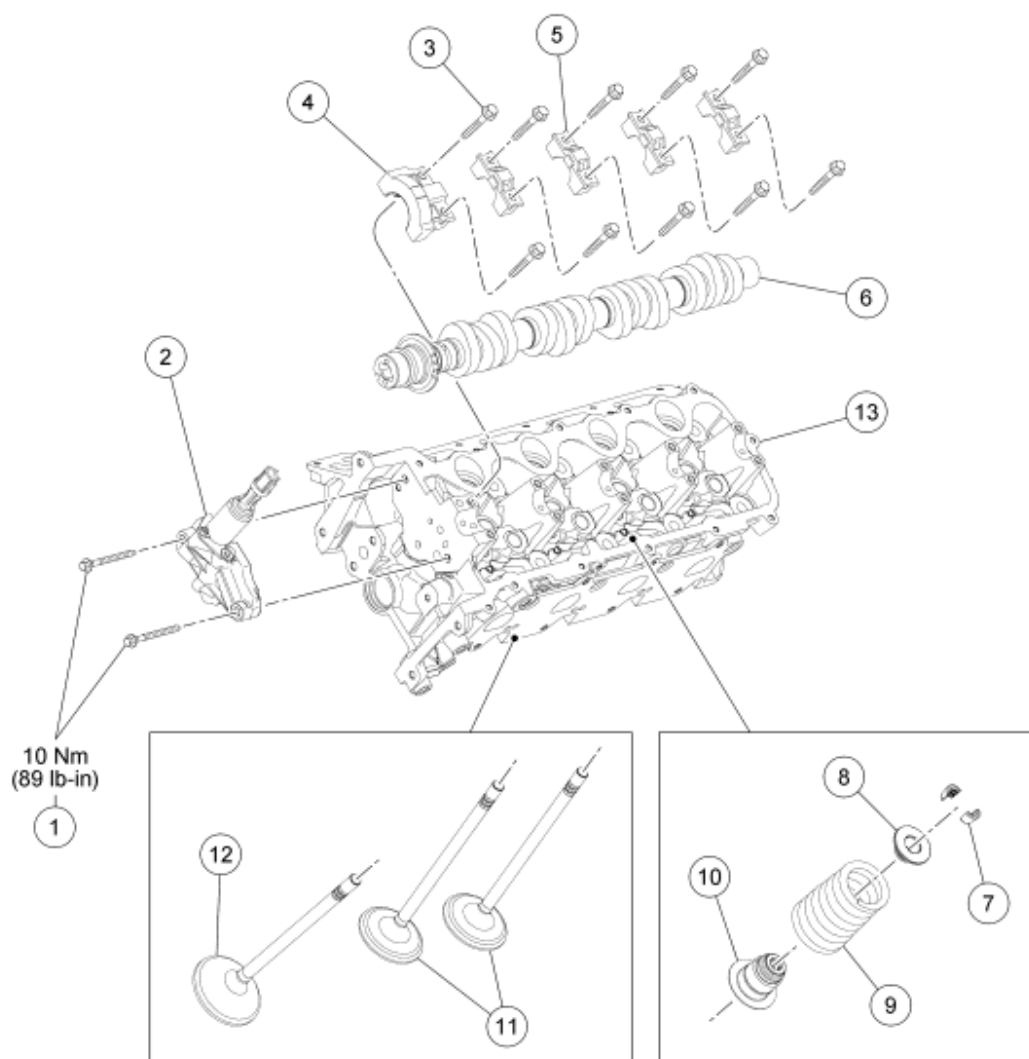
Material

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

NOTE: LH side shown, RH side similar.

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



N0070935

Fig. 335: Cylinder Head Components With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701520	Variable camshaft timing (VCT) housing assembly bolts (2 required)
2	6C261 LH/ 6C260 RH	VCT housing assembly
3	N807834	Camshaft bearing cap bolt (10 required)
4	6B284	Camshaft front bearing cap
5	6B280	Camshaft bearing cap (4 required)
6	6C255 LH/ 6251 RH	Camshaft
7	6518	Valve spring retainer key (24 required)
8	6514	Valve spring retainer (12 required)
9	6513	Valve spring (12 required)

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

10	6A517	Valve seal (12 required)
11	6507	Intake valves (8 required)
12	6505	Exhaust valve (4 required)
13	6050 LH/ 6049 RH	Cylinder head

DISASSEMBLY

1. Remove the bolts and the variable camshaft timing (VCT) housing.
 - Discard the gasket.
2. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

NOTE: The camshaft must be installed in the head to use the special tool necessary to compress the valve springs.

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

3. Install the camshaft bearing caps in their original locations.
 - Position the front camshaft bearing cap.
 - Position the remaining camshaft bearing caps.
 - Install the bolts finger-tight.
4. Using the special tool, compress the valve spring and remove the valve spring retainer keys.



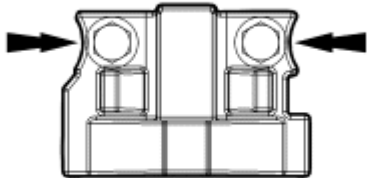
Fig. 336: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

5. Remove the valve spring retainer, the valve spring and the valve seal.
 - Discard the valve seal.
6. Remove the valve from the cylinder head.
7. Repeat the previous 3 steps for each valve.
8. Inspect the components. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

CAUTION: Remove the front thrust camshaft bearing cap straight upward from

the bearing towers or the bearing cap may be damaged from side loading.

9. Remove the 2 bolts and the cylinder head camshaft front bearing cap.

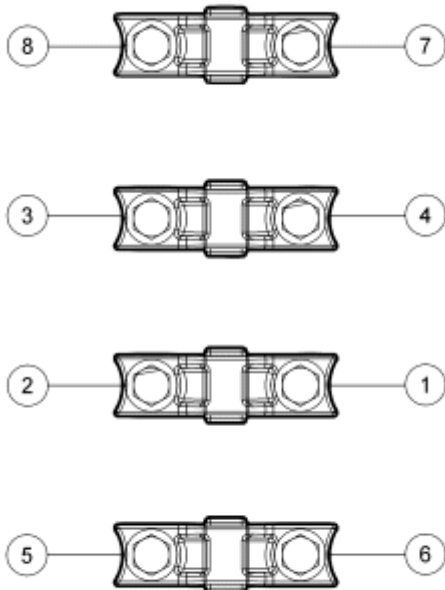


N0070049

Fig. 337: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.

10. Remove the remaining bolts in the sequence shown and remove the cylinder head camshaft bearing caps.



N0070050

Fig. 338: Removing Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

11. Remove the camshaft.
12. Check the cylinder head for distortion. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

ASSEMBLY

1. Lubricate the camshaft and camshaft journals with clean engine oil and install the camshaft.

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

2. Install the camshaft bearing caps in their original locations.
 - Position the front camshaft bearing cap.
 - Position the remaining camshaft bearing caps.
 - Install the bolts finger-tight.

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

3. Install the valve into the cylinder head.

NOTE: Lubricate the valve seal and valve stem with clean engine oil prior to installation.

4. Position a new valve seal onto the valve stem.
5. Using the special tool, install the new valve seal.

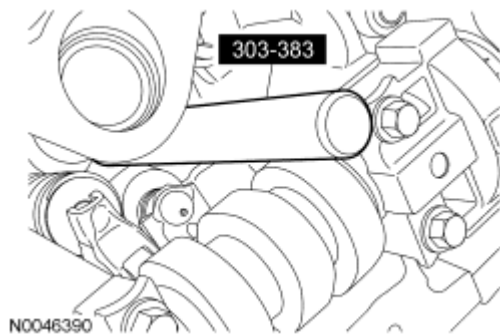


Fig. 339: Installing Valve Seal Using Special Tool
Courtesy of FORD MOTOR CO.

6. Using the special tool, install the valve spring, the valve spring retainer and the valve spring retainer keys.



Fig. 340: Compressing Valve Spring With Special Tool
Courtesy of FORD MOTOR CO.

7. Repeat the previous 2 steps for each valve.

CAUTION: Remove the front thrust camshaft bearing cap straight upward from the bearing towers or the bearing cap may be damaged from side loading.

8. Remove the 2 bolts and the cylinder head camshaft front bearing cap.

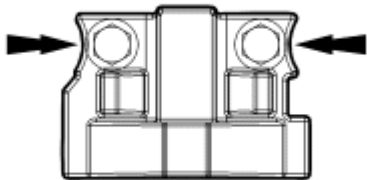
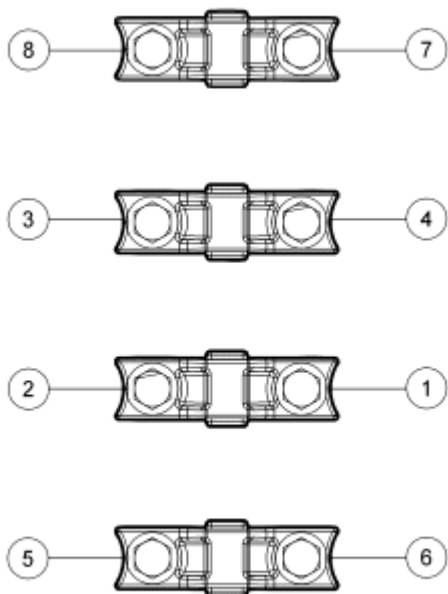


Fig. 341: Removing Camshaft Front Bearing Cap Bolts
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft bearing caps must be installed in their original locations. Record camshaft bearing cap locations. Failure to follow these instructions may result in engine damage.

9. Remove the remaining bolts in the sequence shown and remove the cylinder head camshaft bearing caps.



N0070050

Fig. 342: Removing Camshaft Bearing Caps Bolts In Sequence
Courtesy of FORD MOTOR CO.

10. Remove the camshaft.
11. Install a new gasket, the VCT housing and the bolts.
 - Tighten to 10 N.m (89 lb-in).

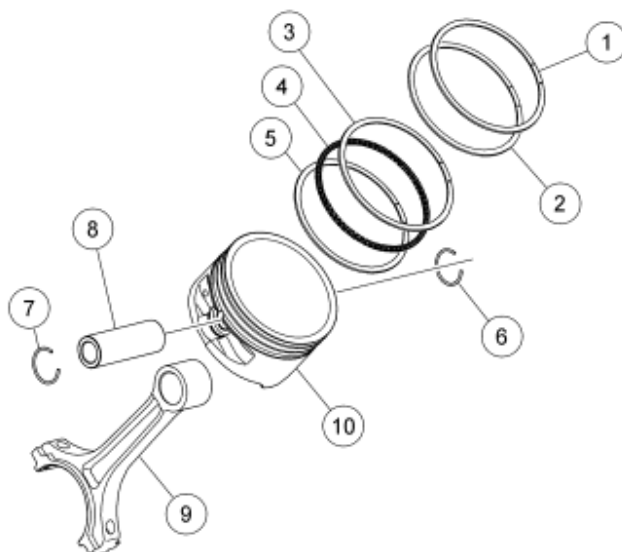
PISTON

Material

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

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2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



N0010114

Fig. 343: Identifying Piston Components
Courtesy of FORD MOTOR CO.

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

DISASSEMBLY

WARNING: Since the retainer ring has a tendency to spring out, cover the end of the pin bore with a hand or shop rag when removing the ring. Wear eye protection. Failure to follow these instructions may result in serious personal injury.

1. Remove the piston rings from the piston.
 - Discard the piston rings.

2. Mark the piston and the connecting rod on the same side for assembly reference.

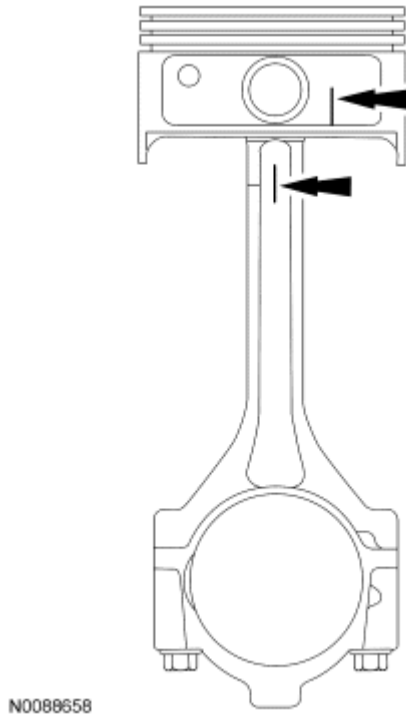


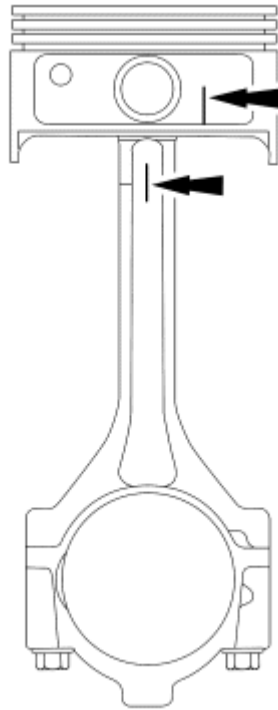
Fig. 344: Marking Piston & Connecting Rod On Same Side For Assembly Reference
Courtesy of FORD MOTOR CO.

3. Remove the piston pin retainers and the piston pin.
4. Separate the piston from the connecting rod.
5. Clean and inspect the piston and connecting rod. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.

ASSEMBLY

NOTE: The connecting rod must be installed into the piston with identification markings toward the front.

1. Position the connecting rod in the piston.



N0088658

Fig. 345: Marking Piston & Connecting Rod On Same Side For Assembly Reference
Courtesy of FORD MOTOR CO.

2. Lubricate the piston pin and pin bore with clean engine oil.
3. Install the piston pin in the piston and connecting rod assembly.
4. Install the piston pin retaining clips in the piston.
5. Lubricate the piston and the new piston rings with clean engine oil.
6. Install the piston rings onto the piston.

ASSEMBLY

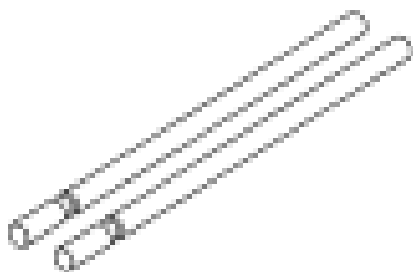
ENGINE

Special Tools

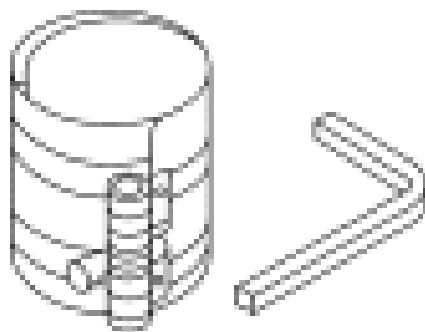
Illustration	Tool Name	Tool Number
	Alignment Pins, Cylinder Head	303-1040 (SR-015486)

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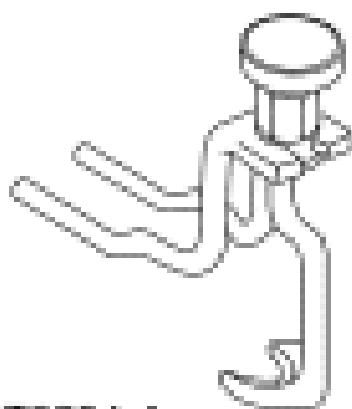
ST2606-A



ST1376-A

Compressor, Piston Ring

303-D032 (D81L-6002-C) or equivalent



ST2604-A

Compressor, Valve Spring

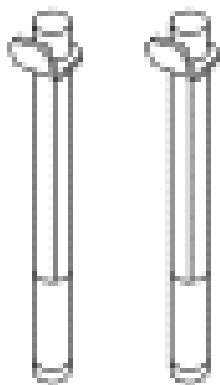
303-1039

Installer, Connecting Rod

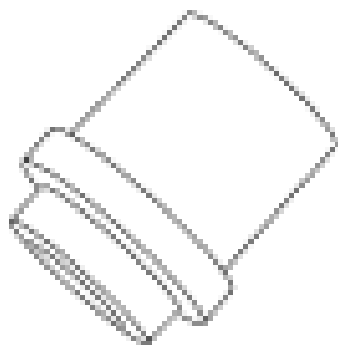
303-442 (T93P-6136-A)

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ST1337-A



ST2197-A



ST1482-A

Installer, Crankshaft Front Seal

303-635

Installer, Crankshaft Oil Slinger

303-517 (T95P-6701-CH)

Installer, Crankshaft Rear Seal

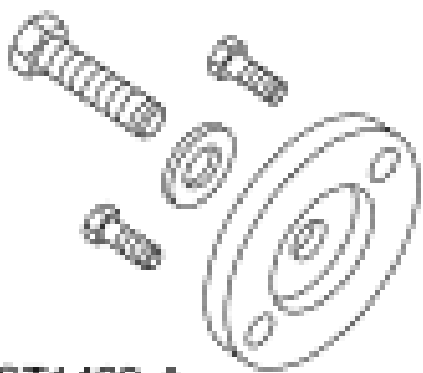
303-516 (T95P-6701-EH)

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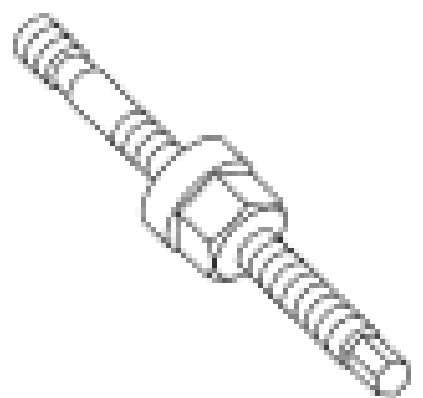
ST1479-A



ST1480-A

Installer, Crankshaft Rear Seal

303-518 (T95P-6701-DH)



ST2428-A

Installer, Crankshaft Vibration Damper

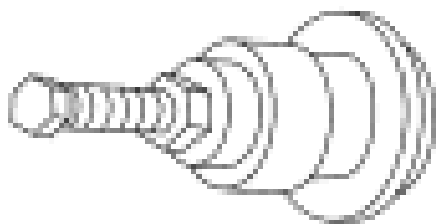
303-102 (T74P-6316-B)

Installer, Front Cover Seal

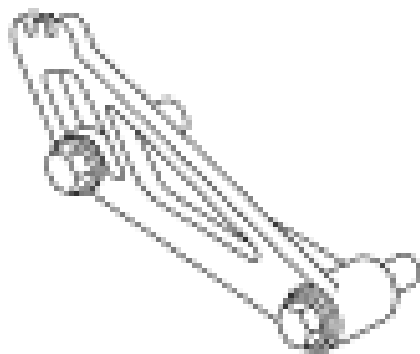
303-335 (T88T-6701-A)

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ST132B-A



ST2B07-A

Locking Tool, Camshaft Phaser Sprocket

303-1046



ST1377-A

Modular Engine Lift Bracket

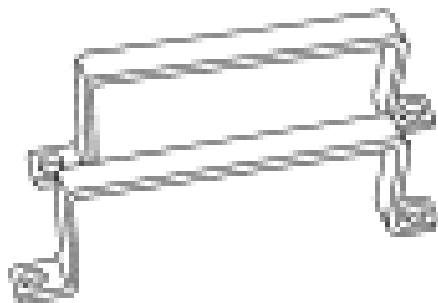
303-F047 (014-00073) or equivalent

Remover/Installer, Cylinder Head

303-572 (T97T-6000-A)

2009 Mercury Mountaineer

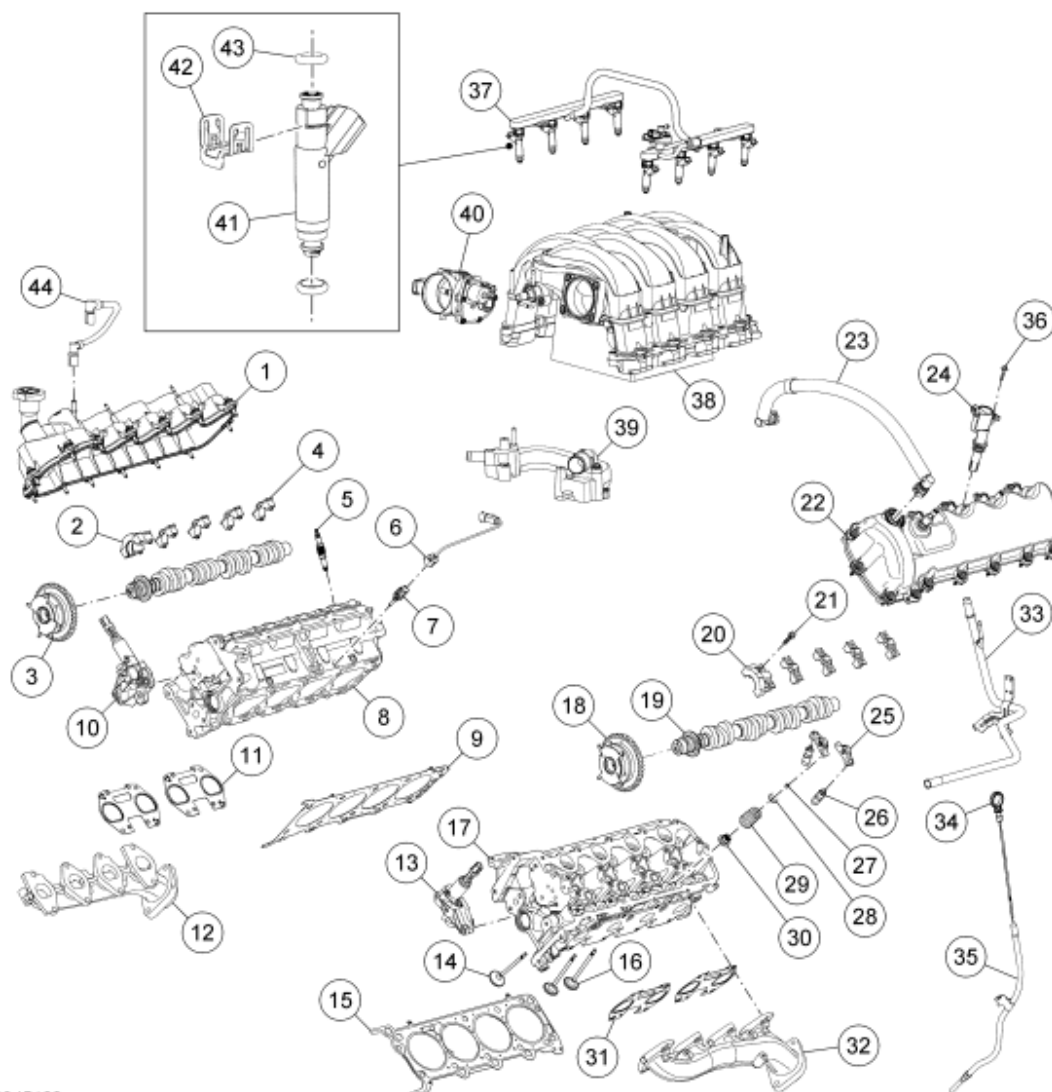
2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

**ST1668-A****Material**

Item	Specification
Gasket Maker TA-16	WSK-M2G348-A5
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	-
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	-

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2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



N0045182

Fig. 346: Engine - Upper End
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6582	RH valve cover
2	6B284	RH camshaft thrust bearing cap
3	6C524	RH camshaft phaser sprocket
4	6B280	Camshaft bearing cap (8 required)
5	12405	Spark plug (8 required)
6	14B102	Cylinder head temperature (CHT) sensor jumper harness
7	6G004	CHT sensor
8	6049	RH cylinder head
9	6051	RH cylinder head gasket

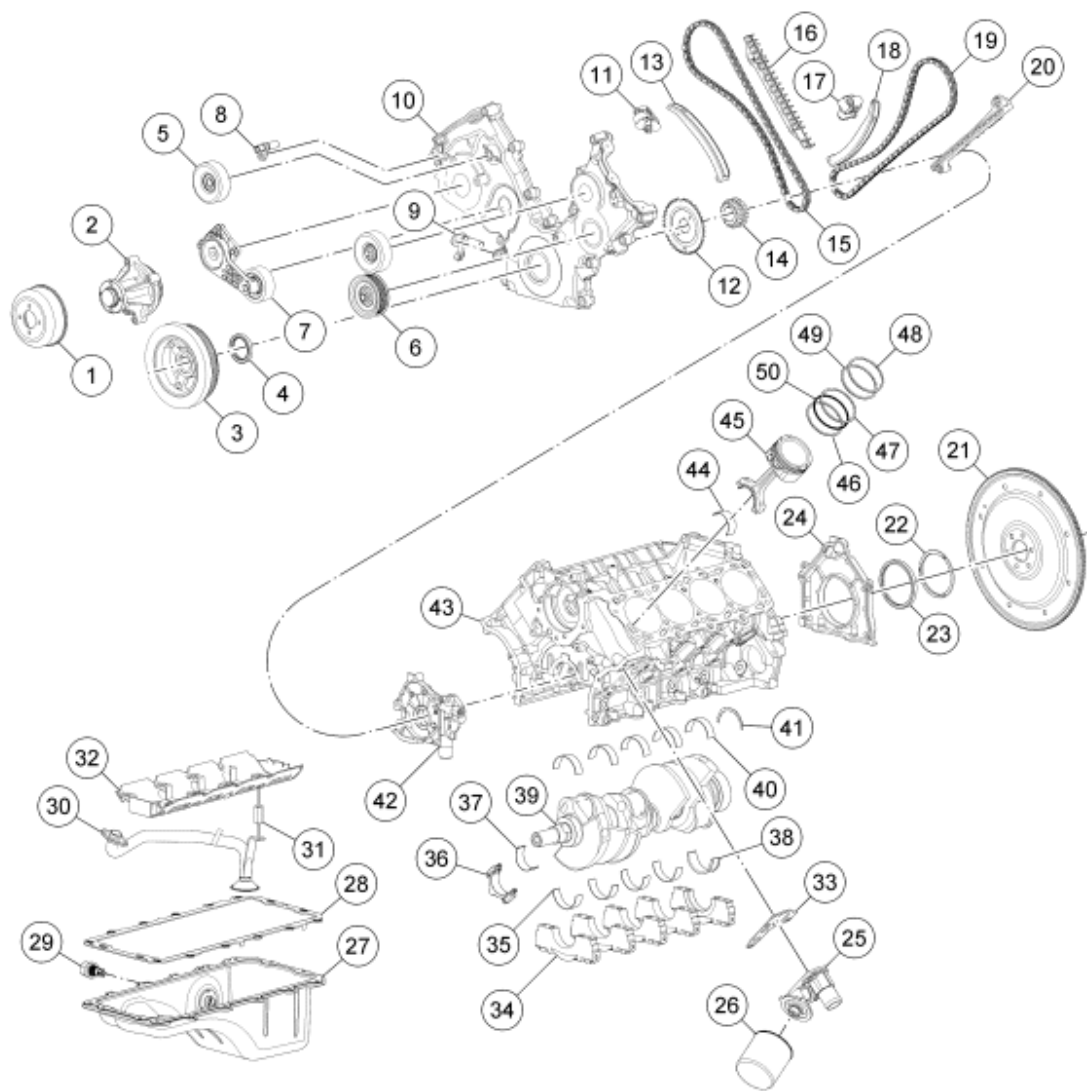
2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

10	6C261	RH variable camshaft timing (VCT) oil control solenoid assembly
11	9Y431	Exhaust manifold gasket (2 required)
12	9430	Exhaust manifold - RH
13	6C261	LH VCT oil control solenoid assembly
14	6505	Exhaust valve (8 required)
15	6083	LH cylinder head gasket
16	6507	Intake valve (16 required)
17	6050	LH cylinder head
18	6C524	LH camshaft phaser sprocket
19	6C255	LH camshaft
20	6B284	LH camshaft thrust bearing cap
21	N807834	Camshaft bearing cap bolt (20 required)
22	6A505	LH valve cover
23	6K817	PCV tube
24	12A366	Ignition coil (8 required)
25	6529	Roller follower (24 required)
26	6C501	Hydraulic lash adjuster (24 required)
27	6518	Valve spring retainer key (48 required)
28	6514	Valve spring retainer (24 required)
29	6513	Valve spring (24 required)
30	6A517	Valve stem seal (24 required)
31	9Y431	Exhaust manifold gasket (2 required)
32	9431	LH exhaust manifold
33	18B402	Coolant tube
34	6750	Oil level indicator
35	6K873	Oil level indicator tube
36	W706175	Ignition coil bolt (8 required)
37	9F792	Fuel rail assembly
38	9424	Intake manifold assembly
39	8C369	Engine coolant crossover
40	9F991	Electronic throttle body
41	9F860	Fuel injector (8 required)
42	9C995	Fuel injector clip (8 required)
43	9F798	O-ring seal (16 required)
44	6758	PCV breather hose

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



N0043036

Fig. 347: Engine - Lower End
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	8A528	Coolant pump pulley
2	8501	Coolant pump
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal
5	19A216	Accessory drive belt idler pulley (2 required)
6	6C348	Accessory drive belt idler pulley
7	6B209	Accessory drive belt tensioner
8	6B288	Camshaft position (CMP) sensor (2 required)

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2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

9	6C315	Crankshaft position (CKP) sensor
10	6C086	Engine front cover
11	6L266	RH timing chain tensioner
12	12A227	Ignition pulse wheel
13	6K255	RH tensioner arm
14	6306	Crankshaft sprocket
15	6268	RH timing chain
16	6M256	RH timing chain guide
17	6M269	LH timing chain tensioner
18	6M274	LH tensioner arm
19	6268	LH timing chain
20	6B274	LH timing chain guide
21	6375	Flexplate
22	6701	Crankshaft oil slinger
23	6310	Crankshaft rear seal
24	6K318	Crankshaft rear seal retainer plate
25	6881	Oil filter adapter
26	6714	Oil filter
27	6675	Oil pan
28	6710	Oil pan gasket
29	12A648	Engine oil temperature sensor
30	6622	Oil pump screen and pickup tube
31	N806180	Oil pump screen and pickup tube spacer
32	6687	Windage tray
33	6A636	Oil filter adapter gasket
34	6325	Crankshaft main bearing cap (5 required)
35	6A338	Lower crankshaft bearing (4 required)
36	6210	Connecting rod cap (8 required)
37	6211	Connecting rod lower bearing (8 required)
38	6K302	Lower crankshaft thrust washer
39	6303	Crankshaft
40	6333	Upper crankshaft bearing (5 required)
41	6A341	Upper crankshaft thrust washer
42	6621	Oil pump
43	6010	Cylinder block
44	6211	Connecting rod upper bearing (8 required)
45	6110	Piston (8 required)
46	6159	Outer oil control ring (8 required)
47	6159	Outer oil control ring (8 required)

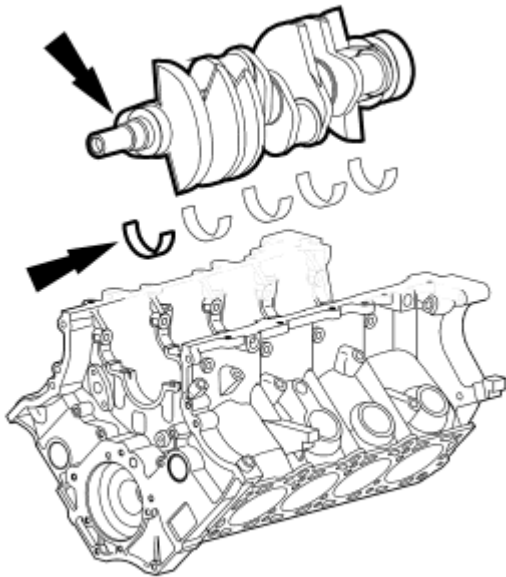
2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

48	6150	Upper compression ring (8 required)
49	6152	Lower compression ring (8 required)
50	6161	Inner oil control ring (8 required)

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.

1. Install the crankshaft main bearings.
 - Install the crankshaft upper main bearings into the cylinder block.
 - Install the crankshaft lower main bearings into the bearing caps.
 - Make sure all oil passages are aligned.
 - Lubricate all main bearings with clean engine oil.
2. Lubricate the crankshaft bearing journals with clean engine oil. Install the crankshaft onto the upper crankshaft main bearings.



A0054093

Fig. 348: Locating Crankshaft Onto Upper Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

NOTE: The oil groove on the thrust washer must face toward the rear of the engine (against the crankshaft thrust surface).

3. Push the crankshaft rearward and install the rear crankshaft upper thrust washer at the back of the No. 5 main boss.

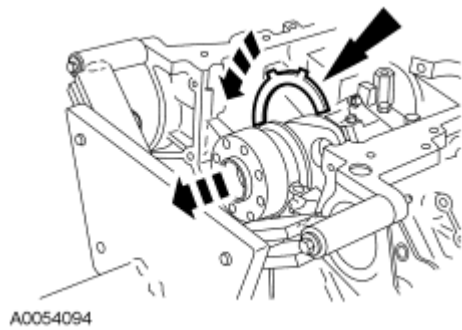


Fig. 349: Locating Crankshaft Upper Thrust Washer At Back Of Upper Main Bearing
Courtesy of FORD MOTOR CO.

NOTE: Rotate the jackscrews into the main bearing caps enough to provide clearance to the cylinder block prior to installing the bearing caps

4. Install the thrust washer on the rear (No. 5) main bearing cap and install the rear (No. 5) main bearing cap.

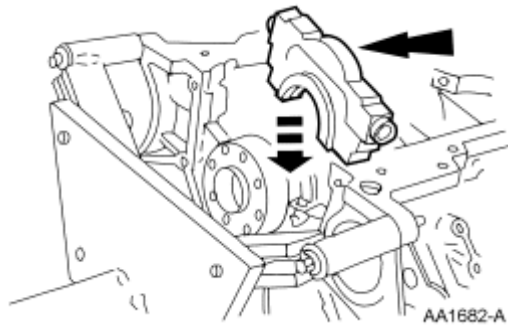
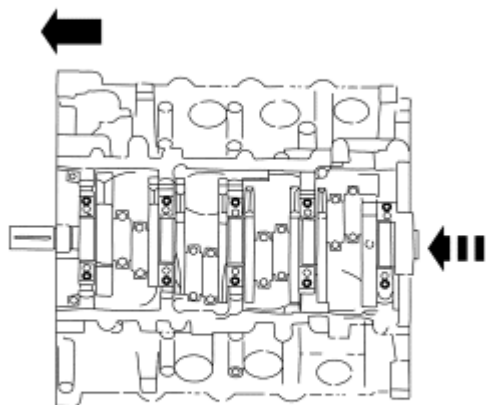


Fig. 350: Locating Rear Main Bearing Cap
Courtesy of FORD MOTOR CO.

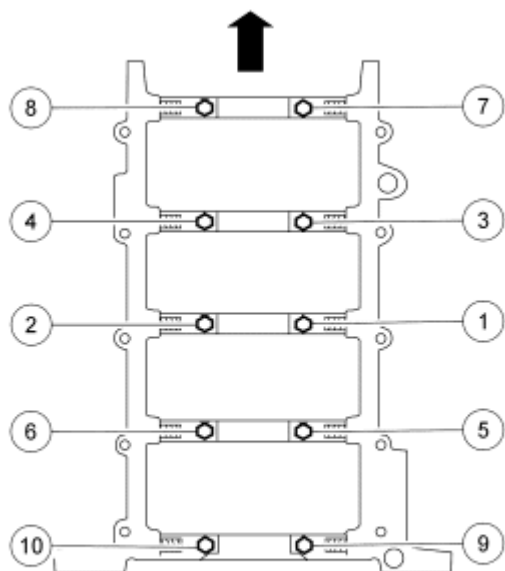
5. Install the crankshaft lower main bearings into the main bearing caps and lubricate them with clean engine oil. Locate the main bearing cap on the cylinder block and, keeping the cap as square as possible, alternately draw the cap down evenly using the cap fasteners.
6. Push the crankshaft forward to seat the crankshaft thrust washer. Hold the crankshaft in the forward position.



AA0362-A

Fig. 351: Pushing Crankshaft Forward To Seat Crankshaft Thrust Washer
Courtesy of FORD MOTOR CO.

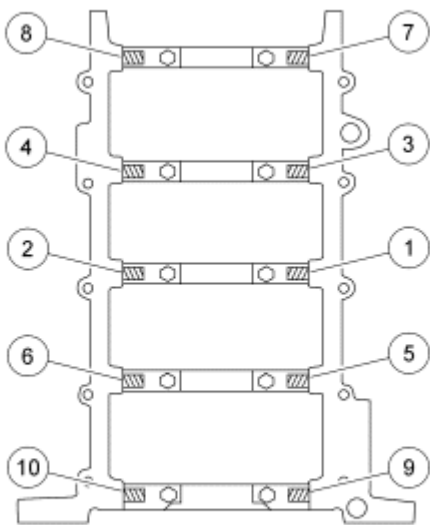
7. Tighten the vertical main bearing cap fasteners in the sequence shown, in 2 stages.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.



N0013765

Fig. 352: Identifying Main Bearing Cap Fasteners Tightening Sequence
Courtesy of FORD MOTOR CO.

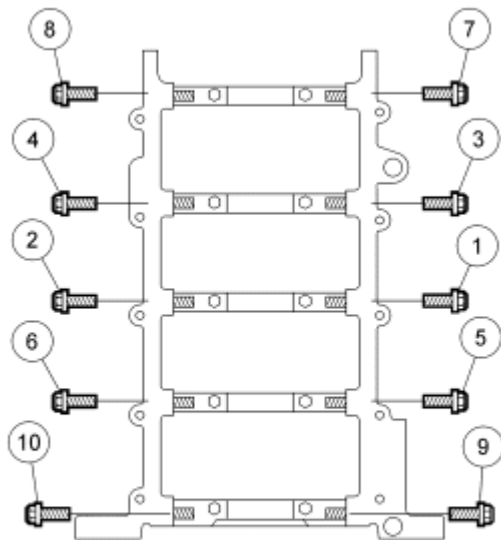
8. Tighten the jackscrews against the cylinder block in the sequence shown in 2 stages.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 10 Nm (89 lb-in).



N0015132

Fig. 353: Identifying Jack Screws Tightening Sequence
Courtesy of FORD MOTOR CO.

9. Install the side bolts and tighten them in the sequence shown.
 - Tighten to 21 Nm (15 lb-ft).



N0015131

Fig. 354: Identifying Side Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

10. Check the crankshaft end play. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
11. Check that crankshaft torque-to-turn does not exceed 6 Nm (53 lb-in).
12. Check the piston-to-cylinder block and piston ring clearances. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
13. Assemble the pistons. For additional information, refer to **Piston**.
14. Make sure the ring gaps (oil spacer-A, oil ring-B and compression ring-C) are correctly spaced around the circumference of the piston.

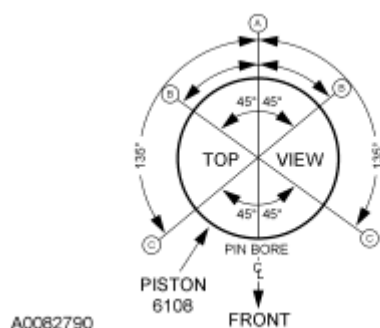


Fig. 355: Identifying Piston Ring Gaps Positioning
Courtesy of FORD MOTOR CO.

CAUTION: Install the piston and connecting rod assemblies carefully, or the cylinder walls or crankshaft journals may be damaged.

NOTE: The following piston installation steps are for all 8 connecting rods, rod bearings and pistons. Only one connecting rod, rod bearing and piston shown.

15. Use the special tools to install the connecting rod with the upper connecting rod bearing in place.
 - Lubricate the piston and ring with clean engine oil.
 - Lubricate the rod bearings with clean engine oil.

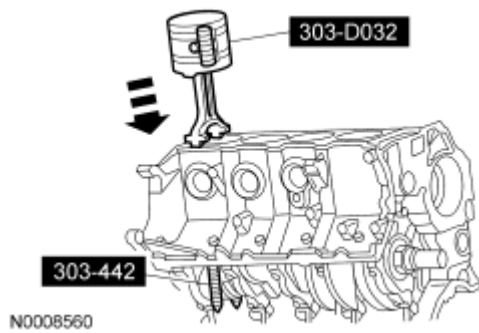


Fig. 356: Using Special Tools To Install Piston And Connecting Rod Assembly
Courtesy of FORD MOTOR CO.

CAUTION: Remove the special tools carefully, or the crankshaft journals may be damaged.

16. Once the connecting rod is seated on the crankshaft journal, remove the special tools.

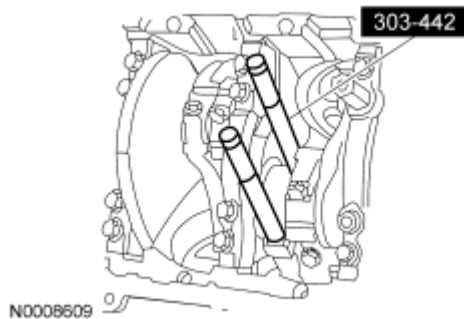


Fig. 357: Identifying Special Tool (303-442)
Courtesy of FORD MOTOR CO.

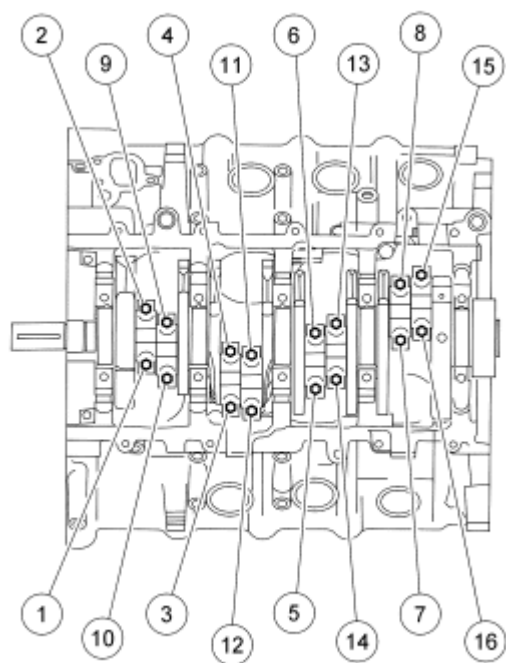
CAUTION: The rod cap installation must keep the same orientation as marked during disassembly, or the engine may be damaged.

NOTE: The connecting rod caps are of the "cracked" design and must mate with the connecting rod ends. Excessive bearing clearance will result if not mated correctly.

17. Position the lower bearing and connecting rod and install the new bolts loosely.

NOTE: Main bearing caps shown removed for clarity.

18. Tighten the bolts in 2 stages, in the sequence shown.
- Stage 1: Tighten to 43 Nm (32 lb-ft).
 - Stage 2: Tighten an additional 105 degrees.



N0043038

Fig. 358: Identifying Main Bearing Caps Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

19. Position the oil pump and install the 3 bolts.
 - Tighten to 10 Nm (89 lb-in).



N0006304

Fig. 359: Locating Oil Pump Bolts
Courtesy of FORD MOTOR CO.

20. Install the pickup tube spacer.
 - Tighten to 25 Nm (18 lb-ft).

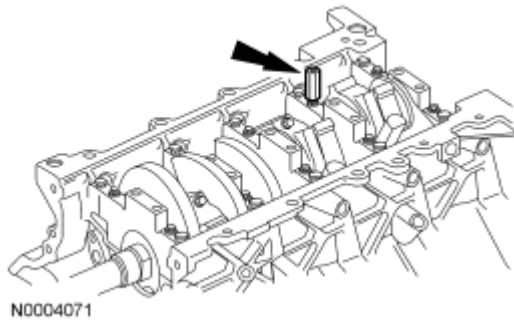


Fig. 360: Locating Pickup Tube Spacer
Courtesy of FORD MOTOR CO.

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

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

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

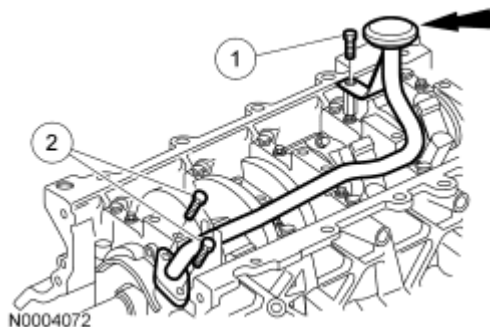


Fig. 361: Locating Oil Pump Screen And Pickup Tube
Courtesy of FORD MOTOR CO.

CAUTION: Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore, or the engine may be damaged.

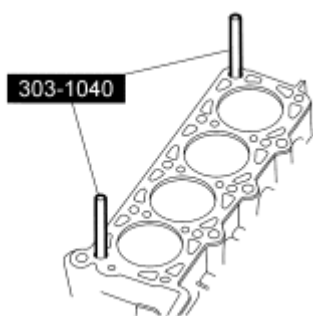
NOTE: The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.

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

NOTE: Do not turn the crankshaft until instructed to do so.

NOTE: LH shown, RH similar.

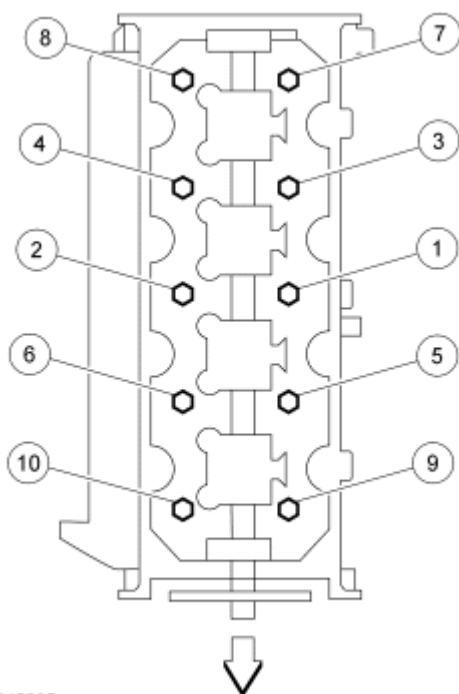
22. Using the special tools, position the cylinder head gaskets and cylinder heads over the dowels and install the 20 cylinder head bolts loosely.



N0014090

Fig. 362: Positioning Cylinder Head Gaskets And Cylinder Heads Over Dowels
Courtesy of FORD MOTOR CO.

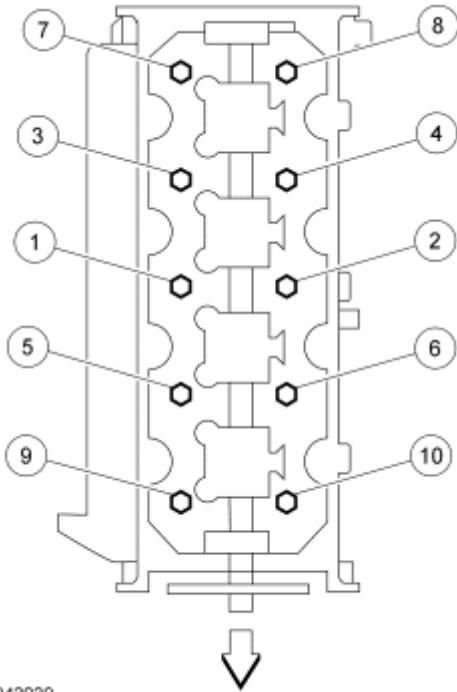
23. Tighten the LH cylinder head bolts in 3 stages, in the sequence shown.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Tighten an additional 90 degrees.



N0010205

Fig. 363: Tightening Bolts In Sequence
Courtesy of FORD MOTOR CO.

24. Tighten the RH cylinder head bolts in 3 stages, in the sequence shown.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Tighten an additional 90 degrees.



N0043039

Fig. 364: Identifying RH Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

25. Remove the special tool from the LH cylinder head.

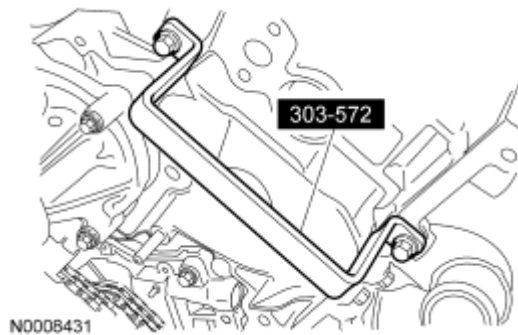


Fig. 365: Identifying Special Tool Onto Cylinder Head
Courtesy of FORD MOTOR CO.

26. Remove the special tool from the RH cylinder head.

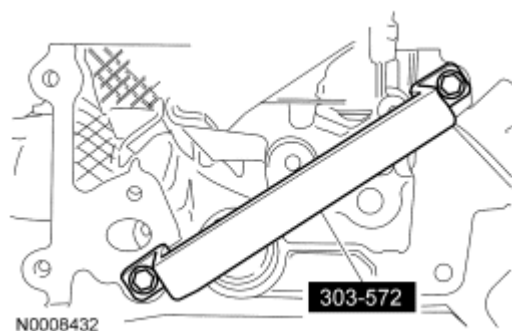


Fig. 366: Identifying Special Tool On Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

27. Install the hydraulic lash adjusters into the RH and LH cylinder heads.

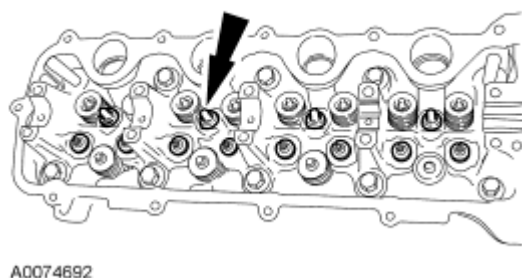


Fig. 367: Identifying Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

28. Install the LH and RH camshafts.

NOTE: LH shown, RH similar.

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

29. Install the LH and RH camshaft bearing caps in their original locations.

- Position the front camshaft bearing cap.
- Position the remaining camshaft bearing caps.

- Install the bolts loosely.
- Tighten to 10 Nm (89 lb-in) in the sequence shown.

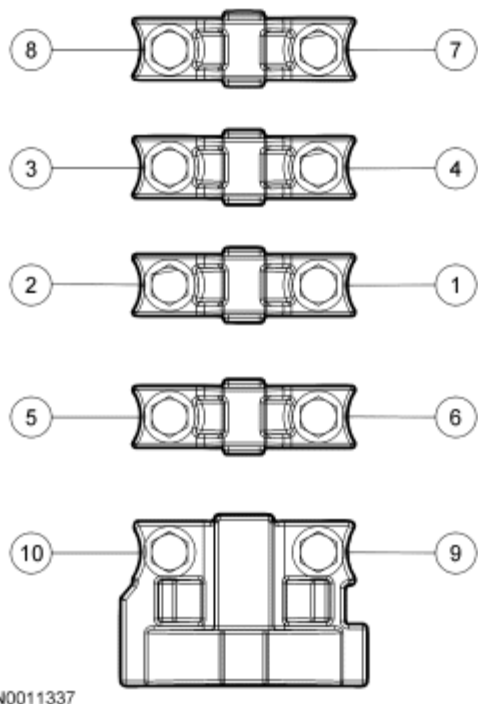


Fig. 368: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: LH shown, RH similar.

30. Position the camshaft phaser sprockets and install new camshaft phaser bolts finger-tight.

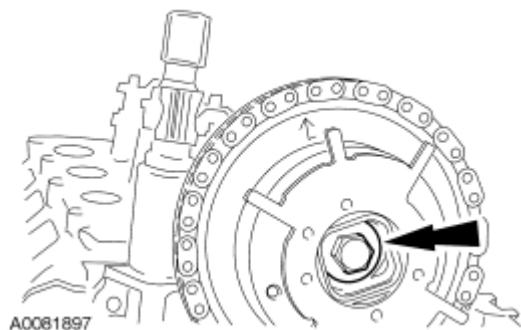


Fig. 369: Identifying Camshaft Phaser And Sprocket Assembly Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: LH shown, RH similar.

31. Using the special tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

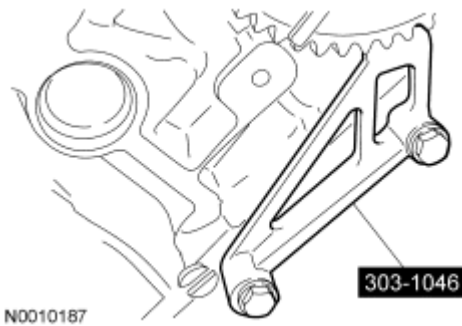


Fig. 370: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

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

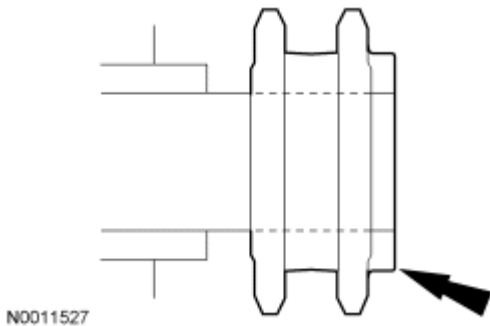


Fig. 371: Identifying Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

33. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.

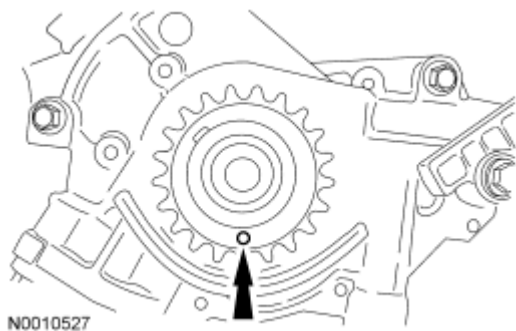


Fig. 372: Locating Crankshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

34. Rotate the camshaft sprockets to position the RH camshaft sprocket timing mark in the 11 o'clock position and the LH camshaft sprocket timing mark in the 12 o'clock position.

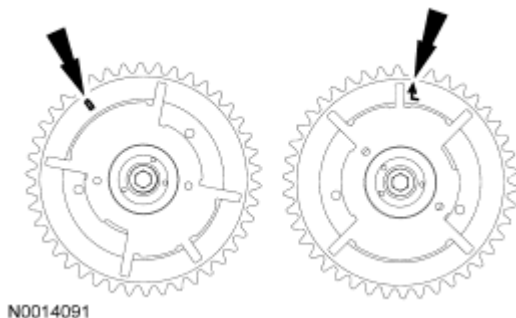


Fig. 373: Rotating Camshaft Sprockets To Position RH Camshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

CAUTION: If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. Any cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead, will require installation of a new tensioner. Failure to follow this instruction may result in damage to the engine.

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

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

36. Compress the tensioner plunger, using a vise.

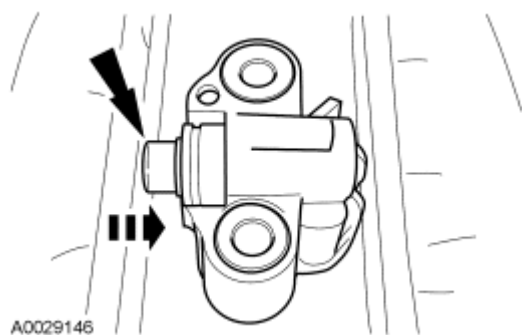


Fig. 374: Compressing Tensioner Plunger
Courtesy of FORD MOTOR CO.

37. Install a retaining clip on the tensioner to hold the plunger in during installation.

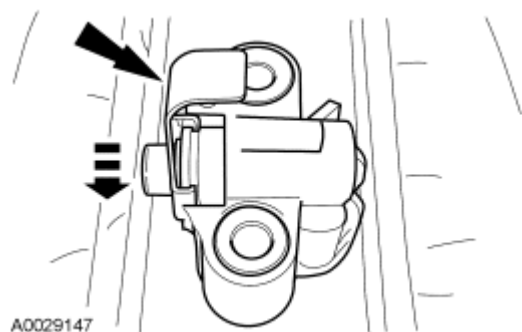


Fig. 375: Identifying Retaining Clip on Tensioner
Courtesy of FORD MOTOR CO.

38. Remove the tensioner from the vise.
39. If the copper links are not visible, mark one link on one end and one link on the other end and use as timing marks.

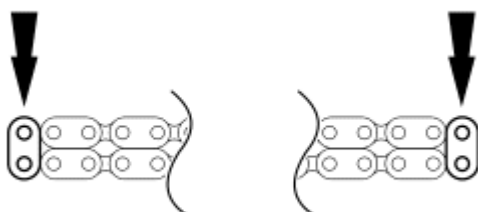
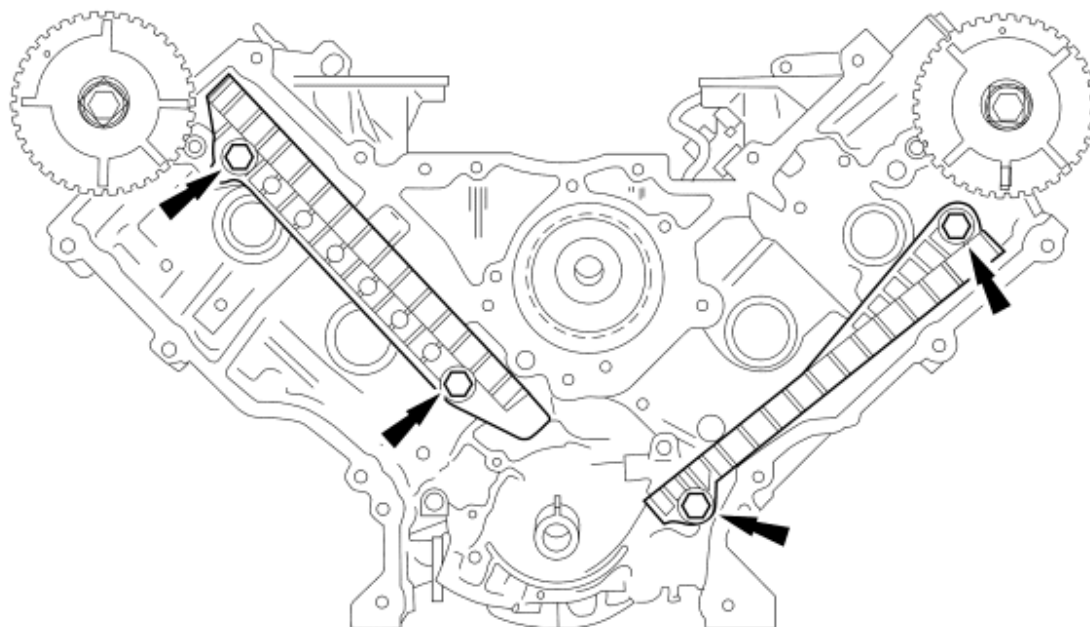


Fig. 376: Identifying Timing Chain Copper Links
Courtesy of FORD MOTOR CO.

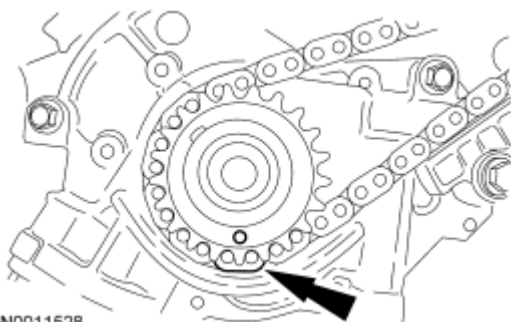
40. Install the 4 bolts and the LH and RH timing chain guides.
- Tighten to 10 Nm (89 lb-in).



N0006303

Fig. 377: Identifying Timing Chain Guides
Courtesy of FORD MOTOR CO.

41. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



N0011528

Fig. 378: Aligning Crankshaft Sprocket Timing Mark And LH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: Make sure the upper half of the timing chain is below the tensioner arm dowel.

42. Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

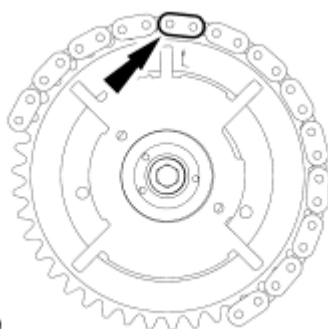


Fig. 379: Positioning LH Timing Chain On Camshaft Sprocket
Courtesy of FORD MOTOR CO.

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

43. Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

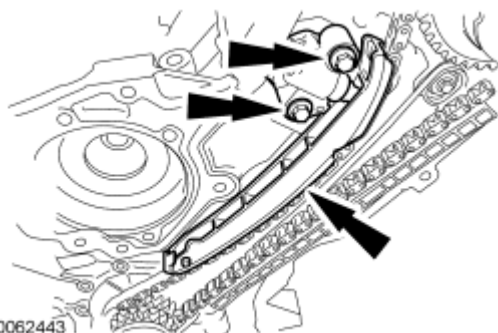


Fig. 380: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

44. Remove the retaining clip from the LH timing chain tensioner.

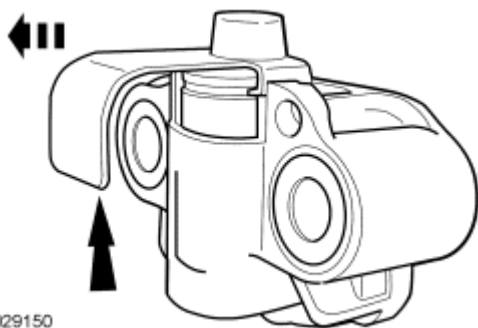


Fig. 381: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

45. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.

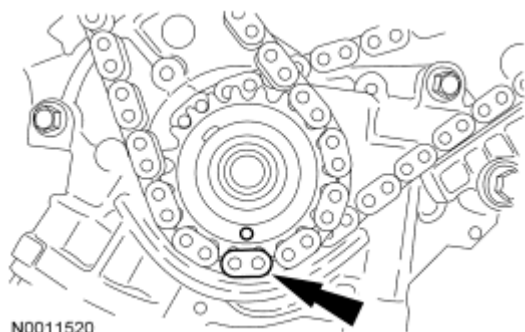


Fig. 382: Aligning Crankshaft Sprocket Timing Mark And RH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: The lower half of the timing chain must be positioned above the tensioner arm dowel.

NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

46. Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

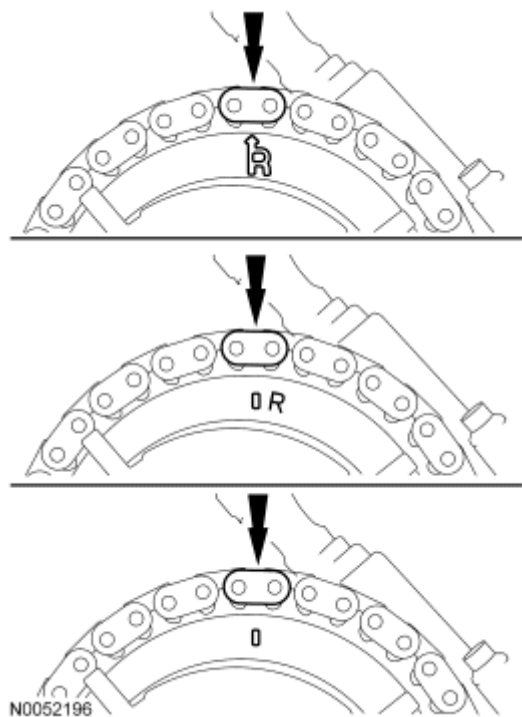


Fig. 383: Locating Camshaft Sprocket Timing Mark Aligned With Copper Chain Link

Courtesy of FORD MOTOR CO.

47. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and 2 bolts.
- Tighten to 25 Nm (18 lb-ft).

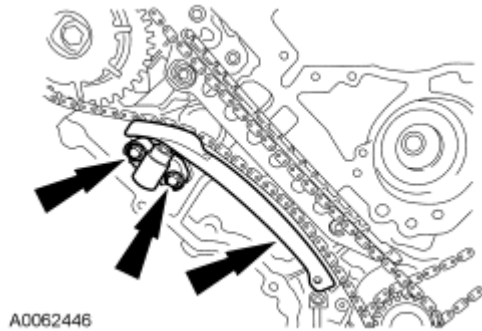


Fig. 384: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

48. Remove the retaining clip from the RH timing chain tensioner.

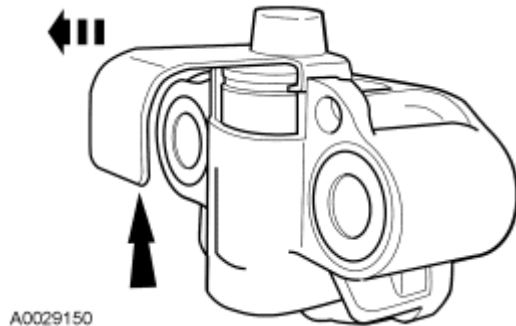


Fig. 385: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

49. As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.

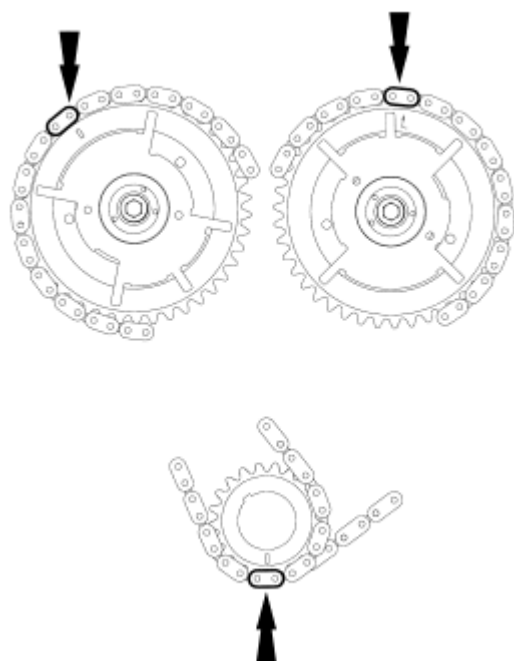


Fig. 386: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

50. Install the crankshaft sensor ring on the crankshaft.

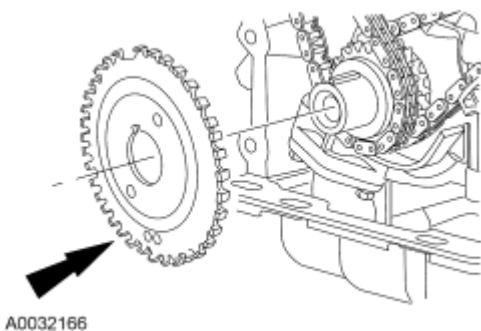


Fig. 387: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

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

51. Using the special tool, install all of the camshaft roller followers.



N0010191

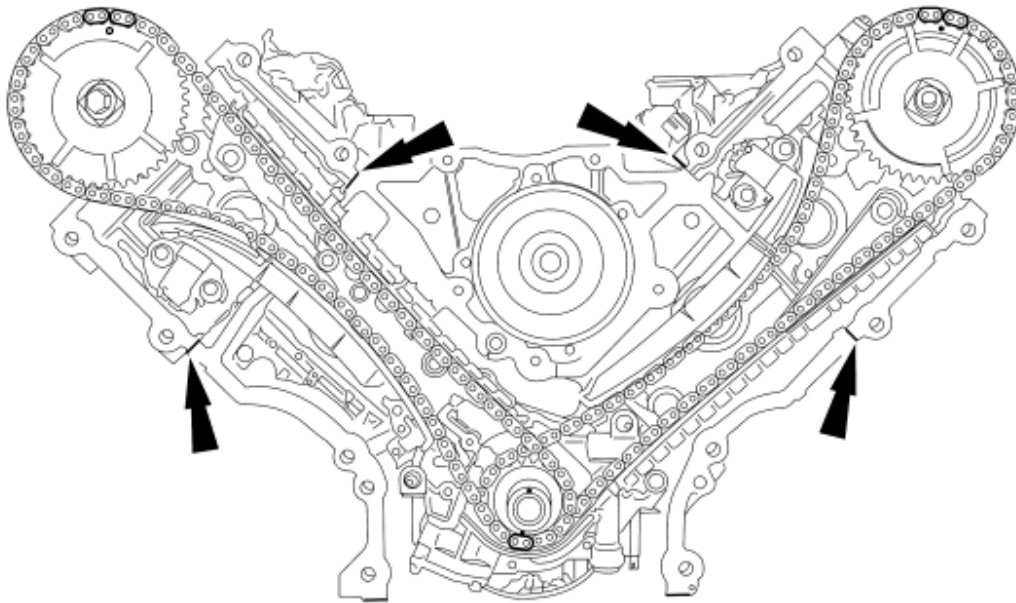
Fig. 388: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

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

NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

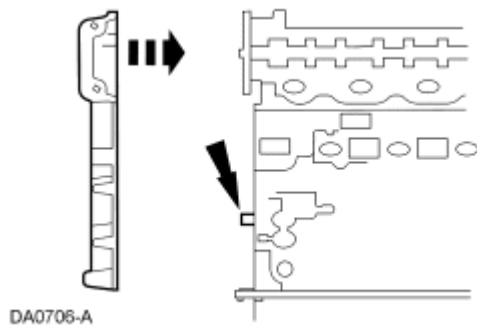
52. Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown.



N0010501

Fig. 389: Applying Bead Of Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

53. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.



DA0706-A

Fig. 390: Installing Engine Front Cover Gasket
Courtesy of FORD MOTOR CO.

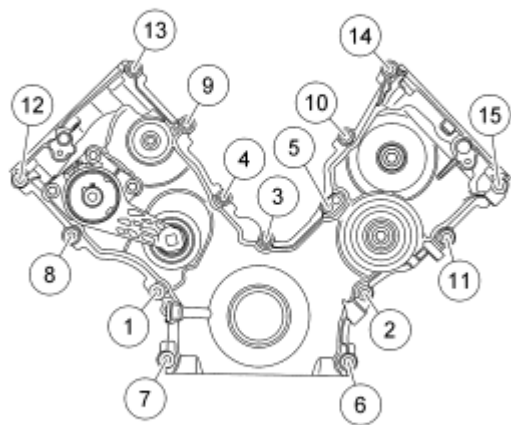
54. Tighten the engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

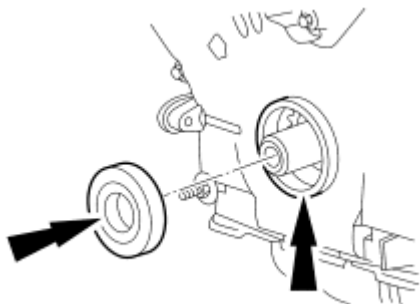
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1



N0039598

Fig. 391: Identifying Tightening Sequence Of Engine Front Cover Fasteners
Courtesy of FORD MOTOR CO.

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



A0029187

Fig. 392: Locating Crankshaft Front Seal
Courtesy of FORD MOTOR CO.

56. Using the special tools, install the crankshaft front oil seal into the engine front cover.

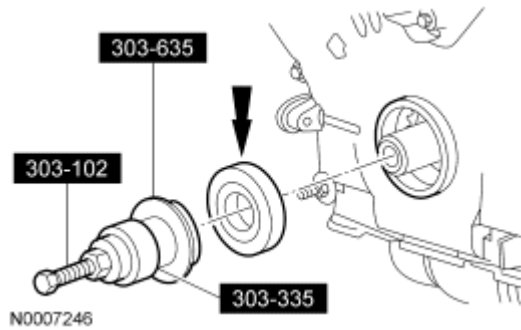


Fig. 393: Installing Crankshaft Front Seal Using Special Tools
Courtesy of FORD MOTOR CO.

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

57. Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.

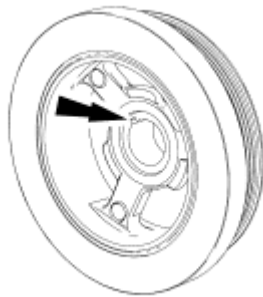


Fig. 394: Applying Silicone Gasket And Sealant To Woodruff Key Slot In Crankshaft Pulley
Courtesy of FORD MOTOR CO.

58. Using the special tool, install the crankshaft pulley.

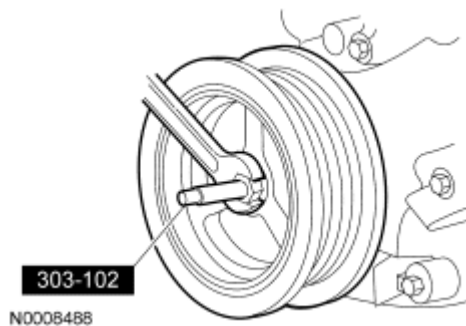


Fig. 395: Installing Crankshaft Pulley Using Special Tool
Courtesy of FORD MOTOR CO.

59. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.

- Stage 1: Tighten to 90 Nm (66 lb-ft).
- Stage 2: Loosen 360 degrees.
- Stage 3: Tighten to 50 Nm (37 lb-ft).
- Stage 4: Tighten an additional 90 degrees.

CAUTION: Do not rotate the coolant pump housing once the coolant pump has been positioned in the cylinder block. Damage to the O-ring seal will occur.

NOTE: Lubricate the new O-ring seal using clean engine coolant and install the O-ring seal onto the coolant pump.

60. Position the coolant pump and install the 4 bolts loosely.

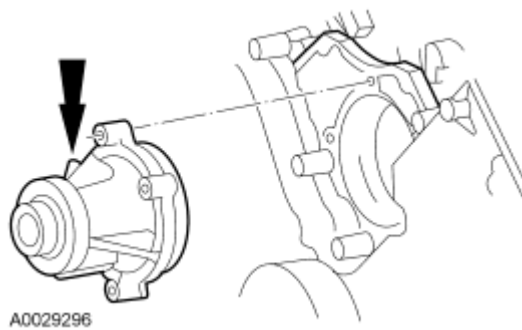


Fig. 396: Identifying Coolant Pump
Courtesy of FORD MOTOR CO.

61. Tighten the 4 coolant pump bolts.

- Tighten to 25 Nm (18 lb-ft).

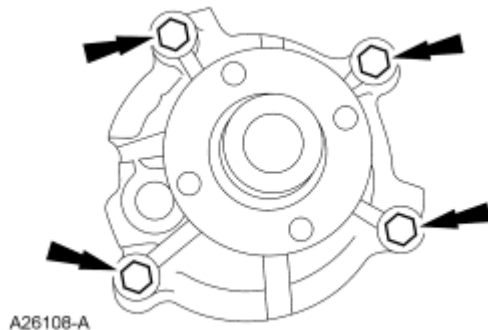


Fig. 397: Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

62. Position the accessory drive belt tensioner and install the 3 bolts.

- Tighten to 25 Nm (18 lb-ft).

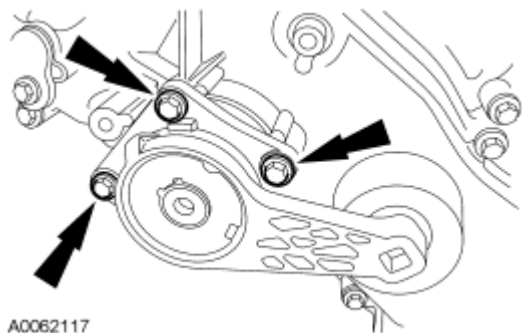


Fig. 398: Identifying Accessory Drive Belt Tensioner Bolts
Courtesy of FORD MOTOR CO.

63. Install the 3 accessory drive belt idler pulleys, the coolant pump pulley and the 7 bolts.
- Tighten to 25 Nm (18 lb-ft).

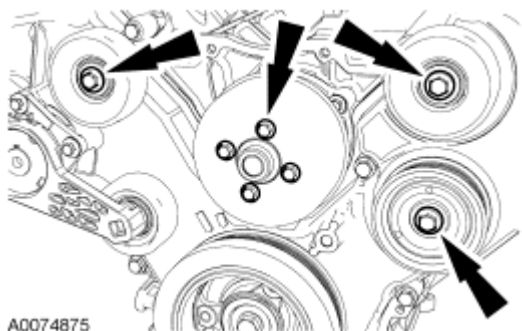


Fig. 399: Locating Coolant Pump Pulley And Accessory Drive Belt Idler Pulley Bolts
Courtesy of FORD MOTOR CO.

64. Install the crankshaft position (CKP) sensor and the bolt.
- Tighten to 10 Nm (89 lb-in).

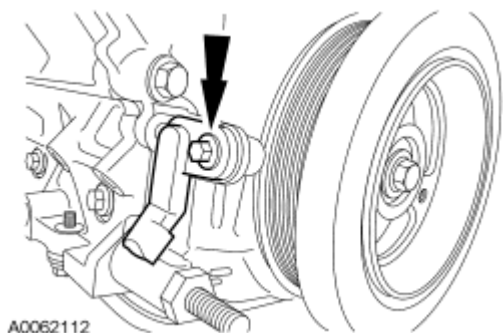


Fig. 400: Locating Crankshaft Position (CKP) Sensor Bolt
Courtesy of FORD MOTOR CO.

65. Install the LH camshaft position (CMP) sensor and the bolt.
- Tighten to 10 Nm (89 lb-in).

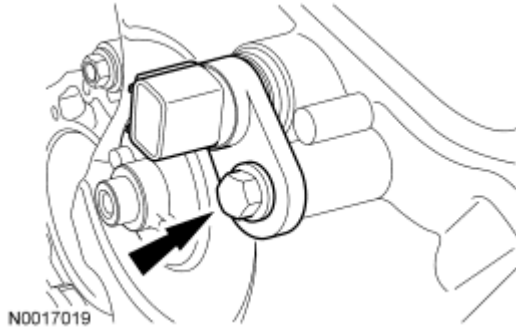


Fig. 401: Locating Camshaft Position (CMP) Sensor And Bolt
Courtesy of FORD MOTOR CO.

66. Install the RH CMP sensor and the bolt.
- Tighten to 10 Nm (89 lb-in).

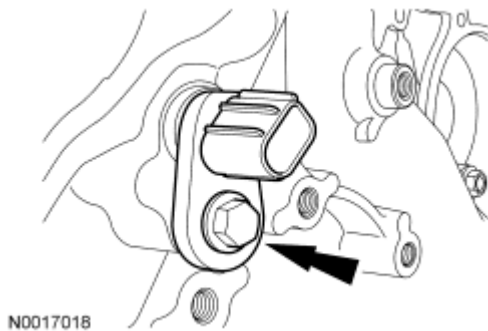


Fig. 402: Locating RH CMP Sensor And Bolt
Courtesy of FORD MOTOR CO.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

67. Apply silicone gasket and sealant in 2 places where the engine front cover meets the RH cylinder head.

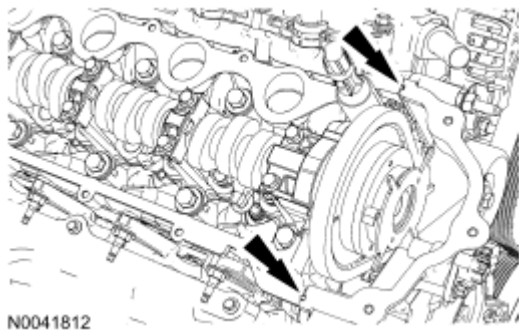


Fig. 403: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

CAUTION: Install the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

68. Position the RH valve cover and gasket on the cylinder head and tighten the 9 bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

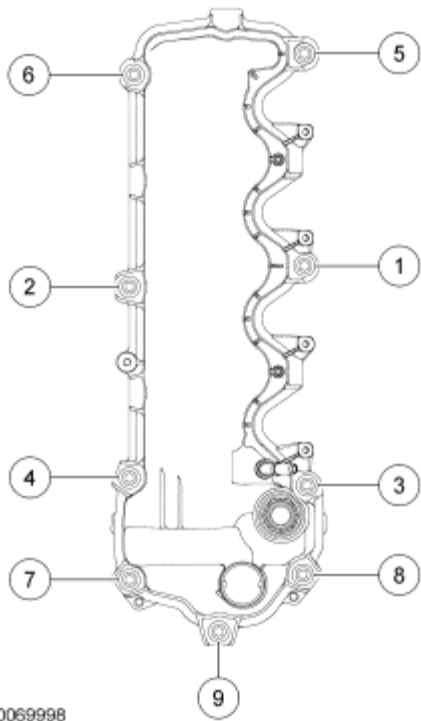


Fig. 404: Tightening RH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging.

Failure to follow this procedure can cause future oil leakage.

69. Apply silicone gasket and sealant in 2 places where the engine front cover meets the LH cylinder head.

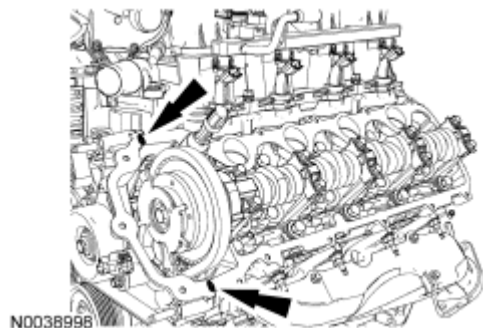


Fig. 405: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

CAUTION: Install the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

70. Position the LH valve cover and gasket on the cylinder head and tighten the 10 bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

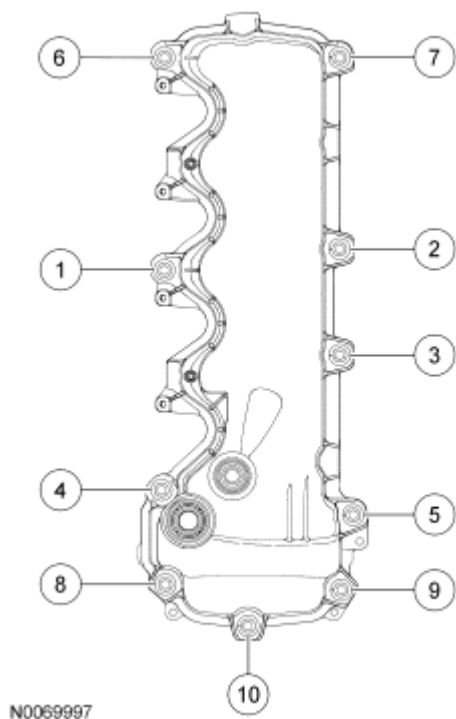
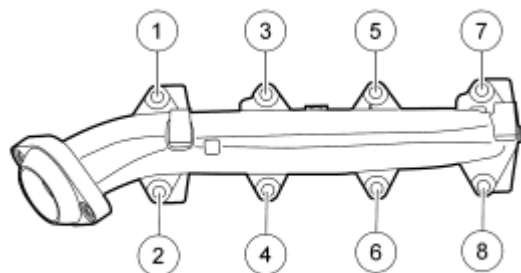


Fig. 406: Tightening LH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

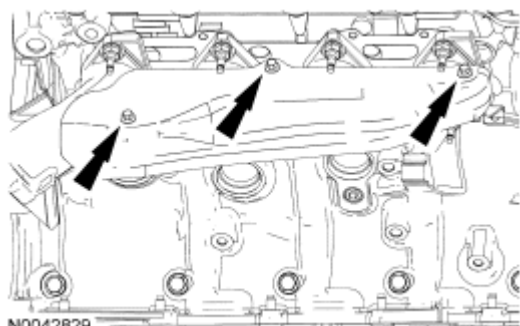
71. Inspect the RH exhaust manifold for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
72. Install 8 new RH exhaust manifold studs.
 - Tighten to 12 Nm (9 lb-ft).
73. Position new gaskets, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).



N0040498

Fig. 407: Identifying Tightening Sequence Of Exhaust Manifold-To-Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

74. Position the RH heat shield and install the bolts.
 - Tighten to 10 Nm (89 lb-in).



N0042829

Fig. 408: Identifying RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

75. Position the RH engine support insulator bracket and install the bolts.
 - Tighten to 72 Nm (53 lb-ft).

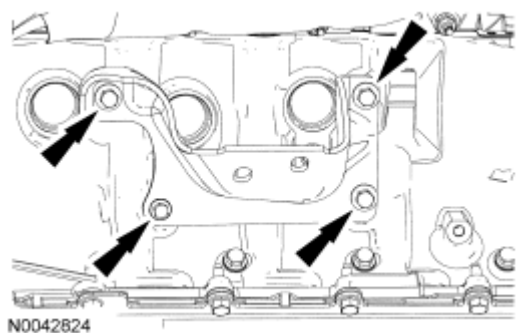


Fig. 409: Locating RH Engine Support Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

76. Position the oil level indicator tube and install the bolt.
- Install a new O-ring seal and lubricate the O-ring seal with clean engine oil prior to installation.
 - Tighten to 10 Nm (89 lb-in).

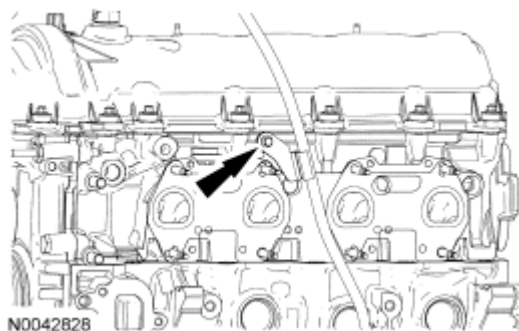
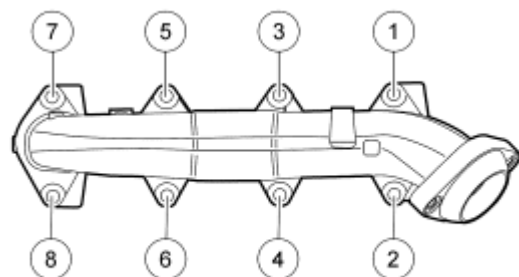


Fig. 410: Locating Oil Level Indicator Tube Bolt
Courtesy of FORD MOTOR CO.

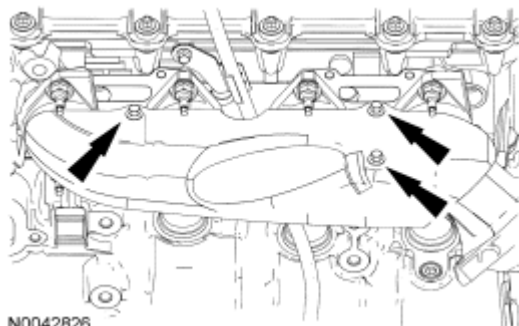
77. Inspect the LH exhaust manifold for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
78. Install 8 new LH exhaust manifold studs.
- Tighten to 12 Nm (9 lb-ft).
79. Position new gaskets, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown.
- Tighten to 25 Nm (18 lb-ft).



N0040497

Fig. 411: Identifying Tightening Sequence Of Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

80. Position the LH exhaust manifold heat shield and install the bolts.
 - Tighten to 10 Nm (89 lb-in).



N0042826

Fig. 412: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

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

81. Clean the oil filter adapter sealing surfaces using silicone gasket remover, metal surface prep and a plastic scraping tool. Follow the directions on the packaging.

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

NOTE: Clean and inspect the mating surfaces and install new gaskets.

82. Position the oil filter adapter and install the bolts.
 - Tighten to 25 Nm (18 lb-ft).

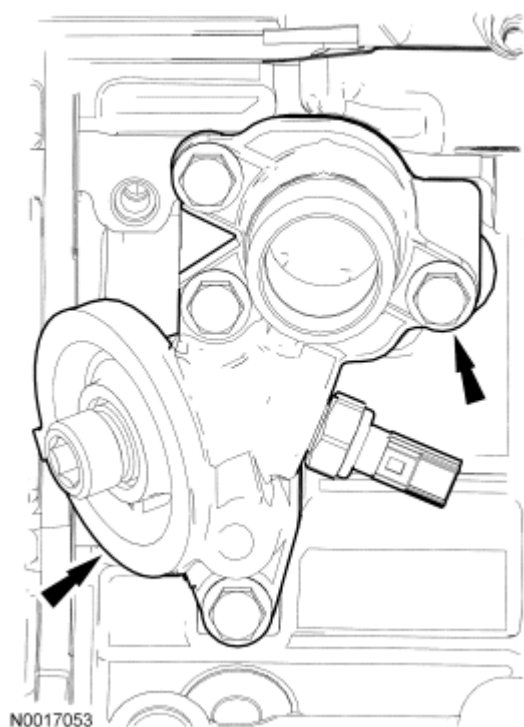


Fig. 413: Locating Oil Filter Adapter And Bolts
Courtesy of FORD MOTOR CO.

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

83. Install a new oil filter.
 - Tighten the oil filter until the gasket makes contact, then use an oil filter strap wrench to tighten the filter an additional 270 degrees.
84. Position the LH engine support insulator bracket and install the bolts.
 - Tighten to 72 Nm (53 lb-ft).

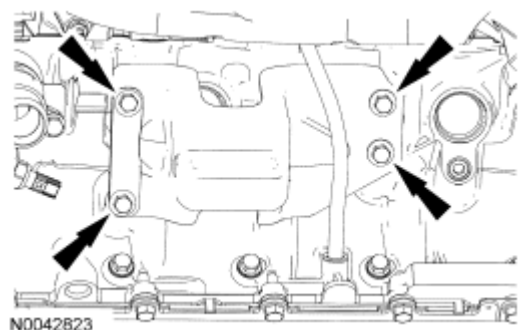


Fig. 414: Locating LH Engine Support Insulator Bracket Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

85. Install the 8 ignition coils and the 8 bolts.
- Tighten to 6 Nm (53 lb-in).

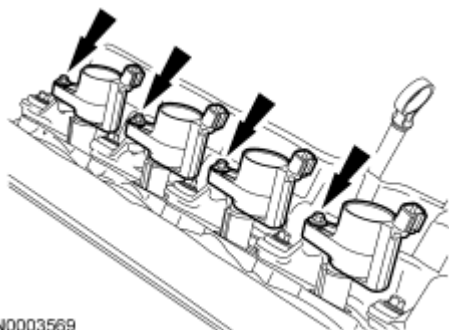


Fig. 415: Identifying Ignition Coils And Bolts
Courtesy of FORD MOTOR CO.

86. Connect the PCV hose to the LH valve cover.

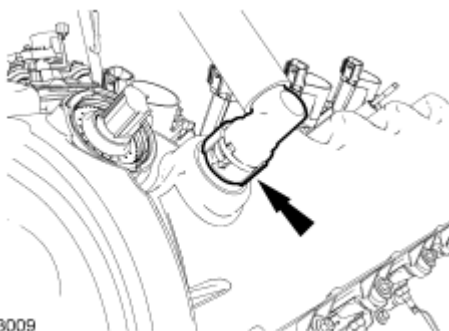


Fig. 416: Locating Positive Crankcase Ventilation (PCV) Hose
Courtesy of FORD MOTOR CO.

87. Connect the breather tube to the RH valve cover.

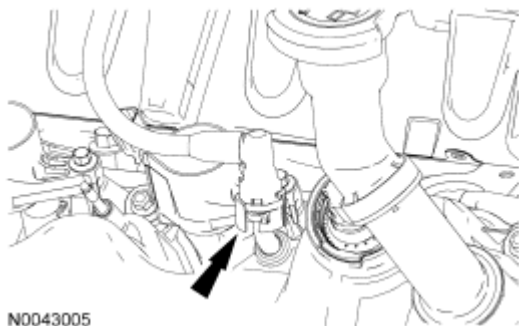


Fig. 417: Locating Breather Tube Connector Retaining Clip
Courtesy of FORD MOTOR CO.

NOTE: Install new O-ring seals and lubricate the O-ring seals with clean engine

coolant.

88. Position the heater supply tube and the hoses as an assembly and install the stud bolt.
- Tighten to 10 Nm (89 lb-in).

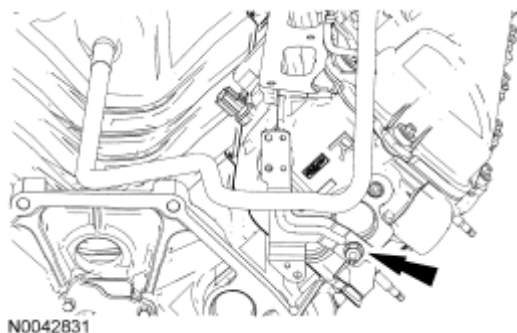


Fig. 418: Locating Heater Supply Tube Stud Bolt
Courtesy of FORD MOTOR CO.

89. Position the engine wiring harness and attach the electrical connectors to the heater supply tube bracket.

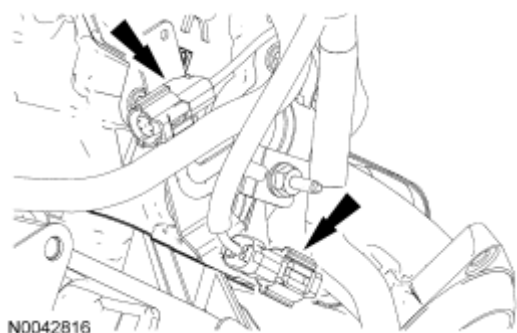


Fig. 419: Locating Electrical Connector Retainers And Engine Wiring Harness
Courtesy of FORD MOTOR CO.

90. Position the ground strap and install the nut.
- Tighten to 10 Nm (89 lb-in).

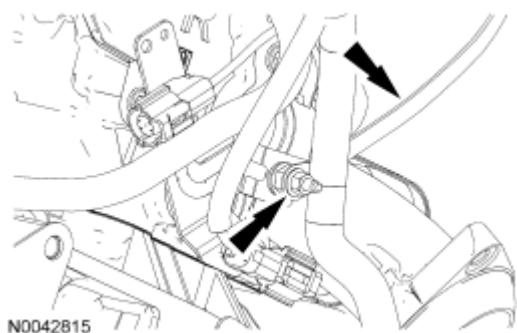


Fig. 420: Locating Ground Strap Nut

Courtesy of FORD MOTOR CO.

91. Connect the cylinder head temperature (CHT) sensor electrical connector.

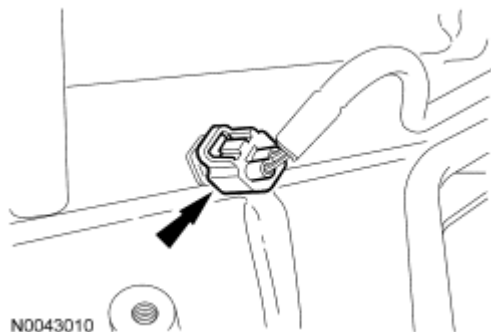


Fig. 421: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

92. Attach the wiring harness retainers to the RH valve cover studs.

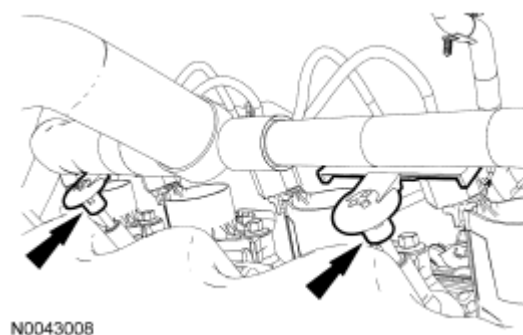


Fig. 422: Locating RH Valve Cover Studs
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

93. Connect the RH and LH ignition coil electrical connectors.

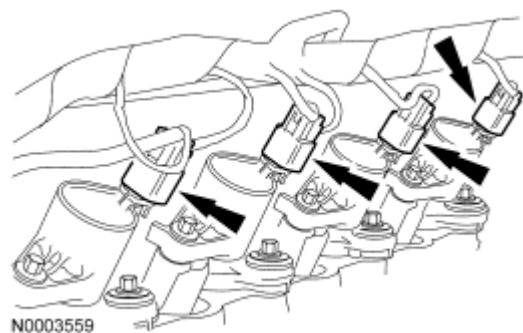


Fig. 423: Locating Ignition Coil Electrical Connectors

Courtesy of FORD MOTOR CO.

94. Attach the wiring harness retainers to the LH valve cover studs.

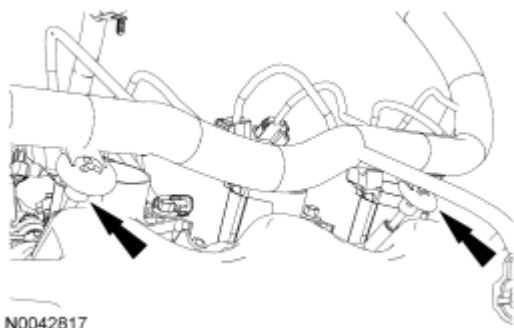


Fig. 424: Locating LH Valve Cover Studs
Courtesy of FORD MOTOR CO.

95. Position the LH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

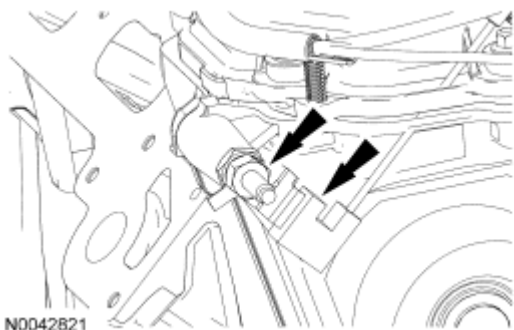


Fig. 425: Locating LH Radio Interference Capacitor And Nuts
Courtesy of FORD MOTOR CO.

96. Position the cooling fan wiring harness and install the nut.
- Tighten to 25 Nm (18 lb-ft).

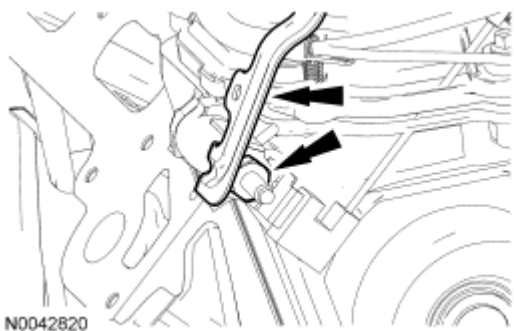


Fig. 426: Locating Cooling Fan Wiring Harness Bracket Nut

Courtesy of FORD MOTOR CO.

97. Connect the LH camshaft position sensor and attach the wiring harness retainers.

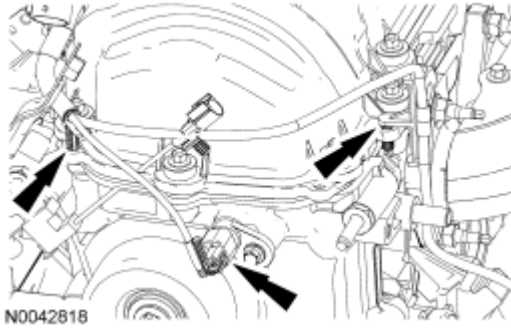


Fig. 427: Locating LH Camshaft Position Sensor And Attach Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

98. Connect the oil pressure sensor electrical connector.

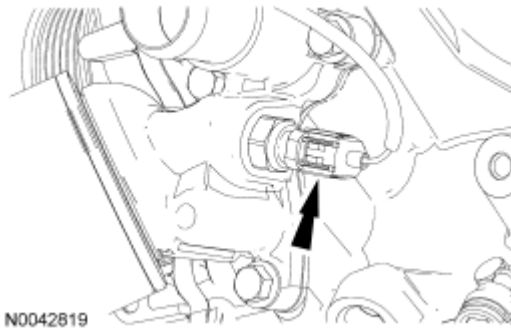


Fig. 428: Locating Oil Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

99. Position the RH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

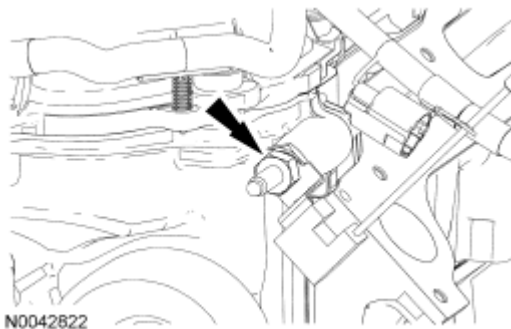


Fig. 429: Locating RH Radio Ignition Interference Capacitor Nut
Courtesy of FORD MOTOR CO.

100. Attach the wiring harness retainers.

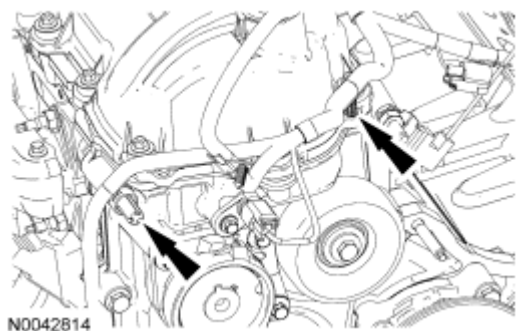


Fig. 430: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

101. Connect the RH and LH variable camshaft timing (VCT) solenoid electrical connectors.

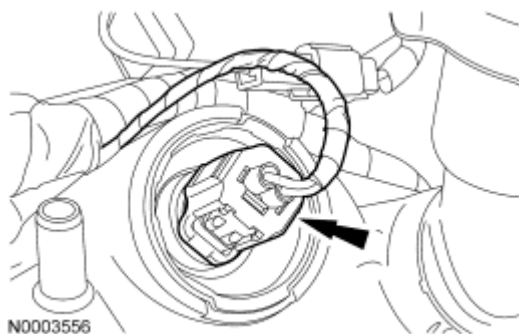


Fig. 431: Locating Camshaft Timing (VCT) Solenoid Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

102. Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

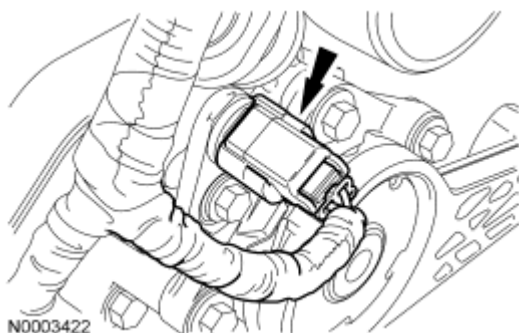


Fig. 432: Identifying RH CMP Sensor Electrical Connector

Courtesy of FORD MOTOR CO.

103. Connect the crankshaft position sensor electrical connector and attach the wiring harness retainer.

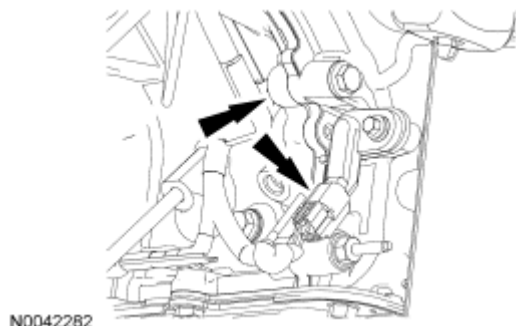


Fig. 433: Locating Crankshaft Position Sensor Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

104. Install the special tool.

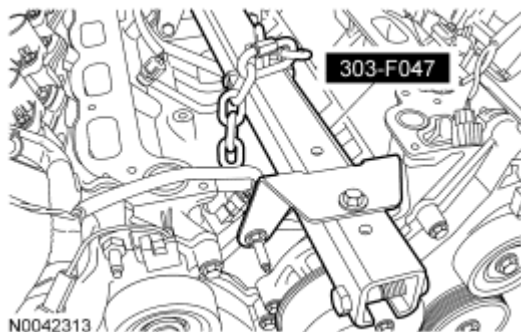


Fig. 434: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

105. Using a suitable floor crane, remove the engine from the engine stand.

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

106. Inspect the crankshaft rear seal retainer plate. Clean the mating surface for the rear seal retainer plate with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

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

107. Apply a bead of gasket maker to the crankshaft rear seal retainer mating surface on the engine block.

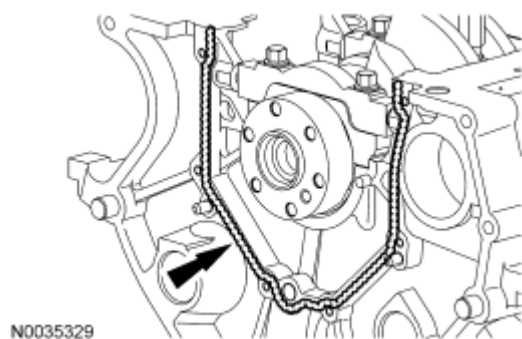


Fig. 435: Applying Bead Of Gasket Maker To Rear Crankshaft Seal Retainer Mating Surface On Engine Block
Courtesy of FORD MOTOR CO.

108. Install the crankshaft rear seal retainer plate and loosely install the 6 bolts.

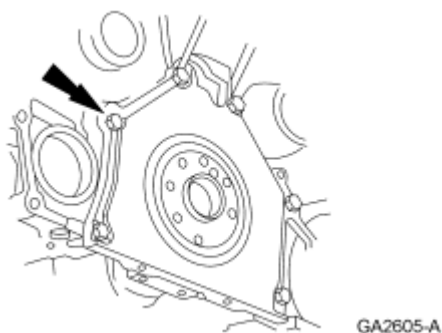


Fig. 436: Locating Crankshaft Rear Seal Retainer Plate Bolts
Courtesy of FORD MOTOR CO.

109. Tighten the 6 bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

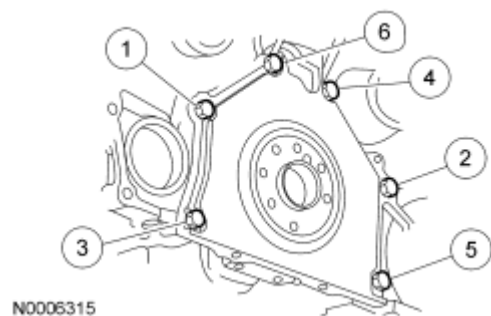


Fig. 437: Tightening Bolts In Sequence
Courtesy of FORD MOTOR CO.

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

cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

110. Inspect the oil pan. Clean the mating surface for the oil pan with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

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

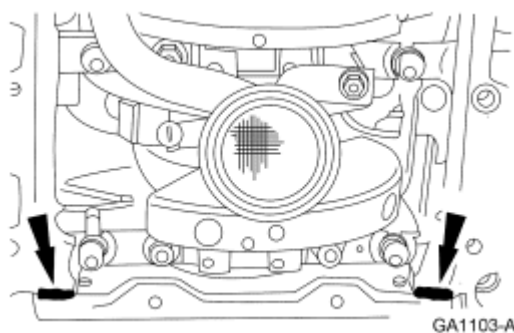
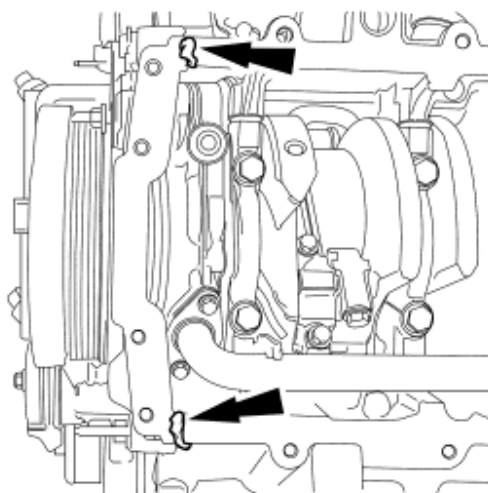


Fig. 438: Applying Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

112. Apply silicone gasket and sealant at the engine front cover-to-cylinder block sealing surface.



A0045427

Fig. 439: Applying Silicone Gasket And Sealant At Engine Front Cover-To-Cylinder Block Sealing Surface

Courtesy of FORD MOTOR CO.

113. Install the oil pan gasket and the oil pan and loosely install the 16 bolts.

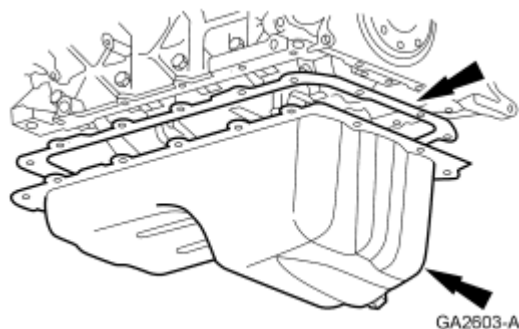


Fig. 440: Positioning New Oil Pan Gasket And Oil Pan

Courtesy of FORD MOTOR CO.

114. Tighten the 16 bolts in 3 stages, in the sequence shown.
- Stage 1: Tighten to 2 N.m (18 lb-in).
 - Stage 2: Tighten to 20 N.m (15 lb-ft).
 - Stage 3: Tighten an additional 60 degrees.

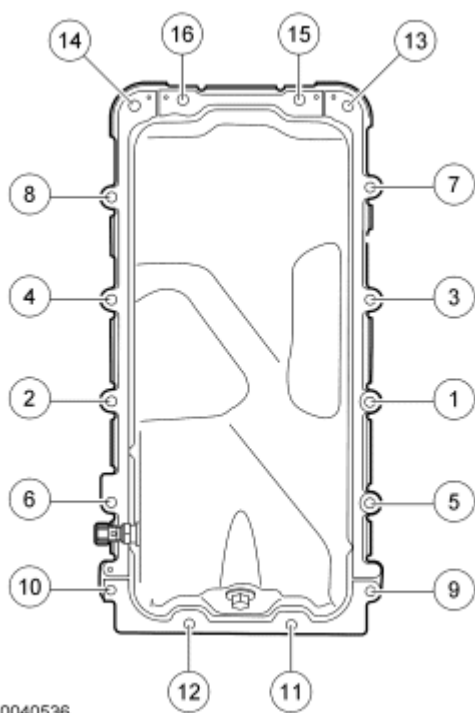


Fig. 441: Identifying Tightening Sequence Of Bolts
Courtesy of FORD MOTOR CO.

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

115. Using the special tools, install a new crankshaft rear seal.

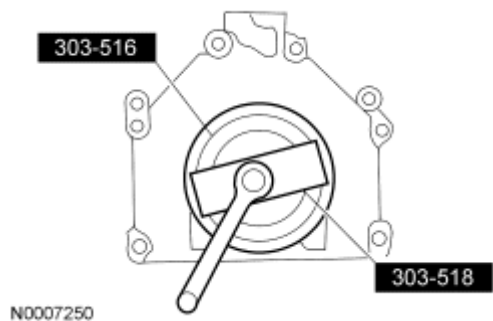


Fig. 442: Using Special Tools To Install New Crankshaft Rear Seal
Courtesy of FORD MOTOR CO.

116. Using the special tools, install the crankshaft rear oil slinger.

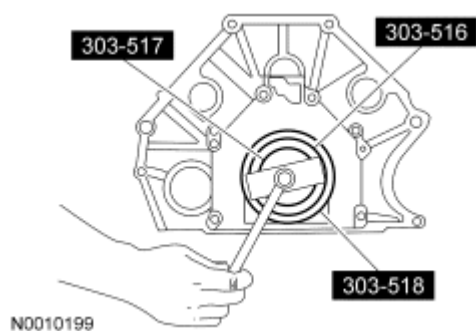


Fig. 443: Installing Crankshaft Rear Oil Slinger Using Special Tools
Courtesy of FORD MOTOR CO.

117. Install the spacer plate.

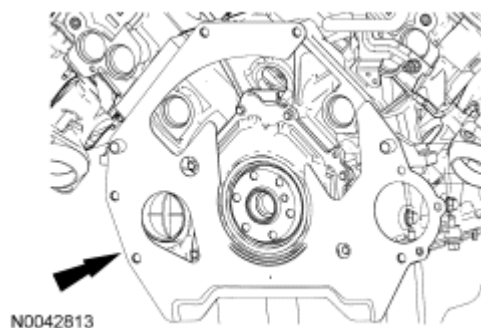


Fig. 444: Locating Spacer Plate
Courtesy of FORD MOTOR CO.

118. Position the flexplate and install the bolts in the sequence shown.

- Tighten to 80 Nm (59 lb-ft).

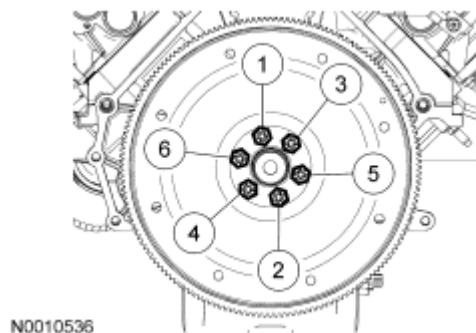


Fig. 445: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

INSTALLATION

ENGINE

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

Special Tools

Illustration	Tool Name	Tool Number
 ST1377-A	Modular Engine Lift Bracket	303-F047 (014-00073) or equivalent

Material

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

1. Position the engine in the vehicle and remove the floor crane.
2. Remove the special tool.

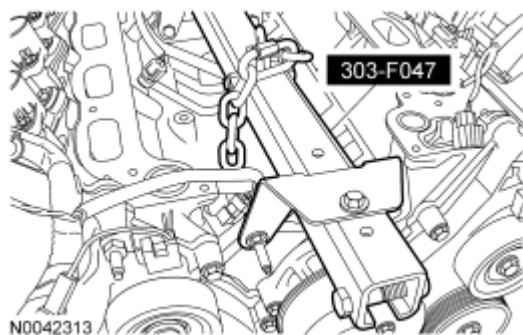


Fig. 446: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

3. Install the LH engine support insulator through bolt.
 - Tighten to 103 Nm (76 lb-ft).

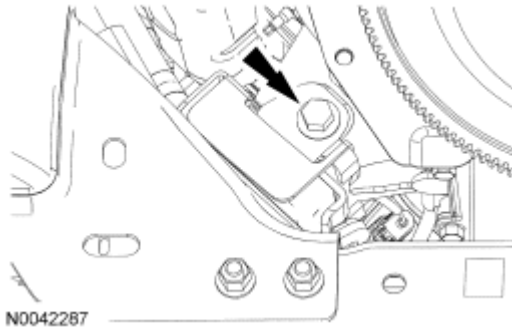


Fig. 447: Locating LH Engine Support Insulator Through-Bolt
Courtesy of FORD MOTOR CO.

4. If equipped, attach the block heater wiring harness retainers and connect the block heater electrical connector.

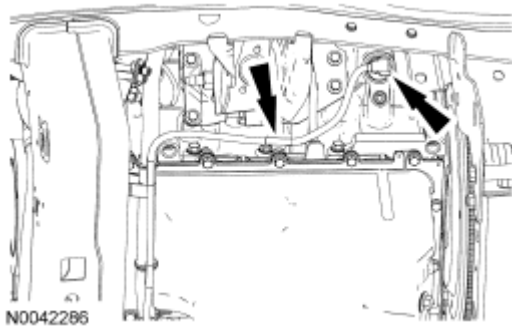


Fig. 448: Locating Block Heater Wiring Harness Retainers And Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

5. Install the RH engine support insulator nuts.
 - Tighten to 90 Nm (66 lb-ft).

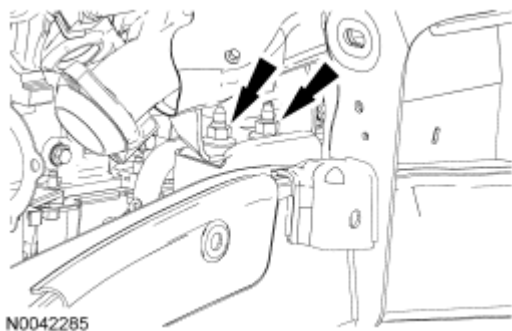


Fig. 449: Locating RH Engine Support Insulator Nuts
Courtesy of FORD MOTOR CO.

6. Position the RH splash shield and install the pushpins.

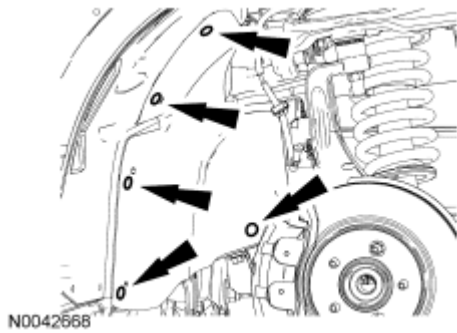


Fig. 450: Locating Pushpins And Splash Shield
Courtesy of FORD MOTOR CO.

7. Position the battery cable bracket on the RH engine support insulator bracket and install the bolt.
 - Tighten to 15 Nm (11 lb-ft).

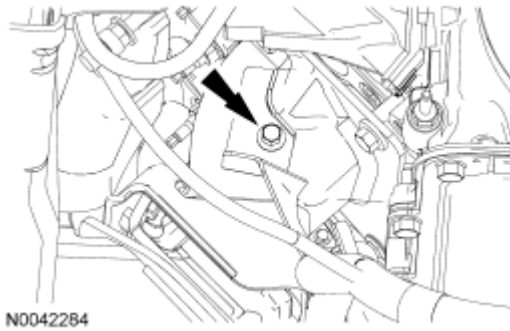


Fig. 451: Locating RH Engine Support Insulator Bracket Bolt
Courtesy of FORD MOTOR CO.

8. Install the oil temperature sensor.
 - Tighten to 15 Nm (11 lb-ft).

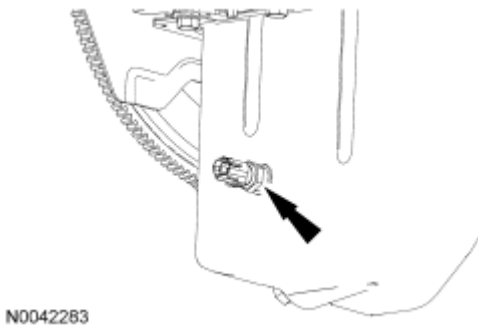


Fig. 452: Locating Oil Temperature Sensor
Courtesy of FORD MOTOR CO.

9. Position the A/C compressor and install the 2 nuts and the stud bolt.
 - Tighten to 25 Nm (18 lb-ft).

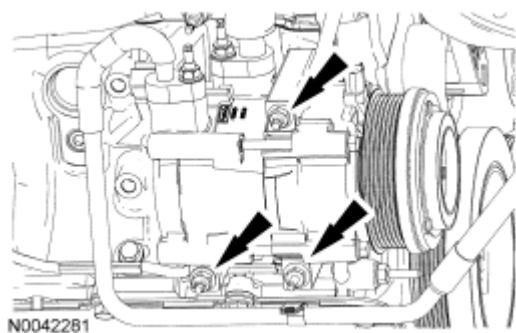


Fig. 453: Locating A/C Compressor Stud Bolt And Nut
Courtesy of FORD MOTOR CO.

10. Position the A/C hose bracket and install the nut. Attach the wiring harness retainer and connect the A/C clutch electrical connector.
 - Tighten to 20 Nm (15 lb-ft).

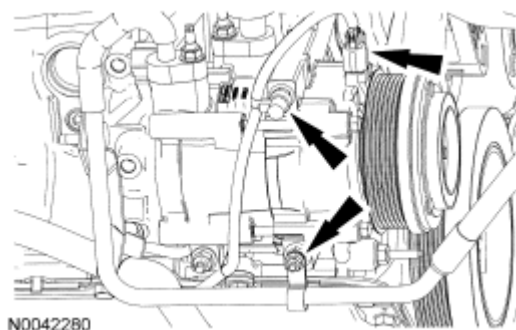


Fig. 454: Locating A/C Hose Bracket And A/C Clutch Electrical Connector
Courtesy of FORD MOTOR CO.

11. Connect the lower radiator hose to the oil filter adapter.

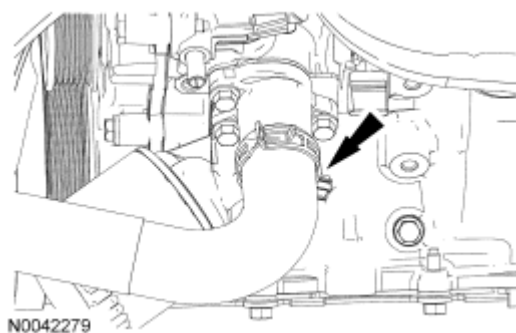


Fig. 455: Locating Lower Radiator Hose Clamp
Courtesy of FORD MOTOR CO.

12. Position the power steering pump and install the stud bolts.
 - Tighten to 25 Nm (18 lb-ft).

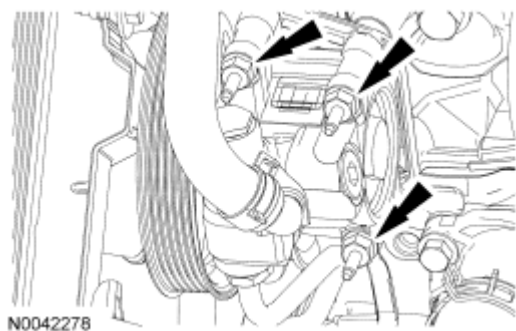


Fig. 456: Locating Power Steering Pump Stud Bolts
Courtesy of FORD MOTOR CO.

13. Attach the wiring harness retainer to the power steering pump stud bolt.

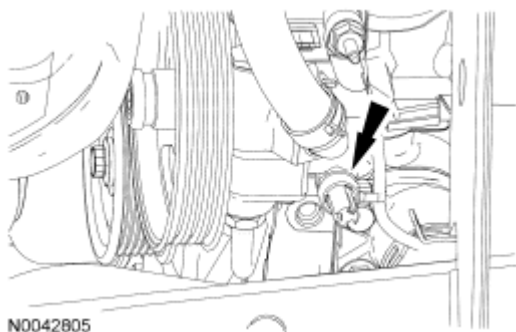


Fig. 457: Locating Power Steering Pump Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

14. Position the wiring harness bracket and install the nuts.
 - Tighten to 10 Nm (89 lb-in).

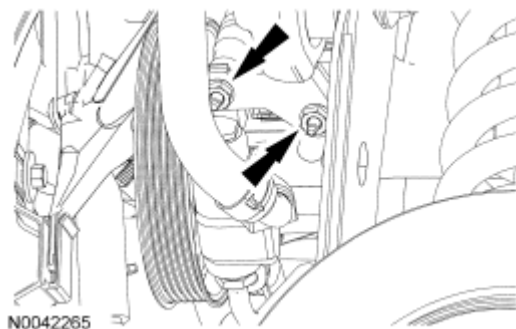


Fig. 458: Locating Wiring Harness Bracket Nuts
Courtesy of FORD MOTOR CO.

15. Position the wiring harness bracket and install the nut.
 - Tighten to 10 Nm (89 lb-in).

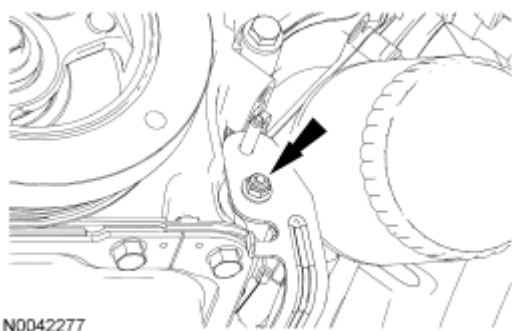


Fig. 459: Locating Battery Cable Bracket Nut
Courtesy of FORD MOTOR CO.

16. Position the power steering pressure hose bracket and install the nut.
 - Tighten to 10 Nm (89 lb-in).

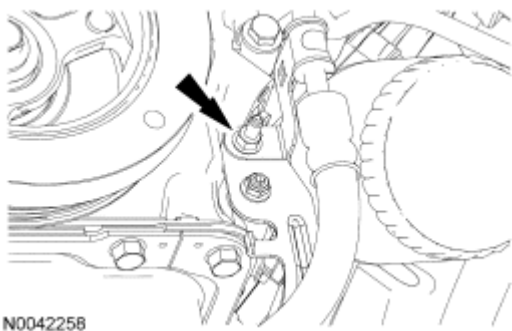


Fig. 460: Locating Power Steering Pressure (PSP) Hose Bracket Nut
Courtesy of FORD MOTOR CO.

17. Position the inner fender splash shield and install the 3 pushpins and 3 screws.

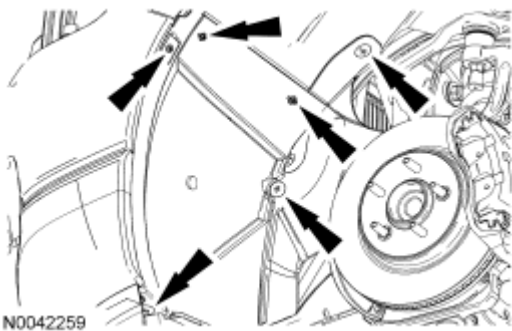


Fig. 461: Locating Inner Fender Splash Shield Pushpins And Screws
Courtesy of FORD MOTOR CO.

18. Install the transmission. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** article.
19. Position the ground wire and install the nut.

- Tighten to 12 Nm (9 lb-ft).

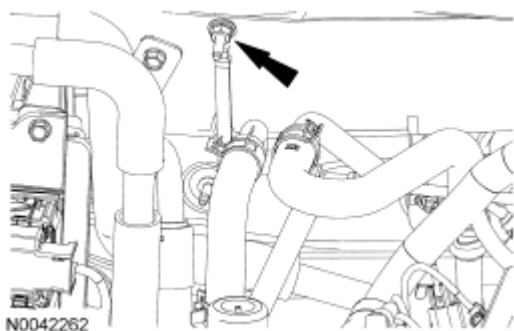


Fig. 462: Locating Ground Wire And Nut
Courtesy of FORD MOTOR CO.

20. Connect the heater hose.

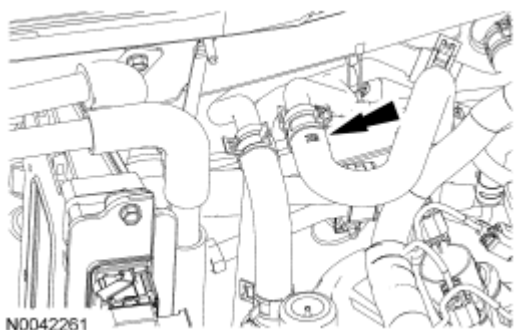


Fig. 463: Locating Heater Hose
Courtesy of FORD MOTOR CO.

21. Attach the wiring harness pin-type retainer, and connect the 2 PCM electrical connectors and the inline electrical connector.

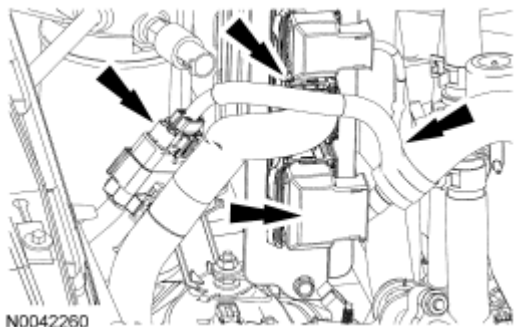


Fig. 464: Locating Wiring Harness Pin-Type Retainer, Powertrain Control Module (PCM) Electrical Connectors & In-Line Electrical Connector
Courtesy of FORD MOTOR CO.

22. Attach the heater hose retainer to the RH valve cover.

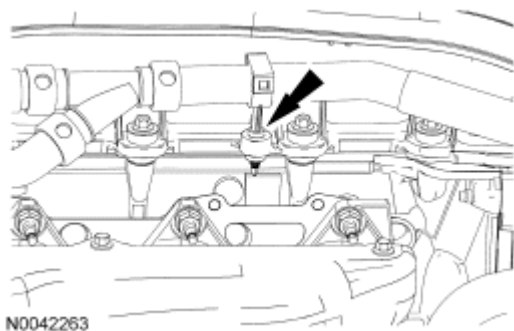


Fig. 465: Locating Heater Hose Retainer
Courtesy of FORD MOTOR CO.

23. Connect the evaporative emission (EVAP) canister purge valve electrical connector.

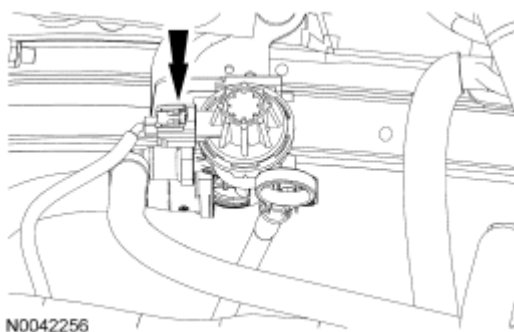


Fig. 466: Locating Evaporative Emission (EVAP) Canister Purge Valve Electrical Connector
Courtesy of FORD MOTOR CO.

24. Position new gaskets, the coolant crossover, the heated PCV fitting and the heated PCV fitting hose as an assembly and install the bolts.
- Tighten to 10 Nm (89 lb-in).

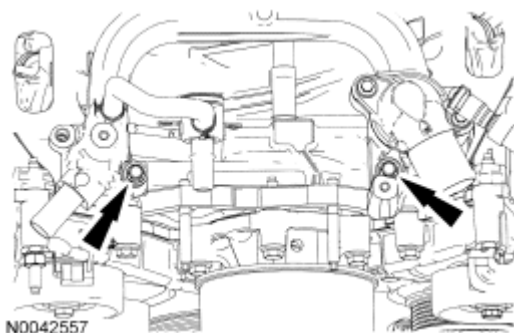


Fig. 467: Locating PCV Fitting Hose Assembly Bolts
Courtesy of FORD MOTOR CO.

25. Install the upper radiator hose.

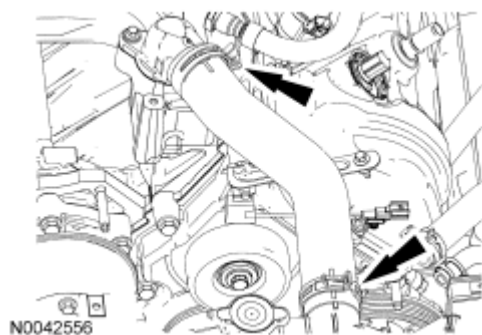


Fig. 468: Locating Upper Radiator Hose Clamps
Courtesy of FORD MOTOR CO.

26. Connect the heater hose.

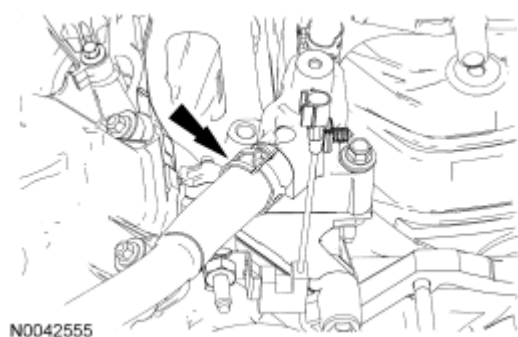


Fig. 469: Locating Heater Hose Clamp
Courtesy of FORD MOTOR CO.

27. Position the alternator, alternator bracket and the wiring harness as an assembly and install the bolts.
- Tighten to 10 Nm (89 lb-in).

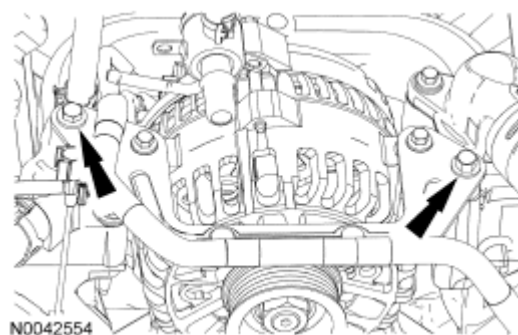
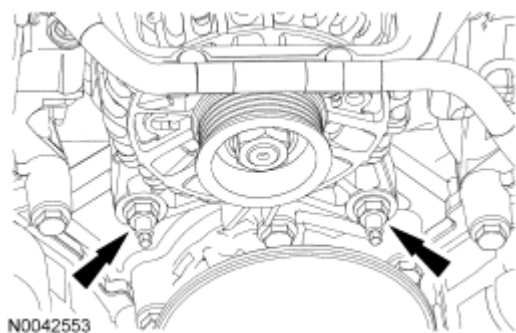
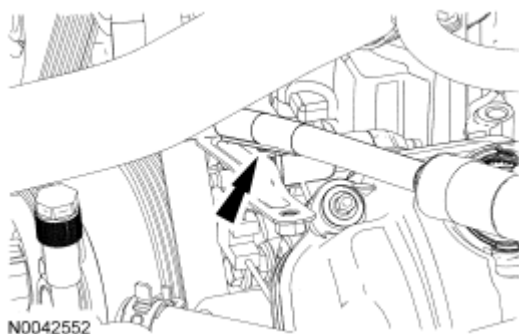


Fig. 470: Locating Alternator Bracket And Wiring Harness Bolts
Courtesy of FORD MOTOR CO.

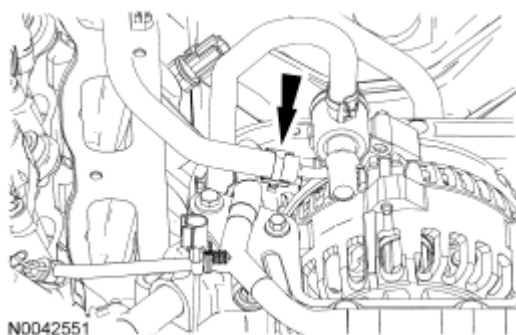
28. Tighten the nuts
- Tighten to 25 Nm (18 lb-ft).

**Fig. 471: Locating Nuts****Courtesy of FORD MOTOR CO.**

29. Attach the wiring harness retainer to the cooling fan wiring harness bracket.

**Fig. 472: Locating Wiring Harness Retainer From Cooling Fan Wiring Harness Bracket****Courtesy of FORD MOTOR CO.**

30. Connect the heated PCV fitting coolant hose.

**Fig. 473: Locating Heated PCV Fitting Coolant Hose****Courtesy of FORD MOTOR CO.**

31. Connect the electrical connector.



Fig. 474: Locating Electrical Connector
Courtesy of FORD MOTOR CO.

32. Rotate the accessory drive belt tensioner clockwise and install the accessory drive belt.

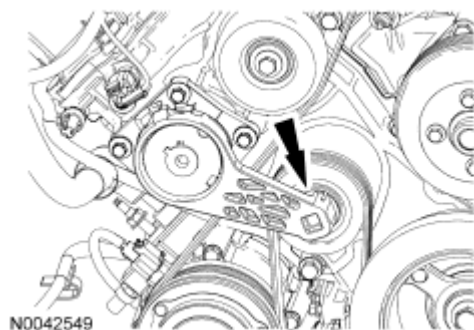


Fig. 475: Locating Accessory Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

33. Install the cooling fan. For additional information, refer to **ENGINE COOLING** article.
34. Connect the wiring harness terminals, install the nuts and close the cover.
- Tighten to 12 Nm (9 lb-ft).

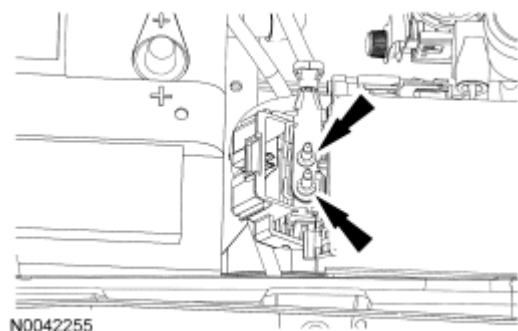


Fig. 476: Locating Wiring Harness Terminals Nuts
Courtesy of FORD MOTOR CO.

35. Install the intake manifold. For additional information, refer to **Intake Manifold**.
36. Position the hood and install the 4 bolts.

- Tighten to 12 Nm (9 lb-ft).

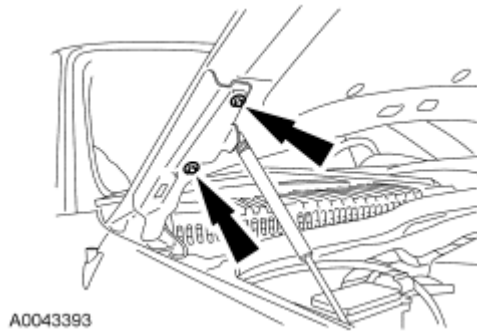


Fig. 477: Locating Hood Hinge Bolts
Courtesy of FORD MOTOR CO.

37. Connect the windshield washer hose.

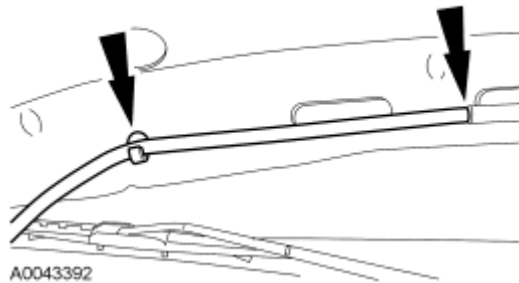


Fig. 478: Locating Windshield Washer Hose And Retainer
Courtesy of FORD MOTOR CO.

38. Fill the engine with clean engine oil.
39. Fill and bleed the cooling system. For additional information, refer to **ENGINE COOLING** article.
40. Carry out the fluid level check for the transmission. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** article.

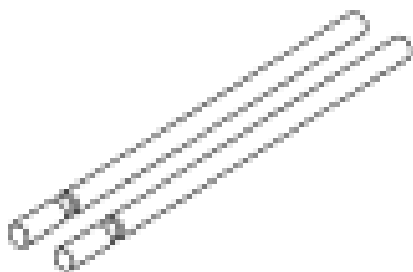
CYLINDER HEAD

Special Tools

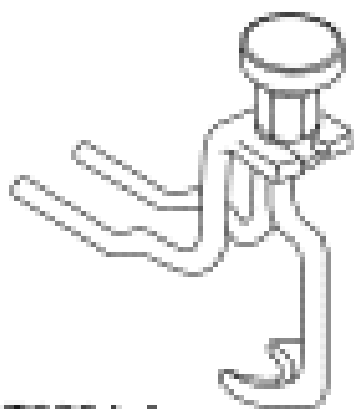
Illustration	Tool Name	Tool Number
	Alignment Pins, Cylinder Head	303-1040 (SR-015486)

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer



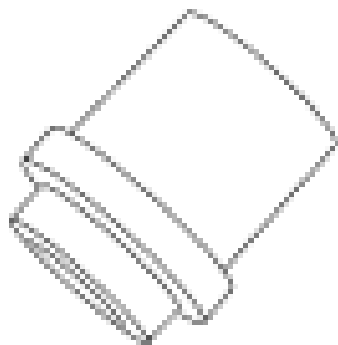
ST2B06-A



ST2B04-A

Compressor, Valve Spring

303-1039



ST2197-A

Installer, Crankshaft Front Seal

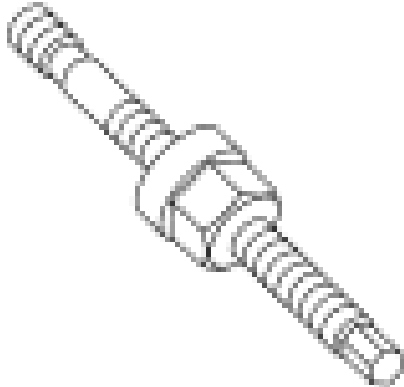
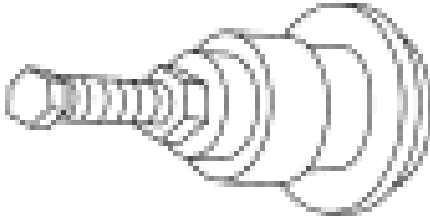
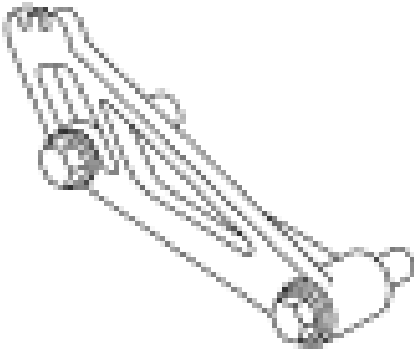
303-635

Installer, Crankshaft Vibration
Damper

303-102 (T74P-6316-B)

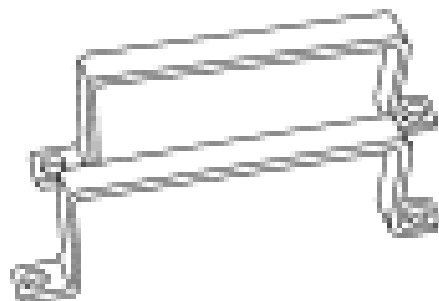
2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

 ST2428-A		
 ST132B-A	Installer, Front Cover Seal	303-335 (T88T-6701-A)
 ST2607-A	Locking Tool, Camshaft Phaser Sprocket	303-1046
	Modular Engine Lift Bracket	303-F047 (014-00073) or equivalent

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

**ST1377-A****ST1668-A**

Remover/Installer, Cylinder Head

303-572 (T97T-6000-A)

Material

Item	Specification
Hydraulic Chain Tensioner Retaining Clip 1L3Z-6P250-AA	-
Motorcraft Metal Surface Prep ZC-31	-
Motorcraft Premium Gold Engine Coolant with Bittering Agent (US only) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Silicone Gasket Remover ZC-30	-
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All cylinder heads

CAUTION: Make sure all coolant residue and foreign material are cleaned from the block surface and cylinder bore. Failure to follow this instruction may result in engine damage.

NOTE: The use of sealing aids (aviation cement, copper spray and glue) is not permitted. The gasket must be installed dry.

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

NOTE: Do not turn the crankshaft until instructed to do so.

NOTE: LH shown, RH similar.

1. Using the special tools, position the cylinder head gaskets and cylinder heads over the dowels and install the cylinder head bolts loosely.

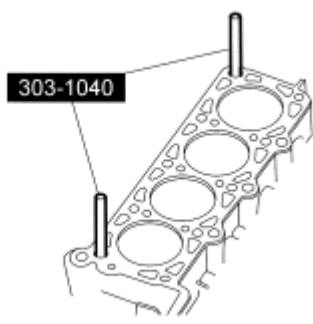
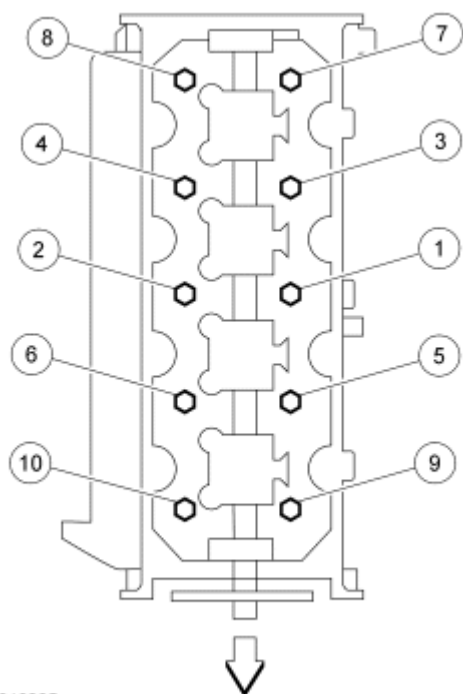


Fig. 479: Positioning Cylinder Head Gaskets And Cylinder Heads Over Dowels
Courtesy of FORD MOTOR CO.

LH cylinder head

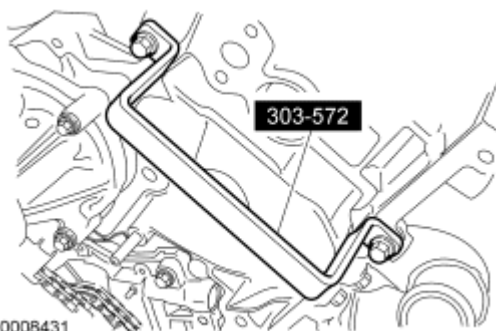
2. Tighten the LH cylinder head bolts in 3 stages, in the sequence shown.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Tighten an additional 90 degrees.



N0010205

Fig. 480: Tightening Bolts In Sequence
Courtesy of FORD MOTOR CO.

3. Remove the special tool from the LH cylinder head.



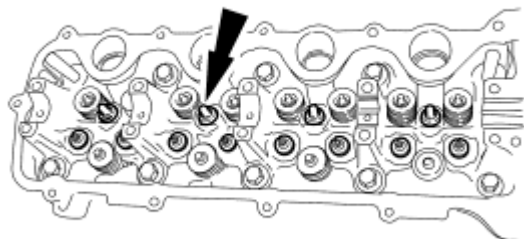
N0008431

Fig. 481: Identifying Special Tool Onto Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

NOTE: The hydraulic lash adjusters must be installed in their original locations.

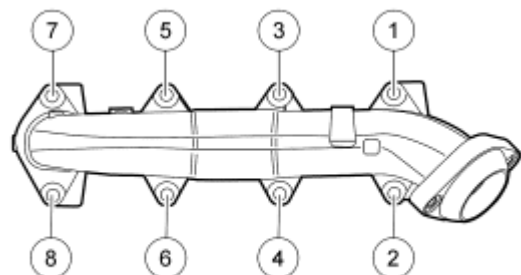
4. Install the hydraulic lash adjusters into the LH cylinder head.



A0074692

Fig. 482: Identifying Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

5. Remove the oil level indicator tube, install a new O-ring seal, and lubricate the O-ring seal with clean engine oil. Position the oil level indicator tube loosely in the engine block before installing the LH exhaust manifold.
6. Inspect the LH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
7. Install 8 new LH exhaust manifold studs.
 - Tighten to 12 Nm (9 lb-ft).
8. Position new gaskets, the LH exhaust manifold and tighten the 8 new nuts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).



N0040497

Fig. 483: Identifying Tightening Sequence Of Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

9. Position the LH exhaust manifold heat shield and install the bolts.
 - Tighten to 10 Nm (89 lb-in).

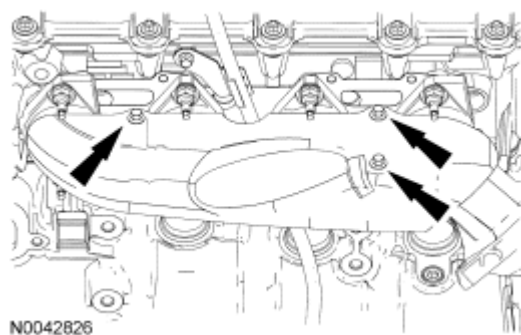
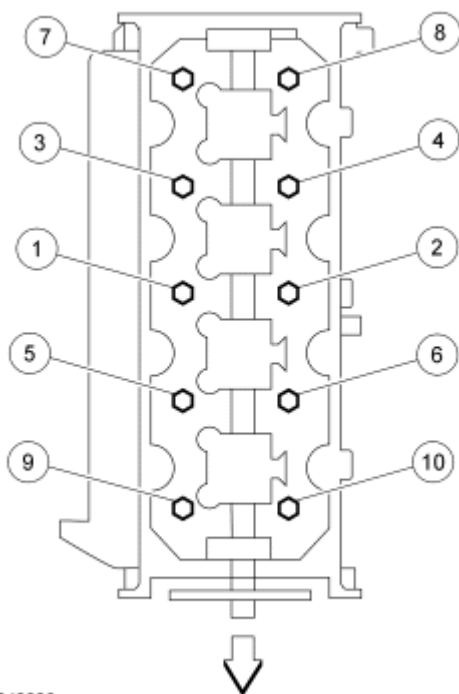


Fig. 484: Locating LH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

RH cylinder head

10. Tighten the RH cylinder head bolts in 3 stages, in the sequence shown.
 - Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
 - Stage 3: Tighten an additional 90 degrees.



N0043039

Fig. 485: Identifying RH Cylinder Head Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Remove the special tool from the RH cylinder head.

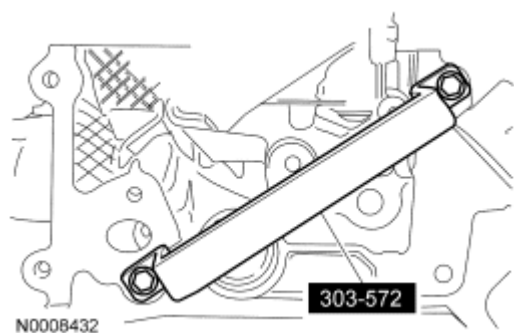


Fig. 486: Identifying Special Tool On Cylinder Head
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the hydraulic lash adjusters with clean engine oil prior to installation.

NOTE: The hydraulic lash adjusters must be installed in their original locations.

12. Install the hydraulic lash adjusters into the RH cylinder head.

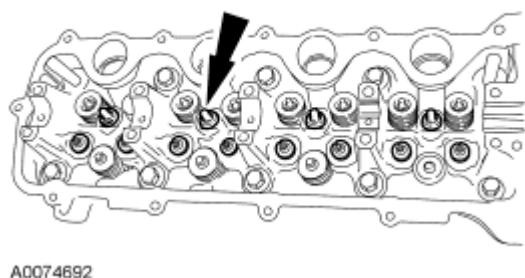
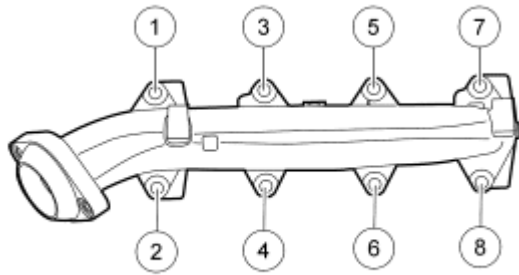


Fig. 487: Identifying Hydraulic Lash Adjusters
Courtesy of FORD MOTOR CO.

13. Inspect the RH exhaust manifold gasket mating surfaces for flatness. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION** article.
14. Install 8 new RH exhaust manifold studs.
 - Tighten to 12 Nm (9 lb-ft).
15. Position new gaskets, the RH exhaust manifold and tighten the 8 new nuts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).



N0040498

Fig. 488: Identifying Tightening Sequence Of Exhaust Manifold-To-Catalytic Converter Nuts
Courtesy of FORD MOTOR CO.

16. Position the RH heat shield and install the bolts.
- Tighten to 10 Nm (89 lb-in).

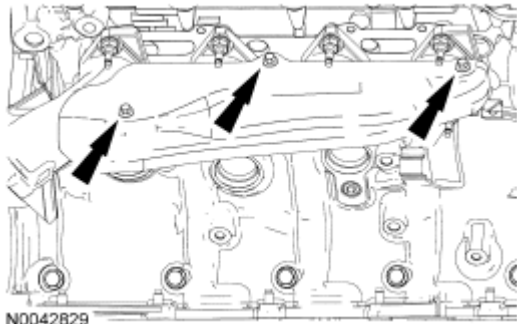


Fig. 489: Identifying RH Exhaust Manifold Heat Shield Bolts
Courtesy of FORD MOTOR CO.

NOTE: Install new O-ring seals and lubricate the O-ring seals with clean engine coolant.

17. Position the heater supply tube and the hoses as an assembly and install the stud bolt.
- Tighten to 10 Nm (89 lb-in).

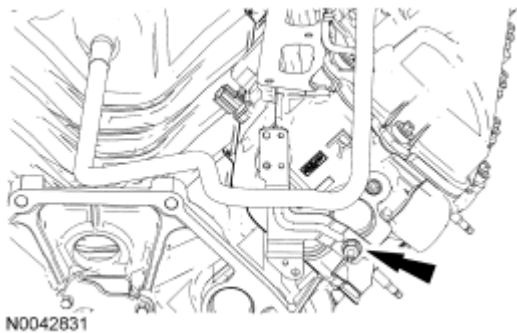


Fig. 490: Locating Heater Supply Tube Stud Bolt
Courtesy of FORD MOTOR CO.

18. Position the ground strap and install the nut.
 - Tighten to 10 Nm (89 lb-in).

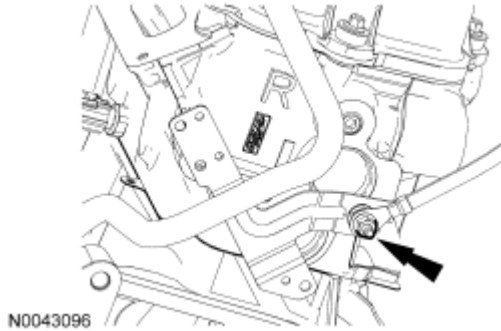


Fig. 491: Locating Ground Strap Nut
Courtesy of FORD MOTOR CO.

All cylinder heads

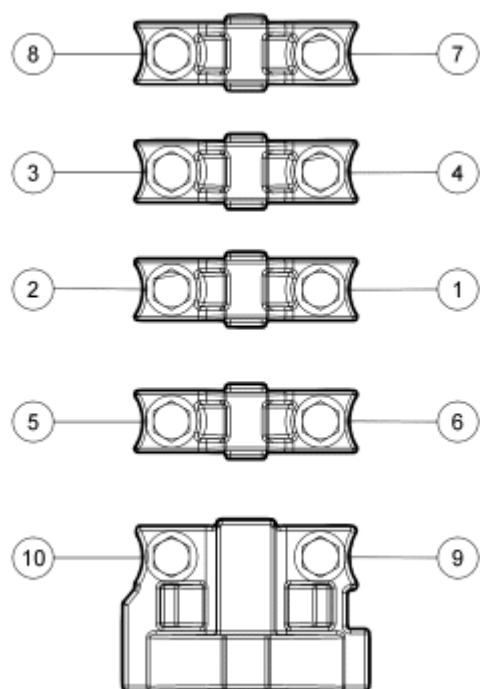
NOTE: Lubricate the camshaft and camshaft journals with clean engine oil prior to installation.

19. Install the LH and RH camshafts.

NOTE: LH shown, RH similar.

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

20. Install the LH and RH camshaft bearing caps in their original locations.
 - Position the front camshaft bearing cap.
 - Position the remaining camshaft bearing caps.
 - Install the bolts loosely.
 - Tighten to 10 Nm (89 lb-in) in the sequence shown.



N0011337

Fig. 492: Identifying Camshaft Bearing Cap Bolt Loosening/Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

NOTE: LH shown, RH similar.

21. Install the camshaft phaser sprockets and new camshaft phaser bolts finger tight.

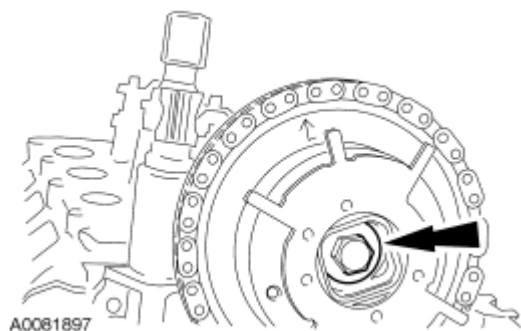


Fig. 493: Identifying Camshaft Phaser And Sprocket Assembly Bolt

Courtesy of FORD MOTOR CO.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

CAUTION: Only use hand tools to remove the camshaft phaser sprocket assembly or damage may occur to the camshaft or camshaft phaser unit.

CAUTION: Damage to the camshaft phaser sprocket assembly will occur if mishandled or used as a lifting or leveraging device.

NOTE: LH shown, RH similar.

22. Using the special tool, tighten the LH and RH camshaft phaser sprocket bolts in 2 stages.
- Stage 1: Tighten to 40 Nm (30 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

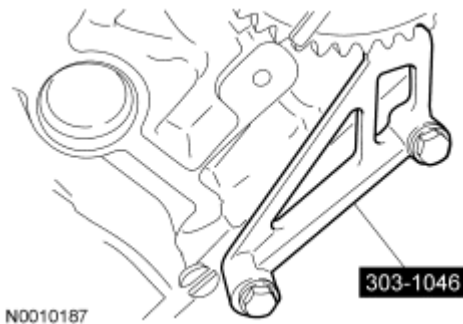


Fig. 494: Identifying Special Sprocket Phaser Tool
Courtesy of FORD MOTOR CO.

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

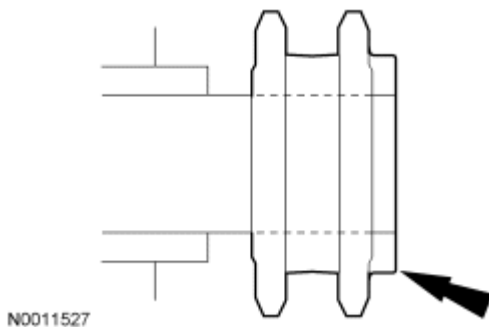


Fig. 495: Identifying Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

24. Rotate the crankshaft to position the crankshaft sprocket timing mark in the 6 o'clock position.

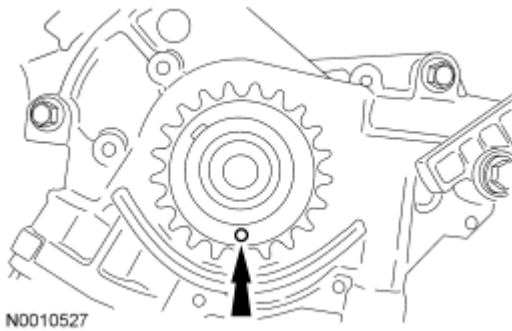


Fig. 496: Locating Crankshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

25. Rotate the camshaft sprockets to position the RH camshaft sprocket timing mark in the 11 o'clock position and the LH camshaft sprocket timing mark in the 12 o'clock position.

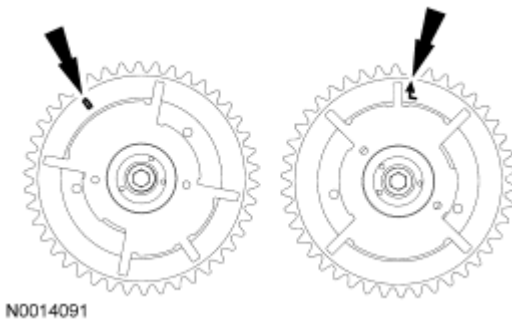


Fig. 497: Rotating Camshaft Sprockets To Position RH Camshaft Sprocket Timing Mark
Courtesy of FORD MOTOR CO.

CAUTION: If one or both tensioner mounting bolts are loosened or removed, the tensioner-sealing bead must be inspected for seal integrity. Any cracks, tears, cuts or separation from the tensioner body, or permanent compression of the seal bead, will require replacement of the tensioner. Failure to follow this instruction may result in engine damage.

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

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

27. Compress the tensioner plunger, using a vise.

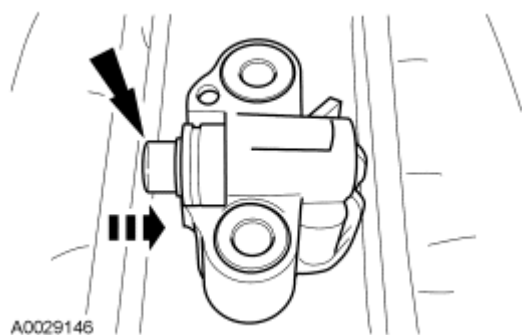


Fig. 498: Compressing Tensioner Plunger
Courtesy of FORD MOTOR CO.

28. Install a retaining clip on the tensioner to hold the plunger in during installation.

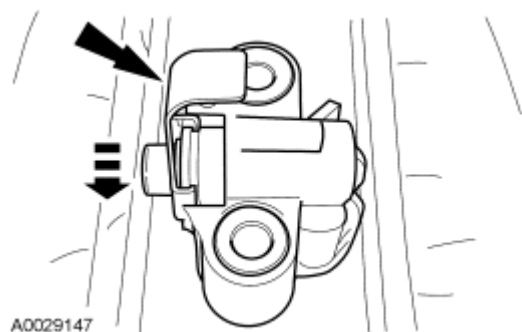


Fig. 499: Identifying Retaining Clip on Tensioner
Courtesy of FORD MOTOR CO.

29. Remove the tensioner from the vise.
30. If the copper links are not visible, mark one link on one end and one link on the other end and use as timing marks.

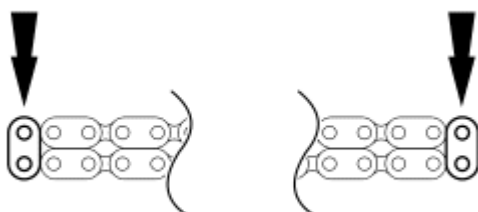
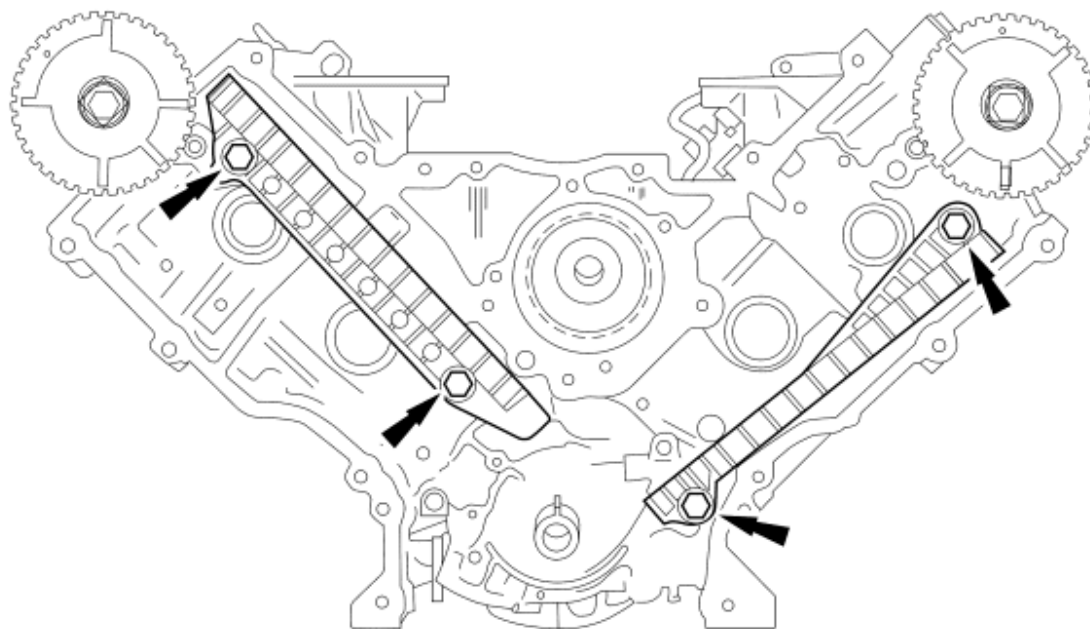


Fig. 500: Identifying Timing Chain Copper Links
Courtesy of FORD MOTOR CO.

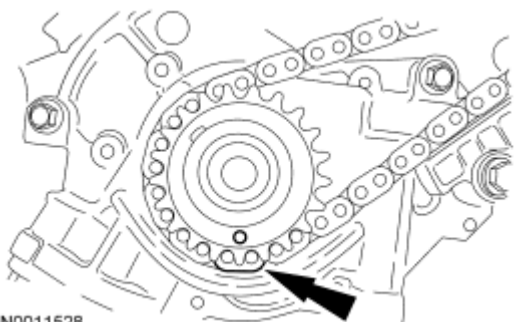
31. Install the 4 bolts and the LH and RH timing chain guides.
- Tighten to 10 Nm (89 lb-in).



N0006303

Fig. 501: Identifying Timing Chain Guides
Courtesy of FORD MOTOR CO.

32. Position the lower end of the LH (inner) timing chain on the crankshaft sprocket, aligning the timing mark on the outer flange of the crankshaft sprocket with the single copper (marked) link on the chain.



N0011528

Fig. 502: Aligning Crankshaft Sprocket Timing Mark And LH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: Make sure the upper half of the timing chain is below the tensioner arm dowel.

33. Position the LH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

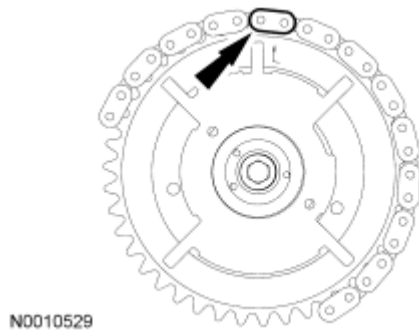


Fig. 503: Positioning LH Timing Chain On Camshaft Sprocket
Courtesy of FORD MOTOR CO.

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

34. Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner and 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

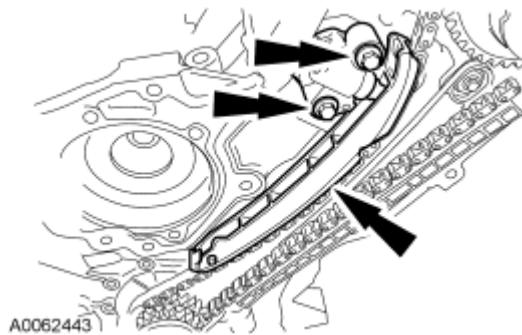


Fig. 504: Identifying LH Timing Chain Tensioner & Tensioner Arm
Courtesy of FORD MOTOR CO.

35. Remove the retaining clip from the LH timing chain tensioner.

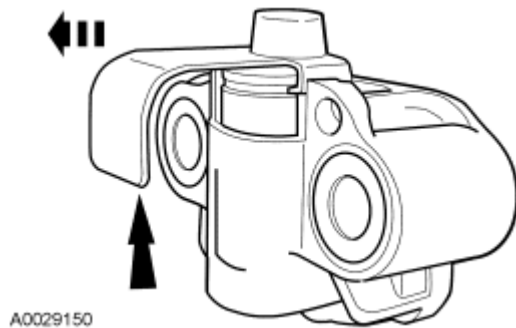


Fig. 505: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

36. Position the lower end of the RH (outer) timing chain on the crankshaft sprocket, aligning the timing mark on the sprocket with the single copper (marked) chain link.

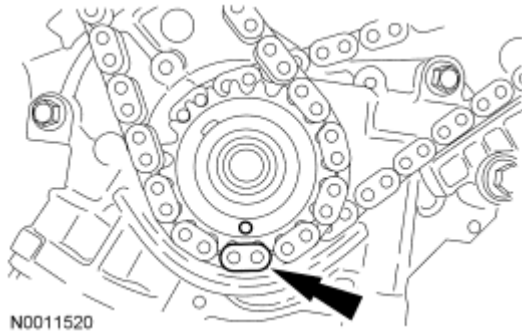


Fig. 506: Aligning Crankshaft Sprocket Timing Mark And RH Timing Chain Link
Courtesy of FORD MOTOR CO.

NOTE: The lower half of the timing chain must be positioned above the tensioner arm dowel.

NOTE: The camshaft phaser and sprocket will be stamped with one of the illustrated timing marks for the RH camshaft.

37. Position the RH timing chain on the camshaft sprocket. Make sure the camshaft sprocket timing mark is aligned with the copper (marked) chain link.

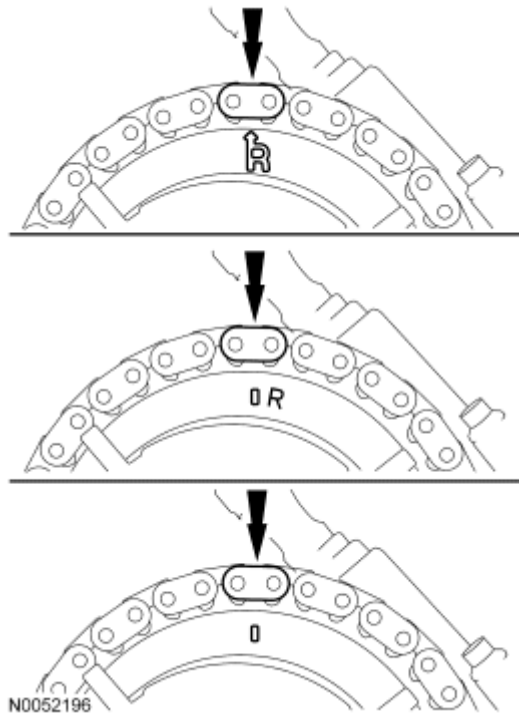


Fig. 507: Locating Camshaft Sprocket Timing Mark Aligned With Copper Chain Link

Courtesy of FORD MOTOR CO.

38. Position the RH timing chain tensioner arm on the dowel pin and install the RH timing chain tensioner and 2 bolts.
- Tighten to 25 Nm (18 lb-ft).

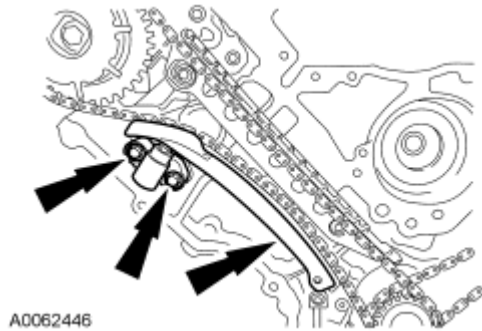


Fig. 508: Identifying RH Timing Chain Tensioner, Tensioner Arm And Bolts
Courtesy of FORD MOTOR CO.

39. Remove the retaining clip from the RH timing chain tensioner.

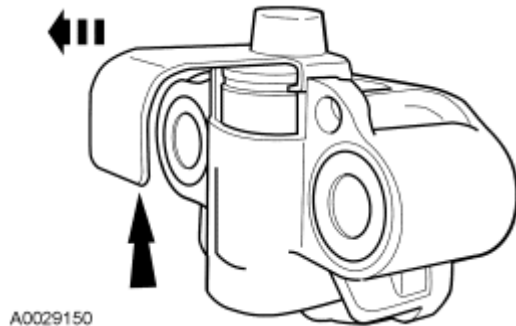
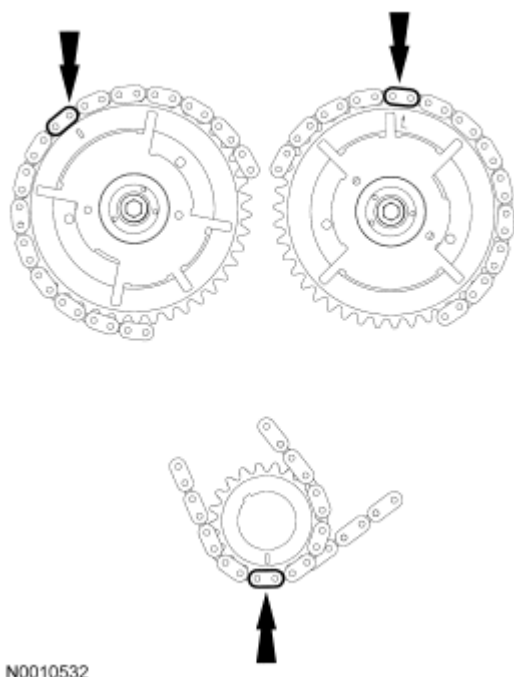


Fig. 509: Identifying Retaining Clip And Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

NOTE: The RH and LH camshaft phaser sprockets are similar. Refer to the single timing mark to identify the RH camshaft phaser sprocket and the L timing mark to identify the LH camshaft phaser sprocket.

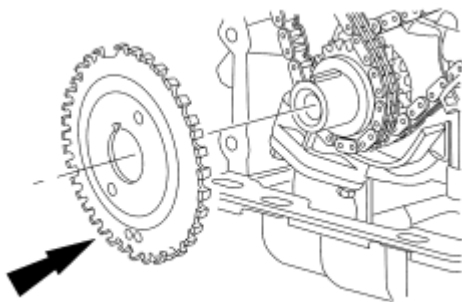
40. As a post-check, verify correct alignment of all timing marks. Make sure the timing marks on the sprockets correspond to the above note.



N0010532

Fig. 510: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

41. Install the crankshaft sensor ring on the crankshaft.

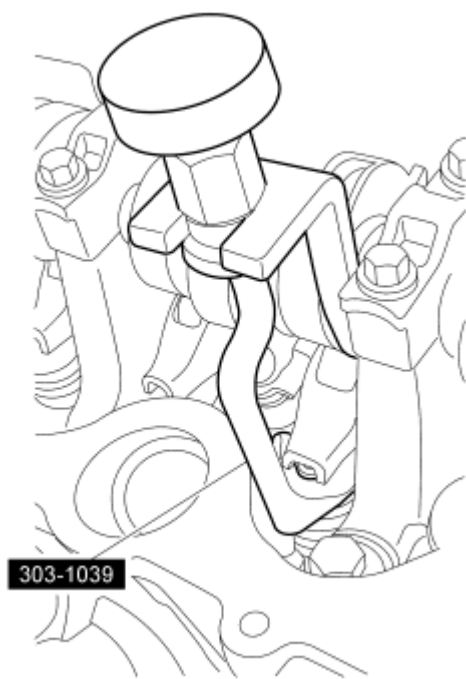


A0032166

Fig. 511: View Of Crankshaft Sensor Ring At Crankshaft
Courtesy of FORD MOTOR CO.

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

42. Using the special tool, install all of the camshaft roller followers.



N0010191

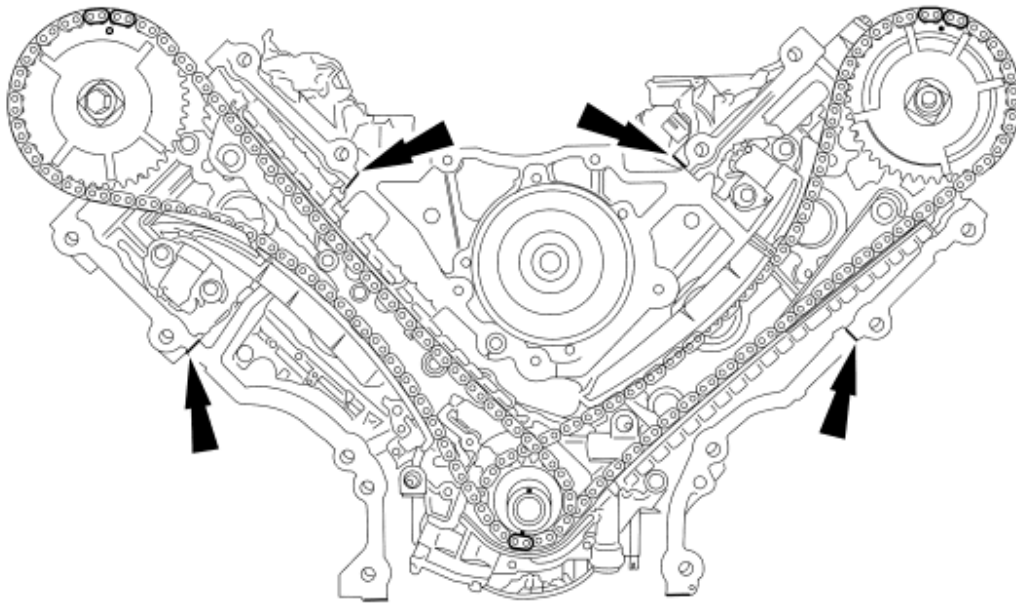
Fig. 512: Compressing Spring Using Special Tool
Courtesy of FORD MOTOR CO.

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

NOTE: If the engine front cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

NOTE: Make sure that the engine front cover gasket is in place on the engine front cover before installation.

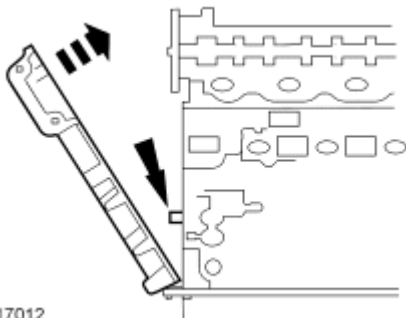
43. Apply a bead of silicone gasket and sealant along the cylinder head-to-cylinder block surface at the locations shown.



N0010501

Fig. 513: Applying Bead Of Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

44. Install a new engine front cover gasket on the engine front cover. Position the engine front cover onto the dowels. Install the 15 fasteners finger-tight.



N0017012

Fig. 514: Installing Engine Front Cover Gasket On Engine Front Cover
Courtesy of FORD MOTOR CO.

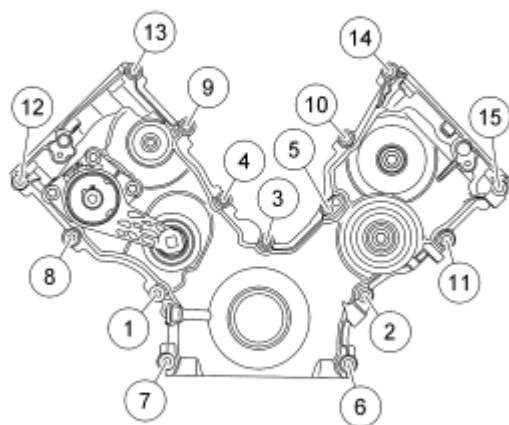
45. Tighten the engine front cover fasteners in the sequence shown to 25 Nm (18 lb-ft).

Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53

2009 Mercury Mountaineer

2009 ENGINE Engine - 4.6L (3V) - Explorer, Explorer Sport Trac & Mountaineer

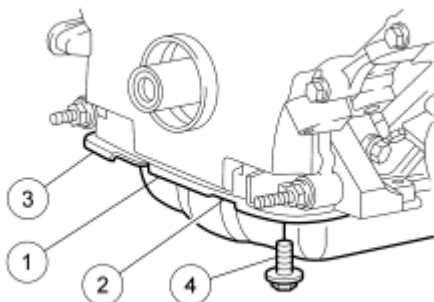
3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shoulder Pilot, M8 x 1.25 x 50 - M6 x 1 x 10
7	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N808294	Bolt, Hex Head Pilot, M8 x 1.25 x 53
12	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
13	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
14	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1
15	N806300	Stud, Hex Shoulder Pilot, M8 x 1.25 x 1.25 x 91.1



N0039598

Fig. 515: Identifying Tightening Sequence Of Engine Front Cover Fasteners
Courtesy of FORD MOTOR CO.

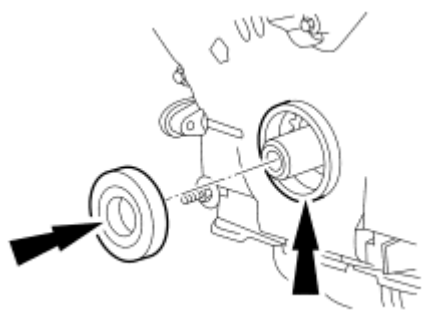
46. Loosely install the 4 bolts, then tighten the bolts in 2 stages, in the sequence shown.
- Stage 1: Tighten to 20 Nm (15 lb-ft).
 - Stage 2: Tighten an additional 60 degrees.



N0008507

Fig. 516: Identifying Tightening Sequence Of Front Oil Pan Bolts
Courtesy of FORD MOTOR CO.

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



A0029187

Fig. 517: Locating Crankshaft Front Seal
Courtesy of FORD MOTOR CO.

48. Using the special tools, install the crankshaft front oil seal into the engine front cover.

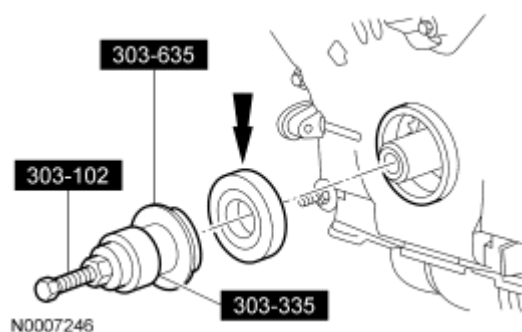
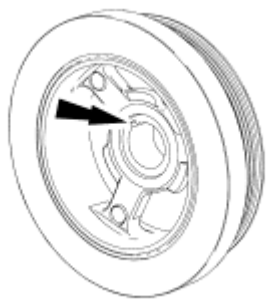


Fig. 518: Installing Crankshaft Front Seal Using Special Tools
Courtesy of FORD MOTOR CO.

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

49. Apply silicone gasket and sealant to the Woodruff key slot in the crankshaft pulley.



N0010530

Fig. 519: Applying Silicone Gasket And Sealant To Woodruff Key Slot In Crankshaft Pulley
Courtesy of FORD MOTOR CO.

50. Using the special tool, install the crankshaft pulley.

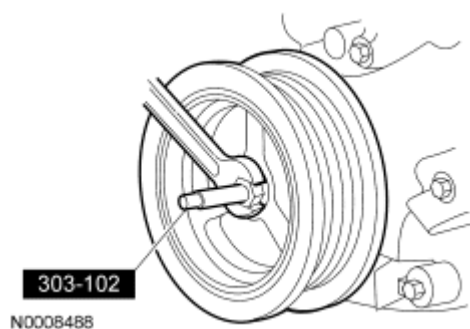


Fig. 520: Installing Crankshaft Pulley Using Special Tool
Courtesy of FORD MOTOR CO.

51. Using a new crankshaft pulley bolt, install the bolt and washer and tighten the bolt in 4 stages.
- Stage 1: Tighten to 90 Nm (66 lb-ft).
 - Stage 2: Loosen 360 degrees.
 - Stage 3: Tighten to 50 Nm (37 lb-ft).
 - Stage 4: Tighten an additional 90 degrees.
52. Install the RH side accessory drive belt idler pulley, the coolant pump pulley and the 5 bolts.
- Tighten to 25 Nm (18 lb-ft).

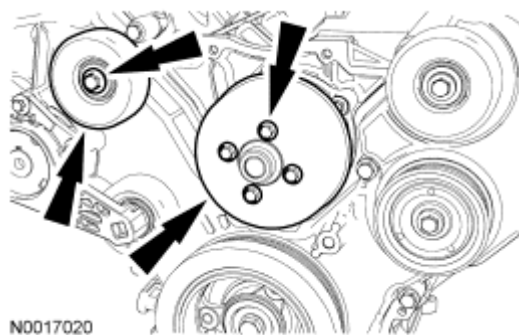


Fig. 521: Locating Accessory Drive Belt Idler Pulley And Bolts
Courtesy of FORD MOTOR CO.

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

53. Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

NOTE: If not secured within 4 minutes, the sealant must be removed and the

sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

54. Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

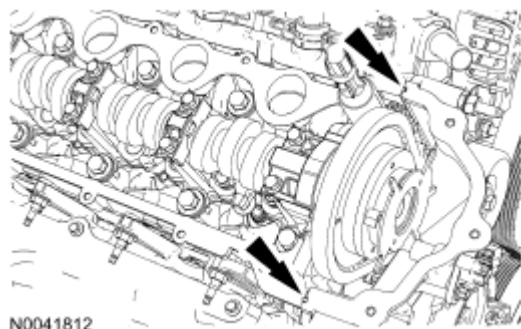


Fig. 522: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

CAUTION: Install the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

55. Position the RH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

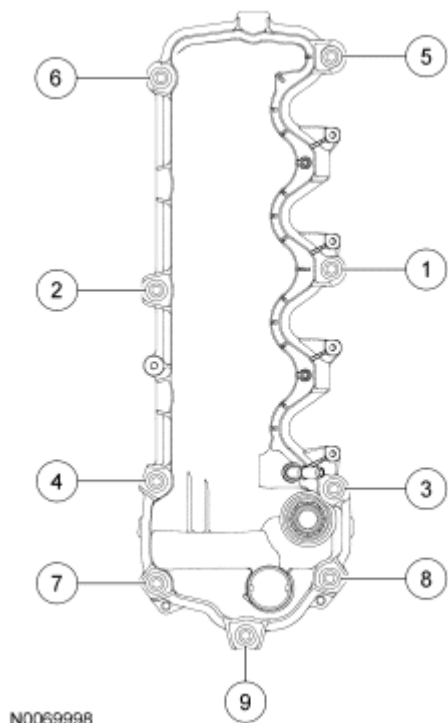


Fig. 523: Tightening RH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

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

56. Clean the valve cover mating surface with silicone gasket remover and metal surface prep. Follow the directions on the packaging.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

57. Apply silicone gasket and sealant in 2 places where the engine front cover meets the cylinder head.

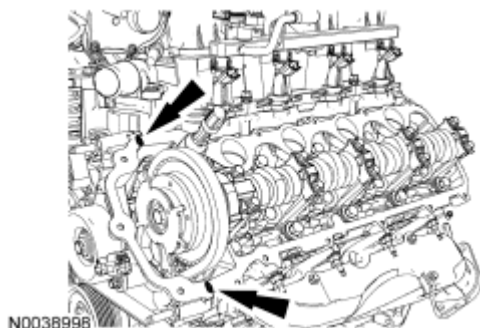


Fig. 524: Locating Silicone Gasket And Sealant Area
Courtesy of FORD MOTOR CO.

CAUTION: Install the valve cover carefully, or the variable camshaft timing (VCT) solenoid may be damaged.

58. Position the LH valve cover and gasket on the cylinder head and tighten the bolts in the sequence shown.
- Tighten to 10 Nm (89 lb-in).

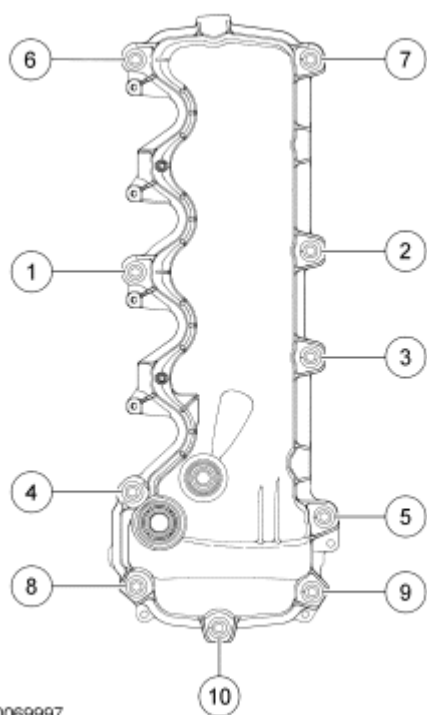


Fig. 525: Tightening LH Valve Cover In Sequence
Courtesy of FORD MOTOR CO.

59. Position the oil level indicator tube and install the bolt.
 - Tighten to 10 Nm (89 lb-in).



Fig. 526: Locating Oil Level Indicator Tube Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

60. Install the 8 ignition coils and the 8 bolts.
 - Tighten to 6 Nm (53 lb-in).

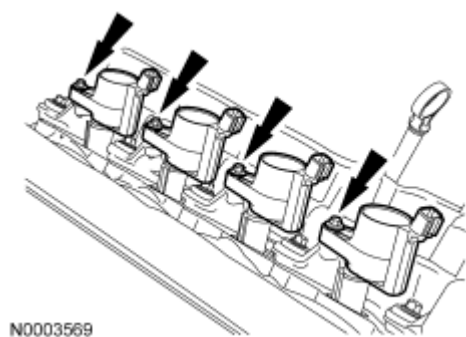


Fig. 527: Identifying Ignition Coils And Bolts
Courtesy of FORD MOTOR CO.

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

61. Install a new oil filter.
 - Tighten the oil filter until the gasket makes contact, then use an oil filter strap wrench to tighten the filter an additional 270 degrees.
62. Connect the PCV hose to the LH valve cover.

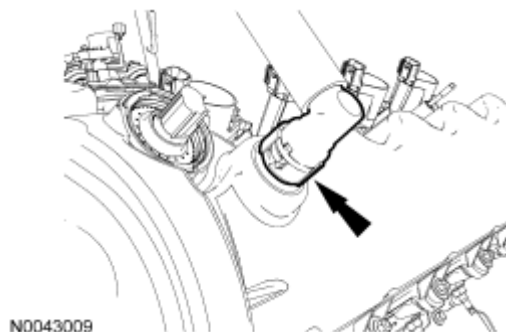


Fig. 528: Locating Positive Crankcase Ventilation (PCV) Hose
Courtesy of FORD MOTOR CO.

63. Connect the breather tube to the RH valve cover.

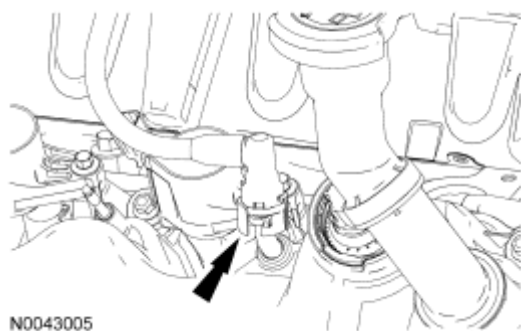


Fig. 529: Locating Breather Tube Connector Retaining Clip
Courtesy of FORD MOTOR CO.

64. Position the engine wiring harness and attach the electrical connectors to the heater supply tube bracket.

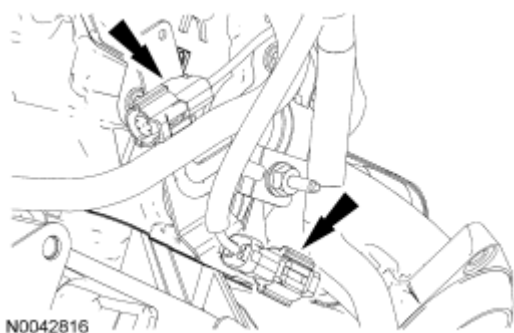


Fig. 530: Locating Electrical Connector Retainers And Engine Wiring Harness
Courtesy of FORD MOTOR CO.

65. Connect the cylinder head temperature (CHT) sensor electrical connector.

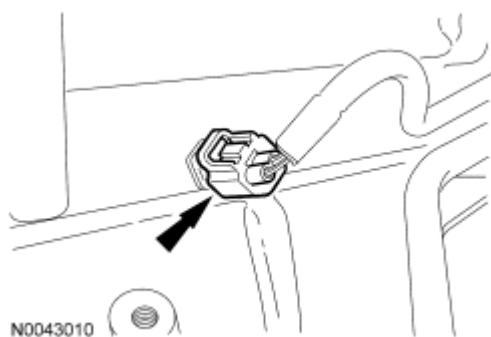


Fig. 531: Locating Cylinder Head Temperature (CHT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

66. Attach the wiring harness retainers to the RH valve cover studs.

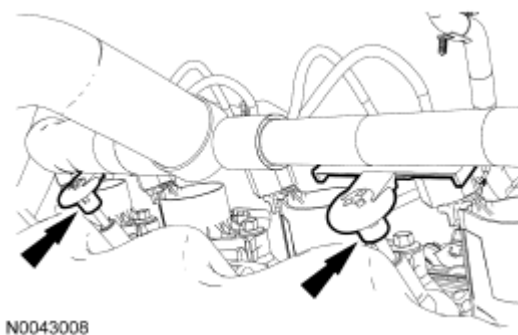


Fig. 532: Locating RH Valve Cover Studs
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

67. Connect the RH and LH ignition coil electrical connectors.

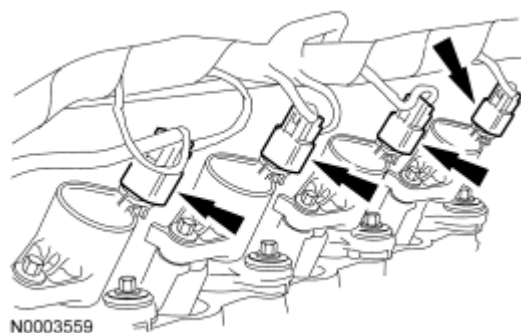


Fig. 533: Locating Ignition Coil Electrical Connectors
Courtesy of FORD MOTOR CO.

68. Attach the wiring harness retainers to the LH valve cover studs.

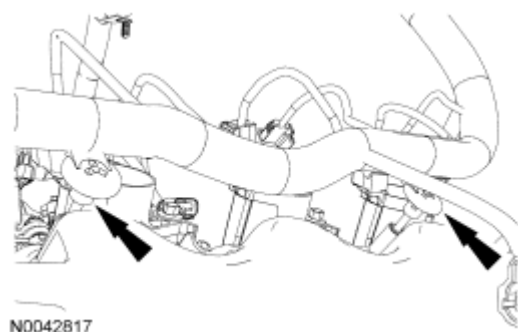


Fig. 534: Locating LH Valve Cover Studs
Courtesy of FORD MOTOR CO.

69. Position the LH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

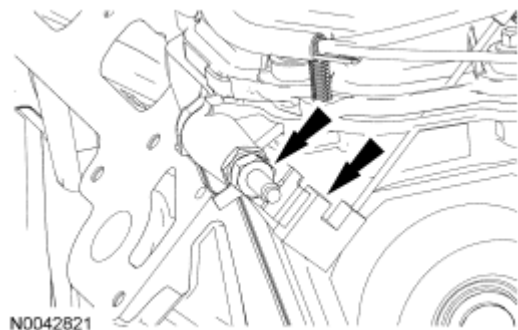


Fig. 535: Locating LH Radio Interference Capacitor And Nuts
Courtesy of FORD MOTOR CO.

70. Position the cooling fan wiring harness and install the nut.

- Tighten to 25 Nm (18 lb-ft).

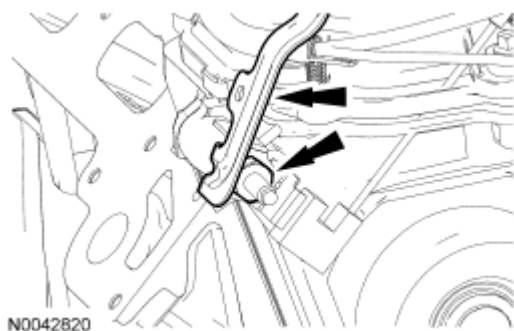


Fig. 536: Locating Cooling Fan Wiring Harness Bracket Nut
Courtesy of FORD MOTOR CO.

71. Connect the LH camshaft position sensor and attach the wiring harness retainers.

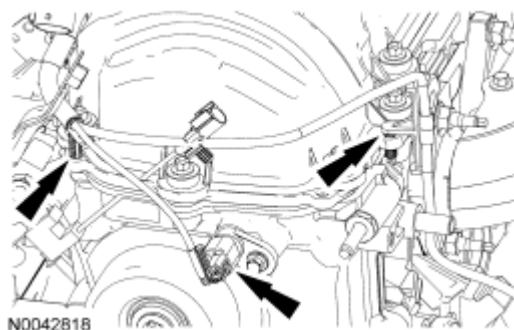


Fig. 537: Locating LH Camshaft Position Sensor And Attach Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

72. Connect the oil pressure sensor electrical connector.

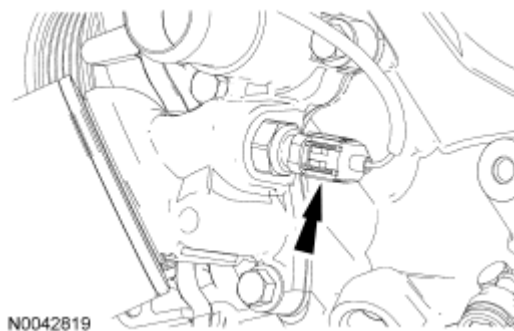


Fig. 538: Locating Oil Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

73. Position the RH radio interference capacitor and install the nut.
- Tighten to 25 Nm (18 lb-ft).

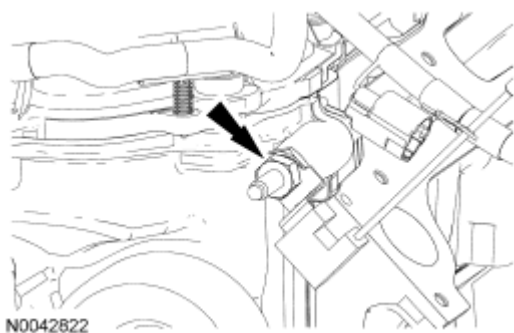


Fig. 539: Locating RH Radio Ignition Interference Capacitor Nut
Courtesy of FORD MOTOR CO.

74. Attach the wiring harness retainers.

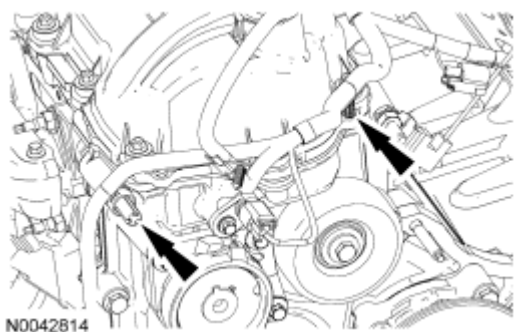


Fig. 540: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

75. Connect the RH and LH variable camshaft timing (VCT) solenoid electrical connectors.

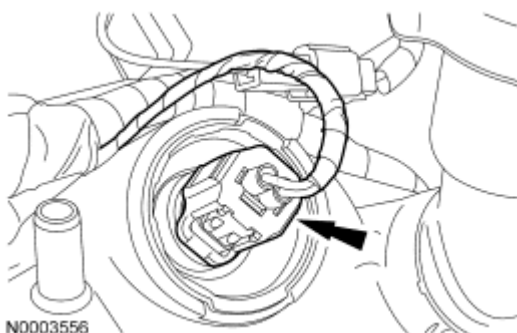


Fig. 541: Locating Camshaft Timing (VCT) Solenoid Electrical Connectors
Courtesy of FORD MOTOR CO.

NOTE: RH shown, LH similar.

76. Disconnect the RH and LH camshaft position (CMP) sensor electrical connectors.

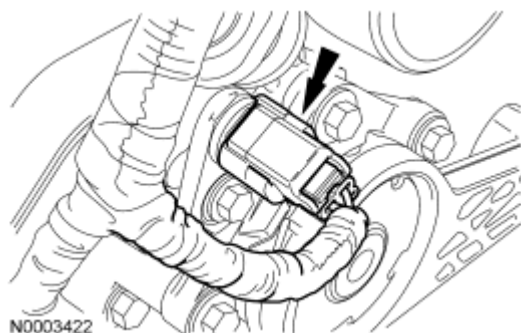


Fig. 542: Identifying RH CMP Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

77. Connect the crankshaft position sensor electrical connector and attach the wiring harness retainer.

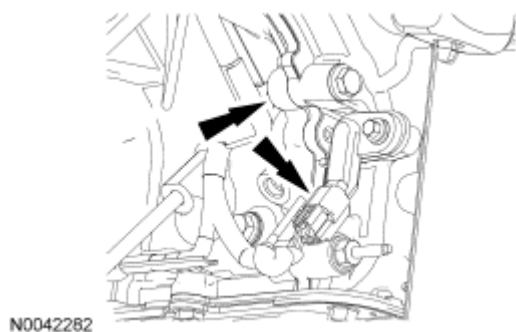


Fig. 543: Locating Crankshaft Position Sensor Electrical Connector And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

78. Install the special tool.

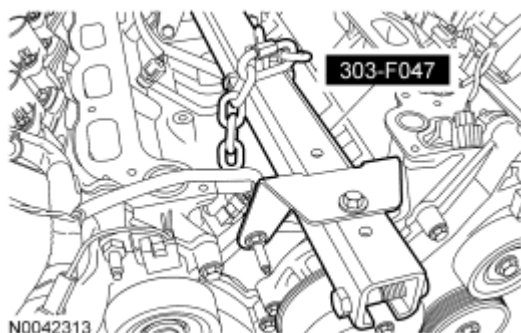


Fig. 544: Identifying Special Tool (303-F047)
Courtesy of FORD MOTOR CO.

79. Using a suitable floor crane, remove the engine from the engine stand.
80. Install the engine. For additional information, refer to **Engine**.