2008 ENGINE

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

SPECIFICATIONS

MATERIALS

MATERIALS

Item	Specification	Fill Capacity
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A	-
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX (US); XT-2-LM12 (Canada)	MERCON®	-
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	5.7L (6.0 qt) includes filter change
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-
Thread Sealant with PTFE TA-24	WSK-M2G350-A2	-

GENERAL SPECIFICATIONS

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Item	Specification
Engine	
Bore/stroke	89.0 x 79.5 mm (3.12 in)
Compression ratio	10.0:1
Displacement	3.0L (4V) (182 CID)
Engine and transaxle assembly weight (without accessory drive components)	234 kg (516 lb)

Engine weight (without accessory drive components and flexplate)	146 kg (322 lb)
Fire order	1-4-2-5-3-6
No. cylinders	6
Oil pressure (Minimum at 1,500 RPM with engine warmed up after 10 minutes of idling)	138 kPa (20 psi)
Spark plug	AGSF-32M Gap = 1.30-1.40 mm (0.052-0.056 in)
Cylinder Head and Valve Train	
Combustion chamber volume	52 cc (3.17 CI)
Cylinder head gasket surface flatness	-
Roller follower ratio @ max. lift	2.0:1
Valve arrangement (front to rear)	LH intake I-I-I-I-I-I LH exhaust E-E-E-E-E-E RH intake I-I-I-I-I-I RH exhaust E-E-E-E-E-E
Valve face angle	45.5 degrees
Valve face runout	0.05 mm (0.001 in)
Valve guide bore diameter	6.015-6.044 mm (0.236-0.237 in)
Valve head diameter - exhaust	30 mm (1.18 in)
Valve head diameter - intake	35 mm (1.38 in)
Valve head diameter (exhaust) - gauge diameter	28.0 mm (1.10236 in)
Valve head diameter (intake) - gauge diameter	33.5 mm (1.3189 in)
Valve seat angle	44.75 degrees
Valve seat runout	0.04 mm (0.001 in)
Valve seat width - exhaust	1.4-1.7 mm (0.055-0.066 in)
Valve seat width - intake	1.1-1.4 mm (0.043-0.055 in)
Valve spring compression pressure (N @ spec. length)	693 N @ 30.09 mm (156 lbs @ 1.18 in)
Valve spring free length (approx.)	46.6 mm (1.84 in)
Valve spring installed height (N @ spec. length)	39.89 mm (1.57 in)
Valve spring installed pressure	240 N @ 39.89 mm (53.95 lbs @ 1.57 in)
Valve spring installed pressure - service limit	10% force loss @ specified height
Valve spring squareness	2.5%
Valve stem diameter - exhaust	5.950-5.970 mm (0.2343-0.2350 in)
Valve stem diameter - intake	5.975-5.995 mm (0.2350-0.2358 in)
Valve stem-to-guide clearance - exhaust	0.045-0.094 mm (0.0017-0.037 in)
Valve stem-to-guide clearance - intake	0.019-0.069 mm (0.0007-0.0027 in)
Hydraulic Lash Adjuster	
Clearance to bore	0.018-0.069 mm (0.0007-0.0027 in)

Collapsed lash adjuster gap	0.50-1.11 mm (0.019-0.043 in)
Diameter (standard)	16-15.988 mm (0.6290-0.6294 in)
Hydraulic leakdown rate	5-25 seconds
Camshaft	
Allowable lobe lift loss	0.76 mm (0.03 in)
Camshaft journal bore inside diameter	27.012-26.987 mm (1.063-1.062 in)
Camshaft journal-to-bearing clearance - service limit	0.121 mm (0.0047 in)
Camshaft journal-to-bearing clearance - standard	0.025-0.076 mm (0.001-0.0029 in)
End play - service limit	0.190 mm (0.00748 in)
Journal diameter (all)	26.962-26.936 mm (1.061-1.060 in)
Lobe lift	4.80 mm (0.189 in)
Runout	-
Theoretical valve lift @ 0 lash	9.80 mm (0.388 in)
Cylinder Block	
Cylinder bore diameter - grade 1	89.000-89.010 mm (3.50393-3.504323 in)
Cylinder bore diameter - grade 2	89.010-89.020 mm (3.504323-3.504717 in)
Cylinder bore diameter - grade 3	89.020-82.030 mm (3.504717-3.50511 in)
Cylinder bore maximum out-of-round	0.015 mm (0.0005 in)
Cylinder bore maximum out-of-round - service limit	0.020 mm (0.0007 in)
Cylinder bore maximum taper	0.020 mm (0.0008 in)
Head gasket surface flatness	-
Main bearing bore inside diameter	67.998-68.022 mm (2.677-2.6780 in)
Crankshaft	
Connecting rod journal diameter	49.969-49.991 mm (1.967-1.968 in)
Connecting rod journal maximum out-of-round	0.006 mm (0.0002 in)
Connecting rod journal maximum taper	0.008 mm (0.0003 in)
Crankshaft maximum end play	0.135-0.255 mm (0.005-0.010 in)
Main bearing journal diameter	62.968-62.992 mm (2.467-2.479 in)
Main bearing journal maximum out-of-round	0.006 mm (0.0002 in)
Main bearing journal maximum taper	0.008 mm (0.0003 in)
Main bearing journal-to-cylinder block clearance	0.024-0.072 mm (0.0009-0.003 in)
Piston and Connecting Rod	
Connecting rod bearing bore diameter	53.015-53.035 mm (2.0872-2.0879 in)
Connecting rod bearing-to-crankshaft clearance	0.028-0.066 mm (0.001-0.0025 in)
Connecting rod length (center-to-center)	138.06-138.14 mm (5.435-5.38 in)
Connecting rod maximum allowed bend	0.038 mm per 25 (0.0014 per 0.984 in)
Connecting rod maximum allowed twist	0.050 mm per 25 (0.0019 per 0.984 in)
Connecting rod pin bore diameter	21.017-21.031 mm (0.827-0.828 in)
Connecting rod side clearance	0.100-0.30 mm (0.0039-0.0118 in)

Connecting rod-to-pin clearance - service limit	0.035 mm (0.0013 in)
Connecting rod-to-pin clearance - standard	0.004-0.02 mm (0.0001-0.0007 in)
Piston diameter - coated, grade 1	88.990-89.010 mm (3.5035-3.5043 in)
Piston diameter - coated, grade 2	88.998-89.022 mm (3.5039-3.5048 in)
Piston diameter - coated, grade 3	89.010-89.030 mm (3.5043-3.5051 in)
Piston diameter - uncoated, grade 1	88.970-88.980 mm (3.50275-3.50314 in)
Piston diameter - uncoated, grade 2	88.978-88.992 mm (3.50306-3.50362 in)
Piston diameter - uncoated, grade 3	89.010-89.030 mm (3.50432-3.50511 in)
Piston pin bore diameter	21.008-21.012 mm (0.8270-0.8272 in)
Piston pin diameter	21.011-21.013 mm (0.8271-0.8273 in)
Piston pin length	60.51-60.08 mm (2.382-2.365 in)
Piston ring end gap - compression (bottom, gauge diameter)	0.27-0.42 mm (0.0106-0.0165 in)
Piston ring end gap - compression (bottom, service limit)	0.65 mm (0.0255 in) max
Piston ring end gap - compression (top, gauge diameter)[a]	0.100-0.250 mm (0.0039-0.0098 in)
Piston ring end gap - compression (top, service limit)	0.50 mm (0.0196 in) max
Piston ring end gap - oil ring (steel rail, gauge diameter)	0.15-0.65 mm (0.0059-0.0255 in)
Piston ring end gap - oil ring (steel rail, service limit)	0.90 mm (0.0354 in) max
Piston ring groove width - compression (bottom)	1.530-1.545 mm (0.0602-0.0608 in)
Piston ring groove width - compression (top)	1.230-1.245 mm (0.0484-0.0490 in)
Piston ring groove width - oil ring	3.030-3.055 mm (0.1192-0.0120 in)
Piston ring-to-groove clearance	-
Piston ring width	-
Piston pin-to-piston fit	0.002 to 0.009 mm (0.00007-0.0003 in)
Piston-to-connecting rod clearance	-
Piston-to-cylinder bore clearance	0.012 to 0.022 mm (0.0005-0.0009 in)

[a] Specification 82.4 mm (3.2441 in) diameter gauge

TORQUE SPECIFICATIONS

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Description	Nm	lb-ft	lb-in
Accelerator cable bracket bolts	10	-	89
Accelerator cable snow shield bolts	10	-	89
Accessory drive belt tensioner bolt	45	33	-
Air conditioning compressor bracket bolts	25	18	-

Air conditioning compressor bolts	25	18	-
Battery cable nut	10		89
Block heater	21	15	-
Brake hose and wiring retainers	15	11	
Camshaft journal and thrust cap bolts[a]	-	-	-
Camshaft oil seal retainer bolts	10	-	89
Camshaft position (CMP) sensor bolt	10	-	89
Catalyst monitor sensor electrical connector bracket nut	10		89
Center accessory drive belt idler pulley bolt	25	18	-
Coil-on-plug bolts	6	-	53
Coolant bypass tube nut and bolt	10	-	89
Coolant pump bolts	10	-	89
Crankcase cover bolts	10	-	89
Crankshaft position (CKP) sensor bolt	10	-	89
Crankshaft pulley bolt[a]	-	-	-
Cross brace bolts	90	66	-
Cross brace nut	175	129	-
Cylinder head bolts[a]	-	-	-
Driveshaft-to-power takeoff bolts and washers	37	27	-
Engine control wiring harness (B+) shield nuts	6	-	53
Engine front cover bolts and studs[a]	-	-	-
Engine lift bracket bolt	118	87	-
Engine oil filter[a]	-	-	-
Engine oil pressure (EOP) switch	14	10	-
Engine support insulator bolts	48	35	-
Engine support insulator bracket bolt	90	66	-
Engine support insulator bracket nuts	55	41	-
Exhaust gas recirculation (EGR) tube	40	30	-
EGR tube nuts	40	30	-
EGR vacuum regulator stud bolt nut	6	-	53
Exhaust manifold nuts[a]	-	-	-
Exhaust manifold studs	12	9	-
Exhaust Y-pipe flange nuts	29	21	
Flexplate bolts	80	59	-
Front roll restrictor bolt	115	85	
Gearshift cable bracket bolts	23	17	
Generator B+ wiring harness nut	6		53
Generator B+ wire nut	8	-	71
Generator bolt	47	35	-
Generator studs	8	-	71

Generator stud nuts	47	35	-
Ground strap bolt	10	-	89
Ground wire bolt	10	-	89
Ground wire eyelet nut	25	18	-
Halfshaft support bracket bolts	48	35	-
Heated oxygen sensor (HO2S)	47	35	-
Ignition coil-on-plug bolts	6	-	53
Intermediate shaft bracket nuts	27	20	
Lateral support crossmember bolts	115	85	
LH accessory drive belt idler pulley bolt	47	35	-
LH transaxle support insulator through bolt	115	85	-
Lower ball joint pinch bolts and nuts	63	46	
Lower intake manifold bolts[a]	-	-	-
Oil level indicator tube stud bolt	10	-	89
Oil pan baffle nuts[a]	-	-	-
Oil pan bolts and studs	25	18	-
Oil pan drain plug	26	19	-
Oil pan-to-transaxle bolts	40	30	-
Oil pump bolts	10	-	89
Oil pump screen and pickup tube bolts and nut	10	-	89
Output shaft speed (OSS) sensor bolt	13	10	-
Power distribution box cable nuts	12	9	-
Power transfer unit (PTU) bolts	45	33	
PTU vent tube bolt	14	10	
Powertrain control module (PCM) wiring nut	8		71
Radio interference capacitor nut	6	-	53
Rear transaxle support insulator through bolt	103	76	-
RH accessory drive belt idler pulley and bracket bolts	25	18	-
RH and LH lower splash shield bolts	9	-	80
RH transaxle support insulator bracket nuts and bolt	80	59	-
RH radio ignition interference capacitor nut	6	-	53
RH transaxle support insulator through bolt	115	85	-
Speed control actuator nuts	9	-	80
Stabilizer link-to-strut nuts	63	46	
Tie-rod end nuts	55	41	
Timing chain guide bolts	25	18	-
Timing chain tensioner bolts	25	18	-
Torque converter-to-flexplate nuts	40	30	-
Transaxle cooler tube bracket bolt	13	10	
Transaxle cooler tube fitting nut	23	17	
Transaxle-to-engine bolts	47	35	-

Transaxle-to-engine stud and nuts	48	35	-
Transaxle-to-oil pan bracket bolt	25	18	-
Upper intake manifold bolts[a]	-	-	-
Upper radiator support bracket bolts	10	-	89
Valve cover bolts and stud bolts[a]	-	-	-
Wiring harness-to-valve cover stud bolt nut	6	-	53

[a] Refer to the procedure in this article.

DESCRIPTION AND OPERATION

ENGINE

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

- Dual overhead camshafts
- Four valves per cylinder
- Sequential multiport fuel injection (SFI)
- Composite lower intake manifold and composite upper intake manifold
- Aluminum cylinder heads
- Two-piece design aluminum cylinder block
- Electronic ignition system with 6 ignition coils

Identification

For quick identification refer to the safety certification decal.

- The decal is located on the LH front door lock face panel.
- An engine identification label is also attached to the engine.
- The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine displacement in liters or cubic inch displacement and model year.

Exhaust Emission Control System

Operation and required maintenance of the exhaust emission control devices used on this engine are covered in the **Introduction - Gasoline Engines** article.

Induction System

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

- are mounted between the fuel rail and the intake manifold.

- meter fuel into the air intake stream in accordance with engine demand.
- are positioned so that their tips direct fuel just ahead of the engine intake valves.

Valve Train

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

Positive Crankcase Ventilation System

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

Lubrication System

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

Oil Pump

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

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

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

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

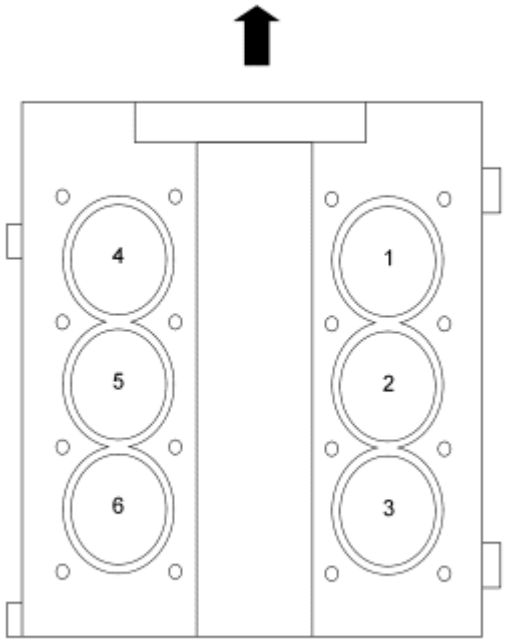
Cooling System

The engine cooling system includes the following:

- Radiator
- Dual electric fan assemblies

- Degas bottle (aids in maintaining the correct volume of engine coolant)
- Coolant thermostat
- Coolant hoses

Engine Cylinder Identification



N0069904

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

UPPER INTAKE MANIFOLD

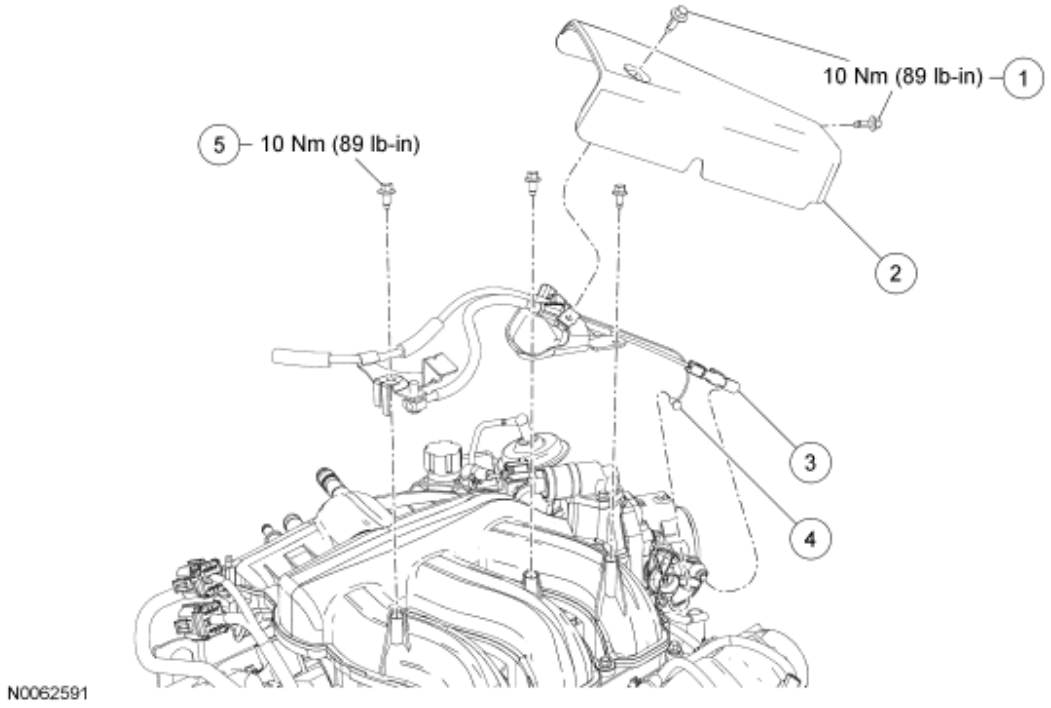


Fig. 2: Upper Intake Manifold Components With Torque Specifications (1 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W702251	Accelerator cable snow shield bolts (2 required)
2	9E776	Accelerator cable snow shield
3	9A825	Speed control cable to throttle body
4	9A758	Accelerator cable to throttle body
5	-	Accelerator/speed control cable bracket bolt (3 required)

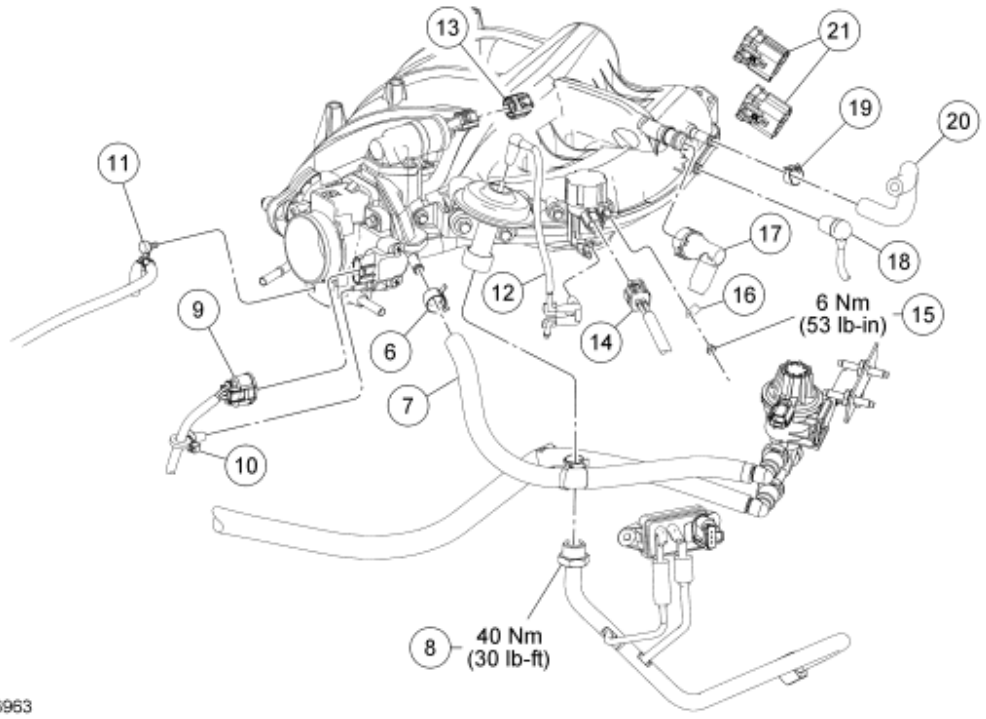


Fig. 3: Upper Intake Manifold Components With Torque Specifications (2 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	W52593	Evaporative emissions (EVAP) tube clamp
7	9D289	EVAP tube
8	-	Exhaust gas recirculation (EGR) tube fitting (part of 9D477)
9	14A464	Throttle position (TP) sensor electrical connector (part of 9H589)
10	W700497	Wiring retainer (part of 9H589)
11	-	Transaxle vent tube pin-type retainer (part of 7034)
12	-	Vacuum harness tube (part of 9E498)
13	14A464	Idle air control (IAC) valve electrical connector (part of 9H589)
14	14A464	EGR vacuum regulator electrical connector (part of 9H589)
15	-	EGR vacuum regulator stud bolt nut
16	-	Wiring retainer (part of 9H589)
17	-	Positive crankcase ventilation (PCV) tube
18	-	Vacuum harness tube fitting (part of 9E498)

19	392984	Brake booster vacuum hose clamp
20	2C053	Brake booster vacuum hose
21	14A464	Engine control wiring harness electrical connectors (part of 9H589)

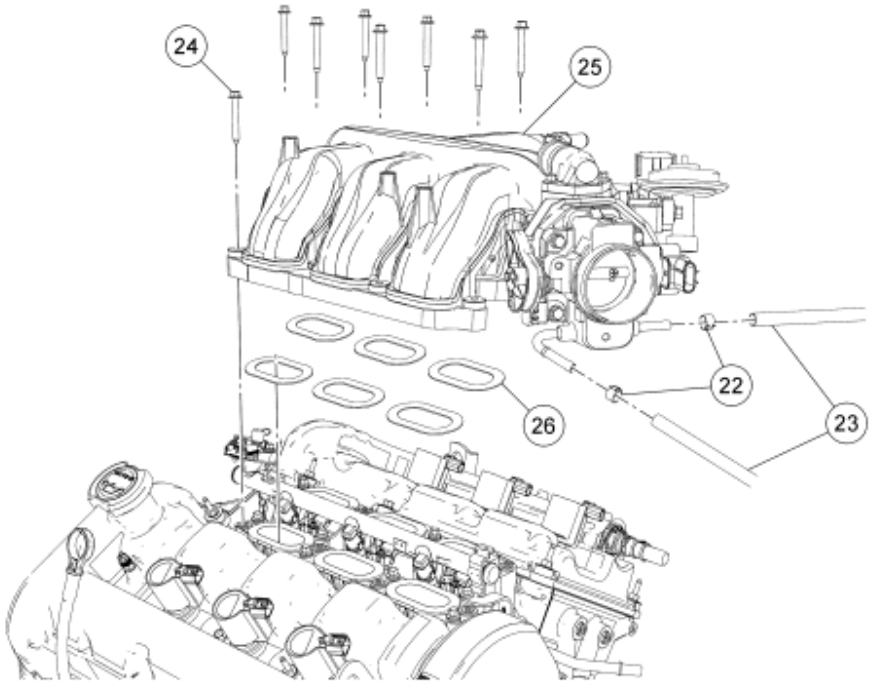


Fig. 4: Upper Intake Manifold Components (3 Of 3)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
22	-	Throttle body coolant hose clamps (2 required)
23	-	Throttle body coolant hoses (2 required)
24	9Y450	Upper intake manifold bolt (8 required)
25	9424	Upper intake manifold
26	-	Upper intake manifold gasket (6 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 air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
3. Remove the 2 bolts and the accelerator cable snow shield.

4. Detach the speed control and accelerator cables from the throttle body.
5. Remove the 3 accelerator/speed control cable bracket bolts.
    - Position the cables and brackets aside.
6. Remove the EGR tube fitting from the EGR valve.
7. Detach the transaxle vent tube pin-type retainer from the throttle body.
8. Disconnect the throttle position (TP) sensor electrical connector and detach the wiring retainer.
9. Disconnect the vacuum harness tube fittings from the EGR valve and the EGR vacuum regulator.
10. Disconnect the evaporative emissions (EVAP) tube from the upper intake manifold.
11. Disconnect the idle air control (IAC) valve electrical connector.
12. Disconnect the EGR vacuum regulator electrical connector.
13. Remove the nut from the EGR vacuum regulator stud bolt and detach the wiring retainer.
14. Disconnect the PCV, brake booster and vacuum harness tubes from the upper intake manifold.
15. Detach the 2 main engine control wiring harness electrical connectors from the upper intake manifold.
16. Disconnect and plug the 2 throttle body coolant hoses.
17. Remove the 8 bolts and the upper intake manifold.
    - Remove and discard the gaskets.

INSTALLATION

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

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

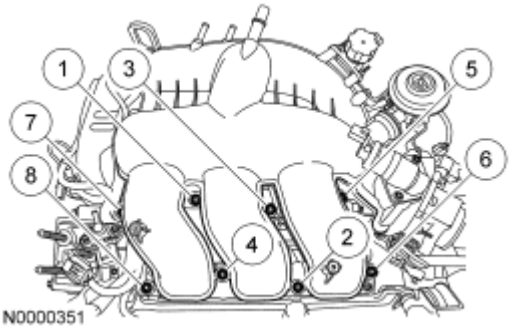


Fig. 5: Identifying Tightening Sequence Of Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

2. Connect the 2 throttle body coolant hoses.
3. Attach the 2 main engine control wiring harness electrical connectors to the upper intake manifold.
4. Connect the PCV, brake booster and vacuum harness tubes to the upper intake manifold.
5. Attach the wiring retainer to the EGR vacuum regulator stud bolt and install the nut.
    - Tighten to 6 Nm (53 lb-in).

6. Connect the EGR vacuum regulator electrical connector.
7. Connect the IAC valve electrical connector and wiring harness retainer.
8. Connect the EVAP tube to the upper intake manifold.
9. Connect the vacuum harness tube fittings to the EGR valve and the EGR vacuum regulator.
10. Connect the TP sensor electrical connector and attach the wiring retainer.
11. Attach the transaxle vent tube pin-type retainer to the throttle body.
12. Install the EGR tube fitting to the EGR valve.
    - Tighten to 40 Nm (30 lb-ft).
13. Position the accelerator/speed control cables and brackets and install the 3 bolts.
    - Tighten to 10 Nm (89 lb-in).
14. Attach the speed control and accelerator cables to the throttle body.
15. Install the accelerator cable snow shield and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
16. Install the air cleaner outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.

LOWER INTAKE MANIFOLD

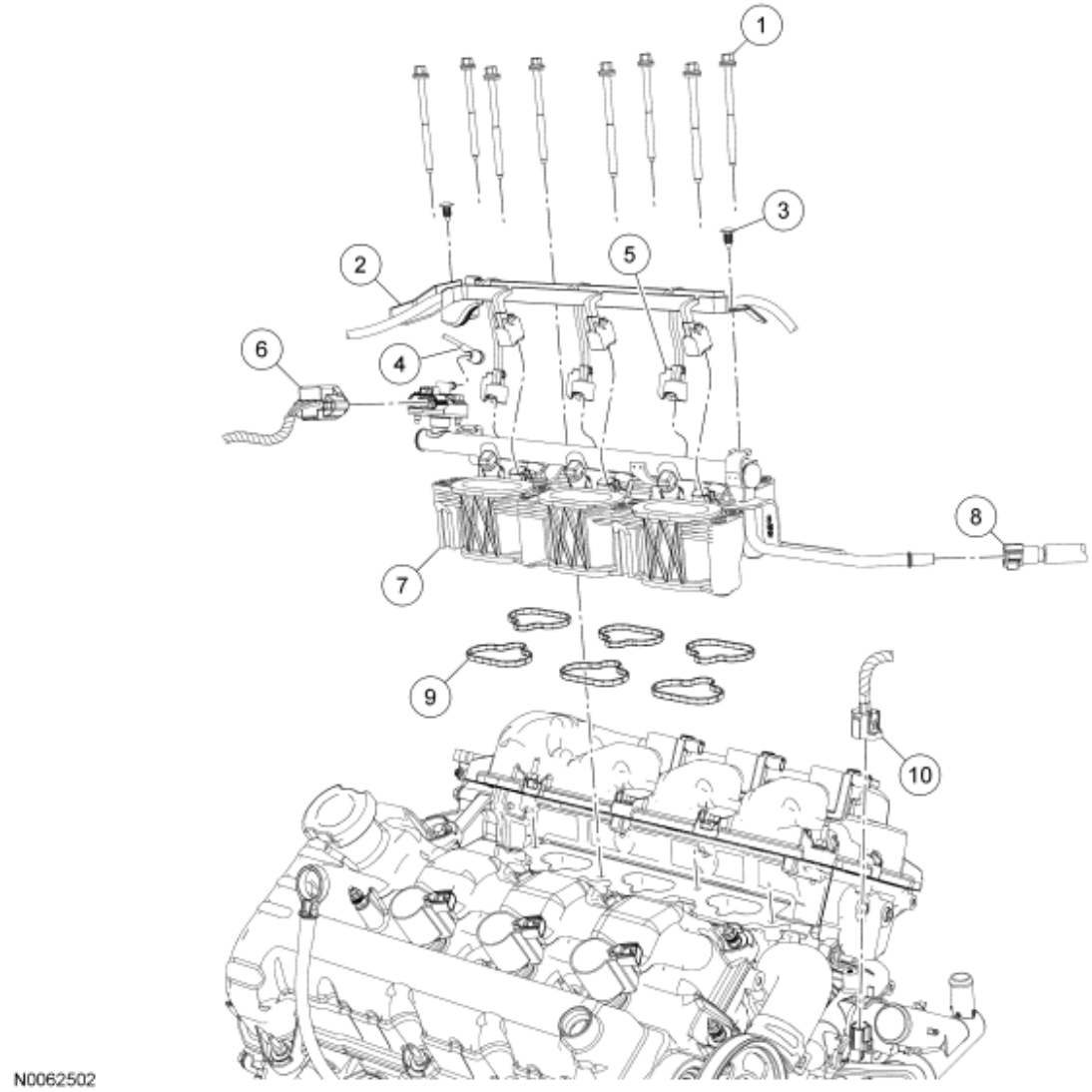


Fig. 6: Lower Intake Manifold Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W708187	Lower intake manifold bolt (8 required)
2	-	Wire shield (part of 9H589)
3	-	Wire shield pin-type retainer (2 required) (part of 9H589)
4	9E499	Fuel rail pressure and temperature sensor vacuum tube fitting
5	14A464	Fuel injector electrical connector (6 required) (part of 9H589)
6	14A464	Fuel rail pressure and temperature sensor electrical connector (part of 9H589)
7	9424	Lower intake manifold

8	9288	Fuel tube
9	9439	Lower intake manifold gasket (6 required)
10	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 9H589)

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. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
3. Remove the upper intake manifold. For additional information, refer to **Upper Intake Manifold**.
4. Disconnect the engine coolant temperature (ECT) sensor electrical connector.
5. Disconnect the fuel supply tube quick connect coupling at the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
6. Disconnect the fuel rail pressure and temperature sensor electrical connector and vacuum tube.
7. Disconnect the 6 fuel injector electrical connectors and the 2 wire shield pin-type retainers.
8. Remove the 8 lower intake manifold bolts and the lower intake manifold.
   - Remove and discard the gaskets.

INSTALLATION

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

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

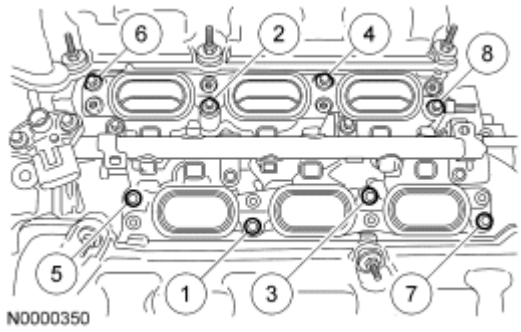


Fig. 7: Identifying Tightening Sequence Of Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

2. Connect the 6 fuel injector electrical connectors and the 2 wire shield pin-type retainers.
3. Connect the fuel rail pressure and temperature sensor electrical connector and vacuum tube.
4. Connect the fuel supply tube quick connect coupling at the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
5. Connect the ECT sensor electrical connector.
6. Install the upper intake manifold. For additional information, refer to **Upper Intake Manifold**.
7. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

VALVE COVER - LH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A6

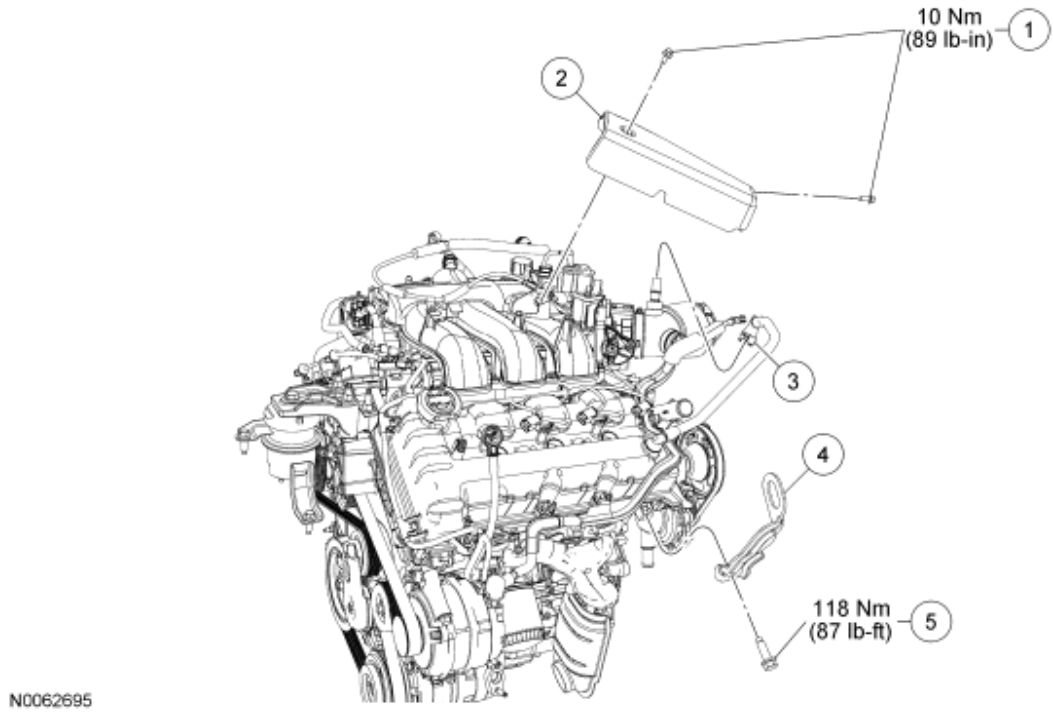


Fig. 8: Valve Cover Components - LH With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W702251	Accelerator cable snow shield bolts (2 required)
2	9E766	Accelerator cable snow shield
3	6853	Crankcase ventilation tube
4	17A084	Engine lift bracket
5	W701627	Engine lift bracket bolt

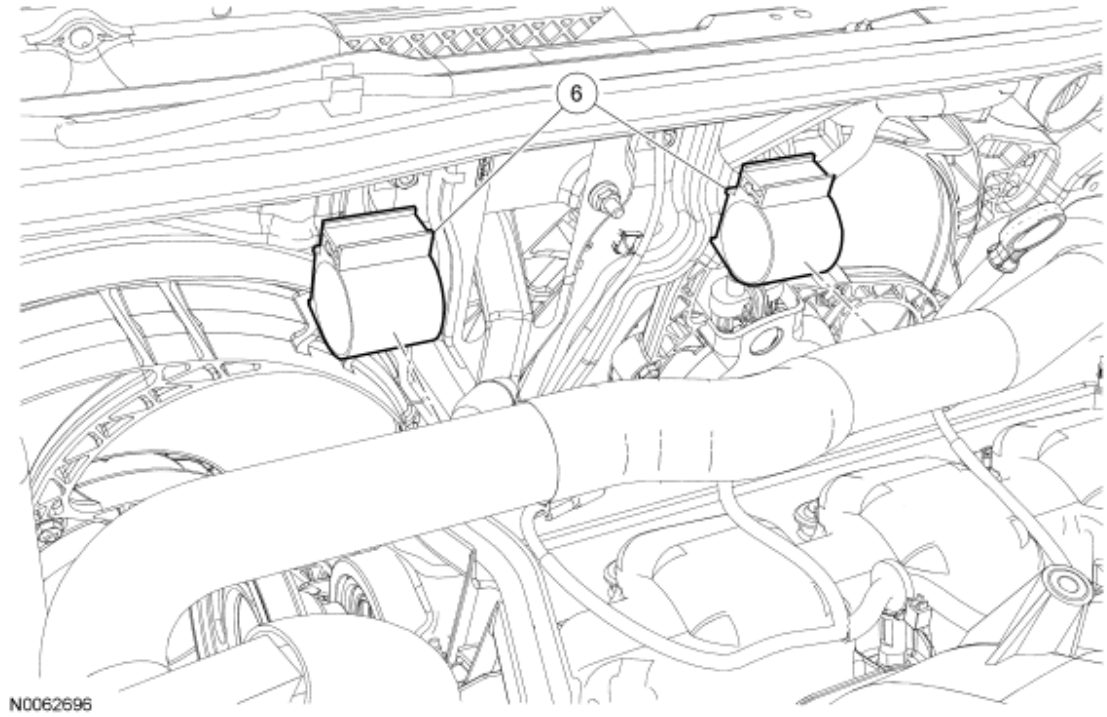


Fig. 9: Identifying Retainers
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
6	-	Upper radiator hose retainers (2 required)

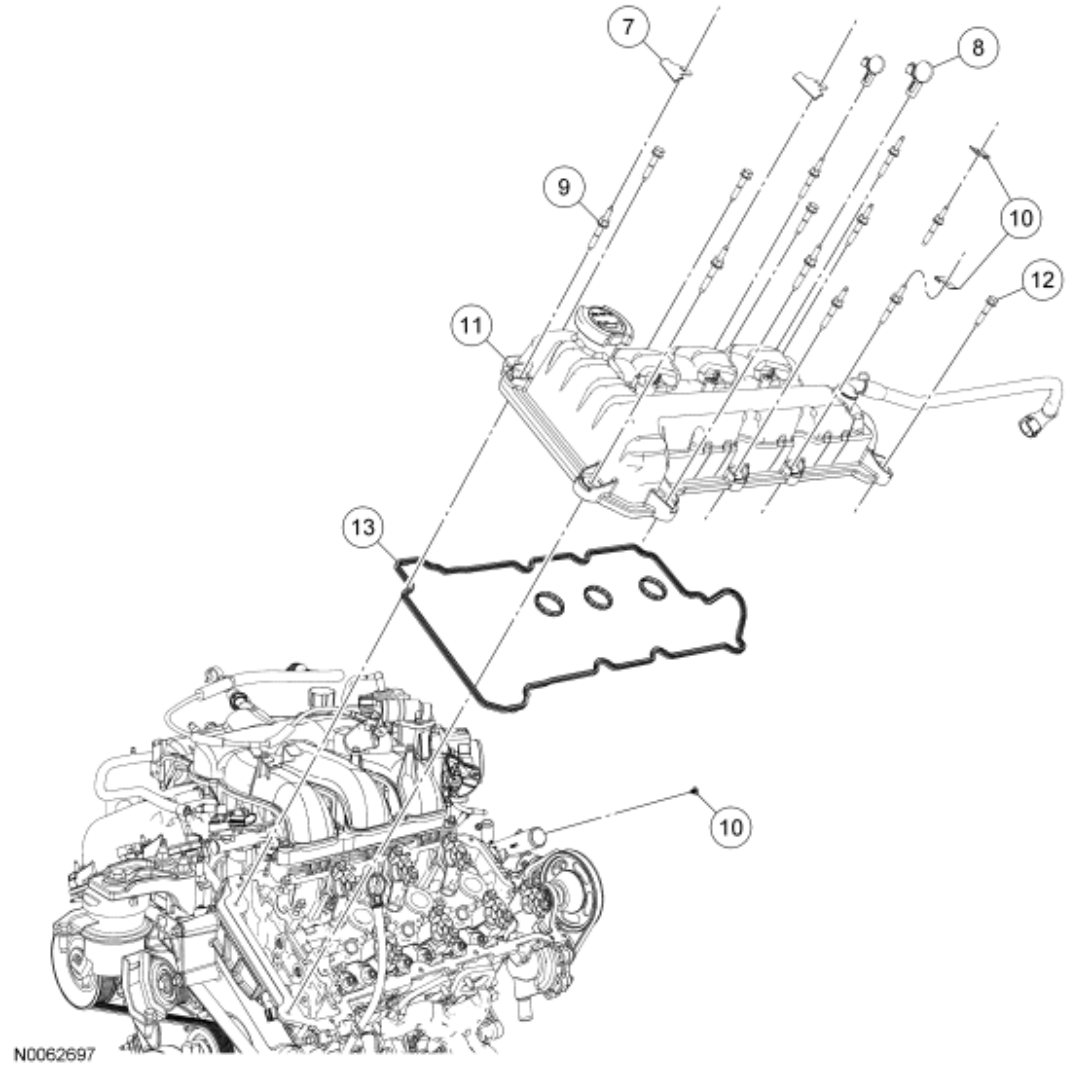


Fig. 10: Valve Cover Components
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
7	13A506	Wiring retainer (2 required) (part of 9H589)
8	W700497	Wiring retainer (2 required) (part of 9H589)
9	6C519	Valve cover stud bolt (9 required)
10	14A099	B+ cable wiring retainers (3 required)
11	6A505	Valve cover
12	6C519	Valve cover bolt (4 required)
13	6A559	Valve cover gasket

REMOVAL

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

1. Remove the LH ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.
2. If equipped, remove the bolt and the engine lift bracket.
3. Remove the 2 bolts and the accelerator cable snow shield.

CAUTION: Do not disconnect the crankcase ventilation tube from the valve cover or damage to the ventilation tube may occur.

4. Disconnect the crankcase ventilation tube from the air cleaner outlet pipe.
5. Detach the upper radiator hose from the 2 retainers on the cooling fan shroud and position the hose aside.
6. Detach the 4 wiring retainers from the valve cover stud bolts.
7. Detach the 3 wiring retainers from the valve cover stud bolts and position the B+ cable aside.

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

8. Remove the 5 bolts, 8 stud bolts and the valve cover.
   - Remove and discard the gasket.

INSTALLATION

1. Clean the valve cover, cylinder head and front cover sealing surfaces with metal surface prep and install a new valve cover gasket.

NOTE: The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.

2. Apply a 5 mm (0.19 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.
3. Position the valve cover and install the bolts and stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

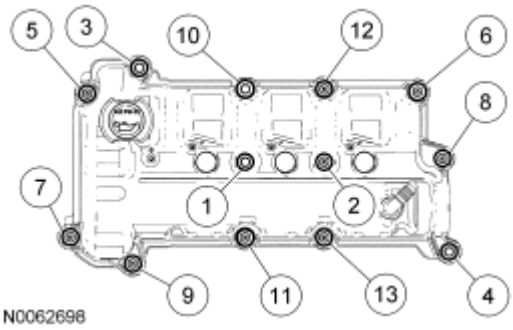


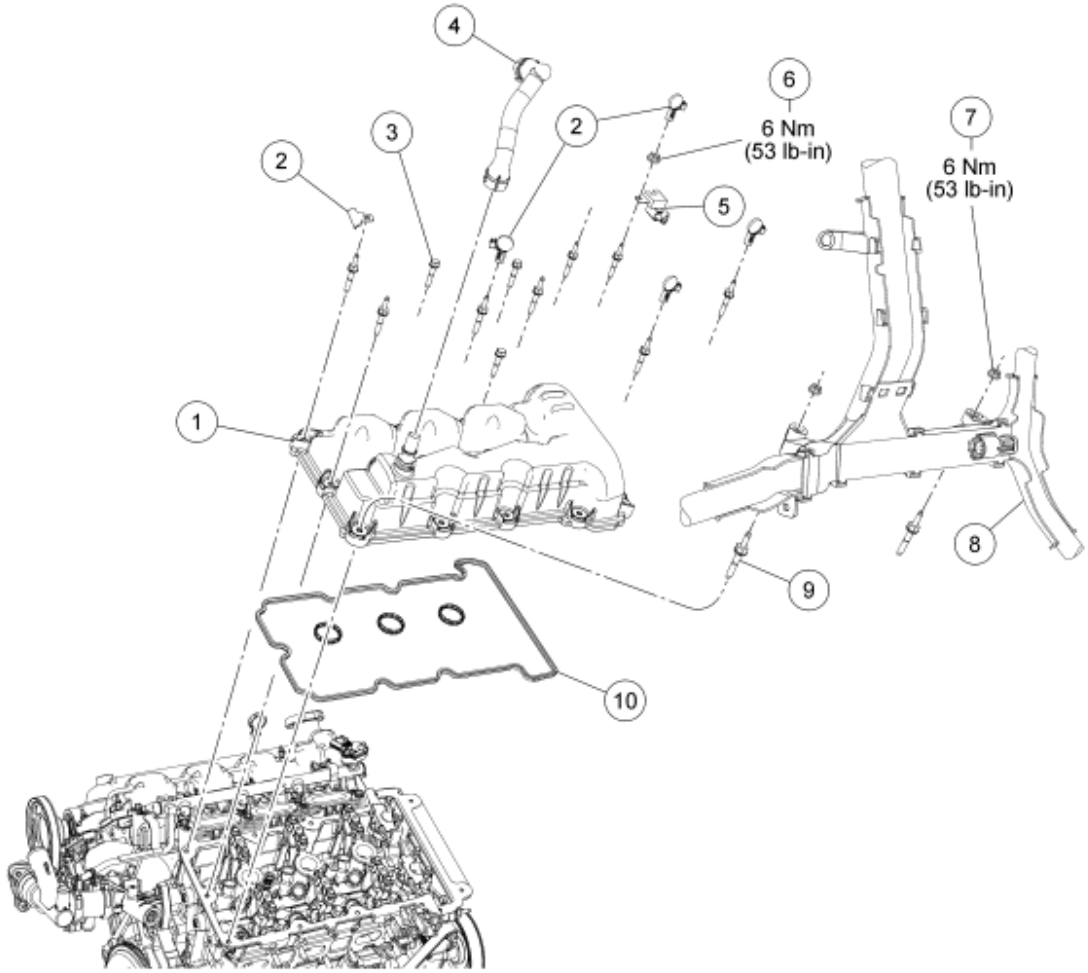
Fig. 11: Identifying Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Attach the 3 wiring (B+ cable) retainers onto the valve cover stud bolts.
5. Attach the 4 wiring retainers to the valve cover stud bolts.
6. Attach the upper radiator hose to the 2 retainers on the cooling fan shroud.
7. Attach the crankcase ventilation tube to the air cleaner outlet pipe.
8. Install the accelerator cable snow shield and the 2 bolts.
    - Tighten to 10 Nm (89 lb-in).
9. If equipped, install the engine lift bracket and the bolt.
    - Tighten to 118 Nm (87 lb-ft).
10. Install the LH ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.

VALVE COVER - RH

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A6



N0062725

Fig. 12: Valve Cover Components - RH With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6582	Valve cover
2	W700497	Wiring retainers (5 required)
3	6C519	Valve cover bolt (3 required)
4	6K817	Positive crankcase ventilation (PCV) tube
5	18801	Radio ignition interference capacitor electrical connector
6	W520411	Radio ignition interference capacitor nut
7	W520411	Engine control wiring harness shield nut (2 required)

8	12B637	Engine control wiring harness shield
9	6C519	Valve cover stud bolt (10 required)
10	6584	Valve cover gasket

REMOVAL

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

1. Remove the RH ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.
2. Remove the PCV tube.
3. Disconnect the radio ignition interference capacitor electrical connector and detach the 5 wiring retainers from the stud bolts.
4. Remove the nut and the radio ignition interference capacitor.
5. Remove the 2 nuts and position the engine control wiring harness shield aside.
6. Remove the 3 bolts, 10 stud bolts and the valve cover.
   - Remove and discard the gasket.

INSTALLATION

1. Clean the valve cover, cylinder head and front cover sealing surfaces with metal surface prep and install a new valve cover gasket.

NOTE: The valve cover must be installed and the bolts and stud bolts tightened within 4 minutes of sealant application.

2. Apply a 5 mm (0.19 in) dot of silicone gasket sealant to the front cover-to-cylinder head joints.
3. Position the valve cover and install the 3 bolts and 10 stud bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

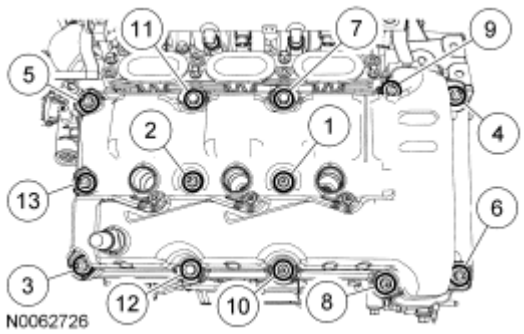


Fig. 13: Identifying Tightening Sequence

Courtesy of FORD MOTOR CO.

4. Position the engine control wiring harness shield and install the 2 nuts.
   - Tighten to 6 Nm (53 lb-in).
5. Install the radio ignition interference capacitor and the nut.
   - Tighten to 6 Nm (53 lb-in).
6. Attach the wiring retainers to the stud bolts and connect the radio ignition interference capacitor electrical connector.
7. Install the PCV tube.
8. Install the RH ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.

LOWER END COMPONENTS - EXPLODED VIEW

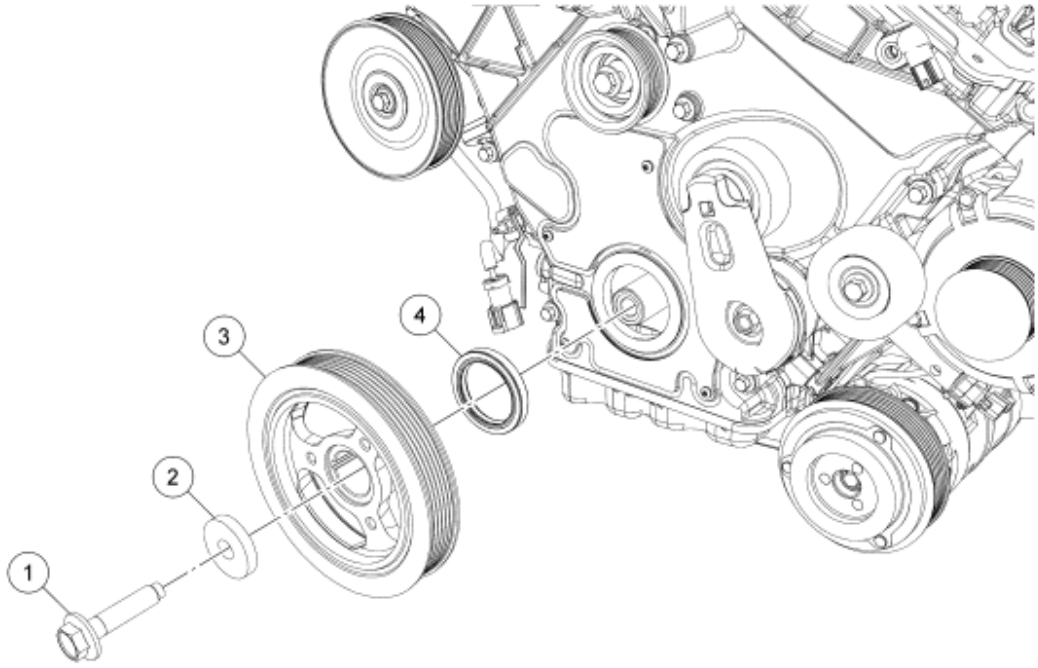


Fig. 14: Crankshaft Pulley and Front Seal
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701512	Crankshaft pulley bolt
2	W701511	Washer
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal

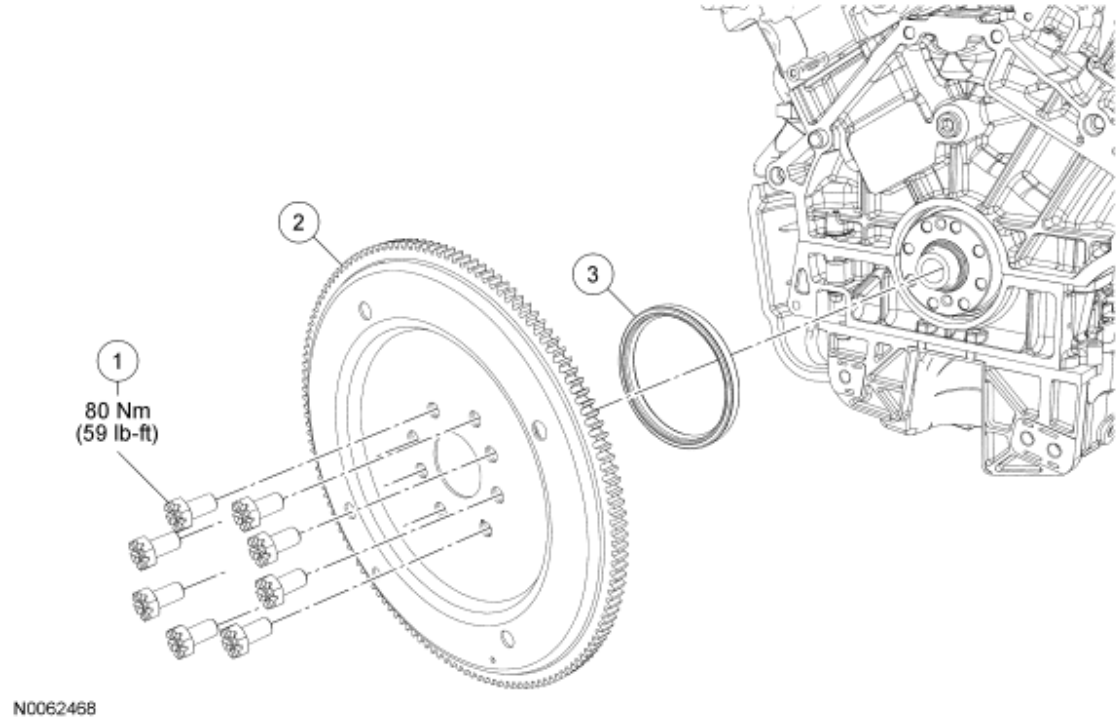


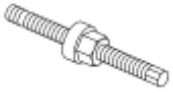
Fig. 15: Flexplate and Rear Seal With Torque Specification
Courtesy of FORD MOTOR CO.

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

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

CRANKSHAFT PULLEY

Special Tools

Illustration	Tool Name	Tool Number
 ST2296-A	Installer, Front Cover Oil Seal	303-335 (T88T-7601-A)
 ST1287-A	Replacer, Crankshaft Damper	303-102 (T74P-6316-B)

 ST1286-A	Remover, Crankshaft Vibration Damper	303-009 (T58P-6316-D)
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

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

REMOVAL

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 3.0L (4V)** article.
3. Use the special tool to hold the crankshaft pulley and remove the crankshaft pulley bolt.

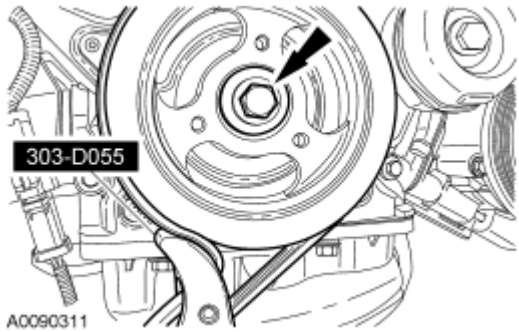


Fig. 16: Identifying Special Tool (303-D055) And Crankshaft Pulley Bolts
Courtesy of FORD MOTOR CO.

4. Using the special tool, remove the crankshaft pulley.

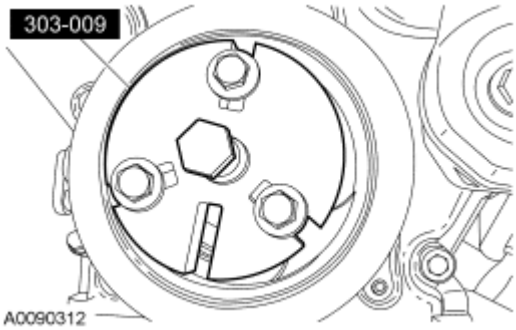


Fig. 17: Removing Crankshaft Pulley Using Special Tool (303-009)
Courtesy of FORD MOTOR CO.

INSTALLATION

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

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

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

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

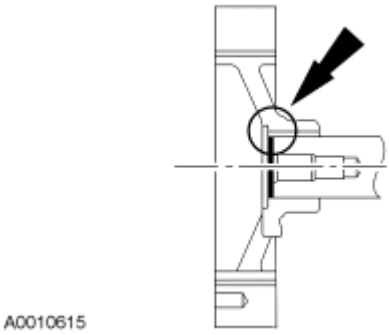


Fig. 18: Applying Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

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

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

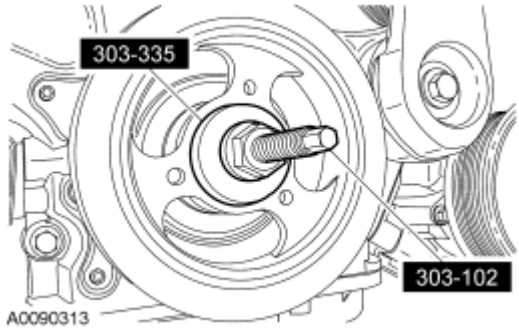


Fig. 19: Installing Crankshaft Pulley Using Special Tools (303-102, 303-335)
Courtesy of FORD MOTOR CO.

4. Install the bolt and washer. Using the special tool to hold the crankshaft pulley, tighten the bolt in 4 stages:
   - Stage 1: Tighten to 120 Nm (89 lb-ft).
   - Stage 2: Loosen one full turn.
   - Stage 3: Tighten to 50 Nm (37 lb-ft).
   - Stage 4: Tighten an additional 90 degrees.

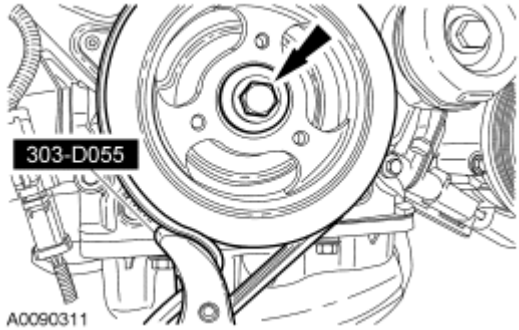
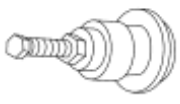


Fig. 20: Identifying Special Tool (303-D055) And Crankshaft Pulley Bolts
Courtesy of FORD MOTOR CO.

5. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 3.0L (4V)** article.

CRANKSHAFT FRONT SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST132B-A	Installer, Front Cover Seal	303-335 (T88T-6701-A)

 ST1287-A	Replacer, Crankshaft Damper	303-102 (T74P-6316-B)
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)

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. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.
3. Using the special tool, remove and discard the crankshaft front seal.

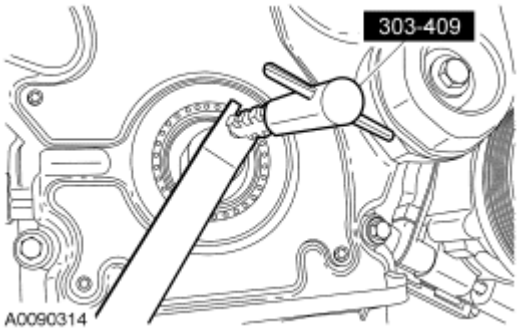


Fig. 21: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Clean all sealing surfaces with metal surface prep.

1. Apply clean engine oil to the seal lip and seal bore before installing the seal.
2. Using the special tools, install a new crankshaft front seal.

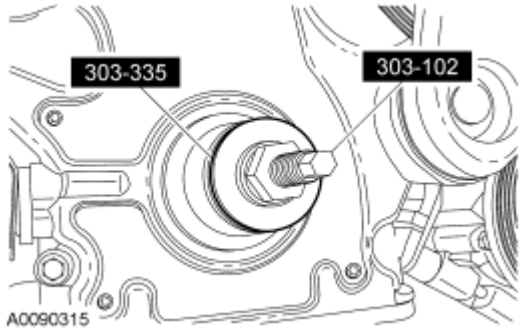


Fig. 22: Installing Crankshaft Seal Using Special Tools (303-335 And 303-102)
Courtesy of FORD MOTOR CO.

3. Install the crankshaft pulley. For additional information, refer to **Crankshaft Pulley**.

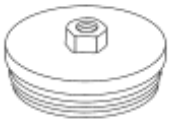
FLEXPLATE

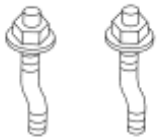
REMOVAL AND INSTALLATION

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the transmission. For additional information, refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - CD4E** article.
3. Remove the bolts and the flexplate.
   - To install, tighten to 80 Nm (59 lb-ft).
4. To install, reverse the removal procedure.

CRANKSHAFT REAR SEAL

Special Tools

Illustration	Tool Name	Tool Number
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
 ST1382-A	Remover, Crankshaft Rear Seal	303-519 (T95P-6701-EH)

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

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. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the flexplate. For additional information, refer to **Flexplate**.
3. Using the special tools, remove and discard the crankshaft rear oil seal.

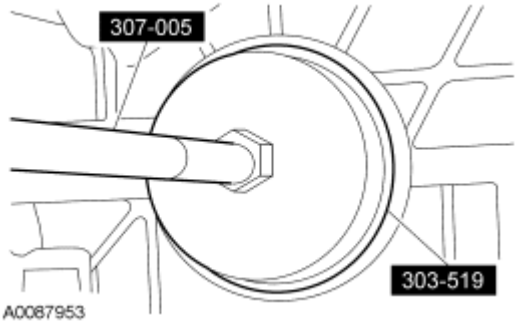


Fig. 23: Identifying Special Tools (307-005 And 303-519)
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Clean all sealing surfaces with metal surface prep.

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

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

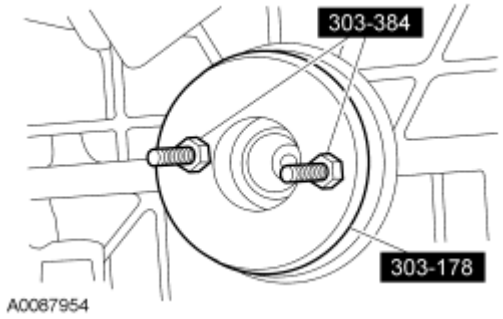


Fig. 24: Identifying Special Tools (303-384 And 303-178)
Courtesy of FORD MOTOR CO.

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

ENGINE FRONT COVER

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-A6

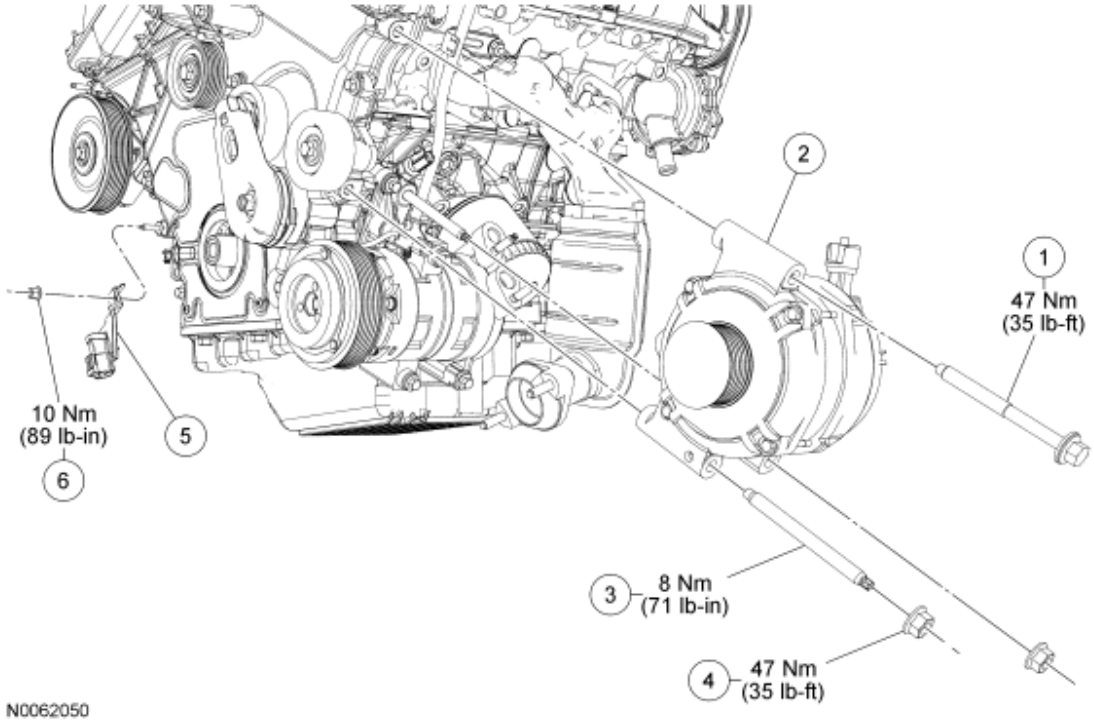


Fig. 25: Engine Front Cover Components With Torque Specifications (1 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W709986	Generator bolt
2	10300	Generator
3	W710416	Generator stud
4	W520414	Generator stud nut (2 required)
5	15A024	Catalyst monitor sensor electrical connector bracket
6	W701542	Catalyst monitor sensor electrical connector bracket nut

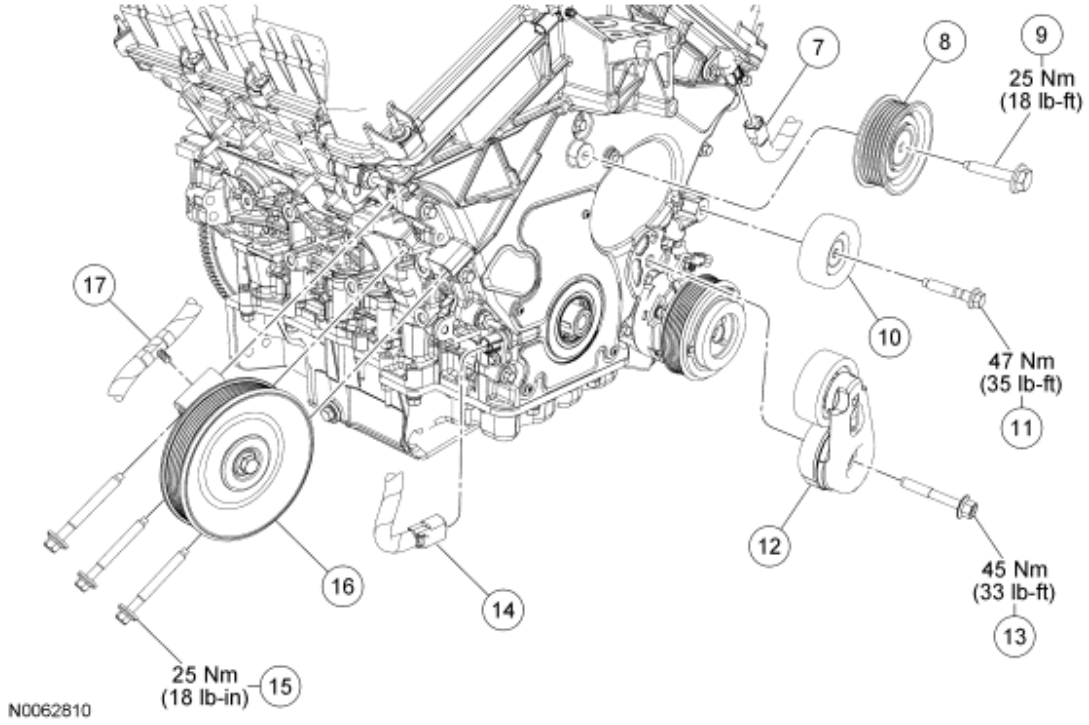


Fig. 26: Engine Front Cover Components With Torque Specifications (2 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
7	14A464	Crankshaft position (CKP) sensor electrical connector (part of 9H589)
8	6C348	Center accessory drive belt idler pulley
9	-	Center accessory drive belt idler pulley bolt (part of 6C348)
10	19A216	LH accessory drive belt idler pulley
11	-	LH accessory drive belt idler pulley bolt (part of 19A216)
12	6B209	Accessory drive belt tensioner
13	W701625	Accessory drive belt tensioner bolt
14	14A464	Camshaft position (CMP) sensor electrical connector (part of 9H589)
15	W706902	RH accessory drive belt idler pulley and bracket bolt (3 required)
16	3F671	RH accessory drive belt idler pulley and bracket
17	9H589	Wiring harness retainer

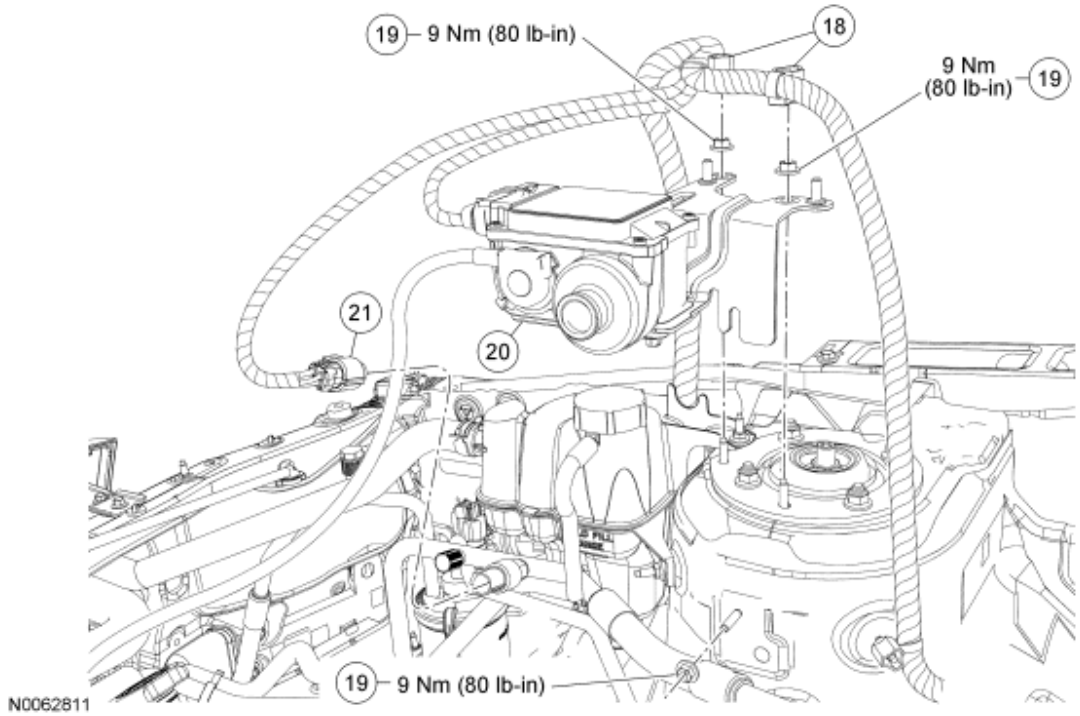


Fig. 27: Engine Front Cover Components With Torque Specifications (3 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
18	-	Wire harness retainers (2 required) (part of 14290)
19	W707137	Speed control actuator nuts (3 required)
20	9C735	Speed control actuator
21	-	A/C pressure switch electrical connector (part of 14290)

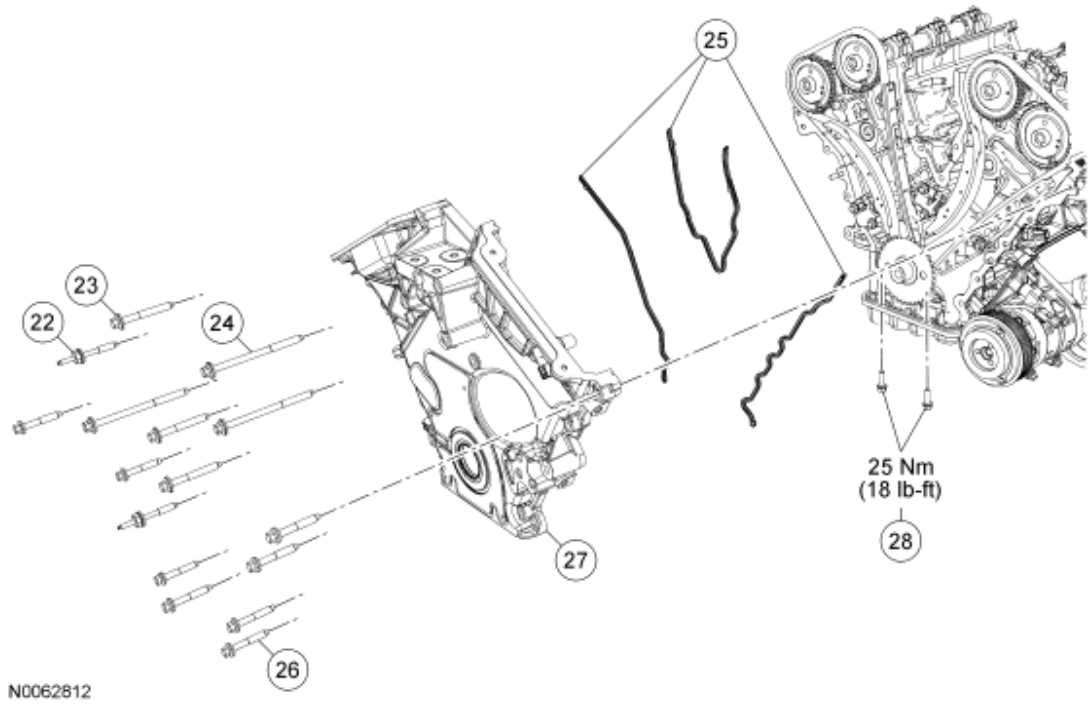


Fig. 28: Engine Front Cover Components With Torque Specification (4 Of 4)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
22	W710030	Engine front cover stud bolt (2 required)
23	W708222	Engine front cover bolt (3 required)
24	W708221	Engine front cover bolt (3 required)
25	6D081	Engine front cover gaskets (3 required)
26	W701525	Engine front cover bolt (8 required)
27	6019	Engine front cover
28	W709678	Oil pan-to-front cover bolts (2 required)

REMOVAL

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

4. Remove the crankshaft front seal. For additional information, refer to **Lower End Components - Exploded View** and **Crankshaft Front Seal**.
5. Remove the generator bolt and the 2 nuts.

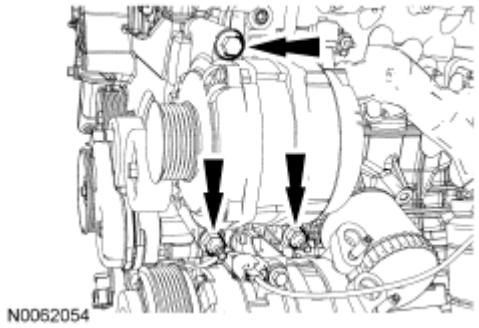


Fig. 29: Identifying Bolt And Nuts
Courtesy of FORD MOTOR CO.

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

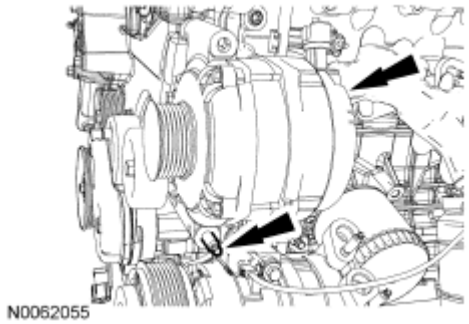


Fig. 30: Identifying Stud And Generator
Courtesy of FORD MOTOR CO.

7. Remove the bolt and the accessory drive belt tensioner.
8. Remove the bolt and the LH accessory drive belt idler pulley.
9. Remove the bolt and the center accessory drive belt idler pulley.
10. Remove the 3 RH accessory drive belt idler pulley and bracket bolts.
    - Detach the wiring harness retainer and remove the idler pulley assembly.

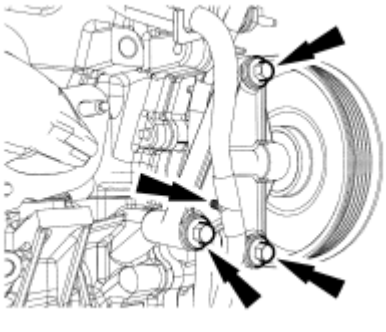


Fig. 31: Identifying Bolts
Courtesy of FORD MOTOR CO.

11. Detach the wiring harness retainer, remove the nut and the catalyst monitor sensor electrical connector bracket.
12. Disconnect the crankshaft position (CKP) sensor electrical connector.
13. Disconnect the camshaft position (CMP) sensor electrical connector.
14. Remove the LH and RH valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.
15. Remove the engine support insulator. For additional information, refer to **Engine Support Insulators**.
16. Disconnect the A/C pressure switch electrical connector.
17. Detach the 2 wire harness retainers from the speed control actuator mounting studs.
18. Remove the 3 nuts and position the speed control actuator aside.
19. Remove the 2 oil pan-to-front cover bolts.
20. Remove the 14 bolts, 2 stud bolts and the engine front cover.
    - Remove and 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.

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

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

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

2. Apply a 6 mm (0.23 in) diameter dot of silicone gasket and sealer to the cylinder block, lower cylinder

block, cylinder head and oil pan mating surfaces.

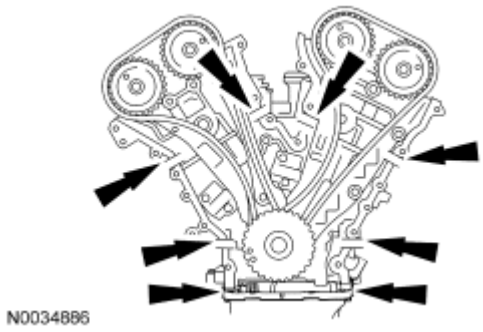


Fig. 32: Identifying Area For Applying Sealant
Courtesy of FORD MOTOR CO.

3. Position the engine front cover and install the bolts. Tighten in the sequence shown to 25 Nm (18 lb-ft).

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

6	W701525	Head Pilot, M8 x 1.25 x 47.5
7	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
8	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
9	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
10	W708221	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 115
11	W708221	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 115
12	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5
13	W710030	Stud, Hex Flange Head Pilot, M6 x 1 x 20 / M8 x 1.25 x 47.5
14	W708222	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 64
		Bolt, Hex Flange

15	W708221	Head Pilot, M8 x 1.25 x 115
16	W701525	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 47.5

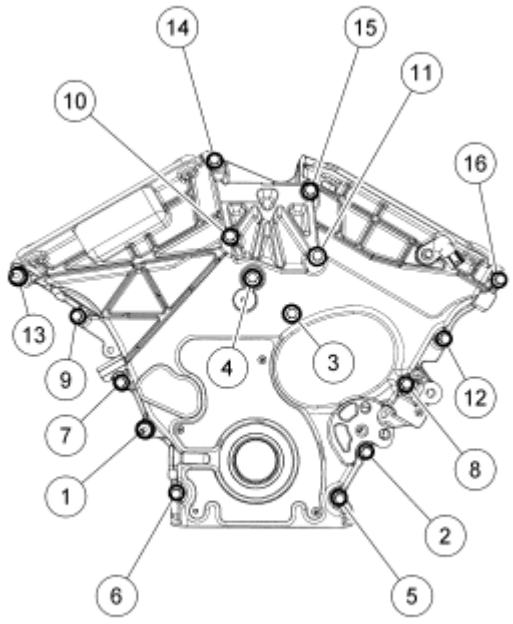


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Fig. 33: Identifying Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Install the 2 oil pan-to-front cover bolts.
   - Tighten to 25 Nm (18 lb-ft).
5. Remove the oil pan drain plug and drain the engine oil.
   - Install the plug and tighten to 26 Nm (19 lb-ft).
6. Install the speed control actuator and 3 nuts.
   - Tighten to 9 Nm (80 lb-in).
7. Attach the 2 wire harness retainers to the speed control actuator mounting studs.
8. Connect the A/C pressure switch electrical connector.
9. Install the engine support insulator. For additional information, refer to **Engine Support Insulators**.
10. Install the LH and RH valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.
11. Connect the CMP electrical connector.

12. Connect the CKP electrical connector.
13. Install the catalyst monitor sensor electrical connector bracket and the nut.
    - Tighten to 10 Nm (89 lb-in).
    - Attach the wiring harness retainer.
14. Position the RH accessory drive belt idler pulley and bracket and attach the wiring harness retainer.
    - Install the 3 bolts and tighten to 25 Nm (18 lb-ft).

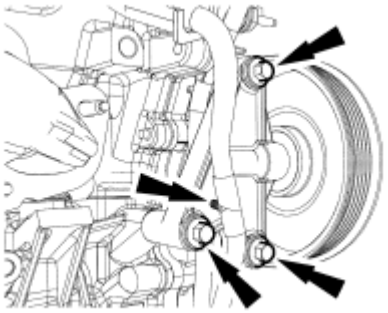


Fig. 34: Identifying Bolts And Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

15. Install the center accessory drive belt idler pulley.
    - Tighten to 25 Nm (18 lb-ft).
16. Install the LH accessory drive belt idler pulley.
    - Tighten to 47 Nm (35 lb-ft).
17. Install the accessory drive belt tensioner and the bolt.
    - Tighten to 45 Nm (33 lb-ft).
18. Position the generator and install the stud.
    - Tighten to 8 Nm (71 lb-in).
19. Install the generator bolt and 2 nuts.
    - Tighten to 47 Nm (35 lb-ft).
20. Install the crankshaft front seal. For additional information, refer to **Lower End Components - Exploded View** and **Crankshaft Front Seal**.
21. Fill the engine with clean engine oil.
22. Connect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.

TIMING DRIVE COMPONENTS

REMOVAL

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

may cause engine failure.

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

1. Remove the engine front cover. For additional information, refer to **Engine Front Cover**.

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

2. Remove the ignition pulse wheel.

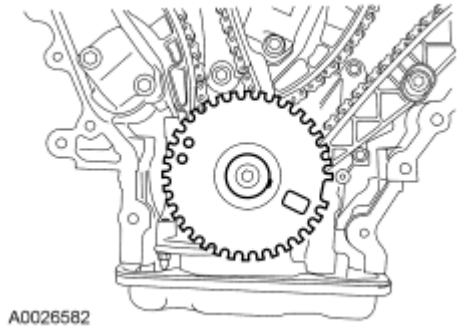


Fig. 35: Identifying Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

3. Install the crankshaft pulley bolt.

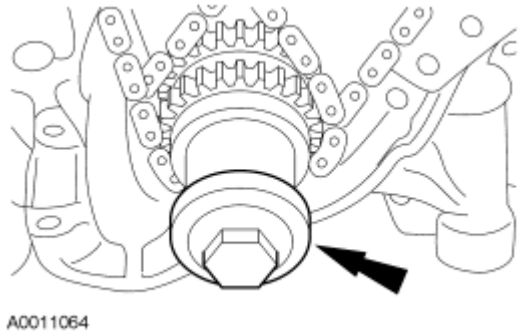


Fig. 36: Identifying Damper Bolt
Courtesy of FORD MOTOR CO.

4. Remove the LH and RH spark plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.
5. Rotate the crankshaft clockwise to position the crankshaft keyway in the 11 o'clock position and position the camshafts in the correct position. This will position the No. 1 cylinder at top dead center (TDC).
    - Verify that the camshafts are correctly located. If not, rotate the crankshaft one additional turn and

recheck.

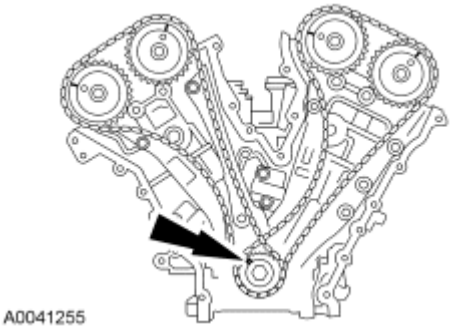


Fig. 37: Identifying Crankshaft Keyway In 11 O'Clock Position
Courtesy of FORD MOTOR CO.

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

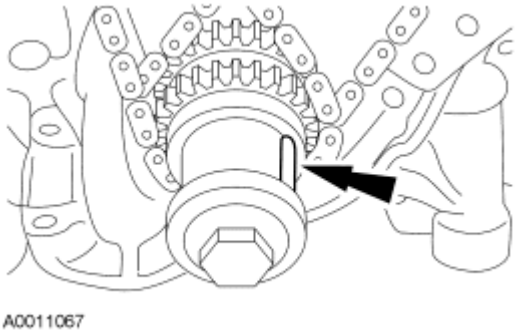


Fig. 38: Identifying Crankshaft Keyway
Courtesy of FORD MOTOR CO.

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

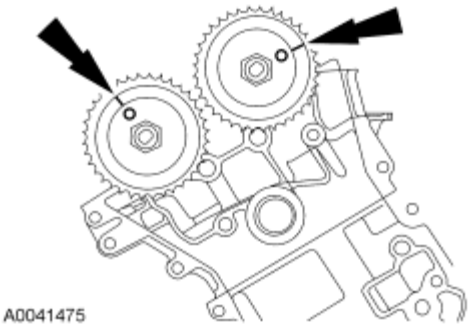


Fig. 39: Locating Camshafts Align Marks
Courtesy of FORD MOTOR CO.

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

2. Remove the tensioner.
3. Remove the tensioner arm.

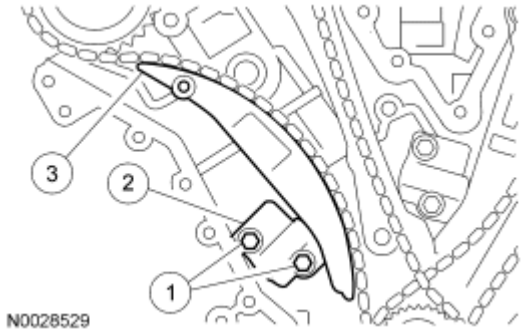


Fig. 40: Identifying RH Timing Chain Tensioner Arm & Bolts
Courtesy of FORD MOTOR CO.

9. Remove the bolts, RH timing chain guide and the timing chain.

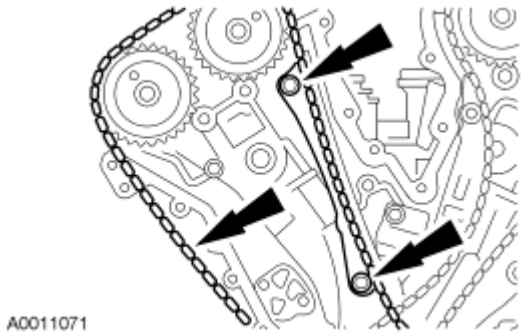


Fig. 41: Locating Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

10. Rotate the crankcase clockwise 600 degrees (1-2/3 turns) to position the crankcase keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

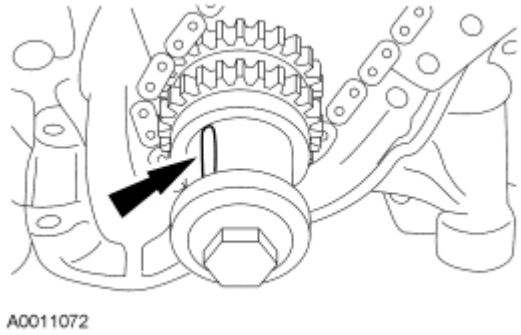


Fig. 42: Positioning Crankcase Key Way In 11 O'Clock Position
Courtesy of FORD MOTOR CO.

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

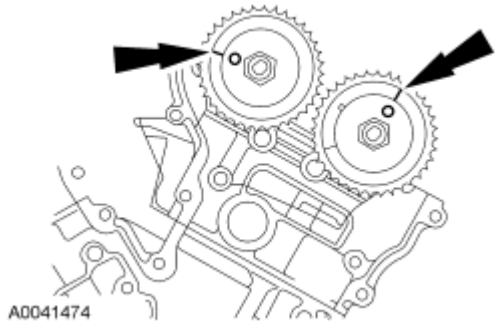


Fig. 43: Locating Camshafts Aligning Marks
Courtesy of FORD MOTOR CO.

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

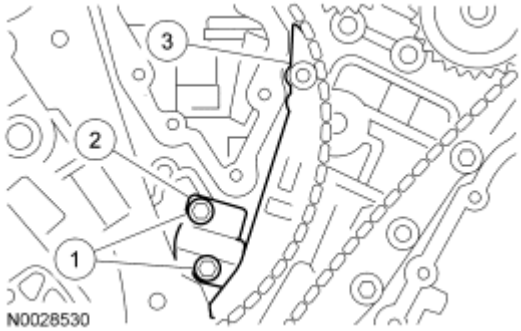


Fig. 44: Locating LH Timing Chain & Tensioner Arm
Courtesy of FORD MOTOR CO.

13. Remove the LH timing chain and timing chain guide.

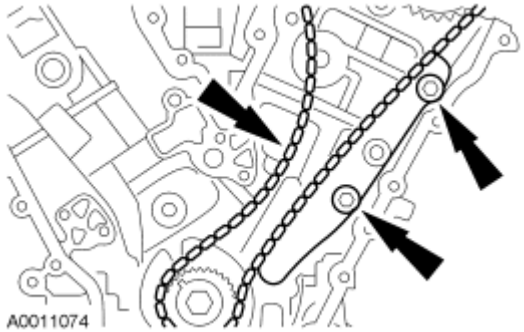


Fig. 45: Locating Timing Chain & Timing Chain Guide
Courtesy of FORD MOTOR CO.

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

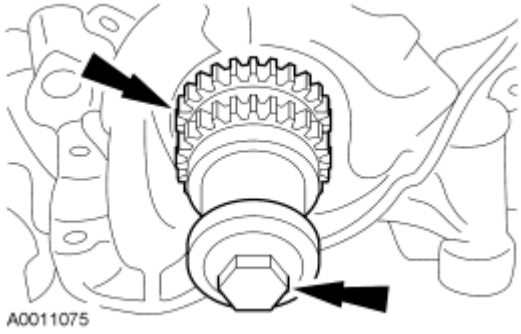


Fig. 46: Locating Damper Bolt & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

INSTALLATION

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

1. Install the crankshaft sprockets with the timing marks out.

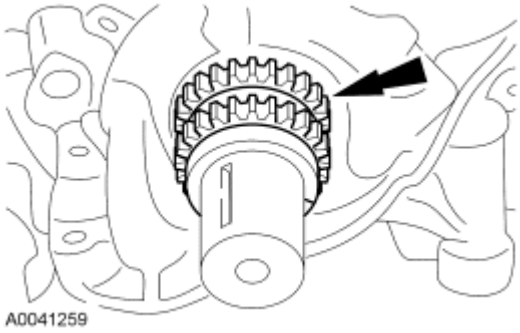


Fig. 47: Locating Crankshaft Sprockets With Timing Marks Out
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

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

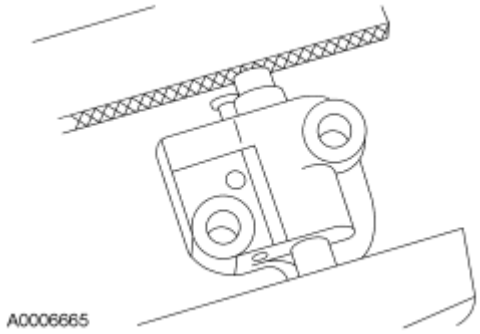


Fig. 48: Identifying Chain Tensioner In Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

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

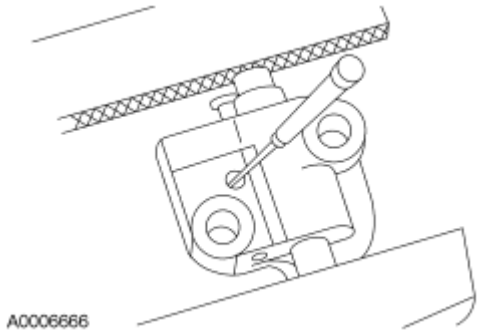


Fig. 49: Holding Chain Tensioner Ratchet Lock Mechanism Away From Ratchet Stem
Courtesy of FORD MOTOR CO.

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

4. Slowly compress the timing chain tensioner.
5. Retain the tensioner piston with a 1.5 mm (0.05 in) wire or paper clip.

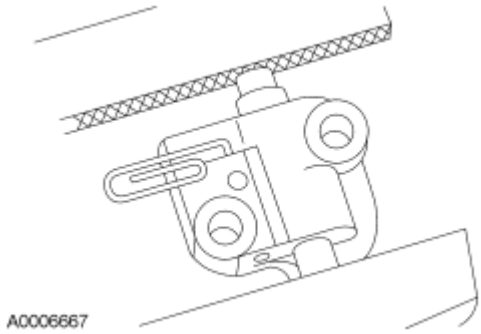


Fig. 50: Retaining Tensioner Piston With 1.5-mm (0.06-in) Wire Or Paper Clip
Courtesy of FORD MOTOR CO.

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

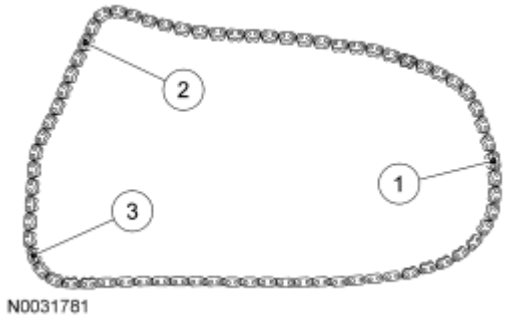


Fig. 51: Locating Crankshaft & Camshaft Timing Marks On LH & RH Timing Chains
Courtesy of FORD MOTOR CO.

7. Verify that the LH camshafts are correctly positioned.

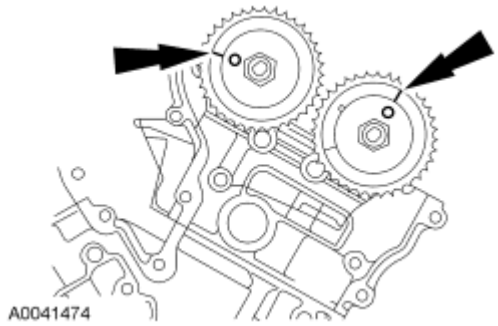


Fig. 52: Locating Camshafts Aligning Marks
Courtesy of FORD MOTOR CO.

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

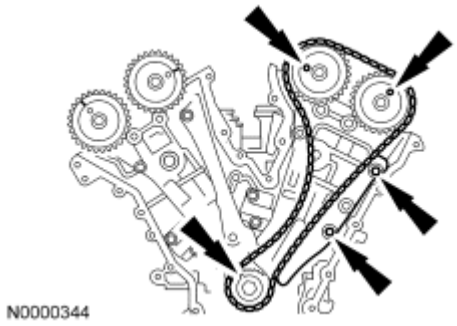


Fig. 53: Aligning Marks On Timing Chain With Marks On Camshaft & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

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

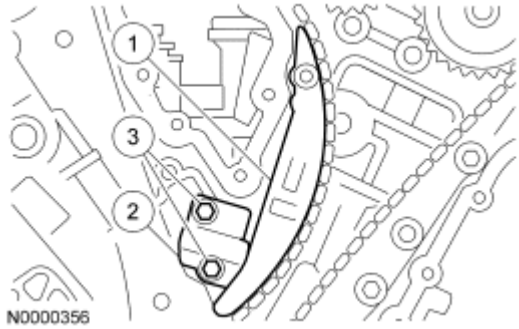


Fig. 54: Identifying Timing Chain Tensioner Arm & Bolts
Courtesy of FORD MOTOR CO.

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

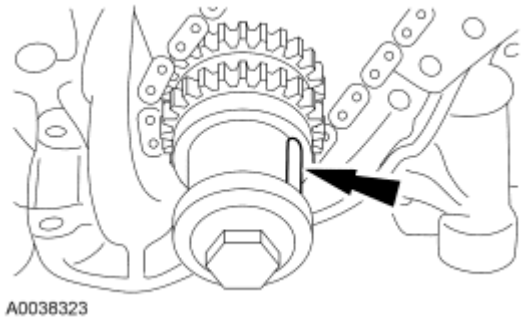


Fig. 55: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

11. Verify that the RH camshafts are correctly positioned.

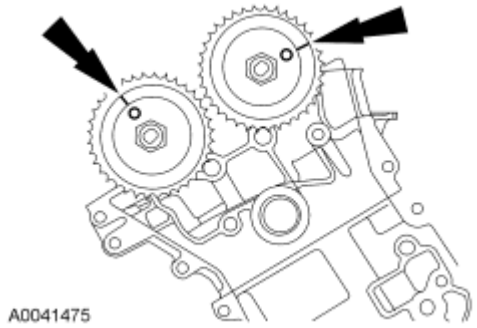


Fig. 56: Locating Camshafts Align Marks
Courtesy of FORD MOTOR CO.

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

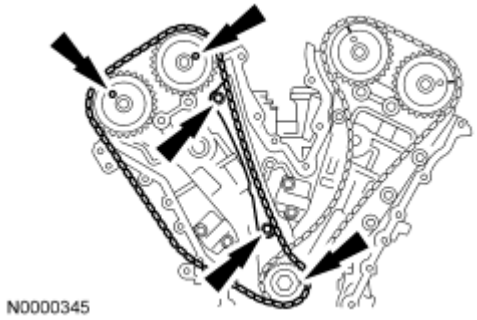


Fig. 57: Aligning Marks On Timing Chain With Marks On Camshaft & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

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

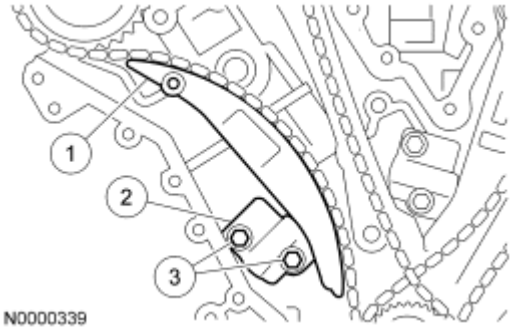


Fig. 58: Identifying Tensioner Arm, Tensioner And Bolts
Courtesy of FORD MOTOR CO.

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

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

16. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and the crankshaft timing marks.
    3. There should be 30 chain links between the camshaft and the crankshaft timing marks.

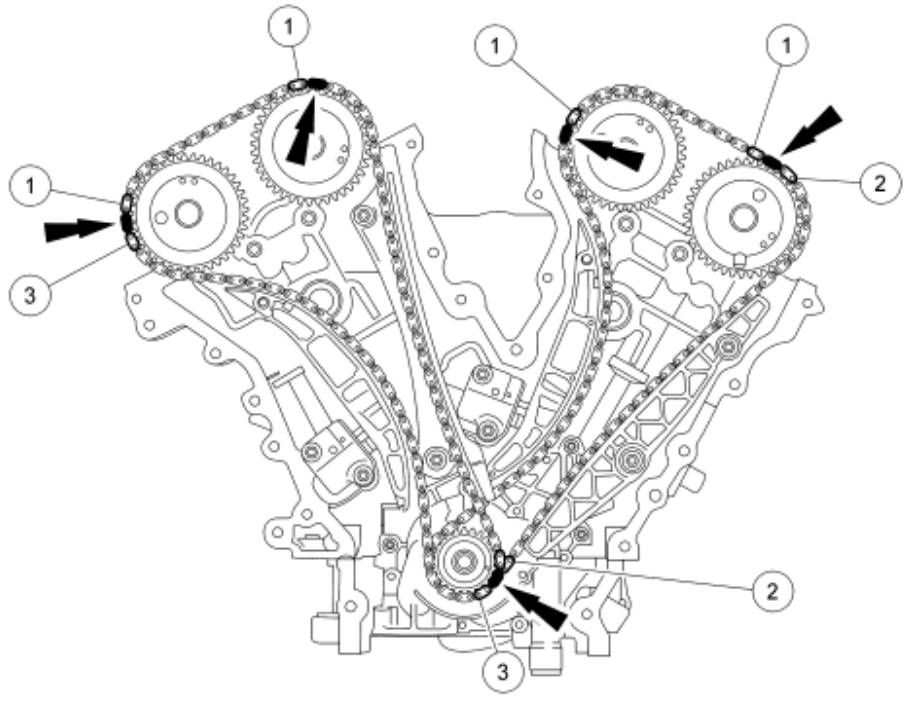


Fig. 59: Checking Chain Links Timing Marks

Courtesy of FORD MOTOR CO.

17. Remove the crankshaft pulley bolt.

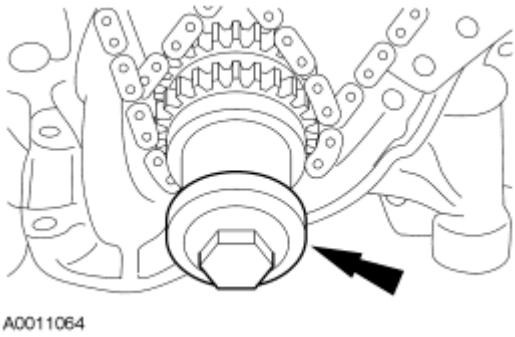


Fig. 60: Identifying Damper Bolt
Courtesy of FORD MOTOR CO.

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

18. Install the ignition pulse wheel.

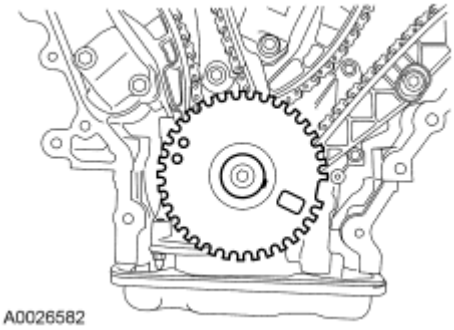


Fig. 61: Identifying Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

19. Install the LH and RH spark plugs. For additional information, refer to **ENGINE IGNITION - 3.0L (4V)** article.
20. Install the engine front cover. For additional information, refer to **Engine Front Cover**.

VALVE TRAIN COMPONENTS - EXPLODED VIEW

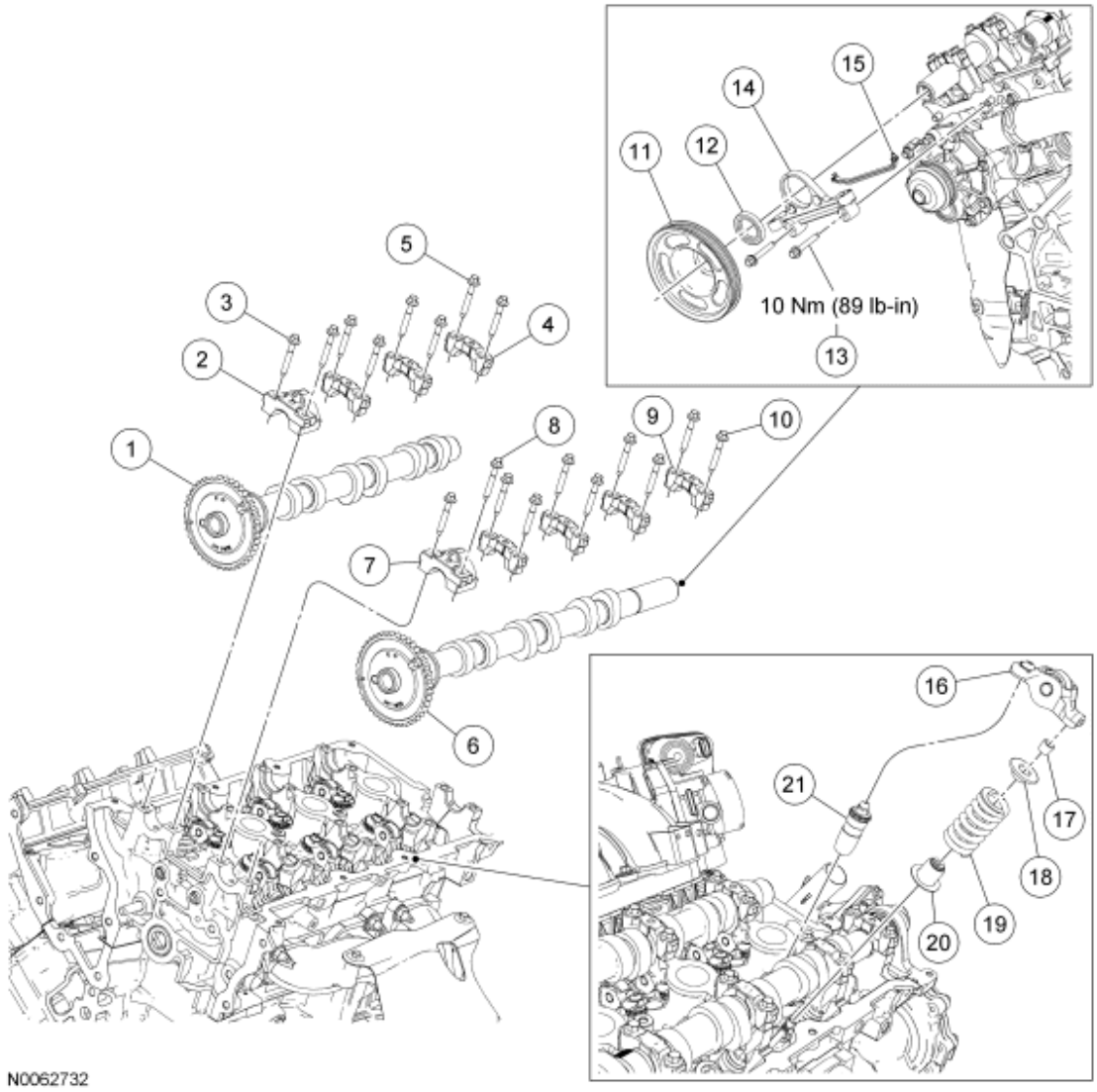


Fig. 62: Valve Train Components - LH With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6A266	LH intake camshaft
2	6B280	Intake camshaft thrust bearing cap
3	W710702	Intake camshaft thrust bearing cap bolt (2 required)
4	6A258	Intake camshaft bearing cap (3 required)
5	W710702	Intake camshaft bearing cap bolt (6 required)
6	6A266	LH exhaust camshaft
7	6B280	Exhaust camshaft thrust bearing cap
8	W710702	Exhaust camshaft thrust bearing cap bolt

		(2 required)
9	6B280	Exhaust camshaft bearing cap (4 required)
10	W710702	Exhaust camshaft bearing cap bolt (8 required)
11	6A359	Coolant pump drive pulley
12	6K292	Camshaft oil seal
13	W701242	Camshaft oil seal retainer bolt (2 required)
14	6B293	Camshaft oil seal retainer
15	6B295	Camshaft oil seal retainer gasket
16	6529	Roller follower (12 required)
17	6518	Valve spring retainer key (24 required)
18	6514	Valve spring retainer (12 required)
19	6513	Valve spring (12 required)
20	6A517	Valve stem seal (12 required)
21	6C501	Hydraulic lash adjuster (12 required)

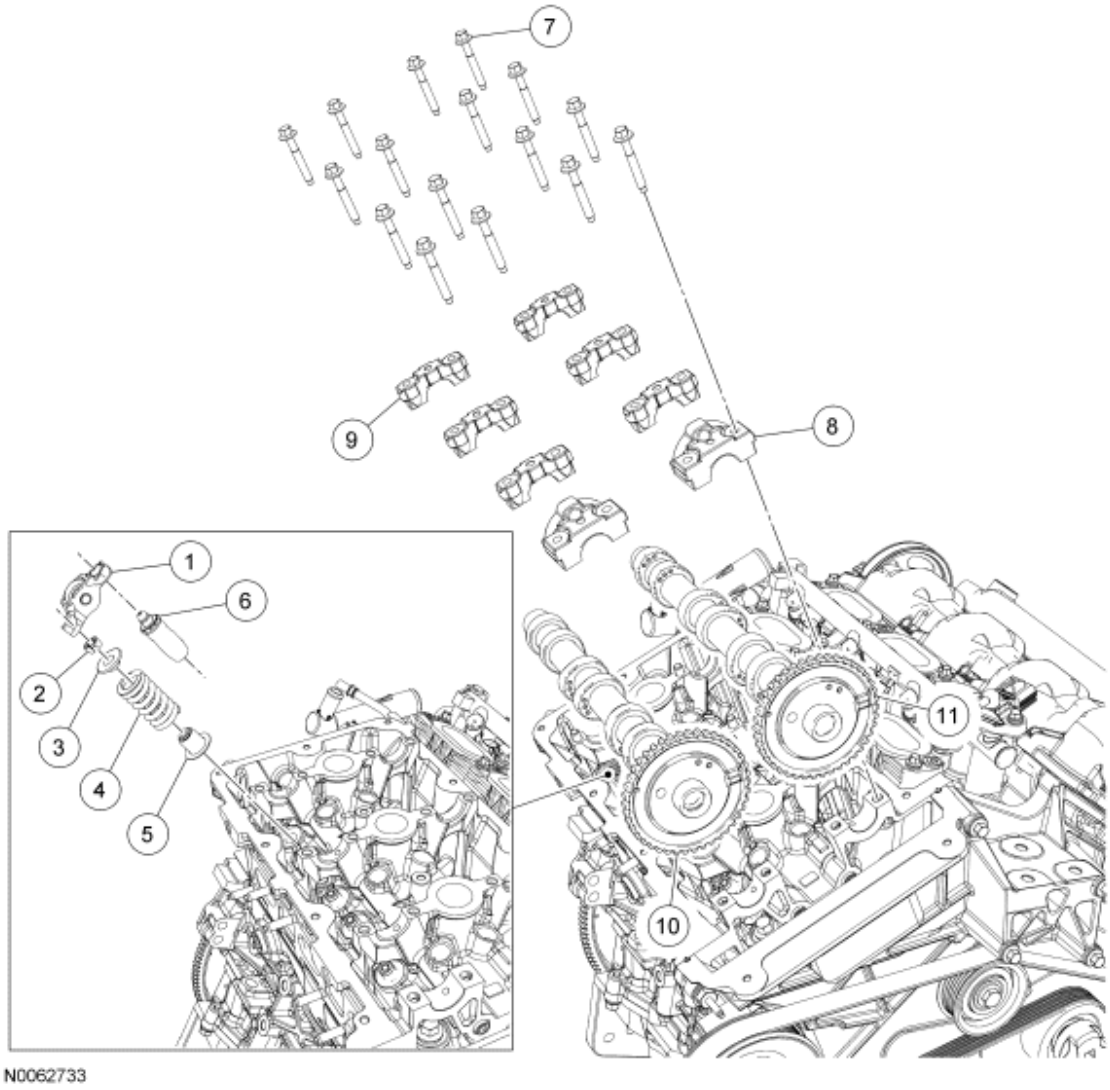


Fig. 63: Valve Train Components - RH
Courtesy of FORD MOTOR CO.

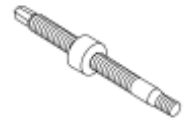
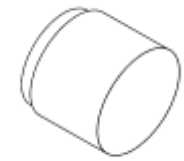
Item	Part Number	Description
1	6529	Roller follower
2	6518	Valve spring retainer key
3	6514	Valve spring retainer
4	6513	Valve spring
5	6A517	Valve stem seal
6	6C501	Hydraulic lash adjuster
7	W710702	Camshaft bearing cap bolt (16 required)
8	6B280	Camshaft bearing thrust cap (2 required)
9	6A258	Camshaft bearing cap (6 required)
10	6A266	Exhaust camshaft

11	6A266	Intake camshaft

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

CAMSHAFTS - LH

Special Tools

Illustration	Tool Name	Tool Number
 ST1970-A	Installer, Camshaft Oil Seal	303-464 (T94P-6256-BH)
 ST3042-A	Installer, Camshaft Pulley	303-458 (T94P-6312-AH3), part of 303-S455
 ST1586-A	Installer, Power Steering Pump Pulley	211-185 (T91P-3A733-A)
 ST3044-A	Plate, Water Pump Pulley	303-456 (T94P-6312-AH1), part of 303-S455
 ST2060-A	Protector, Camshaft Oil Seal	303-463 (T94P-6256-AH)
 ST3045-A	Protector, Water Pump Shaft	303-457 (T94P-6312-AH2), part of 303-S455
	Remover, Crankshaft Vibration Damper	303-009 (T58P-6316-D)

 ST1286-A		
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700-CH)
 ST3043-A	Spacer, Water Pump Pulley	303-459 (T94P-6312-AH4), part of 303-S455

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 coolant pump belt. For additional information refer to **ACCESSORY DRIVE - 3.0L (4V)** article.
2. Remove the timing drive components. For additional information, refer to **Timing Drive Components**.

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

3. Using the special tools, remove the coolant pump pulley.

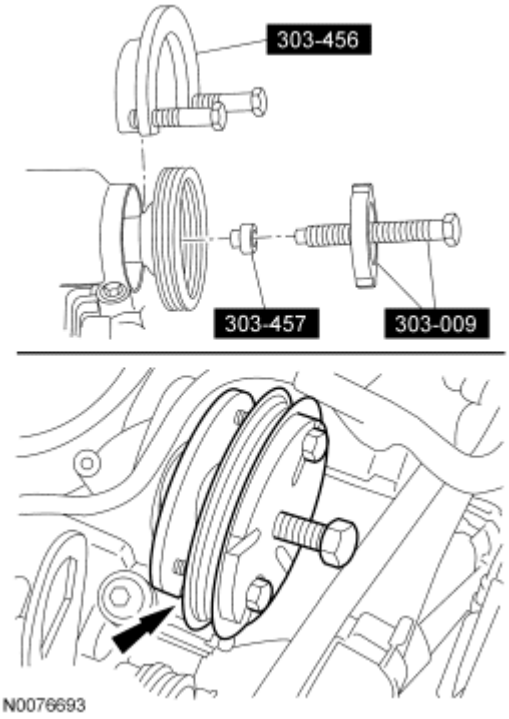


Fig. 64: Removing Coolant Pump Pulley Using Special Tools (303-009, 303-456, 303-457)
Courtesy of FORD MOTOR CO.

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

4. Using the special tools, remove and discard the camshaft oil seal.

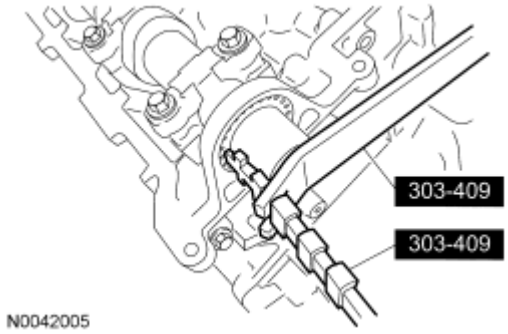


Fig. 65: Identifying Special Tools (303-409)
Courtesy of FORD MOTOR CO.

5. Remove the 2 bolts and the camshaft oil seal retainer.
   - Discard the press-in-place gasket.

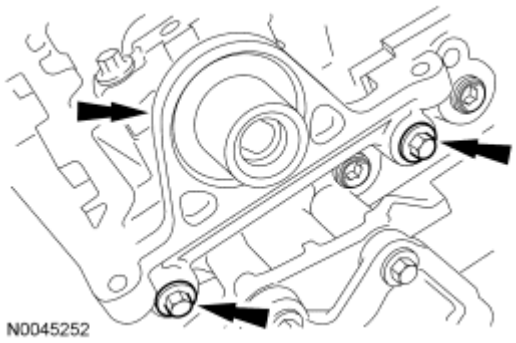


Fig. 66: Locating Camshaft Oil Seal Retainer & Bolts
Courtesy of FORD MOTOR CO.

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

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

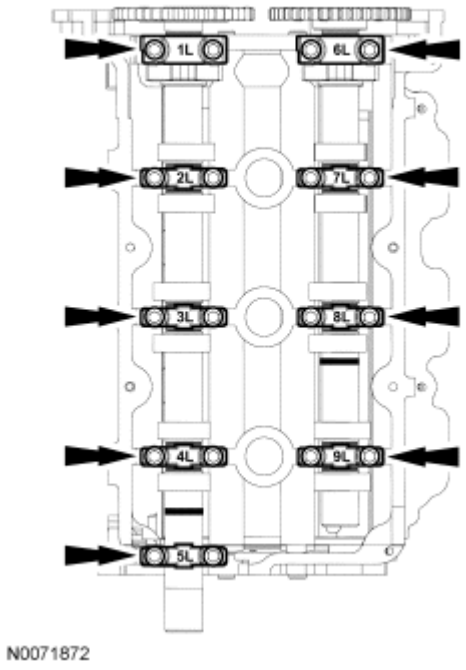


Fig. 67: Marking Camshaft Bearing Caps
Courtesy of FORD MOTOR CO.

CAUTION: After loosening all of the camshaft bearing cap bolts, remove the

camshaft bearing thrust caps (1L and 6L) first, or damage to the thrust caps may occur.

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

7. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (1L and 6L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

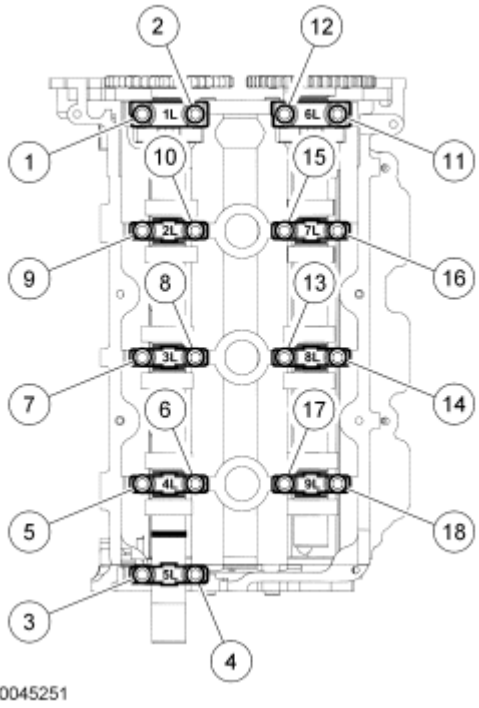


Fig. 68: Identifying Loosening Sequence Of Camshaft Bearing Thrust Caps
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Lubricate the camshafts with clean engine oil and carefully position the camshafts into the cylinder head.
    - Align the camshafts as shown.

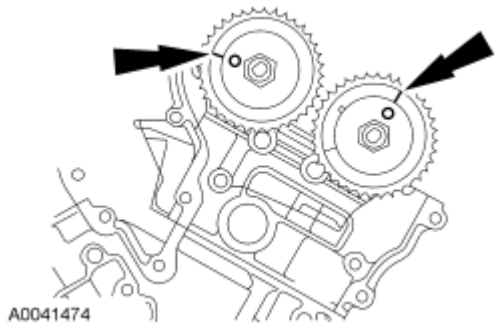


Fig. 69: Locating Camshafts Aligning Marks
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft caps must be installed in their original positions or damage to the engine may occur.

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

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

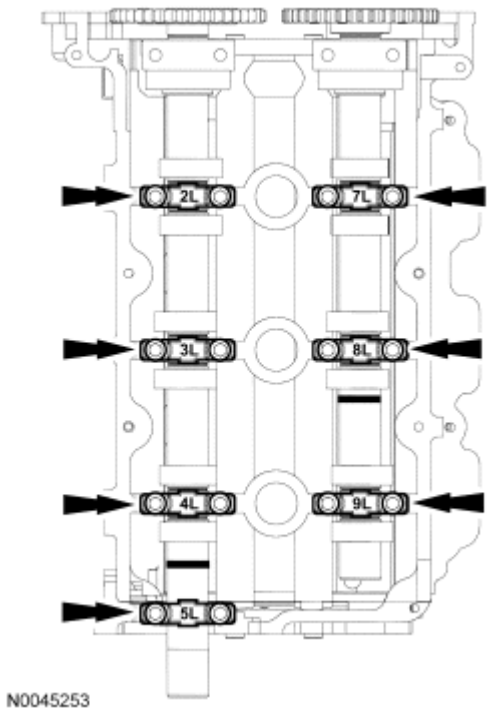


Fig. 70: Locating Camshaft Bearing Caps Installing Sequence
Courtesy of FORD MOTOR CO.

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

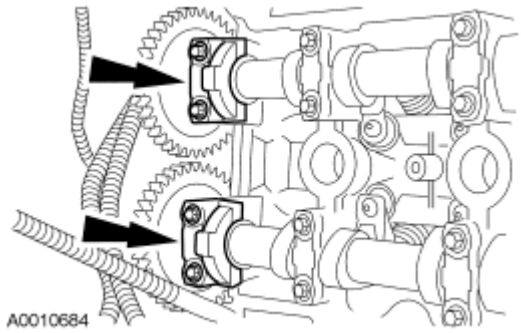


Fig. 71: Locating Camshaft Bearing Thrust Caps
Courtesy of FORD MOTOR CO.

4. Install the bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).

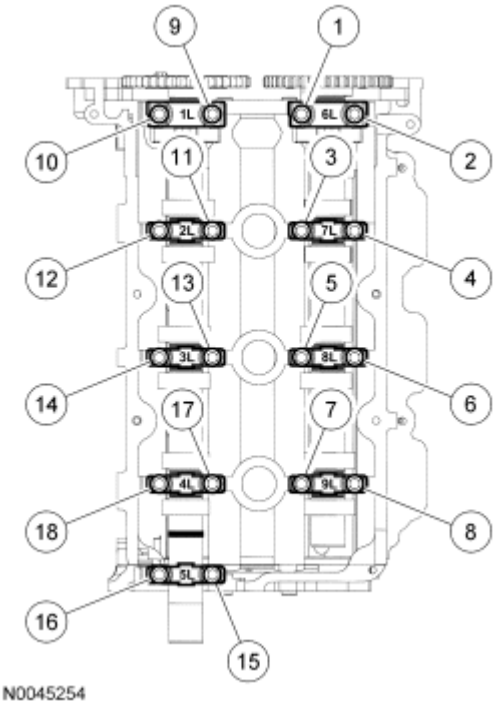


Fig. 72: Identifying Tightening Sequence Of Bolts
Courtesy of FORD MOTOR CO.

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

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

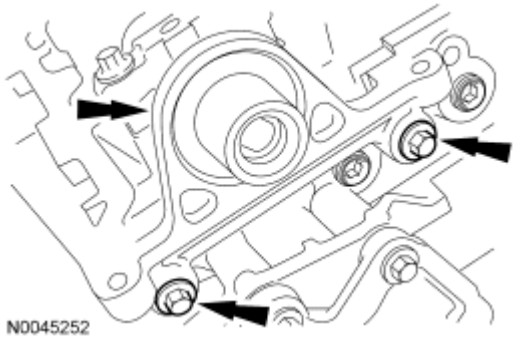


Fig. 73: Locating Camshaft Oil Seal Retainer & Bolts
Courtesy of FORD MOTOR CO.

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

6. Using the special tools, install the camshaft oil seal.

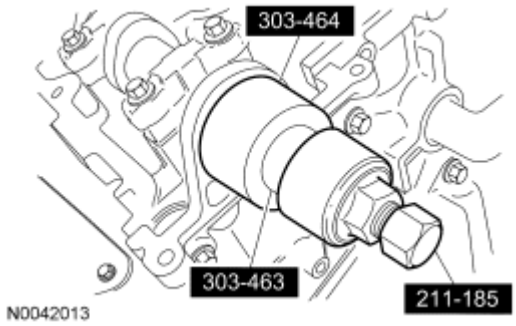


Fig. 74: Identifying Special Tools (303-463, 303-464 And 211-185)
Courtesy of FORD MOTOR CO.

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

7. Install the special tool in the camshaft as shown in the illustration.
   - Adjust the collar on the special tool screw to get the best thread engagement in the rear of the camshaft.

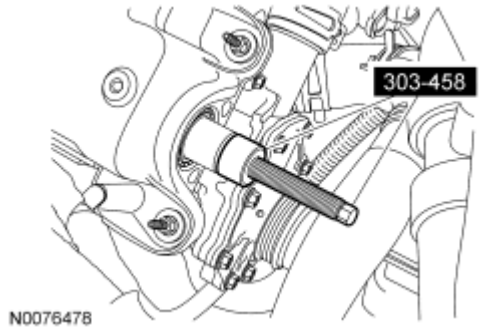


Fig. 75: Installing Special Tool On Camshaft
Courtesy of FORD MOTOR CO.

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

NOTE: Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-485).

8. Position the coolant pump pulley over the previously installed special tool and on the end of the camshaft. Install the special tools as shown in the illustration.
   - Using the special tools, install a new service coolant pump pulley flush with the end of the camshaft.

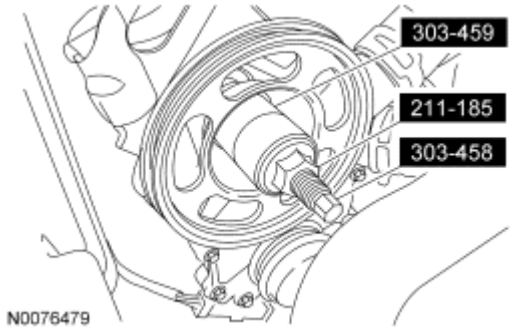


Fig. 76: Installing Coolant Pump Pulley Using Special Tools (211-185, 303-458, 303-459)
Courtesy of FORD MOTOR CO.

9. Install the timing drive components. For additional information, refer to **Timing Drive Components**.
10. Install the coolant pump belt. For additional information refer to **ACCESSORY DRIVE - 3.0L (4V)** article.

CAMSHAFTS - RH

Material

Item	Specification

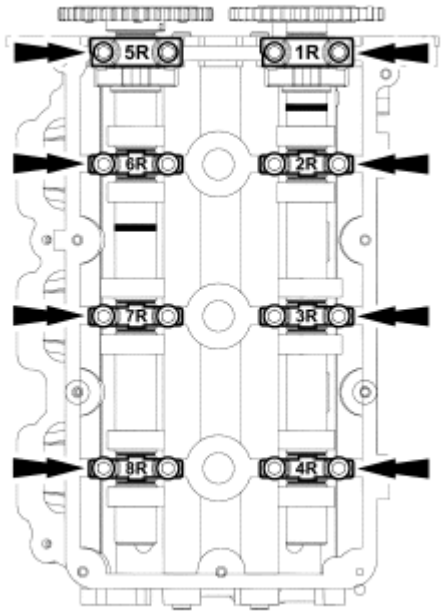
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

REMOVAL

1. Remove the timing drive components. For additional information, refer to **Timing Drive Components**.

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

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



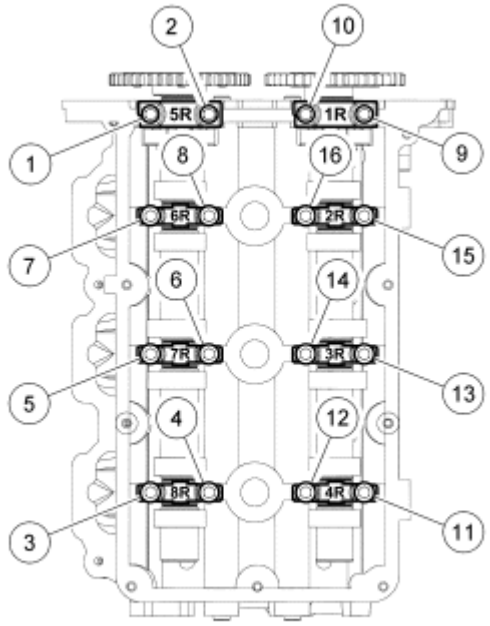
N0071873

Fig. 77: Marking Camshaft Bearing Cap Positions
Courtesy of FORD MOTOR CO.

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

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

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

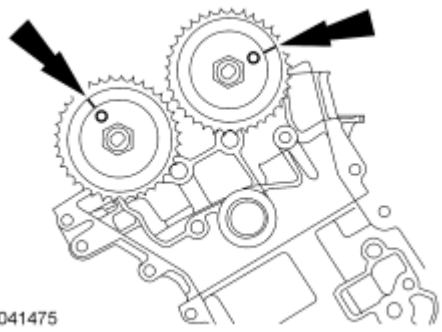


N0045707

Fig. 78: Identifying Loosening Sequence Of Camshaft Bearing Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Lubricate the camshafts with clean engine oil and carefully position the camshafts into the cylinder head.
    - Align the camshafts as shown.



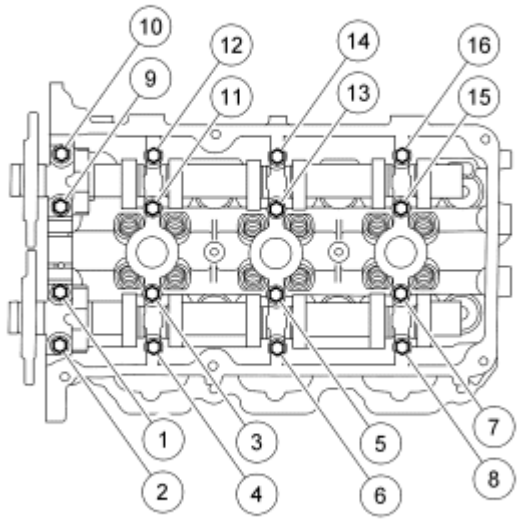
A0041475

Fig. 79: Locating Camshafts Align Marks
Courtesy of FORD MOTOR CO.

CAUTION: The camshaft caps must be installed in their original positions or damage to the engine may occur.

CAUTION: Do not install the camshaft bearing thrust caps until all of the camshaft bearing caps have been installed, or damage to the thrust caps may occur.

2. Lubricate the bearing surfaces of the camshaft bearing caps with clean engine oil and install the bearing caps.
   - Loosely install the bolts.
3. Lubricate the bearing surfaces of the camshaft bearing thrust caps with clean engine oil and install the bearing thrust caps.
   - Loosely install the bolts.
4. Install the bolts.
   - Tighten in the sequence shown to 10 Nm (89 lb-in).



N0000342

Fig. 80: Identifying Tightening Sequence Of Bolts
Courtesy of FORD MOTOR CO.

5. Install the timing drive components. For additional information, refer to **Timing Drive Components**.

CAMSHAFT ROLLER FOLLOWER

Special Tools

Illustration	Tool Name	Tool Number
 ST1975-A	Compressor, Valve Spring	303-473 (T94P-6565-BH)

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the LH and RH valve covers. For additional information, refer to **Valve Cover - LH** and **Valve Cover - RH**.

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

3. Remove the 6 spark plugs.
   - To install, tighten to 15 Nm (11 lb-ft).
4. Remove the RH splash shield.
   - To install, tighten to 9 Nm (80 lb-in).
5. Rotate the crankshaft until the camshaft lobe is pointing directly away from the roller follower.
6. Using the special tool, remove the roller followers.

Fig. 81: Removing Roller Using Special Tool (303-473)
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the camshaft followers with clean engine oil.

7. To install, reverse the removal procedure.

HYDRAULIC LASH ADJUSTER

Material

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

REMOVAL AND INSTALLATION

1. Remove the camshaft roller followers. For additional information, refer to **Camshaft Roller Follower**.

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

2. Remove the hydraulic lash adjusters.

NOTE: Inspect the hydraulic lash adjusters for scoring marks and uneven wear in the bore. Install new lash adjusters if necessary.

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

VALVE SPRING, RETAINER, AND SEAL

Special Tools

Illustration	Tool Name	Tool Number

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

Material

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

REMOVAL

1. Remove the camshaft roller followers. For additional information, refer to **Camshaft Roller Follower**.

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

2. Pressurize the cylinder using compressed air.
3. Using the special tool, remove the key, retainer and the valve spring.

Fig. 82: Identifying Special Tool (303-473)
Courtesy of FORD MOTOR CO.

NOTE: Camshaft removed for clarity.

4. Remove the valve seal.

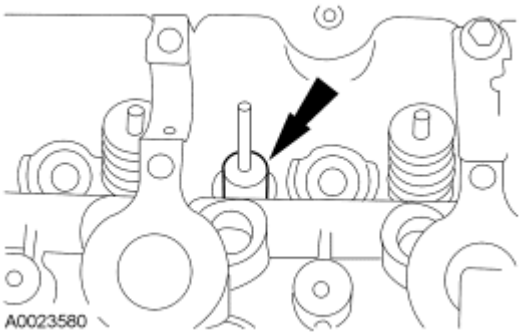


Fig. 83: Locating Valve Seal
Courtesy of FORD MOTOR CO.

INSTALLATION

NOTE: Lubricate the valve guide with clean engine oil.

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

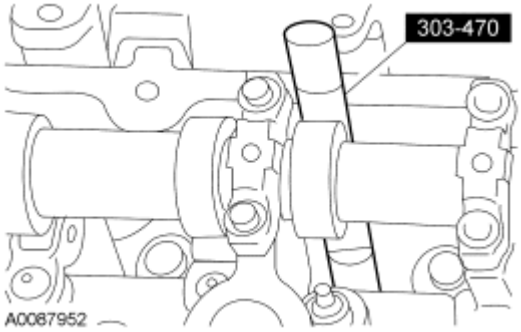


Fig. 84: Installing Valve Seal
Courtesy of FORD MOTOR CO.

2. Using the special tool, install the valve spring, retainer and key.

Fig. 85: Identifying Special Tool (303-473)

Courtesy of FORD MOTOR CO.

3. Install the camshaft roller followers. For additional information, refer to **Camshaft Roller Follower**.

CYLINDER HEAD - RH

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

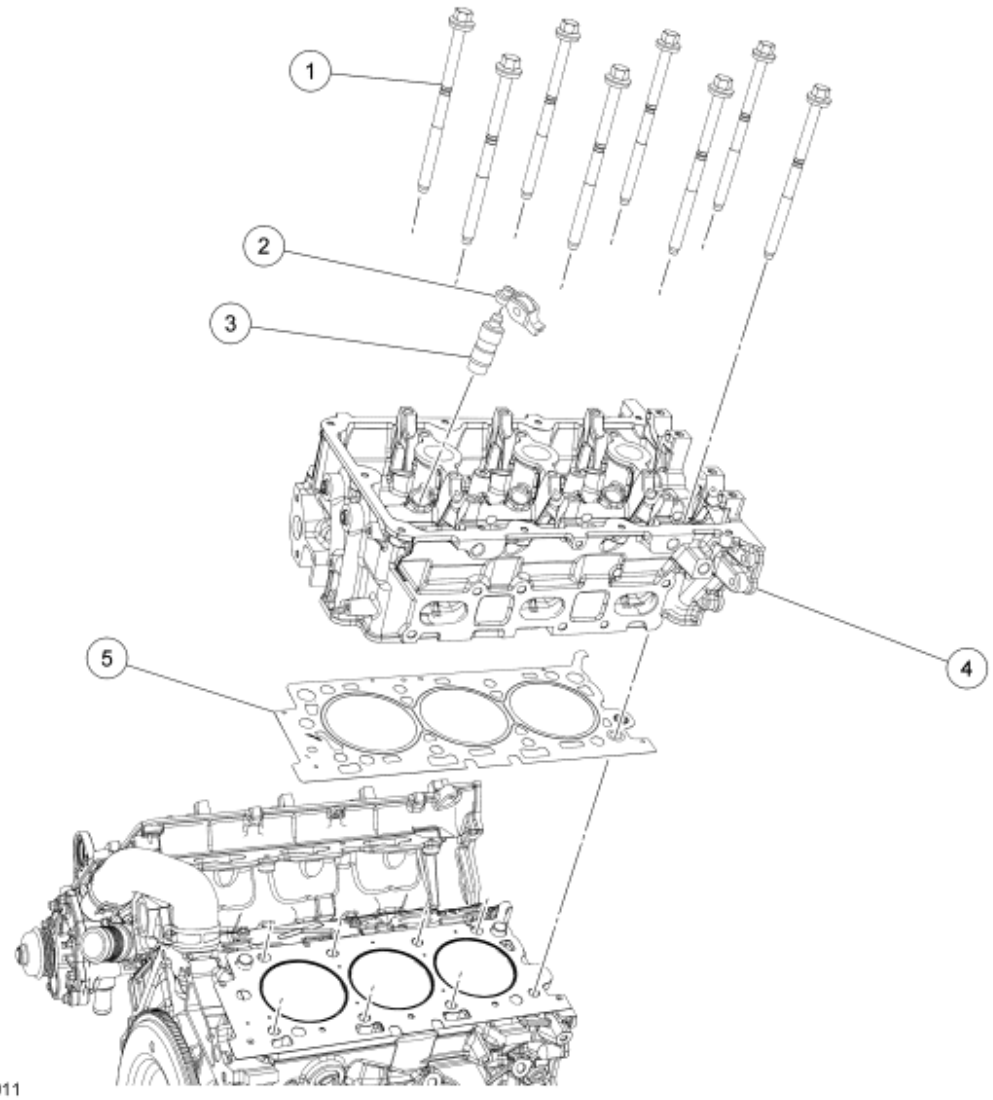


Fig. 86: Cylinder Head Components
Courtesy of FORD MOTOR CO.

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

REMOVAL

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the lower intake manifold. For additional information, refer to **Lower Intake Manifold**.
3. Remove the coolant bypass tube. For additional information, refer to **ENGINE COOLING** article.
4. Remove the RH camshafts. For additional information, refer to **Valve Train Components - Exploded View** and **Camshafts - RH**.

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

5. Remove the camshaft roller followers.

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

6. Remove the hydraulic lash adjusters.
7. Remove the RH exhaust manifold. For additional information refer to **EXHAUST SYSTEM** article.

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

8. Remove the bolts in the sequence shown.

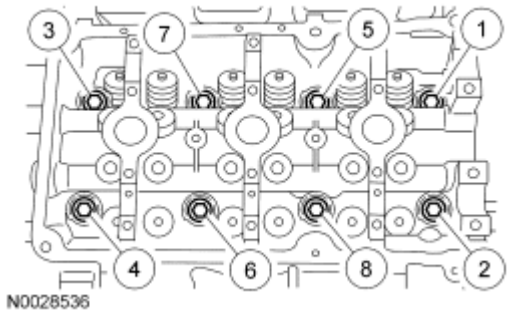


Fig. 87: Identifying Removing Sequence Of Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

9. Remove the cylinder head and support the cylinder head on a bench with the head gasket side up.
    - Discard the gasket and the bolts.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

10. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

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 gauges which make leak paths.

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

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

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

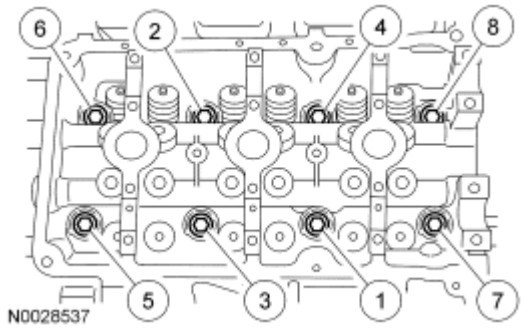


Fig. 88: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

4. Install the RH exhaust manifold. For additional information refer to **EXHAUST SYSTEM** article.

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

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

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

6. Install the camshaft roller followers.
   - Lubricate the camshaft roller followers with clean engine oil.
7. Install the RH camshafts. For additional information, refer to **Valve Train Components - Exploded View** and **Camshafts - RH**.
8. Install the coolant bypass tube. For additional information, refer to **ENGINE COOLING** article.
9. Install the lower intake manifold. For additional information, refer to **Lower Intake Manifold**.

CYLINDER HEAD - LH

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

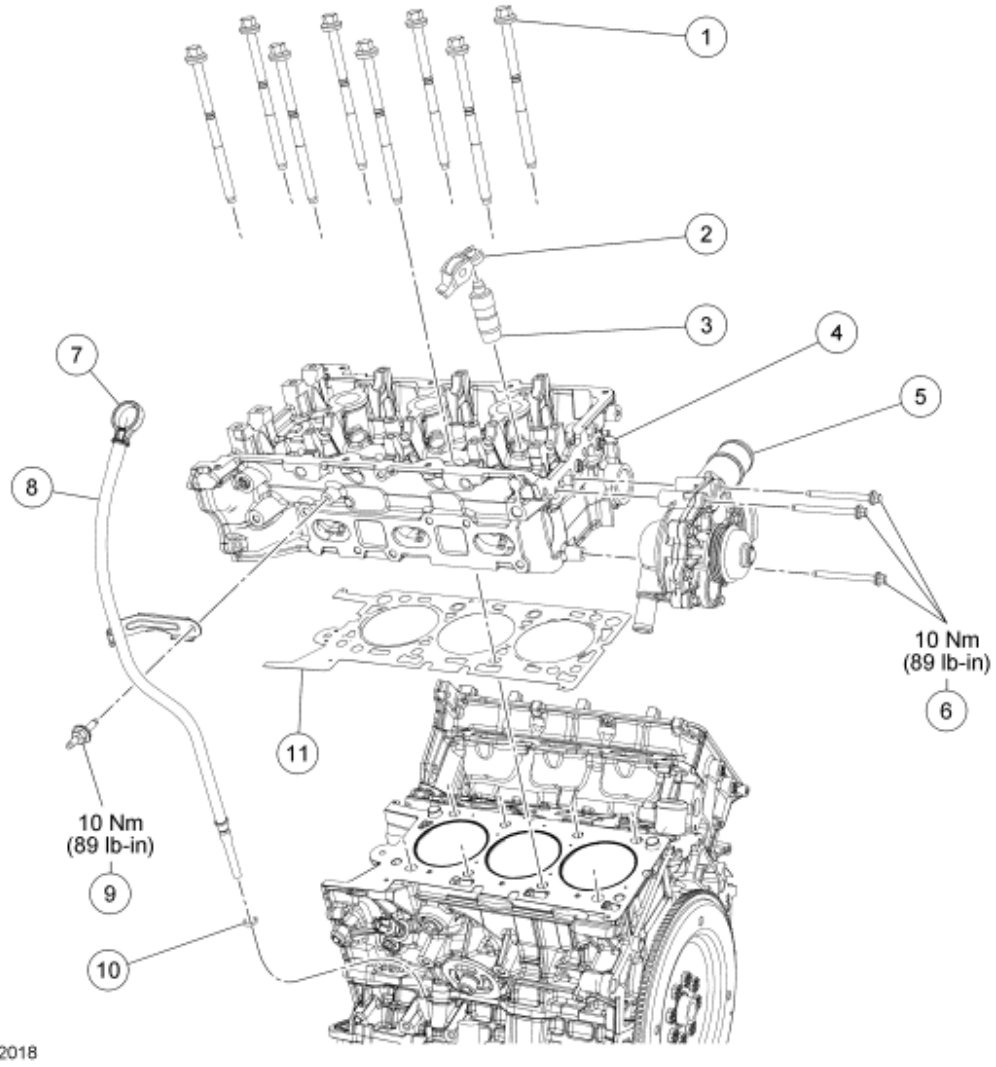


Fig. 89: Cylinder Head Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6065	Cylinder head bolt (8 required)
2	6529	Camshaft roller follower (12 required)
3	6C501	Hydraulic lash adjuster (12 required)
4	6050	Cylinder head
5	8501	Coolant pump
6	W701544	Coolant pump bolts (3 required)
7	6750	Oil level indicator
8	6754	Oil level indicator tube
9	W701822	Oil level indicator tube stud bolt
10	110282	Oil level indicator tube O-ring

11	6083	Cylinder head gasket

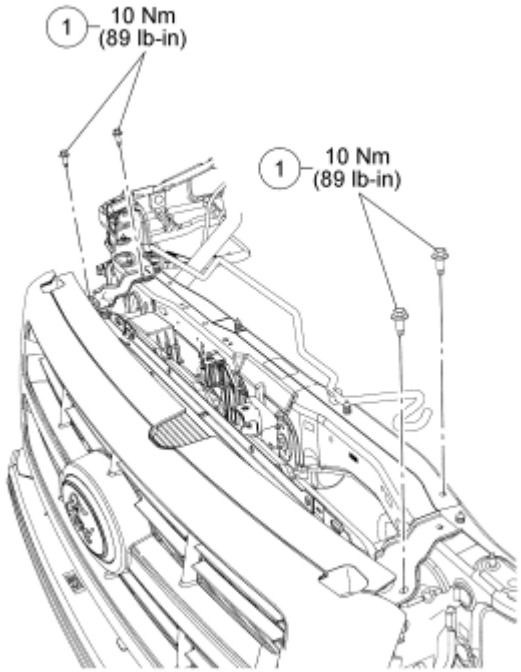


Fig. 90: Identifying Bolts With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W707399	Upper radiator support bracket bolts (4 required)

REMOVAL

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the lower intake manifold. For additional information, refer to **Lower Intake Manifold**.
3. Remove the coolant bypass tube. For additional information, refer to **ENGINE COOLING** article.
4. Remove the LH camshafts. For additional information, refer to **Valve Train Components - Exploded View** and **Camshafts - LH**.

CAUTION: The camshaft roller followers must be installed in their original positions. If not reassembled in their original positions, severe

engine damage may occur.

5. Remove the camshaft roller followers.

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

6. Remove the hydraulic lash adjusters.
7. Remove the LH exhaust manifold. For additional information, refer to **EXHAUST SYSTEM** article.
8. Remove the 4 upper radiator support bracket bolts.
9. Remove the oil level indicator.
10. Remove the stud bolt and then remove the oil level indicator tube.
    - Remove and discard the O-ring seal.
11. Remove the 3 bolts and position the coolant pump aside.

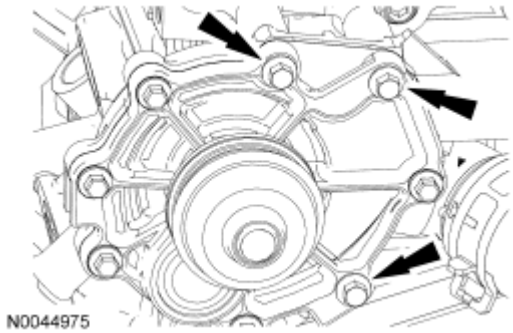
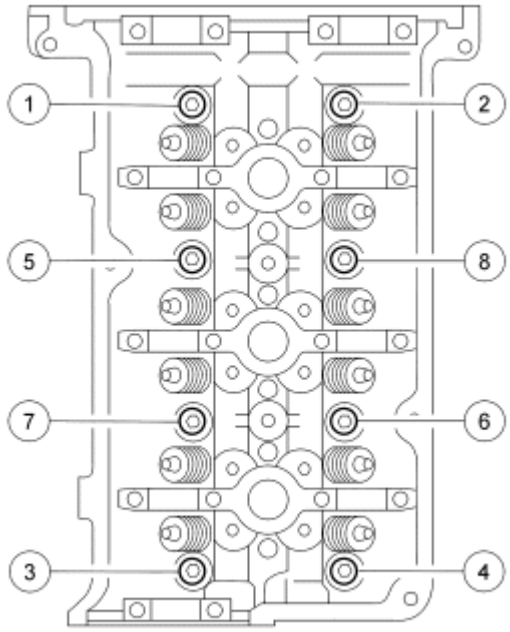


Fig. 91: Locating Coolant Pump And Bolts
Courtesy of FORD MOTOR CO.

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

12. Remove the bolts in the sequence shown.



N0001536

Fig. 92: Identifying Loosening Sequence Of Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

13. Remove the cylinder head and support the cylinder head on a bench with the head gasket side up.
    - Discard the gasket and the bolts.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

14. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).

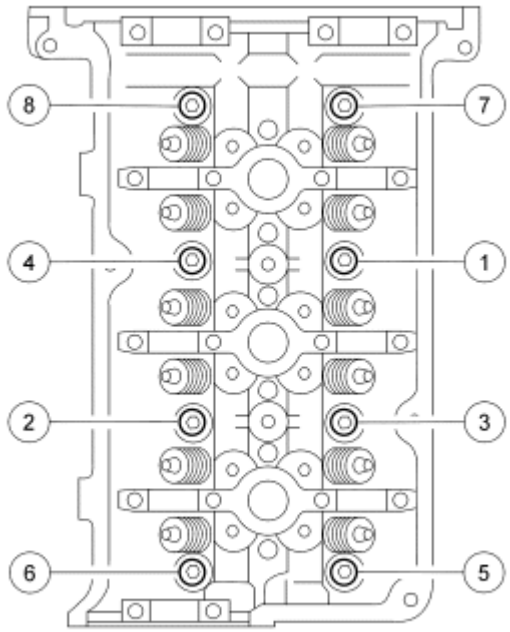
INSTALLATION

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

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

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

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



N0001535

Fig. 93: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

4. Position the coolant pump and install the bolts.
    - Tighten to 10 Nm (89 lb-in).

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

5. Install the oil level indicator tube and the stud bolt.
    - Tighten to 10 Nm (89 lb-in).
6. Install the oil level indicator.
7. Install the 4 upper radiator support bracket bolts.
    - Tighten to 10 Nm (89 lb-in).
8. Install the LH exhaust manifold. For additional information, refer to **EXHAUST SYSTEM** article.

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

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

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

10. Install the camshaft roller followers.
    - Lubricate the camshaft roller followers with clean engine oil.
11. Install the camshafts. For additional information, refer to **Valve Train Components - Exploded View** and **Camshafts - LH**.
12. Install the coolant bypass tube. For additional information, refer to **ENGINE COOLING** article.
13. Install the lower intake manifold. For additional information, refer to **Lower Intake Manifold**.

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

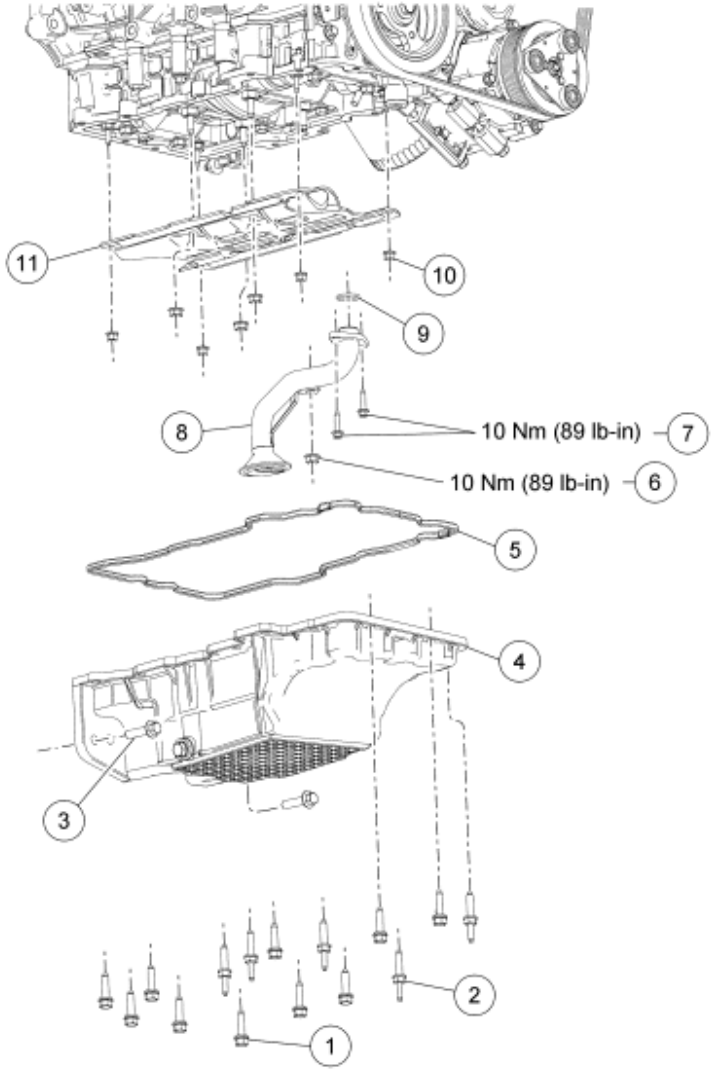


Fig. 94: Engine Lubrication Components - Exploded View With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	W701605	Oil pan-to-engine bolt (10 required)
2	W701606	Oil pan-to-engine stud bolt (5 required)
3	W500120	Oil pan-to-transaxle bolt (2 required)
4	6675	Oil pan
5	6710	Oil pan gasket
6	W701582	Oil pump screen and pickup tube nut
7	W700005	Oil pump screen and pickup tube bolts (2 required)
8	6622	Oil pump screen and pickup tube
9	6625	Oil pump screen and pickup tube O-ring

		seal
10	W701542	Oil pan baffle nut (7 required)
11	6687	Oil pan baffle

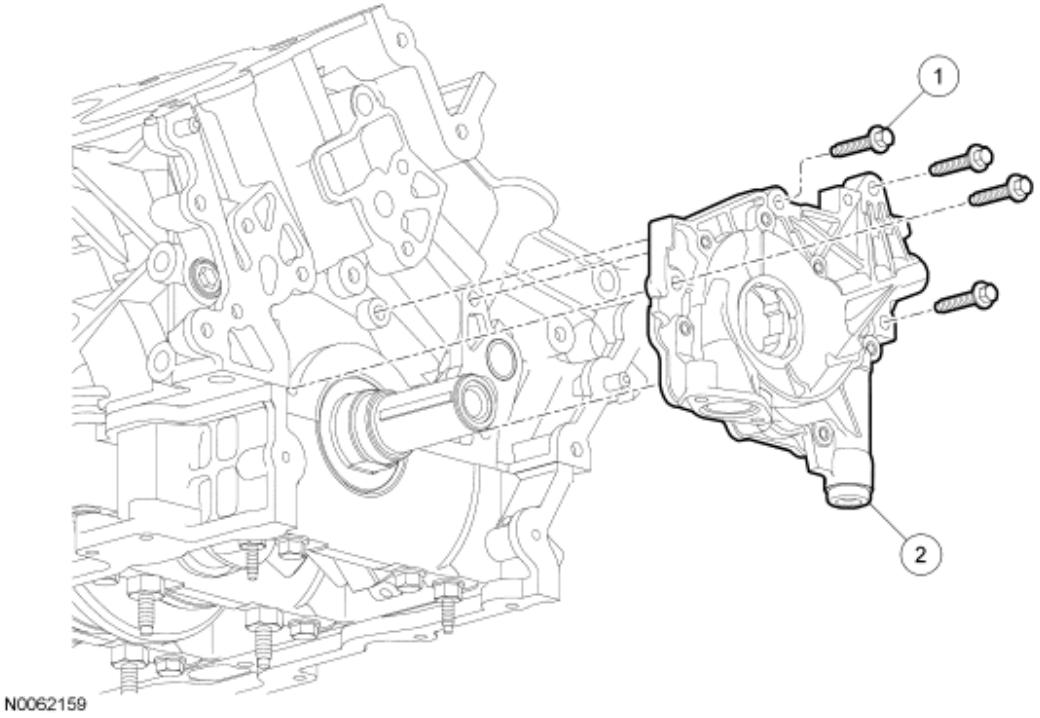


Fig. 95: Oil Pump
Courtesy of FORD MOTOR CO.

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

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

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

REMOVAL

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the exhaust Y-pipe. For additional information, refer to **EXHAUST SYSTEM** article.
3. Drain the engine oil and install the drain plug.
   - Tighten to 26 Nm (19 lb-ft).
4. Remove and discard the oil filter.
5. Remove the 2 oil pan-to-transaxle bolts.

NOTE: For reference during installation, mark the location of the stud bolts.

6. Remove the 10 bolts, 5 stud bolts and the oil pan.
   - Remove and discard the oil pan gasket.

INSTALLATION

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

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

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

2. Apply a 10 mm (0.40 in) diameter dot of silicone sealant to the areas indicated.

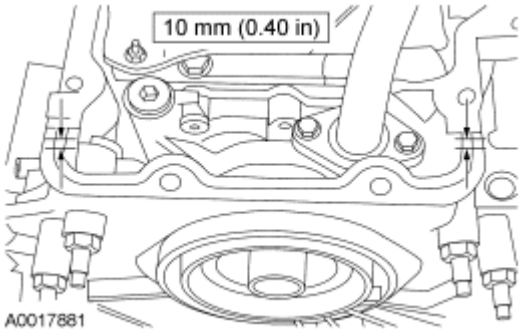


Fig. 96: Identifying Area For Applying Sealant With Specification
Courtesy of FORD MOTOR CO.

3. Position the oil pan and loosely install the bolts and stud bolts.
4. Install the 2 oil pan-to-transaxle bolts.
   - Tighten to 40 Nm (30 lb-ft).
5. Tighten the oil pan-to-engine bolts and stud bolts in the sequence shown to 25 Nm (18 lb-ft).

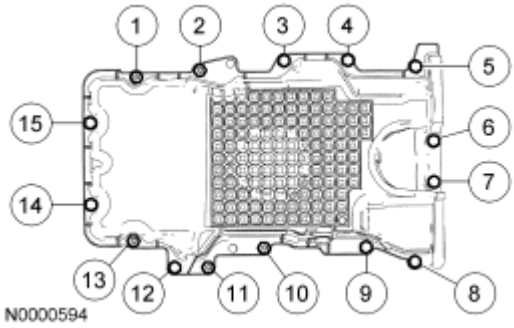


Fig. 97: Identifying Tightening Sequence Of Oil Pan-To-Engine Bolts And Stud Bolts
Courtesy of FORD MOTOR CO.

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

6. Install a new oil filter.
   - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
7. Install the exhaust Y-pipe. For additional information, refer to **EXHAUST SYSTEM** article.
8. 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

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the oil pan. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pan**.
3. Remove the bolts, nut and the oil pump screen and pickup tube.
   - Remove and discard the O-ring seal.

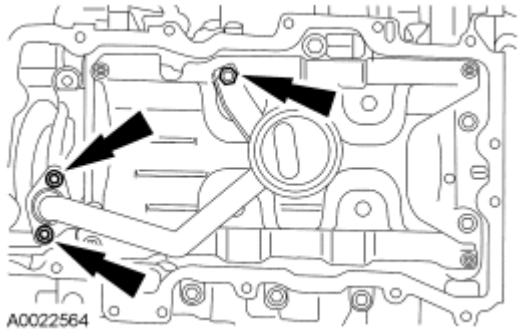


Fig. 98: Locating Oil Pump Screen & Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

1. Install a new O-ring seal on the oil pump screen and pickup tube.
   - Lubricate the O-ring seal with clean engine oil.
2. Install the oil pump screen and pickup tube.
   1. Position the oil pump screen and pickup tube.
   2. Install the bolts and tighten to 10 Nm (89 lb-in).
   3. Install the nut and tighten in 2 stages.
      - Stage 1: Tighten to 5 Nm (44 lb-in).
      - Stage 2: Tighten 45 degrees.

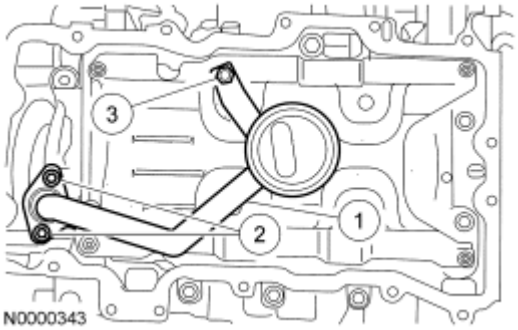


Fig. 99: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

3. Install the oil pan. For additional information, refer to **Oil Pan**.

OIL PAN BAFFLE

REMOVAL AND INSTALLATION

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Remove the oil pump screen and pickup tube. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pump Screen and Pickup Tube**.
3. Remove the 7 nuts and the oil pan baffle.
   - To install tighten the oil pan baffle nuts in 2 stages.
     - Stage 1: Tighten to 5 Nm (44 lb-in).
     - Stage 2: Tighten an additional 45 degrees.
4. To install, reverse the removal procedure.

OIL PUMP

REMOVAL

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

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

2. Remove the timing drive components. For additional information, refer to **Timing Drive Components**.
3. Remove the oil pump screen and pickup tube. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pump Screen and Pickup Tube**.
4. Remove the bolts in the sequence shown.

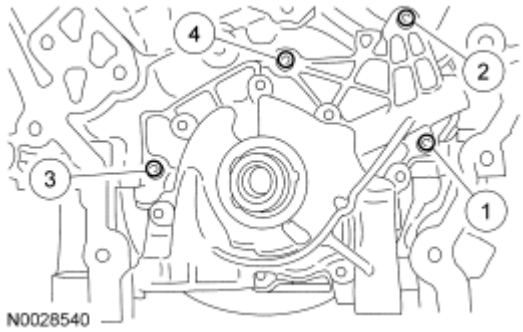


Fig. 100: Identifying Removing Sequence Of Oil Pump Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

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

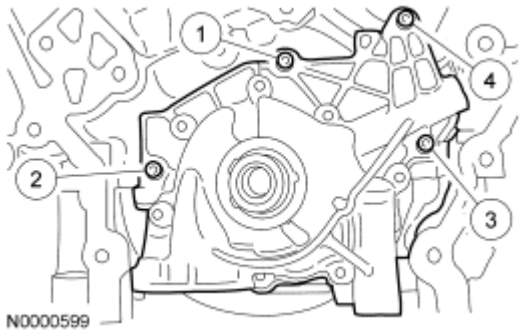


Fig. 101: Identifying Tightening Sequence Of Oil Pump Bolts
Courtesy of FORD MOTOR CO.

2. Install the oil pump screen and pickup tube. For additional information, refer to **Engine Lubrication Components - Exploded View** and **Oil Pump Screen and Pickup Tube**.
3. Install the timing drive components. For additional information, refer to **Timing Drive Components**.

ENGINE OIL PRESSURE (EOP) SWITCH

Material

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

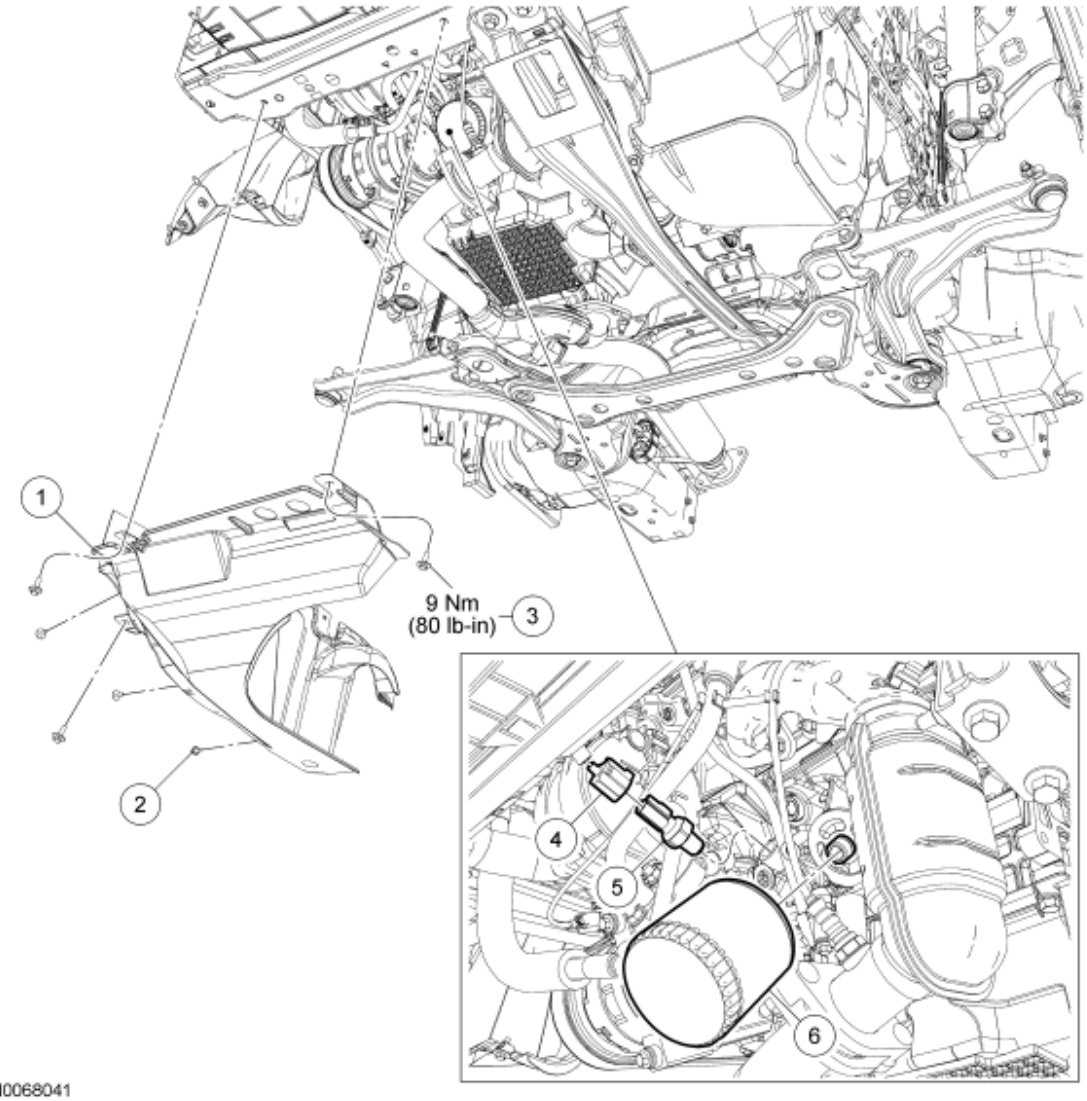


Fig. 102: Engine Oil Pressure (EOP) Switch With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	16102	RH lower splash shield
2	W706713	RH lower splash shield pin-type retainer
3	W707257	RH lower splash shield bolt (5 required)
4	14A464	Engine oil pressure (EOP) switch electrical connector (part of 9H589)
5	9278	EOP switch
6	6714	Engine oil filter

REMOVAL AND INSTALLATION

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

AND LIFTING article.

2. Remove the pin-type retainer, 5 bolts and the RH lower splash shield.
    - To install, tighten to 9 Nm (80 lb-in).

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

3. Remove the engine oil filter.
    - To install, tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.
4. Disconnect the engine oil pressure (EOP) switch electrical connector.
5. Remove the EOP switch.
    - To install, tighten to 14 Nm (10 lb-ft).
6. To install, reverse the removal procedure.
    - Apply Thread Sealant with PTFE to the EOP switch threads.

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

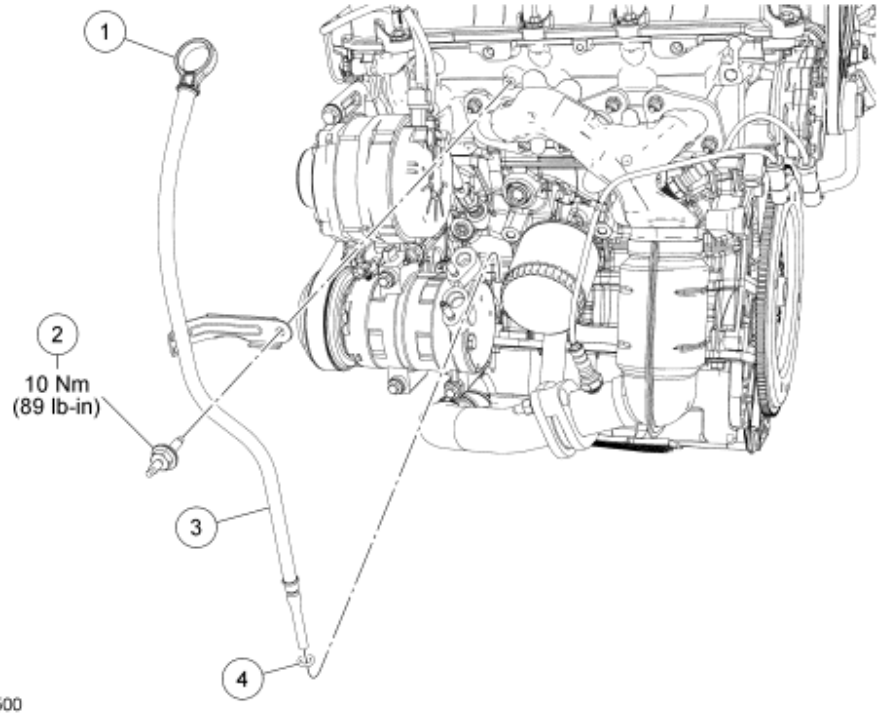


Fig. 103: Oil Level Indicator and Tube With Torque Specification
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6750	Oil level indicator
2	W701822	Oil level indicator tube stud bolt
3	6754	Oil level indicator tube
4	110282	Oil level indicator O-ring seal

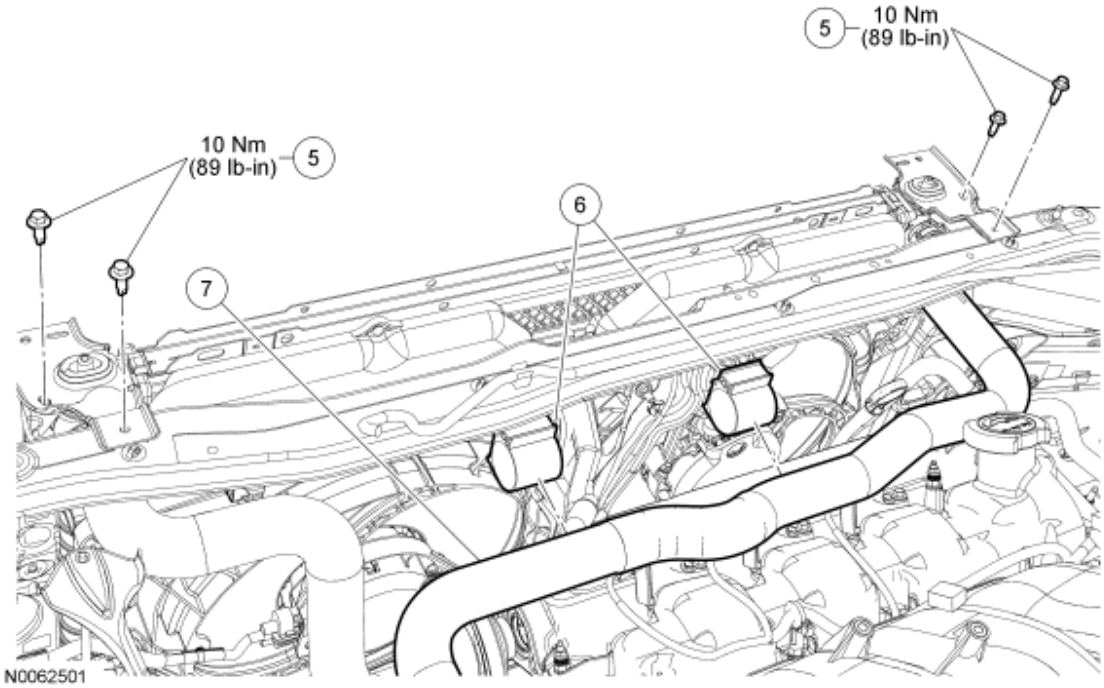


Fig. 104: Radiator Hose With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
5	W707399	Upper radiator support bracket bolts (4 required)
6	-	Upper radiator hose retaining clips (2 required) (part of 8B274)
7	8B274	Upper radiator hose

REMOVAL AND INSTALLATION

1. Detach the upper radiator hose from the 2 retaining clips on the cooling fan shroud.
   - Position the hose aside.
2. Remove the 4 upper radiator support bracket bolts.
   - To install, tighten to 10 Nm (89 lb-in).
3. Remove the oil level indicator.
4. Remove the stud bolt and then remove the oil level indicator tube by guiding it between the radiator support and the cooling fan.
   - Remove and discard the O-ring seal.
   - To install, tighten to 10 Nm (89 lb-in).

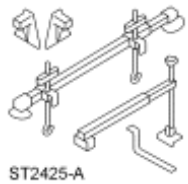
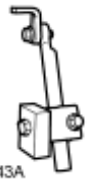
NOTE: Install a new O-ring seal and lubricate with clean engine oil.

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

5. To install, reverse the removal procedure.

ENGINE SUPPORT INSULATORS

Special Tools

Illustration	Tool Name	Tool Number
 ST2425-A	3-Bar Engine Support Kit	303-F072
 ST1595-A	Lifting Brackets, Engine	303-050 (T70P-6000)
 ST2743A	Universal Adapter Brackets	014-0001

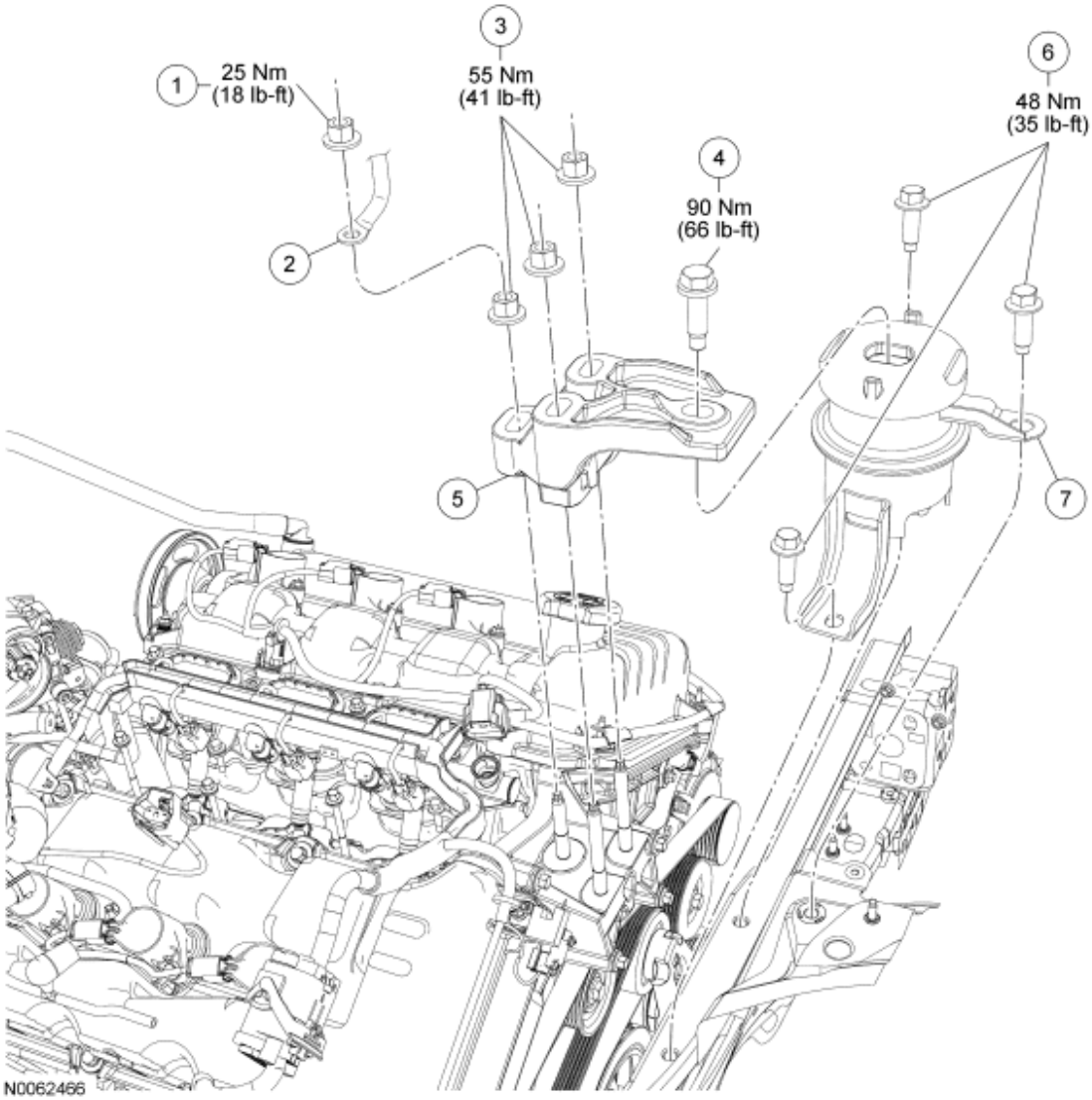


Fig. 105: Engine Support Insulator Components With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	N621942	Ground wire eyelet nut
2	-	Ground wire eyelet
3	N621942	Engine support insulator bracket nuts (3 required)
4	W709667	Engine support insulator bracket bolt
5	6061	Engine support insulator bracket
6	W500233	Engine support insulator bolts (3 required)
7	6068	Engine support insulator

REMOVAL AND INSTALLATION

1. Remove the lower intake manifold. For additional information, refer to **Lower Intake Manifold**.
2. Remove the engine support insulator bracket bolt.
   - To install, tighten to 90 Nm (66 lb-ft).
3. Install the special tools.
   1. Position the 2 universal adapter brackets on top of the cylinder block.
   2. Install 2 M8 x 1.25 x 36 mm (1.41 in) bolts and tighten to 10 Nm (89 lb-in).
   3. Position the universal lifting bracket onto the 2 universal adapter brackets.
   4. Fasten the universal lifting bracket to the 2 universal adapter brackets with a suitable nut and bolt.

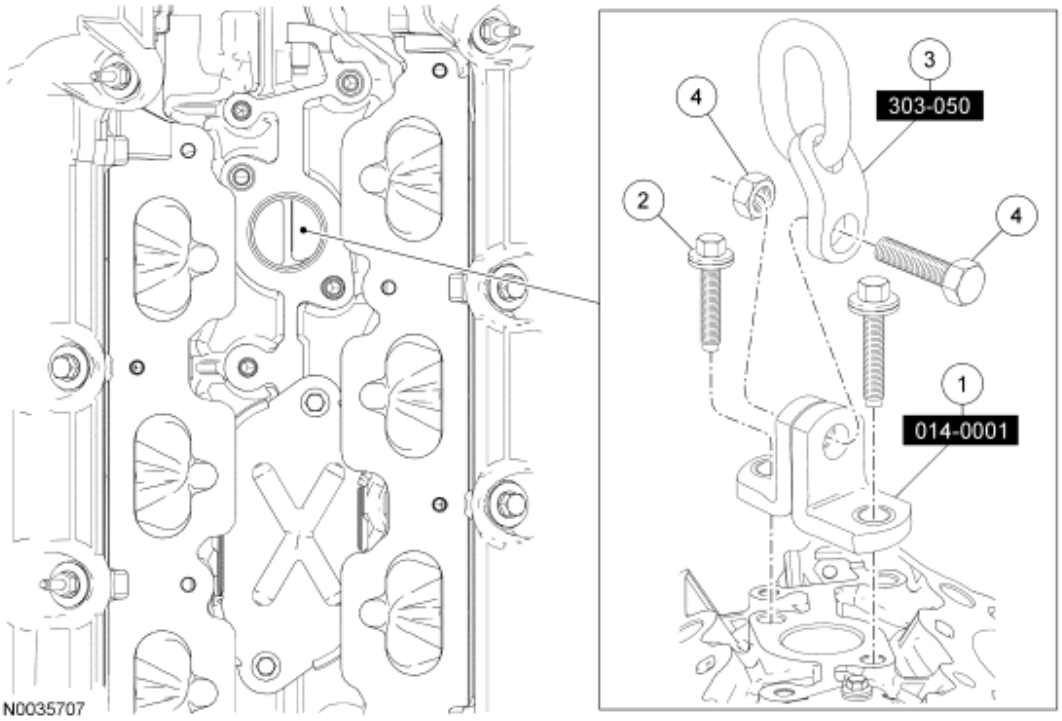


Fig. 106: Identifying Special Tools (303-050 And 014-0001)
Courtesy of FORD MOTOR CO.

4. Using the special tools, lift the engine 12 mm (0.47 in).

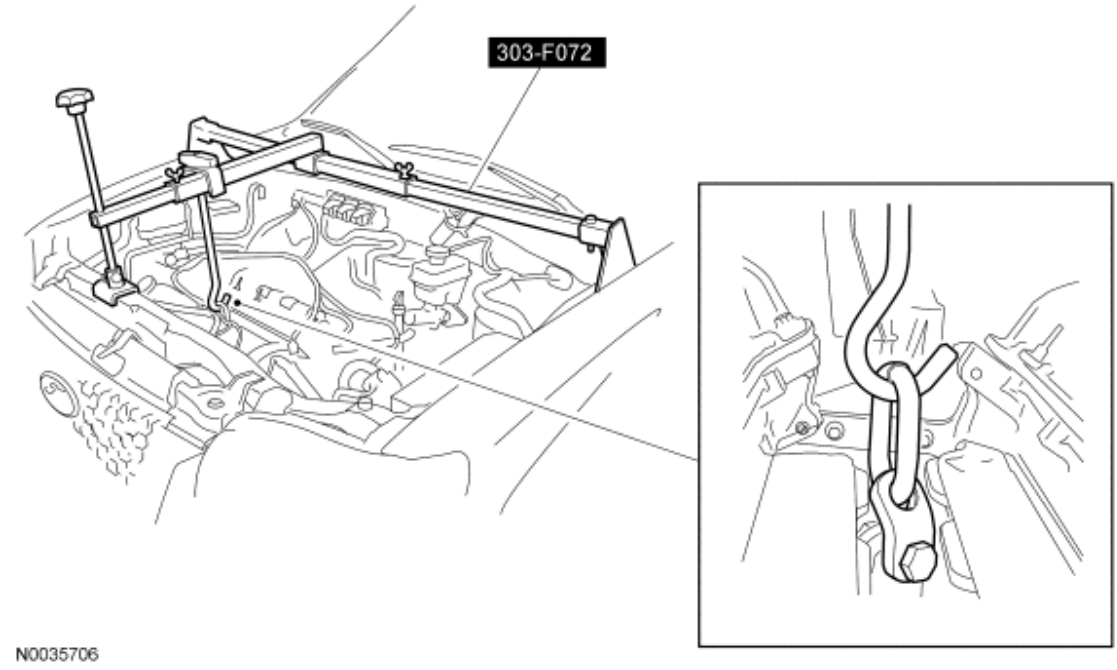


Fig. 107: Lifting Engine 12 mm (0.47 in)
Courtesy of FORD MOTOR CO.

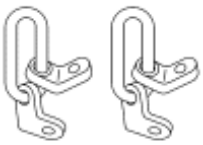
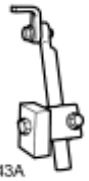
5. Remove the nut and ground wire eyelet from the engine support insulator bracket stud.
   - To install, tighten to 25 Nm (18 lb-ft).
6. Remove the 3 nuts and the engine support insulator bracket.
   - To install, tighten to 55 Nm (41 lb-ft).
7. Remove the 3 bolts and the engine support insulator.
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

REMOVAL

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST2873-A	Engine Lifting Bracket Set	303-1140

 ST1582-A	Front Drive Halfshaft Remover	205-241 (T86P-3514-A)
 ST1595-A	Lifting Brackets, Engine	303-050 (T70P-6000)
 ST1293-A	Powertrain Lift with Tilting Plate	014-00765
 ST2038-A	Remover, Halfshaft (Plate)	205-290 (T89P-3514-B) (use with 205-043)
 ST1185-A	Slide Hammer	101-001
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST1408-A	Tie-Rod End Remover	211-105 (T85M-3395-A)
 ST2743A	Universal Adapter Brackets	014-0001

REMOVAL

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING AND LIFTING** article.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
3. Remove the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
4. Remove the air cleaner outlet pipe and air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
5. Remove the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
6. Remove the lower splash shields.

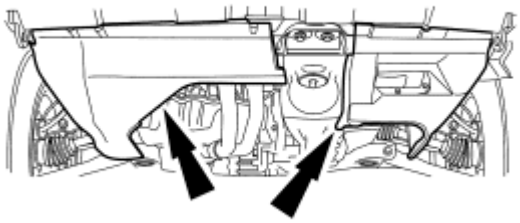


Fig. 108: Splash Shields
Courtesy of FORD MOTOR CO.

7. Disconnect the catalyst monitor sensor electrical connector and the 2 wiring harness retainers.

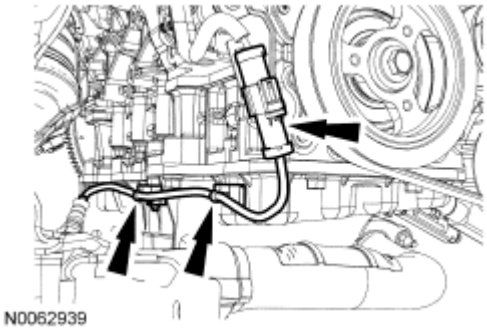


Fig. 109: Identifying Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

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

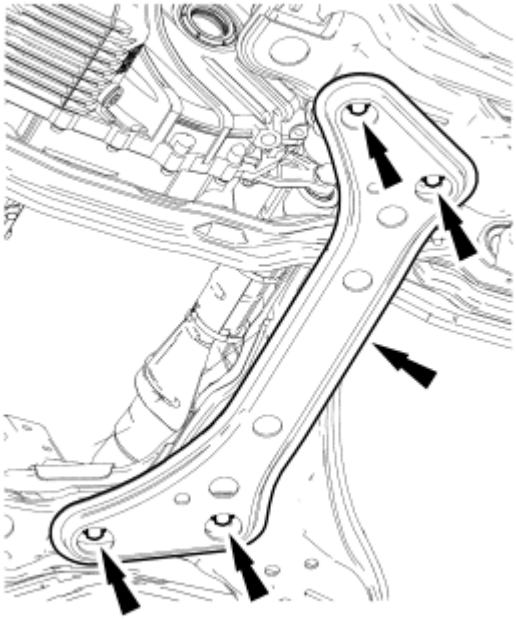


Fig. 110: Identifying Lateral Support Crossmember And Bolts
Courtesy of FORD MOTOR CO.

9. Remove and discard the 6 exhaust Y-pipe-to-catalytic converter nuts.

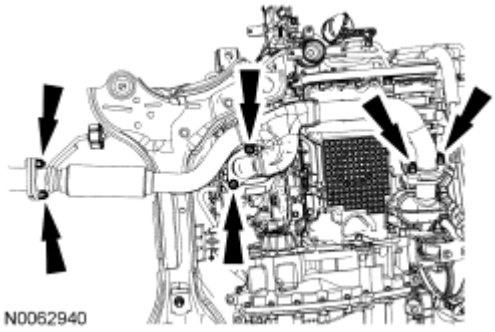


Fig. 111: Identifying Nuts
Courtesy of FORD MOTOR CO.

10. Detach the exhaust hanger and remove the exhaust Y-pipe.

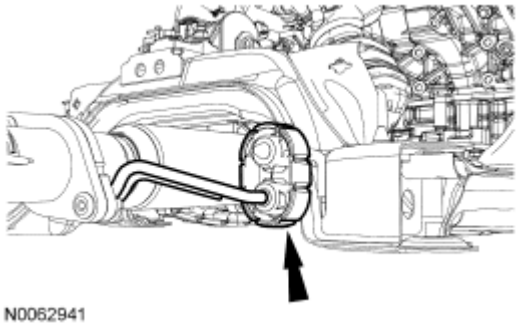


Fig. 112: Identifying Exhaust Hanger
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

11. Remove the LH and RH brake hose retainers and ABS sensor wiring harness bolts.

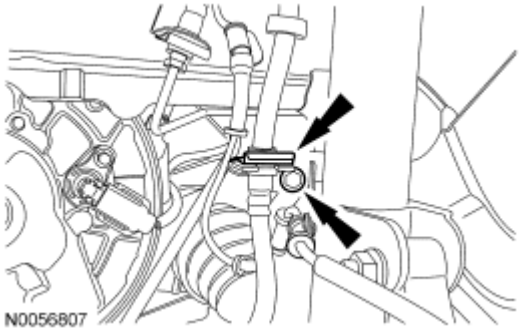


Fig. 113: Identifying Hose Retainer And Bolt
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

12. Remove the LH and RH stabilizer link-to-strut nuts.

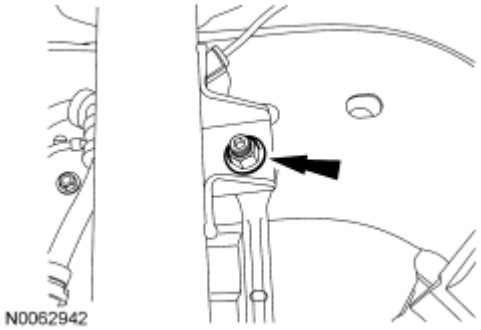


Fig. 114: Identifying Nut
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

13. Remove the LH and RH tie-rod end nuts.

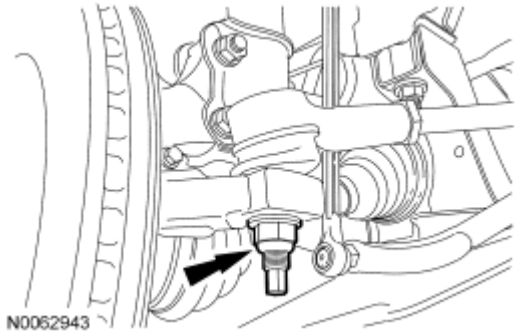


Fig. 115: Identifying Tie-Rod End Nut
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

14. Using the special tool, separate the LH and RH tie-rod ends from the steering knuckles.

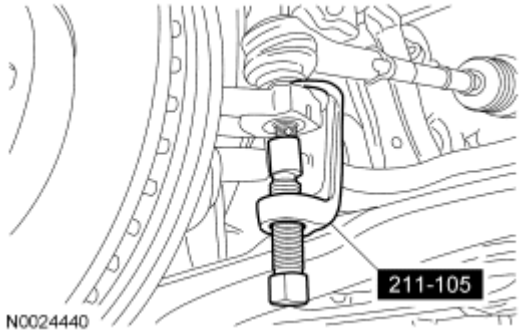


Fig. 116: Disconnecting LH And RH Tie Rod End From Steering Knuckle
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

15. Remove the LH and RH lower ball joint pinch bolts and nuts.
    - Separate the steering knuckles from the lower ball joints.

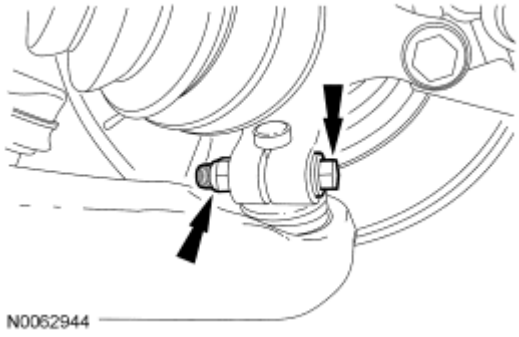


Fig. 117: Identifying Bolt And Nut
Courtesy of FORD MOTOR CO.

16. Using the special tools, separate the LH halfshaft from the transaxle.
    - Support the halfshaft with a length of mechanic's wire.

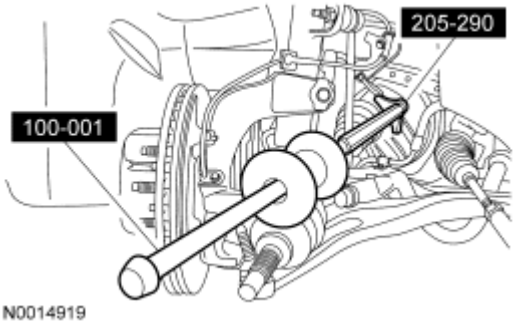


Fig. 118: Removing Front Drive Halfshaft From Differential
Courtesy of FORD MOTOR CO.

17. Using the special tools, separate the RH halfshaft from the intermediate shaft.
    - Support the halfshaft with a length of mechanic's wire.

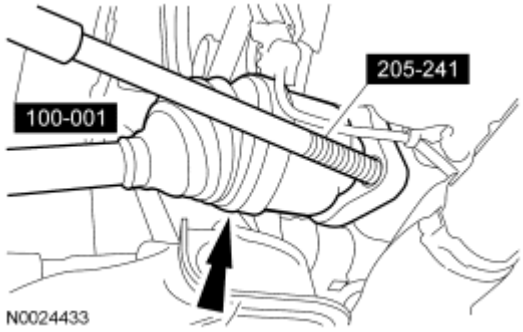


Fig. 119: Removing RH Outer Halfshaft Using Special Tools
Courtesy of FORD MOTOR CO.

18. Remove the 2 intermediate shaft retaining nuts.
    - Remove the intermediate shaft.

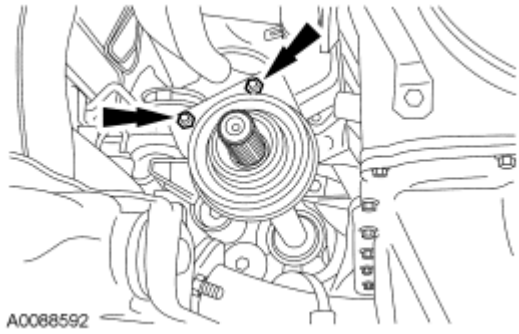


Fig. 120: Locating Intermediate Shaft Retaining Nuts
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

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

NOTE: Index-mark the drive shaft flange and power transfer unit (PTU) flange for installation.

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

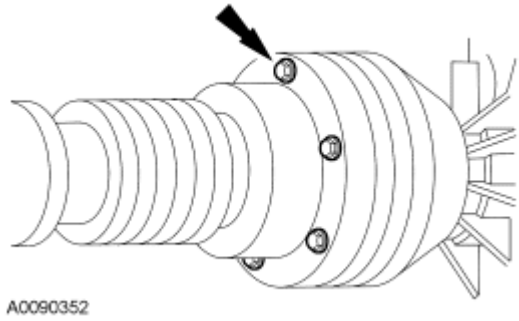


Fig. 121: Locating Driveshaft-To-Power Take Off Bolts & Washers
Courtesy of FORD MOTOR CO.

All vehicles

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

Fig. 122: Rotating Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

21. Drain the engine coolant. For additional information, refer to **ENGINE COOLING** article.
22. Drain the engine oil and install the drain plug.
    - Tighten to 26 Nm (19 lb-ft).
23. Disconnect the A/C clutch field coil electrical connector.

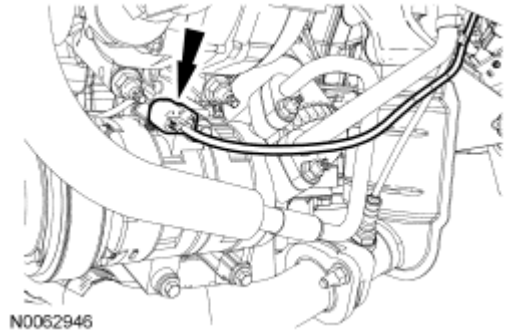


Fig. 123: Identifying Connector
Courtesy of FORD MOTOR CO.

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

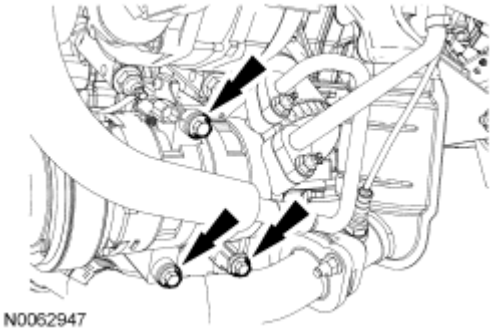


Fig. 124: IdentifyingBolts
Courtesy of FORD MOTOR CO.

25. Remove the 3 accessory drive belt idler pulley assembly bolts.

- Detach the wiring harness retainer and remove the idler pulley assembly.

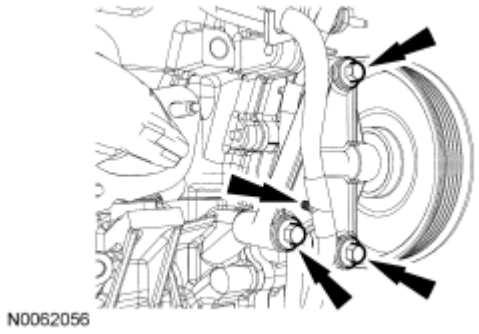


Fig. 125: Identifying Bolts
Courtesy of FORD MOTOR CO.

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

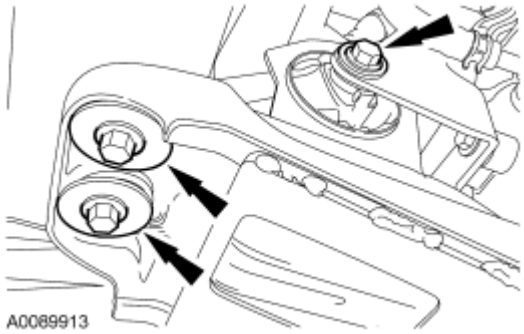


Fig. 126: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember
Courtesy of FORD MOTOR CO.

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

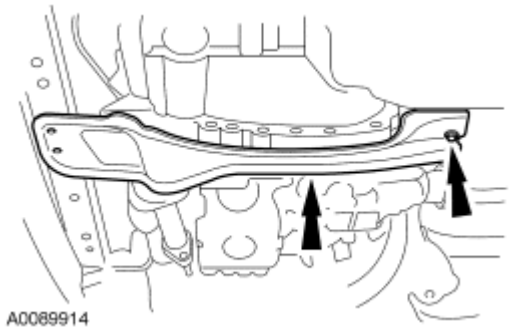


Fig. 127: Identifying Cross Brace And Rear Nut
Courtesy of FORD MOTOR CO.

28. Disconnect the 2 transmission cooler tubes (1 shown).

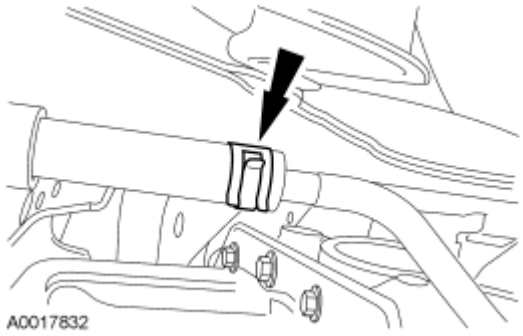


Fig. 128: Locating Transmission Cooler Tubes
Courtesy of FORD MOTOR CO.

29. Loosen the transaxle cooler tube fitting.
    - Remove the bracket bolt and the transaxle cooler tube.

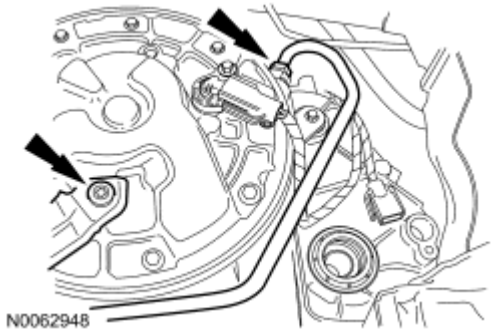


Fig. 129: Identifying Bracket Bolt And Cooler Tube
Courtesy of FORD MOTOR CO.

30. Disconnect the EGR tube fitting from the converter.

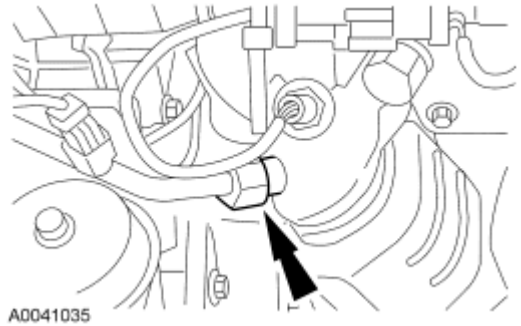


Fig. 130: Locating EGR Tube-To-RH Catalytic Converter Fitting
Courtesy of FORD MOTOR CO.

31. Remove the 2 bolts and the accelerator cable snow shield.

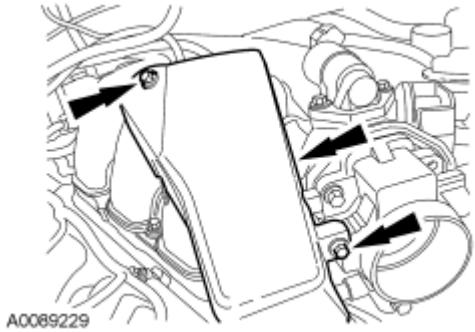


Fig. 131: Locating Accelerator Cable Snow Shield Bolts
Courtesy of FORD MOTOR CO.

32. Disconnect the accelerator cable and the speed control actuator cable.
    - Remove the 2 accelerator cable bracket bolts.

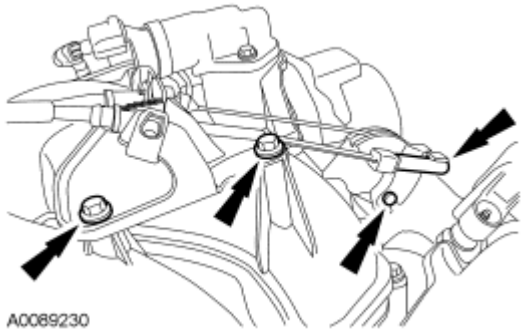


Fig. 132: Accelerator Cable, Speed Control Actuator Cable & Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

33. Remove the bolt and position the cables and brackets aside.

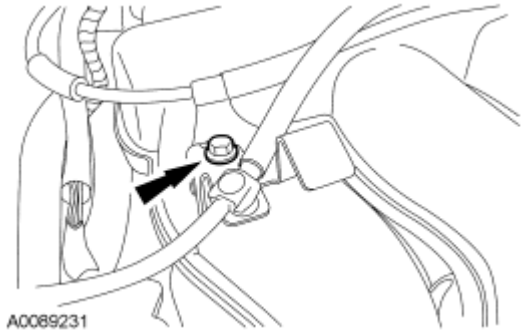


Fig. 133: Cable Bracket
Courtesy of FORD MOTOR CO.

34. Disconnect the upper and lower radiator hoses.

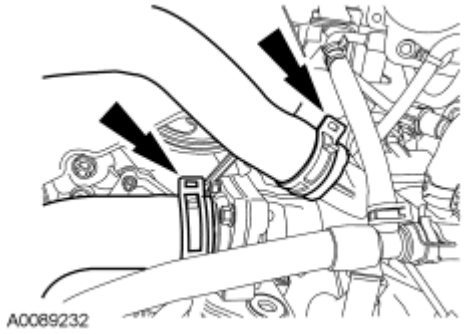


Fig. 134: Locating Hoses
Courtesy of FORD MOTOR CO.

35. Disconnect the heater hoses and the throttle body coolant hose.

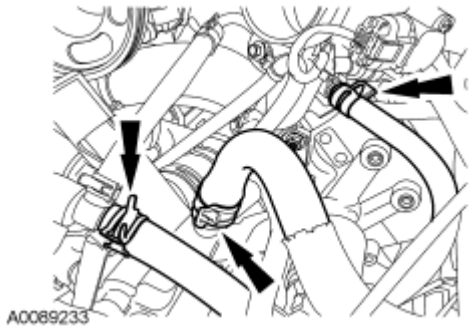


Fig. 135: Locating Heater Hoses & Throttle Body Coolant Hose
Courtesy of FORD MOTOR CO.

36. Detach the transaxle vent tube retainer from the throttle body.

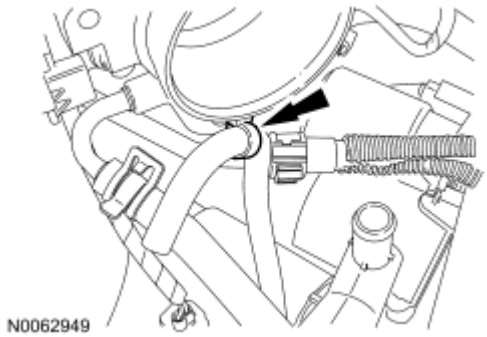


Fig. 136: Identifying Retainer
Courtesy of FORD MOTOR CO.

37. Disconnect the fuel supply tube quick connect coupling. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
38. Disconnect the gearshift cable from the transaxle.

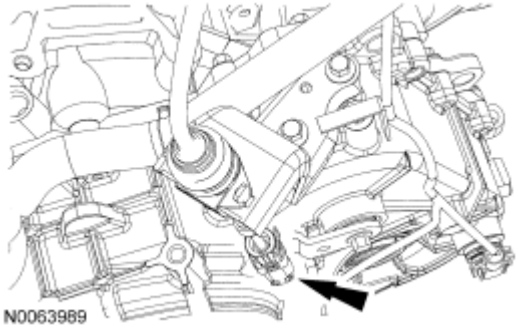


Fig. 137: Identifying Gearshift Cable
Courtesy of FORD MOTOR CO.

39. Disconnect the wire harness retainer from the shift cable bracket, remove the 2 remaining bolts, and position the cable and bracket aside.

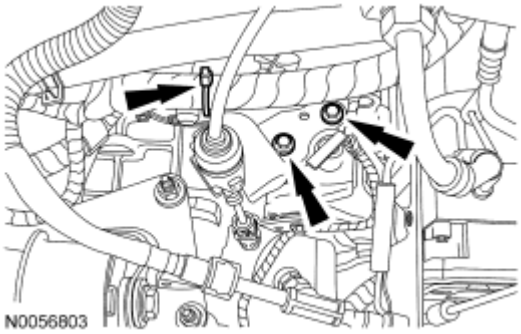


Fig. 138: Identifying Harness Retainer And Bolts
Courtesy of FORD MOTOR CO.

40. Disconnect the differential pressure feedback EGR sensor electrical connector and detach the pin-type retainer.

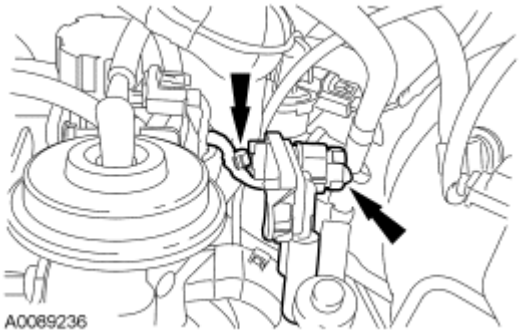


Fig. 139: Locating EGR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

41. Disconnect the EGR tube fitting and remove the EGR tube and the differential pressure feedback EGR sensor as an assembly.

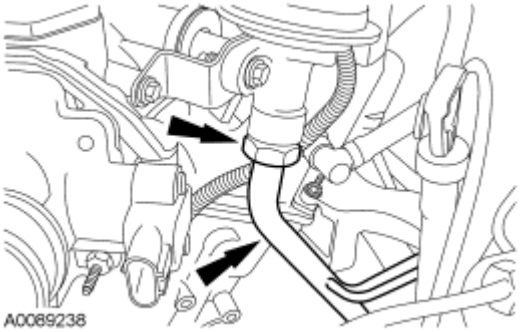


Fig. 140: Locating Exhaust Gas Recirculation (EGR) Tube
Courtesy of FORD MOTOR CO.

42. Disconnect the evaporative emissions (EVAP) canister purge valve tube from the intake manifold.

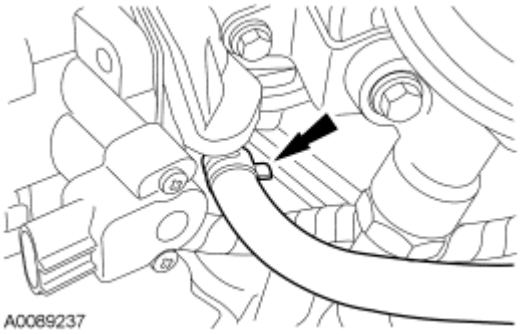


Fig. 141: Locating Vacuum Tube Retainer
Courtesy of FORD MOTOR CO.

43. Disconnect the brake booster vacuum tube from the intake manifold.

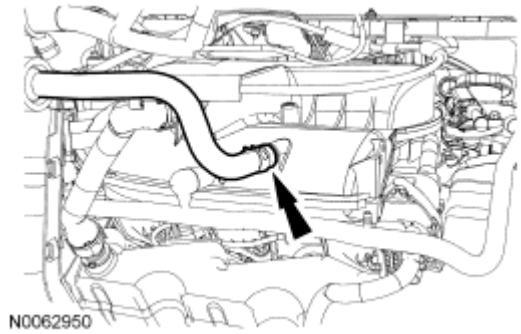


Fig. 142: Identifying Brake Booster Vacuum Tube
Courtesy of FORD MOTOR CO.

44. Disconnect the manifold absolute pressure (MAP) sensor vacuum tube and electrical connector.

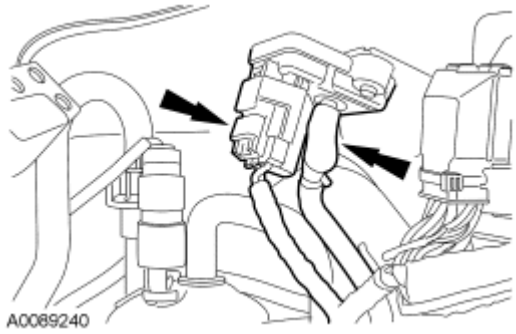


Fig. 143: Locating Manifold Absolute Pressure (MAP) Sensor Vacuum Tube & Electrical Connector
Courtesy of FORD MOTOR CO.

45. Disconnect the PCM electrical connectors and remove the nut.

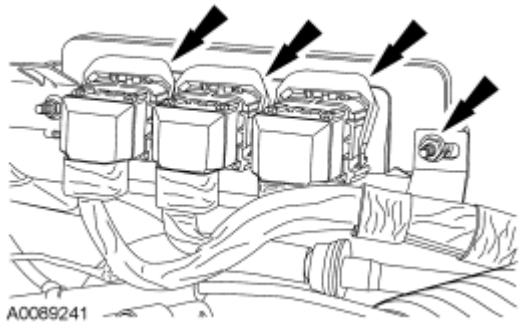


Fig. 144: Locating Powertrain Control Module (PCM) Electrical Connectors
Courtesy of FORD MOTOR CO.

46. Remove the bolt and detach the ground wire.

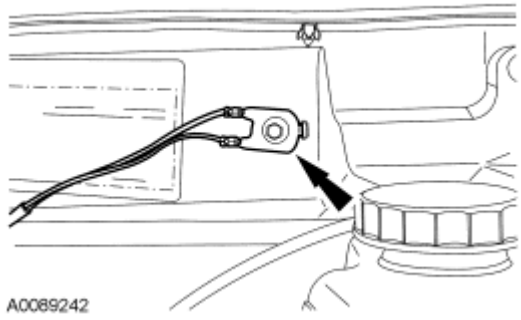


Fig. 145: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

47. Remove the nut and disconnect the cable from the power distribution box.

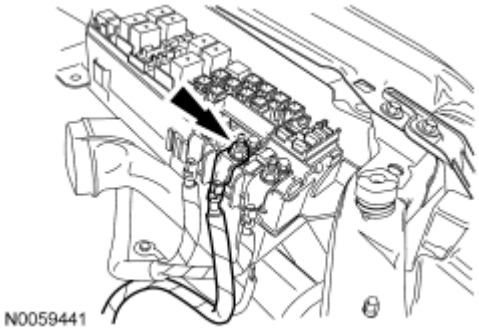


Fig. 146: Identifying Nut
Courtesy of FORD MOTOR CO.

48. Disconnect the electrical connector from the power distribution box.

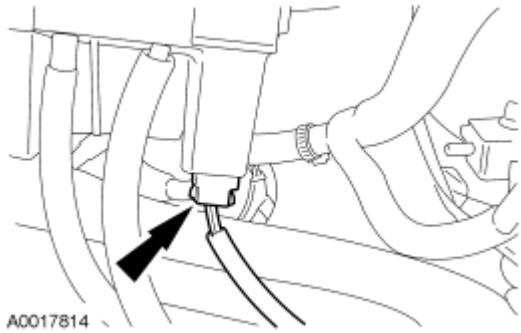


Fig. 147: Power Distribution Box Electrical Connector
Courtesy of FORD MOTOR CO.

49. Remove the bolt and disconnect the ground wire and the electrical connector.

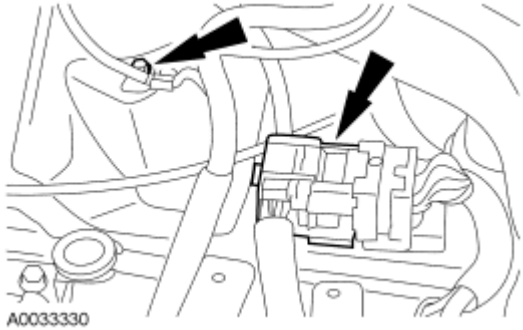


Fig. 148: Locating Ground Strap & Electrical Connector
Courtesy of FORD MOTOR CO.

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

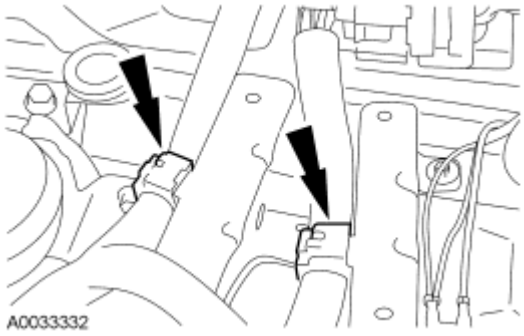


Fig. 149: Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

51. Remove the nut and disconnect the wire from the battery cable.

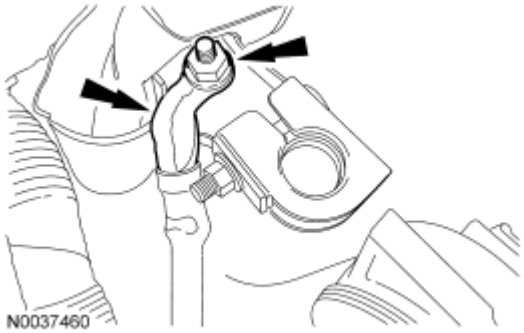


Fig. 150: Locating Battery Cable And Nut
Courtesy of FORD MOTOR CO.

52. Remove the nut and the ground wire from the engine mount stud.

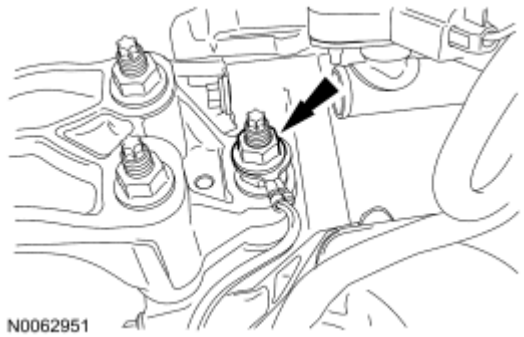


Fig. 151: Identifying Stud
Courtesy of FORD MOTOR CO.

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

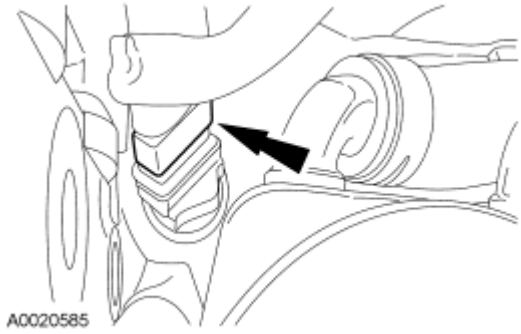


Fig. 152: Locating Engine Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

54. Disconnect the output shaft speed (OSS) sensor electrical connector and remove the bolt and the OSS sensor.

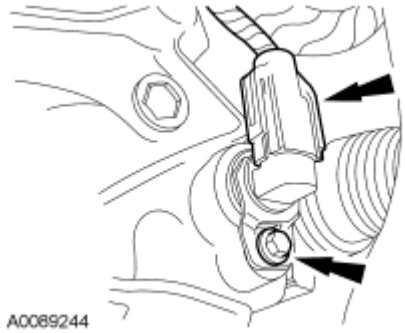


Fig. 153: Locating Output Shaft Speed (OSS) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

55. Remove the torque converter inspection cover.

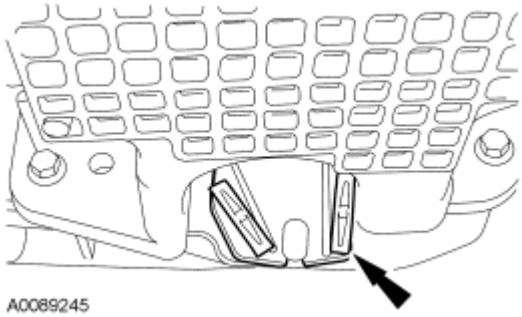


Fig. 154: Locating Torque Converter Inspection Cover
Courtesy of FORD MOTOR CO.

56. Remove the 4 torque converter nuts.

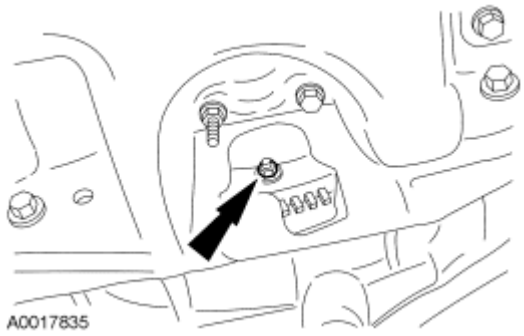


Fig. 155: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

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

Fig. 156: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

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

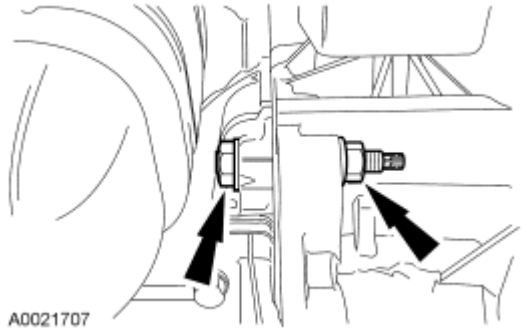


Fig. 157: Locating Transaxle Bolt
Courtesy of FORD MOTOR CO.

CAUTION: Do not allow the engine oil pan to rest on the powertrain lift. Doing so may cause damage to the oil pan.

59. Using the special tools, secure the engine and transaxle to the powertrain lift.

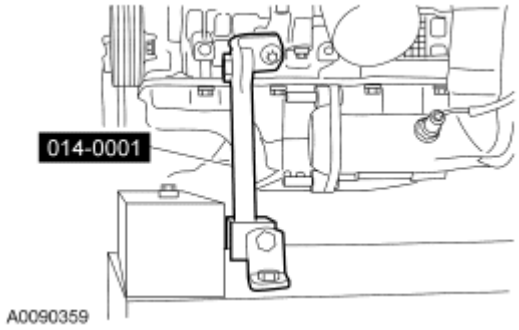


Fig. 158: Securing Engine & Transaxle To Powertrain Lift Using Special Tool (014-0001)
Courtesy of FORD MOTOR CO.

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

60. Remove the RH transaxle support insulator bolt.

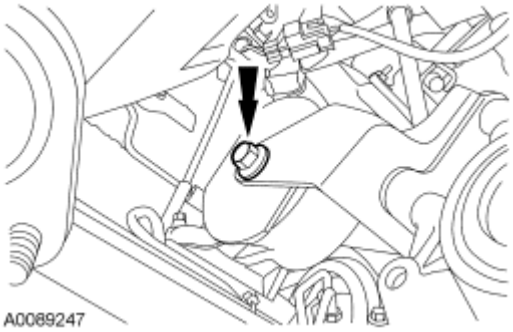


Fig. 159: Locating RH Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

61. Remove the bolt, nuts and the RH transaxle support insulator.

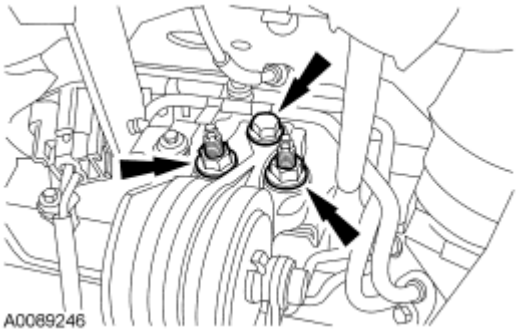


Fig. 160: Locating Transaxle Support Insulator Bolt & Nuts
Courtesy of FORD MOTOR CO.

62. Remove the rear transaxle support bolt.

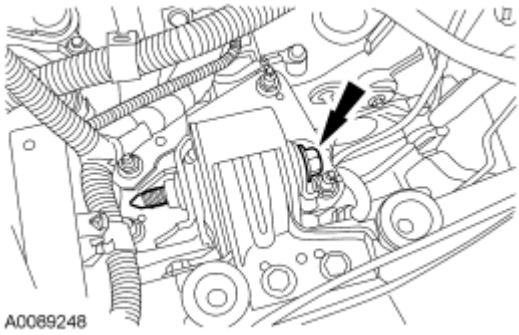


Fig. 161: Locating Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

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

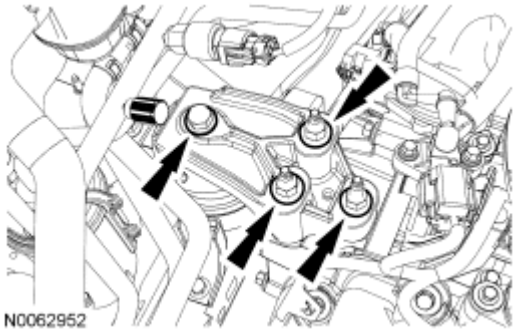


Fig. 162: Identifying Nuts And Bolt
Courtesy of FORD MOTOR CO.

64. Lower the powertrain from the vehicle.
65. Disconnect the LH heated exhaust gas oxygen (HEGO) sensor and LH catalyst monitor sensor electrical connectors.
    - Detach the 3 pin-type retainers from the transaxle support bracket.

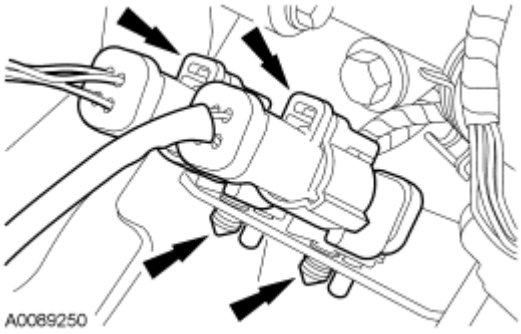


Fig. 163: Locating Heated Oxygen & Catalyst Monitor Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

66. Disconnect the transmission range (TR) sensor electrical connector.

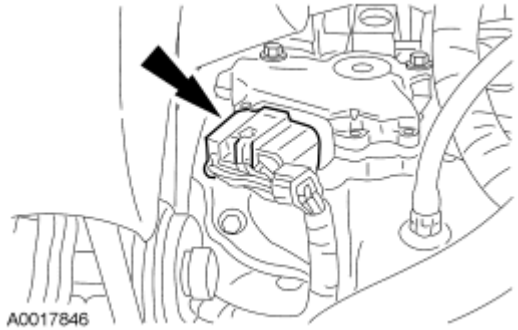


Fig. 164: Locating Transmission Range (TR) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

67. Disconnect the transtransaxle electronic control switch electrical connector.

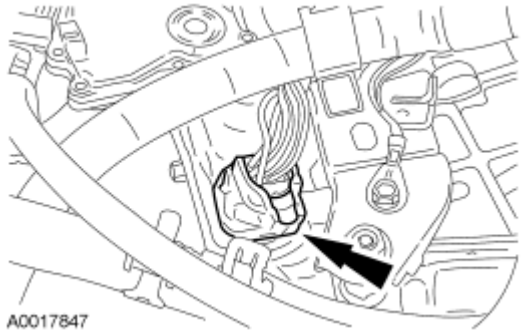


Fig. 165: Locating Transaxle Wiring Harness Electronic Control Switch Electrical Connector
Courtesy of FORD MOTOR CO.

68. Detach the wiring harness from the bracket.

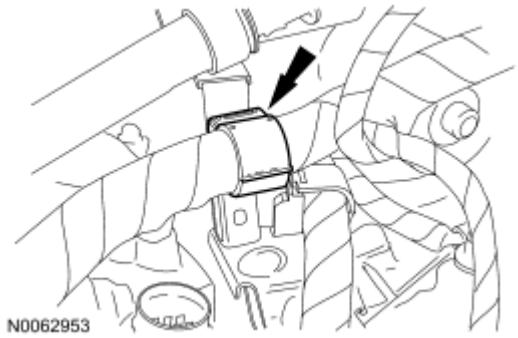


Fig. 166: Identifying Bracket
Courtesy of FORD MOTOR CO.

69. Disconnect the turbine speed sensor (TSS) electrical connector.
    - Detach the 2 wiring harness retainers.

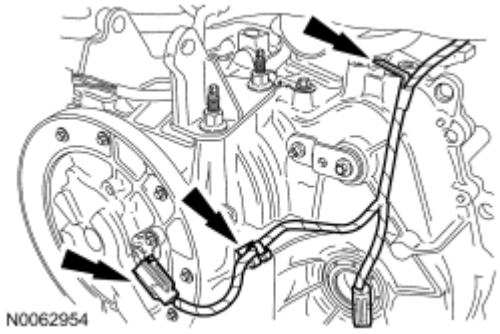


Fig. 167: Identifying (TSS) Connector And Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

AWD vehicles

70. Disconnect the RH HO2S electrical connector.

Fig. 168: Identifying RH HO2S Connector
Courtesy of FORD MOTOR CO.

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

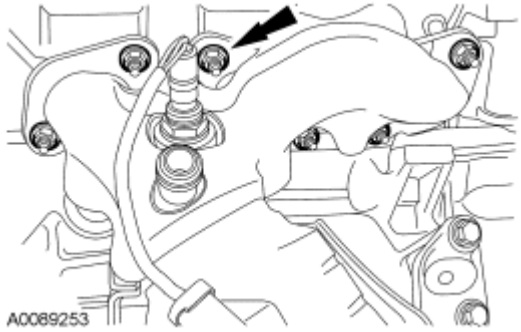


Fig. 169: Locating Nuts & Gasket
Courtesy of FORD MOTOR CO.

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

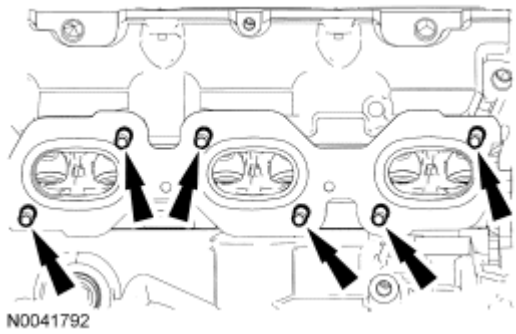


Fig. 170: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

73. Remove the 6 bolts and the halfshaft support bracket.

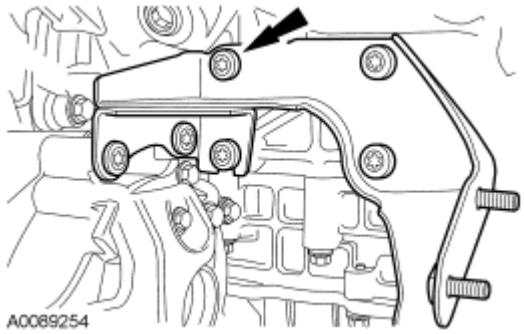


Fig. 171: Locating Half Shaft Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

74. Remove the bolt, detach the pin-type retainer and position the power transfer unit (PTU) vent tube aside.

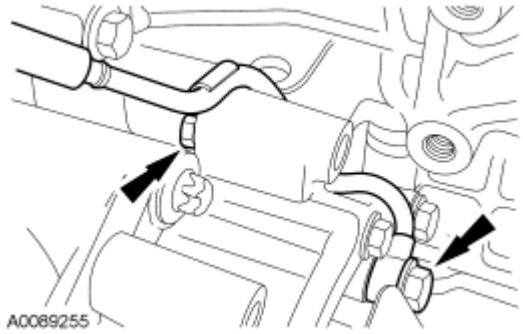


Fig. 172: Locating Pin-Type Retainer & Bolt
Courtesy of FORD MOTOR CO.

75. Remove the 3 PTU bolts.

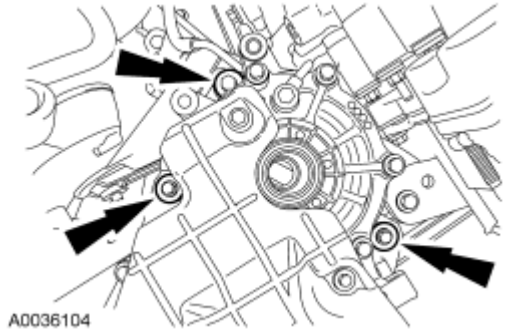


Fig. 173: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

76. Remove the bolt and the PTU.

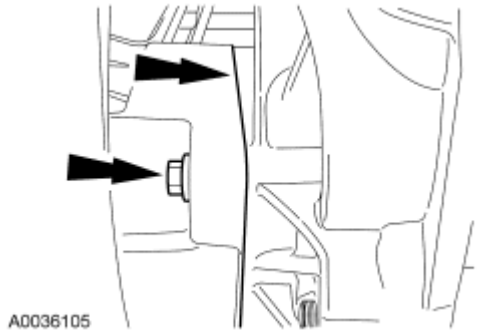


Fig. 174: Locating Transfer Case Bolt & Transfer Case Unit
Courtesy of FORD MOTOR CO.

All vehicles

77. Remove the nut and detach wiring harness retainer.

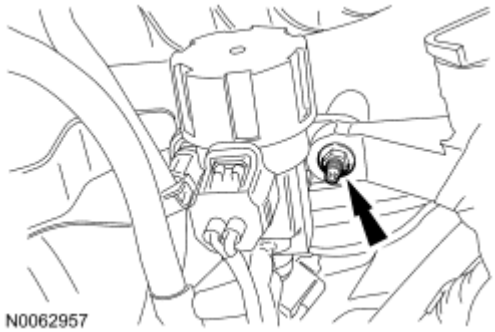


Fig. 175: Identifying Nut
Courtesy of FORD MOTOR CO.

78. Remove the 2 stud bolts and position the EGR regulator aside.

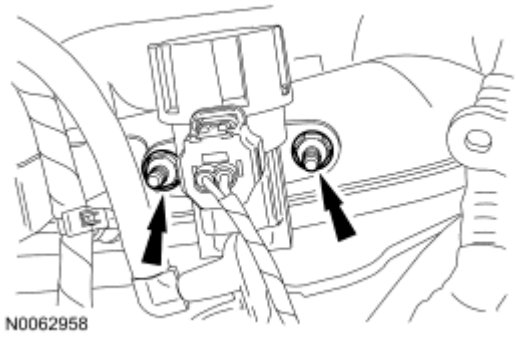


Fig. 176: Identifying Bolts
Courtesy of FORD MOTOR CO.

NOTE: When installing the lower half of the lifting bracket it will be easier to loosely install the upper bolt first then install the lower bolt.

79. Install the lower half of the special tool.

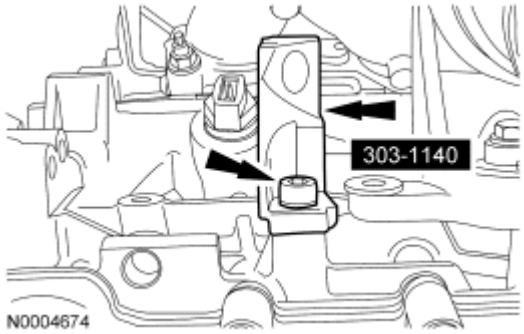


Fig. 177: Identifying Lower Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

80. Install the upper half of the special tool.

Fig. 178: Identifying Upper Half Of Lifting Hook
Courtesy of FORD MOTOR CO.

81. Install the special tools to the front of the RH cylinder head.

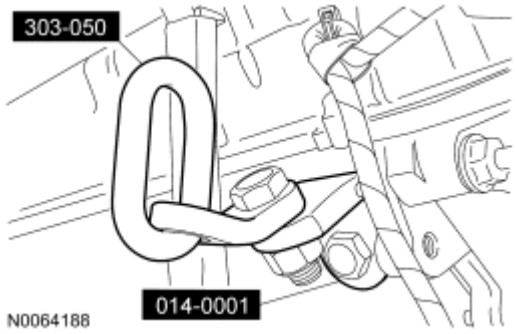


Fig. 179: Identifying Special Tools (303-050 And 014-0001)
Courtesy of FORD MOTOR CO.

82. Install the special tools to the rear of the LH cylinder head.

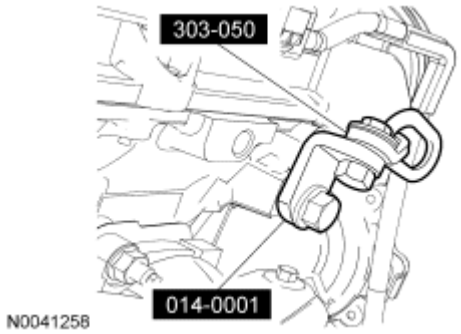


Fig. 180: Identifying Special Tools (303-050 And 014-0001)
Courtesy of FORD MOTOR CO.

83. Using the special tools and a suitable engine crane, remove the engine and transaxle from the lift table.

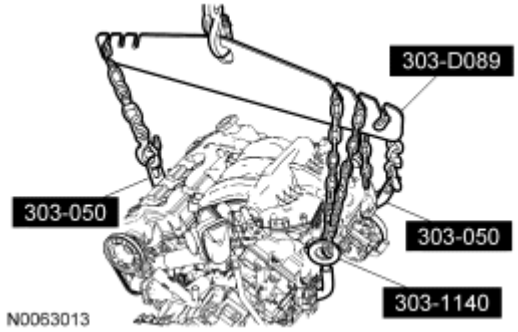


Fig. 181: Identifying Special Tools
Courtesy of FORD MOTOR CO.

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

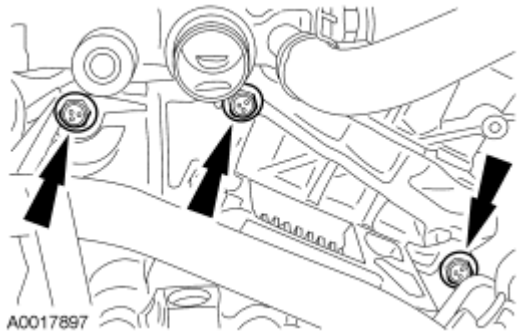


Fig. 182: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

85. Using the special tools and a suitable engine crane, separate the engine and transaxle.

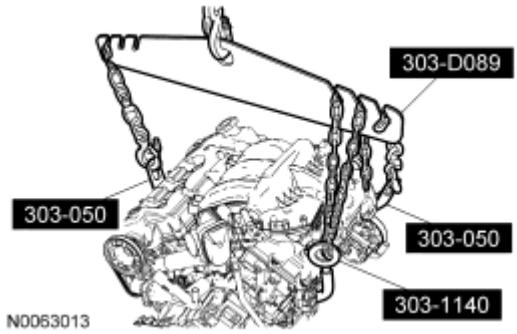
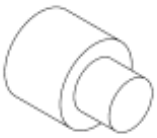


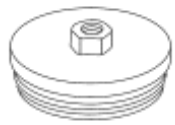
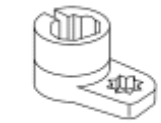
Fig. 183: Identifying Special Tools
Courtesy of FORD MOTOR CO.

DISASSEMBLY

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST3044-A	Plate, Water Pump Pulley	303-456 (T94P-6312-AH1), part of 303-S455
 ST3045-A	Protector, Water Pump Shaft	303-457 (T94P-6312-AH2), part of 303-S455

 ST1382-A	Remover, Crankshaft Rear Oil Seal	303-519 (T95P-6701-EH)
 ST1286-A	Remover, Crankshaft Vibration Damper	303-009 (T58P-6316-D)
 ST1385-A	Remover, Oil Seal	303-409 (T92C-6700CH)
 ST1187-A	Slide Hammer	307-005 (T59L-100-B)
 ST1447-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)
 ST1438-A	Strap Wrench	303-D055 (D85L-6000-A)

Material

Item	Specification
Penetrating and Lock Lubricant XL-1 (US); CXC-51-A (Canada)	-

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

NOTE: For additional information, refer to the exploded view under the assembly

procedure in this article.

All vehicles

1. Remove the bolts and the flexplate.

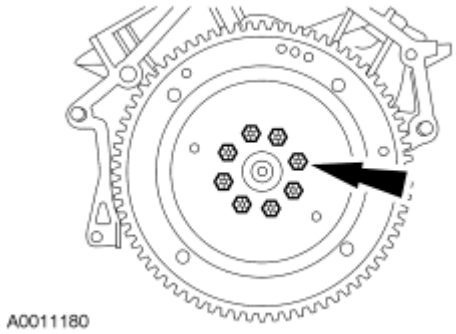


Fig. 184: Locating Flexplate & Bolts
Courtesy of FORD MOTOR CO.

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

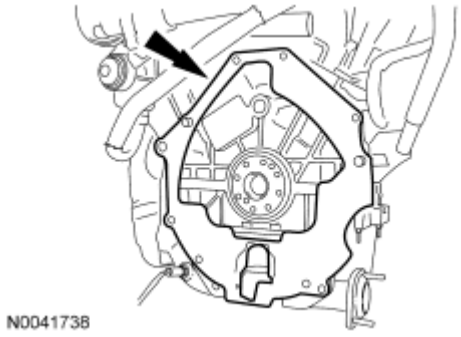


Fig. 185: Locating Engine-To-Transaxle Separator Plate
Courtesy of FORD MOTOR CO.

3. Using the special tools, remove and discard the crankshaft rear oil seal.

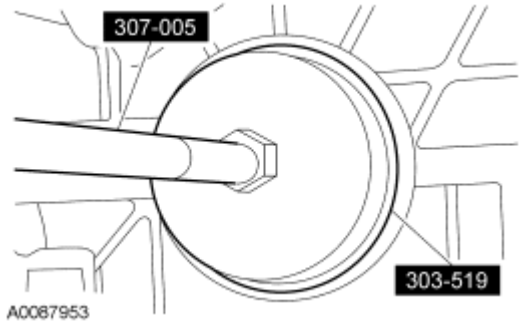


Fig. 186: Identifying Special Tools (307-005 And 303-519)

Courtesy of FORD MOTOR CO.

4. Mount the engine on a suitable stand.
5. Detach the wiring harness connectors from the upper intake manifold.

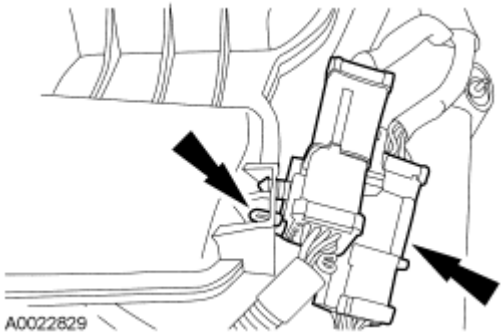


Fig. 187: Locating Engine Control Sensor Wiring Connectors
Courtesy of FORD MOTOR CO.

6. Detach the wiring harness retainer, remove the nut and the catalyst monitor sensor electrical connector bracket.

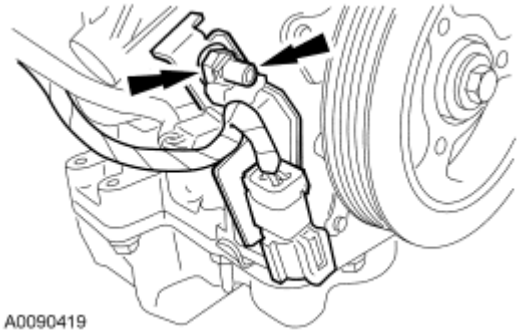


Fig. 188: Locating Heated Oxygen Sensor (HO2S) Electrical Connector Bracket
Courtesy of FORD MOTOR CO.

7. Disconnect the crankshaft position (CKP) sensor electrical connector and detach the wiring harness retainers.

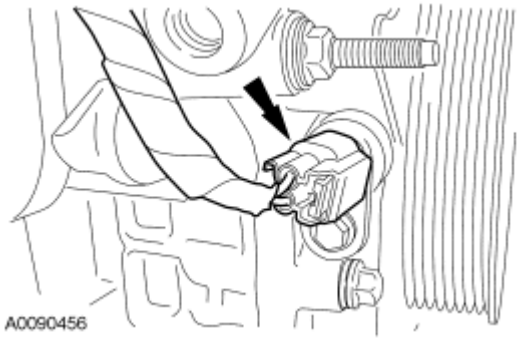


Fig. 189: Locating Crankshaft Position (CKP) Sensor Electrical Connector

Courtesy of FORD MOTOR CO.

8. Disconnect the exhaust gas recirculation (EGR) vacuum regulator electrical connector.

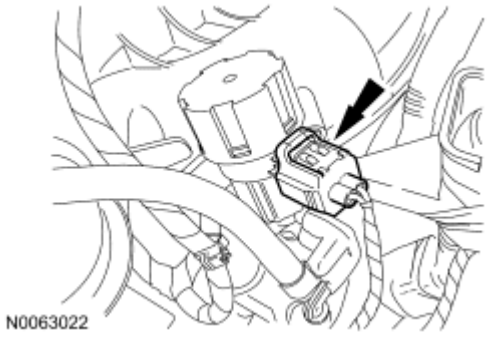


Fig. 190: Identifying (EGR) Connector
Courtesy of FORD MOTOR CO.

9. Remove the 2 wiring harness retaining nuts.

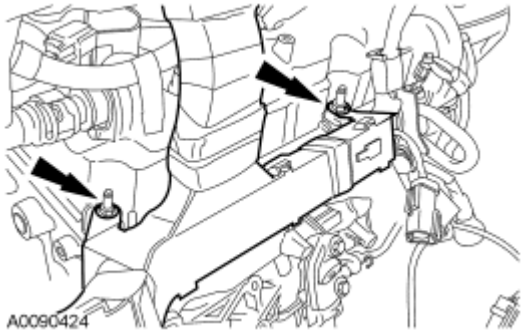


Fig. 191: Locating Engine Control Wiring Harness & Nuts
Courtesy of FORD MOTOR CO.

10. Disconnect the idle air control (IAC) valve and the throttle position (TP) sensor electrical connectors.
    - Detach the wiring harness retainer.

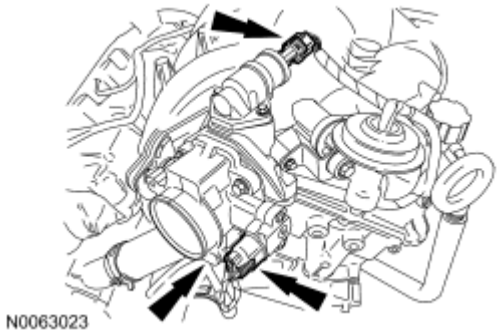


Fig. 192: Identifying (IAC) Valve, (TP) Connector And Retainer
Courtesy of FORD MOTOR CO.

11. Remove the PCV tube.

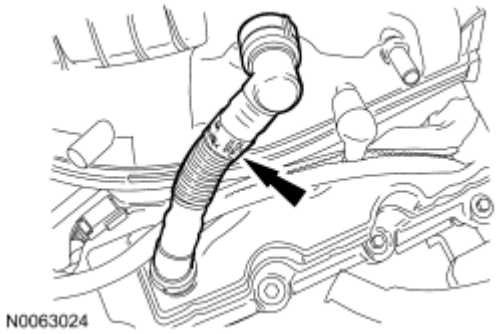


Fig. 193: Identifying PCV Tube
Courtesy of FORD MOTOR CO.

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

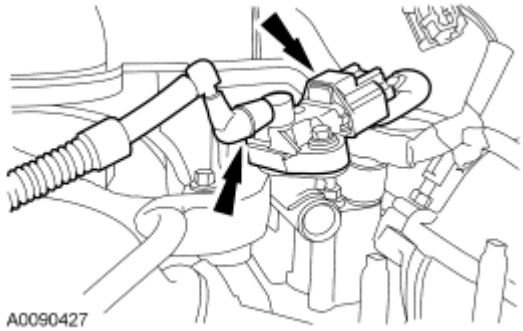


Fig. 194: Locating Fuel Rail Pressure & Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

13. Disconnect the throttle body coolant hose.

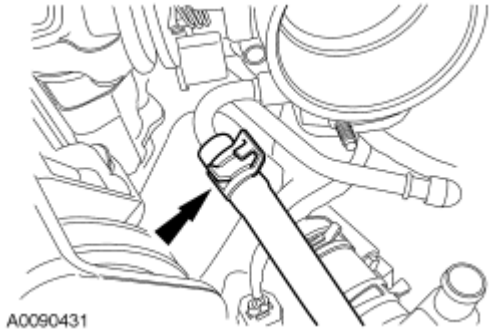


Fig. 195: Locating Throttle Body Coolant Hose
Courtesy of FORD MOTOR CO.

14. Remove the bolts and upper intake manifold.
    - Discard the gaskets.

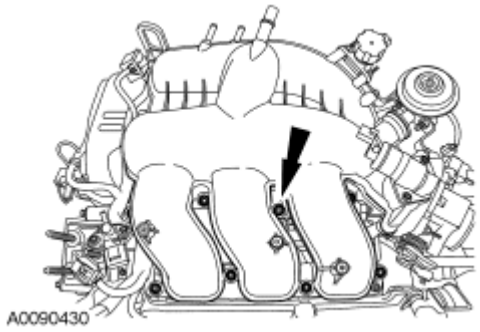


Fig. 196: Locating Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

15. Disconnect the engine coolant temperature (ECT) sensor electrical connector.

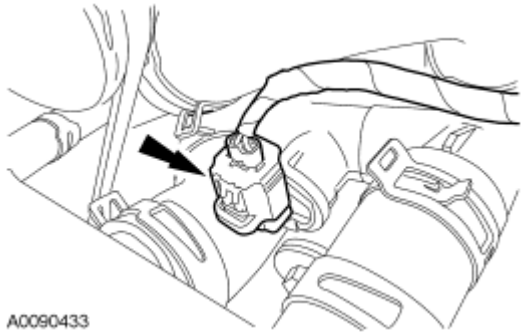


Fig. 197: Locating Engine Coolant Temperature (ECT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

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

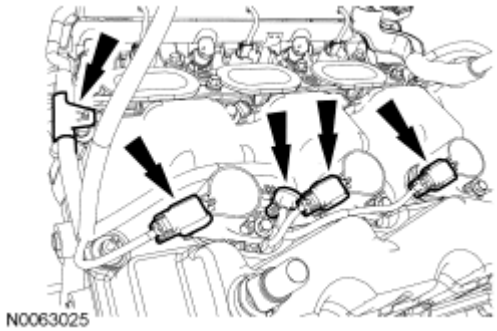


Fig. 198: Identifying Connectors
Courtesy of FORD MOTOR CO.

17. Disconnect the radio interference capacitor electrical connector.
    - Detach the wiring harness retainers.

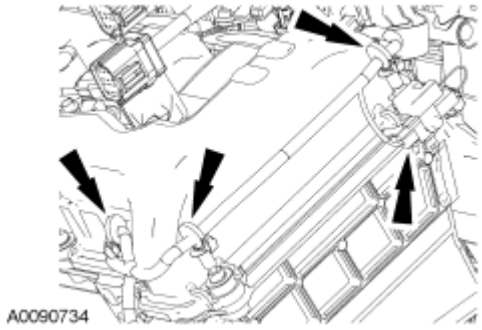


Fig. 199: Locating Radio Interference Capacitor Electrical Connector
Courtesy of FORD MOTOR CO.

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

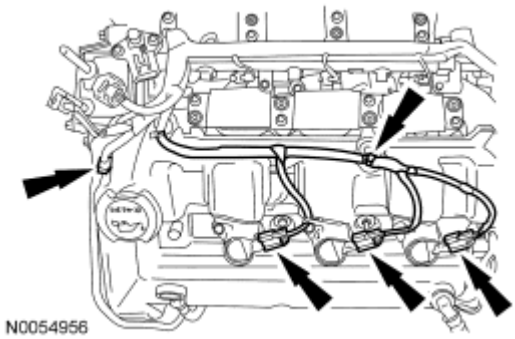


Fig. 200: Coil-On-Plug Electrical Connectors & Wiring Retainers
Courtesy of FORD MOTOR CO.

19. Disconnect the camshaft position sensor (CMP) and engine oil pressure (EOP) switch electrical connectors.
    - Detach the wiring harness retainers.

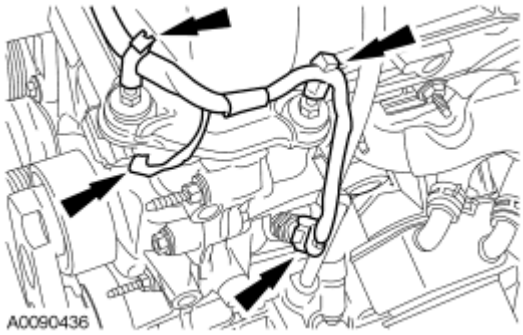


Fig. 201: Locating Camshaft Position Sensor (CMP) & Oil Pressure Sensor Electrical Connectors & Wiring Retainers
Courtesy of FORD MOTOR CO.

20. Disconnect the generator electrical connector.

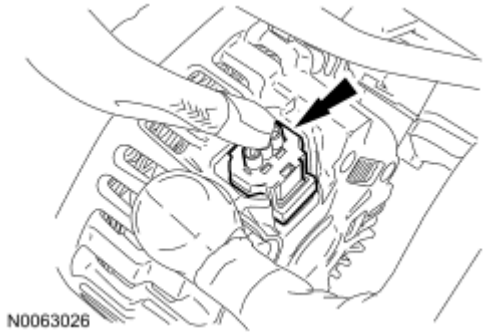


Fig. 202: Identifying Connector
Courtesy of FORD MOTOR CO.

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

Fig. 203: Identifying Nut
Courtesy of FORD MOTOR CO.

22. Disconnect the 6 fuel injector electrical connectors.

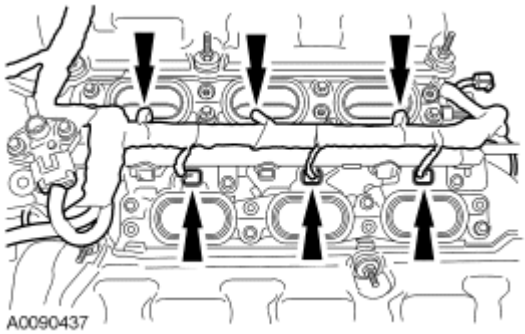


Fig. 204: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

23. Detach the 2 wiring harness retainers (1 shown).
    - Remove the fuel charging wiring harness from the engine.

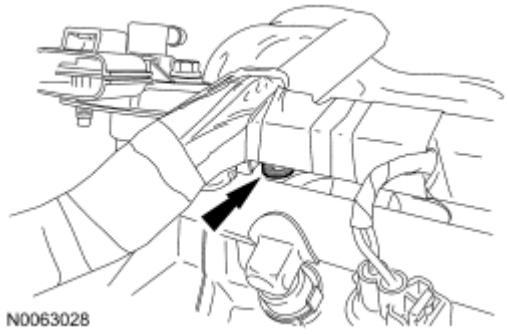


Fig. 205: Identifying Harness Retainer
Courtesy of FORD MOTOR CO.

24. Remove the nut and detach the 4 wiring harness retainers.
    - Remove the B+ harness from the engine.

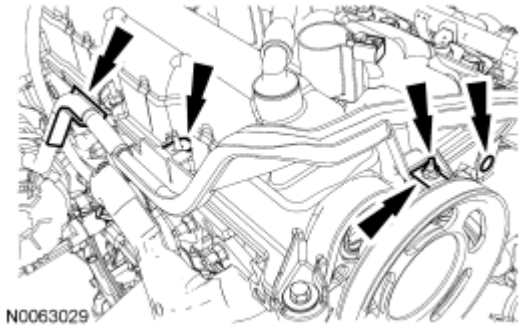


Fig. 206: Identifying Harness Retianers
Courtesy of FORD MOTOR CO.

25. Remove the bolts and the lower intake manifold.
    - Discard the gaskets.

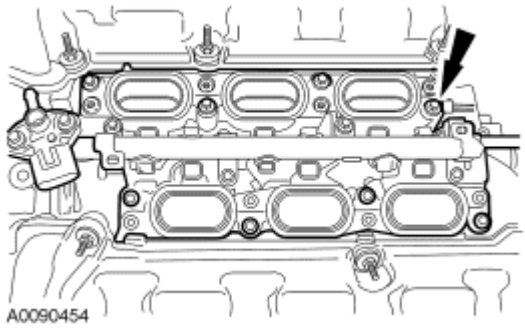


Fig. 207: Locating Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

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

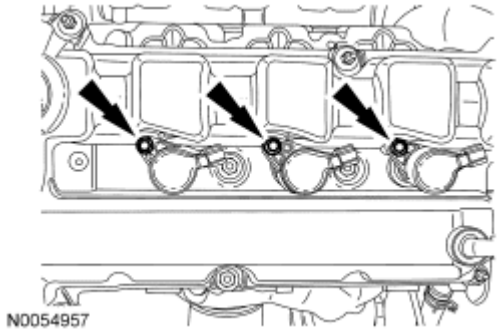


Fig. 208: Coil-On-Plug Bolts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

27. Disconnect the RH heated oxygen sensor (HO2S) electrical connector.

Fig. 209: Identifying Connector
Courtesy of FORD MOTOR CO.

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

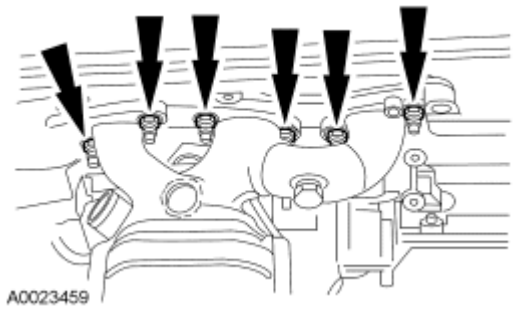


Fig. 210: Locating Gasket & Nuts
Courtesy of FORD MOTOR CO.

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

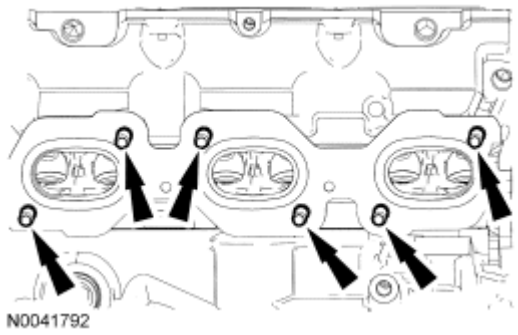


Fig. 211: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

30. Remove the bolts and the halfshaft support bracket.

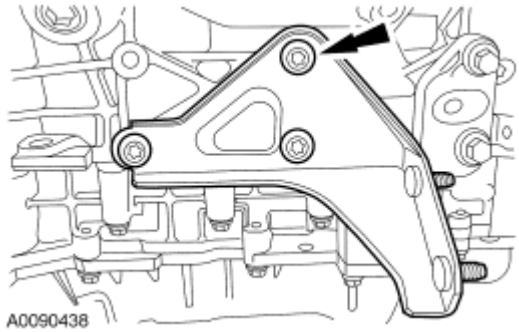


Fig. 212: Locating Halfshaft Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

All vehicles

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

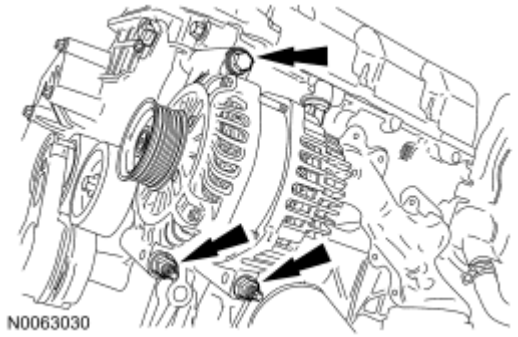


Fig. 213: Identifying Bolt And Nuts

Courtesy of FORD MOTOR CO.

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

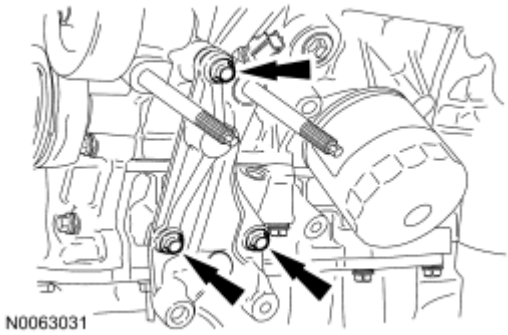


Fig. 214: Identifying Bolts
Courtesy of FORD MOTOR CO.

33. Remove the EOP switch and, if equipped, the block heater.

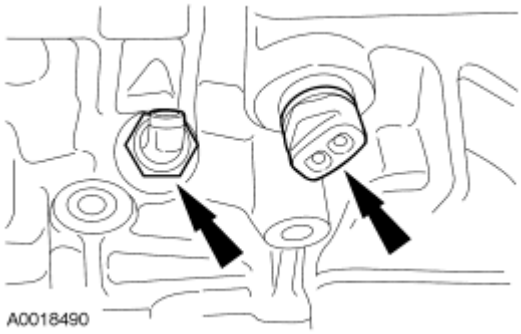


Fig. 215: Locating Oil Pressure Sender
Courtesy of FORD MOTOR CO.

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

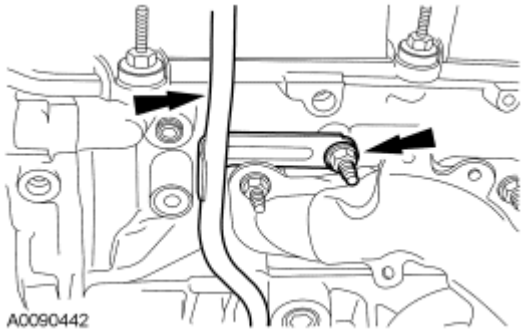


Fig. 216: Oil Level Indicator Tube & Nut
Courtesy of FORD MOTOR CO.

NOTE: If necessary, lubricate the sensor threads with penetrating and lock lubricant to assist in removal.

35. Using the special tool, remove the HO2S.

Fig. 217: Identifying Special Oxygen Sensor Tool
Courtesy of FORD MOTOR CO.

36. Remove the nuts, the LH exhaust manifold and the gasket.
    - Discard the gasket and nuts.

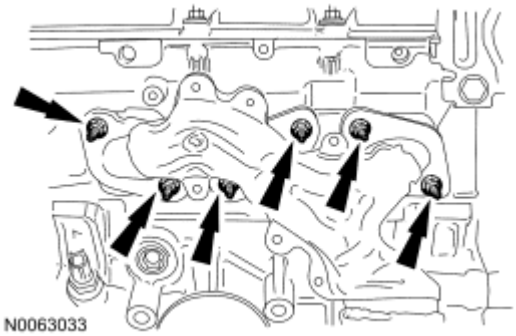


Fig. 218: Identifying Nuts
Courtesy of FORD MOTOR CO.

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

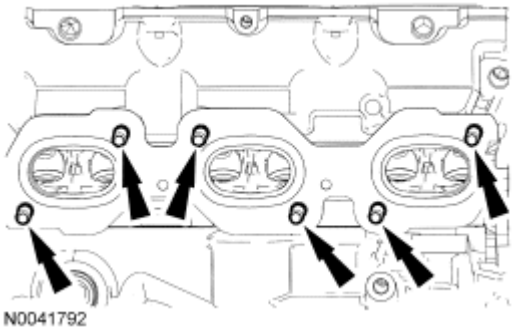


Fig. 219: Locating Exhaust Manifold Studs

Courtesy of FORD MOTOR CO.

38. Remove and discard the oil filter.

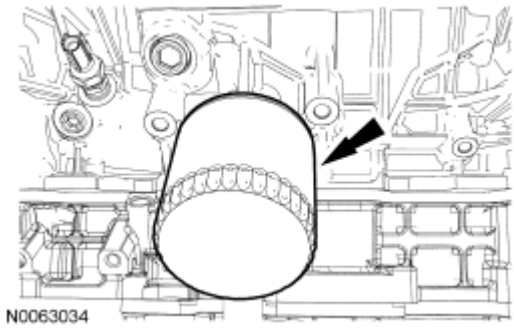


Fig. 220: Identifying Oil Filter
Courtesy of FORD MOTOR CO.

39. Cut and discard the coolant pump belt.

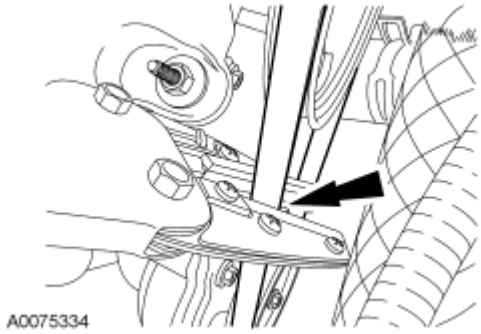


Fig. 221: Locating Coolant Pump Belt
Courtesy of FORD MOTOR CO.

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

40. Using the special tools, remove the coolant pump pulley.

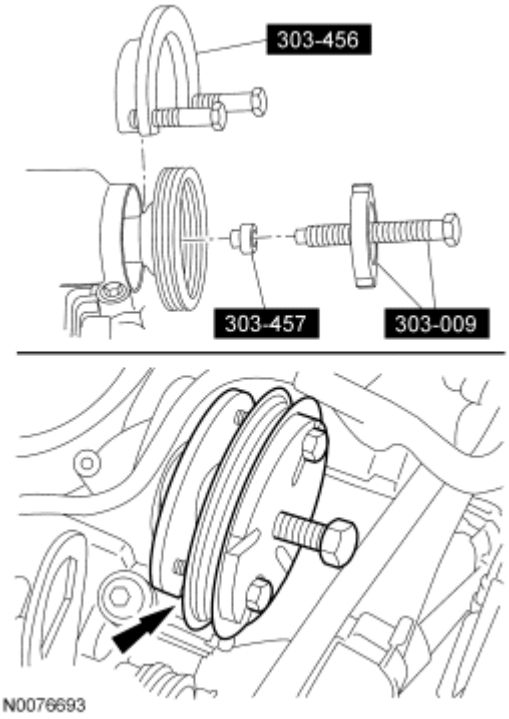


Fig. 222: Removing Coolant Pump Pulley Using Special Tools (303-009, 303-456, 303-457)
Courtesy of FORD MOTOR CO.

41. Disconnect the 2 hoses and remove the thermostat housing.

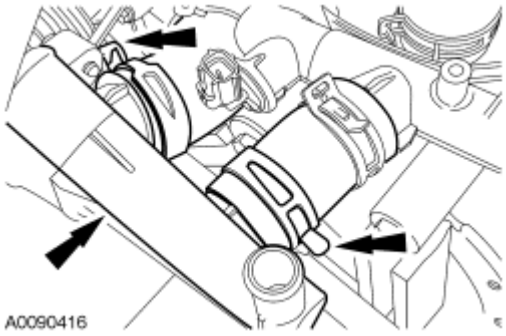


Fig. 223: Locating Coolant Tube
Courtesy of FORD MOTOR CO.

42. Remove the nut, stud bolt and the coolant bypass tube.

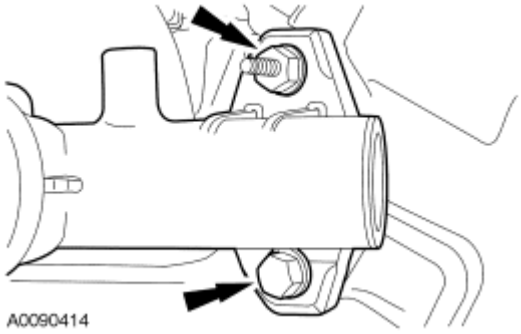


Fig. 224: Locating Coolant Bypass Tube Bolt & Nut
Courtesy of FORD MOTOR CO.

43. Disconnect the coolant pump hose from the cylinder block outlet.

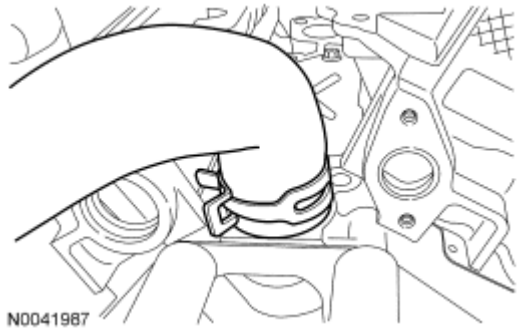


Fig. 225: Locating Coolant Pump Hose From Cylinder Block Outlet
Courtesy of FORD MOTOR CO.

44. Remove the 3 bolts and the coolant pump.

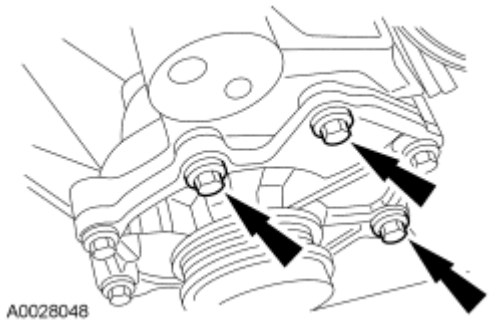


Fig. 226: Identifying Coolant Pump Assembly Bolts
Courtesy of FORD MOTOR CO.

45. Remove the nut and the radio interference capacitor.

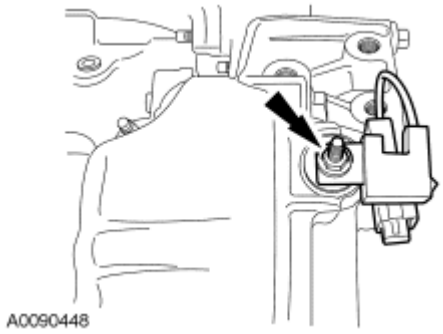


Fig. 227: Locating Radio Interference Capacitor Nut
Courtesy of FORD MOTOR CO.

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

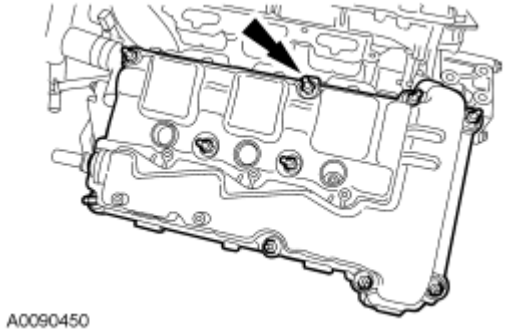


Fig. 228: Locating RH Valve Cover Bolts
Courtesy of FORD MOTOR CO.

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

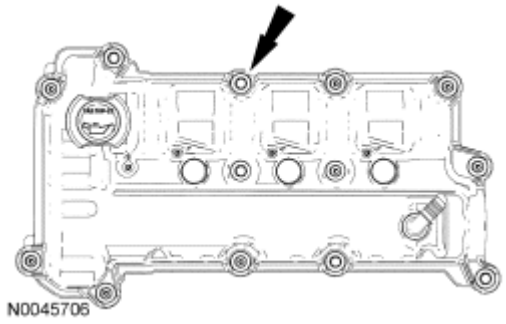


Fig. 229: Locating LH Valve Cover Bolts
Courtesy of FORD MOTOR CO.

48. Remove the bolts, studs and the oil pan.
    - Discard the gasket.

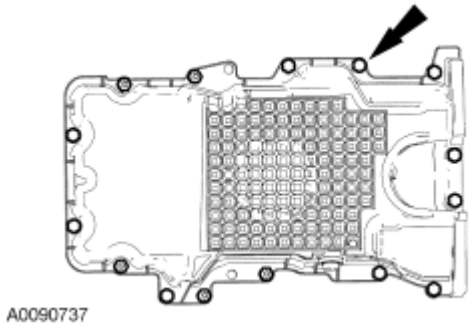


Fig. 230: Locating Oil Pan Gasket Bolts & Stud Bolts
Courtesy of FORD MOTOR CO.

49. Remove the bolts, nut and the oil pump screen and pickup tube.

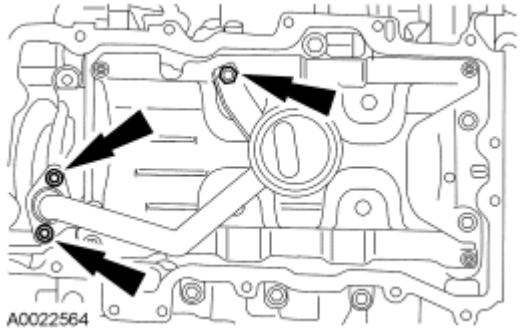


Fig. 231: Locating Oil Pump Screen & Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

50. Remove and discard the O-ring seal.

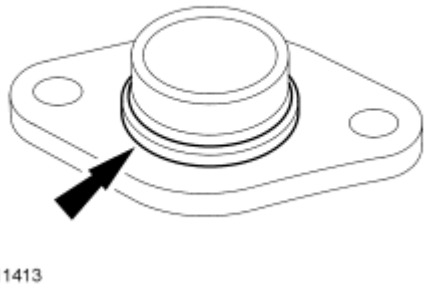


Fig. 232: Locating O-Ring Seal
Courtesy of FORD MOTOR CO.

51. Remove the nuts and the oil pan baffle.

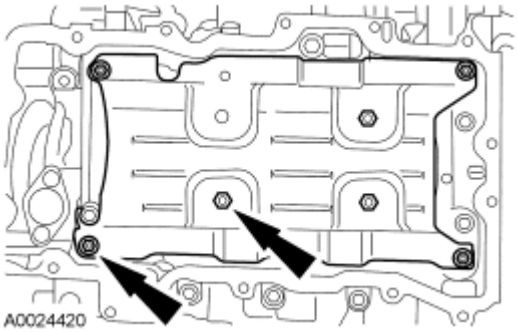


Fig. 233: Locating Oil Pan Baffle Nuts
Courtesy of FORD MOTOR CO.

52. Remove the 3 bolts and the accessory drive belt tensioner, LH and center idler pulley.

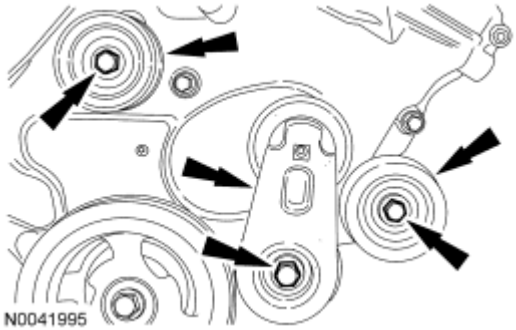


Fig. 234: Locating Accessory Drive Belt Tensioner And Idler Pulleys
Courtesy of FORD MOTOR CO.

53. Use the special tool to hold the crankshaft pulley and remove the bolt.

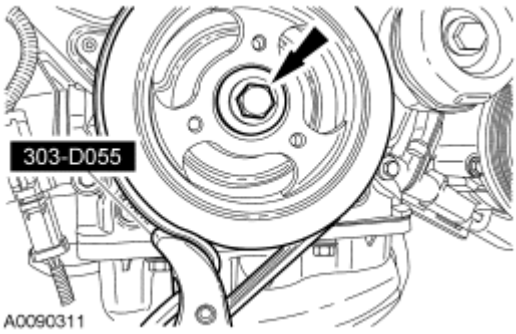


Fig. 235: Identifying Special Tool (303-D055) And Crankshaft Pulley Bolts
Courtesy of FORD MOTOR CO.

54. Using the special tool, remove the crankshaft pulley.

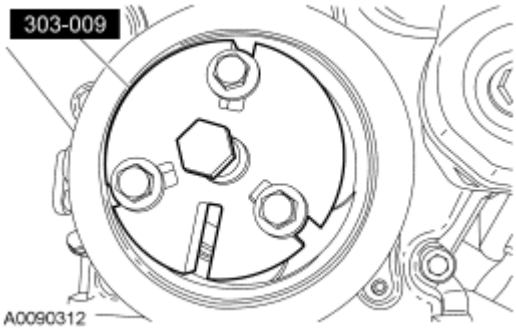


Fig. 236: Removing Crankshaft Pulley Using Special Tool (303-009)
Courtesy of FORD MOTOR CO.

55. Remove and discard the crankshaft front seal.

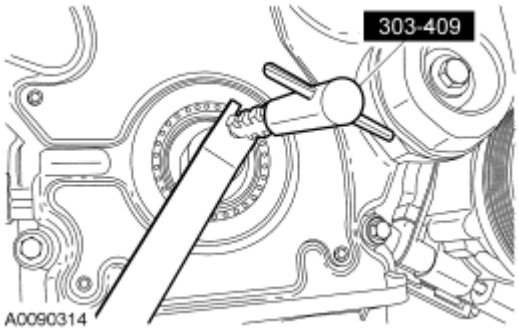
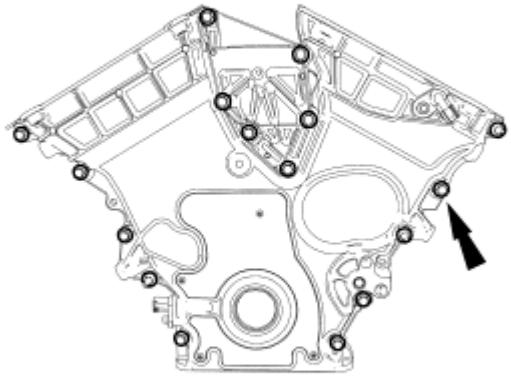


Fig. 237: Removing Crankshaft Front Seal Using Special Tool (303-409)
Courtesy of FORD MOTOR CO.

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

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

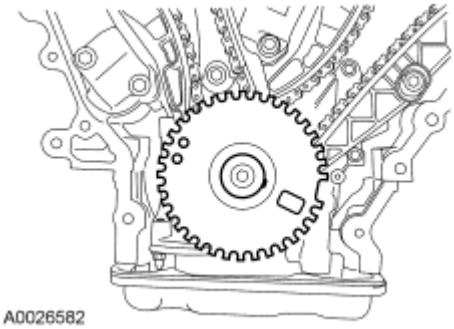


A0090759

Fig. 238: Locating Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

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

57. Remove the ignition pulse wheel.



A0026582

Fig. 239: Identifying Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

58. Remove the LH and RH spark plugs.

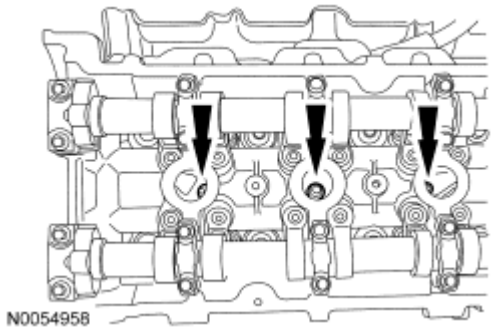


Fig. 240: Spark Plugs
Courtesy of FORD MOTOR CO.

59. Install the crankshaft pulley bolt.

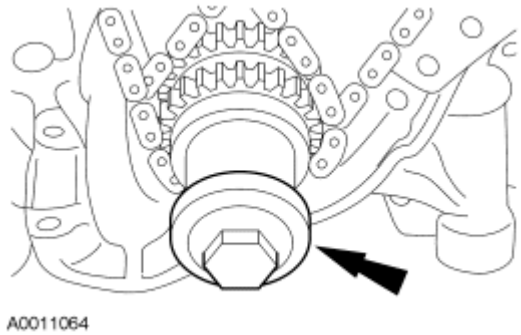


Fig. 241: Identifying Damper Bolt
Courtesy of FORD MOTOR CO.

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

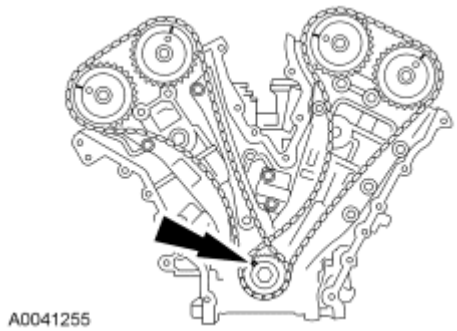


Fig. 242: Identifying Crankshaft Keyway In 11 O'Clock Position
Courtesy of FORD MOTOR CO.

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

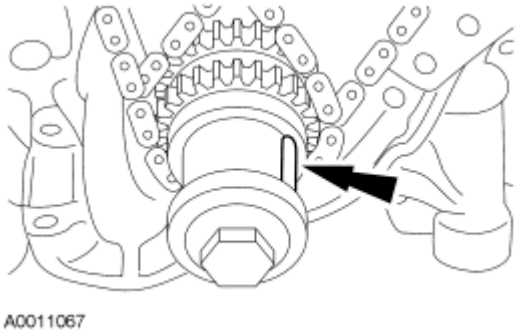


Fig. 243: Identifying Crankshaft Keyway
Courtesy of FORD MOTOR CO.

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

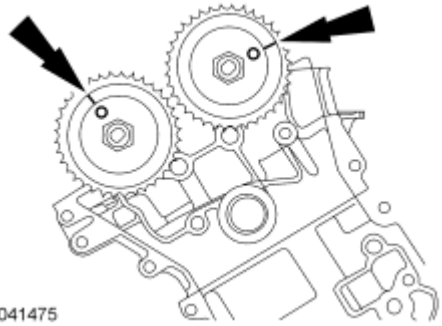


Fig. 244: Locating Camshafts Align Marks
Courtesy of FORD MOTOR CO.

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

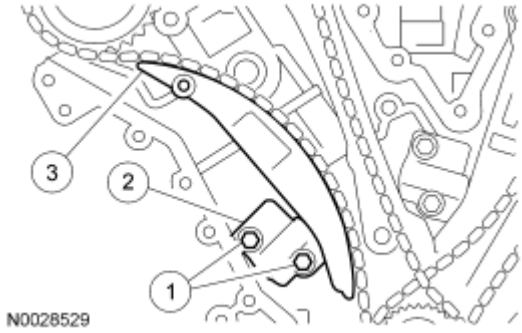


Fig. 245: Identifying RH Timing Chain Tensioner Arm & Bolts
Courtesy of FORD MOTOR CO.

64. Remove the bolts, RH timing chain guide and the timing chain.

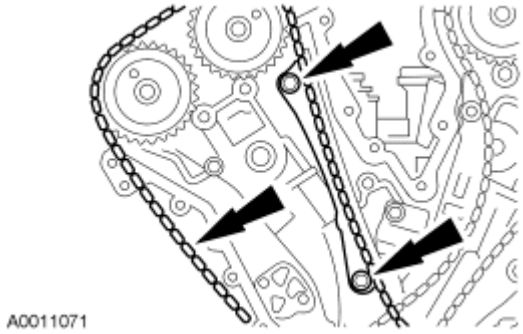


Fig. 246: Locating Timing Chain Guide & Bolts
Courtesy of FORD MOTOR CO.

65. Rotate the crankcase clockwise 600 degrees (1-2/3 turns) to position the crankcase keyway in the 11 o'clock position. This will position the LH camshafts in the neutral position.

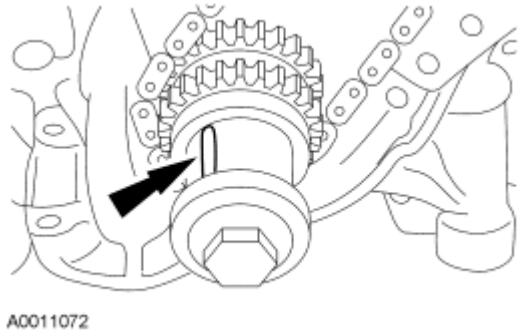


Fig. 247: Positioning Crankcase Key Way In 11 O'Clock Position
Courtesy of FORD MOTOR CO.

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

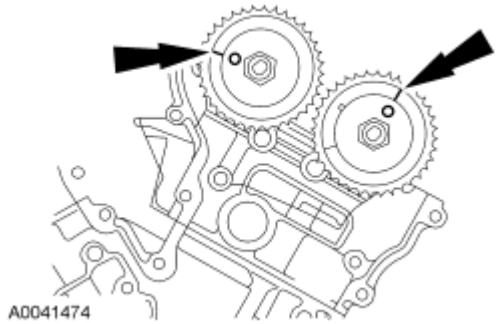


Fig. 248: Locating Camshafts Aligning Marks
Courtesy of FORD MOTOR CO.

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

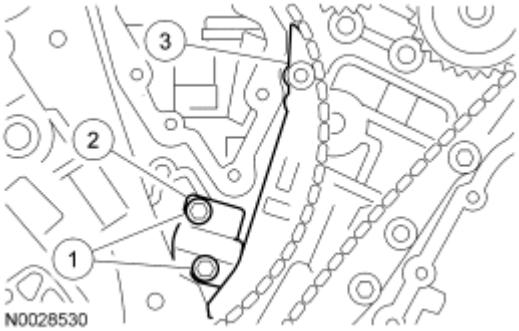


Fig. 249: Locating LH Timing Chain & Tensioner Arm
Courtesy of FORD MOTOR CO.

68. Remove the LH timing chain and timing chain guide.

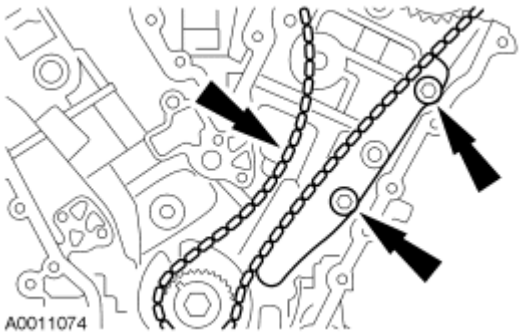


Fig. 250: Locating Timing Chain & Timing Chain Guide
Courtesy of FORD MOTOR CO.

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

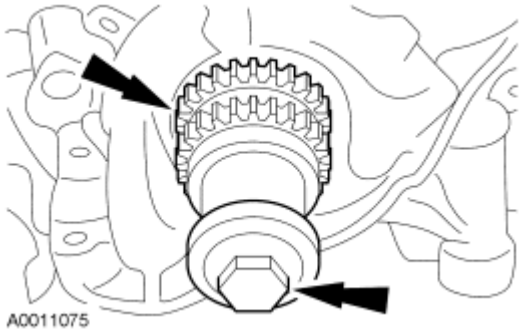


Fig. 251: Locating Damper Bolt & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

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

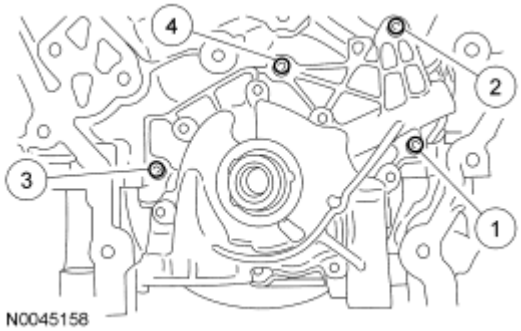


Fig. 252: Identifying Removal Sequence Of Oil Pump Bolts
Courtesy of FORD MOTOR CO.

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

71. Using the special tools, remove the camshaft oil seal and discard.

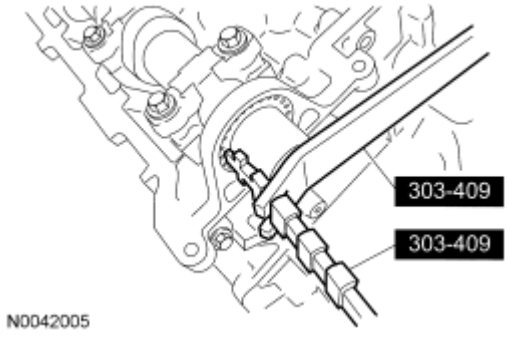


Fig. 253: Identifying Special Tools (303-409)
Courtesy of FORD MOTOR CO.

72. Remove the 2 bolts and the camshaft oil seal retainer.
    - Discard the press-in-place gasket.

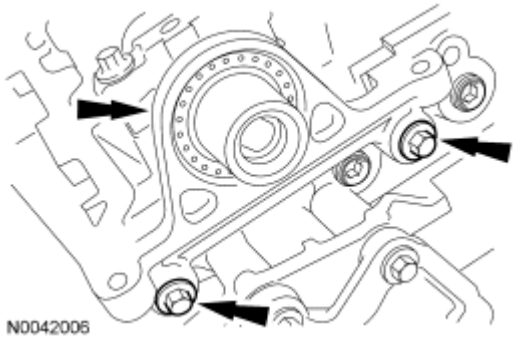


Fig. 254: Locating Camshaft Oil Seal Retainer And Bolts
Courtesy of FORD MOTOR CO.

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

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

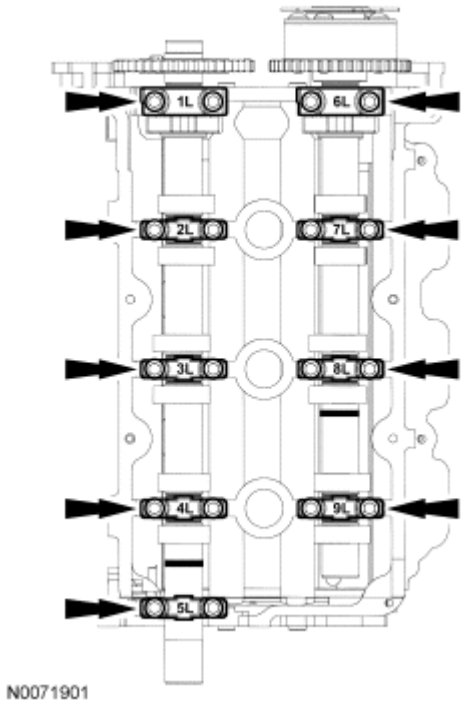


Fig. 255: Identifying Bearing Cap Position And Orientation Marks

Courtesy of FORD MOTOR CO.

CAUTION: After loosening all of the camshaft bearing cap bolts, remove the camshaft bearing thrust caps (1L and 6L) first, or damage to the thrust caps may occur.

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

74. Loosen the bolts evenly in the sequence shown.
    1. Remove the camshaft bearing thrust caps (1L and 6L).
    2. Remove the remaining camshaft bearing caps.
    3. Remove the camshafts from the cylinder head.

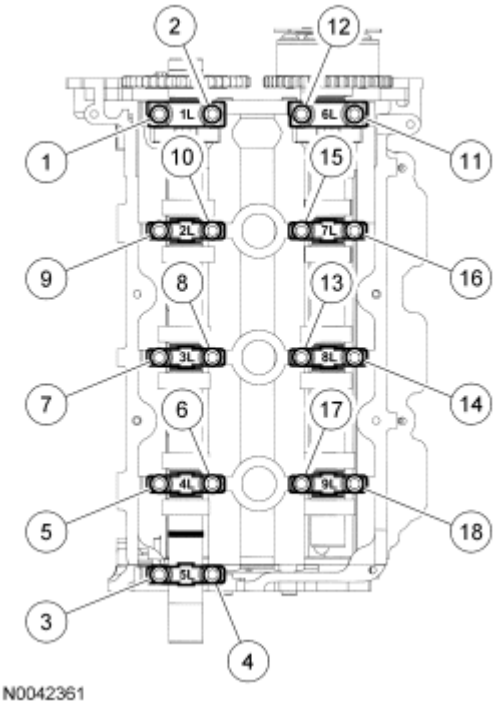


Fig. 256: Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

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

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

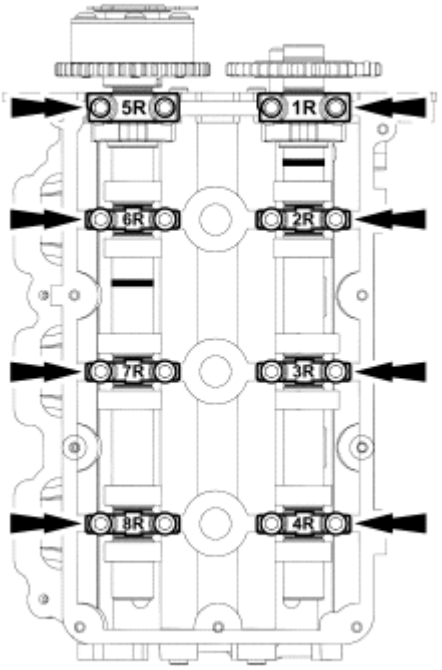


Fig. 257: Identifying Bearing Cap Position And Orientation Marks
Courtesy of FORD MOTOR CO.

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

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

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

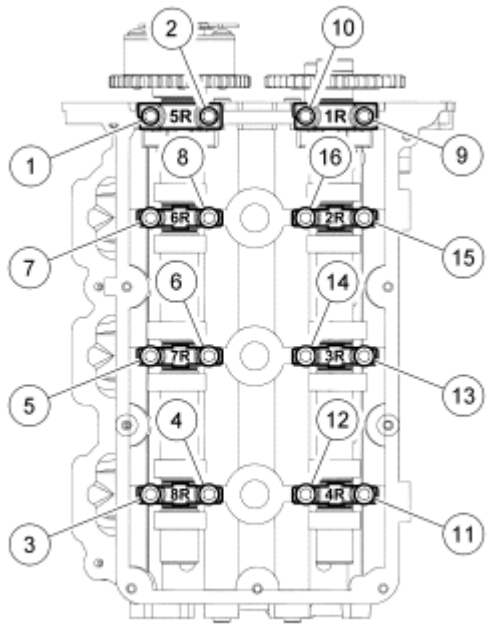


Fig. 258: Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

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

NOTE: RH shown, LH similar.

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

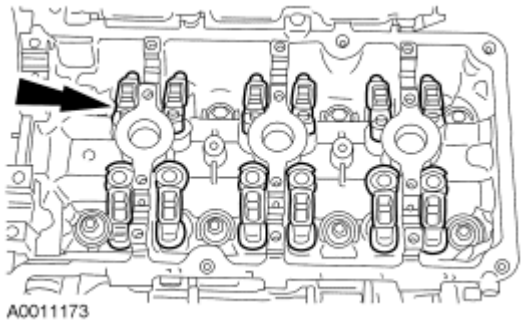


Fig. 259: Locating Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

CAUTION: The hydraulic lash adjusters must be installed in their original

positions. If not reassembled in their original positions, severe engine damage may occur.

78. Remove the hydraulic lash adjusters.

NOTE: RH shown, LH similar.

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

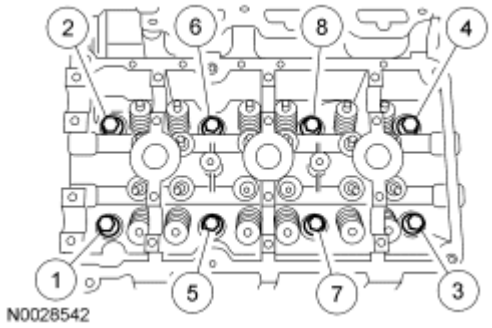


Fig. 260: Identifying Loosening Sequence Of Cylinder Heads Bolts
Courtesy of FORD MOTOR CO.

80. Support the cylinder head on a bench with the head gasket side up.

NOTE: The straightedge used must be flat within 0.0051 mm (0.0002 in) per foot of tool length.

81. Inspect all areas of the deck face with a straightedge and feeler gauge. The cylinder head must not have depressions deeper than 0.0254 mm (0.001 in) across a 38.1 mm (1.5 in) square area, or scratches more than 0.0254 mm (0.001 in).
82. Remove the bolts and the oil separator cover.
    - Discard the gasket.

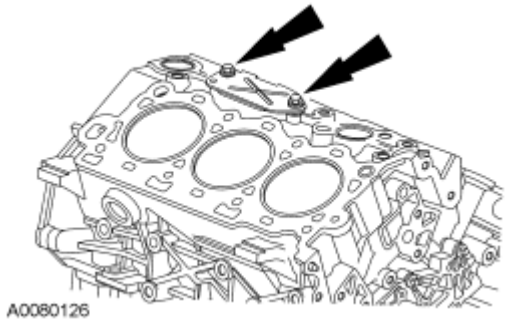


Fig. 261: Locating Oil Separator Cover Bolts
Courtesy of FORD MOTOR CO.

83. Remove the crankshaft key.

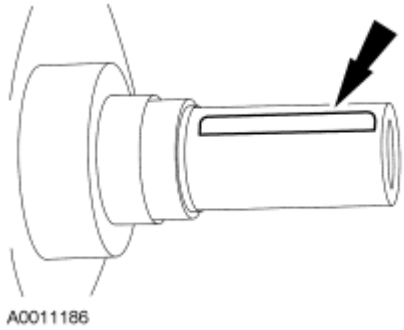
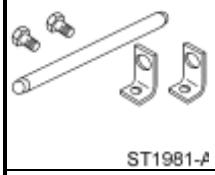


Fig. 262: Locating Crankshaft Key
Courtesy of FORD MOTOR CO.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

Special Tools

Illustration	Tool Name	Tool Number
 ST1981-A	Compressor, Valve Spring	303-300 (T87C-6565-A)
 ST1907-A	Compressor, Valve Spring	303-350 (T89P-6565-A)
 ST1906-A	Installer, Valve Stem Oil Seal	303-470 (T94P-6510-CH)

Material

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

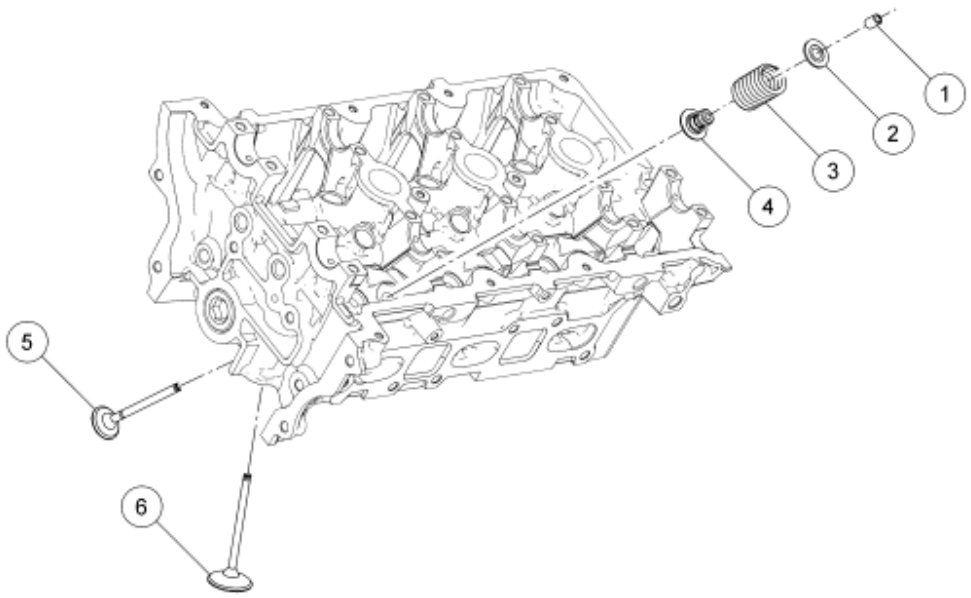


Fig. 263: Cylinder Head Components
Courtesy of FORD MOTOR CO.

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

DISASSEMBLY

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

1. Using the special tool, remove the keys, retainer and spring.

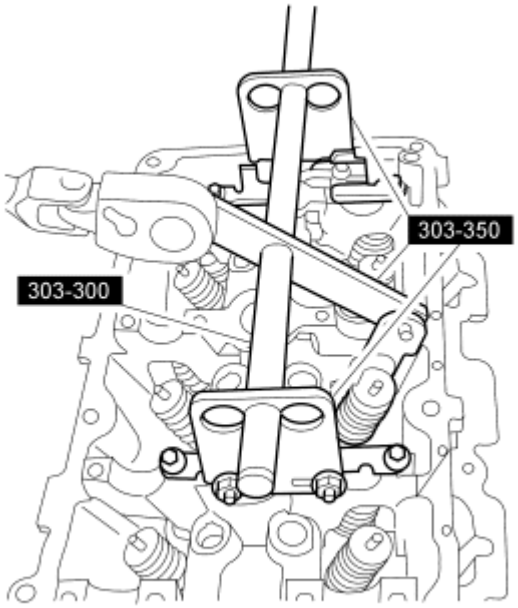


Fig. 264: Identifying Special Tools (303-300 And 303-350)
Courtesy of FORD MOTOR CO.

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

ASSEMBLY

1. Using the special tool, install the valve stem seal.

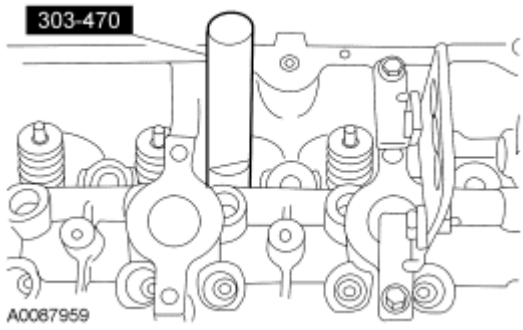


Fig. 265: Installing Valve Stem Seal
Courtesy of FORD MOTOR CO.

2. Install the valve.
3. Using the special tool, install the valve spring, retainer and key.

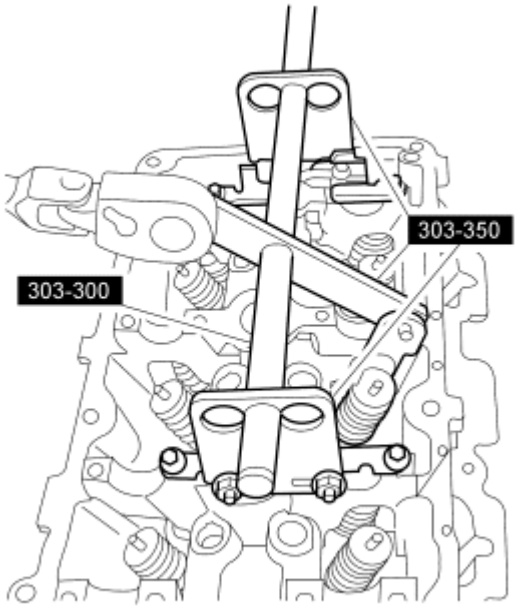


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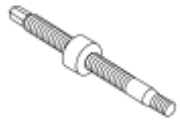
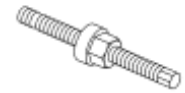
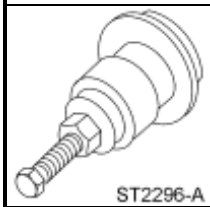
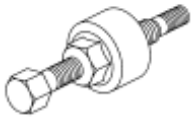
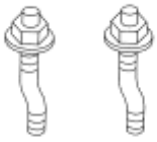
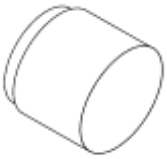
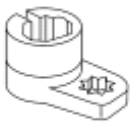
Fig. 266: Identifying Special Tools (303-300 And 303-350)
Courtesy of FORD MOTOR CO.

ASSEMBLY

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST1970-A	Installer, Camshaft Oil Seal	303-464 (T94P-6256-BH)
 ST3042-A	Installer, Camshaft Pulley	303-458 (T94P-6312-AH3), part of 303-S455
 ST1327-A	Installer, Crankshaft Rear Main Oil Seal	303-178 (T82L-6701-A)

 ST1287-A	Installer, Crankshaft Vibration Damper	303-102 (T74P-6316-B)
 ST2296-A	Installer, Front Cover Oil Seal	303-335 (T88T-6701-A)
 ST1586-A	Installer, Power Steering Pump Pulley	211-185 (T91P-3A733-A)
 ST1333-A	Installer Bolts, Crankshaft Rear Main Oil Seal	303-384 (T91P-6701-A)
 ST1595-A	Lifting Brackets, Engine	303-050 (T70P-6000)
 ST2060-A	Protector, Camshaft Oil Seal	303-463 (T94P-6256-AH)
 ST1447-A	Socket, Exhaust Gas Oxygen Sensor	303-476 (T94P-9472-A)
 ST3043-A	Spacer, Water Pump Pulley	303-459 (T94P-6312-AH4), part of 303-S455

 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
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 Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

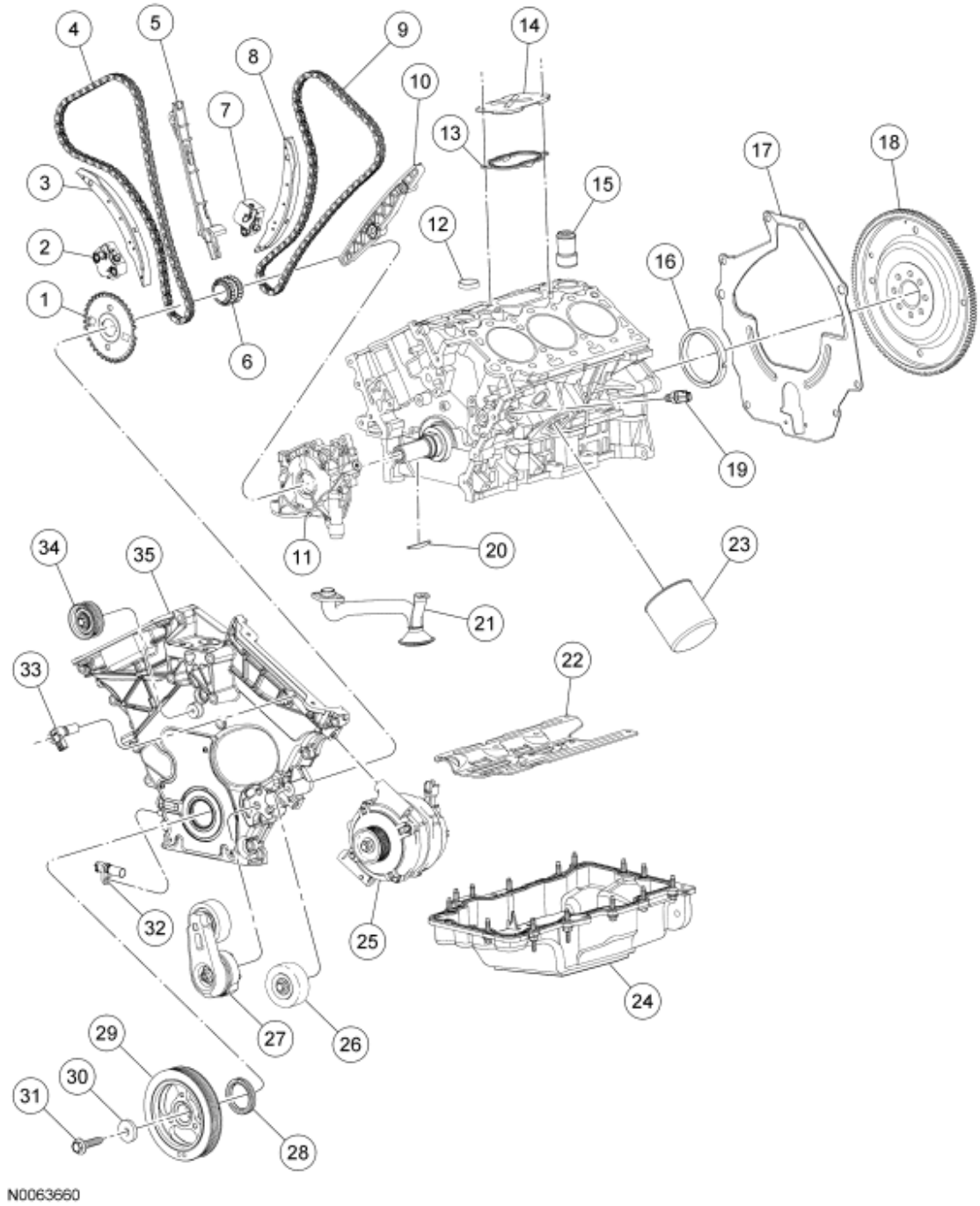


Fig. 267: Exploded View Of Engine Components (1 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	12A227	Ignition pulse wheel
2	6L266	RH timing chain tensioner
3	6K255	RH timing chain tensioner arm

4	6268	RH timing chain
5	6M256	RH timing chain guide
6	6306	Crankshaft sprocket
7	6L266	LH timing chain tensioner
8	6K255	LH timing chain tensioner arm
9	6268	LH timing chain
10	6B297	LH timing chain guide
11	6621	Oil pump
12	W701923	Cup plug
13	6B752	Oil separator gasket
14	-	Cover
15	8A505	Water inlet tube
16	6701	Crankshaft rear oil seal
17	-	Spacer plate
18	6375	Flexplate
19	-	Engine oil pressure (EOP) switch
20	W705934	Woodruff key
21	6622	Oil pickup tube and screen
22	6687	Oil pan baffle
23	6714	Oil filter
24	6675	Oil pan
25	10300	Generator
26	19A216	LH accessory drive belt idler pulley
27	6B209	Accessory drive belt tensioner
28	6700	Crankshaft front seal
29	6316	Crankshaft vibration damper
30	W701511	Crankshaft vibration damper washer
31	W701512	Crankshaft vibration damper bolt
32	6B288	Crankshaft position (CKP) sensor
33	6C315	Camshaft position (CMP) sensor
34	6C348	Center accessory drive belt idler pulley
35	6019	Front cover

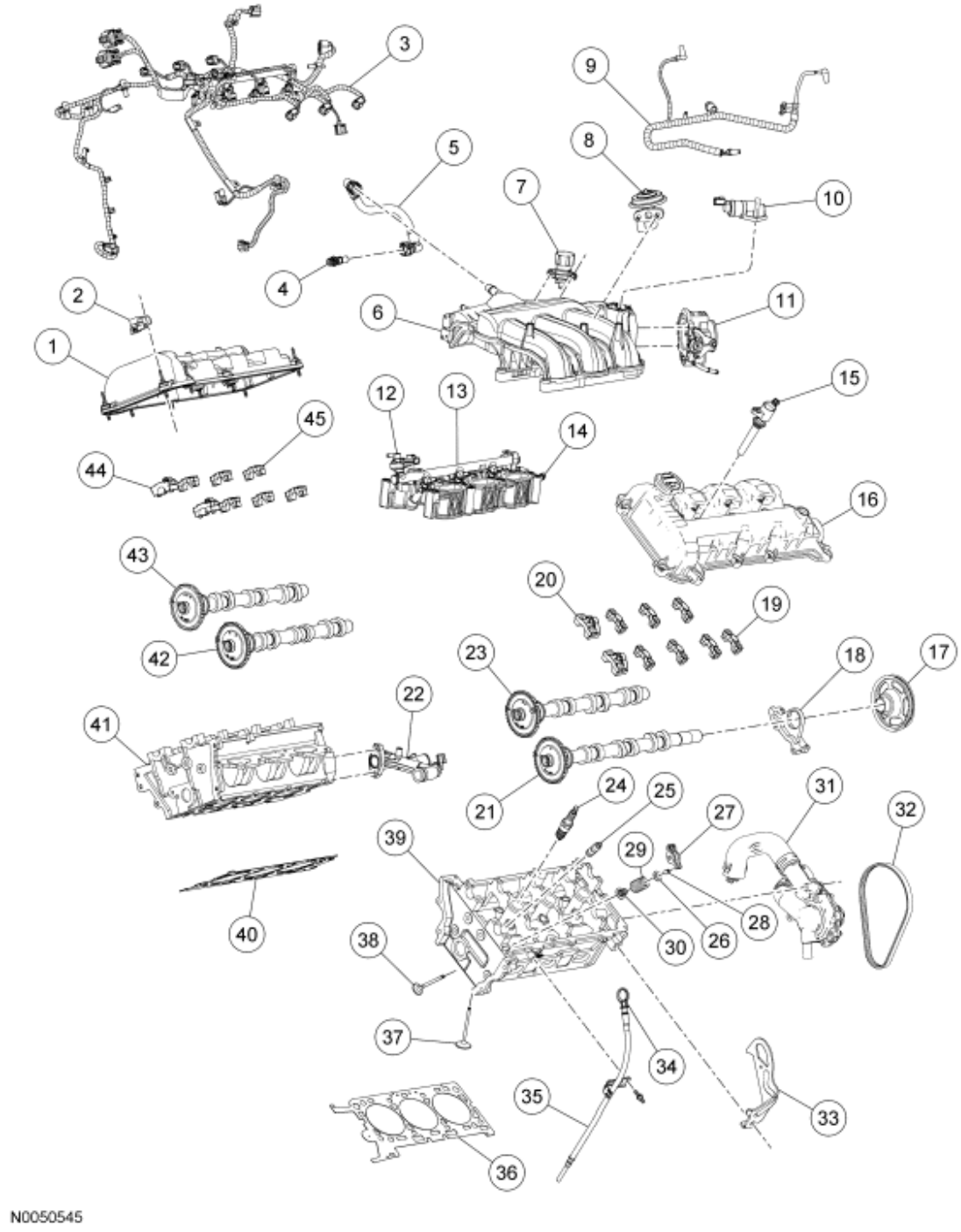


Fig. 268: Exploded View Of Engine (2 Of 2)
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	6582	RH valve cover
2	18801	Radio ignition interference capacitor
3	12B637	Engine control sensor and fuel charging

		wiring harness
4	-	PCV valve
5	-	PCV tube
6	9424	Upper intake manifold
7	9J472	EGR vacuum regulator
8	9D460	EGR valve
9	9E498	Vacuum harness
10	9F715	Idle air control (IAC) valve
11	9E926	Throttle body (TB)
12	4682	Fuel rail pressure and temperature sensor
13	9F792	Fuel rail
14	9J477	Lower intake manifold
15	12A366	Coil-on-plug (6 required)
16	6A505	LH valve cover
17	6A359	Coolant pump drive pulley
18	6B293	Rear seal retainer
19	6A258	Camshaft journal cap
20	6B280	Camshaft bearing cap
21	6A269	LH exhaust camshaft
22	8548	Coolant bypass tube
23	6A267	LH intake camshaft
24	12405	Spark plug
25	6C501	Hydraulic lash adjuster
26	6514	Valve spring retainer
27	6529	Camshaft follower
28	6518	Valve spring retainer key
29	6513	Valve spring
30	6A517	Valve stem seal
31	8501	Coolant pump
32	8K543	Coolant pump belt
33	-	LH engine lifting eye (if equipped)
34	-	Oil level indicator
35	6754	Oil level indicator tube
36	6083	LH cylinder head gasket
37	6507	Intake valve
38	6505	Exhaust valve
39	6049	LH cylinder head
40	6051	RH cylinder head gasket
41	6050	RH cylinder head
42	6A266	RH intake camshaft
43	6A268	RH exhaust camshaft
44		

	6B280	Camshaft bearing cap
45	6A258	Camshaft journal cap

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

CAUTION: If the oil pan was removed during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in engine oil leaks.

All vehicles

1. If removed, install the crankshaft key into the keyway on the crankshaft.

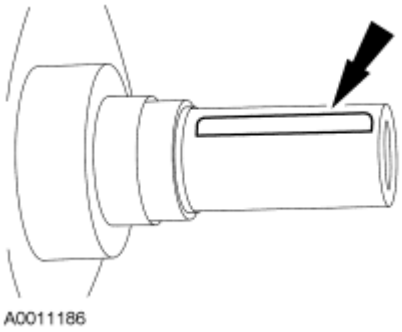


Fig. 269: Locating Crankshaft Key
Courtesy of FORD MOTOR CO.

2. Install the crankcase cover, a new gasket and the bolts.
   - Tighten to 10 Nm (89 lb-in).

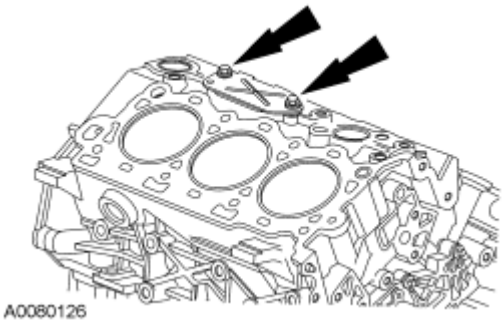


Fig. 270: Locating Oil Separator Cover Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

3. Position the new LH and RH cylinder heads and gaskets. Install new bolts and tighten in the sequence shown in 6 stages.
   - Stage 1: Tighten to 40 Nm (30 lb-ft).
   - Stage 2: Tighten to 90 Nm (66 lb-ft).
   - Stage 3: Loosen one full turn.
   - Stage 4: Tighten to 40 Nm (30 lb-ft).
   - Stage 5: Tighten 90 degrees.
   - Stage 6: Tighten 90 degrees.

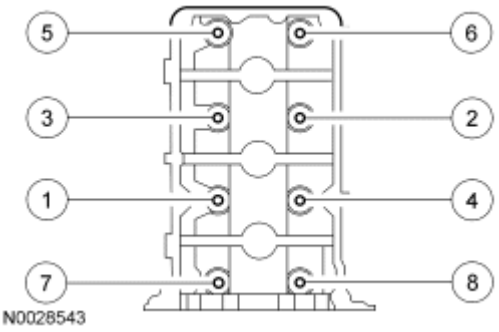


Fig. 271: Identifying Cylinder Heads Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Install the crankshaft pulley bolt and rotate the crankshaft keyway to the 11 o'clock position to locate top dead center (TDC).

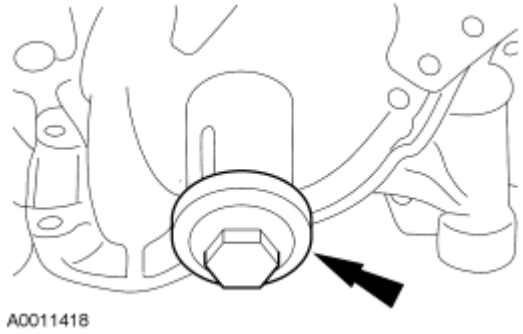


Fig. 272: Locating Crankshaft Damper Bolt
Courtesy of FORD MOTOR CO.

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

5. Install the hydraulic lash adjusters.

- Lubricate the hydraulic lash adjusters with clean engine oil.

6. Apply clean engine oil to the LH and RH camshaft roller followers.

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

NOTE: RH shown, LH similar.

7. Install the LH and RH camshaft roller followers.

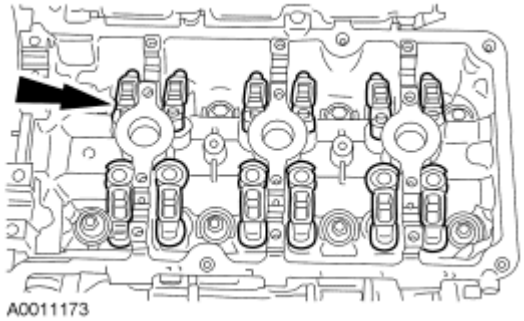


Fig. 273: Locating Camshaft Roller Followers
Courtesy of FORD MOTOR CO.

8. Apply clean engine oil to the LH and RH camshafts.
9. Install the LH and RH camshafts.
   - Locate the camshafts as shown.

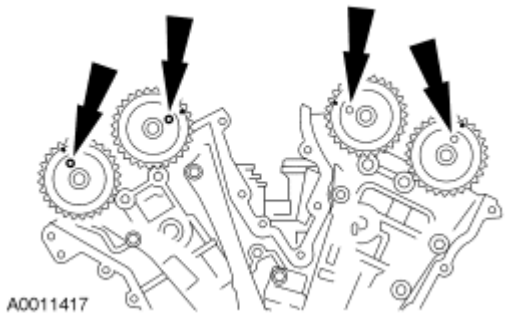


Fig. 274: Locating Camshafts Matching Marks
Courtesy of FORD MOTOR CO.

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

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

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

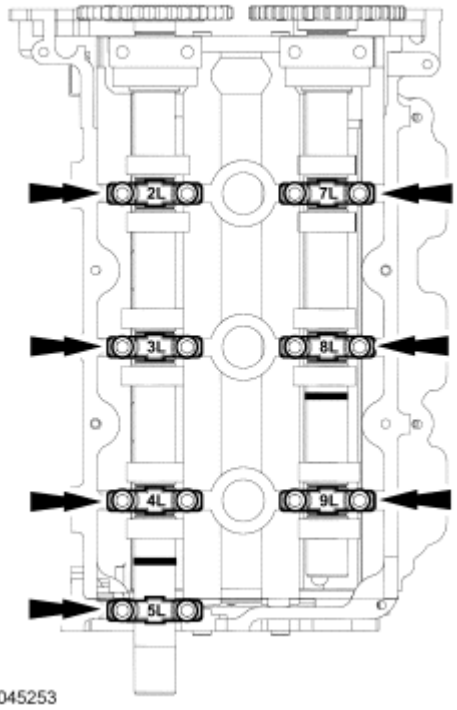


Fig. 275: Locating Camshaft Bearing Caps Installing Sequence
Courtesy of FORD MOTOR CO.

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

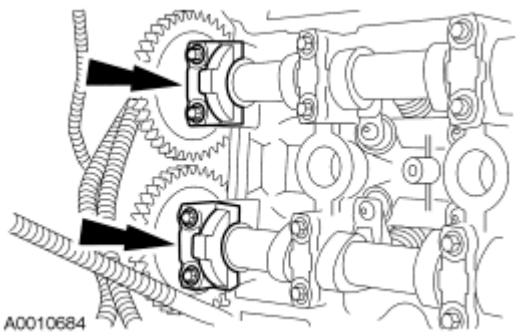


Fig. 276: Locating Camshaft Bearing Thrust Caps

Courtesy of FORD MOTOR CO.

12. Install the bolts.
    - Tighten in the sequence shown to 8 Nm (71 lb-in).

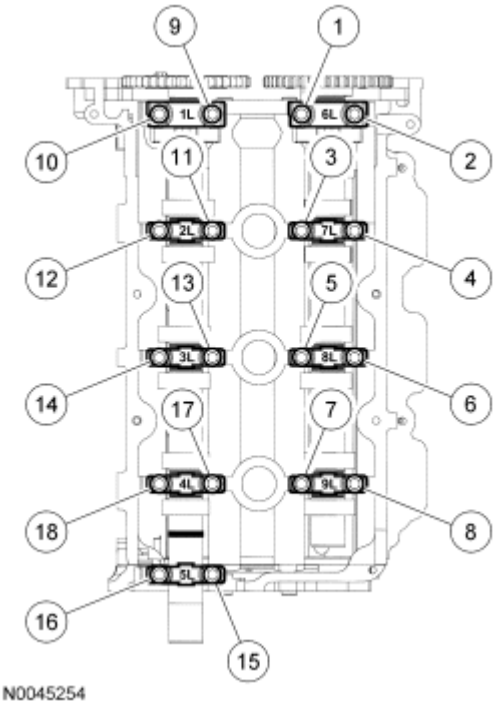


Fig. 277: Identifying Tightening Sequence Of Bolts
Courtesy of FORD MOTOR CO.

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

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

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

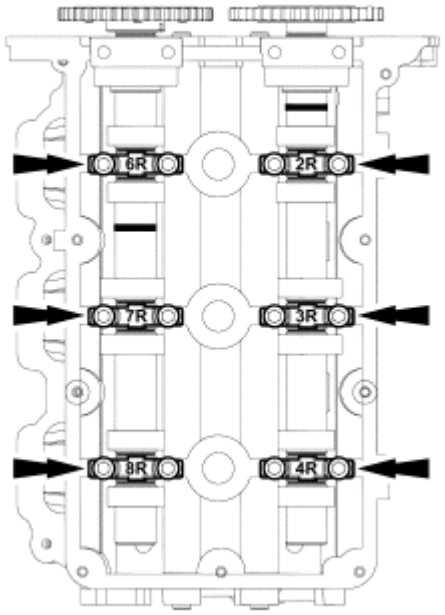


Fig. 278: Locating Camshaft Bearing Caps Installing Sequence
Courtesy of FORD MOTOR CO.

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

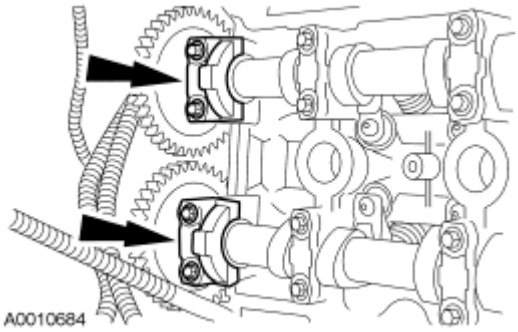


Fig. 279: Locating Camshaft Bearing Thrust Caps
Courtesy of FORD MOTOR CO.

15. Install the bolts.
    - Tighten in the sequence shown to 8 Nm (71 lb-in).

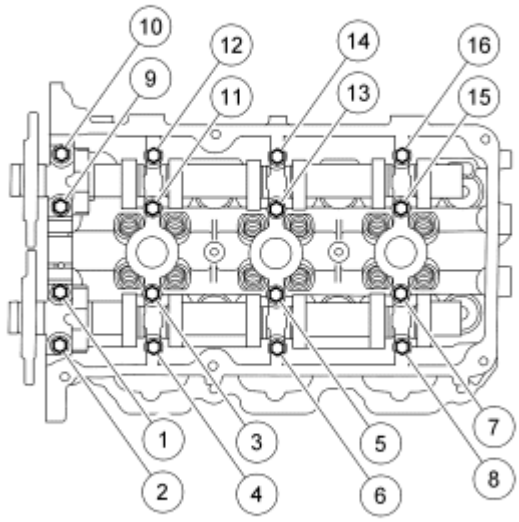


Fig. 280: Identifying Tightening Sequence Of Bolts
Courtesy of FORD MOTOR CO.

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

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

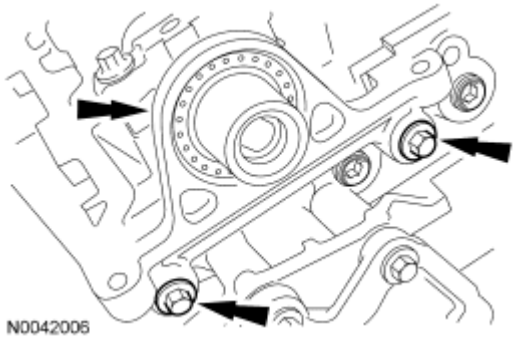


Fig. 281: Locating Camshaft Oil Seal Retainer And Bolts
Courtesy of FORD MOTOR CO.

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

17. Using the special tools, install a new camshaft oil seal.

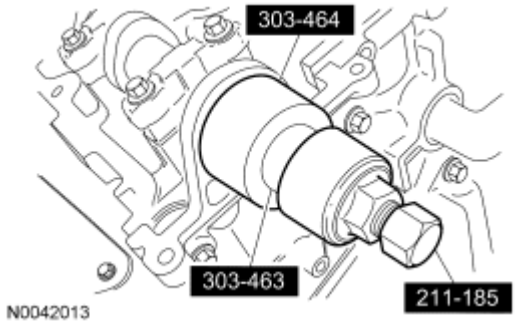


Fig. 282: Identifying Special Tools (303-463, 303-464 And 211-185)
Courtesy of FORD MOTOR CO.

18. Remove the crankshaft pulley bolt.

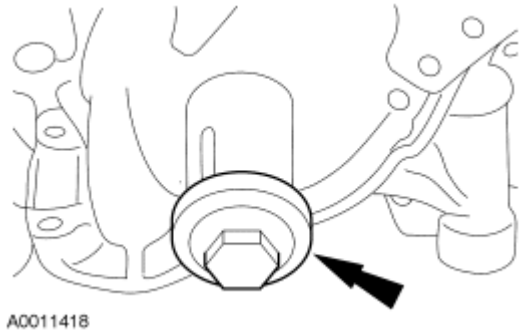


Fig. 283: Locating Crankshaft Damper Bolt
Courtesy of FORD MOTOR CO.

19. Install the crankshaft sprockets with the timing marks out.

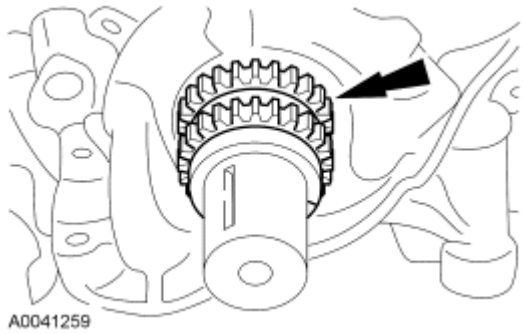


Fig. 284: Locating Crankshaft Sprockets With Timing Marks Out
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

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

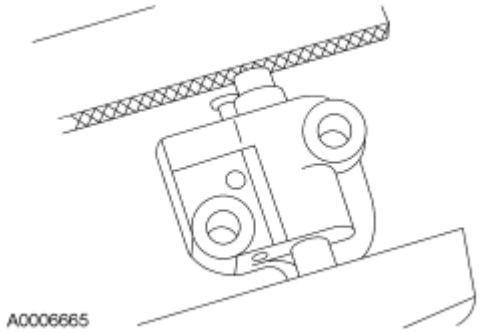


Fig. 285: Identifying Chain Tensioner In Soft-Jawed Vise
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

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

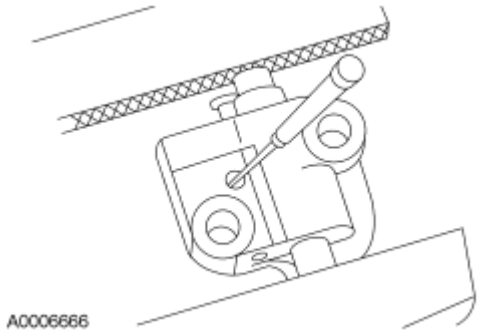


Fig. 286: Holding Chain Tensioner Ratchet Lock Mechanism Away From Ratchet Stem
Courtesy of FORD MOTOR CO.

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

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

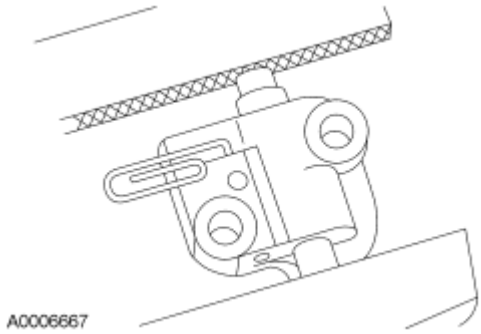


Fig. 287: Retaining Tensioner Piston With 1.5-mm (0.06-in) Wire Or Paper Clip
Courtesy of FORD MOTOR CO.

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

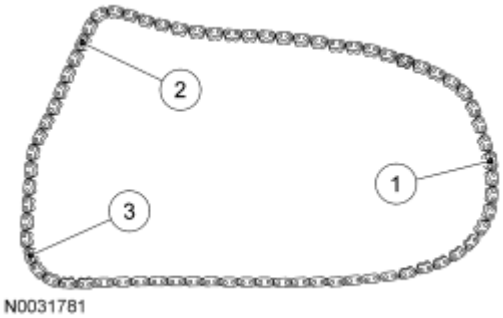


Fig. 288: Locating Crankshaft & Camshaft Timing Marks On LH & RH Timing Chains
Courtesy of FORD MOTOR CO.

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

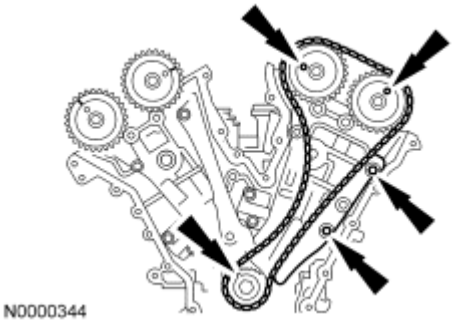


Fig. 289: Aligning Marks On Timing Chain With Marks On Camshaft & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

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

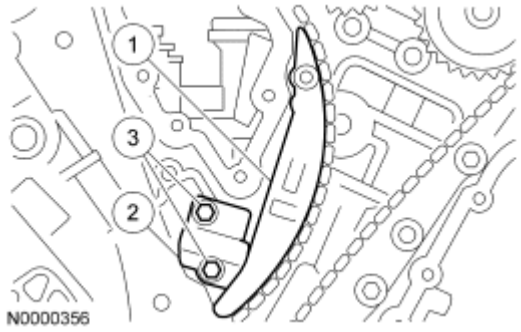


Fig. 290: Identifying Timing Chain Tensioner Arm & Bolts
Courtesy of FORD MOTOR CO.

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

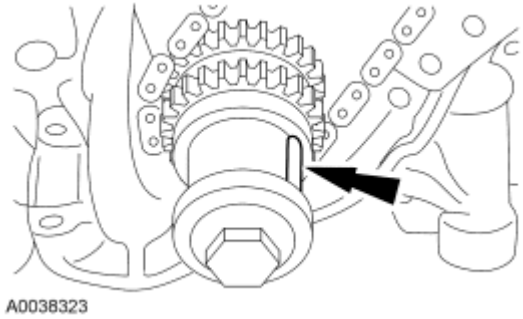


Fig. 291: Locating Crankshaft Keyway
Courtesy of FORD MOTOR CO.

28. Verify that the RH camshafts are correctly positioned.

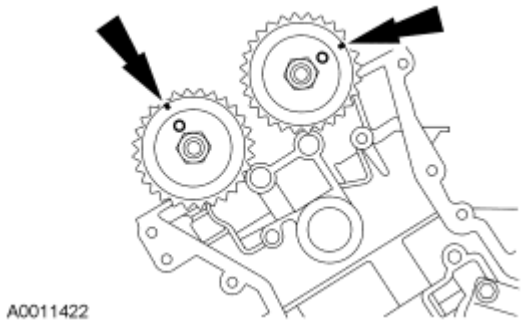


Fig. 292: Aligning Marks RH Camshafts
Courtesy of FORD MOTOR CO.

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

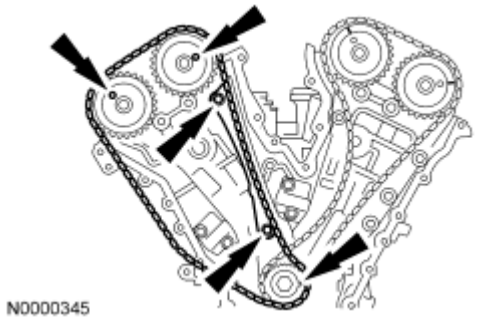


Fig. 293: Aligning Marks On Timing Chain With Marks On Camshaft & Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

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

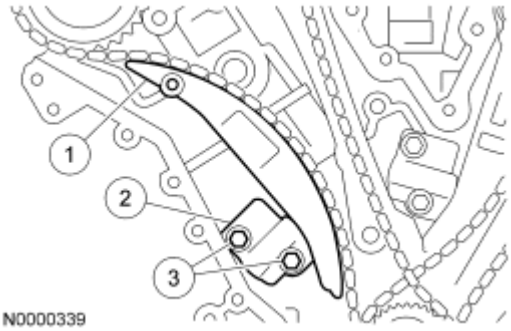


Fig. 294: Identifying Tensioner Arm, Tensioner And Bolts
Courtesy of FORD MOTOR CO.

31. Remove the LH and RH timing chain tensioner piston retaining wires.
32. Rotate the crankshaft counterclockwise 120 degrees to TDC.

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

33. Verify the timing with the following steps.
    1. There should be 12 chain links between the camshaft timing marks.
    2. There should be 27 chain links between the camshaft and the crankshaft timing marks.
    3. There should be 30 chain links between the camshaft and the crankshaft timing marks.

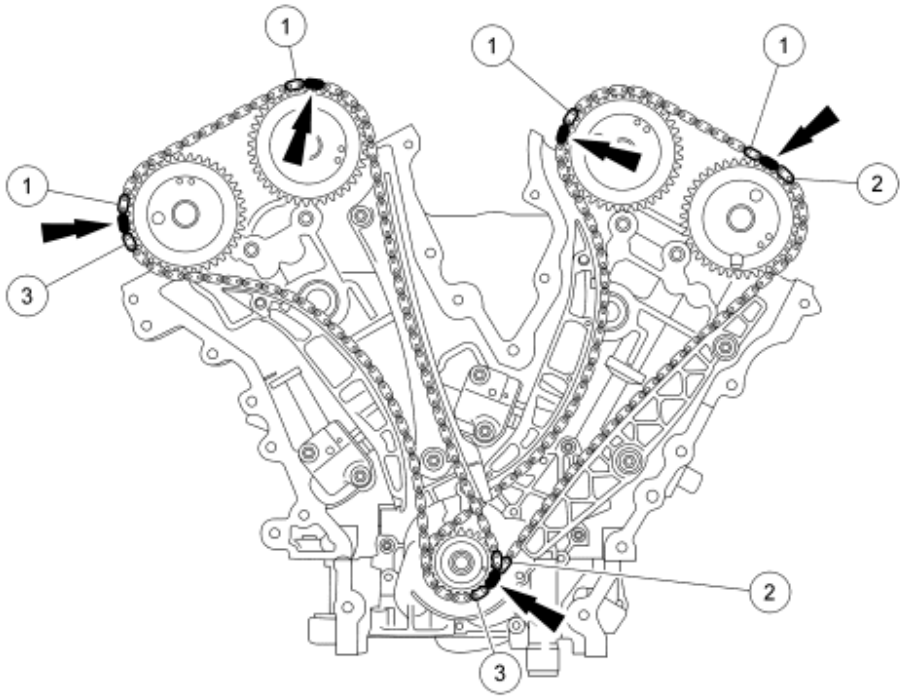


Fig. 295: Checking Chain Links Timing Marks
Courtesy of FORD MOTOR CO.

34. Remove the crankshaft pulley bolt.

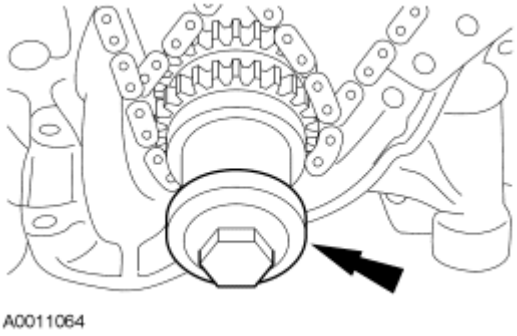


Fig. 296: Identifying Damper Bolt
Courtesy of FORD MOTOR CO.

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

35. Install the ignition pulse wheel.

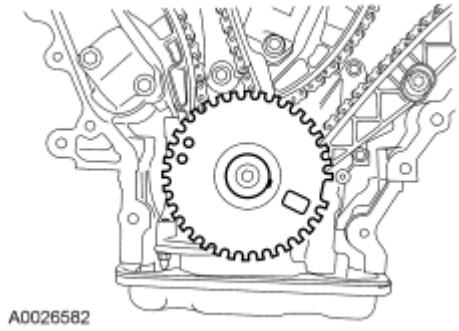


Fig. 297: Identifying Ignition Pulse Wheel
Courtesy of FORD MOTOR CO.

36. Install 3 new gaskets in the front cover.

NOTE: Clean and degrease the sealing surfaces with metal surface prep before applying gasket and sealant.

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

37. Apply a 6 mm (0.24 in) dot of silicone gasket and sealant to the cylinder block to lower cylinder block and cylinder head mating surfaces.

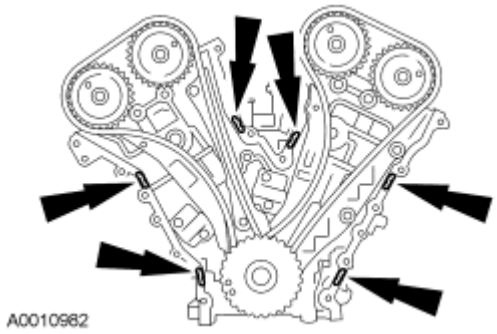


Fig. 298: Applying Sealant To Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: Fasteners 1 and 13 are stud bolts.

38. Position the front cover and install the bolts and stud bolts.
    - Tighten in the sequence shown to 25 Nm (18 lb-ft).

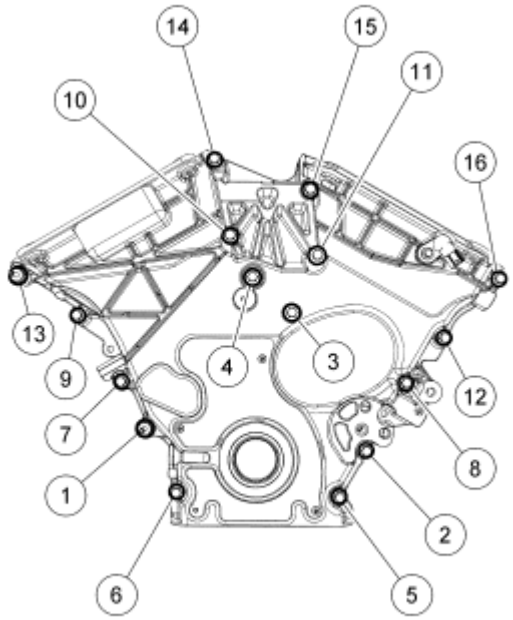


Fig. 299: Identifying Tightening Sequence
Courtesy of FORD MOTOR CO.

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

39. Using the special tools, install the crankshaft front oil seal.

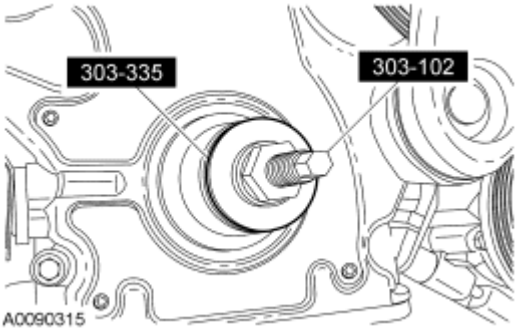


Fig. 300: Installing Crankshaft Seal Using Special Tools (303-335 And 303-102)
Courtesy of FORD MOTOR CO.

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

NOTE: Sealing surfaces must be free of dirt and oil.

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

40. Apply silicone gasket and sealant to the end of the crankshaft pulley keyway slot.

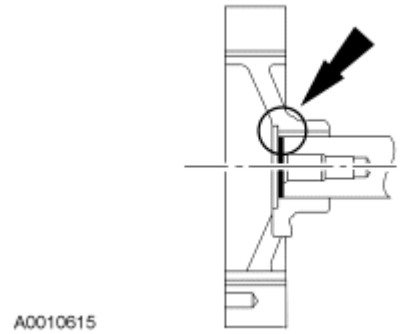


Fig. 301: Applying Silicone Gasket And Sealant
Courtesy of FORD MOTOR CO.

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

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

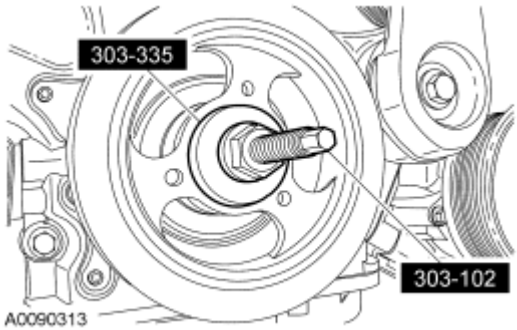


Fig. 302: Installing Crankshaft Pulley Using Special Tools (303-102, 303-335)
Courtesy of FORD MOTOR CO.

42. Install the crankshaft pulley washer and tighten the bolt in 4 stages.
    - Stage 1: Tighten to 120 Nm (89 lb-ft).
    - Stage 2: Loosen one full turn (360 degrees).
    - Stage 3: Tighten to 50 Nm (37 lb-ft).
    - Stage 4: Tighten to 90 Nm (66 lb-ft).

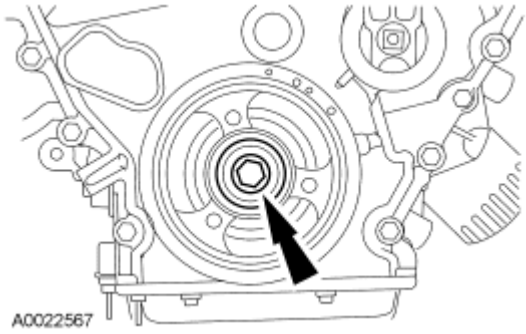


Fig. 303: Locating Crankshaft Vibration Damper Washer & Bolt
Courtesy of FORD MOTOR CO.

43. Install the belt tensioner and the bolt.
    - Tighten to 45 Nm (33 lb-ft).

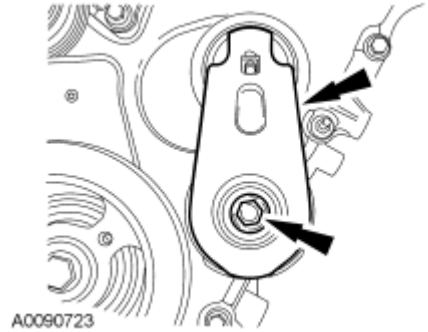


Fig. 304: Locating Belt Tensioner & Bolt
Courtesy of FORD MOTOR CO.

44. Install the LH idler pulley and the bolt.
    - Tighten to 47 Nm (35 lb-ft).

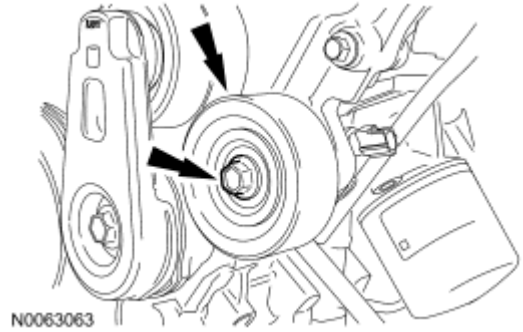


Fig. 305: Identifying pulley And Bolt
Courtesy of FORD MOTOR CO.

45. Install the center idler pulley and the bolt.
    - Tighten to 25 Nm (18 lb-ft).

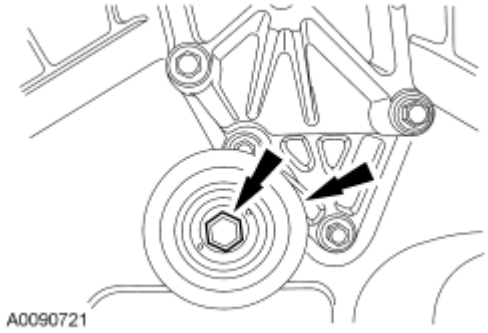


Fig. 306: Locating Idler Pulley & Bolt
Courtesy of FORD MOTOR CO.

46. Position the oil pan baffle. Install the nuts and tighten in 2 stages.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten 45 degrees.

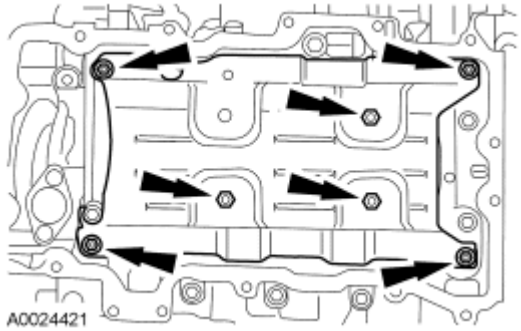


Fig. 307: Locating Oil Pan Baffle And Nuts
Courtesy of FORD MOTOR CO.

47. Install a new O-ring seal on the oil pump screen and pickup tube. Lubricate with clean engine oil.

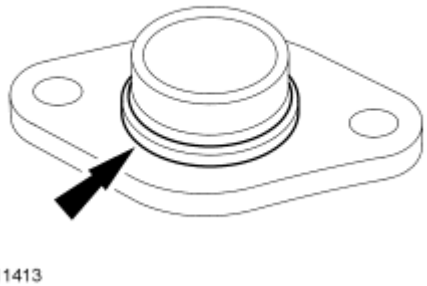


Fig. 308: Locating O-Ring Seal
Courtesy of FORD MOTOR CO.

48. Install the oil pump screen and pickup tube.
    1. Position the oil pump screen and pickup tube.

2. Install the bolts.
3. Install the nut and tighten in 2 stages.
    - Stage 1: Tighten to 5 Nm (44 lb-in).
    - Stage 2: Tighten 45 degrees.

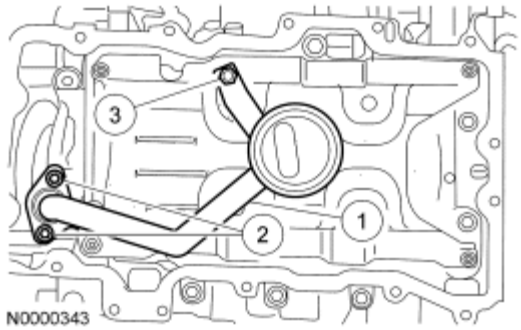


Fig. 309: Identifying Oil Pump Screen, Pickup Tube & Bolts
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

NOTE: The valve cover must be installed and the bolts and studs tightened within 4 minutes of sealant application.

NOTE: Clean cylinder head and front cover surface using metal surface prep before applying silicone gasket and sealant.

49. Apply an 8 mm (0.31 in) dot of silicone gasket and sealant at the cylinder block to front cover mating surface of the LH and RH valve covers.

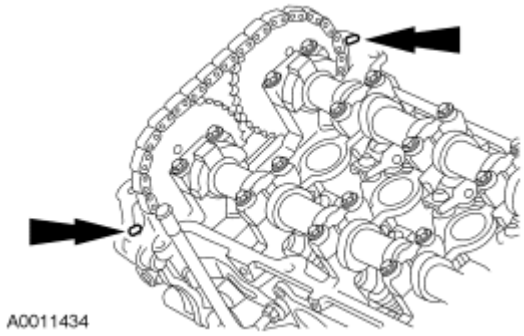


Fig. 310: Applying Silicone Gasket And Sealant At Cylinder Head To Front Cover Mating Surface
Courtesy of FORD MOTOR CO.

NOTE: Install a new valve cover gasket.

50. Position the LH valve cover and install the bolts and stud bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).

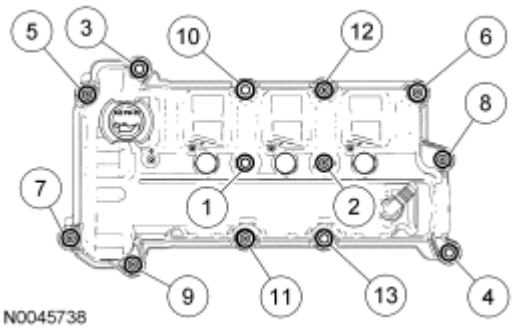


Fig. 311: Identifying Tightening Sequence Of Valve Cover Bolts & Studs
Courtesy of FORD MOTOR CO.

NOTE: Install a new valve cover gasket.

51. Position the RH valve cover and install the bolts and stud bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

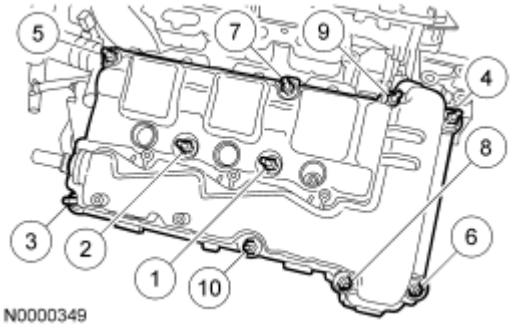


Fig. 312: Identifying Tightening Sequence Of Valve Cover Stud Bolts
Courtesy of FORD MOTOR CO.

52. Install the radio interference capacitor and the nut.
    - Tighten to 6 Nm (53 lb-in).

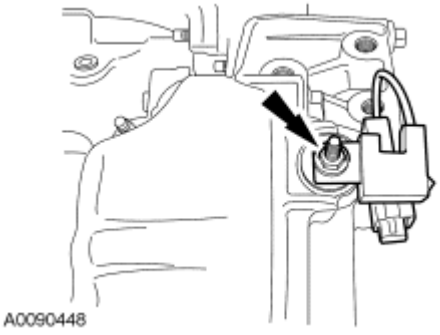


Fig. 313: Locating Radio Interference Capacitor Nut

Courtesy of FORD MOTOR CO.

53. Install the coolant pump and the bolts.
    - Tighten to 10 Nm (89 lb-in).

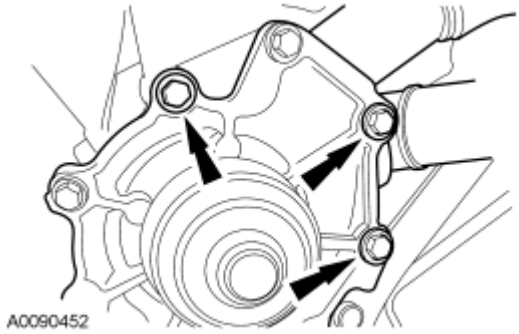


Fig. 314: Locating Coolant Pump & Bolts
Courtesy of FORD MOTOR CO.

54. Connect the coolant pump hose to the cylinder block outlet.

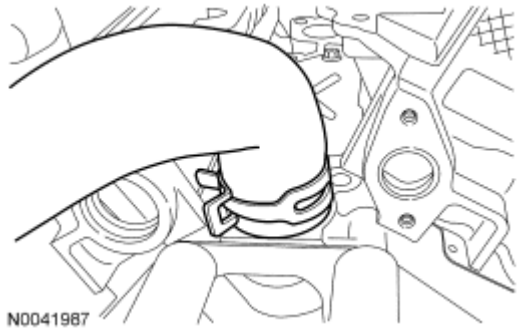


Fig. 315: Locating Coolant Pump Hose From Cylinder Block Outlet
Courtesy of FORD MOTOR CO.

55. Install the bypass tube and the nut and bolt.
    - Tighten to 10 Nm (89 lb-in).

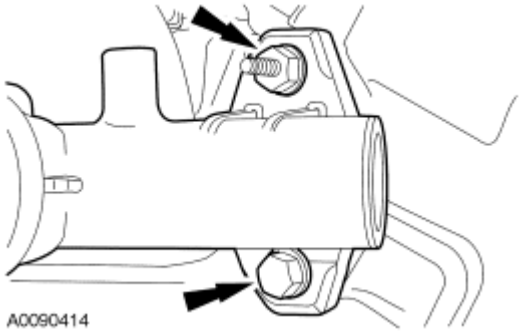


Fig. 316: Locating Coolant Bypass Tube Bolt & Nut

Courtesy of FORD MOTOR CO.

56. Position the coolant tube and connect the hoses.

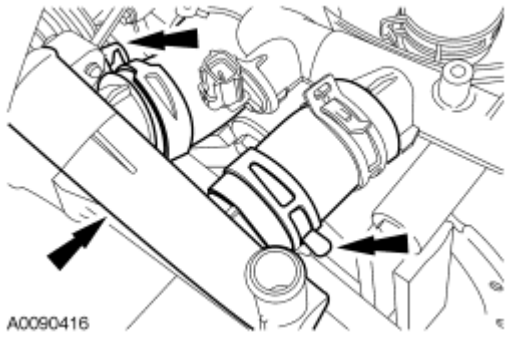


Fig. 317: Locating Coolant Tube
Courtesy of FORD MOTOR CO.

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

57. Install the special tool in the camshaft as shown in the illustration.
    - Adjust the collar on the special tool screw to get the best thread engagement in the rear of the camshaft.

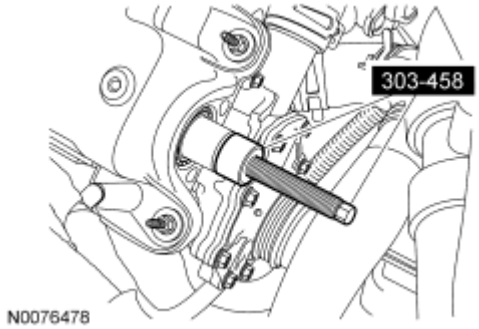


Fig. 318: Installing Special Tool On Camshaft
Courtesy of FORD MOTOR CO.

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

NOTE: Only the roller collared nut from the Power Steering Pump Pulley Installer (211-185) is used on Camshaft Pulley Installer (303-485).

58. Position the coolant pump pulley over the previously installed special tool and on the end of the camshaft.

Install the special tools as shown in the illustration.

- Using the special tools, install a new service coolant pump pulley flush with the end of the camshaft.

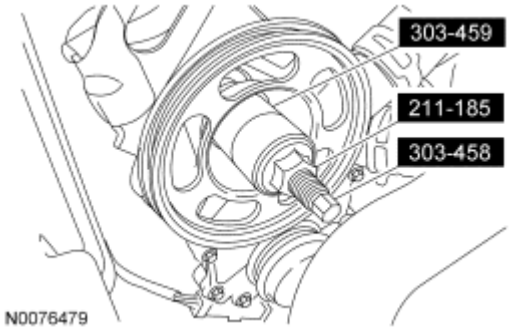


Fig. 319: Installing Coolant Pump Pulley Using Special Tools (211-185, 303-458, 303-459)
Courtesy of FORD MOTOR CO.

59. Install the coolant pump belt on the coolant pump pulley and position it on the camshaft pulley.

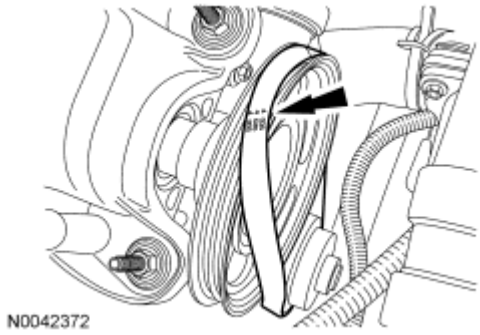


Fig. 320: Locating Coolant Pump Belt On Coolant Pump Pulley
Courtesy of FORD MOTOR CO.

CAUTION: Do not use any screwdrivers, pliers or other metal objects that could cause damage to the belt or camshaft pulley while installing the belt.

60. Rotate the crankshaft clockwise to seat the water pump belt on the camshaft pulley.
61. Lubricate the O-ring seal and install the oil filter.
    - Tighten to 5 Nm (44 lb-in) and then rotate an additional 180 degrees.

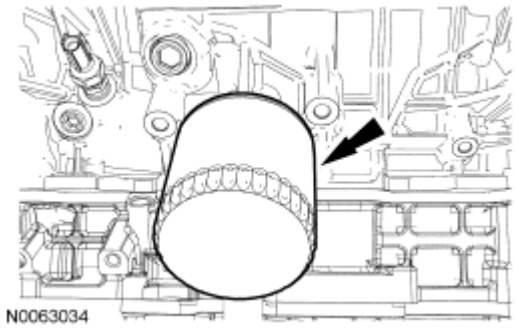


Fig. 321: Identifying Oil Filter
Courtesy of FORD MOTOR CO.

62. Install 6 new LH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

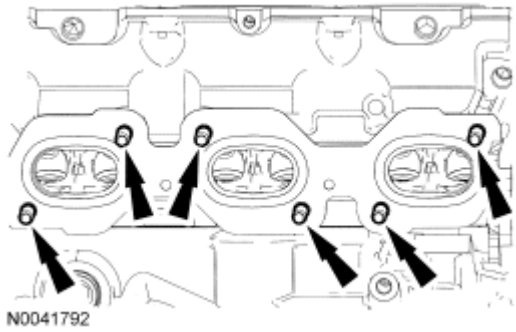


Fig. 322: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

63. Install a new gasket and the LH exhaust manifold and new nuts.
    - Tighten in the sequence shown to 20 Nm (15 lb-ft).

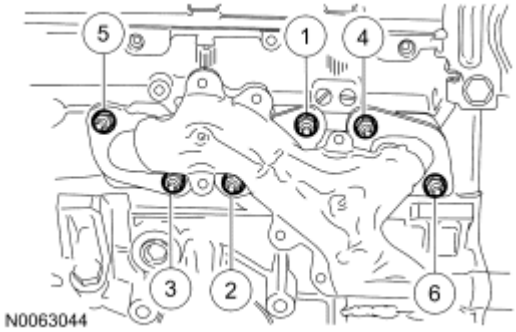


Fig. 323: Identifying Tightening Sequence
Courtesy of FORD MOTOR CO.

NOTE: Make sure to apply anti-seize lubricant to the threads of the heated oxygen sensor (HO2S) before installation.

64. Using the special tool, install the LH HO2S.
    - Tighten to 47 Nm (35 lb-ft).

Fig. 324: Identifying Special Oxygen Sensor Tool
Courtesy of FORD MOTOR CO.

65. Install a new O-ring on the oil level indicator tube. Apply clean engine oil to the O-ring.

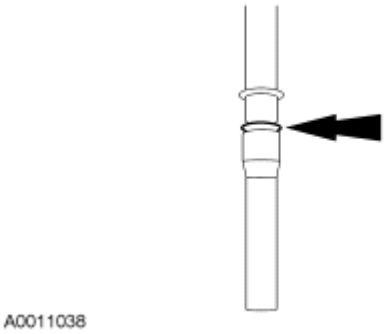


Fig. 325: Locating O-Ring On Oil Level Indicator Tube
Courtesy of FORD MOTOR CO.

66. Position the oil level indicator and tube and install the stud bolt.
    - Tighten to 10 Nm (89 lb-in).

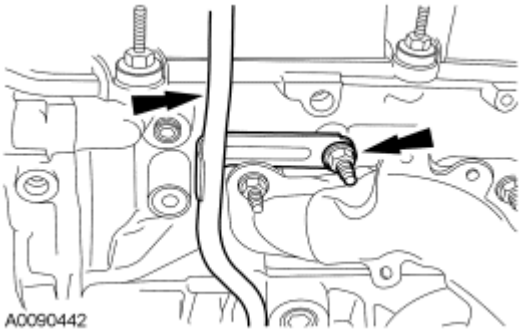


Fig. 326: Oil Level Indicator Tube & Nut
Courtesy of FORD MOTOR CO.

67. Install the engine oil pressure (EOP) switch and, if equipped, the block heater.
    - Tighten the EOP switch to 14 Nm (10 lb-ft).
    - Tighten the block heater to 21 Nm (15 lb-ft).

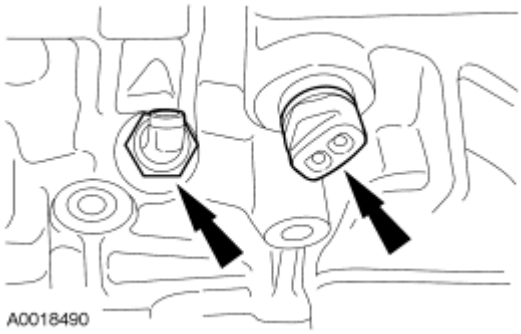


Fig. 327: Locating Oil Pressure Sender
Courtesy of FORD MOTOR CO.

68. Install the 3 bolts and the A/C compressor bracket.
    - Tighten to 25 Nm (18 lb-ft).

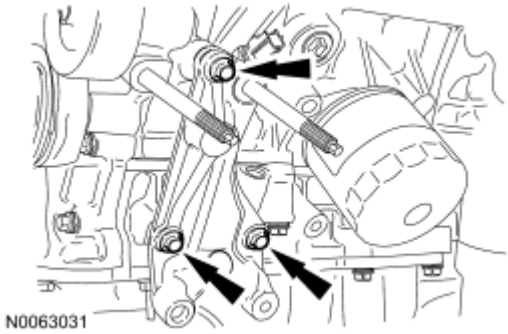


Fig. 328: Identifying Bolts
Courtesy of FORD MOTOR CO.

69. Position the generator and install the bolt and 2 nuts.
    - Tighten to 47 Nm (35 lb-ft).

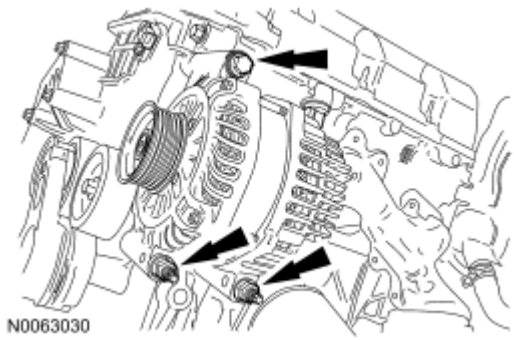


Fig. 329: Identifying Bolt And Nuts
Courtesy of FORD MOTOR CO.

Front wheel drive (FWD) vehicles

70. Install the halfshaft support bracket and the bolts.
    - Tighten to 48 Nm (35 lb-ft).

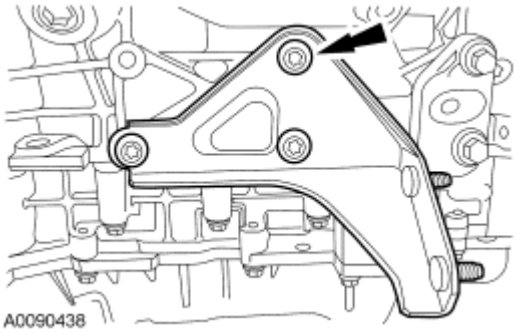


Fig. 330: Locating Halfshaft Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

71. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

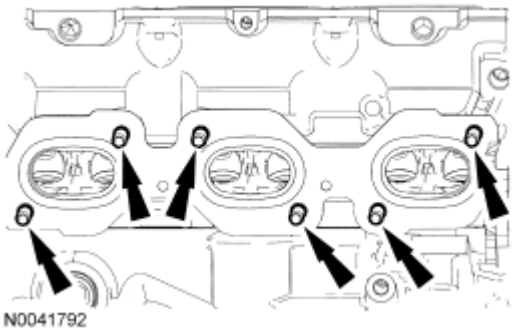


Fig. 331: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

72. Install a new gasket and the RH exhaust manifold and new nuts.
    - Tighten in the sequence shown to 20 Nm (15 lb-ft).

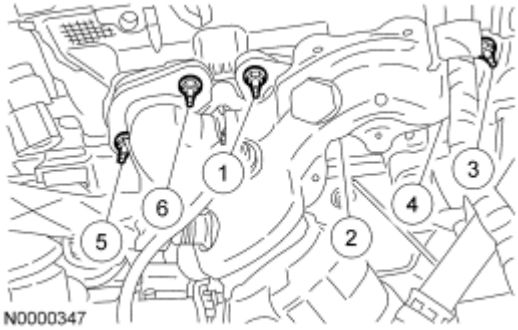


Fig. 332: Identifying Tightening Sequence Of RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

73. Connect the RH HO2S electrical connector.

Fig. 333: Identifying RH HO2S Connector
Courtesy of FORD MOTOR CO.

All vehicles

NOTE: LH shown, RH similar.

Apply a light film of silicone brake caliper grease and dielectric compound to the interior of the spark plug boot prior to installation.

74. Install the 6 coil-on-plugs and the bolts.
    - Tighten to 6 Nm (53 lb-in).

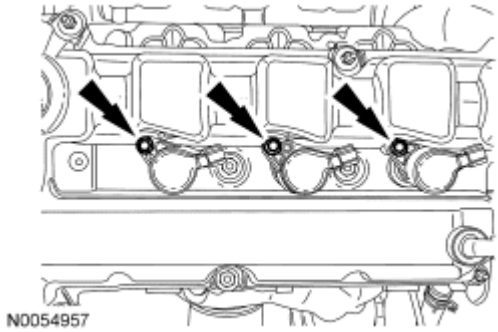


Fig. 334: Coil-On-Plug Bolts
Courtesy of FORD MOTOR CO.

NOTE: Install new gaskets.

75. Install the lower intake manifold and the bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

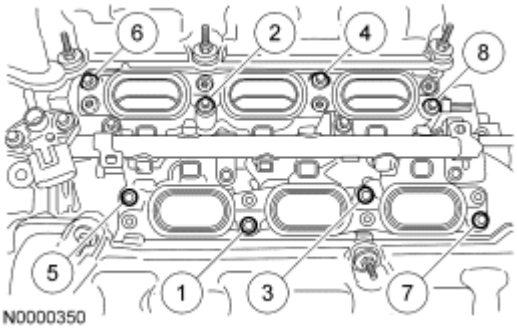


Fig. 335: Identifying Tightening Sequence Of Lower Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

76. Install the B+ wiring harness on the engine.
    - Attach the 4 wiring harness retainers, and install the nut.
    - Tighten to 6 Nm (53 lb-in).

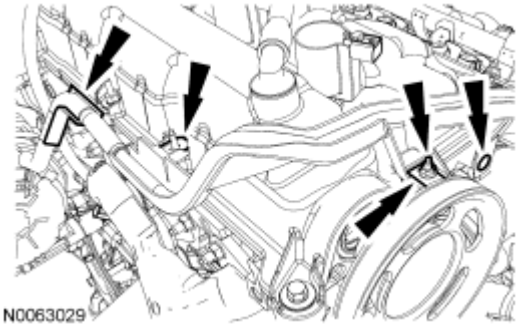


Fig. 336: Identifying Retainers And Nut
Courtesy of FORD MOTOR CO.

77. Position the fuel charging wiring harness on the engine.
    - Attach the 2 wiring harness retainers (1 shown) to the engine.

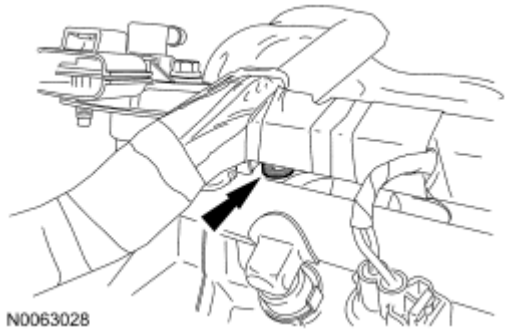


Fig. 337: Identifying Retainer
Courtesy of FORD MOTOR CO.

78. Connect the fuel injector electrical connectors.

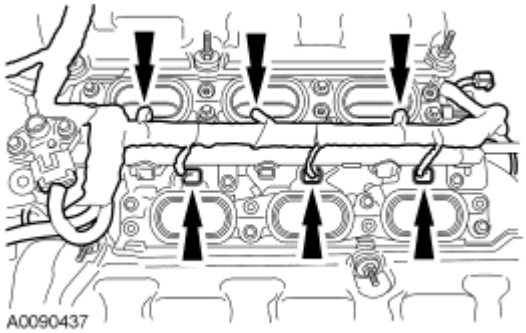


Fig. 338: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

79. Install the B+ wire and nut on the generator.
    - Tighten to 8 Nm (71 lb-in).

Fig. 339: Identifying Nut
Courtesy of FORD MOTOR CO.

80. Connect the generator electrical connector.

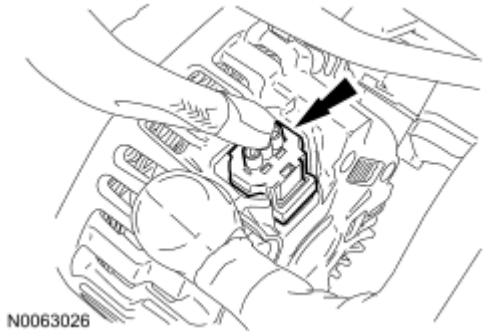


Fig. 340: Identifying Connector
Courtesy of FORD MOTOR CO.

81. Connect the camshaft position sensor (CMP) and EOP switch electrical connectors.
    - Attach the wiring retainers.

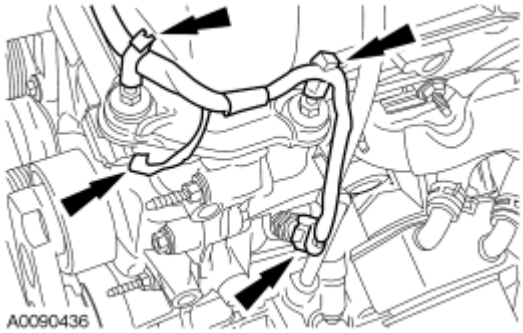


Fig. 341: Locating Camshaft Position Sensor (CMP) & Oil Pressure Sensor Electrical Connectors & Wiring Retainers
Courtesy of FORD MOTOR CO.

82. Connect the LH coil-on-plug electrical connectors.
    - Attach the 2 wiring retainers.

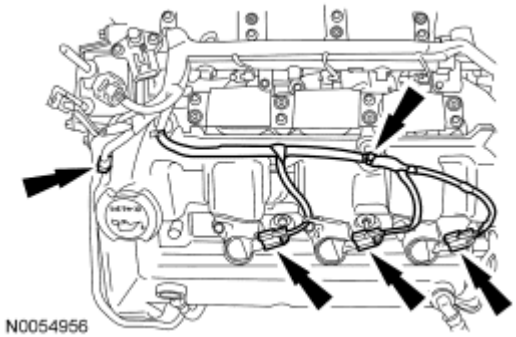


Fig. 342: Coil-On-Plug Electrical Connectors & Wiring Retainers
Courtesy of FORD MOTOR CO.

83. Connect the radio interference capacitor electrical connector.
    - Attach the wiring retainers.

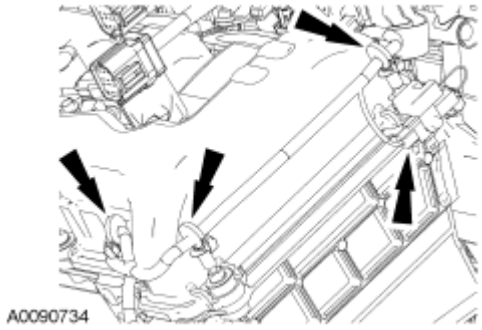


Fig. 343: Locating Radio Interference Capacitor Electrical Connector
Courtesy of FORD MOTOR CO.

84. Connect the RH coil-on-plug electrical connectors.
    - Attach the 2 wiring harness retainers.

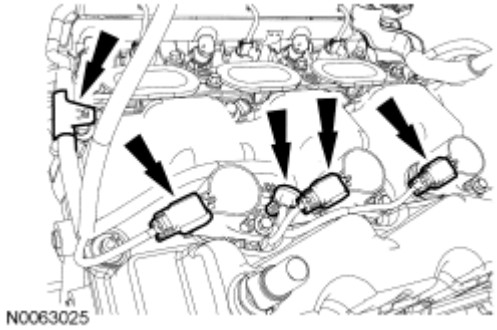


Fig. 344: Identifying Connectors
Courtesy of FORD MOTOR CO.

85. Connect the engine coolant temperature (ECT) sensor electrical connector.

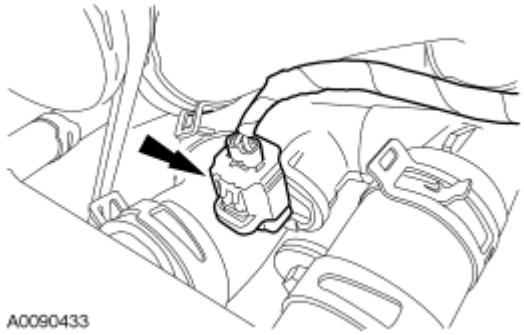


Fig. 345: Locating Engine Coolant Temperature (ECT) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

NOTE: Install new gaskets.

86. Install the upper intake manifold and the bolts.
    - Tighten in the sequence shown to 10 Nm (89 lb-in).

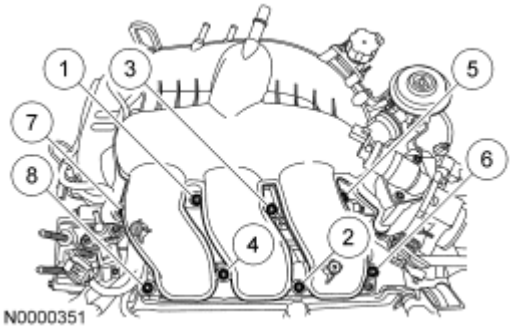


Fig. 346: Identifying Tightening Sequence Of Upper Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

87. Connect the throttle body (TB) coolant hose.

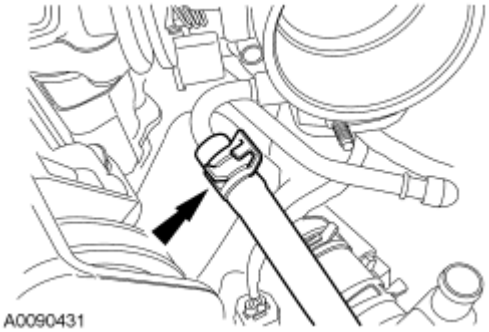


Fig. 347: Locating Throttle Body Coolant Hose
Courtesy of FORD MOTOR CO.

88. Connect the fuel rail pressure and temperature sensor electrical connector and vacuum tube.

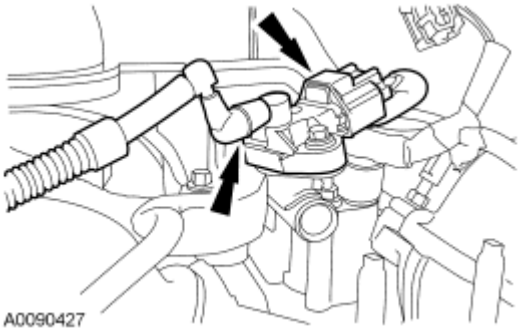


Fig. 348: Locating Fuel Rail Pressure & Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

89. Install the PCV tube.

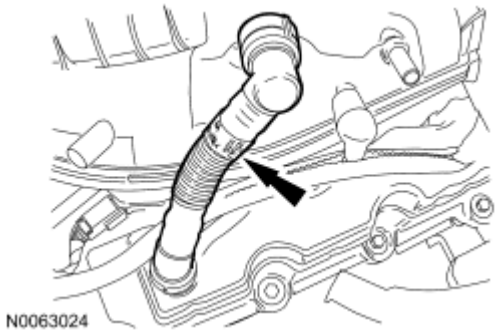


Fig. 349: Identifying PCV Tube
Courtesy of FORD MOTOR CO.

90. Connect the idle air control (IAC) valve and the throttle position (TP) sensor electrical connectors.
    - Attach the wiring retainer.

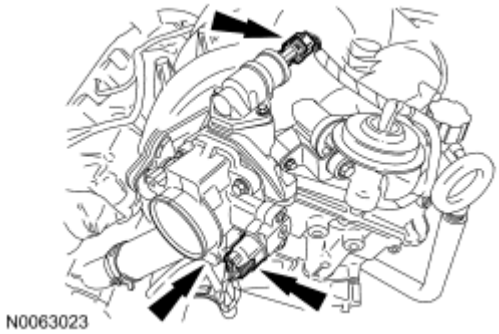


Fig. 350: Identifying (IAC) Valve And (TP) Sensor Connectors
Courtesy of FORD MOTOR CO.

91. Position the engine control wiring harness and install the nuts.
    - Tighten to 6 Nm (53 lb-in).

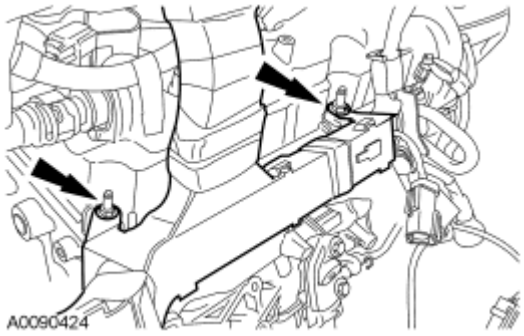


Fig. 351: Locating Engine Control Wiring Harness & Nuts
Courtesy of FORD MOTOR CO.

92. Connect the EGR vacuum regulator electrical connector.

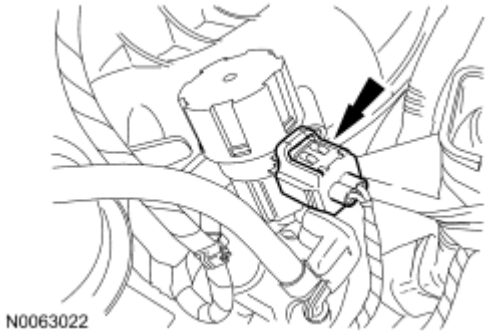


Fig. 352: Identifying Connector
Courtesy of FORD MOTOR CO.

93. Connect the crankshaft position (CKP) sensor electrical connector and attach the wiring retainers.

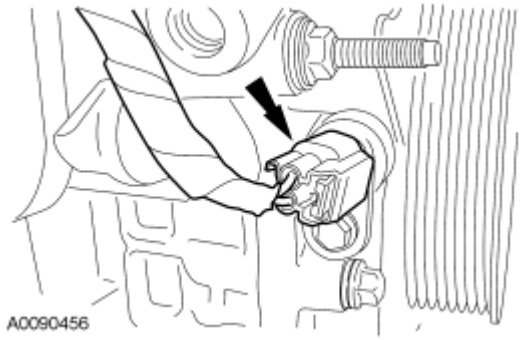


Fig. 353: Locating Crankshaft Position (CKP) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

94. Position the catalyst monitor sensor electrical connector bracket. Install the nut and attach the wiring retainer.
    - Tighten to 10 Nm (89 lb-in).

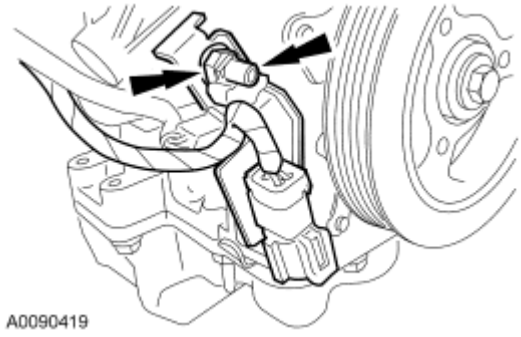


Fig. 354: Locating Heated Oxygen Sensor (HO2S) Electrical Connector Bracket
Courtesy of FORD MOTOR CO.

95. Attach the engine control sensor wiring connectors to the upper intake manifold.

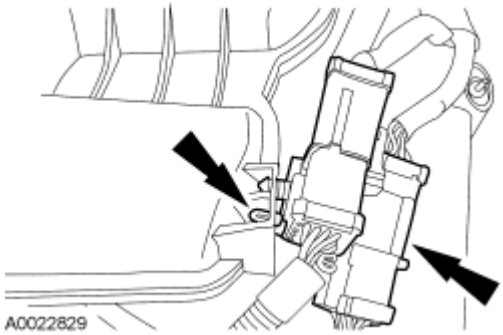


Fig. 355: Locating Engine Control Sensor Wiring Connectors
Courtesy of FORD MOTOR CO.

96. Using the special tools, remove the engine from the engine stand.

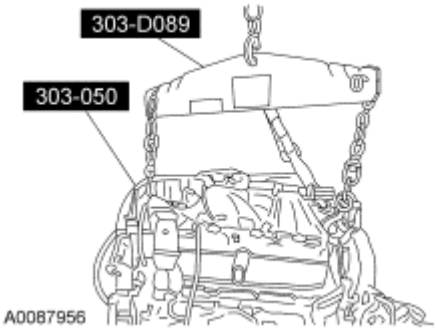


Fig. 356: Aligning Engine With Transaxle
Courtesy of FORD MOTOR CO.

NOTE: Lubricate the seal lips and seal bore with clean engine oil before installing.

97. Using the special tools, install the crankshaft rear oil seal.

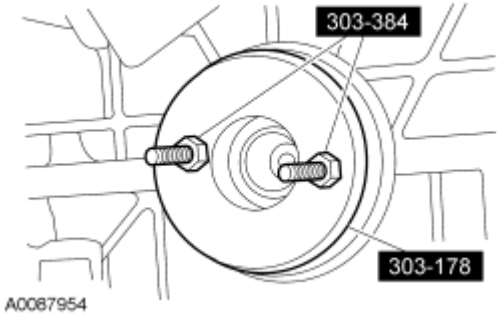


Fig. 357: Identifying Special Tools (303-384 And 303-178)
Courtesy of FORD MOTOR CO.

98. Install the engine-to-transaxle separator plate.

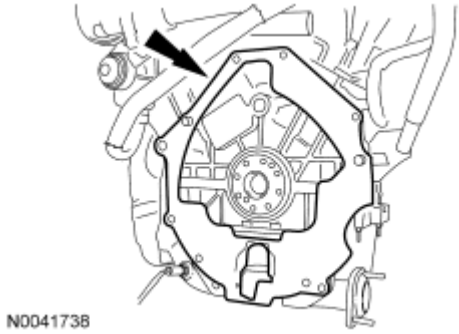


Fig. 358: Locating Engine-To-Transaxle Separator Plate
Courtesy of FORD MOTOR CO.

99. Position the flexplate and install the bolts.
    - Tighten to 80 Nm (59 lb-ft).

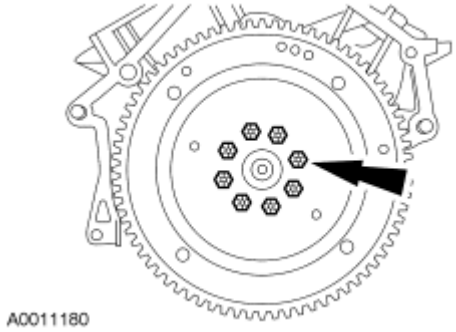


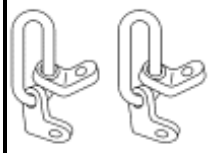
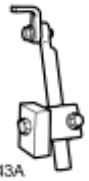
Fig. 359: Locating Flexplate & Bolts
Courtesy of FORD MOTOR CO.

INSTALLATION

ENGINE

Special Tools

Illustration	Tool Name	Tool Number
 ST2873-A	Engine Lifting Bracket Set	303-1140
	Lifting Bracket, Engine	303-050 (T70P-6000)

 ST1595-A		
 ST1293-A	Powertrain Lift with Tilting Plate	014-00765
 ST1602-A	Spreader Bar	303-D089 (D93P-6001-A3) or equivalent
 ST2743A	Universal Adapter Brackets	014-0001

Material

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

INSTALLATION

CAUTION: If the oil pan was removed during engine disassembly, it must be installed after the engine and transaxle are assembled and the transaxle-to-engine bolts are installed. Failure to follow this assembly sequence can result in engine oil leaks.

All vehicles

1. Using the special tools, align the engine with the transaxle.

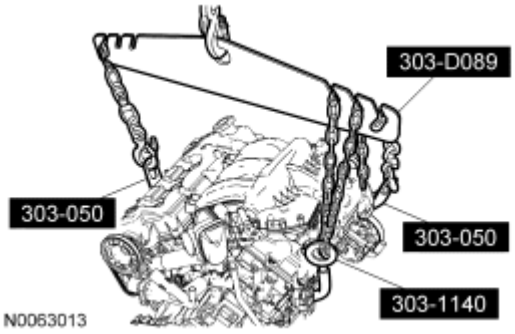


Fig. 360: Identifying Special Tools
Courtesy of FORD MOTOR CO.

2. Install the 5 transaxle-to-engine bolts (3 shown).
   - Tighten to 48 Nm (35 lb-ft).

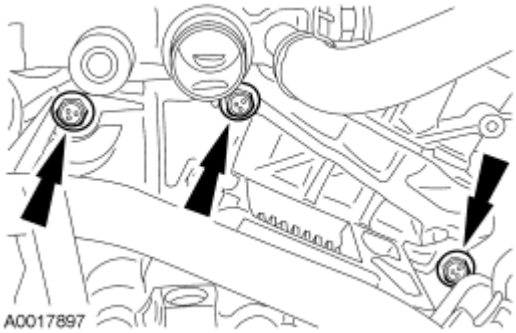


Fig. 361: Locating Transaxle-To-Engine Bolts
Courtesy of FORD MOTOR CO.

3. Using the special tools, secure the engine and transaxle to the powertrain lift.

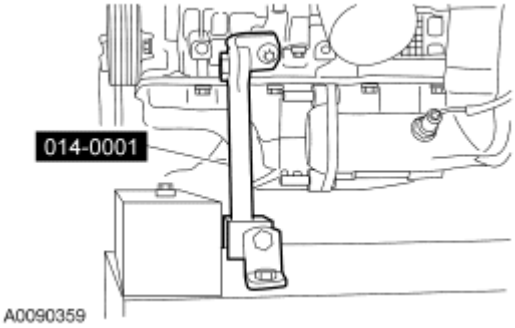


Fig. 362: Securing Engine & Transaxle To Powertrain Lift Using Special Tool (014-0001)
Courtesy of FORD MOTOR CO.

4. Install the EGR regulator and the 2 stud bolts.
   - Tighten to 6 Nm (53 lb-in).

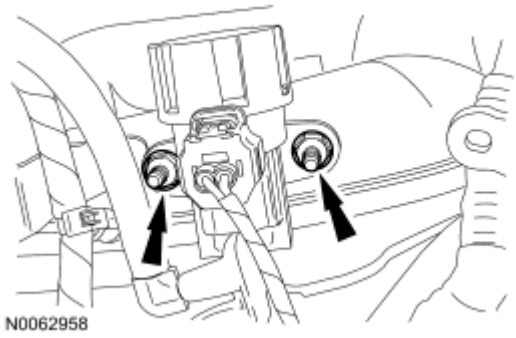


Fig. 363: Identifying Stud Bolts
Courtesy of FORD MOTOR CO.

5. Attach the wiring harness retainer and install the nut.
    - Tighten to 6 Nm (53 lb-in).

Fig. 364: Identifying Nut
Courtesy of FORD MOTOR CO.

All wheel drive (AWD) vehicles

6. Position the power transfer unit (PTU) and install the bolt.
    - Tighten to 45 Nm (33 lb-ft).

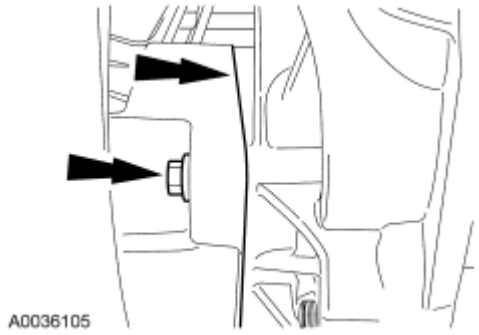


Fig. 365: Locating Transfer Case Bolt & Transfer Case Unit
Courtesy of FORD MOTOR CO.

7. Install the 3 PTU bolts.
    - Tighten to 45 Nm (33 lb-ft).

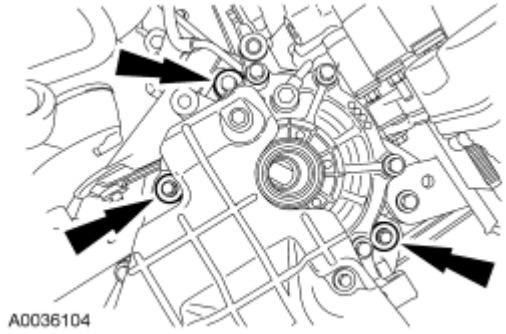


Fig. 366: Locating PTU Bolts
Courtesy of FORD MOTOR CO.

8. Install the PTU vent tube, the pin-type retainer and the bolt.
    - Tighten to 14 Nm (10 lb-ft).

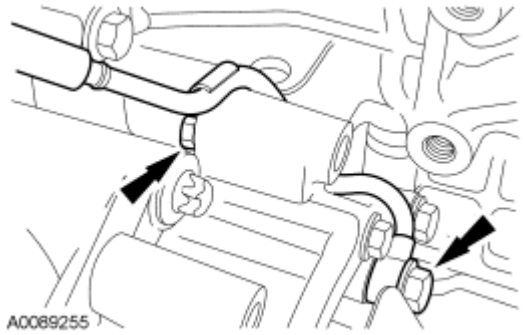


Fig. 367: Locating Pin-Type Retainer & Bolt
Courtesy of FORD MOTOR CO.

9. Install the halfshaft support bracket and the 6 bolts.
    - Tighten to 48 Nm (35 lb-ft).

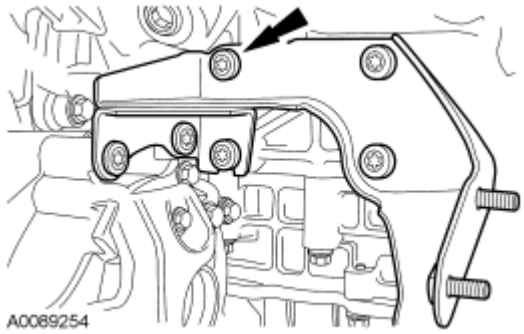


Fig. 368: Locating Half Shaft Support Bracket & Bolts
Courtesy of FORD MOTOR CO.

10. Install 6 new RH exhaust manifold studs.
    - Tighten to 12 Nm (9 lb-ft).

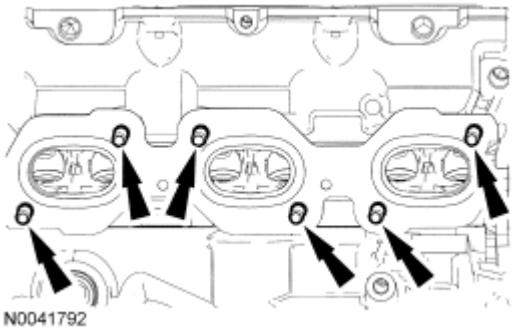


Fig. 369: Locating Exhaust Manifold Studs
Courtesy of FORD MOTOR CO.

11. Using a new gasket, install the RH exhaust manifold and 6 new nuts.
    - Tighten in the sequence shown to 20 Nm (15 lb-ft).

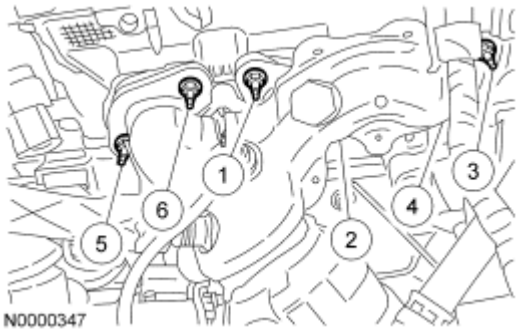


Fig. 370: Identifying Tightening Sequence Of RH Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

12. Connect the RH heated oxygen sensor (HO2S) electrical connector.

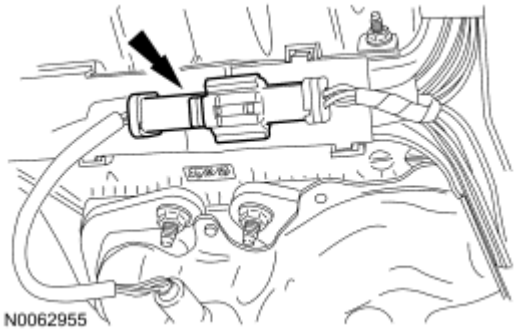


Fig. 371: Identifying (HO2S) Connector
Courtesy of FORD MOTOR CO.

All vehicles

13. Connect the turbine speed sensor (TSS) electrical connector.
    - Attach the wiring harness retainer.

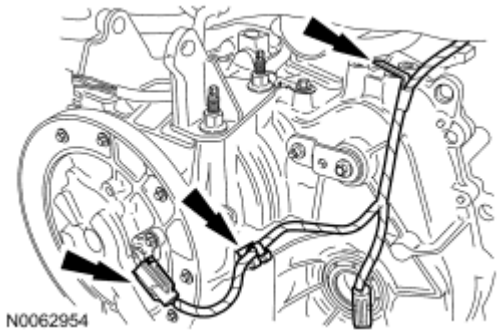


Fig. 372: Identifying (TSS) Connector And Harness Retainer
Courtesy of FORD MOTOR CO.

14. Attach the transaxle control harness to the bracket.

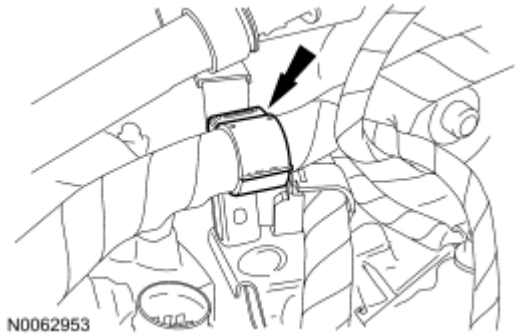


Fig. 373: Identifying Bracket
Courtesy of FORD MOTOR CO.

15. Connect the transaxle wiring harness electronic control switch electrical connector.

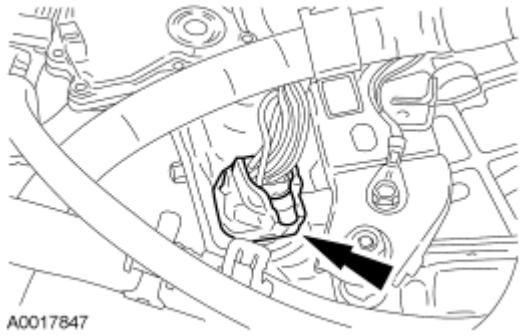


Fig. 374: Locating Transaxle Wiring Harness Electronic Control Switch Electrical Connector
Courtesy of FORD MOTOR CO.

16. Connect the transmission range (TR) sensor electrical connector.

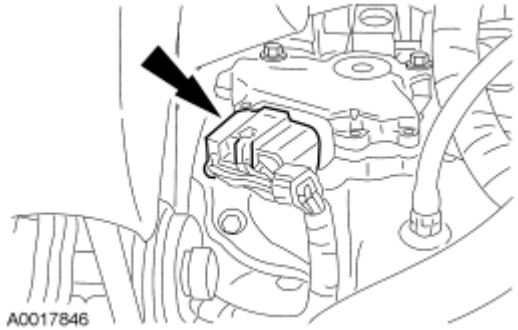


Fig. 375: Locating Transmission Range (TR) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

17. Attach the pin-type retainers to the transansaxle support bracket and connect the HO2S and catalyst monitor sensor electrical connectors.

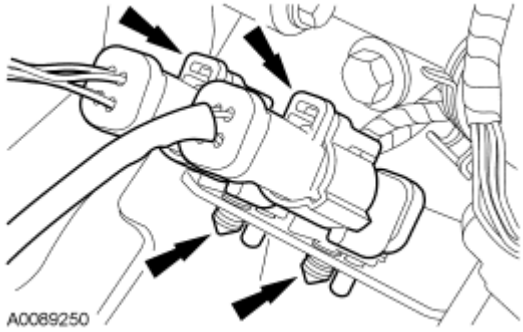


Fig. 376: Locating Heated Oxygen & Catalyst Monitor Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

18. Position the powertrain into the vehicle.

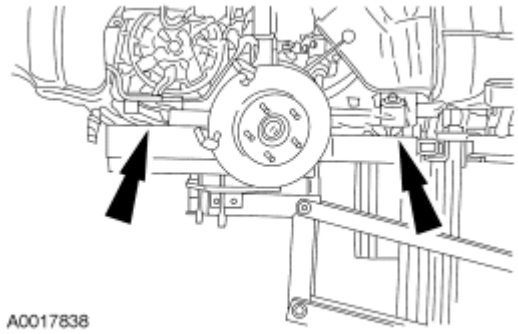


Fig. 377: Positioning Powertrain Into Vehicle
Courtesy of FORD MOTOR CO.

19. Install the engine support bracket, the bolt and the 3 nuts.

- Tighten the nuts to 55 Nm (41 lb-ft) and the bolt to 90 Nm (66 lb-ft).

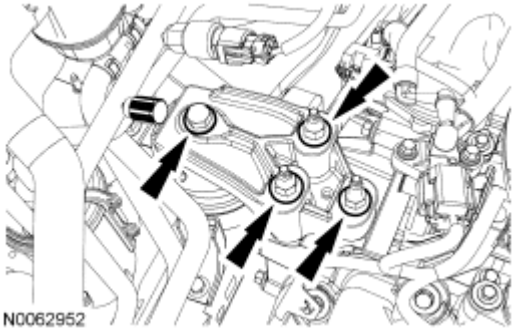


Fig. 378: Identifying Bolt And Nuts
Courtesy of FORD MOTOR CO.

20. Install the rear transaxle support through bolt.
    - Tighten to 103 Nm (76 lb-ft).

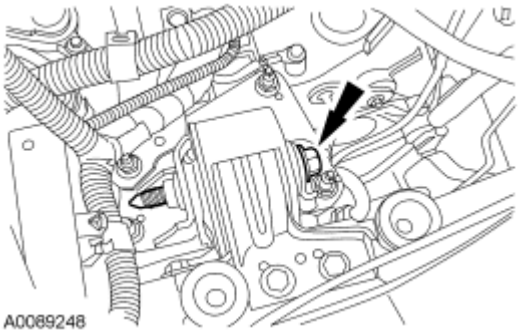


Fig. 379: Locating Transaxle Mount Bolt
Courtesy of FORD MOTOR CO.

21. Position the RH transaxle support insulator and install the bolt and nuts.
    - Tighten to 80 Nm (59 lb-ft).

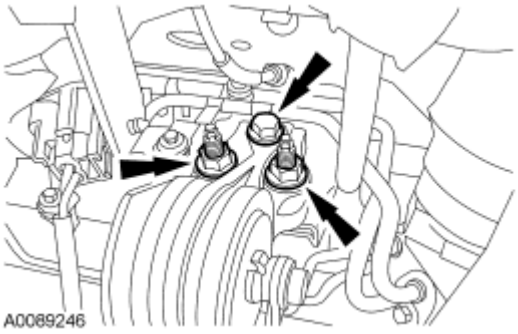


Fig. 380: Locating Transaxle Support Insulator Bolt & Nuts
Courtesy of FORD MOTOR CO.

22. Install the RH transaxle support insulator through bolt.
    - Tighten to 115 Nm (85 lb-ft).

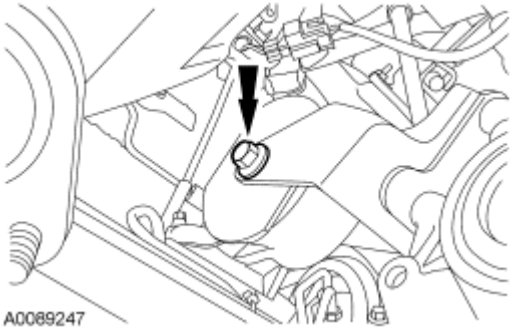


Fig. 381: Locating RH Transaxle Support Insulator Bolt
Courtesy of FORD MOTOR CO.

23. Install the transaxle-to-engine stud and 2 nuts.
    - Tighten to 48 Nm (35 lb-ft).

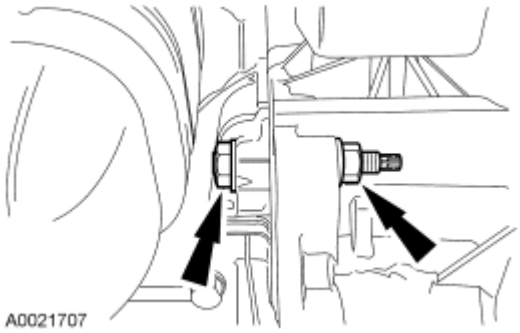


Fig. 382: Locating Transaxle Bolt
Courtesy of FORD MOTOR CO.

NOTE: Clean and degrease all sealing surfaces with metal surface cleaner.

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

24. Apply a 10 mm (0.39 in) dot of silicone gasket and sealant to the front cover-to-cylinder block sealing surface.

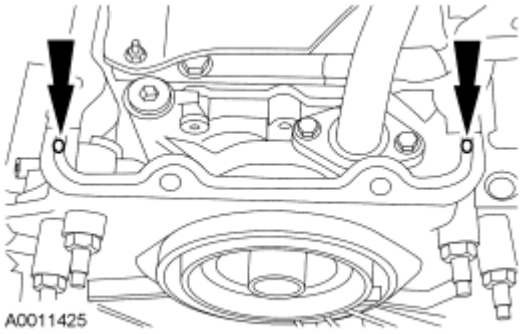


Fig. 383: Applying Silicone Gasket And Sealant To Front Cover-To-Cylinder Block
Courtesy of FORD MOTOR CO.

NOTE: Install a new oil pan gasket.

25. Position the oil pan and gasket and loosely install the bolts and stud bolts.

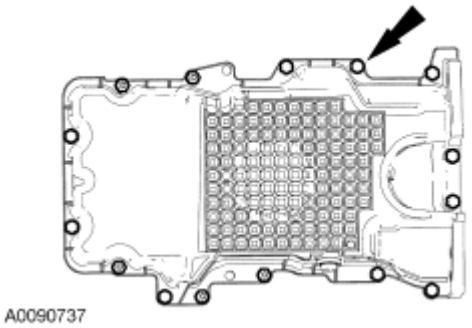


Fig. 384: Locating Oil Pan Gasket Bolts & Stud Bolts
Courtesy of FORD MOTOR CO.

26. Install the 2 oil pan-to-transaxle bolts.
    - Tighten to 40 Nm (30 lb-ft).

Fig. 385: Locating Oil Pan-To-Transaxle Bolts
Courtesy of FORD MOTOR CO.

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

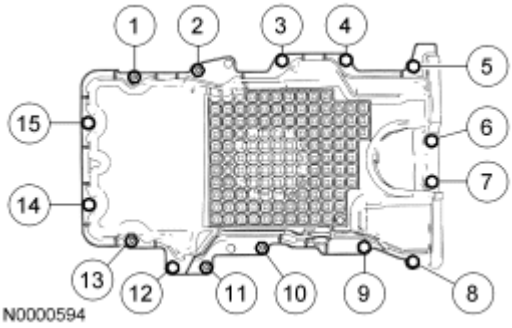


Fig. 386: Identifying Tightening Sequence Of Oil Pan-To-Engine Bolts And Stud Bolts
Courtesy of FORD MOTOR CO.

28. Install the 4 torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).

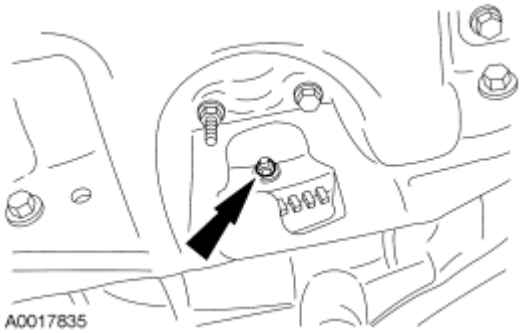


Fig. 387: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

29. Install the torque converter inspection cover.

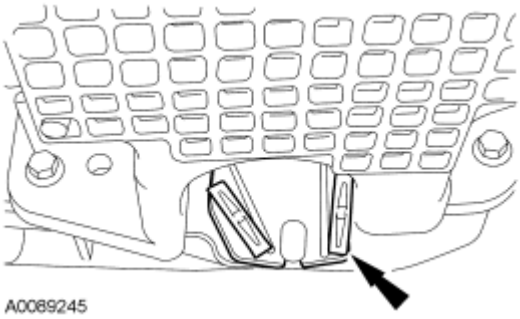


Fig. 388: Locating Torque Converter Inspection Cover
Courtesy of FORD MOTOR CO.

30. Install the output shaft speed (OSS) sensor and the bolt and connect the electrical connector.
    - Tighten to 13 Nm (10 lb-ft).

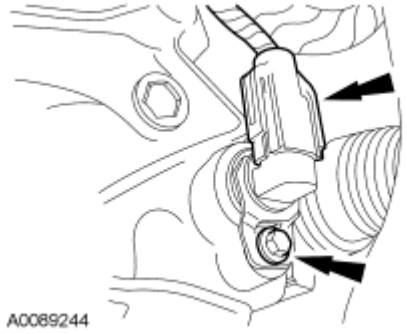


Fig. 389: Locating Output Shaft Speed (OSS) Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

31. If equipped, connect the engine block heater electrical connector.

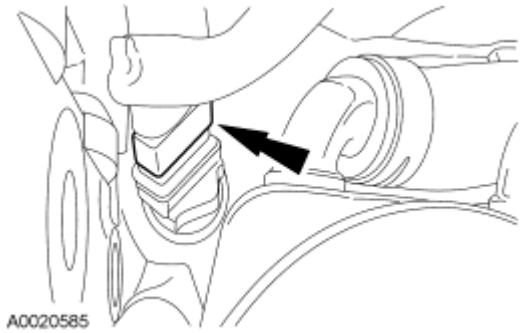


Fig. 390: Locating Engine Block Heater Electrical Connector
Courtesy of FORD MOTOR CO.

32. Install the ground wire eyelet and nut to the engine mount stud.
    - Tighten to 25 Nm (18 lb-ft).

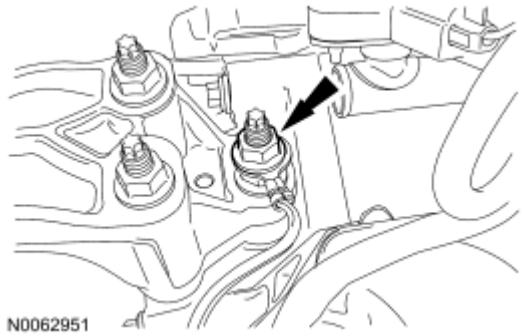


Fig. 391: Identifying Stud
Courtesy of FORD MOTOR CO.

33. Install the wire and nut to the battery cable.
    - Tighten to 10 Nm (89 lb-in).

Fig. 392: Locating Battery Cable And Nut
Courtesy of FORD MOTOR CO.

34. Attach the wiring harness retainers from the battery tray bracket.

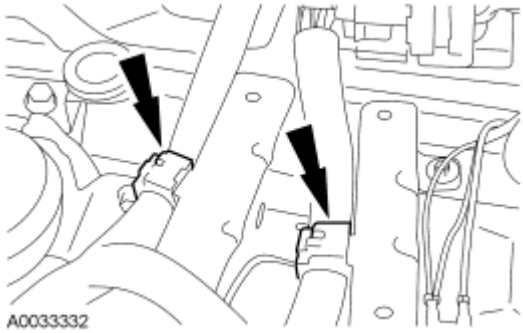


Fig. 393: Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

35. Position the ground strap and the electrical connector and install the bolts.
    - Tighten to 10 Nm (89 lb-in).

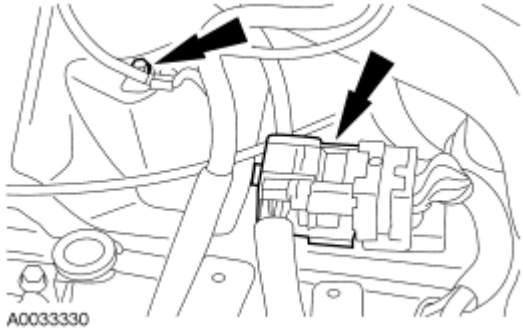


Fig. 394: Locating Ground Strap & Electrical Connector
Courtesy of FORD MOTOR CO.

36. Connect the electrical connector to the power distribution box.

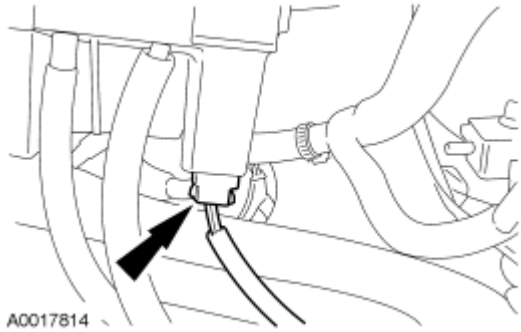


Fig. 395: Power Distribution Box Electrical Connector
Courtesy of FORD MOTOR CO.

37. Install the cable and the nut.
    - Tighten to 12 Nm (9 lb-ft).

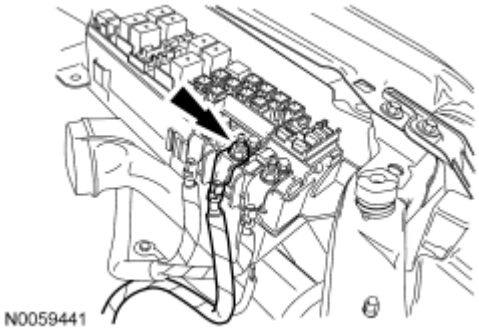


Fig. 396: Identifying Nut
Courtesy of FORD MOTOR CO.

38. Attach the ground wire and install the bolt.
    - Tighten to 10 Nm (89 lb-in).

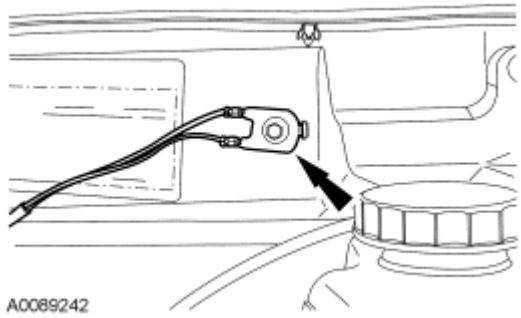


Fig. 397: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

39. Position the wiring and install the nut. Connect the PCM electrical connectors.
    - Tighten to 8 Nm (71 lb-in).

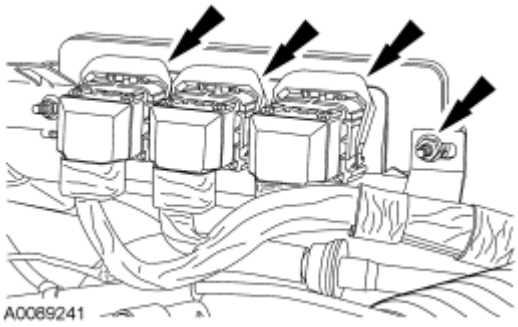


Fig. 398: Locating Powertrain Control Module (PCM) Electrical Connectors
Courtesy of FORD MOTOR CO.

40. Connect the manifold absolute pressure (MAP) sensor electrical connector and vacuum tube.

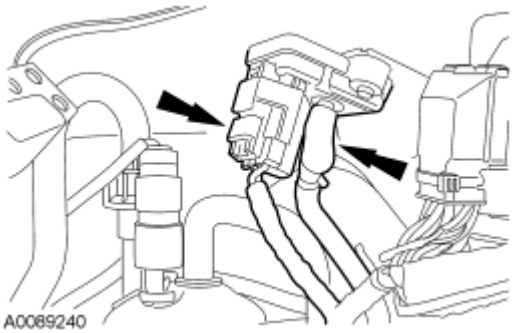


Fig. 399: Locating Manifold Absolute Pressure (MAP) Sensor Vacuum Tube & Electrical Connector
Courtesy of FORD MOTOR CO.

41. Connect the brake booster vacuum tube.

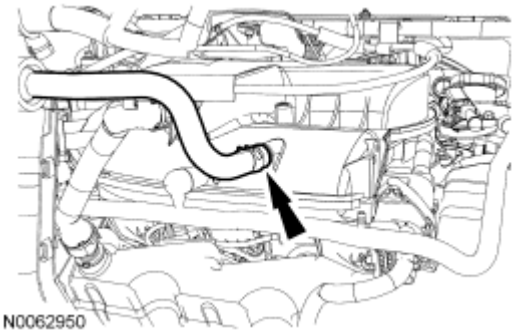


Fig. 400: Identifying Vacuum Tube
Courtesy of FORD MOTOR CO.

42. Connect the evaporative emissions (EVAP) purge valve tube to the intake manifold.

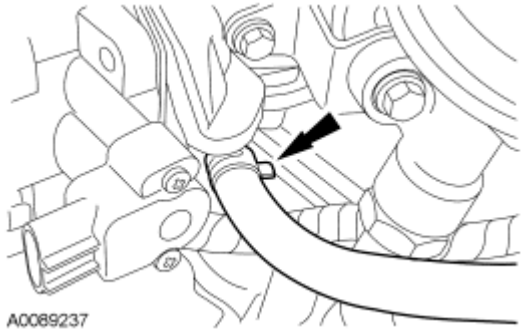


Fig. 401: Locating Vacuum Tube Retainer
Courtesy of FORD MOTOR CO.

43. Position the EGR tube and loosely install the fittings.
    - Tighten the EGR tube-to-EGR valve fitting to 40 Nm (30 lb-ft).

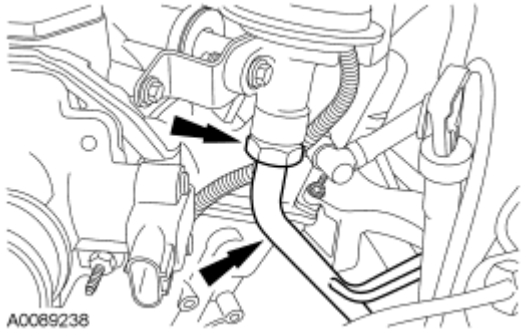


Fig. 402: Locating Exhaust Gas Recirculation (EGR) Tube
Courtesy of FORD MOTOR CO.

44. Connect the differential pressure feedback EGR sensor electrical connector and attach the pin-type retainer.

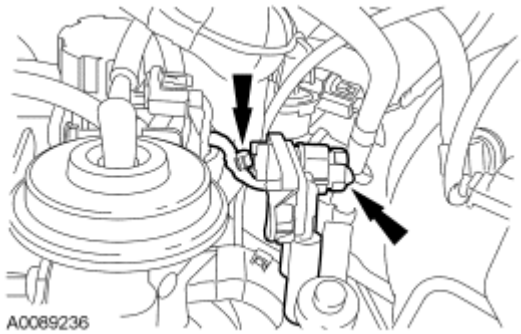


Fig. 403: Locating EGR Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

45. Position the shift cable and bracket in place, install the bolts and install the wiring harness retainer.
    - Tighten to 23 Nm (17 lb-ft).

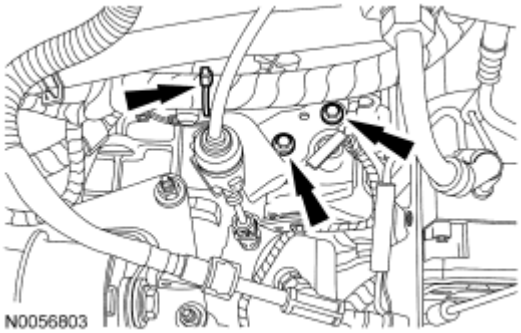


Fig. 404: Identifying Bolts And Retainer
Courtesy of FORD MOTOR CO.

46. Connect the gearshift cable to the transaxle.

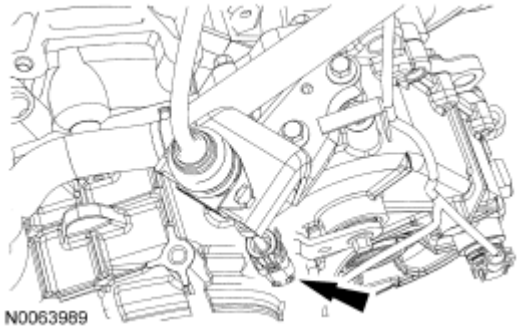


Fig. 405: Identifying Gearshift Cable
Courtesy of FORD MOTOR CO.

47. Attach the wiring harness pin-type retainer to the gearshift cable bracket.

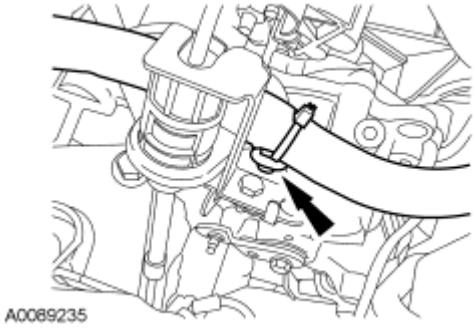


Fig. 406: Locating Pin-Type Retainer
Courtesy of FORD MOTOR CO.

48. Connect the fuel supply tube quick connect coupling at the fuel rail. For additional information, refer to **FUEL SYSTEM - GENERAL INFORMATION** article.
49. Attach the transaxle vent tube retainer to the throttle body.

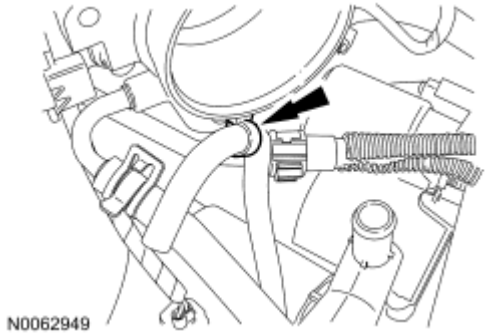


Fig. 407: Identifying Retainer
Courtesy of FORD MOTOR CO.

50. Connect the heater hoses and the throttle body coolant hose.

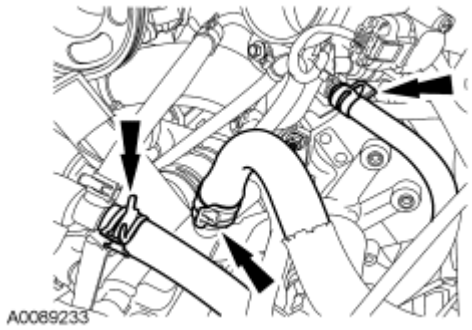


Fig. 408: Locating Heater Hoses & Throttle Body Coolant Hose
Courtesy of FORD MOTOR CO.

51. Connect the upper and lower radiator hoses.

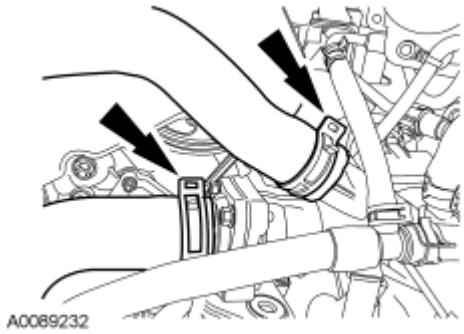


Fig. 409: Locating Hoses
Courtesy of FORD MOTOR CO.

52. Position the accelerator and speed control cables and bracket. Install the nut.
    - Tighten to 10 Nm (89 lb-in).

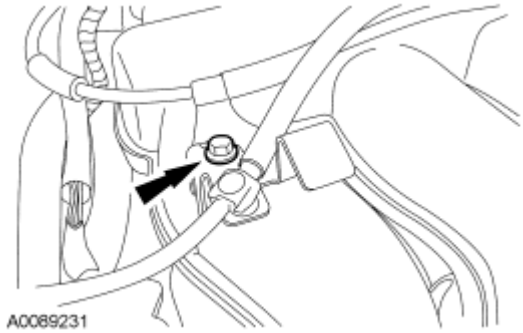


Fig. 410: Cable Bracket
Courtesy of FORD MOTOR CO.

53. Position the bracket and install the bolts.
    - Tighten to 10 Nm (89 lb-in).
    - Connect the accelerator cable and the speed control actuator cable.

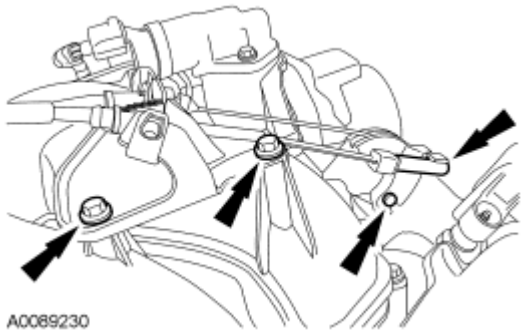


Fig. 411: Accelerator Cable, Speed Control Actuator Cable & Cable Bracket Bolts
Courtesy of FORD MOTOR CO.

54. Position the accelerator cable snow shield and install the bolts.
    - Tighten to 10 Nm (89 lb-in).

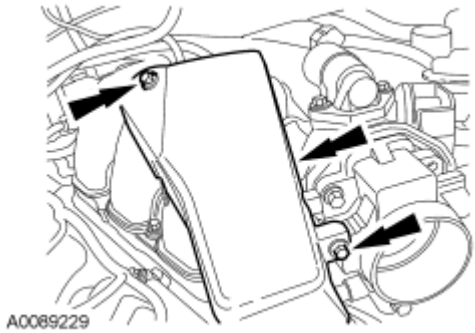


Fig. 412: Locating Accelerator Cable Snow Shield Bolts
Courtesy of FORD MOTOR CO.

55. Tighten the EGR tube-to-RH catalytic converter fitting to 40 Nm (30 lb-ft).

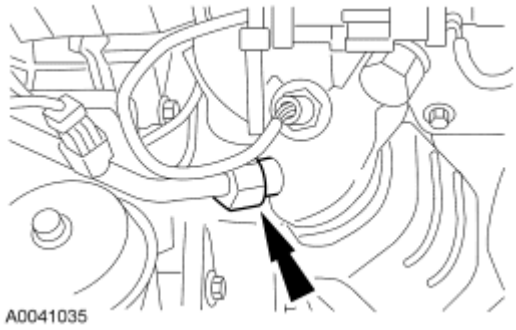


Fig. 413: Locating EGR Tube-To-RH Catalytic Converter Fitting
Courtesy of FORD MOTOR CO.

56. Install the transaxle cooler tube and the bracket bolt.
    - Tighten the bolt to 13 Nm (10 lb-ft), tighten the fitting to 23 Nm (17 lb-ft).

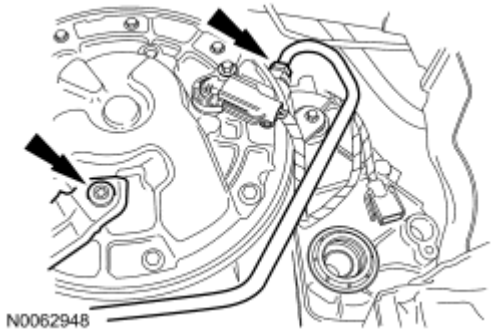


Fig. 414: Identifying Cooler Tube And Bolt
Courtesy of FORD MOTOR CO.

57. Connect the 2 transmission cooler tubes (1 shown).

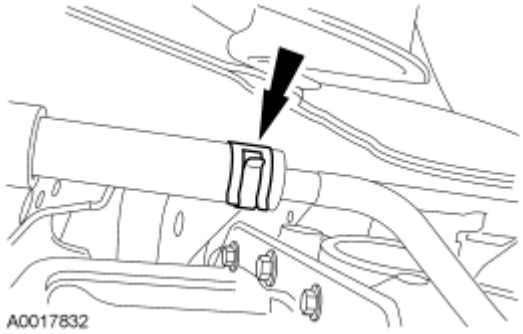


Fig. 415: Locating Transmission Cooler Tubes
Courtesy of FORD MOTOR CO.

58. Install the cross brace and the new nut finger tight.

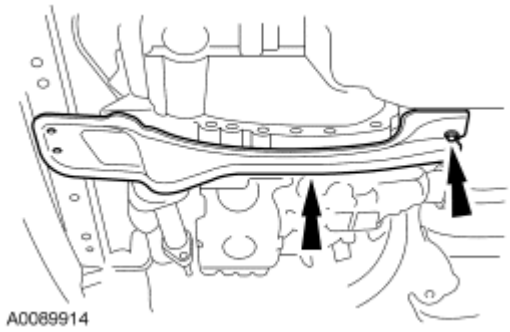


Fig. 416: Identifying Cross Brace And Rear Nut
Courtesy of FORD MOTOR CO.

59. Install the 2 bolts for the cross brace and the bolt for the front roll restrictor.
    - Tighten the 2 cross brace bolts to 90 Nm (66 lb-ft).
    - Tighten the front roll restrictor bolt to 115 Nm (85 lb-ft).

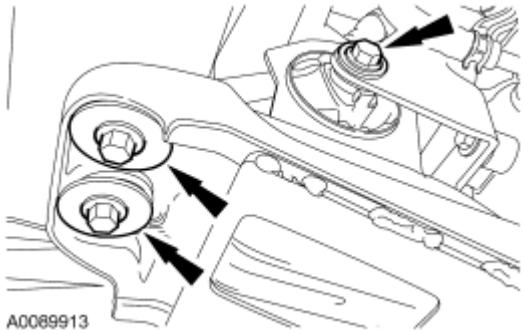


Fig. 417: Identifying Front Roll Restrictor Bolt & Bolts For Engine Support Crossmember
Courtesy of FORD MOTOR CO.

60. Tighten the cross brace nut to 175 Nm (129 lb-ft).

Fig. 418: Identifying Nut
Courtesy of FORD MOTOR CO.

61. Position the RH accessory drive belt idler pulley and bracket and attach the wiring harness retainer.
    - Install the 3 bolts and tighten to 25 Nm (18 lb-ft).

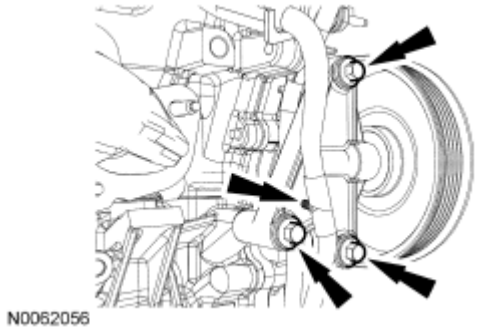


Fig. 419: Identifying Bolts
Courtesy of FORD MOTOR CO.

62. Install the A/C compressor and the bolts.
    - Tighten to 25 Nm (18 lb-ft).

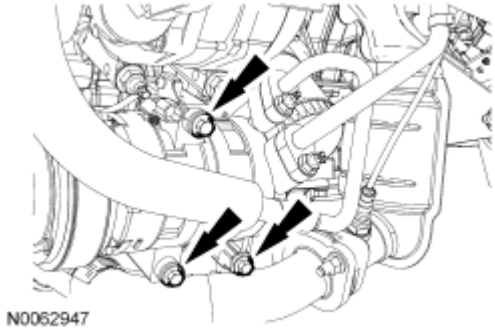


Fig. 420: Identifying Bolts
Courtesy of FORD MOTOR CO.

63. Connect the A/C clutch field coil electrical connector.

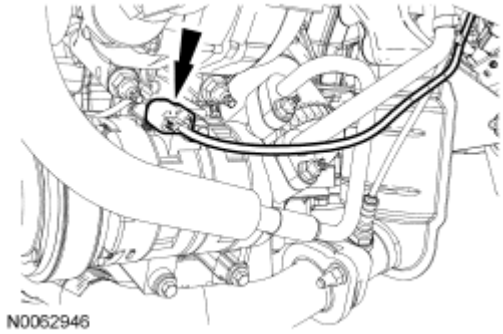


Fig. 421: Identifying Connector
Courtesy of FORD MOTOR CO.

64. Rotate the accessory drive belt tensioner counterclockwise and install the accessory drive belt.

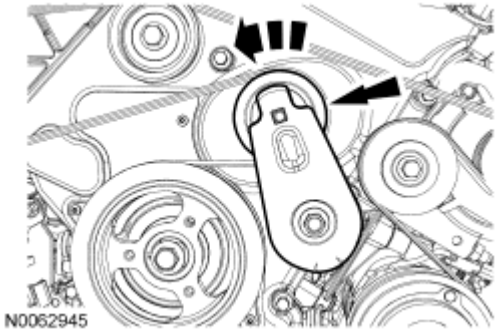


Fig. 422: Rotating Drive Belt Tensioner
Courtesy of FORD MOTOR CO.

AWD vehicles

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

65. Align the index-marks made during removal and install 6 new front driveshaft-to-PTU bolts and washers.
    - Tighten to 37 Nm (27 lb-ft).

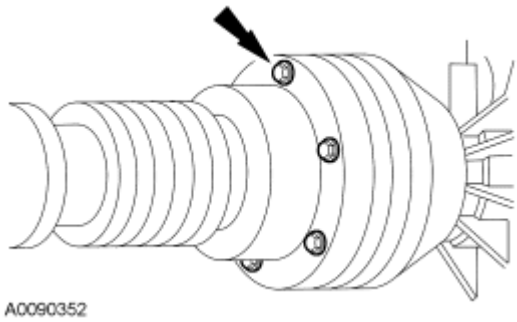


Fig. 423: Locating Driveshaft-To-Power Take Off Bolts & Washers
Courtesy of FORD MOTOR CO.

All vehicles

66. Install the intermediate shaft and the 2 nuts.
    - Tighten to 27 Nm (20 lb-ft).

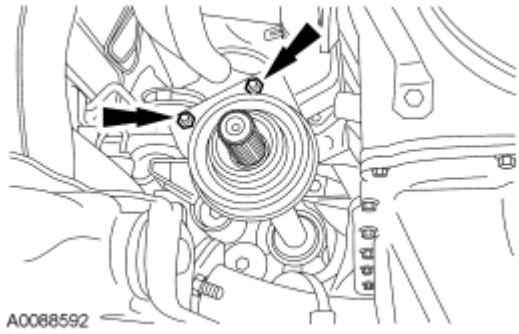


Fig. 424: Locating Intermediate Shaft Retaining Nuts
Courtesy of FORD MOTOR CO.

67. Install the RH halfshaft onto the intermediate shaft.

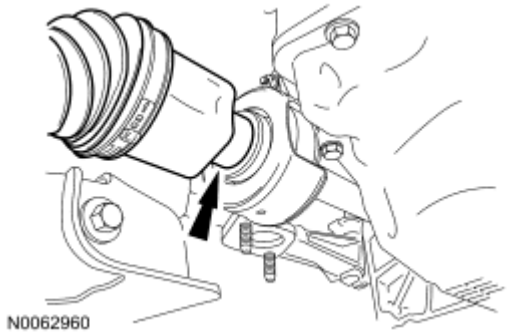


Fig. 425: Identifying RH Halfshaft
Courtesy of FORD MOTOR CO.

68. Install the LH halfshaft into the transaxle.

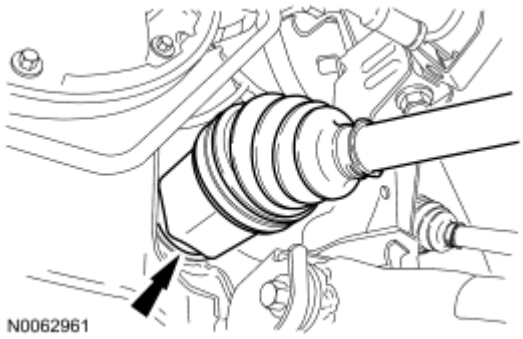


Fig. 426: Identifying LH Halfshaft
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

69. Attach the LH and RH lower ball joints to the steering knuckles and install the pinch bolts and nuts.
    - Tighten to 63 Nm (46 lb-ft).

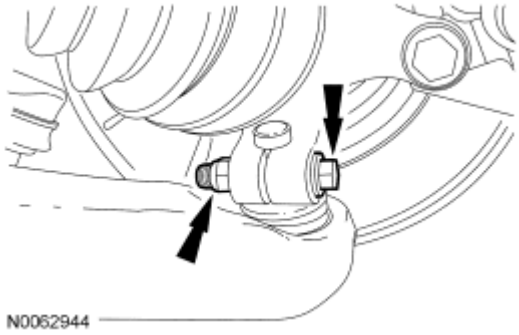


Fig. 427: Identifying Bolt And Nut
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

70. Install the LH and RH tie-rod ends and nuts.
    - Tighten to 55 Nm (41 lb-ft).

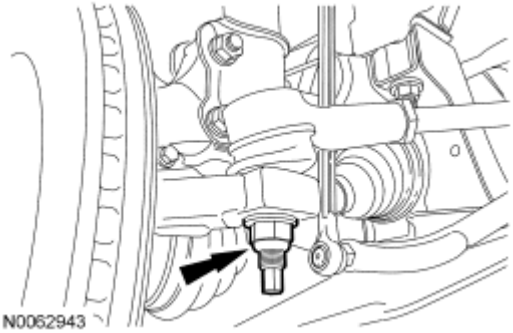


Fig. 428: Identifying Nut
Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

71. Install the LH and RH stabilizer link-to-strut nuts.
    - Tighten to 63 Nm (46 lb-ft).

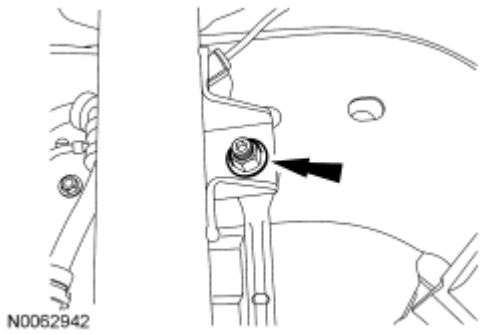


Fig. 429: Identifying Nut

Courtesy of FORD MOTOR CO.

NOTE: LH shown, RH similar.

72. Install the LH and RH brake hose retainers and ABS sensor wiring harness bolts.
    - Tighten to 15 Nm (11 lb-ft).

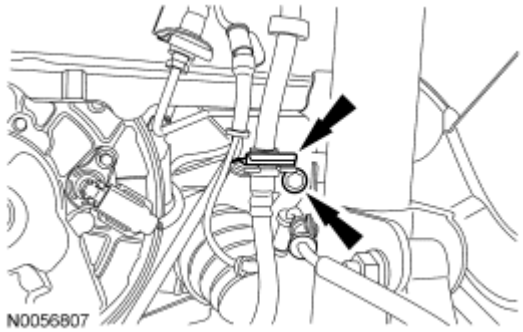


Fig. 430: Identifying Retainer And Bolt
Courtesy of FORD MOTOR CO.

73. Install the Y-pipe and the 2 new exhaust flange-to-RH catalytic converter nuts.
    - Tighten to 29 Nm (21 lb-ft).

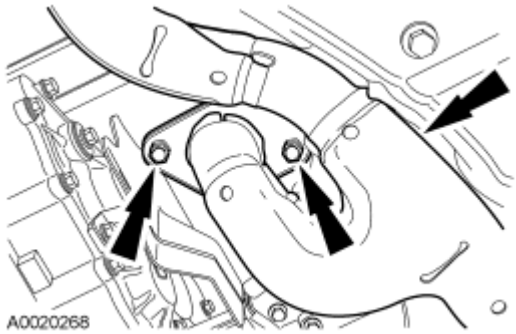


Fig. 431: Rear Exhaust Pipe Flange & Nuts
Courtesy of FORD MOTOR CO.

74. Install the 2 new exhaust flange-to-LH catalytic converter nuts.
    - Tighten to 29 Nm (21 lb-ft).

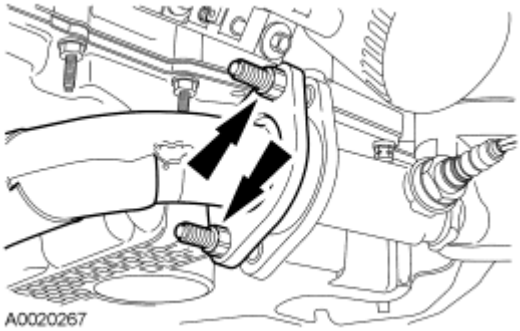


Fig. 432: Front Exhaust Pipe Flange Nuts
Courtesy of FORD MOTOR CO.

75. Attach the Y-pipe to the rear catalytic converter.
    1. Attach the exhaust hanger.
    2. Install the 2 new exhaust flange-to-rear catalytic converter nuts.
        - Tighten to 29 Nm (21 lb-ft).

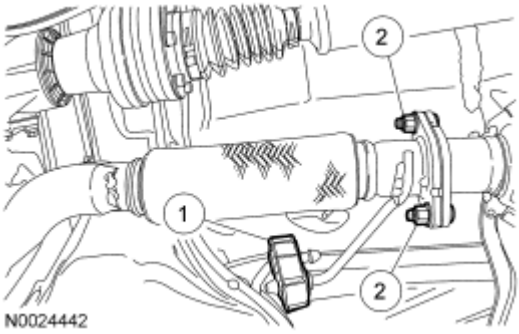


Fig. 433: Exhaust Hanger & Nuts
Courtesy of FORD MOTOR CO.

76. Install the lateral support crossmember and the 4 bolts.
    - Tighten to 115 Nm (85 lb-ft).

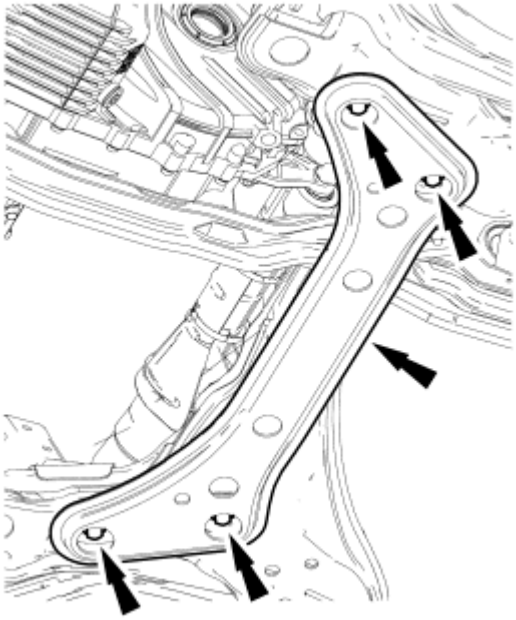


Fig. 434: Identifying Lateral Support Crossmember And Bolts
Courtesy of FORD MOTOR CO.

77. Connect the catalyst monitor sensor electrical connector and the 2 wiring harness retainers.

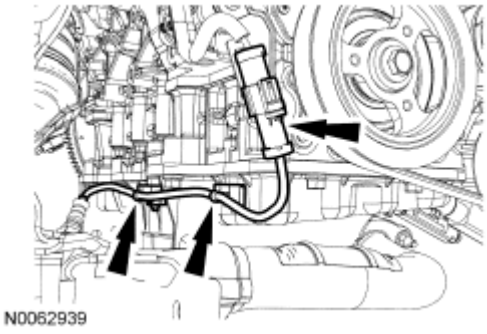


Fig. 435: Identifying Connector And Retianers
Courtesy of FORD MOTOR CO.

78. Install the lower splash shields.

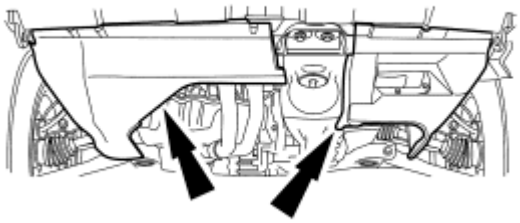


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Fig. 436: Splash Shields
Courtesy of FORD MOTOR CO.

79. Install the front wheels and tires. For additional information, refer to **WHEELS AND TIRES** article.
80. Install the air cleaner outlet pipe and air cleaner. For additional information, refer to **INTAKE AIR DISTRIBUTION AND FILTERING - 3.0L (4V)** article.
81. Install the battery tray. For additional information, refer to **BATTERY, MOUNTING AND CABLES** article.
82. Fill the engine with clean engine oil.
83. Fill and bleed the cooling system. For additional information refer to **ENGINE COOLING** article.

