

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ

2010 ENGINE**Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ****SPECIFICATIONS****MATERIAL SPECIFICATIONS TABLE****MATERIAL SPECIFICATIONS TABLE**

Item	Specification	Fill Capacity
High Temperature 4x4 Front Axle and Wheel Bearing Grease XG-11	WSSM1C267-A1	-
Motorcraft® Metal Surface Prep ZC-31-A	-	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (US); Motorcraft® Premium Gold Engine Coolant (Canada) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1	(1)
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A	5.0L (5.3 qt) includes filter change
Motorcraft® Specialty Green Engine Coolant with Bittering Agent (US); Motorcraft® Specialty Green Engine Coolant (Canada) VC-10-A (US); CVC-10-A (Canada)	WSS-M97B55-A	(1)
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A	-
Silicone Gasket and Sealant TA-30	WSEM4G323-A4	-
Silicone Gasket Remover ZC-30	-	-
Thread Sealant with PTFE TA-24	WSKM2G350-A2	-

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

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engine or cooling system damage.

GENERAL SPECIFICATIONS TABLE**GENERAL SPECIFICATIONS TABLE**

Item	Specification
Displacement	2.5L
No. of cylinders	4
Bore/stroke	89.0/100.0
Firing order	1-3-4-2
Oil pressure (hot @ 2,000 rpm)	200-268 kPa (29-39 psi)
Compression ratio	9.7:1
Engine weight (without accessory drive components and flexplate or flywheel)	115.8 kg (255.3 lb)
Engine and transaxle assembly weight (without accessory drive components)	203.8 kg (449.3 lb)
Cylinder Block	
Cylinder bore diameter	89.0-89.03 mm (3.503-3.505 in)
Cylinder bore maximum out-of-round	0.008 mm (0.0003 in)
Main bearing bore diameter	57.018-57.040 mm (2.244-2.245 in)
Head gasket surface flatness	0.1 mm/general 0.05 mm/200 x 200 (0.004 in/general) (0.0019 in/7.87 x 7.87)
Piston	
Diameter (1)	88.965-88.975 mm (3.5025-3.5029 in)
Diameter (2)	88.975-88.985 mm (3.5029-3.5033 in)
Diameter (3)	88.985-88.995 mm (3.5033-3.5037 in)
Piston-to-bore clearance	0.025-0.045 mm (0.0009-0.0017 in)
Ring groove width - top	1.203-1.205 mm (0.0473-0.0474 in)
Ring groove width - 2nd	1.202-1.204 mm (0.0473-0.0474 in)
Ring groove width - oil	2.501-2.503 mm (0.0984-0.0985 in)
Piston skirt coating thickness	0.008-0.016 mm (0.0003-0.0007 in)
Piston Pin	
Diameter	19.995-20.0 mm (0.8265-0.8267 in)
Length	54.7-55.0 mm (2.1535-2.1653 in)
Cylinder Head	
Cylinder head flatness	0.08 (0.0031 in) maximum overall, a maximum of 0.05 mm (0.0019 in) within 150 mm (5.9 in)
Valve lift @ zero lash (exhaust)	7.7 mm (0.30 in)
Valve lift @ zero lash (intake)	8.8 mm (0.35 in)
Valve guide inner diameter	5.509-5.539 mm (0.216-0.218 in)
Valve seat width - intake/exhaust	0.99-1.84 mm (0.038-0.072 in)
Valve seat angle	45 degrees

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Valve seat runout	0.075 mm (0.0029 in)
Valve lash adjuster bore diameter	31.00-31.03 mm (1.220-1.221 in)
Cam bore diameter	25.015-25.040 mm (0.984-0.985 in)
Valve	
Valve head diameter - intake	34.85-35.15 mm (1.372-1.383 in)
Valve head diameter - exhaust	29.85-30.15 mm (1.175-1.187 in)
Valve stem diameter - intake	5.470-5.485 mm (0.2153-0.2159 in)
Valve stem diameter - exhaust	5.465-5.480 mm (0.2151-0.2157 in)
Valve stem-to-guide clearance - intake	0.0027 mm (0.00010 in)
Valve stem-to-guide clearance - exhaust	0.0029 mm (0.00011 in)
Valve face runout	0.05 mm (0.0019 in)
Valve face angle	45 degrees
Valve Spring - Compression Pressure	
Intake and exhaust (installed)	17.5 kg (38.667 lb)
Intake (valve open) 8.9 mm (0.35 in) of lift	44 kg (97.032 lb)
Exhaust (valve open) 7.4 mm (0.29 in) of lift	42 kg (93.338 lb)
Free length	44.92 mm (1.768 in)
Assembled height	37.9 mm (1.492 in)
Crankshaft	
Main bearing journal diameter	51.978-52.002 mm (2.046-2.047 in)
Production repair	51.730-51.750 mm (2.036-2.037 in)
Main bearing clearance	0.016-0.047 mm (0.0006-0.0015 in)
Connecting rod journal diameter	51.978-52.002 mm ((2.046-2.047 in)
Production repair	51.730-51.750 mm (2.036-2.037 in)
End play	0.22-0.450 mm (0.008-0.018 in)
Rings	
Width - top	1.17-1.185 mm (0.0460-0.0466 in)
Width - 2nd	1.197-1.199 mm (0.0471-0.0472 in)
Width - oil	2.38-2.45 mm (0.093-0.096 in)
Ring gap (in bore) - top	0.16-0.31 mm (0.006-0.012 in)
Ring gap (in bore) - 2nd	0.31-0.46 mm (0.012-0.018 in)
Ring gap (in bore) - oil	0.2-0.7 mm (0.007-0.027 in)
Valve Tappet	
Diameter	30.97-30.98 mm (1.2192-1.2196 in)
Tappet-to-valve clearance - intake	0.22-0.28 mm (0.008-0.011 in)
Tappet-to-valve clearance - exhaust	0.27-0.33 mm (0.010-0.013 in)
Tappet-to-bore clearance	0.02-0.06 mm (0.0007-0.0023 in)
Camshaft	
Lobe lift - intake	8.24999 mm (0.324 in)
Lobe lift - exhaust	7.80007 mm (0.307 in)
Runout (1) ⁽¹⁾	0.03 mm (0.001 in)

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Thrust clearance	0.09-0.24 mm (0.003-0.009 in)
Journal diameter	24.96-24.98 mm (0.982-0.983 in)
Journal-to-bore clearance	0.035-0.080 mm (0.001-0.003 in)
Connecting Rod	
Bearing clearance	0.027-0.052 mm (0.001-0.002 in)
Bearing thickness	1.496-1.520 mm (0.058-0.059 in)
Crank bore diameter	53.023-53.047 mm (2.166-2.167 in)
Pin bore diameter	20.965-20.985 mm (0.825-0.826 in)
Length (center-to-center)	151.8 mm (5.976 in)
Side clearance	1.95-3.05 mm (0.076-0.120 in)
Axial clearance	0.14-0.36 mm (0.005-0.014 in)
(1) No. 3 Journal - Supported by No. 1 and No. 5 journals.	

TORQUE SPECIFICATIONS TABLE

TORQUE SPECIFICATIONS TABLE

Description	Nm	lb-ft	lb-in
A/C compressor mounting bolts	25	18	-
A/C manifold tube bolt	25	18	-
A/C tube nut	8	-	71
A/C tube-to-condenser nut	8	-	71
Accessory drive belt idler pulley and bracket bolts	25	18	-
Accessory drive belt idler pulley bolt	25	18	-
Accessory drive belt tensioner bolts	25	18	-
Balance shaft bolts ⁽¹⁾	-	-	-
Bellhousing-to-engine bolts	48	35	-
Bellhousing-to-oil pan bolt	48	35	-
Block heater	40	30	-
Camshaft bearing cap bolts ⁽¹⁾	-	-	-
Camshaft sprocket bolt	72	53	-
Clutch pressure plate ⁽¹⁾	-	-	-
Clutch slave cylinder bolts	22	16	-
Clutch tube bracket bolts	22	16	-

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Coil-on-plug bolts	8	-	71
Connecting rod cap bolts (1)	-	-	-
Coolant outlet bolts	10	-	89
Coolant pump bolts	10	-	89
Coolant pump pulley bolts	20	-	177
Crankcase rear main oil seal retainer plate bolts (1)	-	-	-
Crankcase vent oil separator bolts	10	-	89
Crankshaft Position (CKP) sensor bolts (1)	-	-	-
Crankshaft pulley bolt (1)	-	-	-
Crankshaft rear seal retainer bolts (1)	-	-	-
Cylinder head bolts (1)	-	-	-
Cylinder head studs	17	-	150
Cylinder Head Temperature (CHT) sensor	12	-	106
Degas bottle nut and bolt	9	-	80
EGR tube	55	41	-
EGR valve bolts	20	-	177
Electronic Power Assist Steering (EPAS) ground wire bolt	12	-	106
Engine front cover bolts (1)	-	-	-
Engine front cover timing hole plug (lower)	12	-	106
Engine front cover timing hole plug (upper)	10	-	89
Engine front cover-to-oil pan bolts	10	-	89
Engine mount bolts	55	41	-
Engine mount bracket bolt	115	85	-
Engine mount bracket nuts	103	76	-
Engine mount damper	23	17	-

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bolt			
Engine mount ground wire bolt	10	-	89
Engine mount nut	55	41	-
Engine oil filter ⁽²⁾	-	-	-
Engine Oil Pressure (EOP) switch	15	-	133
Engine plug bolt	20	-	177
Engine roll-restrictor bolt	90	66	-
Exhaust flexible pipe bracket bolts	35	26	-
Exhaust manifold heat shield bolts	10	-	89
Exhaust manifold nuts ⁽¹⁾	-	-	-
Flexplate bolts ⁽¹⁾	-	-	-
Flywheel bolts ⁽¹⁾	-	-	-
Fuel rail bolts	23	17	-
Generator B+ wiring harness nut	12	-	106
Generator mounting nuts and bolt	47	35	-
Generator stud bolts	24	18	-
Ground wire-to-body bolt	12	-	106
Ground wire-to-engine mount bracket bolt	10	-	89
Intake manifold bolts	18	-	159
Knock Sensor (KS)	20	-	177
Main bearing beam bolts ⁽¹⁾	-	-	-
Oil filter adapter bolts	25	18	-
Oil pan bolts ⁽¹⁾	-	-	-
Oil pan-to-bellhousing bolts	48	35	-
Oil pan drain plug	28	21	-
Oil pump bolts ⁽¹⁾	-	-	-
Oil pump drive chain tensioner shoulder bolt	10	-	89
Oil pump drive chain tensioner spring shoulder bolt	10	-	89
Oil pump screen and pickup tube bolts	10	-	89

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Oil pump sprocket bolt	25	18	-
Oil squirters	4	-	35
Positive battery cable nuts	9	-	80
Radio capacitor and nut	10	-	89
Spark plugs	12	-	106
Starter motor solenoid wire nut	5	-	44
Starter motor B+ wire nut	12	-	106
Starter motor bolt and stud bolt	25	18	-
Starter motor stud bolt ground wire nut	18	-	159
Steering column shaft bolt	20	-	177
Subframe nuts	150	111	-
Subframe bracket-to-body bolts	103	76	-
Sway bar link nuts	40	30	-
Thermostat housing bolts	10	-	89
Tie-rod end nuts	48	35	-
Timing chain guide bolts	10	-	89
Timing chain tensioner bolts	10	-	89
Torque converter nuts	35	26	-
Transaxle mount bolts	90	66	-
Transaxle mount through bolt	90	66	-
Valve cover bolts ⁽¹⁾	-	-	-
Variable Camshaft Timing (VCT) solenoid bolt ⁽¹⁾	10	-	89
VCT system oil filter plug	17	-	150
Windshield washer reservoir/A/C tube bracket bolt	7	-	62

(1) Refer to the appropriate procedure(s) for the specification.

(2) Lubricate the engine oil filter gasket with clean engine oil. Tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.

DESCRIPTION AND OPERATION

ENGINE

The 2.5L (153 CID) 4-cylinder engine has the following features:

- DOHC
- Four valves per cylinder
- Sequential Multi-Port Fuel Injection (SFI)
- Aluminum cylinder head
- Aluminum cylinder block
- Electronic ignition system with 4 coil-on-plug ignition coils

The 2.5L engine is a 4 valve-per-cylinder, dual overhead camshaft engine. The engine uses a coil-on-plug ignition system. The cylinder block is made of aluminum and the bearing caps are integrated into the ladder assembly. An aluminum oil pan bolts to the bottom of the lower cylinder block and to the transmission to provide greater strength. The camshafts are mounted in the cylinder heads and act against valve tappets to open and close the valves. The camshafts are driven off the front of the cylinder head by one timing chain. The chain is driven by a sprocket that is located on the crankshaft. The piston assembly is an aluminum piston with a cast iron connecting rod. The oil pump is driven by the crankshaft via a dedicated chain that is driven by the same sprocket that drives the timing chain.

Engine Identification

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

Engine Code Information Label

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



N0096817

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

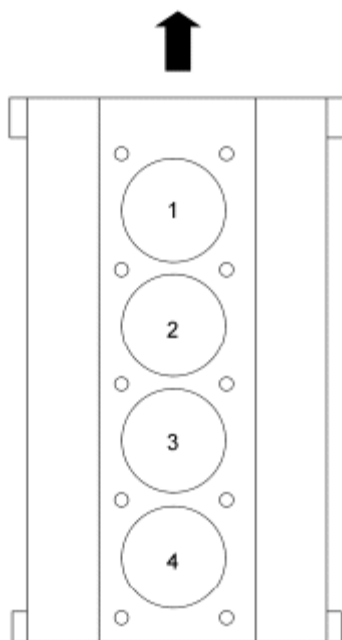
ITEM DESCRIPTION TABLE

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

Engine Cylinder Identification



N0070002

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

Exhaust Emission Control System

Operation and necessary maintenance of the exhaust emission control devices used on this engine are covered in the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Induction System

The **SFI** provides the fuel/air mixture needed for combustion in the cylinders. The 4 solenoid-operated fuel injectors:

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

A constant fuel pressure is maintained across the fuel injectors by the fuel pressure sensor. The fuel pressure sensor is positioned upstream from the fuel injectors on the fuel injection supply manifold.

PCV System

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

Lubrication System

The engine lubrication system operates as follows:

- Oil is drawn into the oil pump through the oil pump screen cover and tube in the sump of the oil pan.
- Oil is pumped through the oil filter on the left front side of the cylinder block.
- Oil enters the main gallery where it is distributed to the crankshaft main journals and to the cylinder head.
- From the main journals, the oil is routed through cross-drilled passages in the crankshaft to lubricate the connecting rod bearings. Controlled leakage through the crankshaft main bearings and connecting rod bearings is slung radially outward to cool and lubricate the cylinder walls as well as the entire connecting rod, piston and piston ring assembly.

DIAGNOSIS AND TESTING

ENGINE

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

GENERAL PROCEDURES

VALVE CLEARANCE CHECK

1. Remove the valve cover. For additional information, refer to **VALVE COVER**.
2. Use a feeler gauge to measure the clearance of each valve and record its location.

NOTE: Turn the engine clockwise only, and only use the crankshaft bolt.

NOTE: Before removing the camshafts, measure the clearance of each valve at base circle, with the lobe pointed away from the tappet. Failure to measure all clearances prior to removing the camshafts will necessitate repeated

removal and installation and wasted labor time.

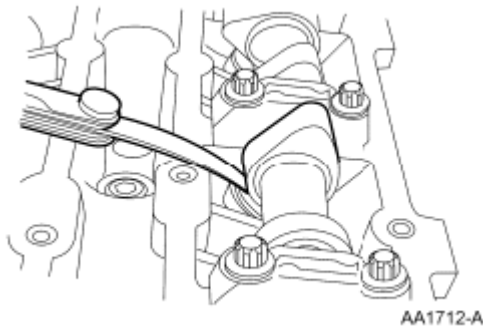


Fig. 3: Measuring Clearance Of Valve
Courtesy of FORD MOTOR CO.

3. Select tappets using this formula: ideal tappet thickness = measured clearance + the existing tappet thickness - nominal clearance.

NOTE: The number on the valve tappet only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

NOTE: The nominal clearance is:

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

NOTE: The acceptable clearances after being fully installed are:

- intake: 0.22-0.28 mm (0.008-0.011 in).
- exhaust: 0.27-0.33 mm (0.010-0.013 in).

Select the closest tappet size to the ideal tappet thickness available and mark the installation location.

4. If any tappets do not measure within specifications, install new tappets in these locations. For additional information, refer to **VALVE TRAIN COMPONENTS - EXPLODED VIEW** and **VALVE TAPPETS**.

BALANCE SHAFT BACKLASH

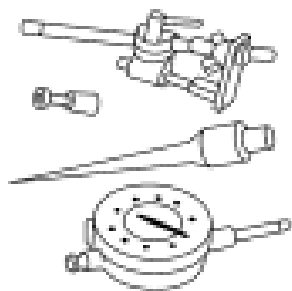
Special Tool(s)

SPECIAL TOOLS TABLE

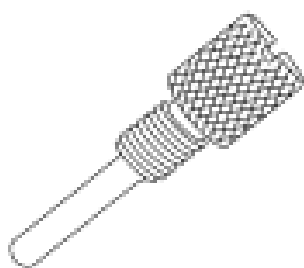
	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
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ST1214-A



ST2638-A

Timing Peg, Crankshaft TDC 303-507

1. Install the Crankshaft **TDC** Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft **TDC** Timing Peg. The engine is now at Top Dead Center (TDC).

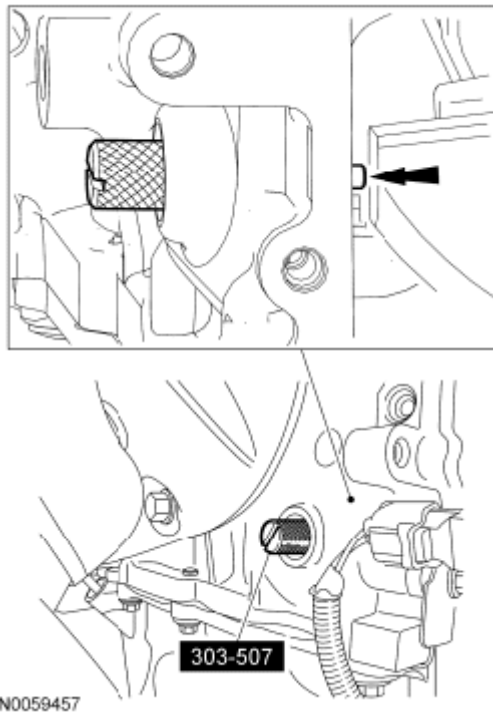


Fig. 4: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

2. Mark the balancer unit and shafts on the top for reference that the balancer unit is at **TDC** .

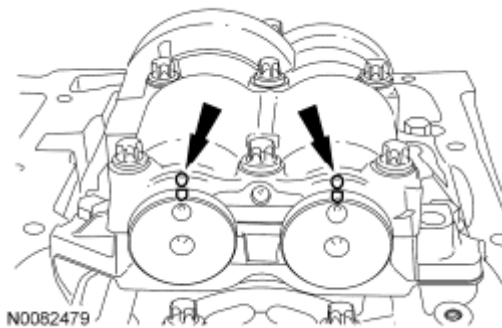


Fig. 5: Locating Balancer Unit And Shafts Mark
Courtesy of FORD MOTOR CO.

3. Remove the 4 bolts and the balancer unit.

NOTE: Due to the precision interior construction of the balancer unit, it should not be disassembled.

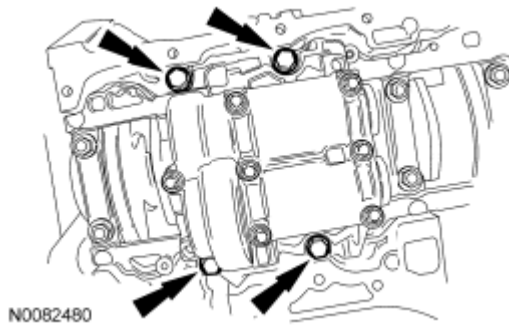


Fig. 6: Locating Balancer Unit Bolts
Courtesy of FORD MOTOR CO.

4. Remove the adjustment shims from the seat faces of the balancer unit.
5. Install the master adjustment shims (No. 50) on the seat faces of the balancer unit.

NOTE: Visually inspect the balancer unit gear for damage and verify that the shaft turns smoothly. If there is any damage or malfunction, replace the balancer unit.

6. With the balancer unit shaft marks at the **TDC** position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

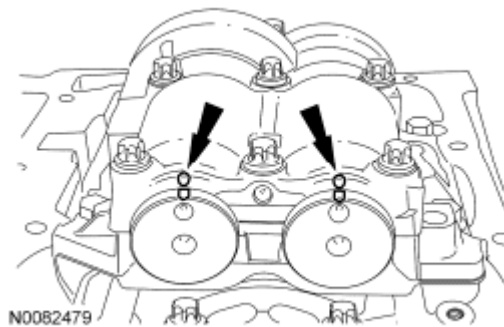


Fig. 7: Locating Balancer Unit And Shafts Reference Mark
Courtesy of FORD MOTOR CO.

7. Install the balancer unit bolts.
 - Tighten in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

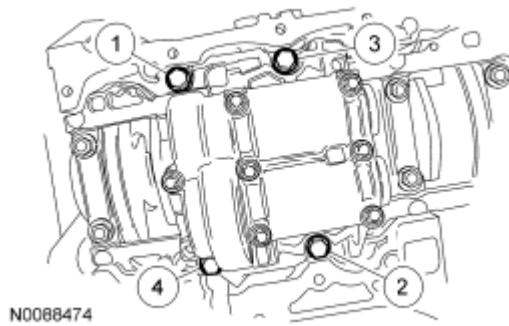


Fig. 8: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

8. Remove the Crankshaft TDC Timing Peg.

- Rotate the crankshaft to confirm that there are no meshing problems between the balancer unit gear and the crankshaft gear.

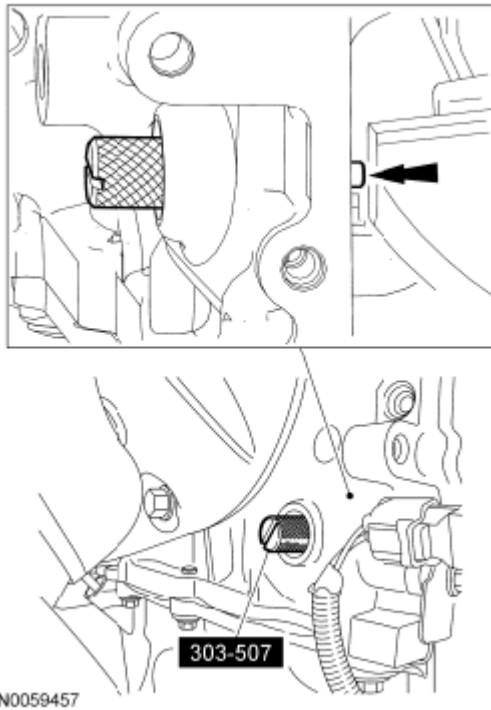


Fig. 9: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

9. Install the Crankshaft TDC Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft TDC Timing Peg.
- Remove the Crankshaft TDC Timing Peg.

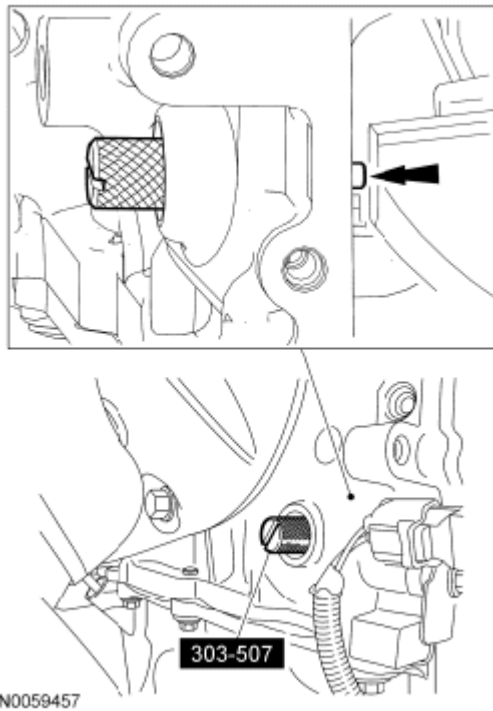


Fig. 10: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

10. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.
 - Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
 - Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.

NOTE: Measure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.

NOTE: The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.

NOTE: For an accurate measurement while measuring the gear backlash, insert a screwdriver as shown into the crankshaft No. 1 crankweight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.

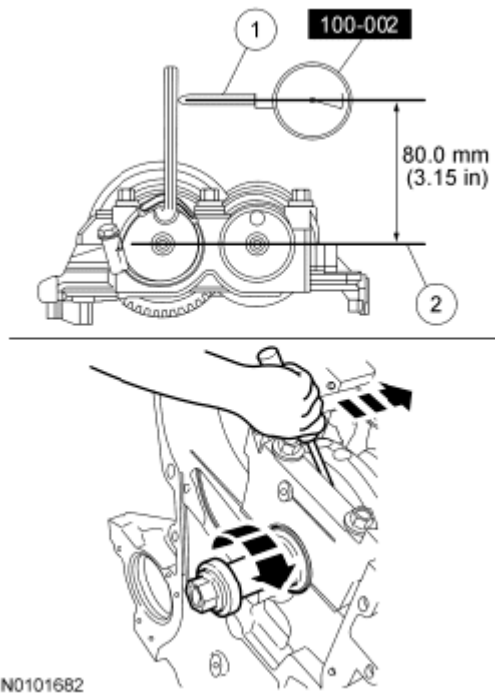


Fig. 11: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

11. Using the backlash measurement, select the proper shims from the Adjustment Shim Selection Table.
 - Remove the balancer unit from the cylinder block.
 - Install the selected adjustment shims on the seat faces of the balancer unit.

NOTE: **If maximum backlash exceeds 0.101 mm (0.003 in), install a new balancer unit.**

ADJUSTMENT SHIM SELECTION TABLE

Backlash mm (in)	Selection shim (No.)	Shim thickness mm (in)	Backlash mm (in)	Selection shim (No.)	Shim thickness mm (in)
0.516-0.528 (0.0203-0.0207)	15	1.15 (0.0452)	0.245-0.257 (0.0096-0.0101)	35	1.35 (0.0531)
0.502-0.514 (0.0197-0.0202)	16	1.16 (0.0456)	0.232-0.243 (0.0091-0.0095)	36	1.36 (0.535)
0.489-0.500 (0.0192-0.0196)	17	1.17 (0.0460)	0.218-0.230 (0.0085-0.0090)	37	1.37 (0.539)
0.475-0.487 (0.0187-0.0191)	18	1.18 (0.0464)	0.205-0.216 (0.0080-0.0085)	38	1.38 (0.0543)
0.462-0.473 (0.0181-0.0186)	19	1.19 (0.0468)	0.191-0.203 (0.0075-0.0079)	39	1.39 (0.0547)
0.448-0.460 (0.0176-0.0181)	20	1.20 (0.0472)	0.178-0.189 (0.0070-0.0074)	40	1.40 (0.0551)
0.435-0.446 (0.0171-0.0175)	21	1.21 (0.0476)	0.164-0.176 (0.0064-0.0069)	41	1.41 (0.0555)
0.421-0.433 (0.0165-0.0170)	22	1.22 (0.0480)	0.151-0.162 (0.0059-0.0063)	42	1.42 (0.0559)
0.408-0.419 (0.0160-0.0164)	23	1.23 (0.0484)	0.137-0.149 (0.0053-0.0058)	43	1.43 (0.0562)
0.394-0.406 (0.0155-0.0159)	24	1.24 (0.0488)	0.124-0.135 (0.0048-0.0053)	44	1.44 (0.0566)
0.381-0.392 (0.0150-0.0154)	25	1.25 (0.492)	0.110-0.122 (0.0043-0.0048)	45	1.45 (0.0570)
0.367-0.379 (0.0144-0.0149)	26	1.26 (0.0496)	0.097-0.108 (0.0038-0.0042)	46	1.46 (0.0574)
0.354-0.365 (0.0139-0.0143)	27	1.27 (0.0499)	0.083-0.095 (0.0032-0.0037)	47	1.47 (0.0578)
0.340-0.352 (0.0133-0.0138)	28	1.28 (0.0503)	0.070-0.081 (0.0027-0.0031)	48	1.48 (0.0582)
0.327-0.338 (0.0128-0.0133)	29	1.29 (0.0507)	0.056-0.068 (0.0022-0.0026)	49	1.49 (0.0586)
0.313-0.325 (0.0123-0.0127)	30	1.30 (0.0511)	0.043-0.054 (0.0016-0.0021)	50 (master)	1.50 (0.0590)
0.300-0.311 (0.0118-0.0122)	31	1.31 (0.0515)	0.029-0.041 (0.0011-0.0016)	51	1.51 (0.0594)
0.286-0.298 (0.0112-0.0117)	32	1.32 (0.0519)	0.015-0.027 (0.0005-0.0010)	52	1.52 (0.0598)
0.272-0.284 (0.0107-0.0111)	33	1.33 (0.0523)	0.002-0.014 (0.00007-0.0005)	53	1.53 (0.0602)
0.259-0.271 (0.0101-0.0106)	34	1.34 (0.0527)	0.000-0.000 (0.0000-0.0000)	54	1.54 (0.0606)

N0101731

Fig. 12: Adjustment Shim Selection Table
Courtesy of FORD MOTOR CO.

- Install the Crankshaft **TDC** Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft **TDC** Timing Peg. The engine is now at **TDC** .

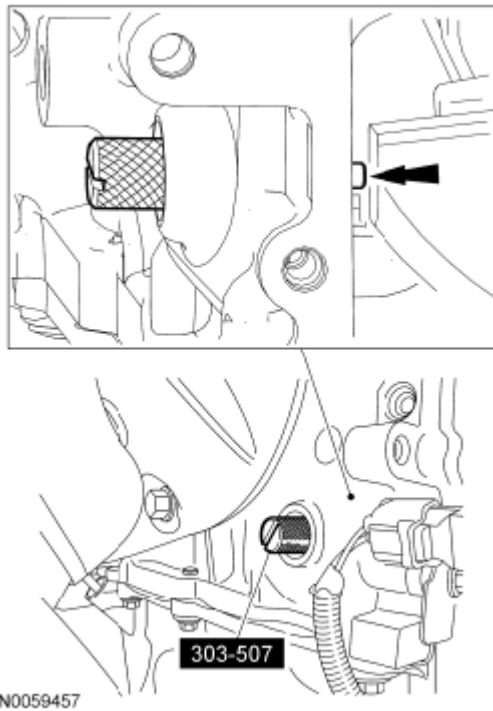


Fig. 13: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

13. With the balancer unit shaft marks in the **TDC** position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

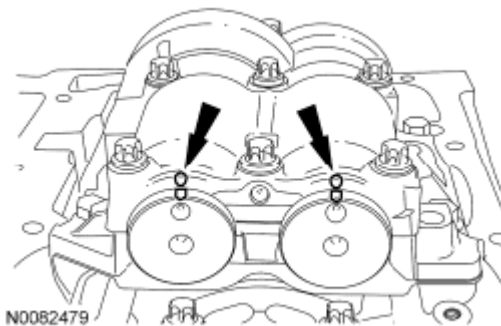


Fig. 14: Locating Balancer Unit And Shafts Reference Mark
Courtesy of FORD MOTOR CO.

14. Install the balancer unit bolts.
 - Tighten in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

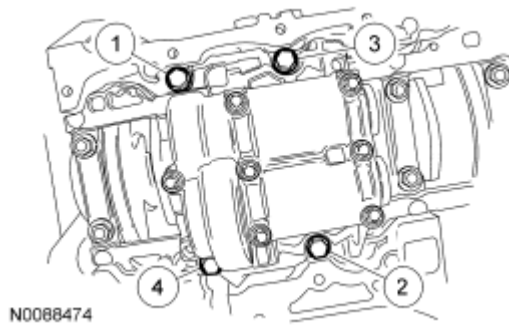


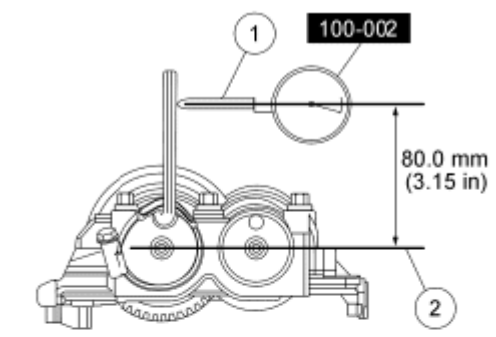
Fig. 15: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

15. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.
- Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
 - Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.
 - If the backlash exceeds the specified range of 0.005 to 0.101 mm (0.00019 to 0.0039 in), install a new balancer unit and repeat the procedure.

NOTE: Remeasure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.

NOTE: The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.

NOTE: For an accurate measurement while measuring the gear backlash, insert a screwdriver as shown into the crankshaft No. 1 crankweight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.



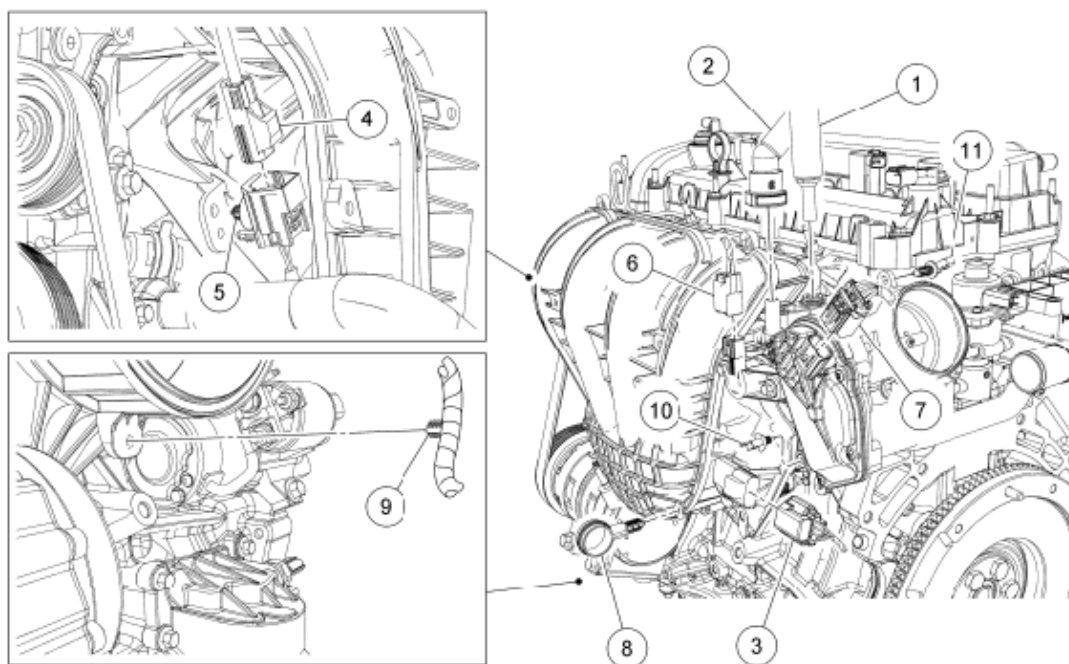
N0101682

Fig. 16: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

IN-VEHICLE REPAIR

INTAKE MANIFOLD

Intake Manifold (View 1 of 2)



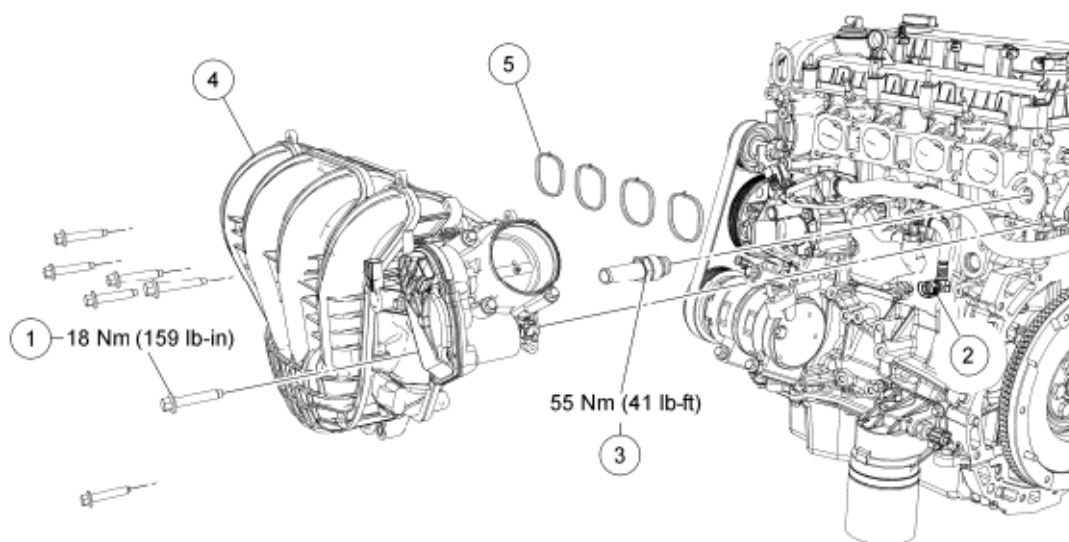
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Fig. 17: Intake Manifold (1 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	19D848	Vacuum supply hose
2	9D289	Fuel vapor return hose
3	14A464	Manifold Absolute Pressure (MAP) sensor electrical connector (part of 12C508)
4	14A464	Knock Sensor (KS) electrical connector (part of 12C508)
5	14A624	KS wire harness pin-type retainer (part of 12C508)
6	14A464	Evaporative Emission (EVAP) canister purge valve electrical connector (part of 12C508)
7	14A464	Electronic throttle control electrical connector (part of 12C508)
8	18K580	Heater hose pin-type retainer
9	13A506	A/C compressor wiring harness retainer (part of 14B060)
10	13A506	Wire harness pin-type retainer
11	14197	Wire harness pin-type retainer

Intake Manifold (View 2 of 2)



N0096699

Fig. 18: Intake Manifold (2 Of 2) With Torque Specifications
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500311	Intake manifold bolt (7 required)
2	6A785	Crankcase vent oil separator tube (part of 6A785)
3	9E470	EGR tube
4	9424	Intake manifold
5	9461	Intake manifold gasket

Removal and Installation

1. With vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the Air Cleaner (ACL) outlet pipe. For additional information, refer to **INTAKE AIR DISTRIBUTION & FILTERING - 2.5L**.
3. Disconnect the vacuum supply hose.
 - Depress the quick connect locking ring.
 - Pull the vacuum hose out of the quick connect fitting.

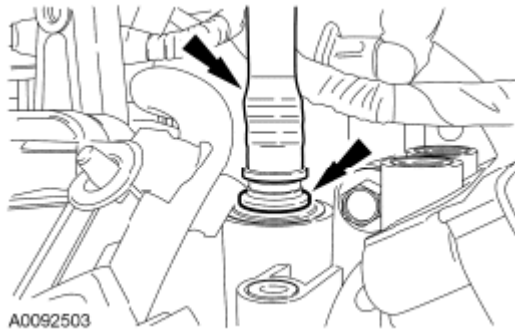


Fig. 19: Locating Quick Connect Locking Ring And Vacuum Supply Hose
Courtesy of FORD MOTOR CO.

4. Disconnect the fuel vapor return hose from the intake manifold.
5. Disconnect the Manifold Absolute Pressure (MAP) electrical connector.
6. Disconnect the Evaporative Emission (EVAP) canister purge valve electrical connector.
7. Disconnect the electronic throttle control electrical connector.
8. Disconnect the Knock Sensor (KS) electrical connector.
 - Detach the wire harness pin-type retainer.
9. Detach the heater hose pin-type retainer.
10. Detach the A/C compressor wiring harness retainer.
11. Detach the 2 wiring harness pin-type retainers from the intake manifold and position the wiring harness aside.
12. If equipped, remove the 7 screws and the underbody cover.

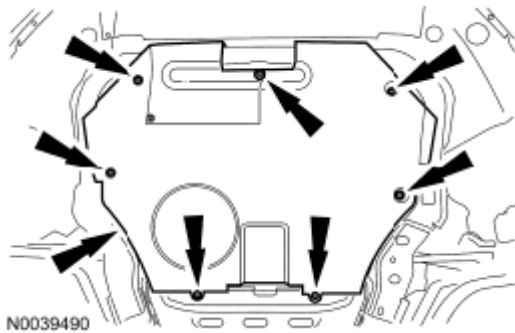


Fig. 20: Locating Underbody Cover Screws
Courtesy of FORD MOTOR CO.

13. Remove the intake manifold lower bolt.
 - To install, tighten to 18 Nm (159 lb-in).

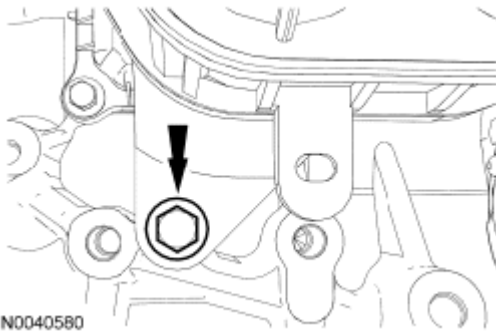


Fig. 21: Locating Intake Manifold Lower Bolt
Courtesy of FORD MOTOR CO.

14. Remove the 6 bolts and position the intake manifold aside to access the crankcase vent oil separator tube and the EGR tube.
 - To install, tighten to 18 Nm (159 lb-in).
15. Remove the EGR tube.
 - To install, tighten to 55 Nm (41 lb-ft).
16. Squeeze the 2 crankcase vent oil separator tube tabs and disconnect the tube from the intake manifold.
 - Remove the intake manifold.
17. To install, reverse the removal procedure.
 - Inspect and install new intake manifold gaskets if necessary.

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

VALVE COVER

Material

MATERIAL SPECIFICATIONS TABLE

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

Valve Cover (View 1 of 2)

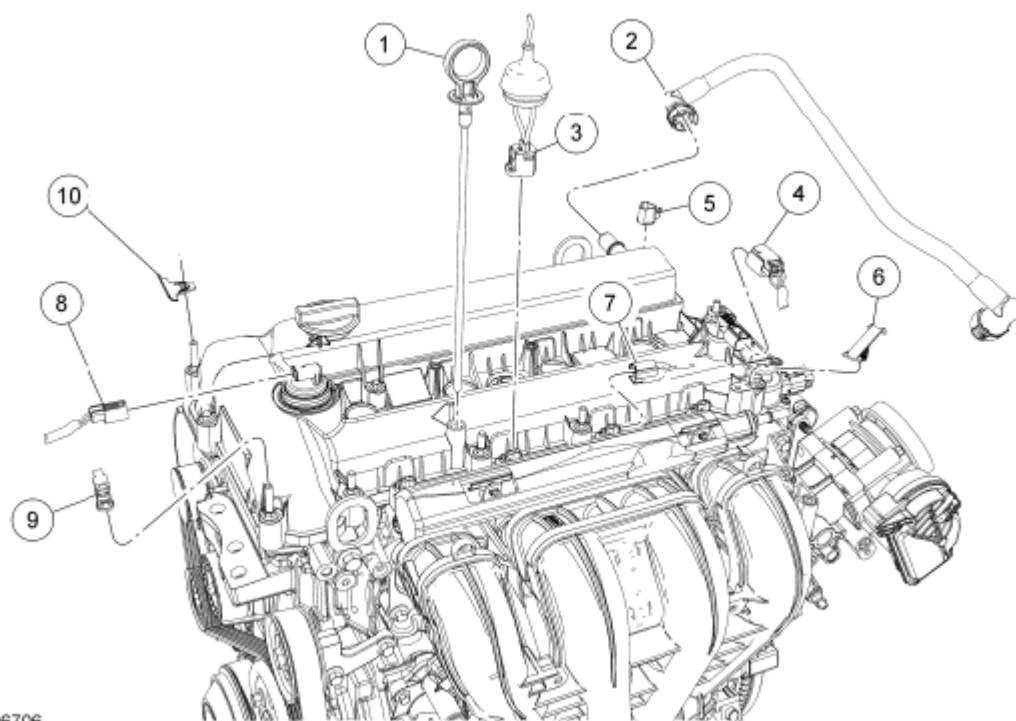


Fig. 22: Valve Cover (1 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6750	Oil level indicator
2	6853	Crankcase vent hose
3	14A464	Cylinder Head Temperature (CHT) sensor electrical connector (part of 12B637)
4	14A464	Camshaft Position (CMP) sensor electrical connector (part of 12B637)
5	14A464	Wire harness retainer (part of 12C508)
6	13A506	Wire harness retainer (part of 12C508)
7	14A464	Radio capacitor electrical connector (part of 12C508)
8	14A163	Variable Camshaft Timing (VCT) oil control solenoid electrical connector (part of 12C508)
9	14A163	Wire harness retainer (part of 14290)

10	14A163	Wire harness retainer (part of 12C508)
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Valve Cover (View 2 of 2)

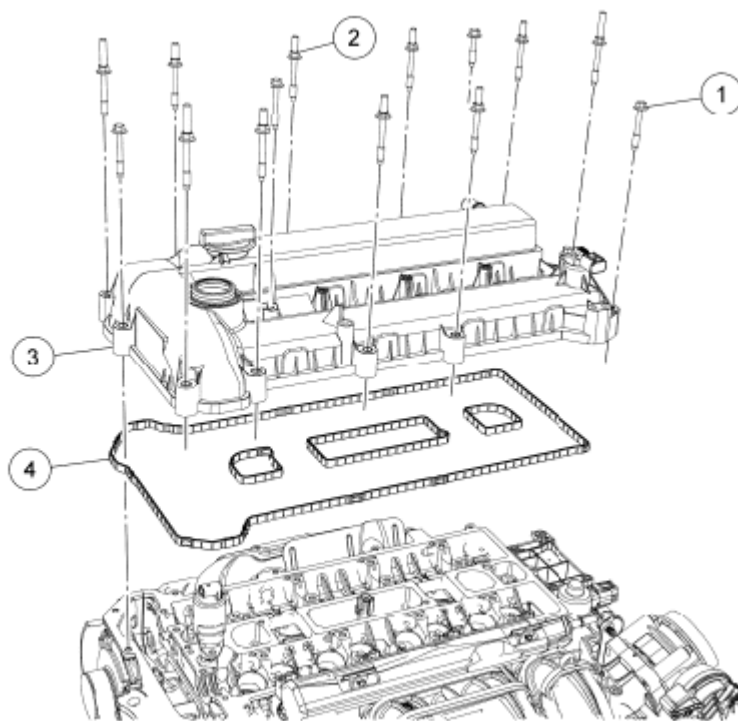


Fig. 23: Valve Cover (2 Of 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6C293	Valve cover retainer (10 required)
2	6C295	Valve cover retainer (4 required)
3	6582	Valve cover
4	6K260	Valve cover gasket

Removal

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

1. Remove the oil level indicator.
2. Remove the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.5L**.

3. Disconnect the crankcase vent hose.
4. Disconnect the Cylinder Head Temperature (CHT) sensor electrical connector.
5. Disconnect the Camshaft Position (CMP) sensor electrical connector.
6. Disconnect the radio capacitor electrical connector.
7. Disconnect the Variable Camshaft Timing (VCT) solenoid electrical connector.
8. Detach all of the wiring harness retainers from the valve cover studs and position the harness aside.
9. Remove the 14 valve cover retainers and the valve cover.
 - Discard the gasket.

Installation

1. Clean and inspect the sealing surfaces.

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

2. Apply silicone gasket and sealant to the locations shown below.

NOTE: The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep.

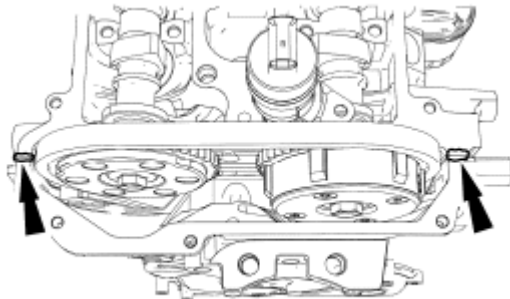


Fig. 24: Locating Silicone Gasket And Sealant Applying Locations
Courtesy of FORD MOTOR CO.

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

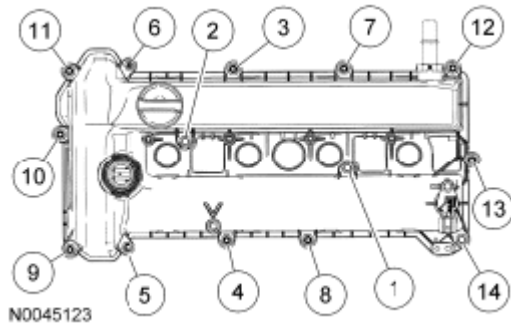


Fig. 25: Identifying Valve Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

4. Position the wiring harness and attach all of the wiring harness retainers to the valve cover studs.
5. Connect the **VCT** solenoid electrical connector.
6. Connect the radio capacitor electrical connector.
7. Connect the **CMP** sensor electrical connector.
8. Connect the **CHT** sensor electrical connector.
9. Connect the crankcase vent hose.
10. Install the ignition coil-on-plugs. For additional information, refer to **ENGINE IGNITION - 2.5L** .
11. Install the oil level indicator.

NOTE: Make sure the notch on the oil level indicator is aligned with the V-shaped boss on the valve cover and fully engaged into the valve cover.

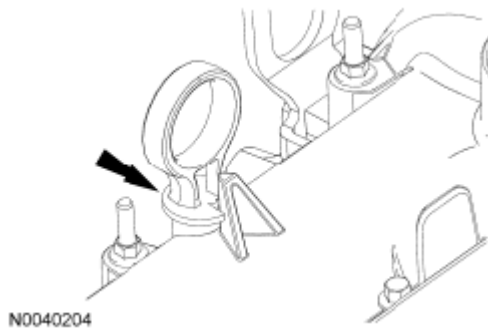


Fig. 26: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

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

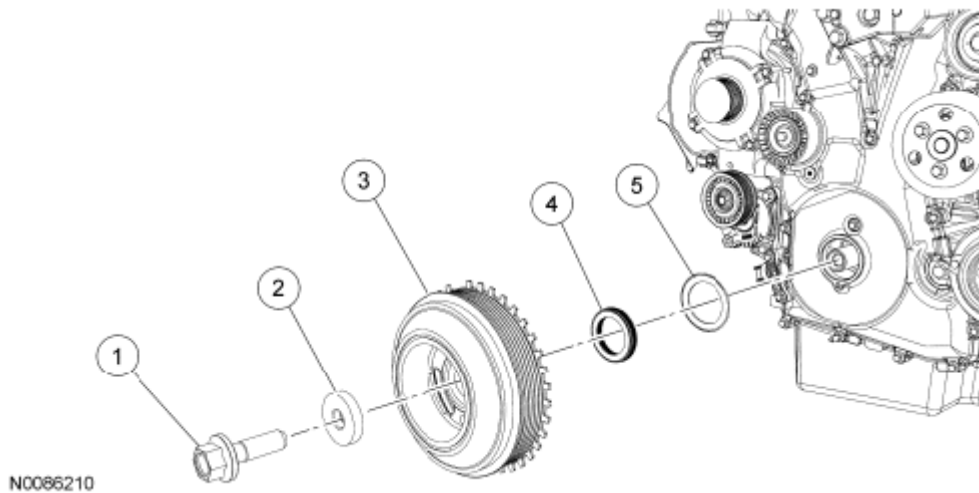


Fig. 27: Identifying Lower End Components - Crankshaft Pulley And Crankshaft Front Seal
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6K340	Crankshaft pulley bolt
2	-	Crankshaft pulley washer (part of 6K340)
3	6316	Crankshaft pulley
4	6700	Crankshaft front seal
5	6378	Diamond washer

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

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

CRANKSHAFT PULLEY

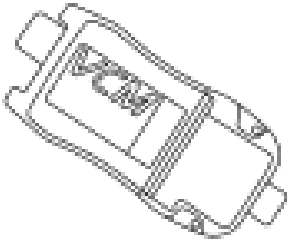
Special Tool(s)

SPECIAL TOOLS TABLE

	Alignment Plate, Camshaft 303-465 (T94P-6256-
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2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ

 ST2645-A	CH)
 ST3054-A	Holding Tool, Crankshaft Damper 303-1416
 ST2638-A	Timing Peg, Crankshaft TDC 303-507
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent diagnostic tool

General Equipment

GENERAL EQUIPMENT TABLE

6 mm x 18 mm bolt

Material**MATERIAL SPECIFICATIONS TABLE**

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

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the front RH wheel and tire. For additional information, refer to **WHEELS & TIRES**.
3. If equipped, remove the 7 screws and the underbody cover.

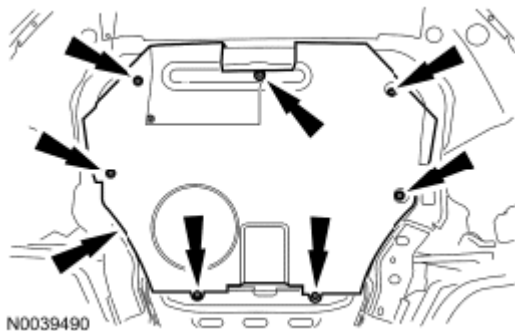


Fig. 28: Locating Underbody Cover Screws
Courtesy of FORD MOTOR CO.

4. Remove the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
5. Remove the valve cover. For additional information, refer to **VALVE COVER**.
6. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

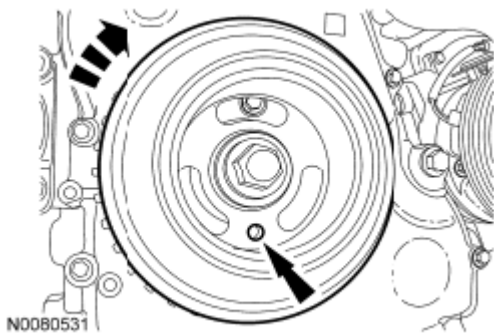


Fig. 29: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

7. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

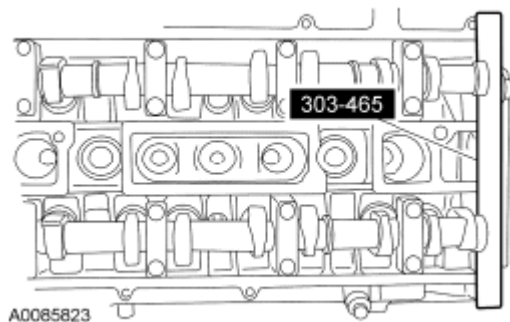


Fig. 30: Identifying Camshaft Alignment Plate In Slots On Rear Of Both Camshafts
Courtesy of FORD MOTOR CO.

8. Remove the engine plug bolt.

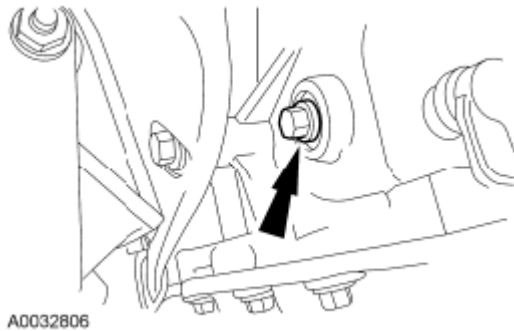


Fig. 31: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

9. Install the Crankshaft TDC Timing Peg.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC . However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the crankshaft pulley removal and installation.

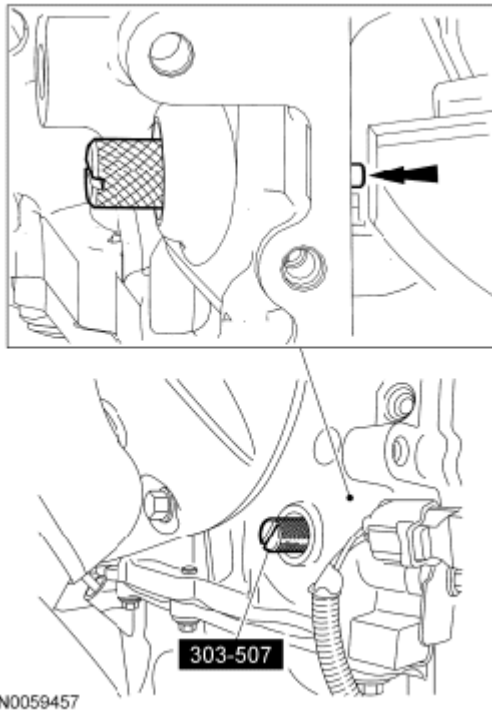


Fig. 32: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

10. Using the Crankshaft Damper Holding Tool and an air impact wrench, remove the crankshaft pulley.
- Remove and discard the crankshaft pulley bolt and washer.
 - Remove the crankshaft pulley.
 - Remove the diamond washer and discard.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during removal of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be removed using an air impact wrench (1/2-in drive minimum).

NOTE: The crankshaft sprocket diamond washer may come off with the crankshaft pulley. The diamond washer must be replaced, remove and discard the diamond washer. If the diamond washer is not installed, engine damage may occur.

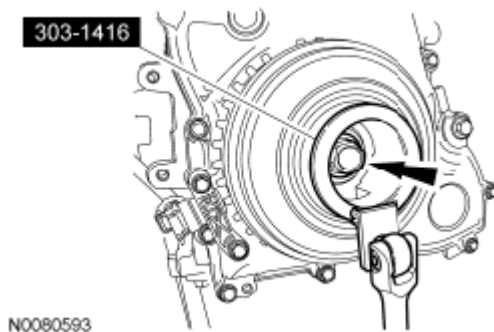


Fig. 33: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

Installation

1. Install a new diamond washer.
2. Position the crankshaft pulley onto the crankshaft with the hole in the pulley at the 6 o'clock position.

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

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

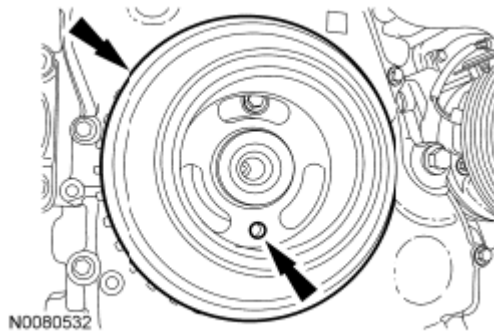


Fig. 34: Positioning Crankshaft Pulley Hole At 6 O'Clock Position
Courtesy of FORD MOTOR CO.

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

NOTE: Only hand-tighten the 6 mm bolt or damage to the front cover can occur.

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

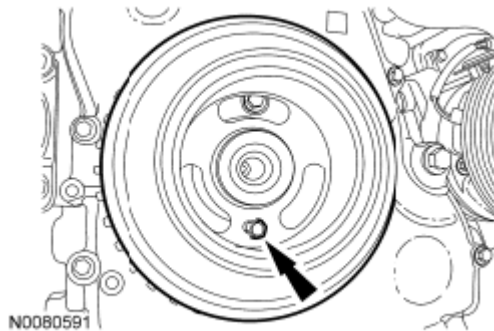


Fig. 35: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

4. Install a new crankshaft pulley bolt. Using the Crankshaft Damper Holding Tool to hold the crankshaft pulley in place, tighten the crankshaft pulley bolt in 2 stages:
 - Stage 1: Tighten to 100 Nm (74 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during installation of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be installed using hand tools only.

NOTE: Do not reuse the crankshaft pulley bolt.

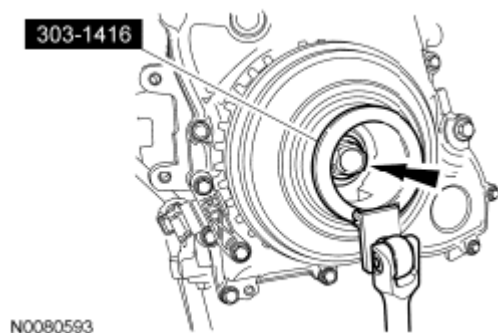


Fig. 36: Locating Crankshaft Pulley Bolt
 Courtesy of FORD MOTOR CO.

5. Remove the 6 mm x 18 mm bolt.

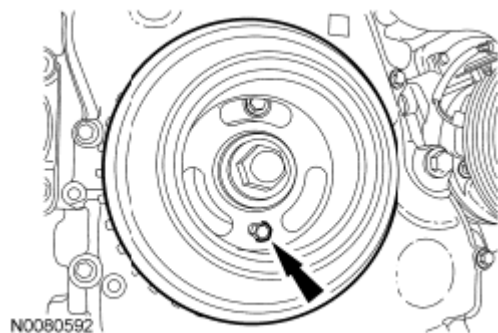


Fig. 37: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
 Courtesy of FORD MOTOR CO.

6. Remove the Crankshaft TDC Timing Peg.



Fig. 38: Removing Crankshaft TDC Timing Peg
 Courtesy of FORD MOTOR CO.

7. Remove the Camshaft Alignment Plate.

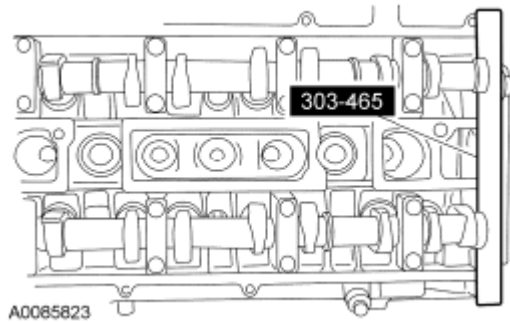


Fig. 39: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

8. Turn the crankshaft clockwise one and three-fourths turns.

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

9. Install the Crankshaft TDC Timing Peg.

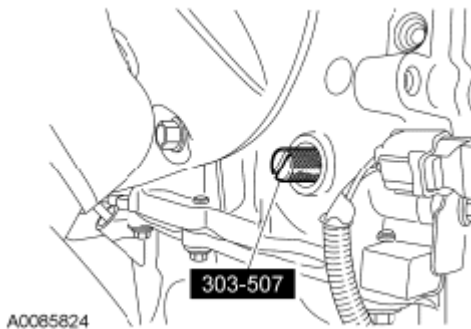


Fig. 40: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

10. Turn the crankshaft clockwise until the crankshaft contacts the Crankshaft TDC Timing Peg.

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

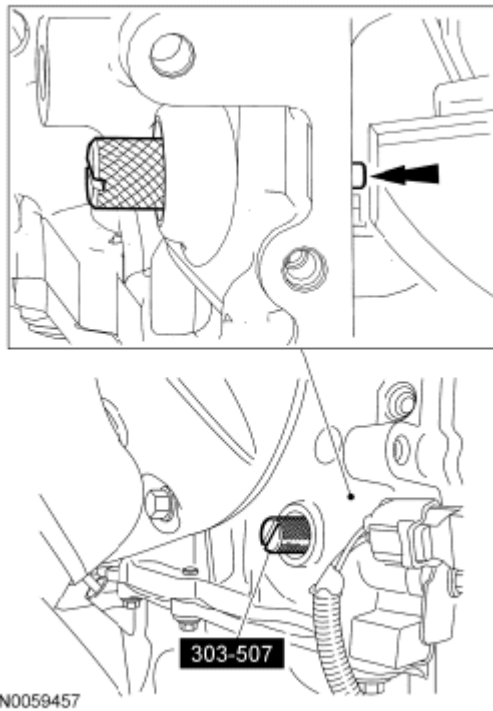


Fig. 41: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

11. Using the 6 mm x 18 mm bolt, check the position of the crankshaft pulley.
 - If it is not possible to install the bolt, the engine valve timing must be corrected by repeating this procedure.

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

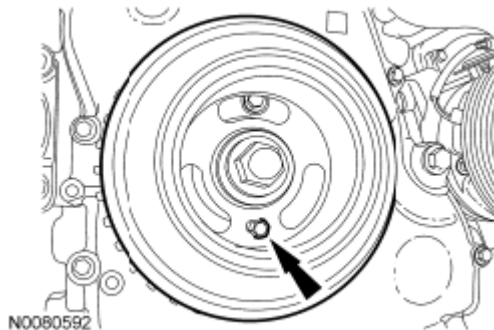


Fig. 42: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

12. Install the Camshaft Alignment Plate to check the position of the camshafts.
 - If it is not possible to install the Camshaft Alignment Plate, the engine valve timing must be corrected by repeating this procedure.

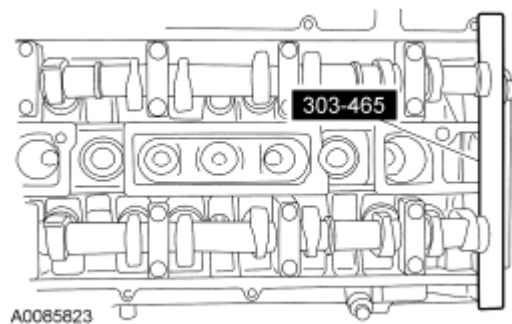


Fig. 43: Identifying Camshaft Alignment Plate
 Courtesy of FORD MOTOR CO.

13. Remove the Camshaft Alignment Plate.

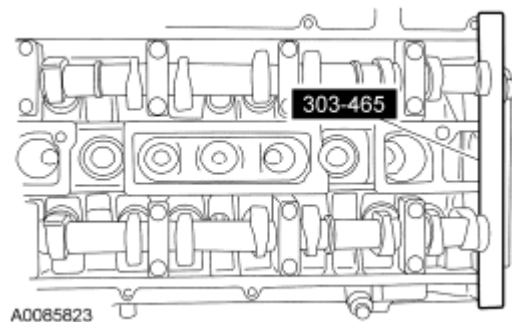


Fig. 44: Identifying Camshaft Alignment Plate
 Courtesy of FORD MOTOR CO.

14. Remove the 6 mm x 18 mm bolt.

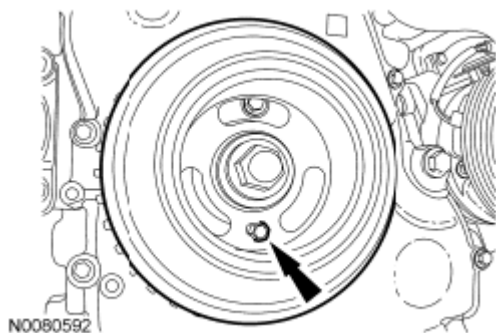


Fig. 45: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
 Courtesy of FORD MOTOR CO.

15. Remove the Crankshaft TDC Timing Peg.

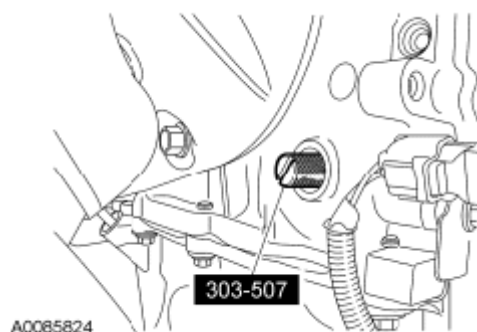


Fig. 46: Identifying Crankshaft TDC Timing Peg
 Courtesy of FORD MOTOR CO.

16. Install the engine plug bolt.
 - To install, tighten to 20 Nm (177 lb-in).

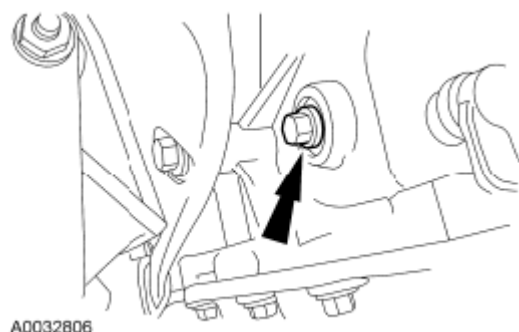


Fig. 47: Locating Engine Plug Bolt
 Courtesy of FORD MOTOR CO.

17. If equipped, install the underbody cover and the 7 screws.

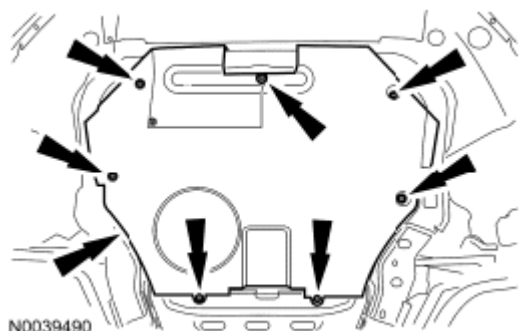


Fig. 48: Locating Underbody Cover And Screws
 Courtesy of FORD MOTOR CO.

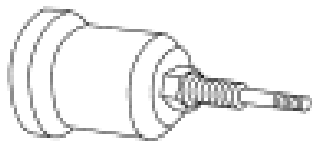
18. Install the accessory drive belt. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.

19. Install the valve cover. For additional information, refer to **VALVE COVER**
20. Using the scan tool, perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

CRANKSHAFT FRONT SEAL

Special Tool(s)

SPECIAL TOOLS

 ST1917-A	Installer, Camshaft Front Oil Seal 303-096 (T74P-6150-A)
 ST1385-A	Remover, Oil Seal 303-409 (T92C-6700-CH)

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and

camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

1. Remove the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.
2. Using the Oil Seal Remover, remove the crankshaft front oil seal.

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

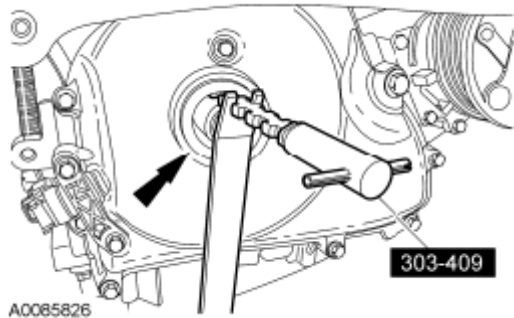


Fig. 49: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

Installation

1. Using the Camshaft Front Oil Seal Installer, install the crankshaft front oil seal.

NOTE: Remove the through bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

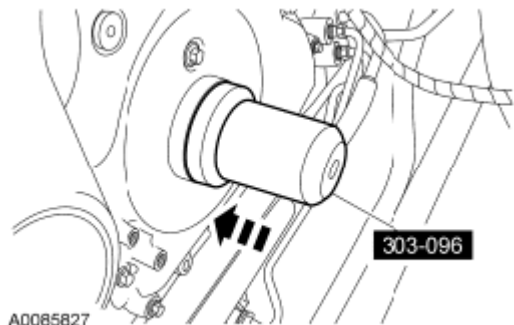


Fig. 50: Installing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

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

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

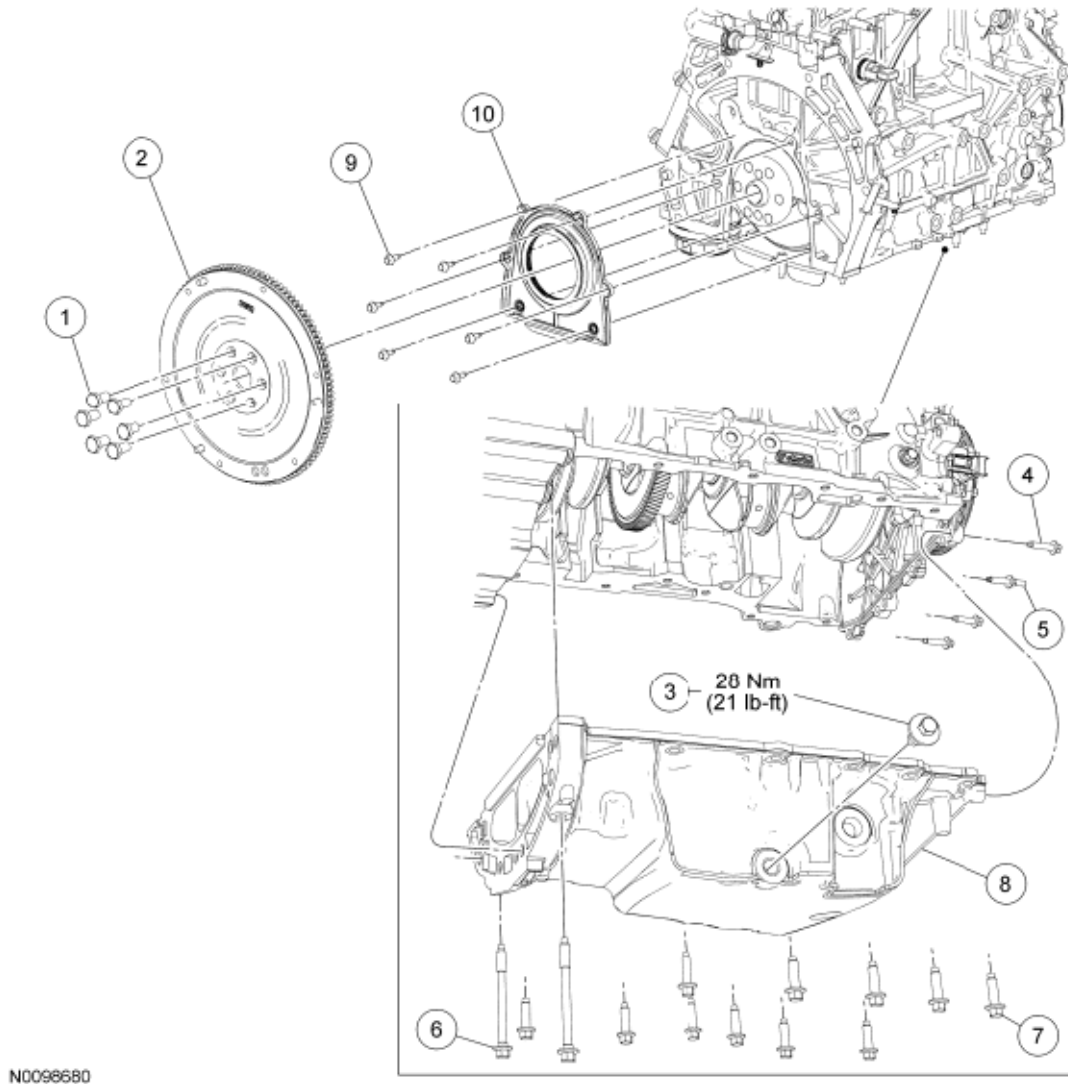


Fig. 51: Identifying Lower End Components - Flexplate, Flywheel And Crankshaft Rear Seal With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION

Item	Part Number	Description
1	6379	Flexplate or flywheel bolt (6)

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		required)
2	6K375/6K390	Flexplate or flywheel
3	6730	Oil pan drain plug
4	W500215	Engine front cover bolt (4 required)
5	940604	Engine front cover stud bolt
6	W706284	Oil pan bolt (2 required)
7	W500224	Oil pan bolt (11 required)
8	6675	Oil pan
9	W500212	Crankshaft rear oil seal with retainer plate bolt (6 required)
10	6K318	Crankshaft rear oil seal with retainer plate

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

FLEXPLATE

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the automatic transaxle. For additional information, refer to the appropriate automatic transmission article.
3. Remove the 6 bolts and the flexplate.

Installation

1. Install the flexplate and tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

NOTE: Special bolts are used for installation. Do not use standard bolts.

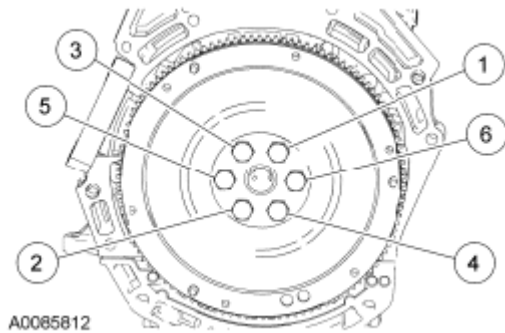


Fig. 52: Identifying Flexplate Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the automatic transaxle. For additional information, refer to the appropriate automatic transmission article.

FLYWHEEL

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the clutch. For additional information, refer to **CLUTCH**.
3. Remove the 6 bolts and the flywheel.

Installation

1. Install the flywheel and tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

NOTE: Special bolts are used for installation. Do not use standard bolts.

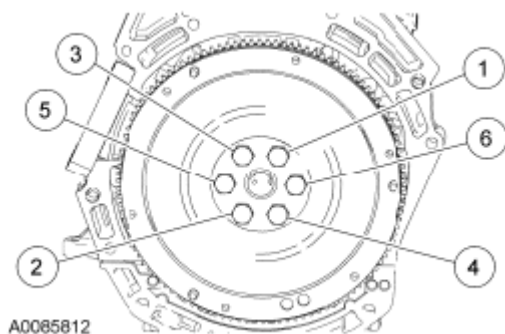


Fig. 53: Identifying Flywheel Bolt Tightening Sequence

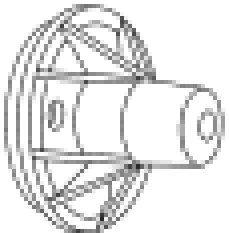
Courtesy of FORD MOTOR CO.

2. Install the clutch and manual transaxle. For additional information, refer to **CLUTCH**.

CRANKSHAFT REAR SEAL

Special Tool(s)

SPECIAL TOOLS TABLE

 ST1506-A	Installer, Crankshaft Rear Main Oil Seal 303-328 (T88P-6701-B1)
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Material

MATERIAL SPECIFICATIONS TABLE

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

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the flexplate or flywheel. For additional information, refer to **FLEXPLATE** or **FLYWHEEL**.
3. Drain the engine oil.
 - Install the drain plug.
 - Tighten to 28 Nm (21 lb-ft).
4. Remove the 16 bolts, stud bolt and the oil pan.

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

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

Installation

1. Using the Crankshaft Rear Main Oil Seal Installer, position the crankshaft rear oil seal with retainer plate onto the crankshaft.

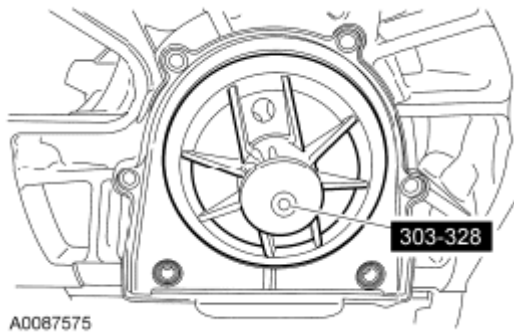


Fig. 54: Positioning Crankshaft Rear Oil Seal With Retainer Plate Onto Crankshaft
Courtesy of FORD MOTOR CO.

2. Install the crankshaft rear oil seal with retainer plate and bolts.
 - To install, tighten in the sequence shown to 10 Nm (89 lb-in).

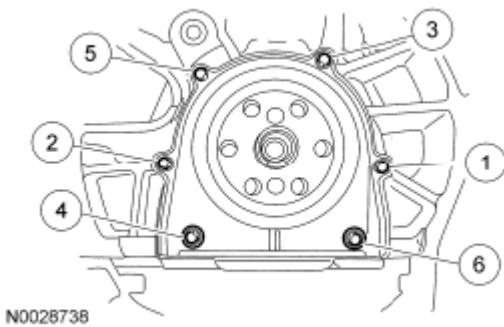


Fig. 55: Identifying Retainer Plate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Clean and inspect all the oil pan, engine front cover and cylinder block mating surfaces.

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

4. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan. Install the oil pan. Install the 2 oil pan bolts finger-tight.

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

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

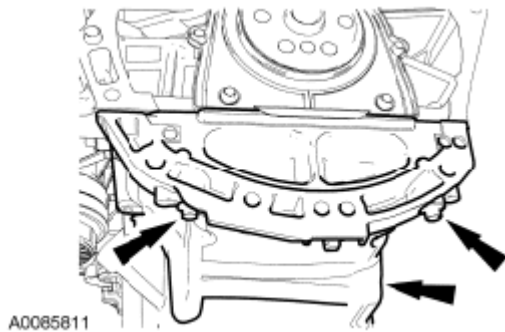


Fig. 56: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

5. Install the 3 bolts and the stud bolt.
 - To install, tighten to 10 Nm (89 lb-in).

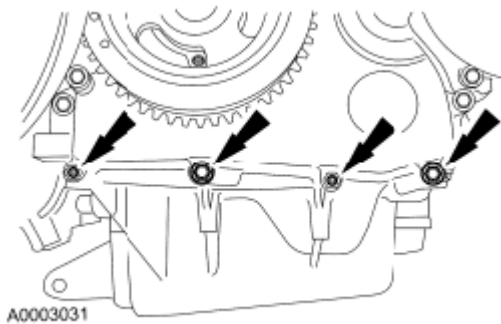


Fig. 57: Locating Bolts And Stud Bolt
Courtesy of FORD MOTOR CO.

6. Install the remaining oil pan bolts and tighten the oil pan bolts in the sequence shown to 20 Nm (177 lb-in).

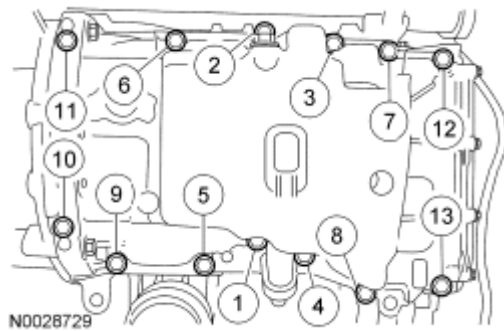


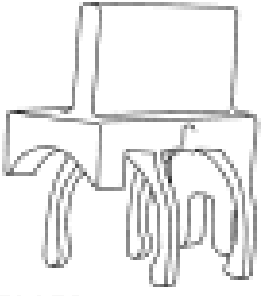
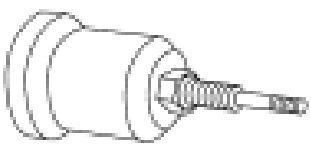
Fig. 58: Identifying Oil Pan Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

7. Install the flexplate or flywheel. For additional information, refer to **FLEXPLATE** or **FLYWHEEL**.
8. Fill the engine with clean engine oil.

ENGINE FRONT COVER

Special Tool(s)

SPECIAL TOOLS TABLE

 ST3055A	Alignment Tool, Crank 303-1417
 ST1917-A	Installer, Camshaft Front Oil Seal 303-096 (T74P-6150-A)
	Remover, Oil Seal 303-409 (T92C-6700-CH)

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ST1385-A

General Equipment

GENERAL EQUIPMENT TABLE

6 mm x 18 mm bolt

Material

MATERIAL SPECIFICATIONS TABLE

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

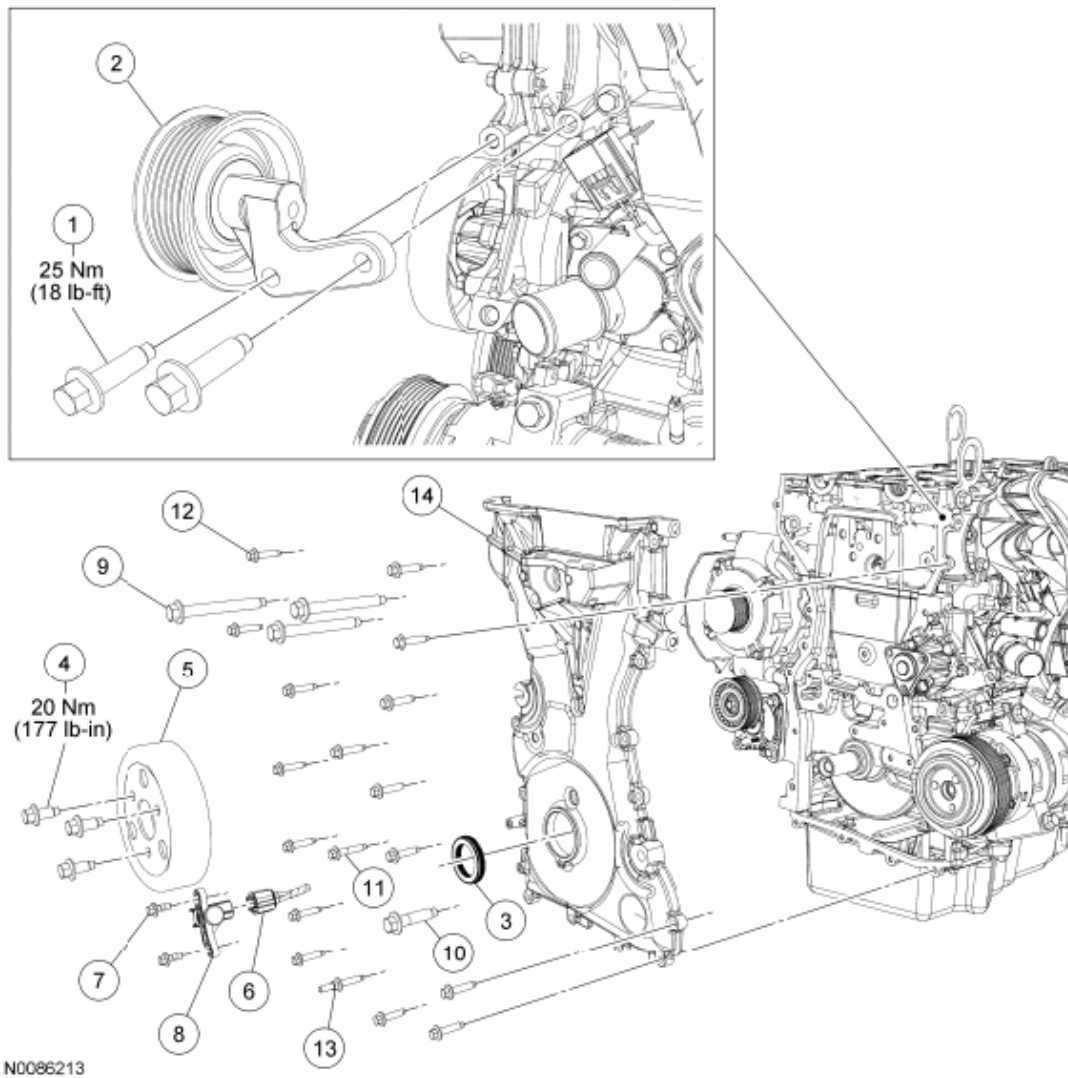


Fig. 59: Exploded View Of Engine Front Cover Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500224	Accessory drive belt idler pulley bolt (2 required)
2	19A216	Accessory drive belt idler pulley and bracket
3	6700	Crankshaft front seal
4	W500221	Coolant pump pulley bolt (3 required)
5	8509	Coolant pump pulley
6	14A464	Crankshaft Position (CKP) sensor electrical connector (part of

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		12C508)
7	W701219	CKP sensor bolt (2 required)
8	6C315	CKP sensor
9	W500328	Engine front cover bolt (3 required)
10	W500320	Engine front cover bolt
11	W500300	Engine front cover bolt
12	W500215	Engine front cover bolt (16 required)
13	-	Engine front cover stud bolt
14	6019	Engine front cover

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Loosen the 3 coolant pump pulley bolts.
3. Remove the accessory drive belt and the accessory drive idler pulley. For additional information, refer to **ACCESSORY DRIVE - 2.5L**.
4. Remove the crankshaft pulley. For additional information, refer to **CRANKSHAFT PULLEY**.
5. If equipped, remove the 7 screws and the underbody cover.

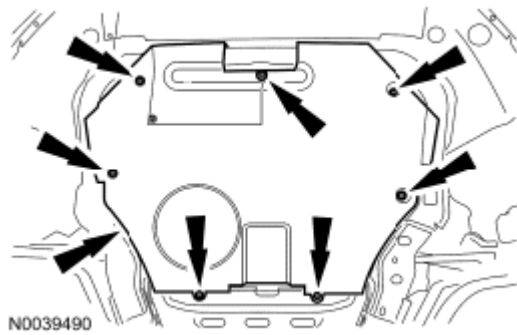


Fig. 60: Locating Underbody Cover And Screws
Courtesy of FORD MOTOR CO.

6. Remove the engine mount. For additional information, refer to **ENGINE MOUNT**.
7. Using the Oil Seal Remover, remove and discard the crankshaft front oil seal.

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

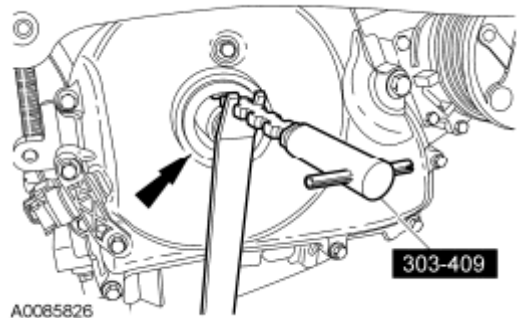
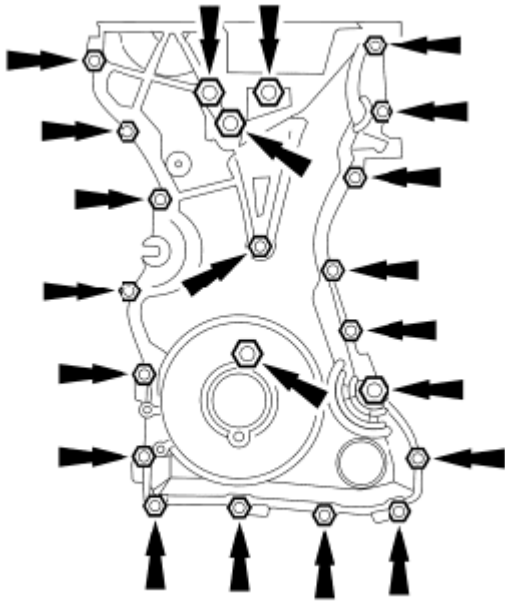


Fig. 61: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

8. Remove the 3 bolts and the coolant pump pulley.
9. Remove the 2 bolts and the accessory drive belt idler pulley and bracket.
10. Disconnect the Crankshaft Position (CKP) sensor electrical connector.
11. Remove the 2 bolts and the **CKP** sensor.
12. Remove the 22 bolts and the engine front cover.



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Fig. 62: Locating Engine Front Cover Bolts
Courtesy of FORD MOTOR CO.

Installation

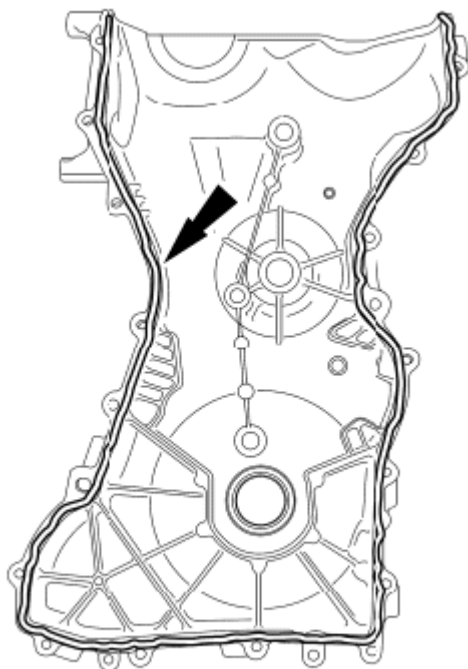
1. Clean and inspect the mounting surfaces of the engine and the front cover.

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

2. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the cylinder head and oil pan joint areas. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the front cover.

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

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



A0032803

Fig. 63: Applying Silicone Gasket & Sealant On Engine Front Cover
Courtesy of FORD MOTOR CO.

3. Install the engine front cover. Tighten the bolts in the sequence shown below, to the following specifications:
 - Tighten the 8-mm bolts to 10 Nm (89 lb-in).
 - Tighten the 13-mm bolts to 48 Nm (35 lb-ft).

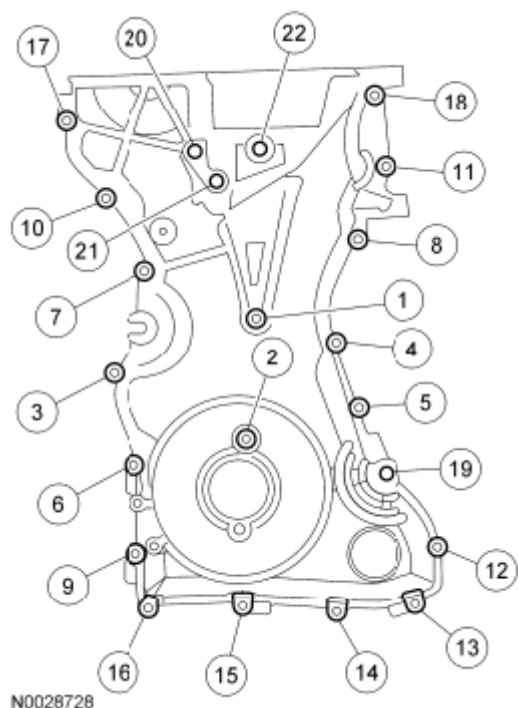


Fig. 64: Identifying Engine Front Cover Bolts Tightening Sequence
 Courtesy of FORD MOTOR CO.

4. Install the accessory drive belt idler pulley and bracket and the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).
5. Install the coolant pump pulley and bolts.

NOTE: The coolant pump pulley bolts should be tightened after the accessory drive belt is installed.

6. Using the Camshaft Front Oil Seal Installer, install the crankshaft front oil seal.

NOTE: Remove the through bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

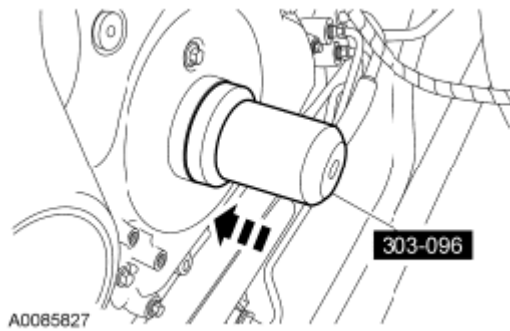


Fig. 65: Installing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

7. Install the engine mount. For additional information, refer to **ENGINE MOUNT**.
8. Install the crankshaft pulley. For additional information, refer to **Installation**.
9. Install a standard 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

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

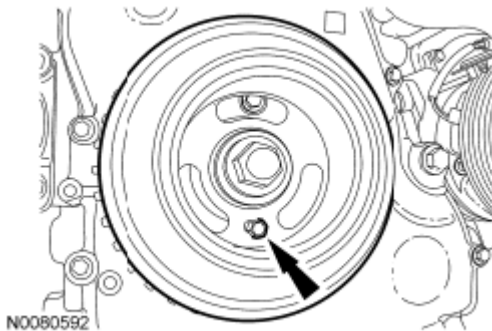


Fig. 66: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

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

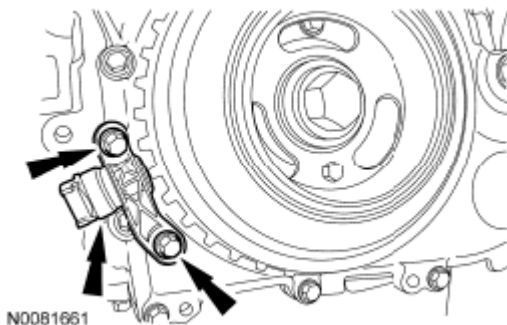


Fig. 67: Locating Bolts & CKP Sensor
Courtesy of FORD MOTOR CO.

11. Using the Crank Alignment Tool, adjust the **CKP** sensor.
 - Tighten the bolts to 7 Nm (62 lb-in).

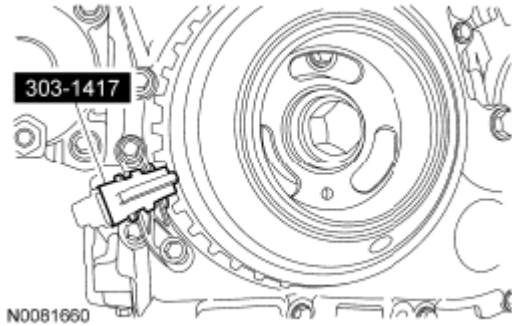


Fig. 68: Identifying Crankshaft Sensor Aligner
Courtesy of FORD MOTOR CO.

12. Connect the **CKP** sensor electrical connector.
13. Remove the 6 mm x 18 mm bolt.

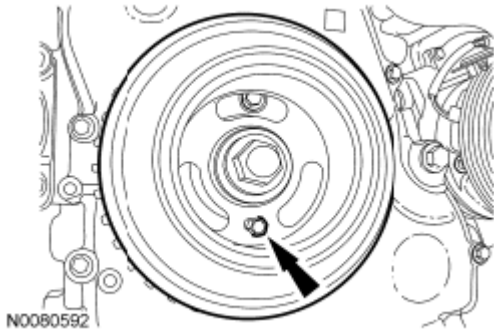


Fig. 69: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

14. If equipped, install the underbody cover and the 7 screws.

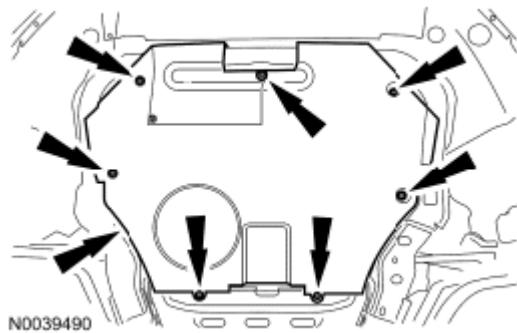


Fig. 70: Locating Underbody Cover & Screws
 Courtesy of FORD MOTOR CO.

15. Install the accessory drive belt and the accessory drive idler pulley. For additional information, refer to **REMOVAL AND INSTALLATION** and **REMOVAL AND INSTALLATION**.
16. Tighten the 3 coolant pump pulley bolts to 20 Nm (177 lb-in).

TIMING DRIVE COMPONENTS

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the engine front cover. For additional information, refer to **Installation**.
3. Compress the timing chain tensioner in the following sequence.
 1. Using a small pick, release and hold the ratchet mechanism.
 2. While holding the ratchet mechanism in the released position, compress the tensioner by pushing the timing chain arm toward the tensioner.
 3. Insert a paper clip into the hole to retain the tensioner.

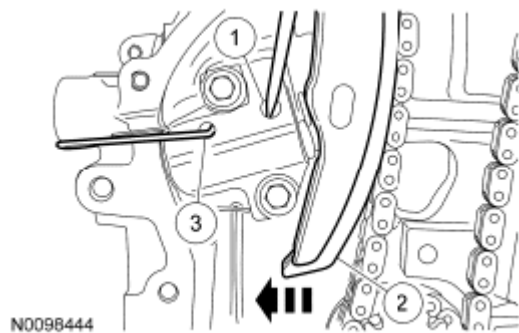


Fig. 71: Compressing Timing Chain Tensioner
Courtesy of FORD MOTOR CO.

4. Remove the 2 bolts and timing chain tensioner.

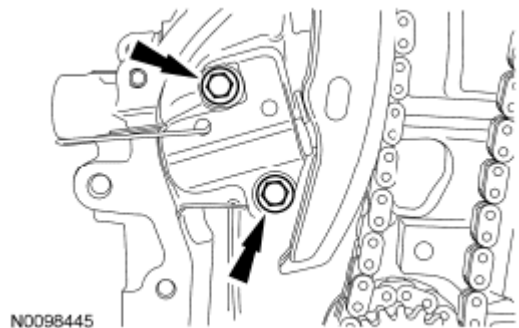


Fig. 72: Locating Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

5. Remove the timing chain tensioner arm.

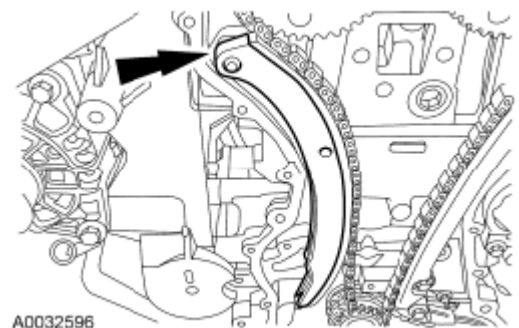


Fig. 73: Locating Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

6. Remove the timing chain.

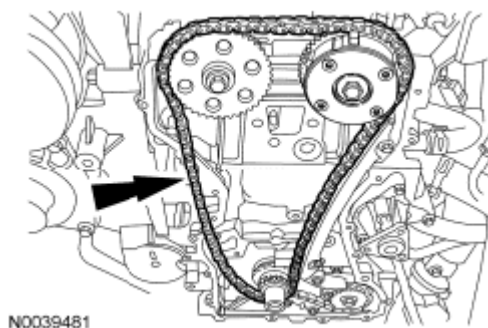


Fig. 74: Locating Timing Chain
Courtesy of FORD MOTOR CO.

7. Remove the 2 bolts and the timing chain guide.

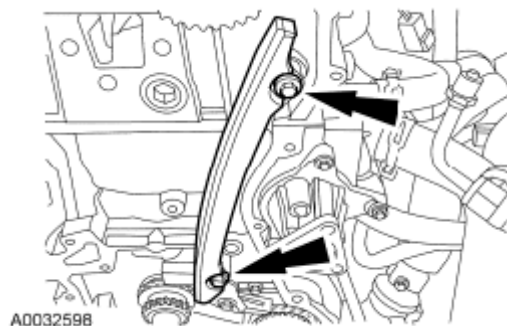


Fig. 75: Locating Bolts & Timing Chain Guide
Courtesy of FORD MOTOR CO.

8. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

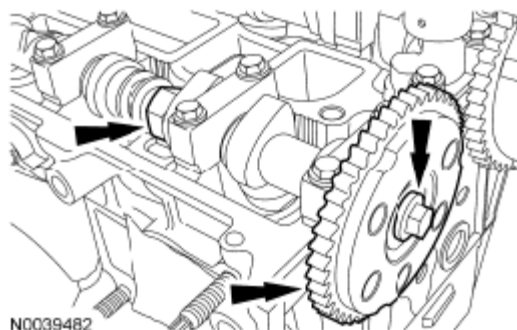


Fig. 76: Locating Flats On Camshaft, Bolt & Exhaust Camshaft Sprocket

Courtesy of FORD MOTOR CO.

9. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the camshaft phaser and sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

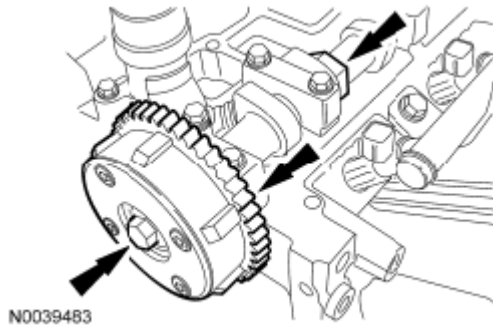


Fig. 77: Locating Flats On Camshaft, Bolt, Camshaft Phaser & Sprocket
Courtesy of FORD MOTOR CO.

Installation

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

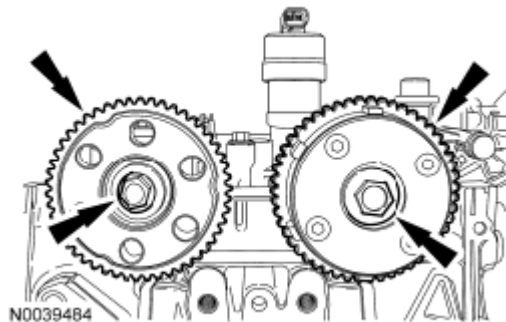


Fig. 78: Locating Camshaft Sprockets & Bolts
Courtesy of FORD MOTOR CO.

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

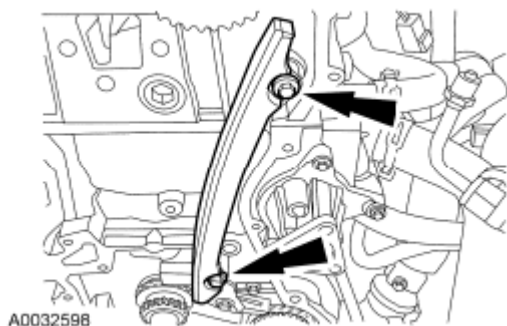


Fig. 79: Locating Bolts & Timing Chain Guide
Courtesy of FORD MOTOR CO.

3. Install the timing chain.

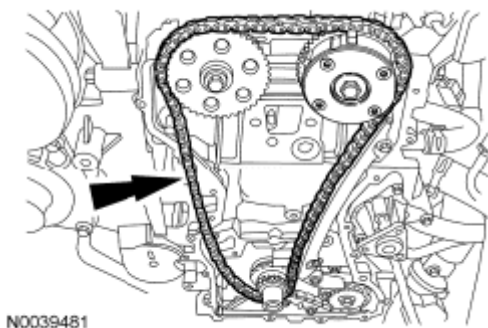


Fig. 80: Locating Timing Chain
Courtesy of FORD MOTOR CO.

4. Install the timing chain tensioner arm.

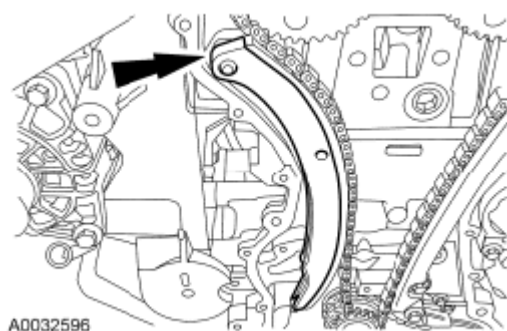


Fig. 81: Locating Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

NOTE: If the timing chain tensioner plunger and ratchet assembly are not pinned in the compressed position, follow the next 4 steps.

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

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

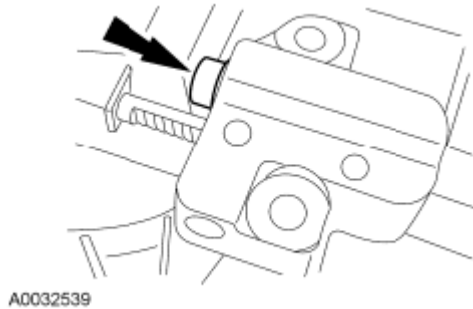


Fig. 82: Compressing Timing Chain Tensioner Plunger
Courtesy of FORD MOTOR CO.

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

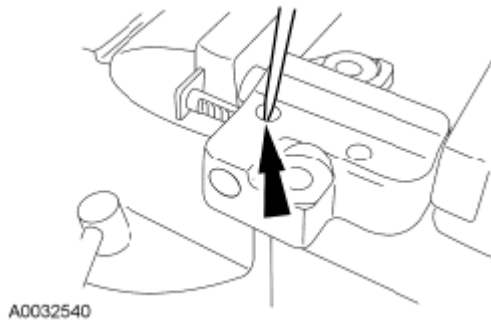


Fig. 83: Holding Ratchet Mechanism Using Small Pick
Courtesy of FORD MOTOR CO.

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

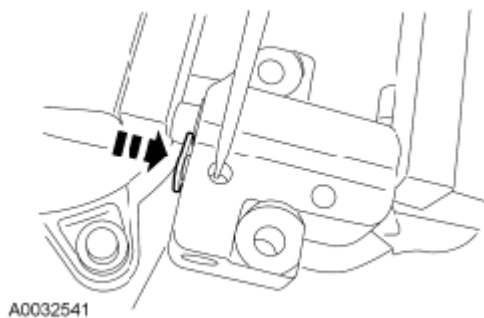


Fig. 84: Pushing Ratchet Arm Back Into Tensioner Housing

Courtesy of FORD MOTOR CO.

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

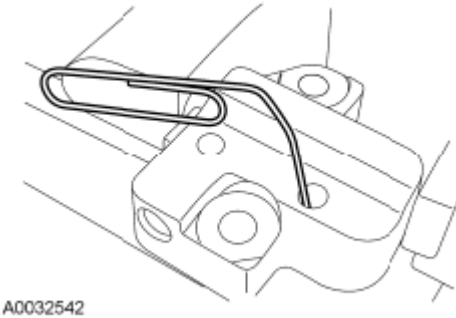


Fig. 85: Installing Paper Clip Into Hole In Tensioner Housing
Courtesy of FORD MOTOR CO.

9. Install the timing chain tensioner and the 2 bolts. Remove the paper clip to release the piston.
 - Tighten to 10 Nm (89 lb-in).

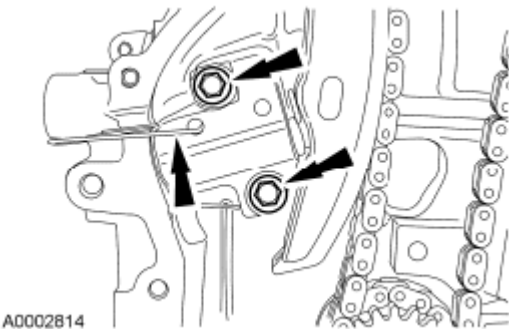


Fig. 86: Locating Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

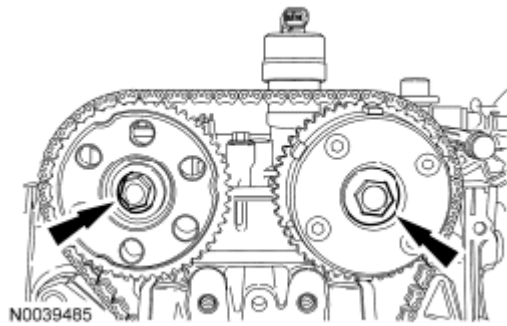


Fig. 87: Locating Camshaft Bolts
Courtesy of FORD MOTOR CO.

11. Install the engine front cover. For additional information, refer to **Installation**.

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM OIL FILTER

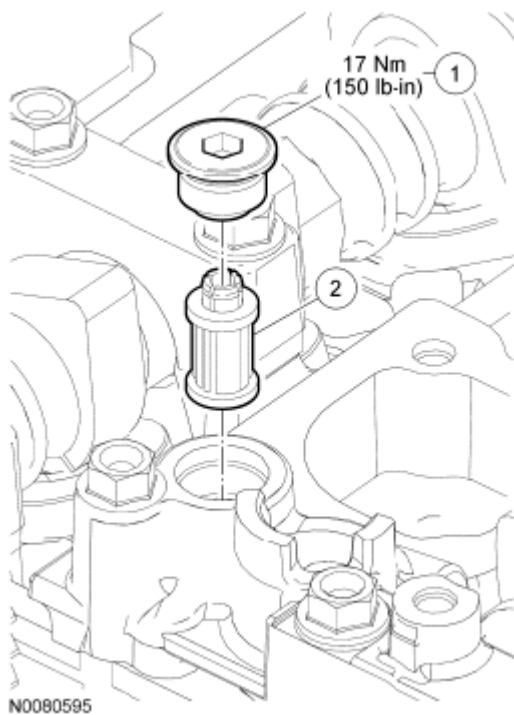


Fig. 88: Identifying Variable Camshaft Timing System Oil Filter With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W710451	Plug
2	6C683	Variable Camshaft Timing (VCT) system oil filter

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ

Removal and Installation

1. Remove the Variable Camshaft Timing (VCT) solenoid. For additional information, refer to **REMOVAL AND INSTALLATION**.
2. Remove the plug and the VCT system oil filter from the intake camshaft thrust cap.
 - To install, tighten to 17 Nm (150 lb-in).
3. To install, reverse the removal procedure.

CAMSHAFTS

Special Tool(s)

SPECIAL TOOLS TABLE

 ST2645-A	Alignment Plate, Camshaft 303-465 (T94P-6256-CH)
 ST2638-A	Timing Peg, Crankshaft TDC 303-507

General Equipment

GENERAL EQUIPMENT TABLE

6 mm x 18 mm bolt
M6 x 30 mm bolt

Material

MATERIAL SPECIFICATIONS TABLE

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

Premium Motor Oil CXO-5W20-LSP12 (Canada); or
equivalent

Silicone Gasket and Sealant TA-30

WSE-M4G323-A4

Removal

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

NOTE: Do not rotate the camshafts or crankshaft unless instructed to do so in this procedure. Rotating the camshafts or crankshaft with timing components loosened or removed can cause serious damage to the valves or pistons.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the accessory drive belt. For additional information, refer to **REMOVAL AND INSTALLATION** .
3. Remove the front RH wheel and tire. For additional information, refer to **REMOVAL** .
4. If equipped, remove the 7 screws and the underbody cover.

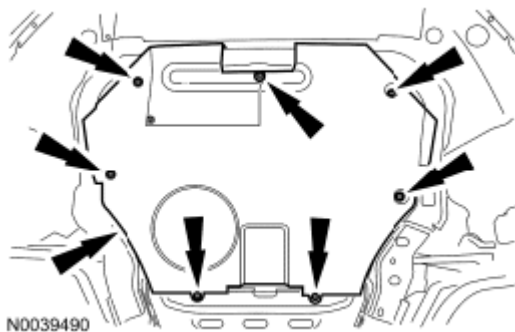


Fig. 89: Locating Underbody Cover And Screws
Courtesy of FORD MOTOR CO.

5. Remove the Variable Camshaft Timing (VCT) solenoid. For additional information, refer to **REMOVAL AND INSTALLATION** .
6. Check the valve clearance. For additional information, refer to **VALVE CLEARANCE CHECK**.
7. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation

only.

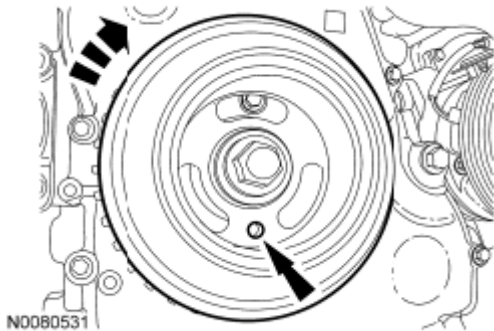


Fig. 90: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

8. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

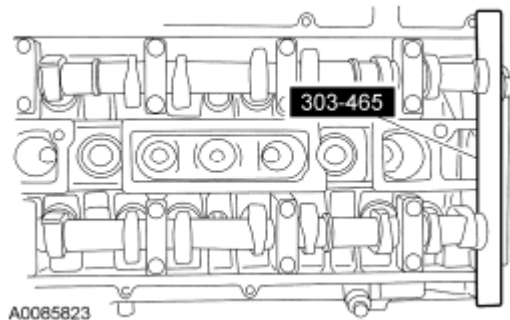


Fig. 91: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

9. Remove the engine plug bolt.

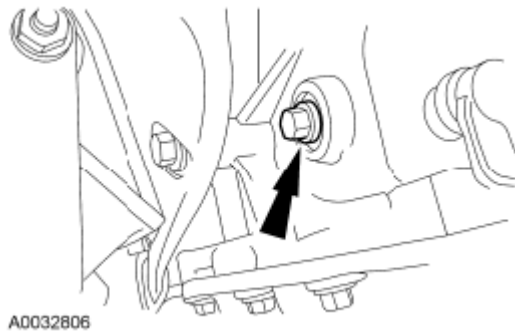


Fig. 92: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

10. Install the Crankshaft TDC Timing Peg.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC . However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the camshaft removal and installation.

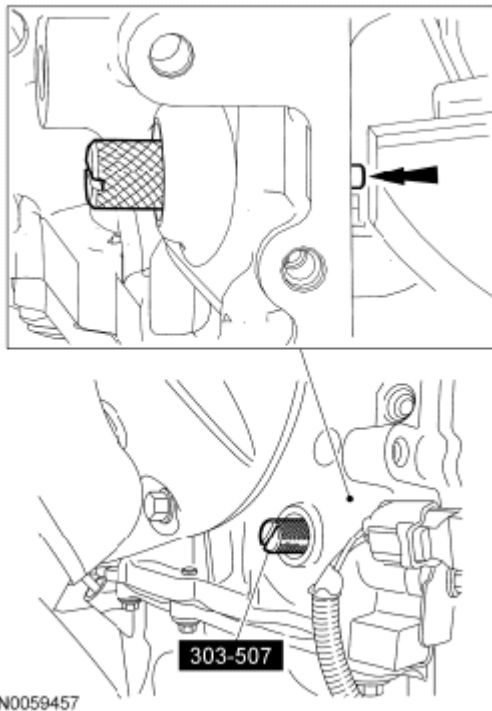


Fig. 93: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

11. Install a standard 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

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

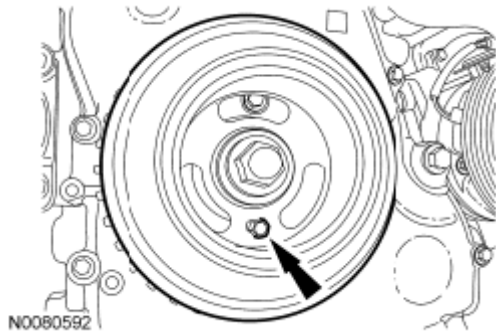


Fig. 94: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

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

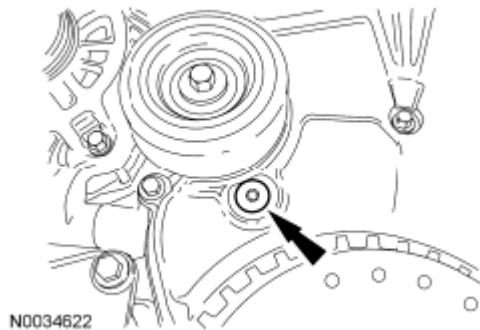


Fig. 95: Locating Lower Timing Hole Plug
Courtesy of FORD MOTOR CO.

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

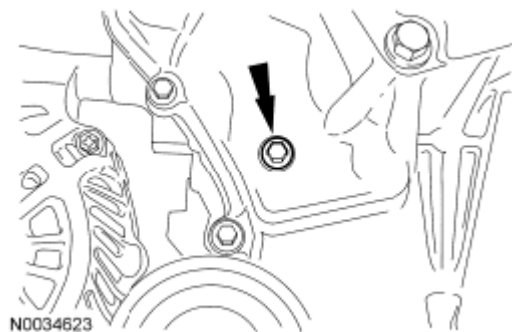


Fig. 96: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

14. Reposition the Camshaft Alignment Plate to the slot on the rear of the intake camshaft only.

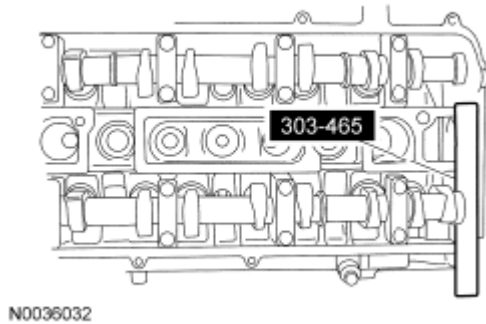


Fig. 97: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

15. Using a small pick tool, release the timing chain tensioner ratchet through the lower front cover timing hole.
- Have an assistant rotate the exhaust camshaft clockwise (using the flats of the camshaft) to collapse the timing chain tensioner plunger.
 - Insert the M6 x 30 mm bolt into the upper front cover timing hole to hold the tensioner arm in the retracted position.

NOTE: Releasing the ratcheting mechanism in the timing chain tensioner allows the plunger to collapse and create slack in the timing chain. Installing the M6 x 30 mm bolt into the upper front cover timing hole will lock the tensioner arm in a retracted position and allow enough slack in the timing chain for removal of the exhaust camshaft gear.

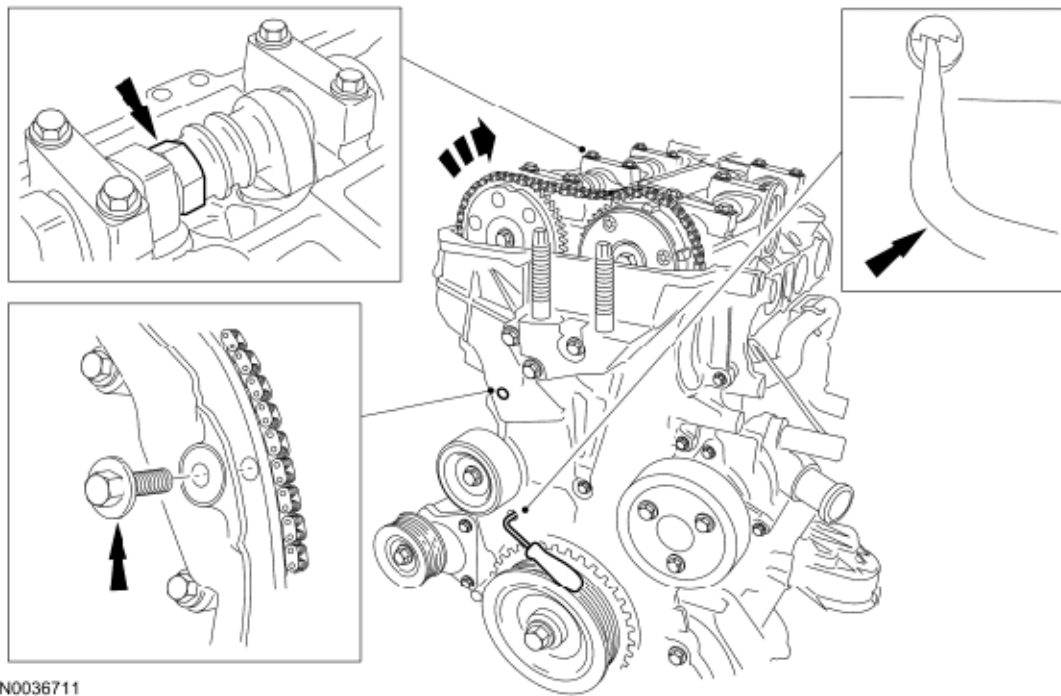


Fig. 98: Releasing Timing Chain Tensioner Ratchet Through Lower Front Cover Timing Hole
Courtesy of FORD MOTOR CO.

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

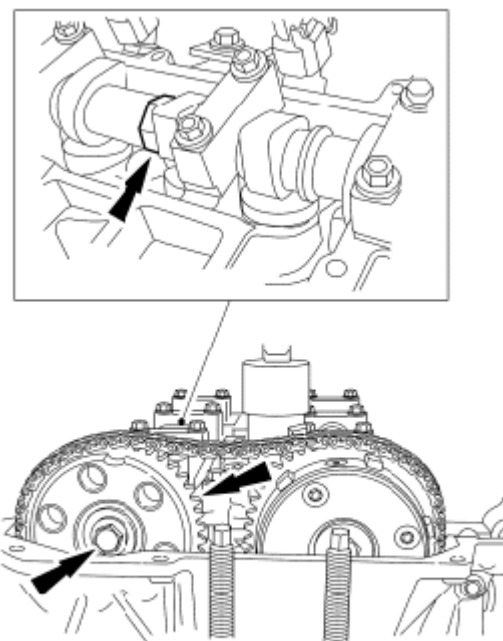


Fig. 99: Locating Flats On Camshaft To Prevent Camshaft Rotation
Courtesy of FORD MOTOR CO.

17. Remove the Camshaft Alignment Plate.

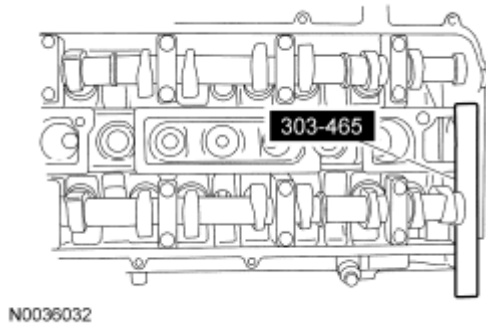


Fig. 100: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

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

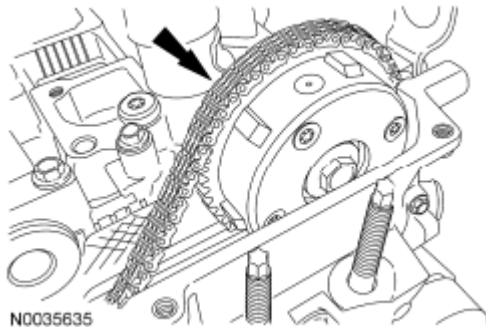


Fig. 101: Locating Timing Chain On Camshaft Phaser & Sprocket
Courtesy of FORD MOTOR CO.

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

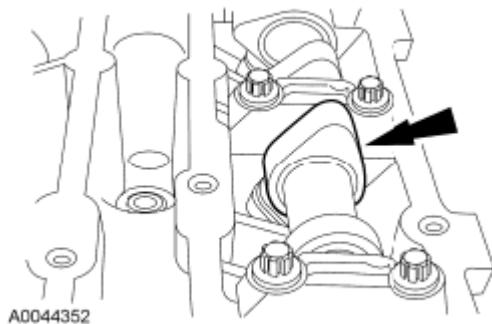


Fig. 102: Identifying Camshaft Lobes Position On No. 1 Cylinder

Courtesy of FORD MOTOR CO.

20. Remove the camshafts from the engine.

- Loosen the camshaft bearing cap bolts, in the sequence shown below, one turn at a time until all tension is released from the camshaft bearing caps.
- Remove the bolts and the camshaft bearing caps.
- Remove the camshafts.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

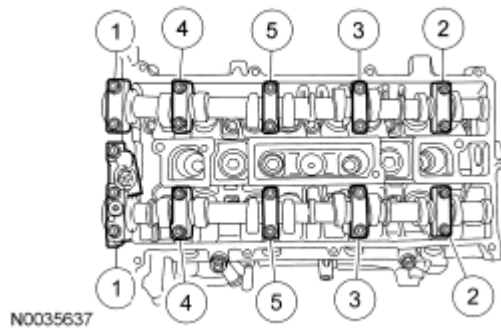


Fig. 103: Identifying Camshaft Bearing Cap Bolt Loosening Sequence
Courtesy of FORD MOTOR CO.

21. If removal of the camshaft phaser and sprocket is necessary, mark the sprocket and camshaft for reference during installation.

- If necessary, place the camshaft in a soft-jawed vise. Remove the bolt and the camshaft phaser and sprocket.

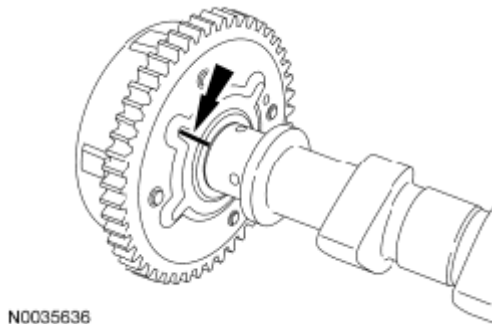


Fig. 104: Locating Sprocket & Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

Installation

1. If necessary, position the camshaft in a soft-jawed vise and install the camshaft phaser and sprocket and the bolt.
 - Align the reference marks on the camshaft phaser and sprocket and the camshaft. Tighten the bolt to 72 Nm (53 lb-ft).

NOTE: If new parts are installed, transfer the reference marks made during disassembly to the new parts.

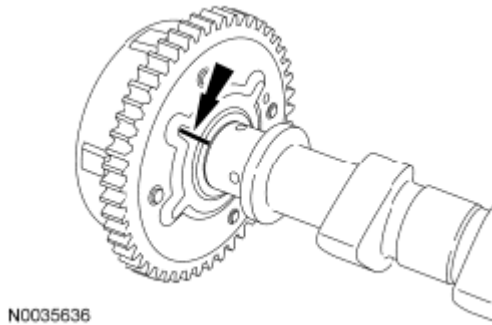


Fig. 105: Locating Sprocket & Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

2. Install the camshafts and bearing caps in their original locations and orientation. Tighten the bearing caps in the sequence shown in 3 stages:
 - Stage 1: Tighten the camshaft bearing cap bolts until finger-tight.
 - Stage 2: Tighten to 7 Nm (62 lb-in).
 - Stage 3: Tighten to 16 Nm (142 lb-in).

NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

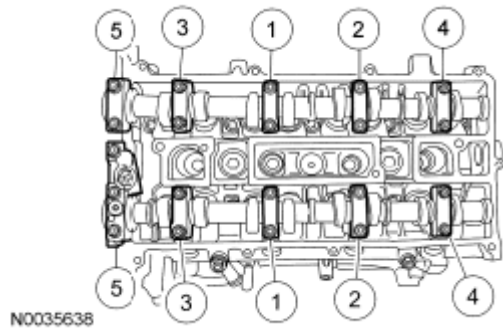


Fig. 106: Identifying Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the Camshaft Alignment Plate.

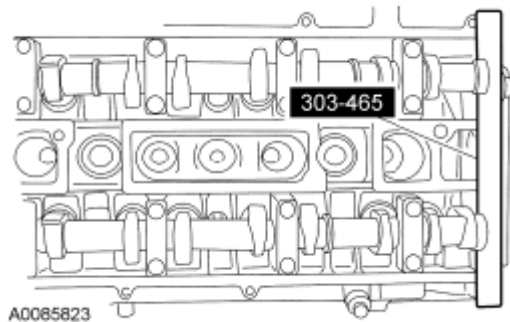


Fig. 107: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

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

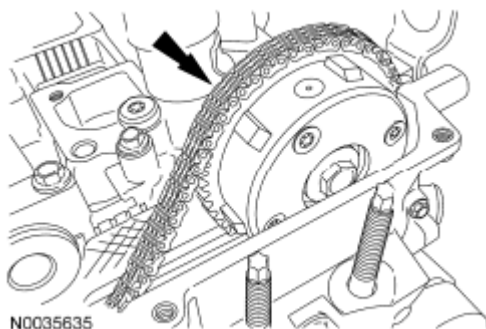


Fig. 108: Locating Timing Chain On Camshaft Phaser & Sprocket
Courtesy of FORD MOTOR CO.

5. Position the exhaust camshaft drive gear in the timing chain and install the gear and bolt on the exhaust camshaft.

- Hand-tighten the bolt.

NOTE: The timing chain must be correctly engaged on the teeth of the crankshaft timing sprocket and the intake camshaft drive gear in order to install the exhaust camshaft drive gear onto the exhaust camshaft.

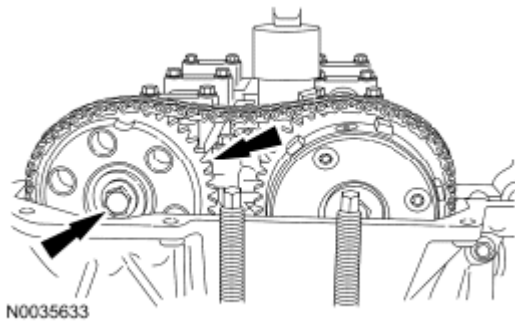


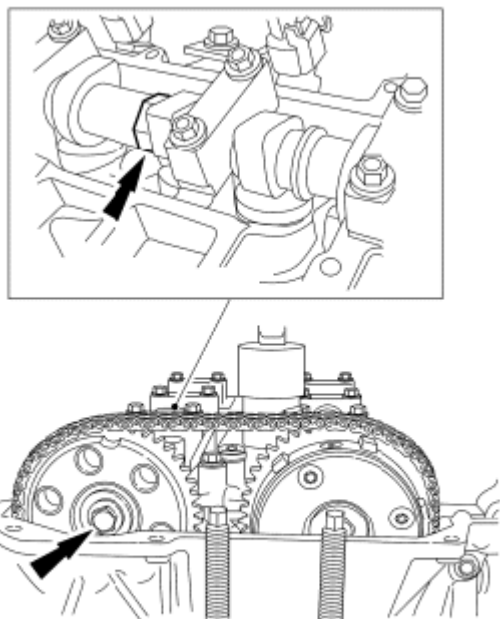
Fig. 109: Locating Exhaust Camshaft Drive Gear & Bolt
Courtesy of FORD MOTOR CO.

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

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

7. Using the flats on the camshaft to prevent camshaft rotation, tighten the exhaust camshaft drive gear bolt to 72 Nm (53 lb-ft).

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.



N0035634

Fig. 110: Locating Flats On Camshaft & Bolt
Courtesy of FORD MOTOR CO.

8. Remove the Camshaft Alignment Plate.

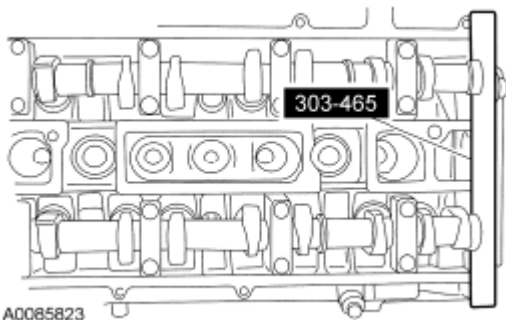


Fig. 111: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

9. Remove the 6 mm x 18 mm bolt.

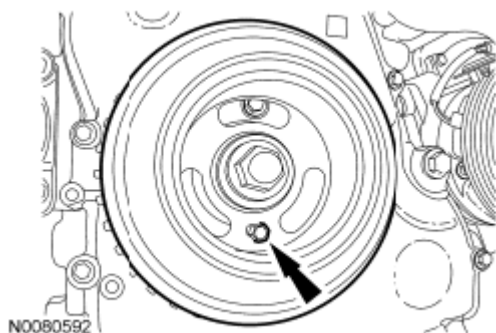


Fig. 112: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

10. Remove the Crankshaft TDC Timing Peg.

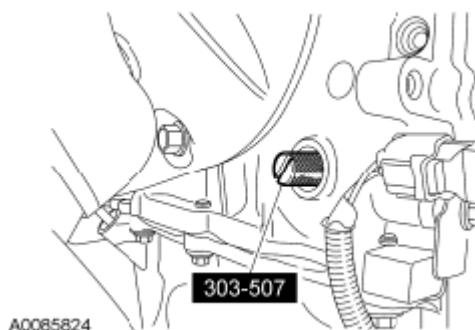


Fig. 113: Removing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

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

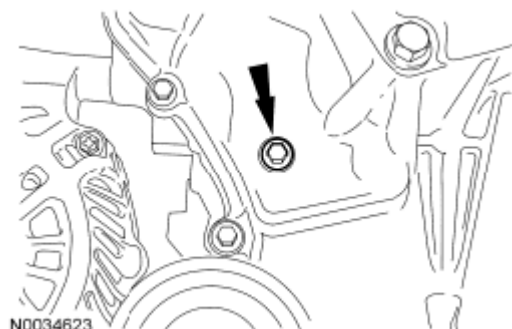


Fig. 114: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Apply silicone gasket and sealant to the threads of the lower timing hole plug.

- Install the lower timing hole plug in the engine front cover.
- Tighten to 12 Nm (106 lb-in).

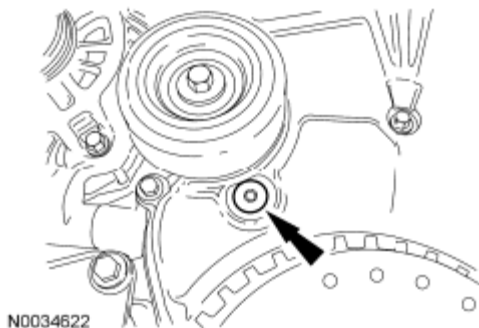


Fig. 115: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Install the engine plug bolt.
- Tighten to 20 Nm (177 lb-in).

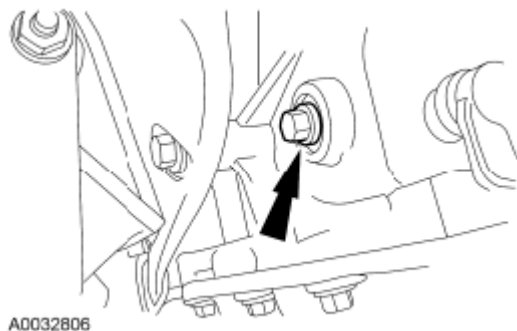


Fig. 116: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

14. If equipped, install the underbody cover and the 7 screws.

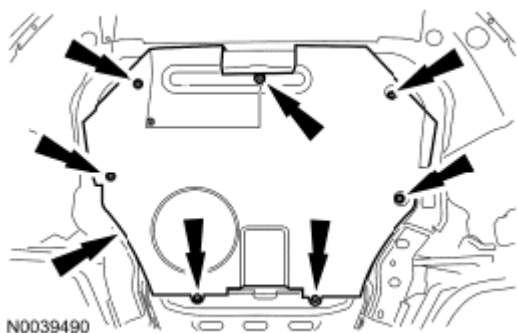


Fig. 117: Locating Underbody Cover & Screws
 Courtesy of FORD MOTOR CO.

15. Install the front RH wheel and tire. For additional information, refer to **INSTALLATION** .
16. Install the accessory drive belt. For additional information, refer to **REMOVAL AND INSTALLATION** .
17. Install the VCT solenoid. For additional information, refer to **REMOVAL AND INSTALLATION** .

CAMSHAFT PHASER AND SPROCKET

Special Tool(s)

SPECIAL TOOLS TABLE

 ST2645-A	Alignment Plate, Camshaft 303-465 (T94P-6256-CH)
 ST2638-A	Timing Peg, Crankshaft TDC 303-507

General Equipment

GENERAL EQUIPMENT TABLE

6 mm x 18 mm bolt
M6 x 30 mm bolt

Material

MATERIAL SPECIFICATIONS TABLE

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

Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent

Silicone Gasket and Sealant TA-30

WSE-M4G323-A4

Removal

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

NOTE: Do not rotate the camshafts or crankshaft unless instructed to do so in this procedure. Rotating the camshafts or crankshaft with timing components loosened or removed can cause serious damage to the valves or pistons.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the accessory drive belt. For additional information, refer to **REMOVAL AND INSTALLATION**.
3. If equipped, remove the 7 screws and the underbody cover.

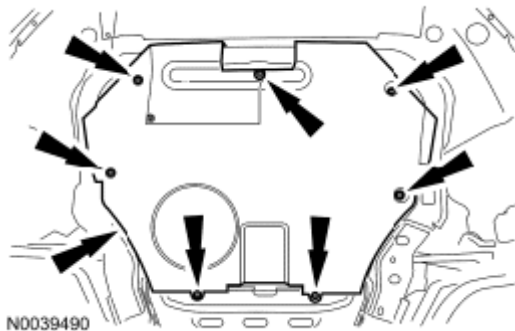


Fig. 118: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

4. Remove the Variable Camshaft Timing (VCT) solenoid. For additional information, refer to **REMOVAL AND INSTALLATION**.
5. Check the valve clearance. For additional information, refer to **VALVE CLEARANCE CHECK**.
6. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
 - The hole in the crankshaft pulley should be in the 6 o'clock position.

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

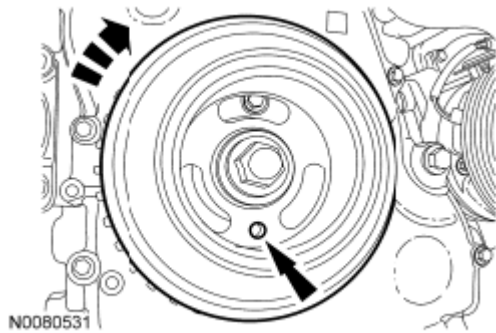


Fig. 119: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

7. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

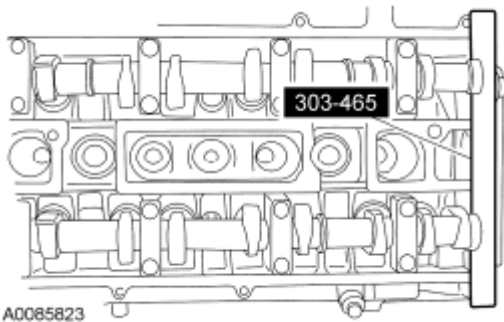


Fig. 120: Identifying Camshaft Alignment Plate In Slots On Rear Of Both Camshafts
Courtesy of FORD MOTOR CO.

8. Remove the engine plug bolt.

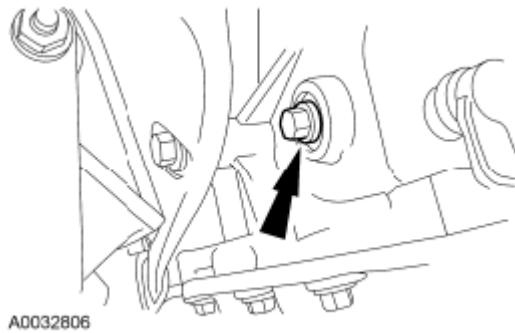


Fig. 121: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

9. Install the Crankshaft TDC Timing Peg.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC . However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the camshaft removal and installation.

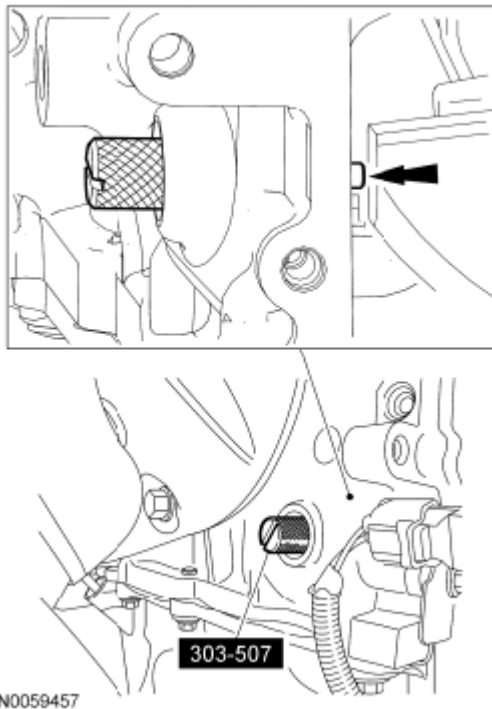


Fig. 122: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

10. Install a standard 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

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

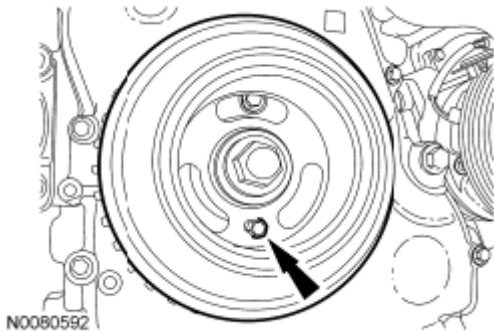


Fig. 123: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

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

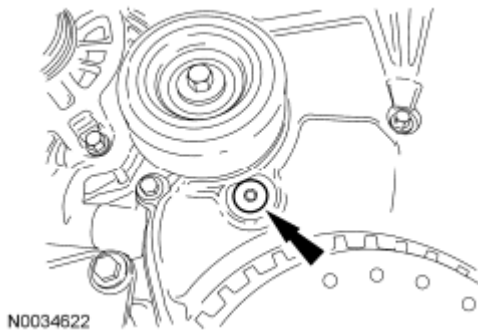


Fig. 124: Locating Lower Timing Hole Plug
Courtesy of FORD MOTOR CO.

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

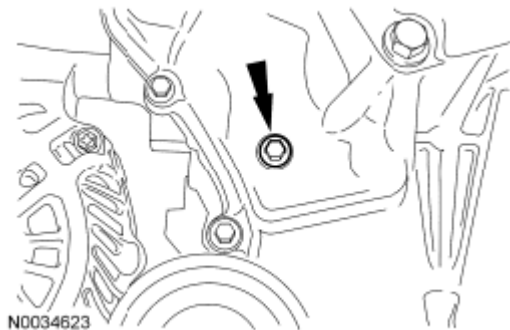


Fig. 125: Locating Upper Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Reposition the Camshaft Alignment Plate to the slot on the rear of the intake camshaft only.

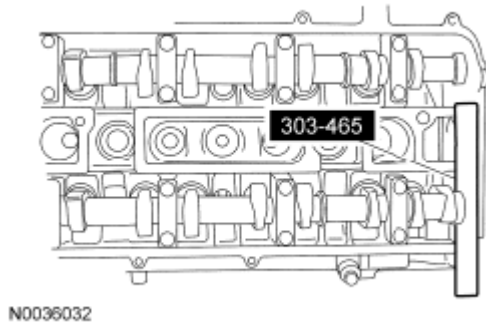


Fig. 126: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

14. Using a small pick tool, release the timing chain tensioner ratchet through the lower front cover timing hole.
 - Have an assistant rotate the exhaust camshaft clockwise (using the flats of the camshaft) to collapse the timing chain tensioner plunger.
 - Insert the M6 x 30 mm bolt into the upper front cover timing hole to hold the tensioner arm in the retracted position.

NOTE: Releasing the ratcheting mechanism in the timing chain tensioner allows the plunger to collapse and create slack in the timing chain. Installing the M6 x 30 mm bolt into the upper front cover timing hole will lock the tensioner arm in a retracted position and allow enough slack in the timing chain for removal of the exhaust camshaft gear.

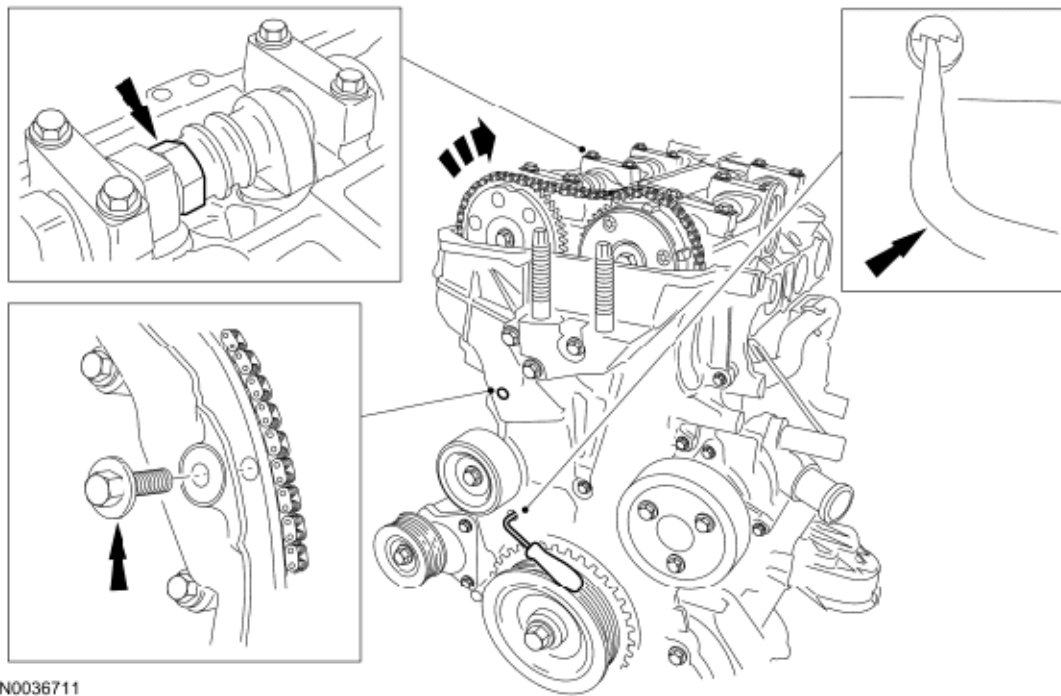


Fig. 127: Releasing Timing Chain Tensioner Ratchet Through Lower Front Cover Timing Hole
 Courtesy of FORD MOTOR CO.

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

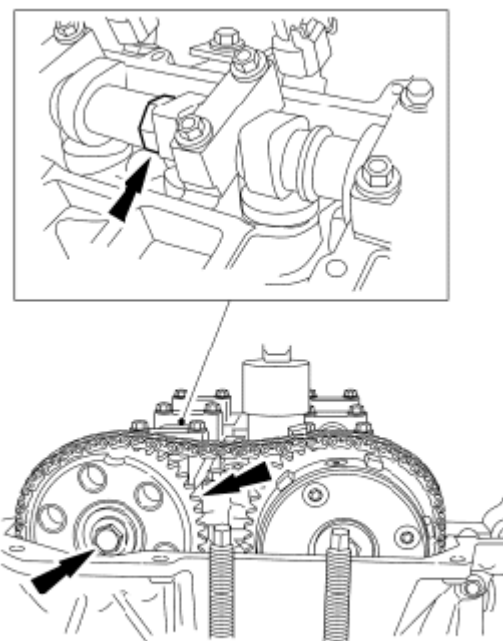


Fig. 128: Locating Flats On Camshaft To Prevent Camshaft Rotation
Courtesy of FORD MOTOR CO.

16. Remove the Camshaft Alignment Plate.

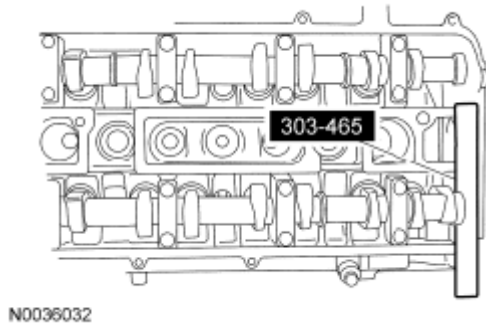


Fig. 129: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

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

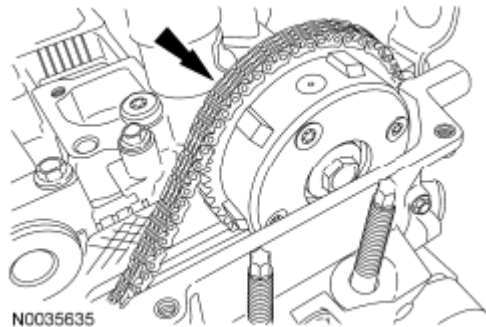


Fig. 130: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

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

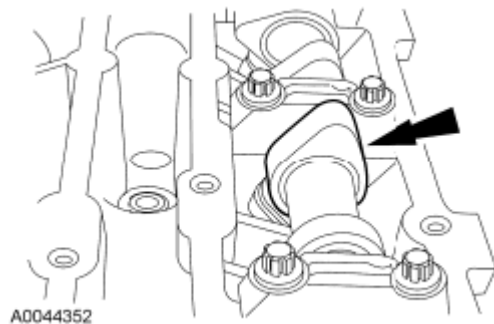


Fig. 131: Locating Camshaft Lobe Position On No. 1 Cylinder

Courtesy of FORD MOTOR CO.

19. Remove the intake camshaft from the engine.

- Loosen the intake camshaft bearing cap bolts, in the sequence shown, one turn at a time until all tension is released from the camshaft bearing caps.
- Remove the bolts and the camshaft bearing caps.
- Remove the intake camshaft.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the intake camshaft.

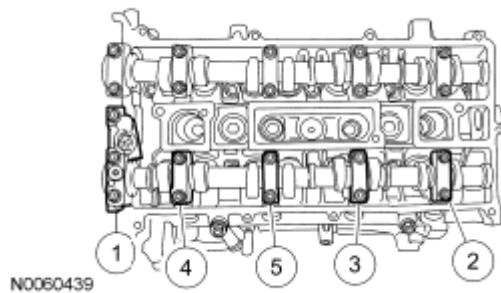


Fig. 132: Identifying Camshaft Bearing Cap Bolt Loosening Sequence
Courtesy of FORD MOTOR CO.

20. Mark the camshaft phaser and sprocket and the camshaft for reference during installation.

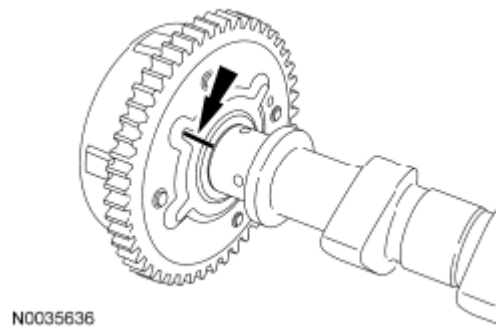


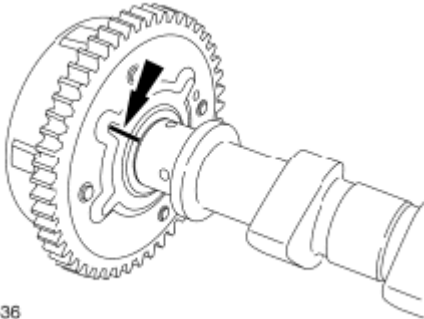
Fig. 133: Locating Sprocket & Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

21. Place the camshaft in a soft-jawed vise. Remove the bolt and the camshaft phaser and sprocket.

Installation

1. Position the camshaft in a soft-jawed vise. Install the camshaft phaser and sprocket and the bolt.
 - Align the reference marks on the camshaft phaser and sprocket and the camshaft. Tighten the bolt to 72 Nm (53 lb-ft).

NOTE: If new parts are installed, transfer the reference marks made during disassembly to the new parts.



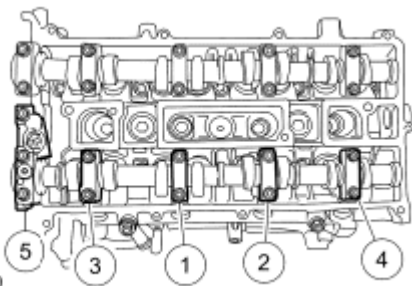
N0035636

Fig. 134: Locating Sprocket & Camshaft Reference Mark
Courtesy of FORD MOTOR CO.

2. Install the intake camshafts and bearing caps. Tighten the intake camshaft bearing caps in the sequence shown in 3 stages:
 - Stage 1: Tighten the intake camshaft bearing cap bolts until finger-tight.
 - Stage 2: Tighten to 7 Nm (62 lb-in).
 - Stage 3: Tighten to 16 Nm (142 lb-in).

NOTE: Install the intake camshaft with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the intake camshaft journals and bearing caps with clean engine oil.



N0060440

Fig. 135: Identifying Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

3. Install the Camshaft Alignment Plate.

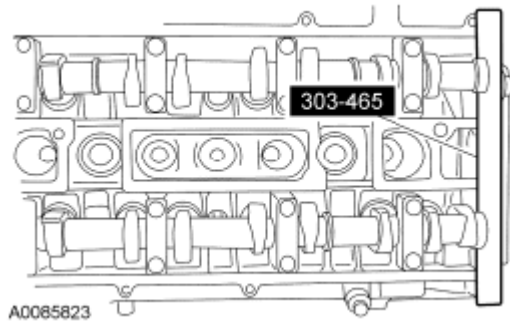


Fig. 136: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

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

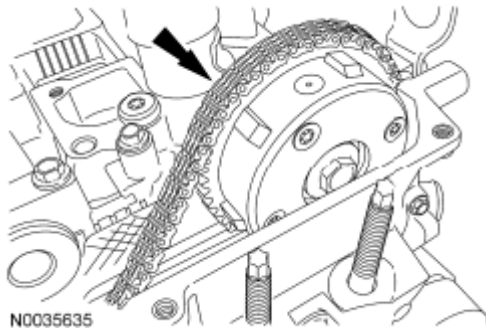


Fig. 137: Locating Timing Chain On Intake Camshaft Drive Gear
Courtesy of FORD MOTOR CO.

5. Position the exhaust camshaft drive gear in the timing chain and install the gear and bolt on the exhaust camshaft.
 - Hand-tighten the bolt.

NOTE: The timing chain must be correctly engaged on the teeth of the crankshaft timing sprocket and the intake camshaft drive gear in order to install the exhaust camshaft drive gear onto the exhaust camshaft.

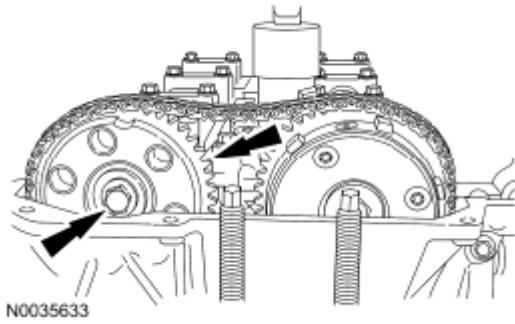


Fig. 138: Locating Exhaust Camshaft Drive Gear & Bolt
Courtesy of FORD MOTOR CO.

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

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

7. Using the flats on the camshaft to prevent camshaft rotation, tighten the exhaust camshaft drive gear bolt to 72 Nm (53 lb-ft).

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

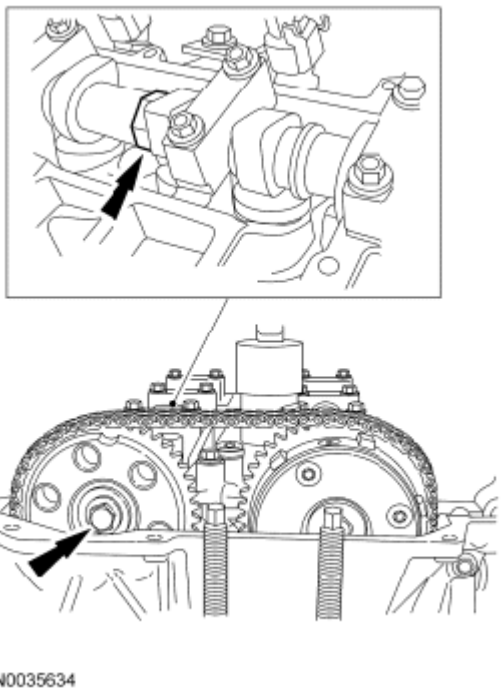


Fig. 139: Locating Flats On Camshaft & Bolt
Courtesy of FORD MOTOR CO.

8. Remove the Camshaft Alignment Plate.

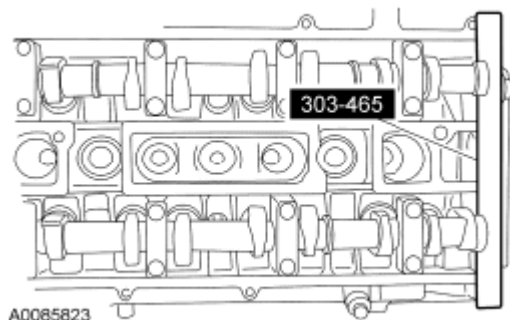


Fig. 140: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

9. Remove the 6 mm x 18 mm bolt.

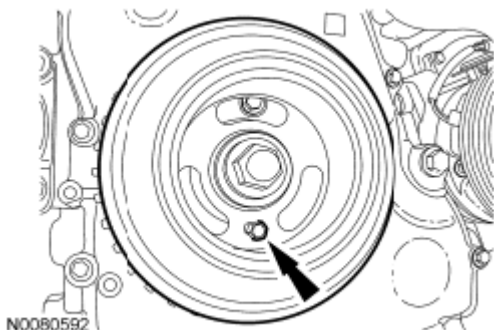


Fig. 141: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

10. Remove the Crankshaft TDC Timing Peg.

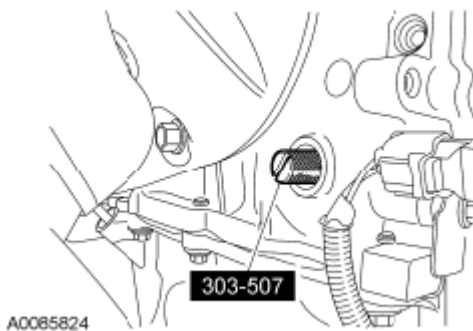


Fig. 142: Removing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

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

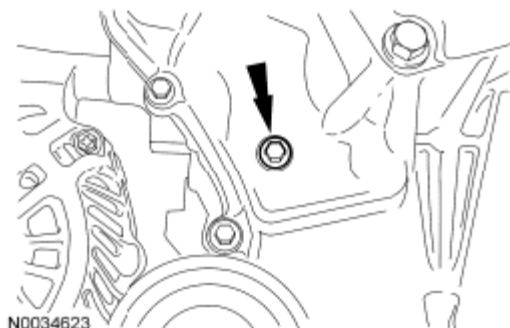


Fig. 143: Locating Upper Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

12. Apply silicone gasket and sealant to the threads of the lower timing hole plug.
 - Install the lower timing hole plug in the engine front cover.
 - Tighten to 12 Nm (106 lb-in).

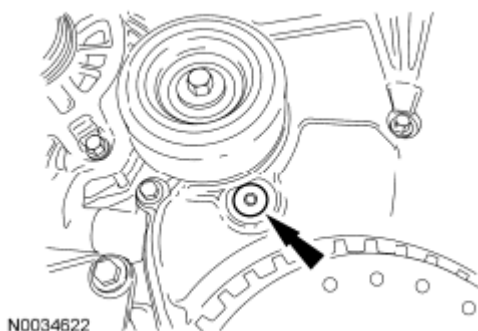


Fig. 144: Locating Lower Front Cover Timing Hole Plug
Courtesy of FORD MOTOR CO.

13. Install the engine plug bolt.
 - Tighten to 20 Nm (177 lb-in).

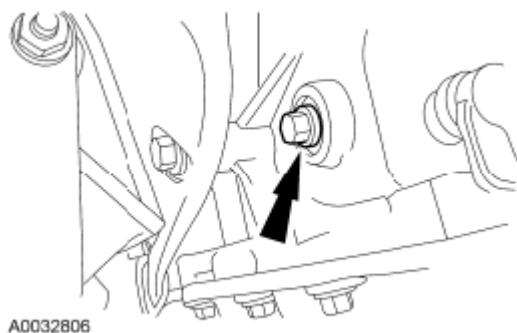


Fig. 145: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

14. If equipped, install the underbody cover and the 7 screws.

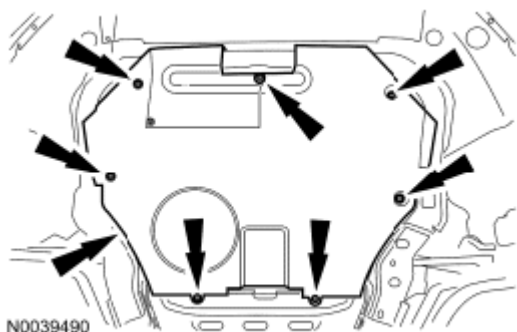


Fig. 146: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

15. Install the accessory drive belt. For additional information, refer to **REMOVAL AND INSTALLATION**.
16. Install the VCT solenoid. For additional information, refer to **REMOVAL AND INSTALLATION**.

VALVE TRAIN COMPONENTS - EXPLODED VIEW

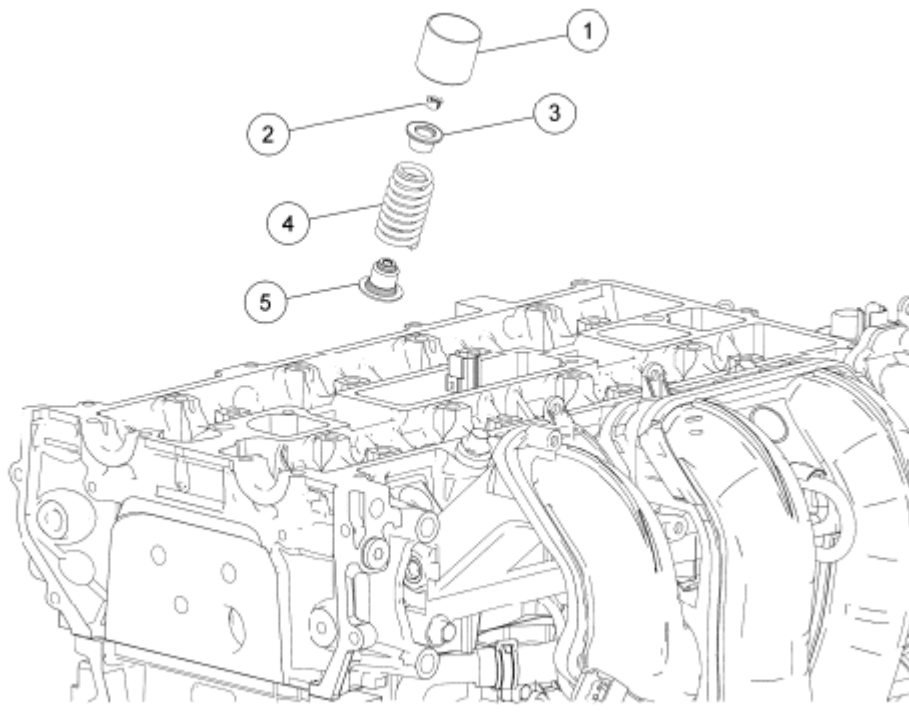


Fig. 147: Identifying Valve Train Components
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6500	Valve tappet (16 required)
2	6518	Valve collet (16 required)
3	6514	Valve spring retainer (16 required)
4	6513	Valve spring (16 required)
5	6517	Valve seal (16 required)

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

VALVE SPRINGS

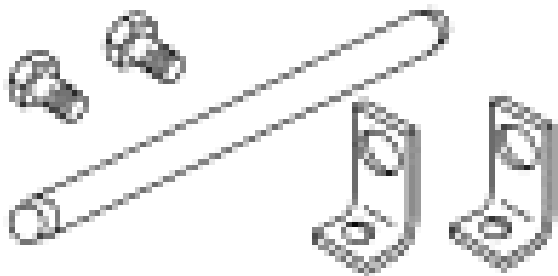
Special Tool(s)

SPECIAL TOOLS TABLE

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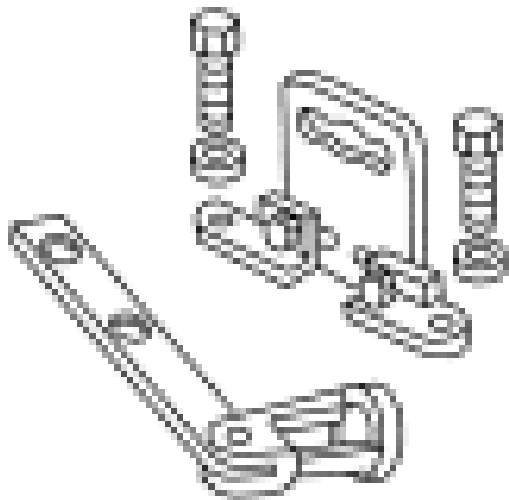
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1981-A

Compressor, Valve Spring 303-300 (T87C-6565-A)



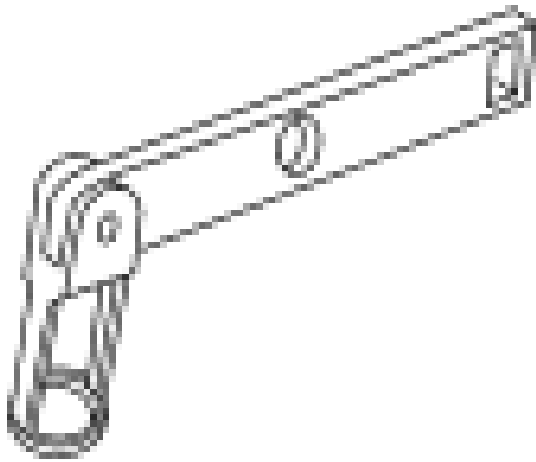
ST1907-A

Compressor, Valve Spring 303-350 (T89P-6565-A)

Compressor, Valve Spring 303-472 (T94P-6565-

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1902-A

AH)

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Removal

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the camshafts. For additional information, refer to **Removal**.
3. Remove and inspect the valve tappets. For additional information, refer to **VALVE TAPPET INSPECTION**.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

4. Remove the spark plugs. For additional information, refer to **REMOVAL AND INSTALLATION**.
5. Connect compressed air supply to the No. 1 cylinder.

NOTE: Use compressed air at 7-10 bars (100-150 psi). Do not disconnect the compressed air from the cylinder until the valve spring, valve spring retainer and valve collet are installed. Any loss of air pressure will allow the valve to fall into the cylinder.

6. Apply compressed air to the cylinder and remove the valve spring.
 - Using the Valve Spring Compressors, compress the valve spring and remove the valve collet, using some grease and a small screwdriver.
 - Remove the valve spring retainer and the valve spring.

NOTE: Place all parts in order to one side.

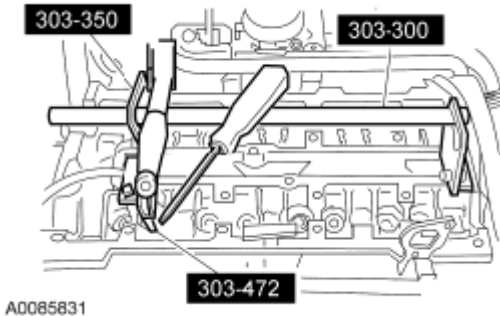


Fig. 148: Identifying Valve Spring & Valve Spring Retainer Special Tools
Courtesy of FORD MOTOR CO.

Installation

1. Using the Valve Spring Compressors, install the valve spring.
 - Insert the valve spring and the valve spring retainer.
 - Compress the valve spring and install the valve collet using some grease and a small screwdriver.

NOTE: Check the seating of the valve collet.

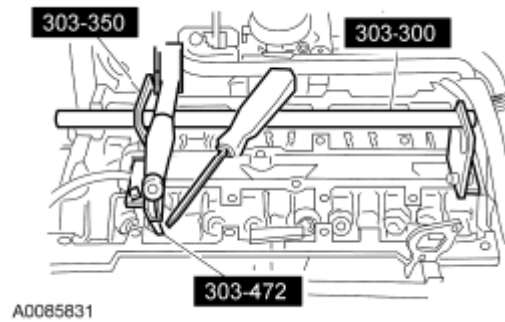


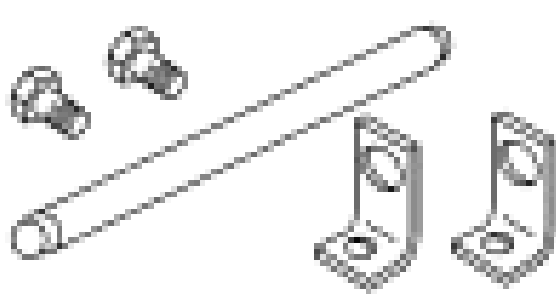
Fig. 149: Identifying Valve Spring & Valve Spring Retainer Special Tools
 Courtesy of FORD MOTOR CO.

2. Disconnect the compressed air supply.
3. Repeat the appropriate removal and installation steps for all of the other cylinders.
4. Install the spark plugs. For additional information, refer to **REMOVAL AND INSTALLATION**.
5. Coat the valve tappets with clean engine oil and insert them.
6. Install the camshafts. For additional information, refer to **Installation**.

VALVE SEALS

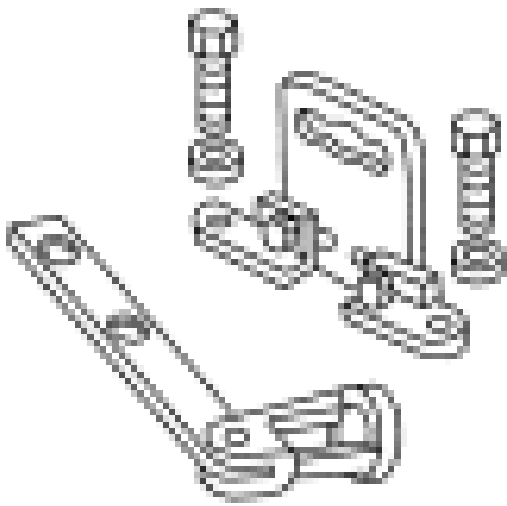
Special Tool(s)

SPECIAL TOOLS TABLE

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

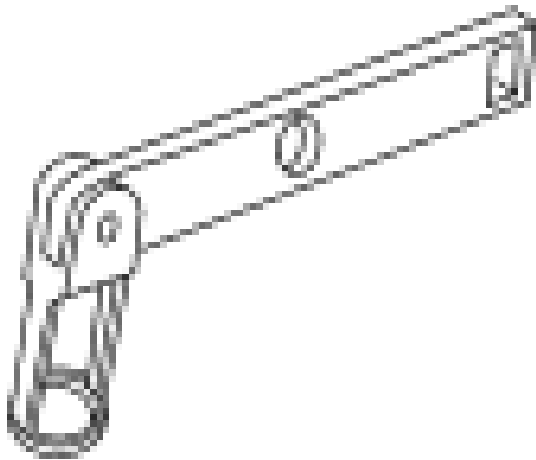
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1907-A

Compressor, Valve Spring 303-350 (T89P-6565-A)

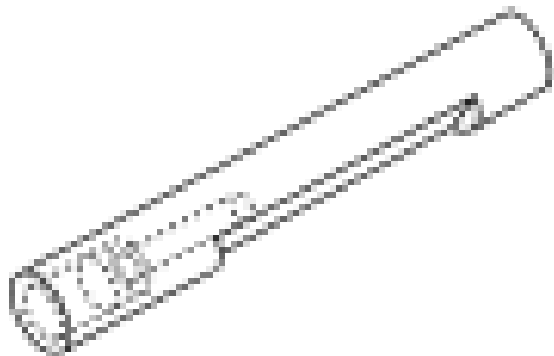


ST1902-A

Compressor, Valve Spring 303-472 (T94P-6565-AH)

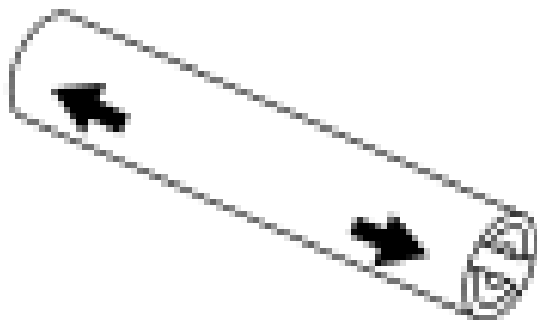
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ST1908-A

Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)



ST1904-A

Remover, Valve Stem Oil Seal 303-468 (T94P-6510-AH)

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

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ST1187-A

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

Removal

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the camshafts. For additional information, refer to **Removal**.
3. Remove and inspect the valve tappets. For additional information, refer to **VALVE TAPPET INSPECTION**.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

4. Remove the spark plugs. For additional information, refer to **REMOVAL AND INSTALLATION**.
5. Connect compressed air supply to the No. 1 cylinder.

NOTE: Use compressed air at 7-10 bars (100-150 psi). Do not disconnect the compressed air from the cylinder until the valve spring, valve spring retainer and valve collet are installed. Any loss of air pressure will allow the valve to fall into the cylinder.

6. Apply compressed air to the cylinder and remove the valve spring.
 - Using the Valve Spring Compressors, compress the valve spring and remove the valve collet, using some grease and a small screwdriver.
 - Remove the valve spring retainer and the valve spring.

NOTE: Place all parts in order to one side.

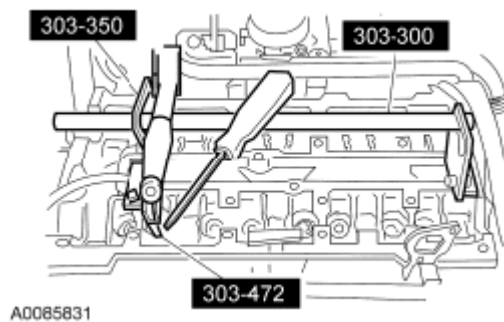


Fig. 150: Identifying Valve Spring & Valve Spring Retainer Special Tools
Courtesy of FORD MOTOR CO.

7. Using the Valve Stem Oil Seal Remover and Slide Hammer, remove and discard the valve seal.

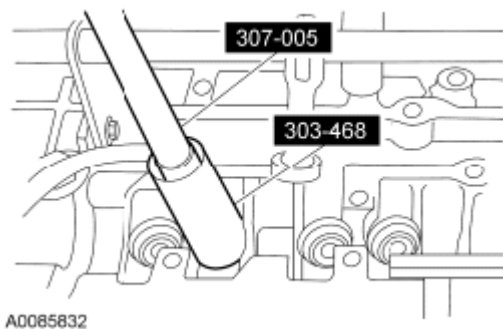


Fig. 151: Removing Valve Seal
Courtesy of FORD MOTOR CO.

Installation

1. Install the valve stem seal installation sleeve.

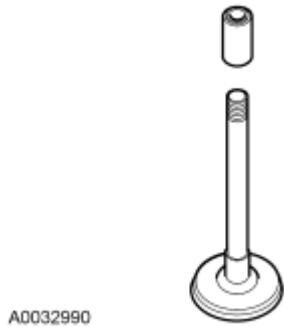


Fig. 152: Identifying Valve Stem Seal Installation Sleeve
Courtesy of FORD MOTOR CO.

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

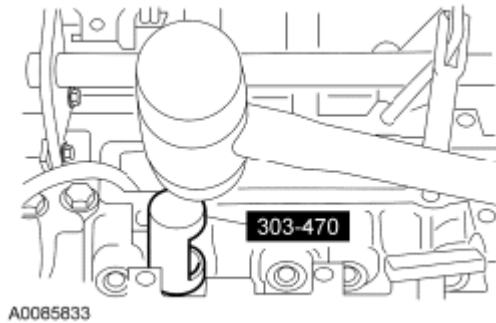


Fig. 153: Installing Valve Seal
Courtesy of FORD MOTOR CO.

3. Using the Valve Spring Compressors, install the valve spring.
 - Insert the valve spring and the valve spring retainer.
 - Compress the valve spring and install the valve collet using some grease and a small screwdriver.

NOTE: Check the seating of the valve collet.

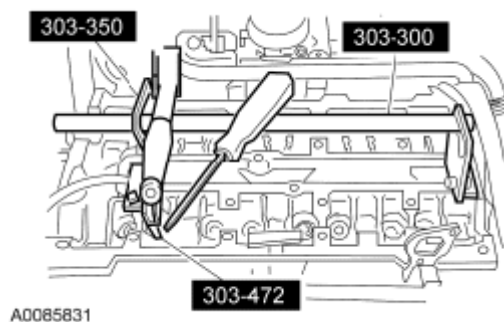


Fig. 154: Identifying Valve Spring & Valve Spring Retainer Special Tools
 Courtesy of FORD MOTOR CO.

4. Disconnect the compressed air supply.
5. Repeat the appropriate removal and installation steps for all of the other cylinders.
6. Install the spark plugs. For additional information, refer to **REMOVAL AND INSTALLATION**.
7. Coat the valve tappets with clean engine oil and insert them.
8. Install the camshafts. For additional information, refer to **Installation**.

VALVE TAPPETS

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930- A

Removal and Installation

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the camshafts. For additional information, refer to **Removal**.
3. Remove and inspect the valve tappets. For additional information, refer to **VALVE TAPPET INSPECTION**.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

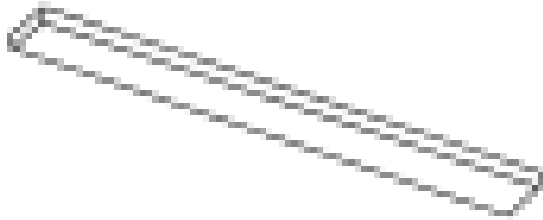
NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

4. To install, reverse the removal procedure.
 - Coat the valve tappets with clean engine oil prior to installation.

CYLINDER HEAD

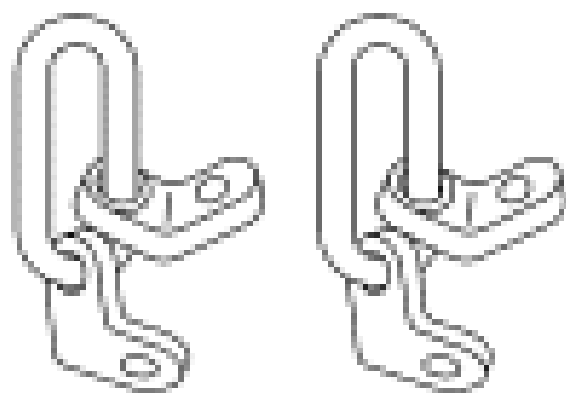
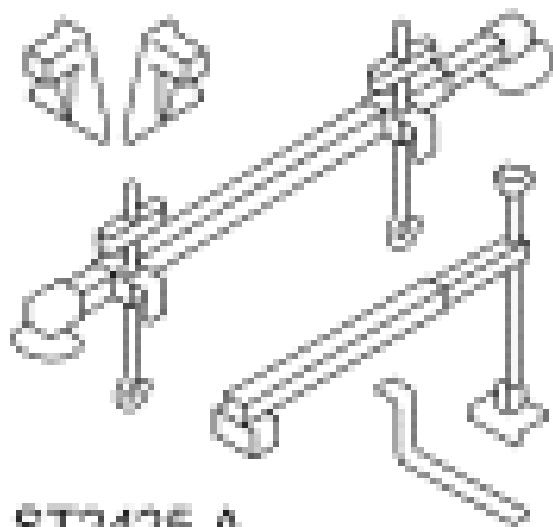
Special Tool(s)

SPECIAL TOOLS TABLE

 ST2645-A	Alignment Plate, Camshaft 303-465 (T94P-6256-CH)
	Engine Support Bar 303-F072

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Lifting Bracket, Engine 303-050 (T70P-6000)

Material

MATERIAL SPECIFICATIONS TABLE

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

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equivalent

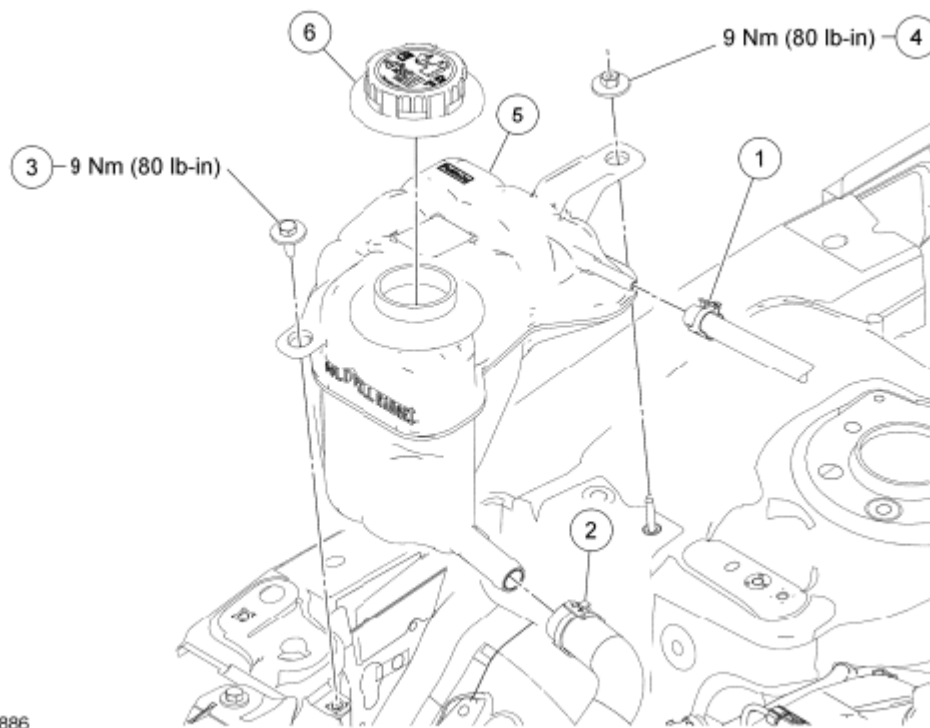
Silicone Gasket and Sealant TA-30

WSE-M4G323-A4

Silicone Gasket Remover ZC-30

-

Degas Bottle



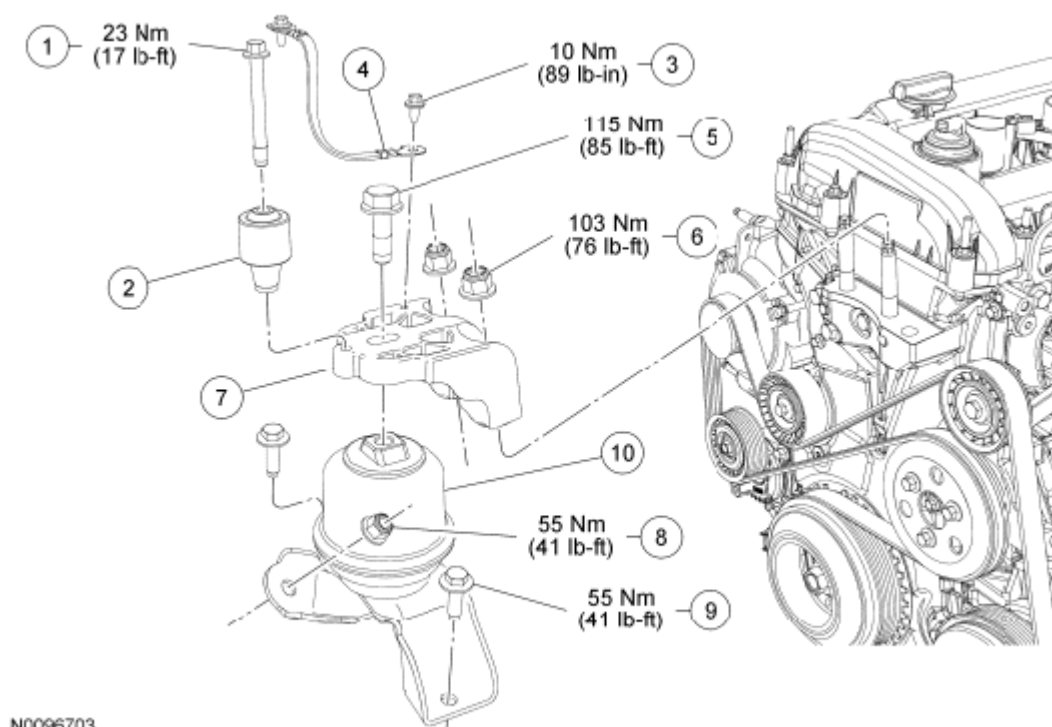
N0081886

Fig. 155: Exploded View Of Degas Bottle Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	8276	Degas bottle-to-radiator hose
2	8C351	Lower degas bottle hose
3	W707398	Degas bottle-to-fender bolt
4	W709603	Degas bottle-to-fender nut
5	8A080	Degas bottle
6	8100	Pressure relief cap

Engine Mount



N0096703

Fig. 156: Exploded View Of Engine Mount Components With Torque Specifications
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W711879	Damper bolt
2	7458	Damper
3	W705936	Ground wire bolt
4	19A095	Ground wire
5	W711684	Engine mount bracket bolt
6	W520214	Engine mount bracket nut (2 required)
7	6A094	Engine mount bracket
8	W711578	Engine mount nut
9	W706496	Engine mount bolt (2 required)
10	6F012	Engine mount

Camshafts

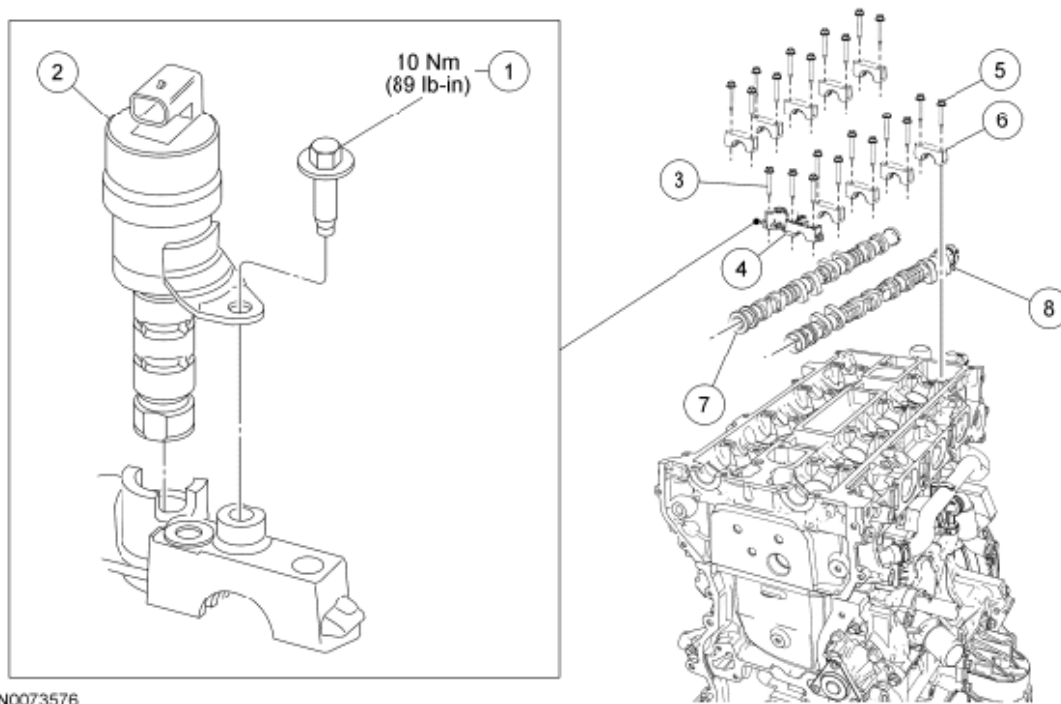


Fig. 157: Exploded View Of Camshafts Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500211	Variable Camshaft Timing (VCT) oil control solenoid bolt
2	6M280	VCT oil control solenoid
3	W500301	Intake camshaft bearing cap bolt
4	6A258	Intake camshaft bearing cap
5	W703383	Camshaft bearing cap bolt (20 required)
6	6A284	Camshaft bearing cap (9 required)
7	6A272	Exhaust camshaft
8	6A267	Intake camshaft

Cylinder Head

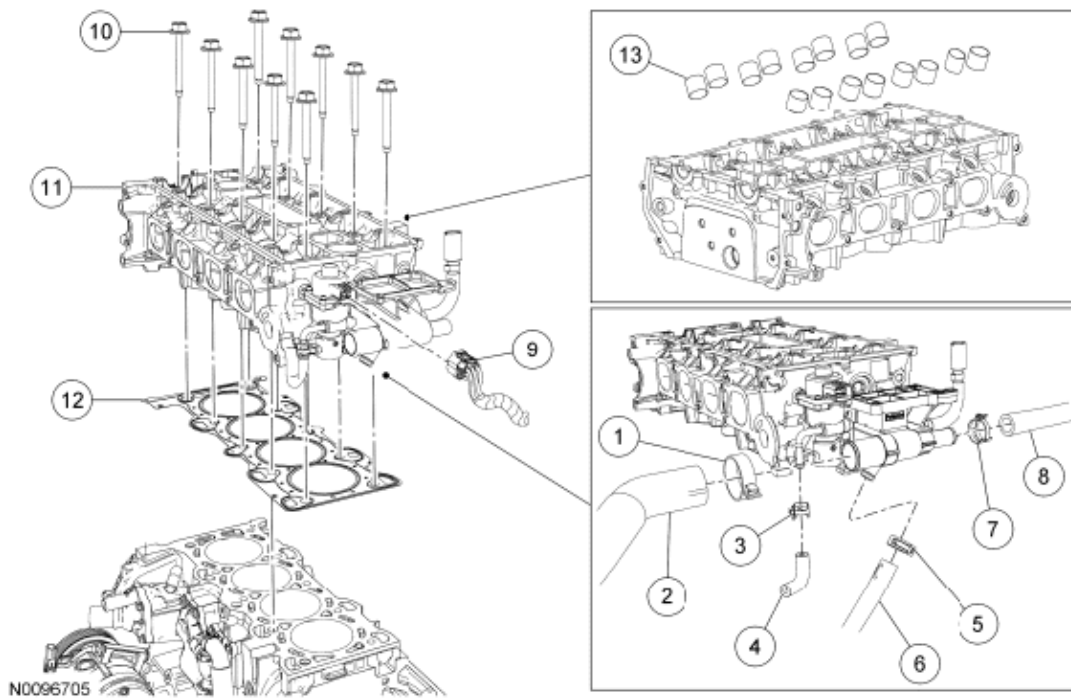


Fig. 158: Exploded View Of Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W527372	Upper radiator hose clamp
2	8B274	Upper radiator hose
3	15161	EGR coolant tube clamp
4	-	EGR coolant hose (part of 18C266)
5	W525958	Bypass hose clamp
6	8548	Bypass hose
7	-	Heater hose clamp (part of 18C266)
8	18C266	Heater hose
9	14A464	EGR valve electrical connector (part of 12B637)
10	6065	Cylinder head bolt (10 required)
11	6050	Cylinder head
12	6051	Cylinder head gasket
13	6500	Valve tappet (16 required)

Removal

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the

crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE**.
3. Check the valve clearance. For additional information, refer to **VALVE CLEARANCE CHECK**.
4. Drain the engine cooling system. For additional information, refer to **DRAINING**.
5. Disconnect the degas bottle-to-radiator hose from the degas bottle.
6. Remove the nut and bolt and position the degas bottle to access the lower degas bottle hose.
7. Disconnect the lower degas bottle hose and remove the degas bottle.
8. Remove the generator. For additional information, refer to **REMOVAL**.
9. Remove the fuel supply rail. For additional information, refer to **REMOVAL**.
10. Remove the intake manifold. For additional information, refer to **INTAKE MANIFOLD**.
11. Remove the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD**.
12. Remove the bolt and the engine mount damper from the engine mount bracket.
13. Remove the bolt and the ground wire from the engine mount bracket.
14. Remove the engine mount bracket bolt.
15. Install the Engine Lifting Brackets and a suitable length of chain to the threaded hole in the LH side of the engine block.

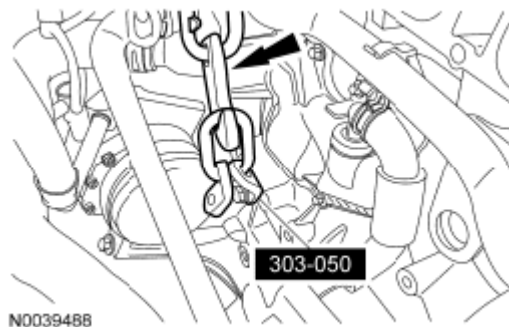


Fig. 159: Locating Engine Lifting Brackets & Chain
Courtesy of FORD MOTOR CO.

16. Using the Engine Support Bar and Engine Lifting Brackets, lift the engine 25 mm (0.98 in).

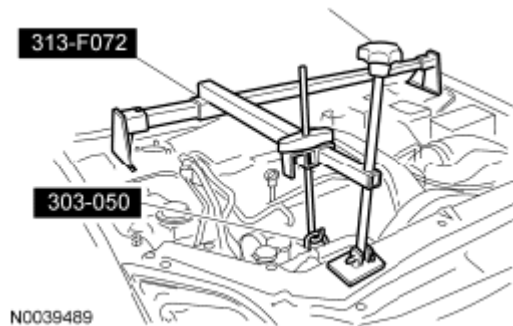


Fig. 160: Identifying Engine Support Bar & Engine Lifting Brackets
Courtesy of FORD MOTOR CO.

17. Remove the nut, 2 bolts and the engine mount.
18. Lower the engine 25 mm (0.98 in).
19. Remove the 2 nuts and the engine mount bracket.
20. Remove the timing drive components. For additional information, refer to **Removal**.
21. Remove the Camshaft Alignment Plate.

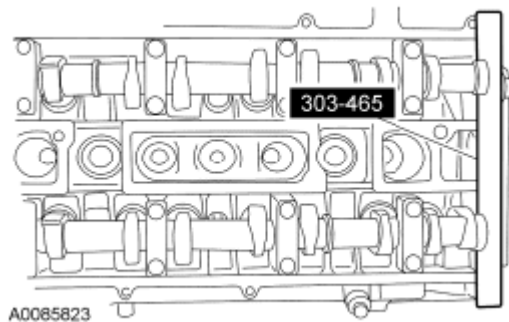


Fig. 161: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

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

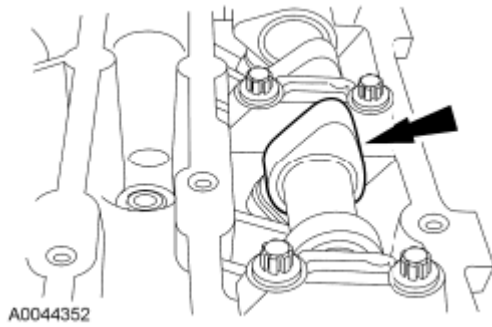


Fig. 162: Locating Camshaft Lobe Position On No. 1 Cylinder
Courtesy of FORD MOTOR CO.

23. Remove the bolt and the Variable Camshaft Timing (VCT) solenoid.
24. Remove the camshafts from the engine.
 - Loosen the camshaft bearing cap bolts, in the sequence shown, one turn at a time until all tension is released from the camshaft bearing caps.
 - Remove the bolts and the camshaft bearing caps.
 - Remove the camshafts.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

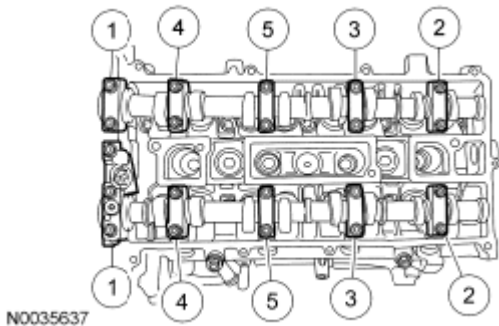


Fig. 163: Identifying Camshaft Bearing Cap Bolt Loosening Sequence
Courtesy of FORD MOTOR CO.

25. Remove and inspect the valve tappets. For additional information, refer to **VALVE TAPPET INSPECTION**.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

26. Disconnect the upper radiator hose, coolant bypass hose and heater hose from the engine coolant outlet.
27. Disconnect the EGR valve electrical connector.
28. Disconnect the coolant hose from the EGR valve.
29. Remove the 10 bolts and the cylinder head.
 - Discard the bolts.
 - Discard the cylinder head gasket.

Installation

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

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

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

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

2. Clean the cylinder head bolt holes in the cylinder block. Make sure all coolant, oil or other foreign material is removed.
3. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **CYLINDER HEAD DISTORTION** and **CYLINDER BLOCK DISTORTION**.
4. Apply silicone gasket and sealant to the locations shown.



Fig. 164: Locating Silicone Gasket & Sealant Application Points
Courtesy of FORD MOTOR CO.

5. Install a new cylinder head gasket.
6. Install the cylinder head and 10 new bolts. Tighten the bolts in the sequence shown in 5 stages:
 - Stage 1: Tighten to 7 Nm (62 lb-in).
 - Stage 2: Tighten to 15 Nm (133 lb-in).
 - Stage 3: Tighten to 45 Nm (33 lb-ft).
 - Stage 4: Turn 90 degrees
 - Stage 5: Turn an additional 90 degrees.

NOTE: The cylinder head bolts are a torque-to-yeild design and must not be reused. New cylinder head bolts must be installed.

NOTE: Lubricate the bolts with clean engine oil prior to installation.

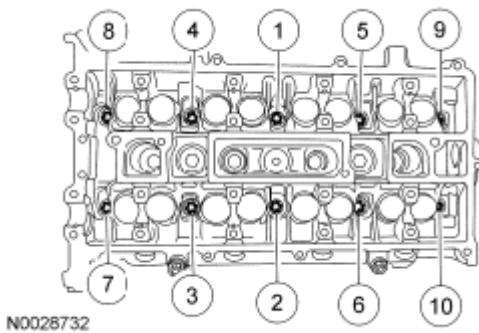


Fig. 165: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

7. Connect the coolant hose to the EGR valve.
8. Connect the EGR valve electrical connector.
9. Connect the upper radiator hose, coolant bypass hose and heater hose to the engine coolant outlet.
10. Install the valve tappets.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

11. Install the camshafts and bearing caps in their original locations and orientation. Tighten the bearing caps in the sequence shown in 3 stages:
- Stages 1: Tighten the camshaft bearing cap bolts until finger-tight.
 - Stages 2: Tighten to 7 Nm (62 lb-in).
 - Stages 3: Tighten to 16 Nm (142 lb-in).

NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

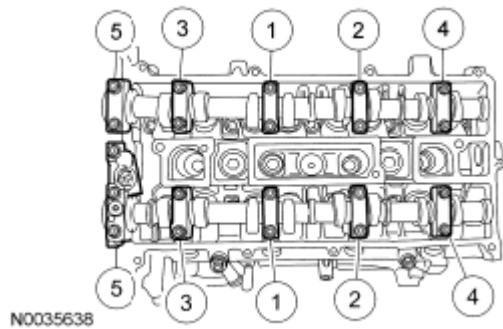


Fig. 166: Identifying Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

12. Install the Camshaft Alignment Plate.

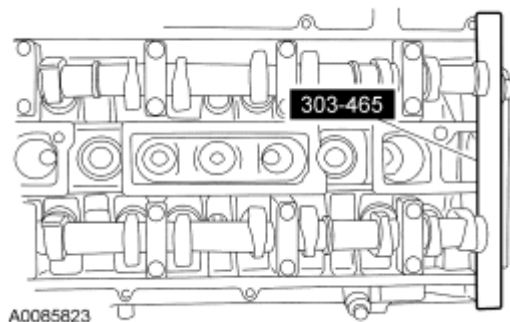


Fig. 167: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

13. Install the **VCT** solenoid and bolt.
 - Tighten to 10 Nm (89 lb-in).
14. Install the timing drive components. For additional information, refer to **Installation**.
15. Install the engine mount bracket and the 2 nuts.
 - Tighten to 103 Nm (76 lb-ft).
16. Using the Engine Support Bar and Engine Lifting Brackets, lift the engine 25 mm (0.98 in).

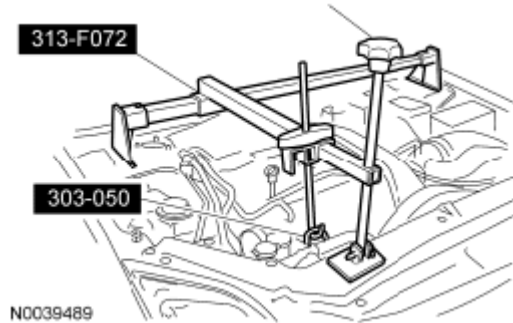


Fig. 168: Identifying Engine Support Bar & Engine Lifting Brackets
 Courtesy of FORD MOTOR CO.

17. Install the engine mount, nut and 2 bolts.
 - Tighten to 55 Nm (41 lb-ft).
18. Lower the engine 25 mm (0.98 in).
19. Install the engine mount bracket bolt.
 - Tighten to 115 Nm (85 lb-ft).
20. Install the ground wire-to-engine mount bracket and bolt.
 - Tighten to 10 Nm (89 lb-in).
21. Install the engine mount damper and the bolt.
 - Tighten to 23 Nm (17 lb-ft).
22. Install the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD**.
23. Install the intake manifold. For additional information, refer to **INTAKE MANIFOLD**.
24. Install the fuel supply rail. For additional information, refer to **INSTALLATION**.
25. Install the generator. For additional information, refer to **INSTALLATION**.
26. Connect the lower degas bottle hose to the degas bottle.
27. Install the degas bottle and the nut and bolt.
 - Tighten to 9 Nm (80 lb-in).
28. Connect the degas bottle-to-radiator hose.
29. Fill and bleed the engine cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING**.

ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW

Oil Filter Adapter, Oil Filter and Engine Oil Pressure (EOP) Switch

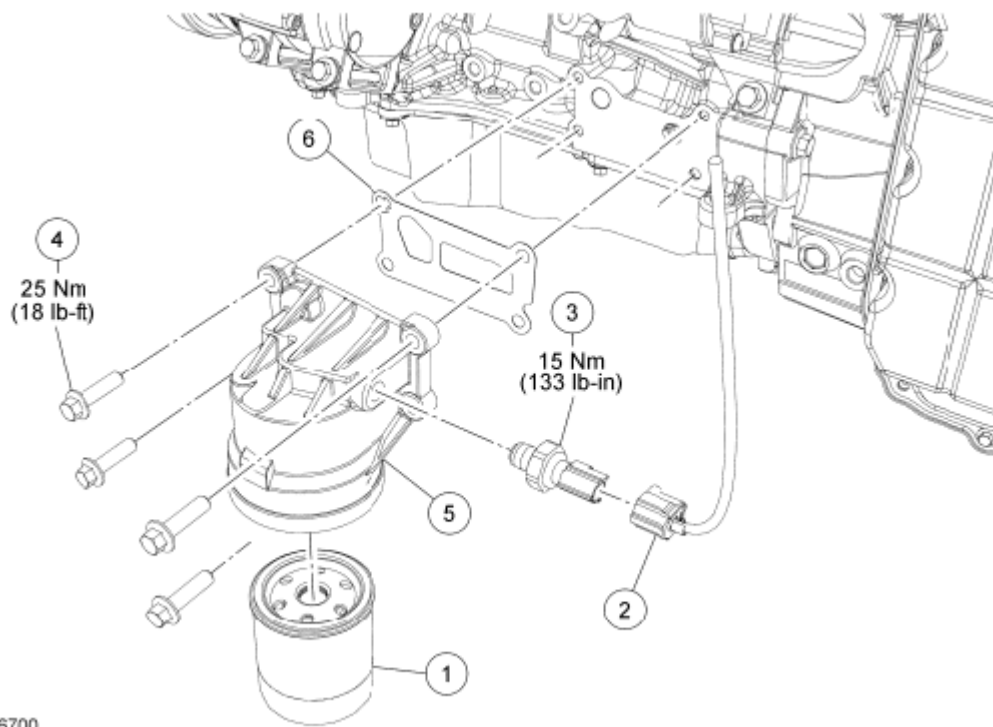


Fig. 169: Identifying Oil Filter Adapter, Oil Filter & Engine Oil Pressure Switch With Torque Specifications

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	6714	Oil filter
2	14A464	Engine Oil Pressure (EOP) switch electrical connector (part of 12C508)
3	9278	EOP switch
4	W500225	Oil filter adapter bolt (4 required)
5	6884	Oil filter adapter
6	6A636	Oil filter adapter gasket

Transmission Bolts for Oil Pan Removal

NOTE: Automatic transmission shown, manual transmission similar.

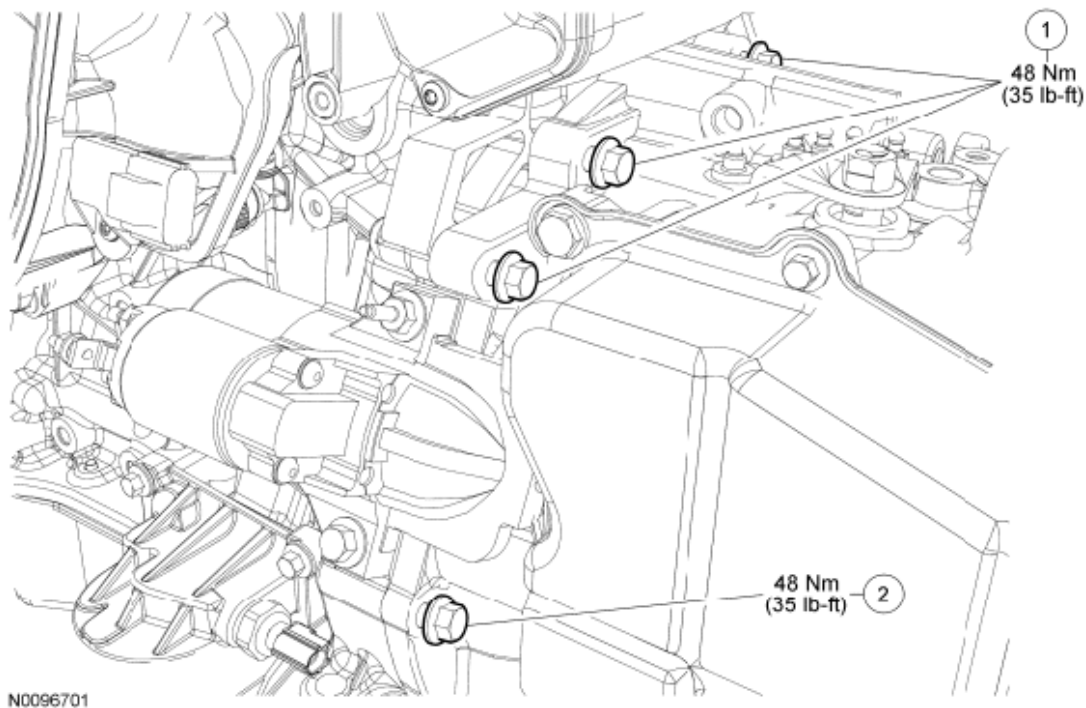
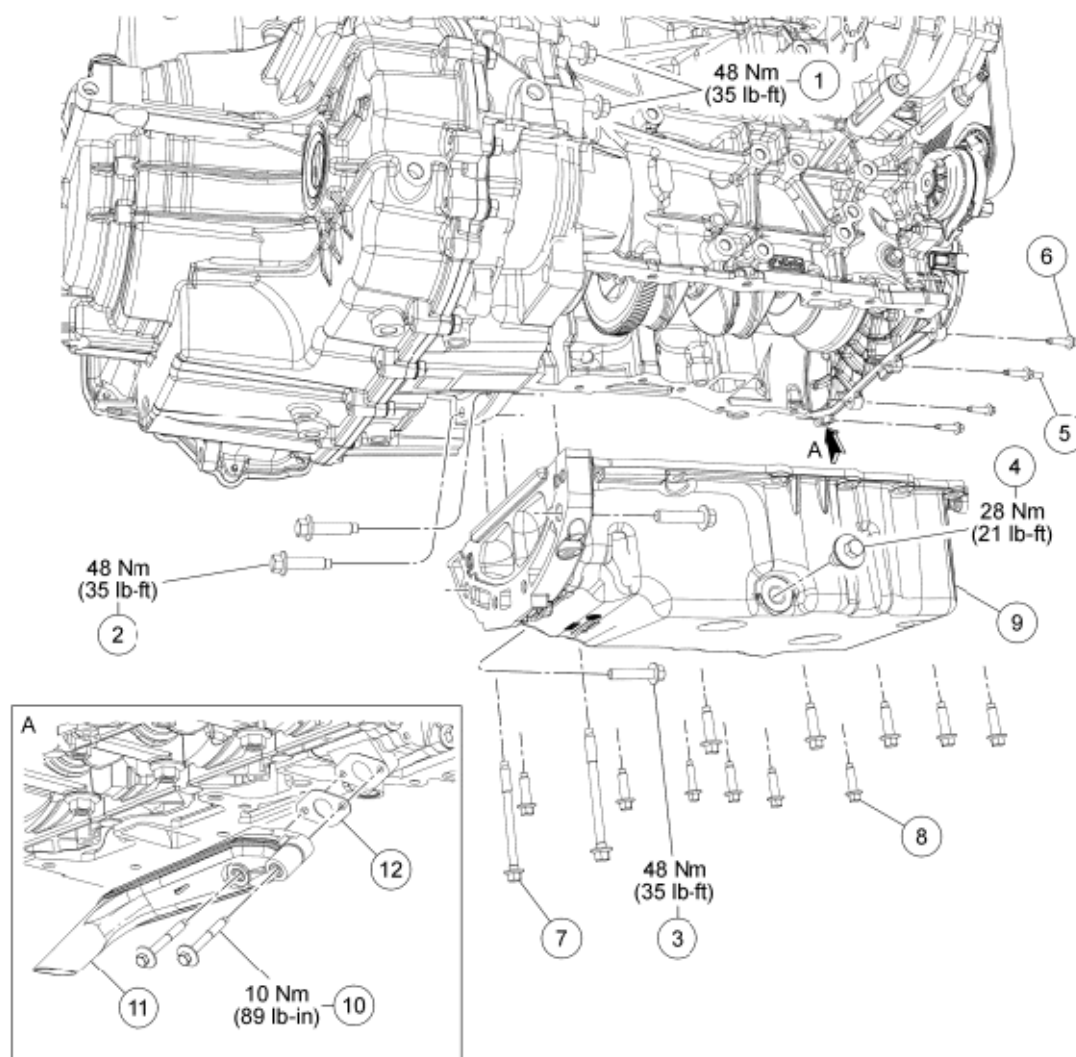


Fig. 170: Identifying Transmission Bolts For Oil Pan Removal With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500121	Upper bellhousing-to-engine bolts
2	W500121	LH bellhousing-to-engine bolt (1 required for automatic transmission, 2 required for manual transmission)

Oil Pan, Oil Pump Screen and Pickup Tube



N0096702

Fig. 171: Identifying Oil Pan, Oil Pump Screen & Pickup Tube Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500121	RH engine-to-bellhousing bolts
2	W500235	Bellhousing-to-oil pan bolt (2 required)
3	W500121	Oil pan-to-bellhousing bolt (2 required)
4	6730	Oil pan drain plug
5	940604	Engine front cover-to-oil pan stud bolt
6	W500215	Engine front cover-to-oil pan bolt (3 required)
7	W706284	Oil pan bolt (2 required)
8	W500224	Oil pan bolt (11 required)
9	6675	Oil pan

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10	W706282	Oil pump screen and pickup tube bolt (2 required)
11	6622	Oil pump screen and pickup tube
12	6625	Oil pump screen and pickup tube gasket

Oil Pump

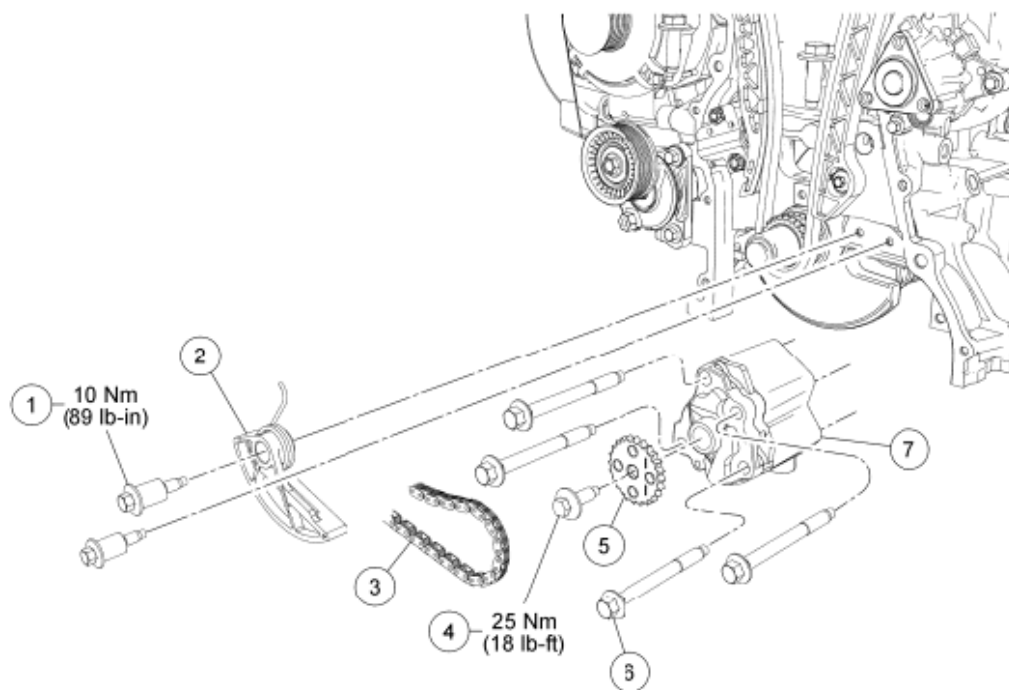


Fig. 172: Identifying Oil Pump Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W703651	Oil pump drive chain tensioner shoulder bolt
2	6C271	Oil pump drive chain tensioner
3	6A895	Oil pump drive chain
4	W704397	Oil pump sprocket bolt
5	6652	Oil pump sprocket
6	W703647	Oil pump bolt (4 required)
7	6600	Oil pump

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

OIL FILTER ADAPTER

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. If equipped, remove the 7 screws and the underbody cover.

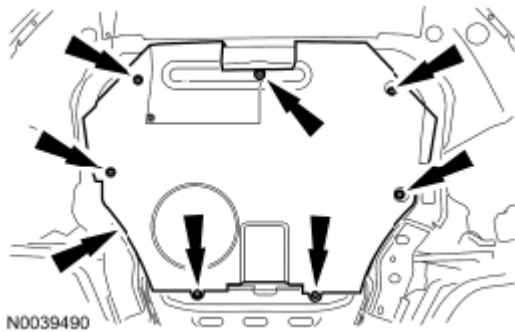


Fig. 173: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

3. Remove the oil filter.
 - To install, lubricate the oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.
4. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
5. Remove the 4 bolts and the oil filter adapter.
 - To install, tighten to 25 Nm (18 lb-ft).

NOTE: Discard the gasket.

6. To install, reverse the removal procedure.

ENGINE OIL PRESSURE (EOP) SWITCH**Material****MATERIAL SPECIFICATIONS TABLE**

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

Removal and Installation

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. If equipped, remove the 7 screws and the underbody cover.

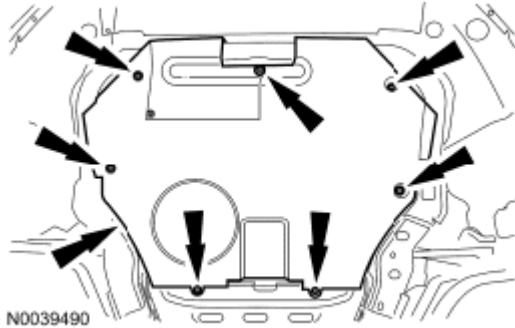


Fig. 174: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

Vehicles equipped with manual transaxle

3. Remove the 2 bolts and position the clutch slave cylinder aside.
 - To install, tighten to 22 Nm (16 lb-ft).

All vehicles

4. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.
5. Remove the **EOP** switch.
 - To install, tighten to 15 Nm (133 lb-in).
6. To install, reverse the removal procedure.
 - Apply thread sealant to the **EOP** switch threads.

OIL PAN

Material

MATERIAL SPECIFICATIONS TABLE

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

Removal**All vehicles**

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the Air Cleaner (ACL). For additional information, refer to **REMOVAL AND INSTALLATION** .

Automatic transmission

3. Remove the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .

All vehicles

4. Loosen the 3 upper transaxle-to-engine bolts 5 mm (0.19 in).

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

5. If equipped, remove the 7 screws and the underbody cover.

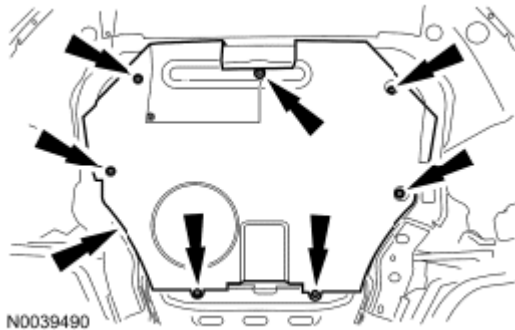


Fig. 175: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

6. Loosen the 1 (automatic transmission) or 2 (manual transmission) LH bellhousing-to-engine bolt(s) 5 mm (0.19 in).
7. Loosen the RH engine-to-bellhousing bolt and stud bolt 5 mm (0.19 in).
8. Remove the 2 oil pan-to-bellhousing bolts.
9. Remove the bellhousing-to-oil pan bolt.
10. Slide the transmission rearward 5 mm (0.19 in).
11. Drain the engine oil.

- Install the drain plug.
 - To install, tighten to 28 Nm (21 lb-ft).
12. Remove the 3 engine front cover-to-oil pan bolts and the stud bolt.
 13. Remove the 13 bolts and the oil pan.

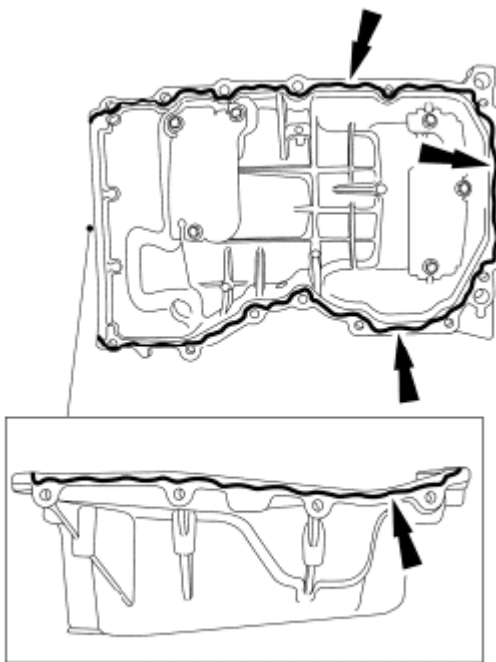
Installation**All vehicles**

1. Clean and inspect all mating surfaces.

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

2. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan-to-engine block and to the oil pan-to-engine front cover mating surface.

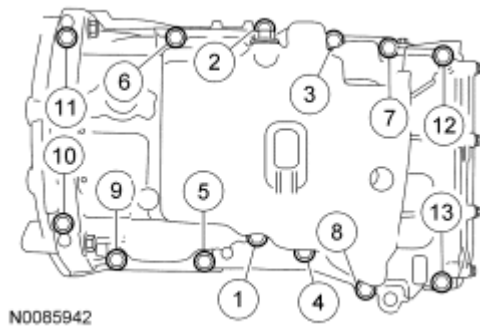
NOTE: If the oil pan is not secured within 10 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 10 minutes, whichever is longer. Failure to follow these instructions can cause future oil leakage.



N0059485

Fig. 176: Locating Bead Of Silicone Gasket & Sealant On Oil Pan-To-Engine Block & Oil Pan-To-Engine Front Cover Mating Surface
 Courtesy of FORD MOTOR CO.

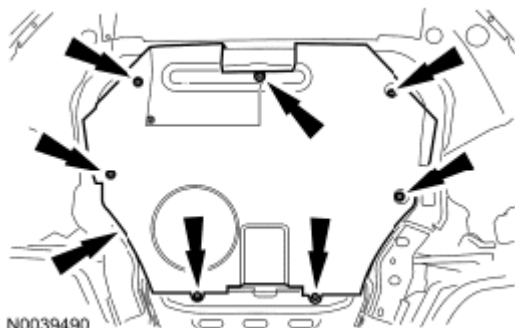
3. Position the oil pan onto the engine and install the oil pan bolts finger-tight.
4. Install the 3 engine front cover-to-oil pan bolts and the stud bolt.
 - Tighten to 10 Nm (89 lb-in).
5. Tighten the oil pan bolts in the sequence shown.
 - Tighten to 25 Nm (18 lb-ft).



N0085942

Fig. 177: Identifying Oil Pan Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

6. Alternate tightening the 1 LH and 1 RH lower bolts to slide the transmission and engine together.
 - Tighten to 48 Nm (35 lb-ft).
7. Tighten the remaining LH bolt (manual transmission) and RH stud bolt.
 - Tighten to 48 Nm (35 lb-ft).
8. Install the bellhousing-to-oil pan bolt.
 - Tighten to 48 Nm (35 lb-ft).
9. Install the 2 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).
10. If equipped, install the underbody cover and the 7 screws.



N0039490

Fig. 178: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

11. Tighten the 3 top bellhousing-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).

Automatic transmission

12. Install the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .

All vehicles

13. Install the ACL assembly. For additional information, refer to **REMOVAL AND INSTALLATION** .
14. Fill the engine with clean engine oil.

OIL PUMP SCREEN AND PICKUP TUBE

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Remove the oil pan. For additional information, refer to **ENGINE LUBRICATION COMPONENTS - EXPLODED VIEW** and **Removal**.
3. Remove the 2 bolts and the oil pump screen and pickup tube.
 - To install, tighten to 10 Nm (89 lb-in).

NOTE: Discard the gasket and clean and inspect the gasket mating surfaces.

4. To install, reverse the removal procedure.

OIL PUMP

Material

MATERIAL SPECIFICATIONS TABLE

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

Removal

1. With the engine in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the engine front cover. For additional information, refer to **Removal**.
3. Drain the engine oil, then install the drain plug.
 - To install, tighten to 28 Nm (21 lb-ft).
4. Remove the 3 oil pan-to-bellhousing bolts.
5. Remove the 13 bolts and the oil pan.
6. Remove the 2 bolts and the oil pump screen and pickup tube.
 - To install, tighten to 10 Nm (89 lb-in).

NOTE: Discard the gasket and clean and inspect the gasket mating surfaces.

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

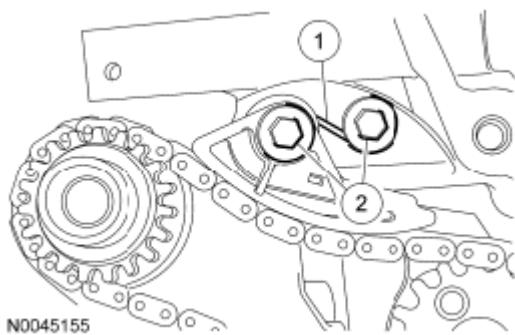


Fig. 179: Identifying Tensioner Spring & Shoulder Bolts
Courtesy of FORD MOTOR CO.

8. Remove the chain from the oil pump sprocket.
9. Remove the bolt and oil pump sprocket.
10. Remove the 4 bolts and the oil pump.

Installation

1. Install the oil pump assembly. Tighten the 4 bolts in the sequence shown below in 2 stages:
 - Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten to 20 Nm (177 lb-in).

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

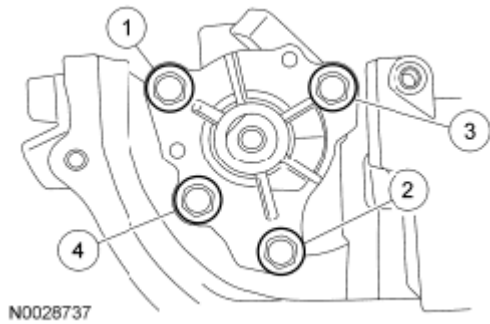


Fig. 180: Identifying Oil Pump Assembly Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

2. Install the oil pump sprocket and bolt.
 - Tighten to 25 Nm (18 lb-ft).
3. Install the chain onto the oil pump sprocket.
4. Install the oil pump drive chain tensioner shoulder bolt.
 - Tighten to 10 Nm (89 lb-in).

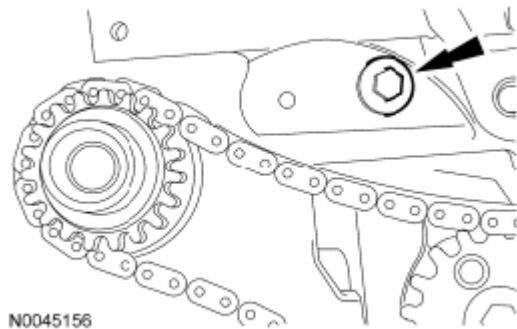


Fig. 181: Locating Oil Pump Chain Drive Tensioner Shoulder Bolt
Courtesy of FORD MOTOR CO.

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

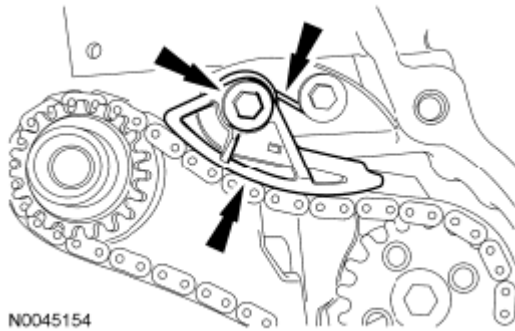


Fig. 182: Locating Oil Pump Drive Chain Tensioner, Bolt & Tensioner Spring
Courtesy of FORD MOTOR CO.

6. Install the oil pump screen and pickup tube and the 2 bolts.

- Tighten to 10 Nm (89 lb-in).

7. Clean all mating surfaces with metal surface prep.

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

8. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan.

NOTE: If the oil pan is not secured within 10 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Allow to dry until there is no sign of wetness, or 10 minutes, whichever is longer. Failure to follow these instructions can cause future oil leakage.

- Position the oil pan onto the engine and install the 2 rear oil pan bolts finger-tight.

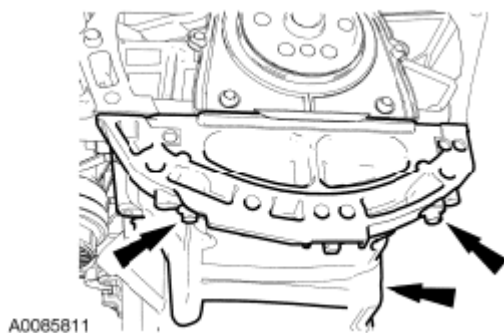
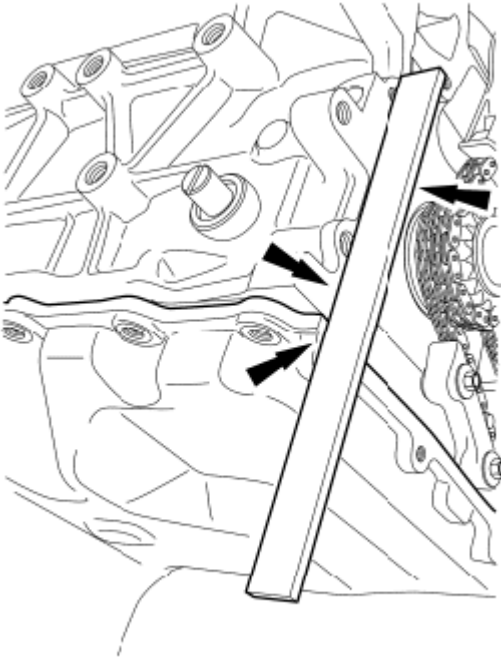


Fig. 183: Locating Rear Oil Pan Bolts
Courtesy of FORD MOTOR CO.

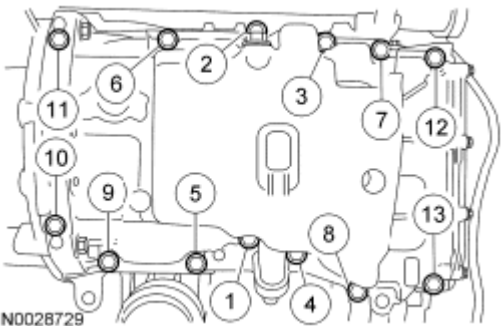
9. Using a suitable straight edge, align the front surface of the oil pan flush with the front surface of the engine block.



N0039349

Fig. 184: Aligning Front Surface Of Oil Pan Flush With Front Surface Of Engine Block
Courtesy of FORD MOTOR CO.

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



N0028729

Fig. 185: Identifying Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

11. Install the 3 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).
12. Install the engine front cover. For additional information, refer to **Installation**.

13. Fill the engine with clean engine oil.

EXHAUST MANIFOLD

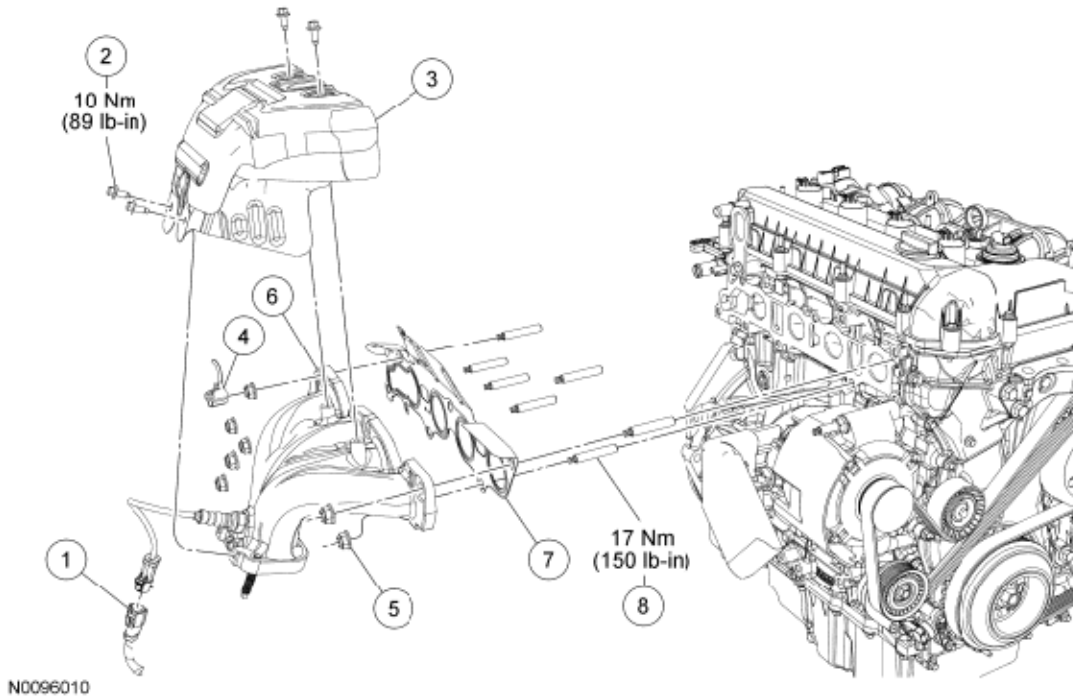


Fig. 186: Identifying Exhaust Manifold Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	14A464	Heated Oxygen Sensor (HO2S) electrical connector (part of 12C508)
2	W713299	Exhaust manifold heat shield bolt (4 required)
3	9N454	Exhaust manifold heat shield
4	-	Block heater wire harness retainer (if equipped)
5	W713652	Exhaust manifold nut (7 required)
6	9430	Exhaust manifold
7	9448	Exhaust manifold gasket
8	W704474	Cylinder head stud (7 required)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the exhaust flexible pipe. For additional information, refer to **REMOVAL**.
3. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector.

4. Remove the 4 exhaust manifold heat shield bolts and the heat shield.
5. If equipped, detach the block heater wire harness retainer from the exhaust manifold stud.
6. Remove and discard the 7 exhaust manifold nuts.
7. Remove the exhaust manifold and discard the exhaust manifold gasket.
8. Remove and discard the 7 cylinder head studs.
9. Clean and inspect the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.

Installation

1. Install the 7 new cylinder head studs.
 - Tighten to 17 Nm (150 lb-in).
2. Install a new exhaust manifold gasket, the exhaust manifold and 7 new nuts in the sequence shown below in 2 stages:
 - Stage 1: Tighten to 48 Nm (35 lb-ft).
 - Stage 2: Tighten to 48 Nm (35 lb-ft).

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

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

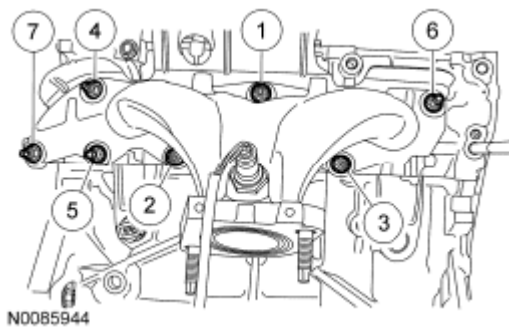


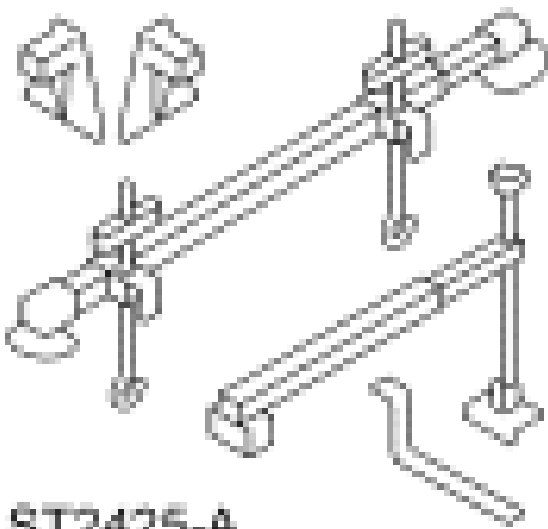
Fig. 187: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

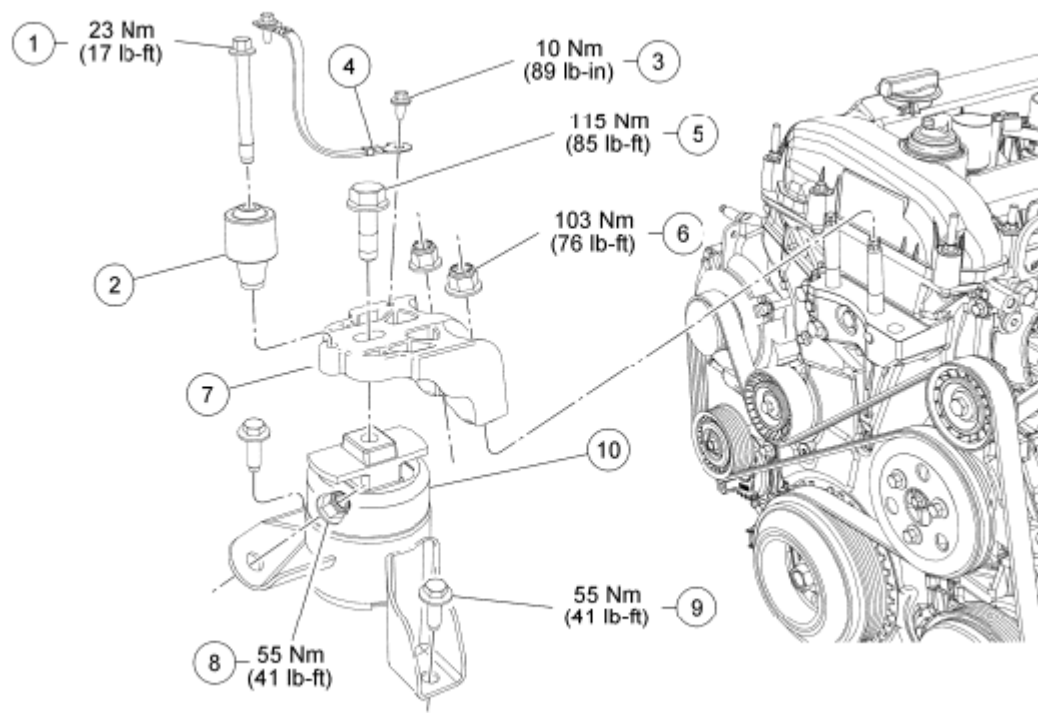
3. If equipped, attach the block heater wire harness retainer to the exhaust manifold stud.
4. Install the exhaust manifold heat shield and the 4 bolts.
 - Tighten to 10 Nm (89 lb-in).
5. Connect the HO2S electrical connector.
6. Install the exhaust flexible pipe. For additional information, refer to **INSTALLATION**.

ENGINE MOUNT

Special Tool(s)

SPECIAL TOOLS TABLE

 ST2425-A	Engine Support Bar 303-F072
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N0101494

Fig. 188: Identifying Engine Mount Components With Torque Specifications
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W711879	Engine mount damper bolt
2	7458	Engine mount damper
3	W705936	Ground wire bolt
4	19A095	Ground wire
5	W711684	Engine mount bracket bolt
6	W520214	Engine mount bracket nut (2 required)
7	6A094	Engine mount bracket
8	W711578	Engine mount nut
9	W706496	Engine mount bolt (2 required)
10	6F012	Engine mount

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING**.
2. Remove the engine coolant degas bottle. For additional information, refer to **REMOVAL AND INSTALLATION**.
3. Install the Engine Support Bar to the front and rear engine lifting eyes.

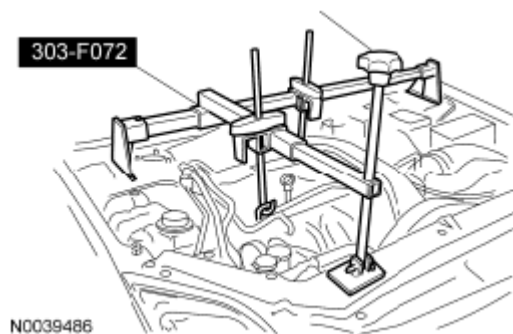


Fig. 189: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

4. Remove the bolt and the engine mount damper.
 - To install, tighten to 23 Nm (17 lb-ft).
5. Remove the bolt and the ground wire.
 - To install, tighten to 10 Nm (89 lb-in).
6. Remove the engine mount bracket bolt.
 - To install, tighten to 115 Nm (85 lb-ft).

7. Use the Engine Support Bar to raise the engine 25 mm (0.98 in).

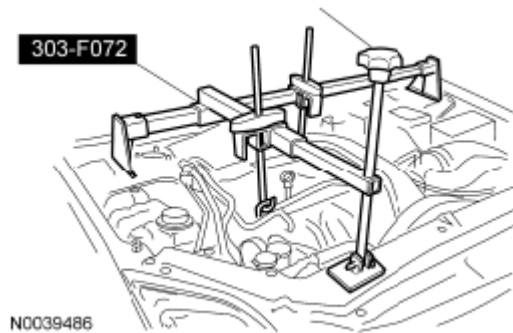


Fig. 190: Identifying Engine Support Bar
Courtesy of FORD MOTOR CO.

8. Remove the 2 engine mount bracket nuts.
- To install, tighten to 103 Nm (76 lb-ft).
9. Remove the nut, 2 bolts and the engine mount.
- To install, tighten to 55 Nm (41 lb-ft).
10. Use the Engine Support Bar to lower the engine 25 mm (0.98 in).
- Remove the engine mount bracket.

NOTE: If the engine mount bracket is to be removed, the engine must be lowered to avoid contact between the A/C tubes and the engine mount bracket.

11. To install, reverse the removal procedure.

ENGINE - AUTOMATIC TRANSAXLE

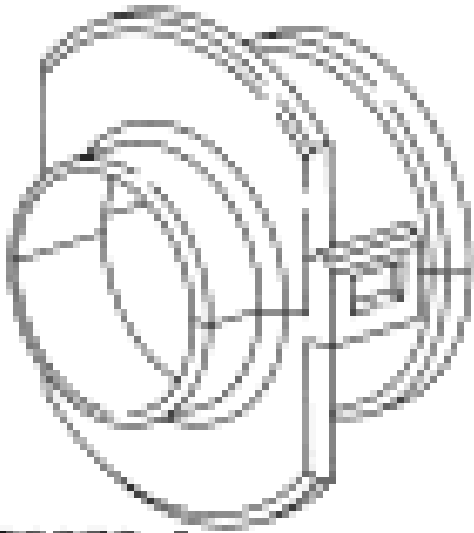
Special Tool(s)

SPECIAL TOOLS TABLE

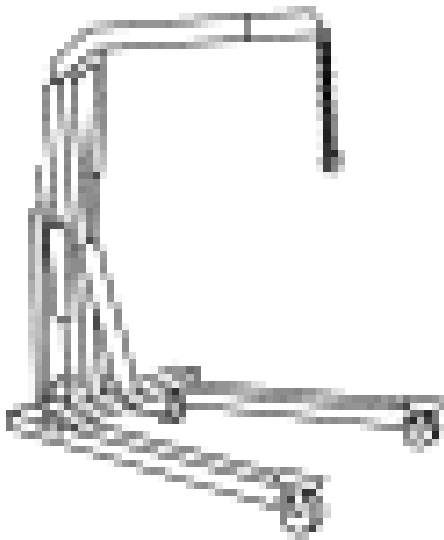
	Disconnect Tool, Transmission Cooler Line 307-569
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2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST2B70-A



ST1341-A

Heavy Duty Floor Crane 014-00071 or equivalent

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



Powertrain Lift 014-00765 or equivalent



Remover, Tie-Rod End 211-105

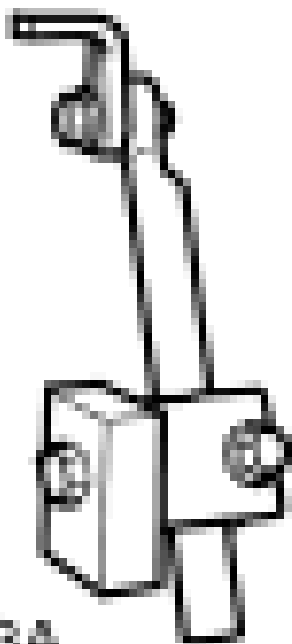
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1602-A

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



ST2743A

Universal Adapter Brackets 014-0001 or equivalent

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

instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
3. Remove the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
4. Recover the A/C system. For additional information, refer to **REFRIGERANT SYSTEM RECOVERY** .
5. Remove the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
6. Remove the 2 nuts and the battery cables from the positive battery cable.

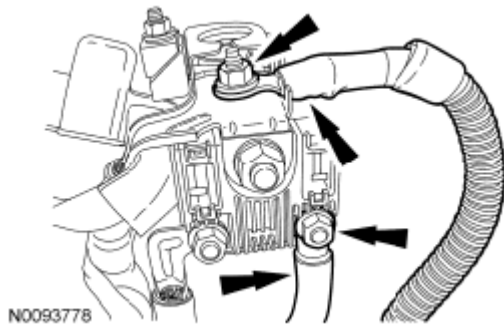


Fig. 191: Locating Nuts & Battery Cables
Courtesy of FORD MOTOR CO.

7. Disconnect the engine wiring harness electrical connector.

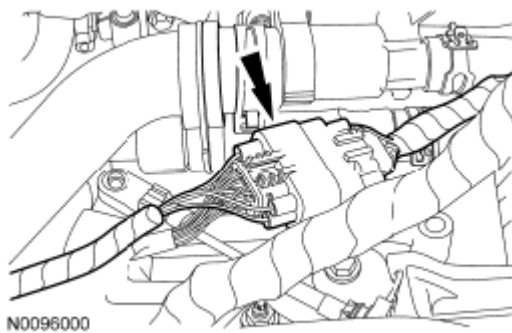


Fig. 192: Locating Engine Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

8. Remove the bolt and the ground wire from the body.

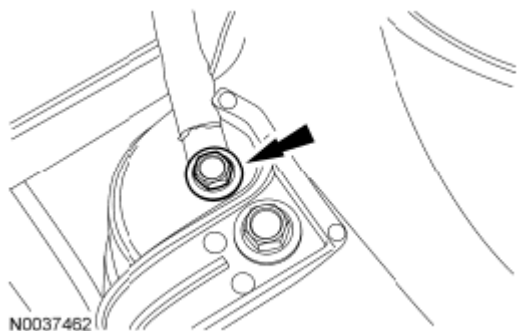


Fig. 193: Locating Ground Wire Bolt
Courtesy of FORD MOTOR CO.

9. Detach the 2 negative battery cable pin-type retainers from the transaxle mount and battery tray bracket.

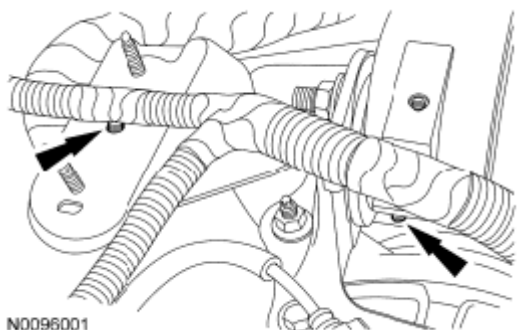


Fig. 194: Locating Negative Battery Cable Pin-Type Retainers
Courtesy of FORD MOTOR CO.

10. Disconnect the 2 engine harness electrical connectors.

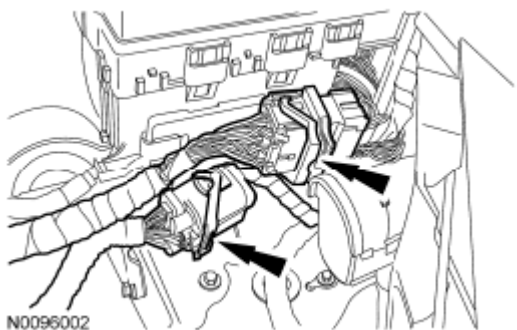


Fig. 195: Locating Engine Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

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

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

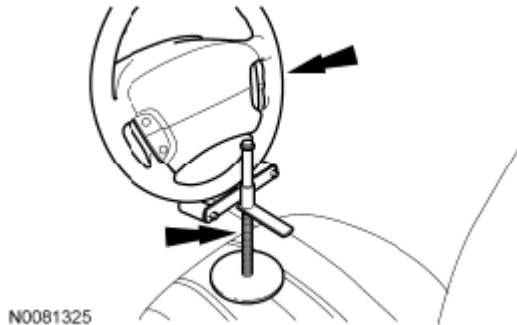


Fig. 196: Holding Steering Wheel In Straight-Ahead Position
Courtesy of FORD MOTOR CO.

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

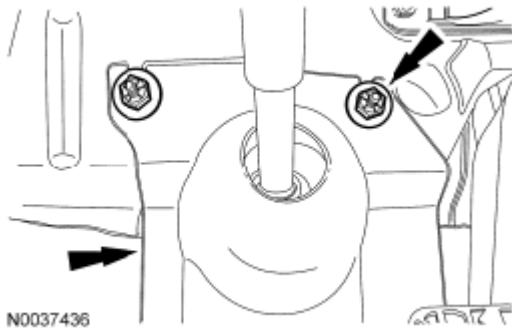


Fig. 197: Locating Steering Joint Cover Nuts
Courtesy of FORD MOTOR CO.

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

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



Fig. 198: Locating Steering Column Shaft Bolt
Courtesy of FORD MOTOR CO.

14. If equipped, remove the 7 screws and the underbody cover.

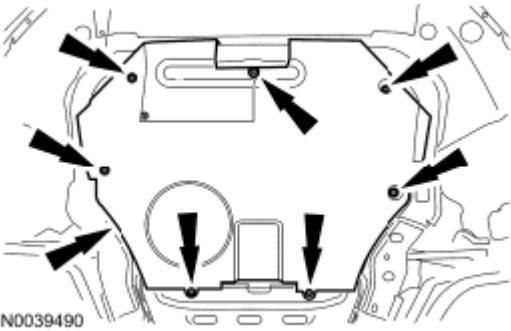


Fig. 199: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

15. Drain the transaxle. For additional information, refer to **TRANSMISSION FLUID DRAIN AND REFILL** .
16. Drain the cooling system. For additional information, refer to **DRAINING** .
17. Release the 4 clips (2 shown) and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

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

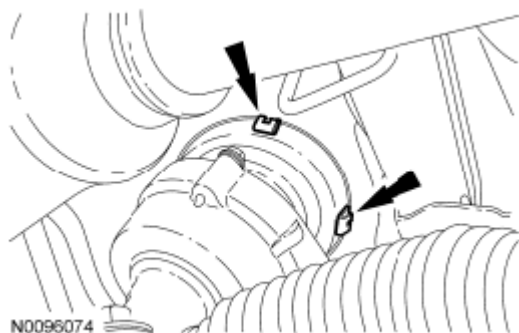


Fig. 200: Locating Steering Gear-To-Dash Seal Clips
Courtesy of FORD MOTOR CO.

18. Remove the engine roll restrictor bolt.

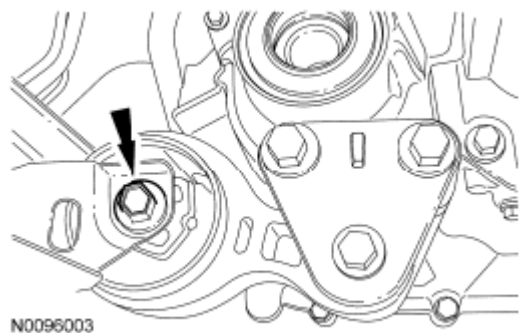


Fig. 201: Locating Engine Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

19. Remove the 4 screws and position the RH fender splash shield aside.

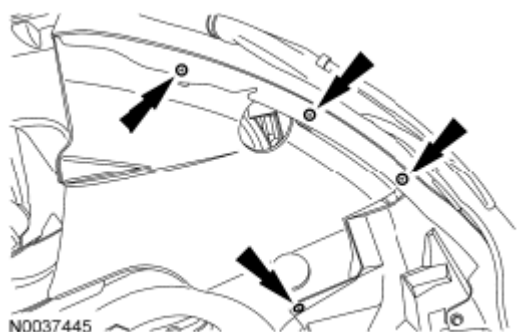


Fig. 202: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

20. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

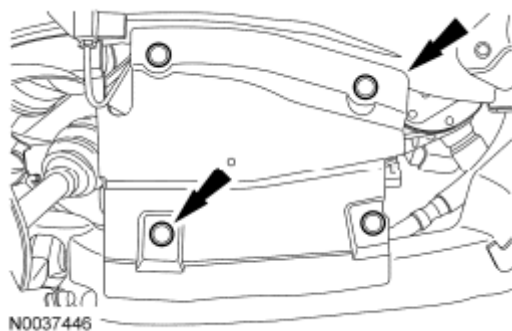


Fig. 203: Locating Pin-Type Retainers
Courtesy of FORD MOTOR CO.

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

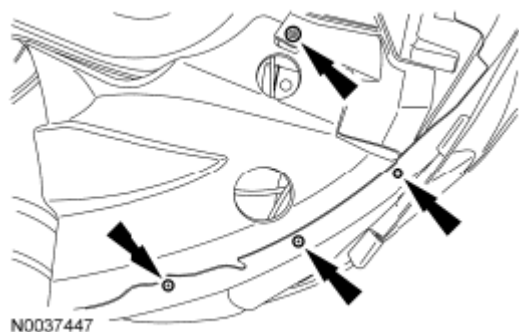


Fig. 204: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

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

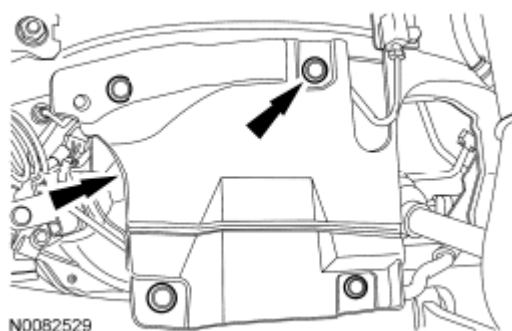


Fig. 205: Locating Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

23. Remove the LH halfshaft and the intermediate shaft. For additional information, refer to **REMOVAL** .
24. Disconnect the 2 Electronic Power Assist Steering (EPAS) system electrical connectors.

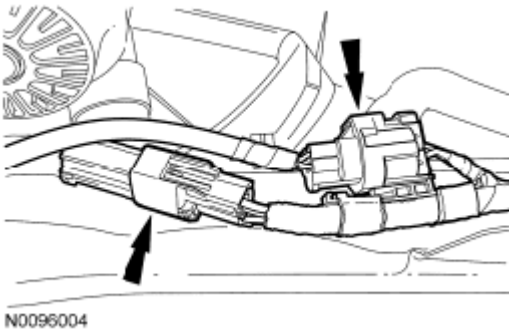


Fig. 206: Locating Electronic Power Assist Steering System Electrical Connectors
Courtesy of FORD MOTOR CO.

25. Detach the 2 EPAS system wiring harness pin-type retainers from the subframe.

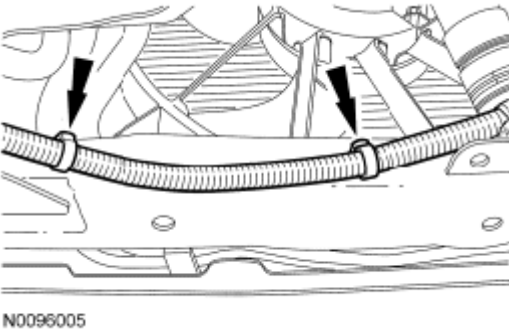


Fig. 207: Locating EPAS System Wiring Harness Pin-Type Retainers
Courtesy of FORD MOTOR CO.

26. Detach the EPAS system wiring harness pin-type retainer from the subframe under the LH fender splash shield.

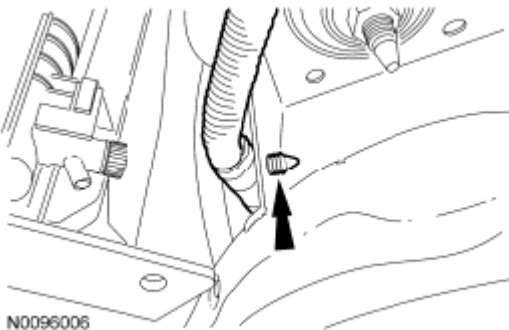


Fig. 208: Locating EPAS System Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

27. Remove the bolt and the EPAS system wiring harness ground.

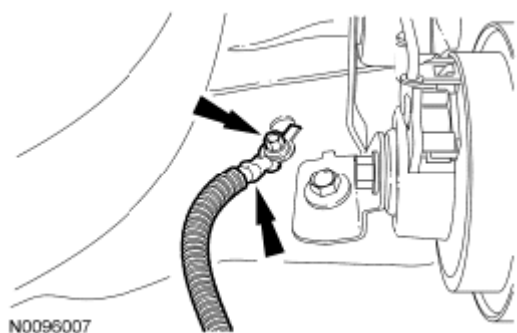


Fig. 209: Locating Bolt & EPAS System Wiring Harness Ground
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

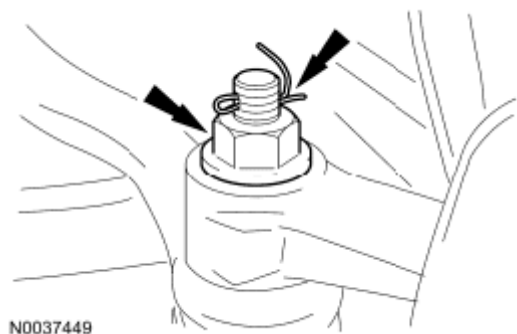


Fig. 210: Locating Tie-Rod Ends Cotter Pins & Nuts
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

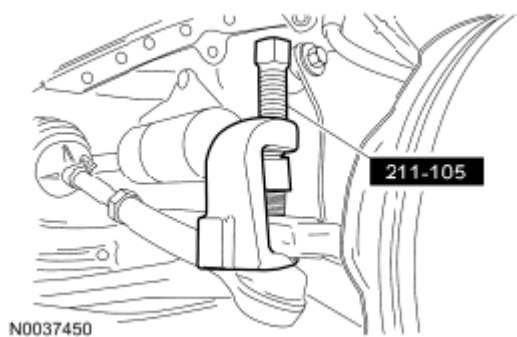


Fig. 211: Identifying Tie-Rod End Remover
Courtesy of FORD MOTOR CO.

30. Remove the nuts and separate the sway bar links from the struts.

NOTE: LH shown, RH similar.

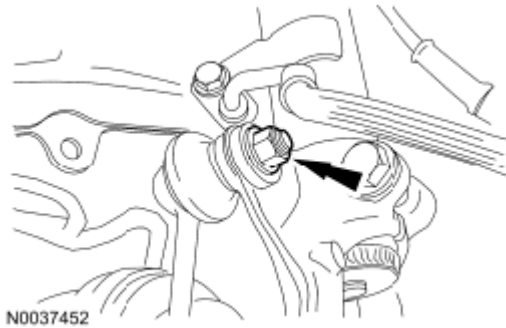


Fig. 212: Locating Sway Bar Links Nuts
Courtesy of FORD MOTOR CO.

31. Position the Powertrain Lift under the subframe assembly.

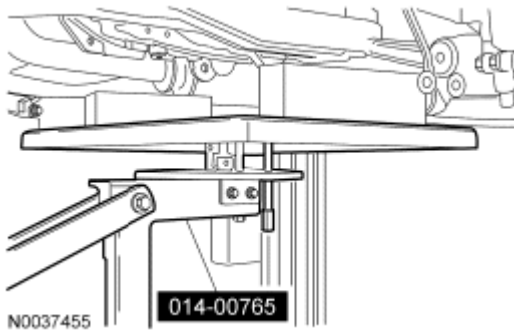


Fig. 213: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

32. Remove the subframe bracket-to-body bolts.

NOTE: LH shown, RH similar.

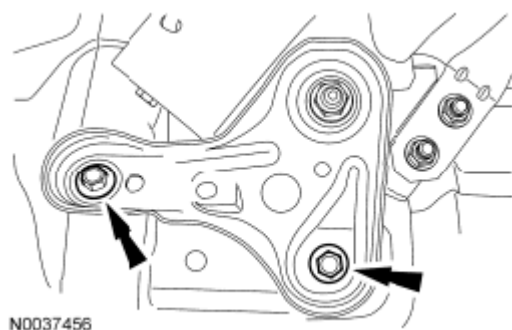


Fig. 214: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

33. Remove the subframe nuts and the subframe brackets.

NOTE: LH shown, RH similar.

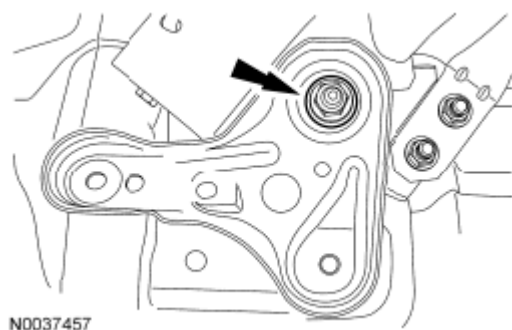


Fig. 215: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

34. Remove the front subframe nuts.

NOTE: LH shown, RH similar.

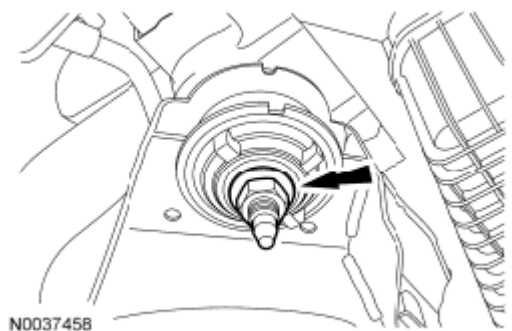


Fig. 216: Locating Front Subframe Nuts

Courtesy of FORD MOTOR CO.

35. Lower the subframe assembly from the vehicle.
36. Remove the engine oil pan drain plug and drain the engine oil.
 - Install the drain plug and tighten to 28 Nm (21 lb-ft).

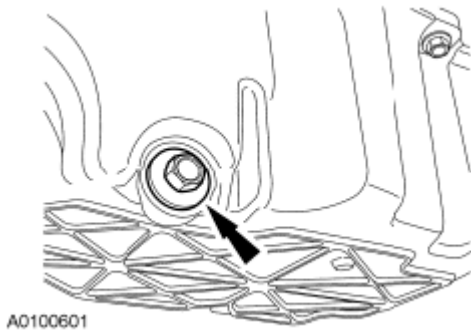


Fig. 217: Locating Engine Oil Pan Drain Plug
Courtesy of FORD MOTOR CO.

37. Remove the engine oil filter.
38. Remove the exhaust flexible pipe. For additional information, refer to **REMOVAL** .
39. Disconnect the crankcase vent tube from the valve cover.

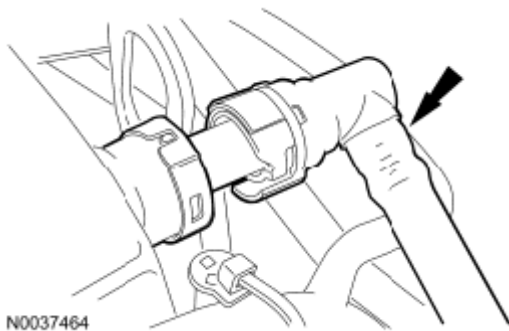


Fig. 218: Locating Crankcase Vent Tube
Courtesy of FORD MOTOR CO.

40. Depress the locking ring and disconnect the brake booster vacuum supply tube from the intake manifold.

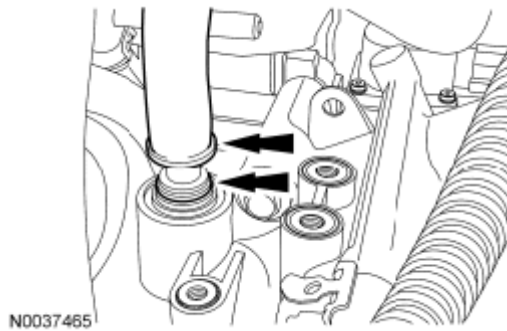


Fig. 219: Locating Locking Ring & Brake Booster Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

41. Disconnect the fuel vapor return tube.

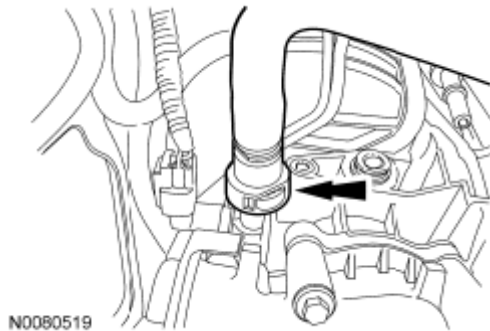


Fig. 220: Locating Fuel Vapor Return Tube
Courtesy of FORD MOTOR CO.

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

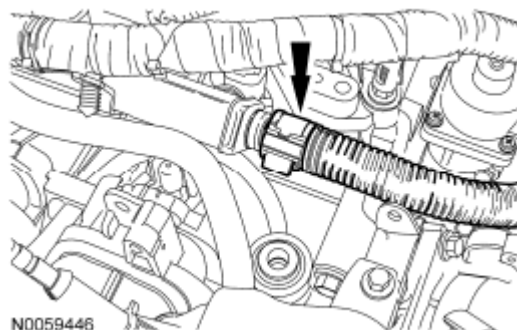


Fig. 221: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

43. Detach the coolant hose retainer.

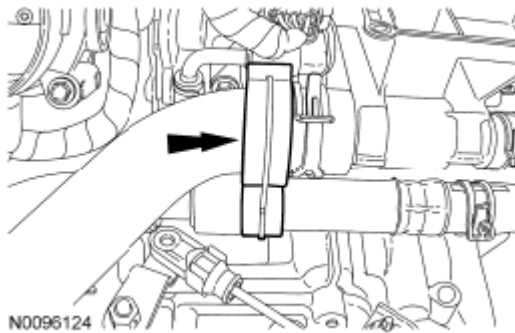


Fig. 222: Locating Coolant Hose Retainer
Courtesy of FORD MOTOR CO.

44. Disconnect the upper radiator and heater hoses from the coolant outlet and disconnect the heater hose in-line connector.

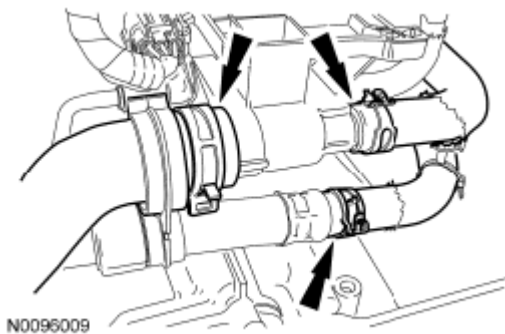


Fig. 223: Locating Heater Hoses & Heater Hose In-Line Connector
Courtesy of FORD MOTOR CO.

45. Disconnect the shift cable from the transaxle manual lever and remove the transaxle shift cable from the bracket.

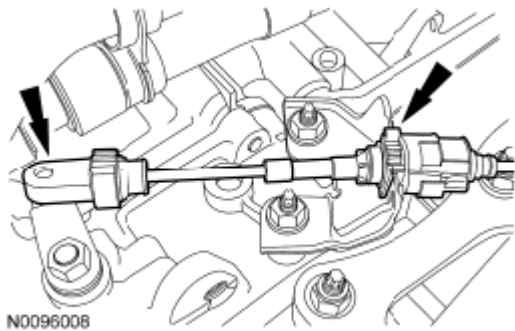


Fig. 224: Locating Transaxle Shift Cable
Courtesy of FORD MOTOR CO.

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

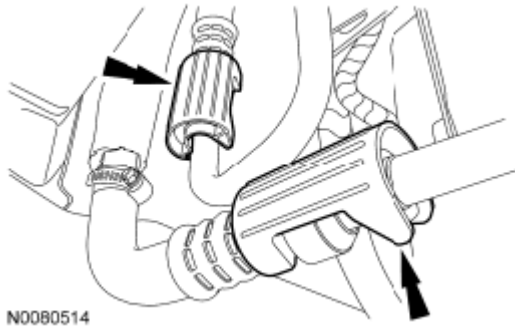


Fig. 225: Locating Secondary Latches
Courtesy of FORD MOTOR CO.

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

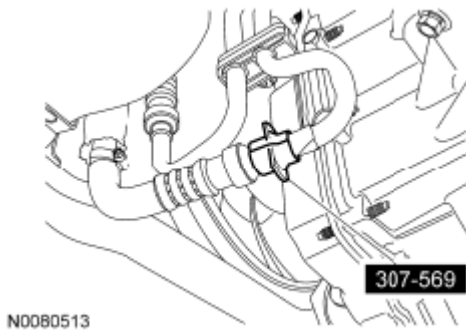


Fig. 226: Identifying Transmission Cooler Line Disconnect Tool
Courtesy of FORD MOTOR CO.

48. Remove the bolt and the ground wire from the engine mount.

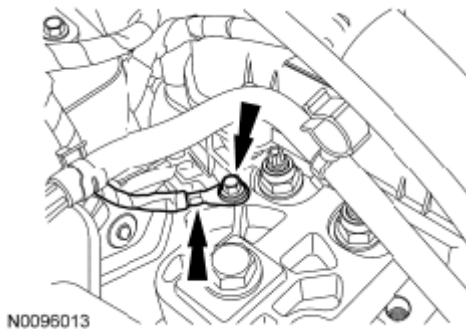


Fig. 227: Locating Bolt & Ground Wire
Courtesy of FORD MOTOR CO.

49. Remove the A/C tube/windshield washer reservoir bracket bolt.

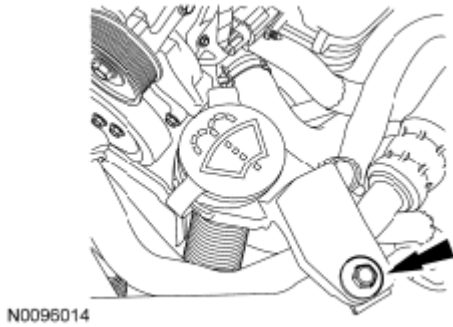


Fig. 228: Locating A/C Tube/Windshield Washer Reservoir Bracket Bolt
Courtesy of FORD MOTOR CO.

50. Remove the nut and disconnect the A/C tube.
- Discard the O-ring seal.

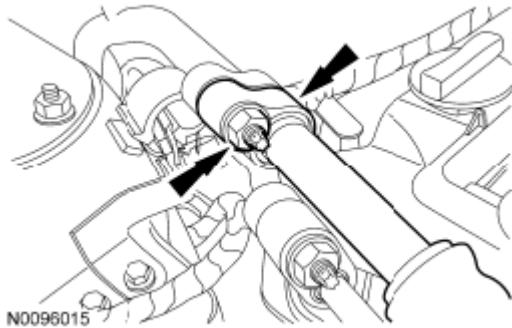


Fig. 229: Locating Nut & A/C Tube
Courtesy of FORD MOTOR CO.

51. Detach the coolant vent hose retaining clip from the A/C tube.

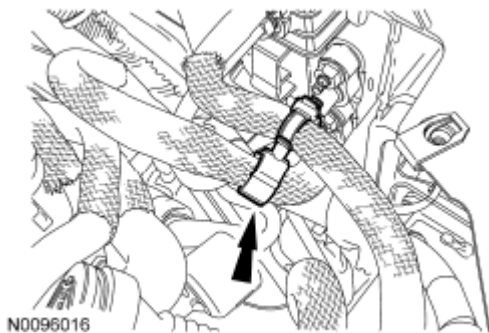


Fig. 230: Locating Coolant Vent Hose Retaining Clip
Courtesy of FORD MOTOR CO.

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

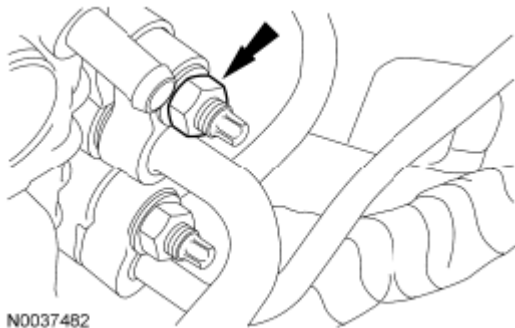


Fig. 231: Locating O-Ring Seal
Courtesy of FORD MOTOR CO.

53. Detach the Knock Sensor (KS) electrical connector from the intake manifold.

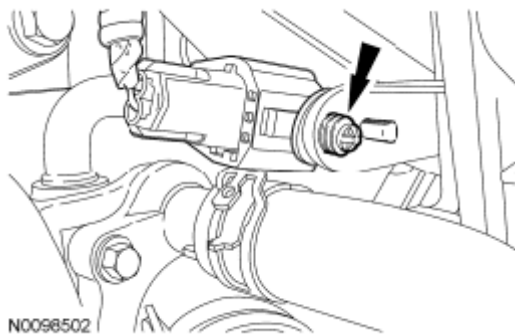


Fig. 232: Locating Knock Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

54. Remove the lower radiator hose from the thermostat housing.

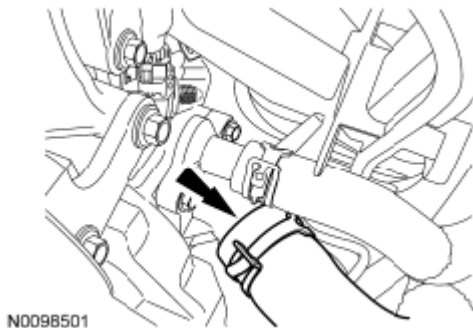


Fig. 233: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

55. If equipped, position the block heater shield aside and disconnect the block heater electrical connector.
- Detach the 8 block heater wiring harness retainers (1 shown) and remove the block heater wiring harness.

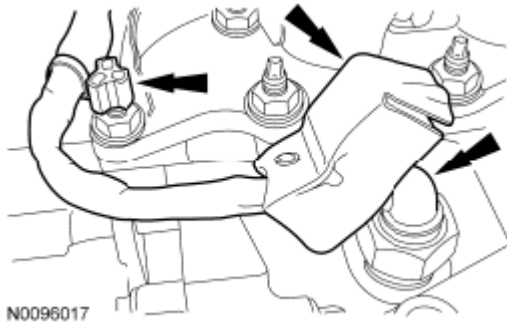


Fig. 234: Locating Block Heater Wiring Harness Retainers & Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

56. Detach the lower radiator hose pin-type retainer from the cooling fan shroud.

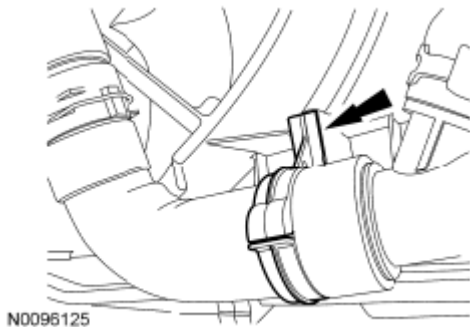


Fig. 235: Locating Lower Radiator Hose Pin-Type Retainer
Courtesy of FORD MOTOR CO.

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

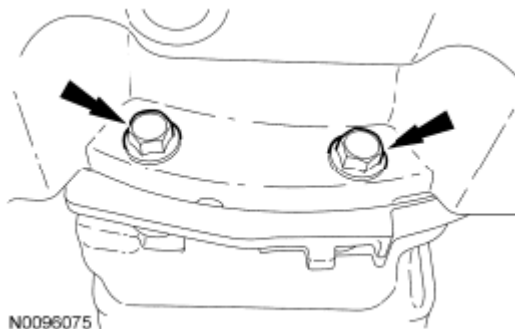


Fig. 236: Locating Bellhousing-To-Oil Pan Bolts

Courtesy of FORD MOTOR CO.

58. Remove the 2 oil pan-to-bellhousing bolts.

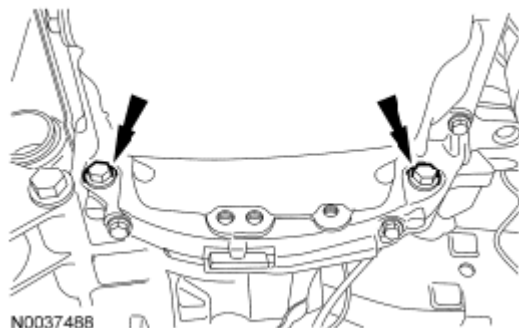


Fig. 237: Locating Oil Pan-To-Bellhousing Bolts
Courtesy of FORD MOTOR CO.

59. Install the Powertrain Lift and Universal Adapter Brackets onto the engine.
 - Raise the engine and transaxle 25.4 mm (1 in) to neutralize the engine and transaxle mounts.

NOTE: Position a block of wood under the transaxle.

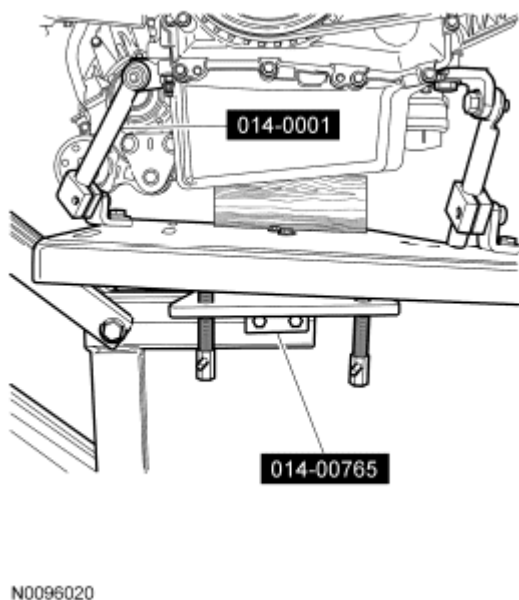


Fig. 238: Raising Engine & Transaxle
Courtesy of FORD MOTOR CO.

60. Remove the nut and the transaxle mount through bolt.

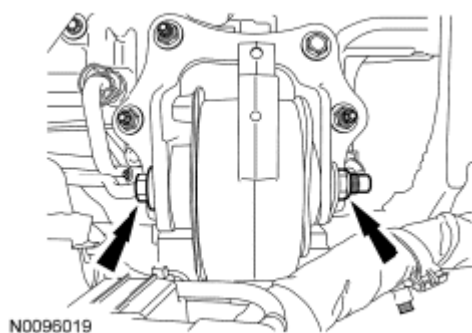


Fig. 239: Locating Nut & Transaxle Mount Through Bolt
Courtesy of FORD MOTOR CO.

61. Remove the bolt, 2 nuts and the engine mount bracket.

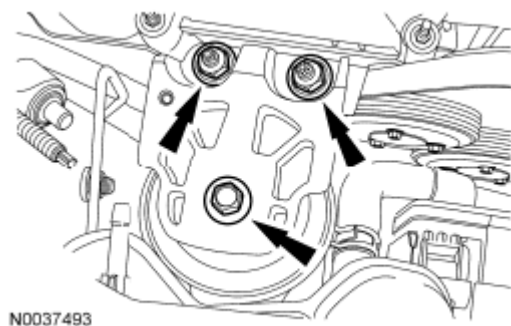


Fig. 240: Locating Bolt, Nuts & Engine Mount Bracket
Courtesy of FORD MOTOR CO.

62. Lower the engine and transaxle from the vehicle.
63. Disconnect the A/C compressor electrical connector.

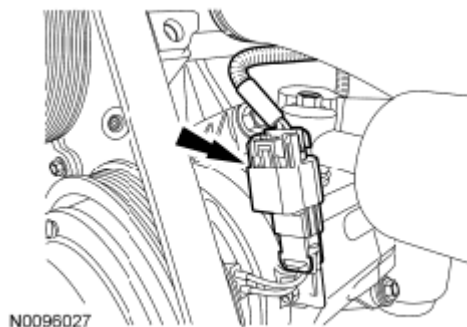


Fig. 241: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

64. Detach the A/C compressor wiring harness pin-type retainer from the intake manifold.

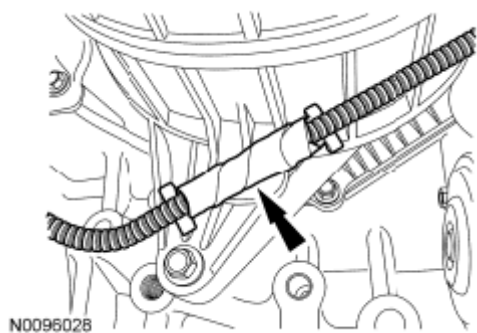


Fig. 242: Locating A/C Compressor Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

65. Remove the 2 nuts and disconnect the starter motor wires.

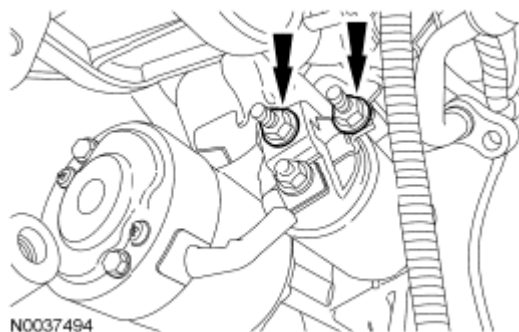


Fig. 243: Locating Nuts & Starter Motor Wires
Courtesy of FORD MOTOR CO.

66. Remove the nut and the ground wire from the starter motor stud bolt.

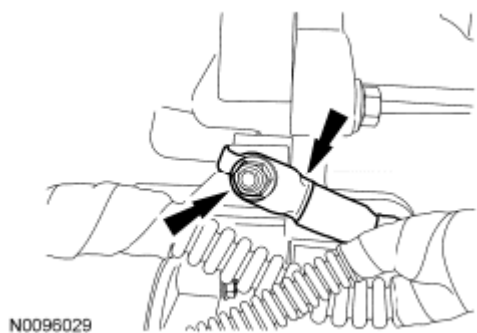


Fig. 244: Locating Nut & Ground Wire
Courtesy of FORD MOTOR CO.

67. Remove the bolt, stud bolt and the starter motor.

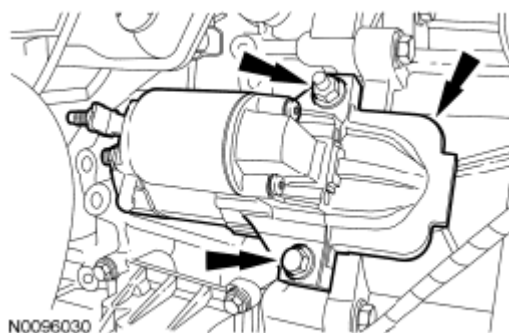


Fig. 245: Locating Bolt, Stud Bolt & Starter Motor
Courtesy of FORD MOTOR CO.

68. Remove the starter motor isolator.

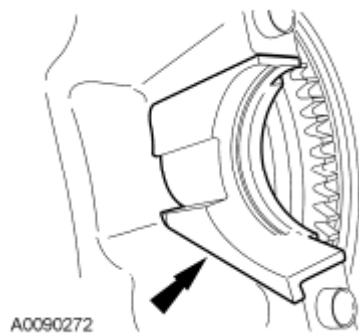


Fig. 246: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

69. Press the locking tab to release the generator air duct and remove.

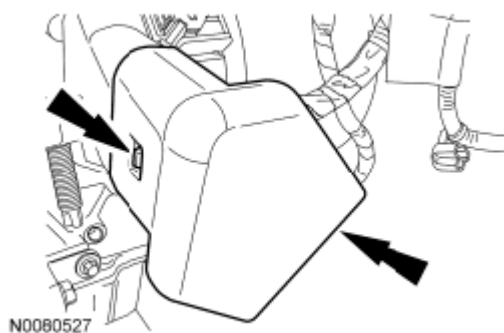


Fig. 247: Locating Locking Tab & Generator Air Duct
Courtesy of FORD MOTOR CO.

70. Disconnect the generator electrical connection.

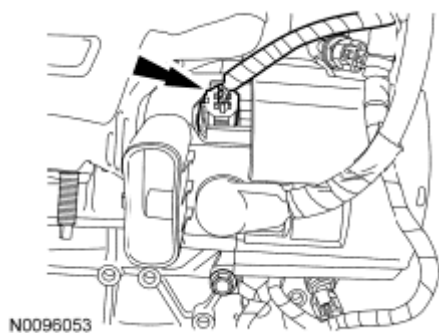


Fig. 248: Locating Generator Electrical Connection
Courtesy of FORD MOTOR CO.

71. Remove the nut and the generator B+ wiring harness.



Fig. 249: Locating Nut & Generator B+ Wiring Harness
Courtesy of FORD MOTOR CO.

72. Detach the 4 wiring harness retainers (3 shown) from the valve cover stud bolts.

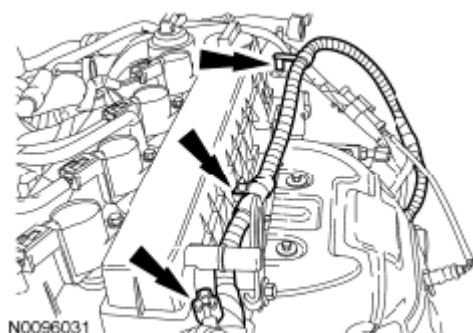


Fig. 250: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

73. Remove the 4 torque converter nuts.

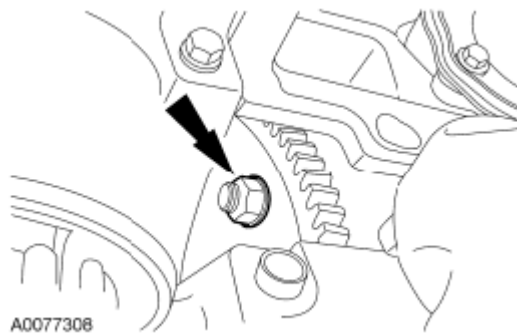


Fig. 251: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

74. Install the Heavy Duty Floor Crane and Spreader Bar and remove the engine and transaxle from the Powertrain Lift table.

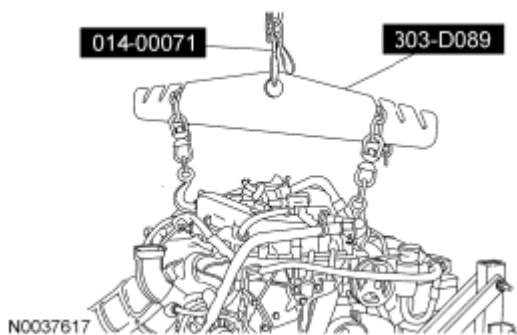


Fig. 252: Identifying Heavy Duty Floor Crane & Spreader Bar
Courtesy of FORD MOTOR CO.

75. Remove the remaining bellhousing-to-engine retainers.
 - Separate the engine and transaxle.

ENGINE - MANUAL TRANSAXLE

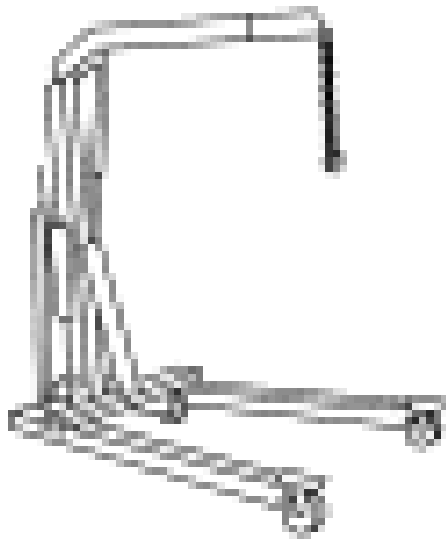
Special Tool(s)

SPECIAL TOOLS TABLE

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2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1341-A

Heavy Duty Floor Crane 014-00071 or equivalent



ST1293-A

Powertrain Lift 014-00765 or equivalent

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



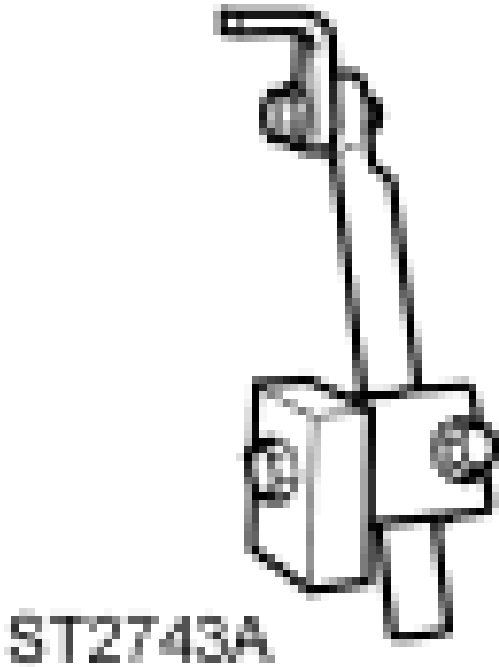
ST1408-A

Remover, Tie-Rod End 211-105



ST1602-A

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



Universal Adapter Brackets 014-0001 or equivalent

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING & LIFTING** .
2. Release the fuel system pressure. For additional information, refer to **FUEL SYSTEM PRESSURE RELEASE** .
3. Remove the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
4. Recover the A/C system. For additional information, refer to **REFRIGERANT SYSTEM RECOVERY** .
5. Remove the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
6. Remove the 2 nuts and the battery cables from the positive battery cable.

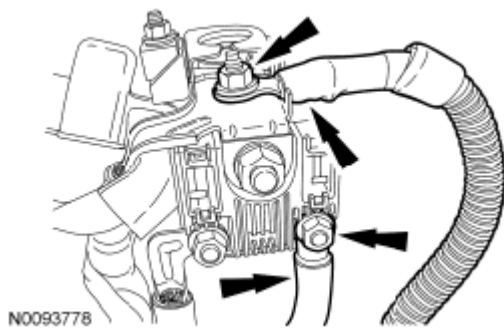


Fig. 253: Locating Nuts & Battery Cables
Courtesy of FORD MOTOR CO.

7. Disconnect the engine wiring harness electrical connector.

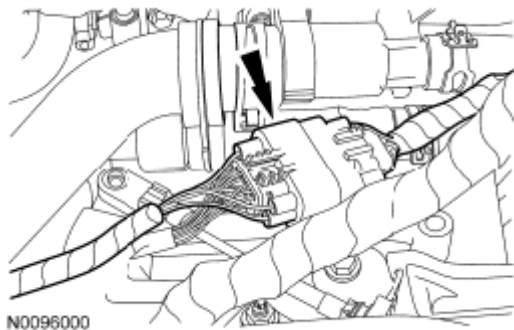


Fig. 254: Locating Engine Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

8. Remove the bolt and the ground wire from the body.

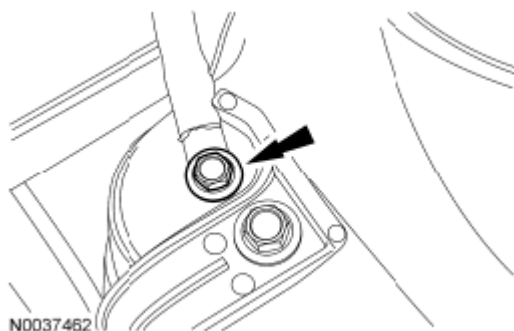


Fig. 255: Locating Bolt & Ground Wire
Courtesy of FORD MOTOR CO.

9. Detach the 2 negative battery cable pin-type retainers from the transaxle mount and battery tray bracket.

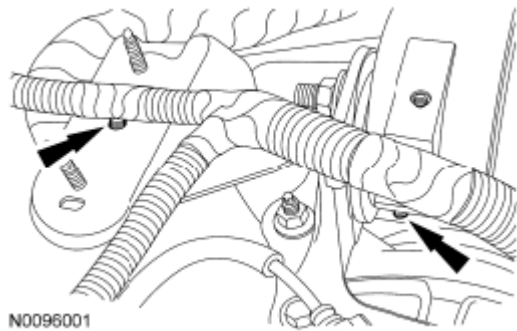


Fig. 256: Locating Negative Battery Cable Pin-Type Retainers
Courtesy of FORD MOTOR CO.

10. Disconnect the 2 engine harness electrical connector.

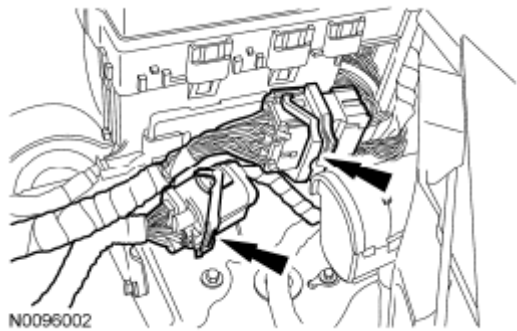


Fig. 257: Locating Engine Harness Electrical Connector
Courtesy of FORD MOTOR CO.

11. Use a steering wheel holding device (such as Hunter® 28-75-1 or equivalent).
 - Using a suitable holding device, hold the steering wheel in the straight-ahead position.

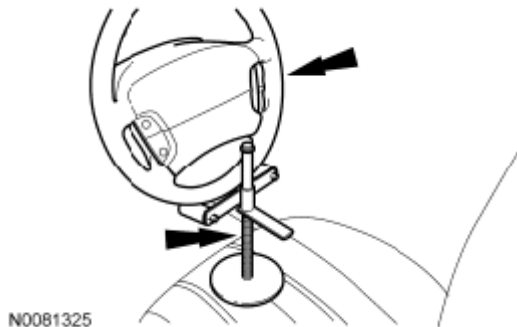


Fig. 258: Holding Steering Wheel In Straight-Ahead Position
Courtesy of FORD MOTOR CO.

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

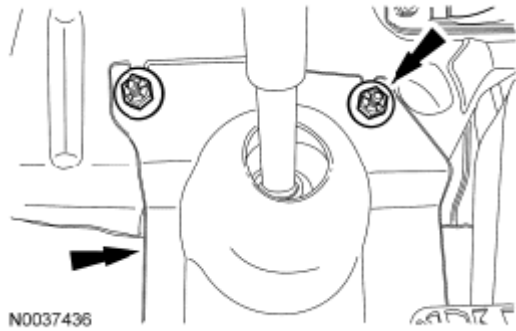


Fig. 259: Locating Nuts & Steering Joint Cover
Courtesy of FORD MOTOR CO.

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

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



Fig. 260: Locating Steering Column Shaft Bolt
Courtesy of FORD MOTOR CO.

14. If equipped, remove the 7 screws and the underbody cover.

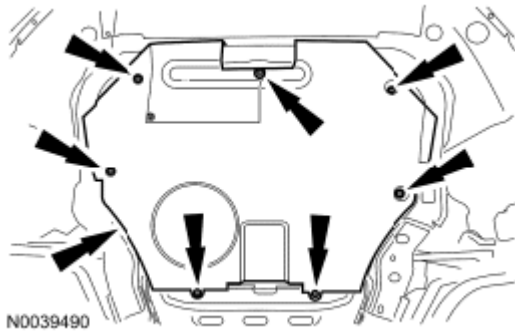


Fig. 261: Locating Underbody Cover & Screws
 Courtesy of FORD MOTOR CO.

15. Drain the cooling system. For additional information, refer to **DRAINING**.
16. Release the 4 clips (2 shown) and slide the steering gear-to-dash seal off of the steering gear and into the passenger compartment.

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

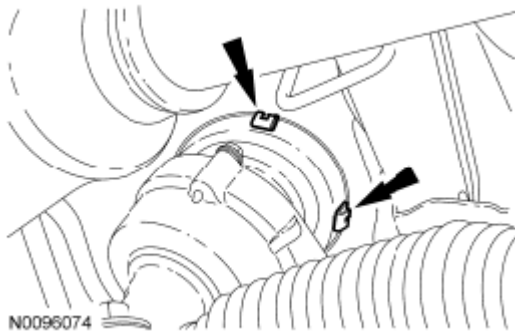


Fig. 262: Locating Steering Gear-To-Dash Seal Clips
 Courtesy of FORD MOTOR CO.

17. Remove the engine roll restrictor bolt.

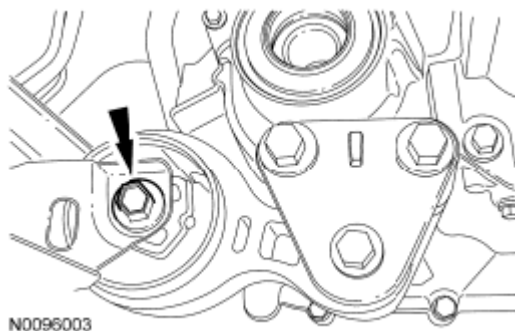


Fig. 263: Locating Engine Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

18. Remove the 4 screws and position the RH fender splash shield aside.

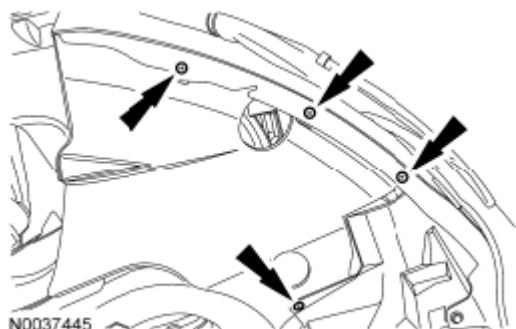


Fig. 264: Locating RH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

19. Remove the 6 pin-type retainers (4 shown) and the RH splash shield.

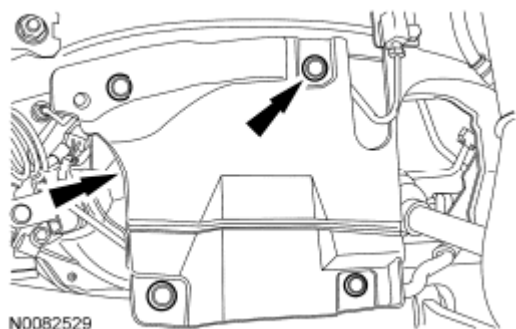


Fig. 265: Locating Pin-Type Retainers & RH Splash Shield
Courtesy of FORD MOTOR CO.

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

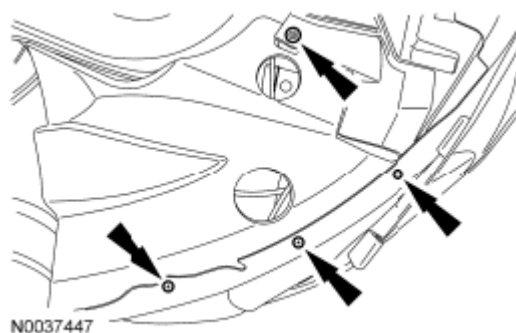


Fig. 266: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

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

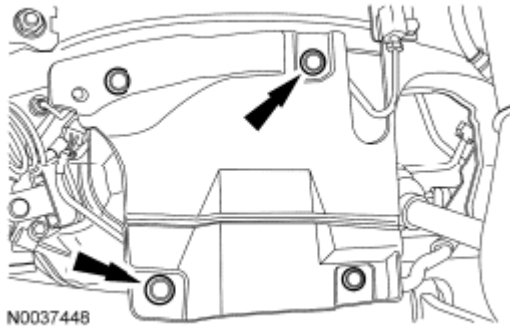


Fig. 267: Locating Pin-Type Retainers & LH Splash Shield
Courtesy of FORD MOTOR CO.

22. Remove the LH halfshaft and the intermediate shaft. For additional information, refer to **REMOVAL**.
23. Disconnect the 2 Electronic Power Assist Steering (EPAS) system electrical connectors.

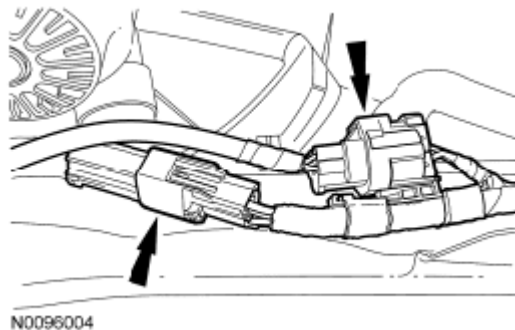


Fig. 268: Locating Electronic Power Assist Steering System Electrical Connectors
Courtesy of FORD MOTOR CO.

24. Detach the 2 EPAS system wiring harness pin-type retainers from the subframe.

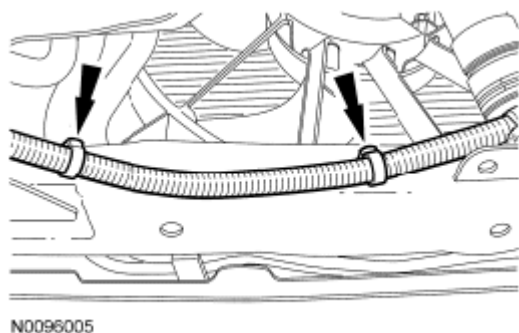


Fig. 269: Locating EPAS System Wiring Harness Pin-Type Retainers
Courtesy of FORD MOTOR CO.

25. Detach the **EPAS** system wiring harness pin-type retainer from the subframe under the LH fender splash shield.

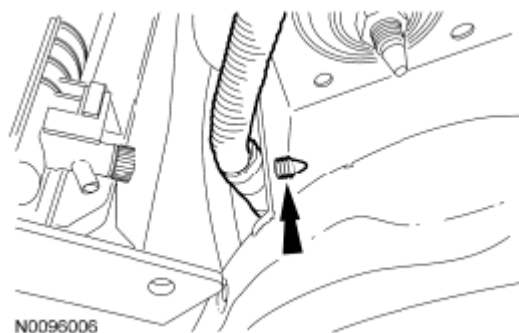


Fig. 270: Locating EPAS System Wiring Harness Pin-Type Retainers
Courtesy of FORD MOTOR CO.

26. Remove the bolt and the **EPAS** system wiring harness ground.

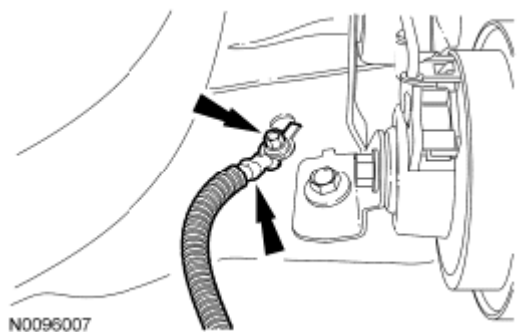


Fig. 271: Locating Bolt & EPAS System Wiring Harness Ground
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

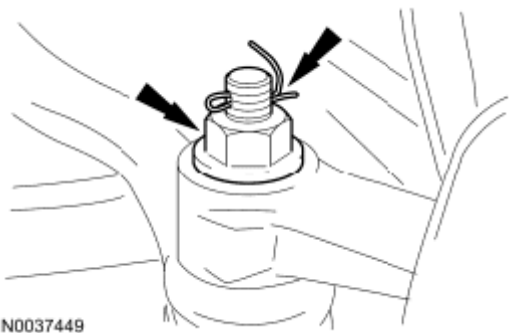


Fig. 272: Locating Tie-Rod Ends Cotter Pins & Nuts
Courtesy of FORD MOTOR CO.

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

NOTE: LH shown, RH similar.

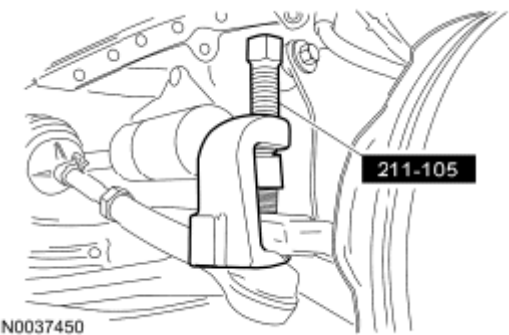


Fig. 273: Identifying Tie-Rod End Remover
Courtesy of FORD MOTOR CO.

29. Remove the nuts and separate the sway bar links from the struts.

NOTE: LH shown, RH similar.

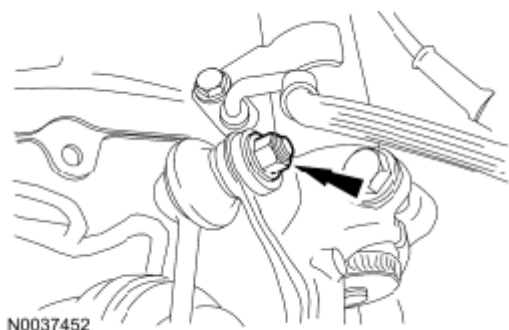


Fig. 274: Locating Sway Bar Links Nuts
Courtesy of FORD MOTOR CO.

30. Position the Powertrain Lift under the subframe assembly.

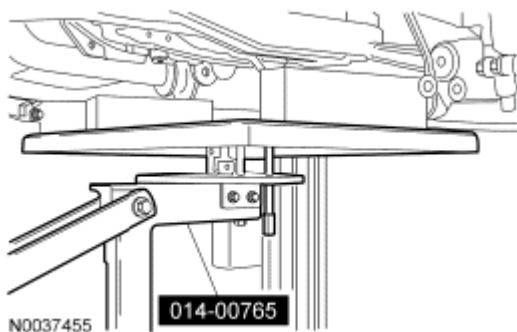


Fig. 275: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

31. Remove the subframe bracket-to-body bolts.

NOTE: LH shown, RH similar.

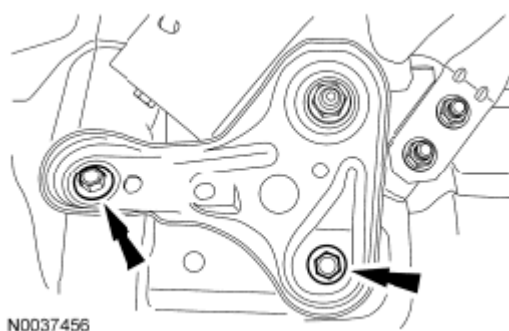


Fig. 276: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

32. Remove the rear subframe nuts and the subframe brackets.

NOTE: LH shown, RH similar.

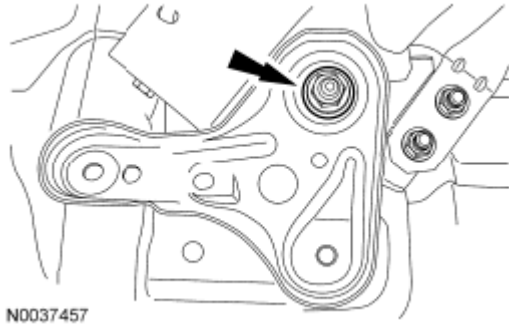


Fig. 277: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

33. Remove the front subframe nuts.

NOTE: LH shown, RH similar.

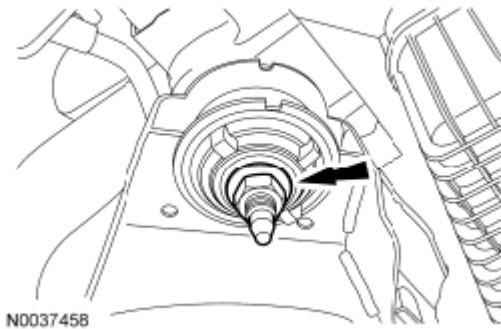


Fig. 278: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

34. Lower the subframe assembly from the vehicle.
35. Remove the engine oil pan drain plug and drain the engine oil.
- Install the drain plug and tighten to 28 Nm (21 lb-ft).

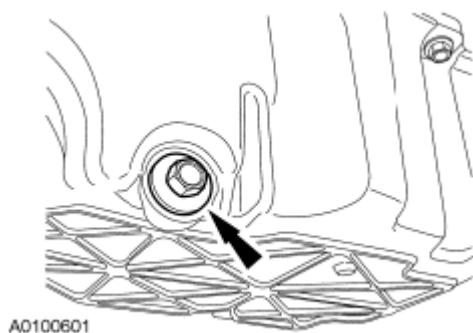


Fig. 279: Locating Engine Oil Pan Drain Plug
Courtesy of FORD MOTOR CO.

36. Remove the engine oil filter.
37. Remove the exhaust flexible pipe. For additional information, refer to **REMOVAL**.
38. Disconnect the crankcase vent tube from the valve cover.

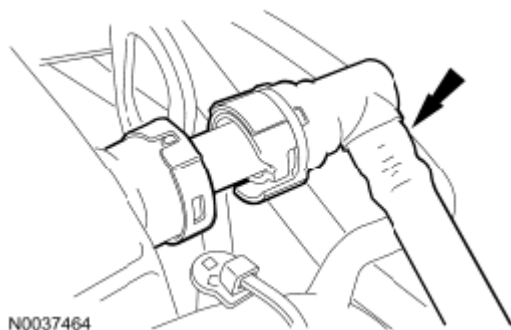


Fig. 280: Locating Crankcase Vent Tube
Courtesy of FORD MOTOR CO.

39. Depress the locking ring and disconnect the brake booster vacuum supply tube from the intake manifold.

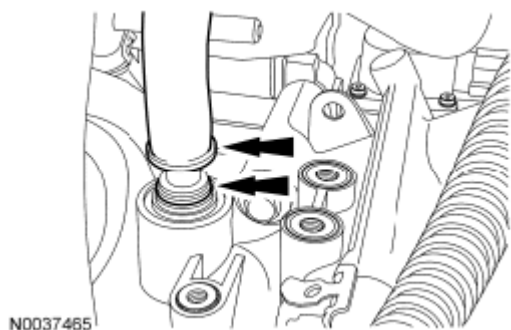


Fig. 281: Locating Locking Ring & Brake Booster Vacuum Supply Tube
Courtesy of FORD MOTOR CO.

40. Disconnect the fuel vapor return tube.

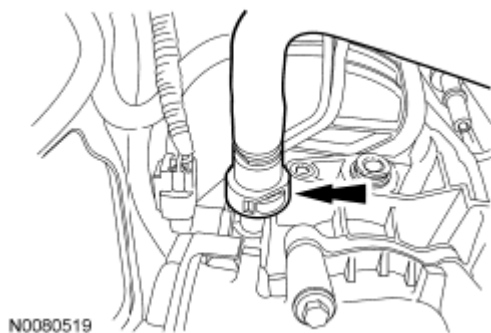


Fig. 282: Locating Fuel Vapor Return Tube
Courtesy of FORD MOTOR CO.

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

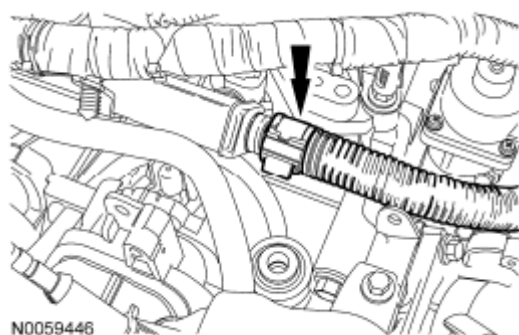


Fig. 283: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

42. Detach the coolant hose retainer.

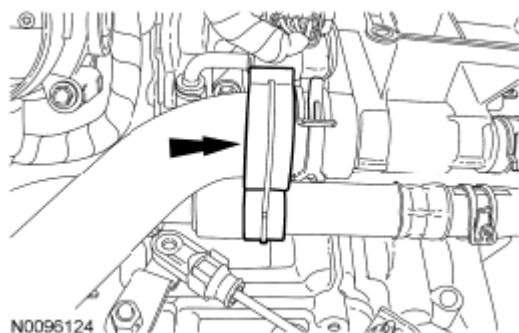


Fig. 284: Locating Coolant Hose Retainer
Courtesy of FORD MOTOR CO.

43. Disconnect the upper radiator and heater hoses from the coolant outlet and disconnect the heater hose in-line connector.

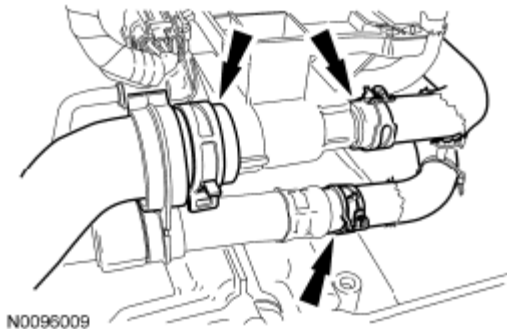


Fig. 285: Locating Heater Hoses & Heater Hose In-Line Connector
Courtesy of FORD MOTOR CO.

44. Disconnect the transaxle control cables from the control levers.
- Detach the control cables from the bracket.

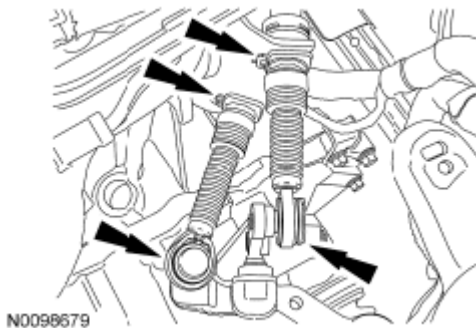


Fig. 286: Locating Transaxle Control Cables
Courtesy of FORD MOTOR CO.

45. Remove the 2 clutch tube bracket bolts.

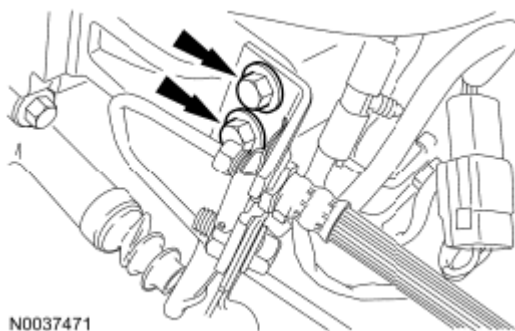


Fig. 287: Locating Clutch Tube Bracket Bolts

Courtesy of FORD MOTOR CO.

46. Remove the 2 bolts and position the clutch slave cylinder aside.

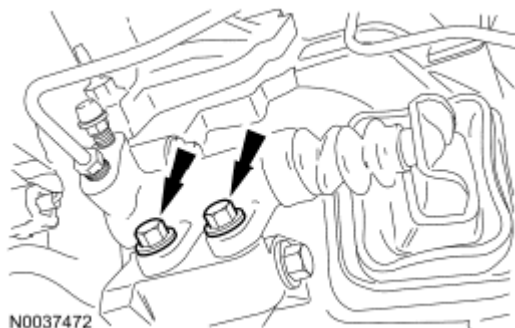


Fig. 288: Locating Clutch Slave Cylinder Bolts
Courtesy of FORD MOTOR CO.

47. Remove the bolt and the ground wire from the engine mount.

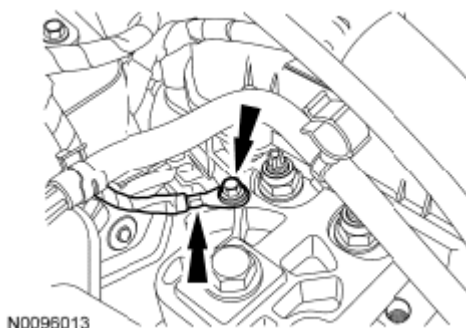


Fig. 289: Locating Bolt & Ground Wire
Courtesy of FORD MOTOR CO.

48. Remove the A/C tube/windshield washer reservoir bracket bolt.

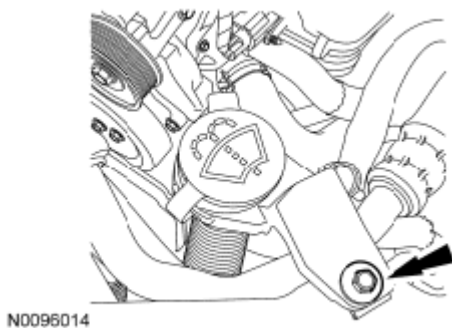


Fig. 290: Locating A/C Tube/Windshield Washer Reservoir Bracket Bolt

Courtesy of FORD MOTOR CO.

49. Remove the nut and disconnect the A/C tube.
- Discard the O-ring seal.

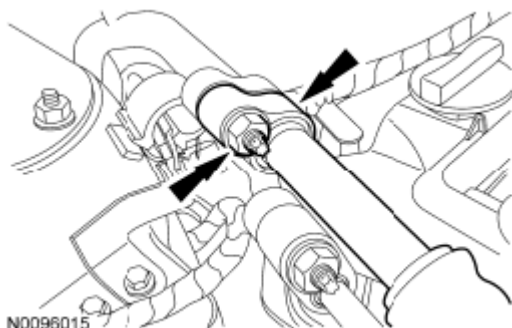


Fig. 291: Locating Nut & A/C Tube
Courtesy of FORD MOTOR CO.

50. Detach the coolant vent hose retaining clip from the A/C tube.

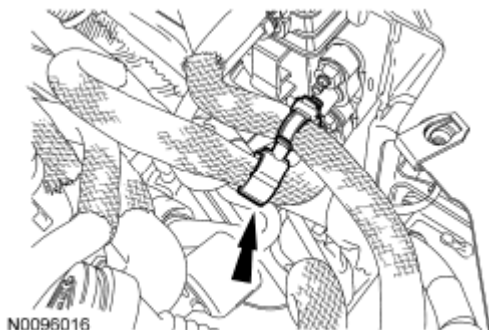


Fig. 292: Locating Coolant Vent Hose Retaining Clip
Courtesy of FORD MOTOR CO.

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

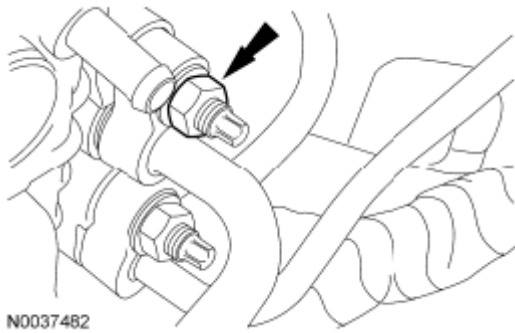


Fig. 293: Locating Upper A/C Tube Nut
Courtesy of FORD MOTOR CO.

52. Detach the Knock Sensor (KS) electrical connector from the intake manifold.

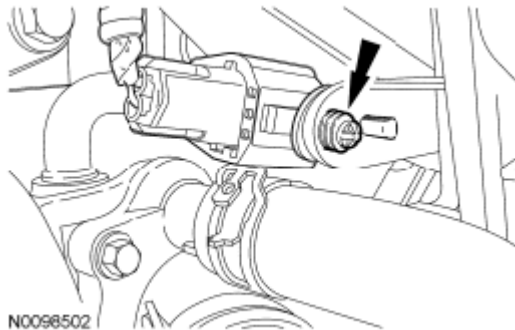


Fig. 294: Locating Knock Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

53. Remove the lower radiator hose from the thermostat housing.

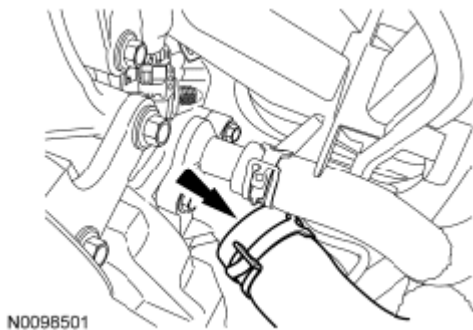


Fig. 295: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

54. If equipped, position the block heater shield aside and disconnect the block heater electrical connector.
- Detach the 8 block heater wiring harness retainers (1 shown) and remove the block heater wiring

harness.

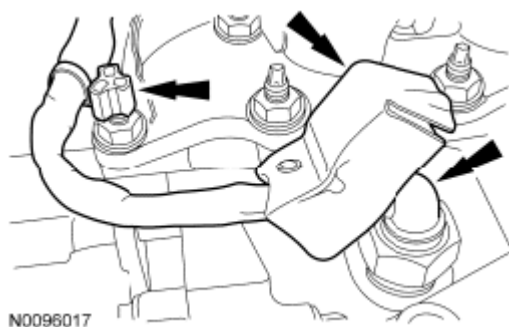


Fig. 296: Locating Block Heater Wiring Harness Retainers & Block Heater Wiring Harness
Courtesy of FORD MOTOR CO.

55. Detach the lower radiator hose pin-type retainer from the cooling fan shroud.



Fig. 297: Locating Lower Radiator Hose Pin-Type Retainer
Courtesy of FORD MOTOR CO.

56. Remove the bellhousing-to-oil pan bolt.

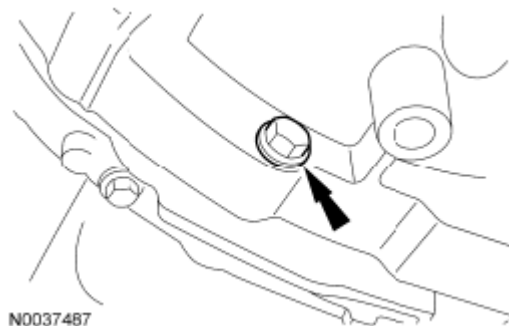


Fig. 298: Locating Rear Subframe Nuts
Courtesy of FORD MOTOR CO.

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

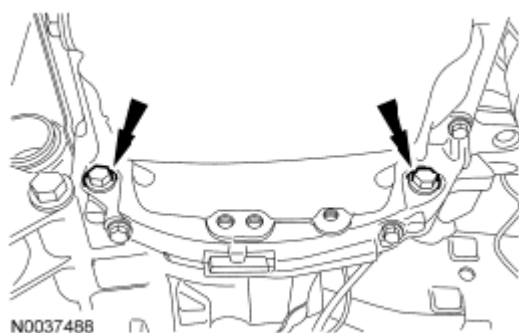


Fig. 299: Locating Oil Pan-To-Bellhousing Bolts
 Courtesy of FORD MOTOR CO.

58. Install the Powertrain Lift and Universal Adapter Brackets onto the engine.
 - Raise the engine and transaxle 25.4 mm (1 in) to neutralize the engine and transaxle mounts.

NOTE: Position a block of wood under the transaxle.

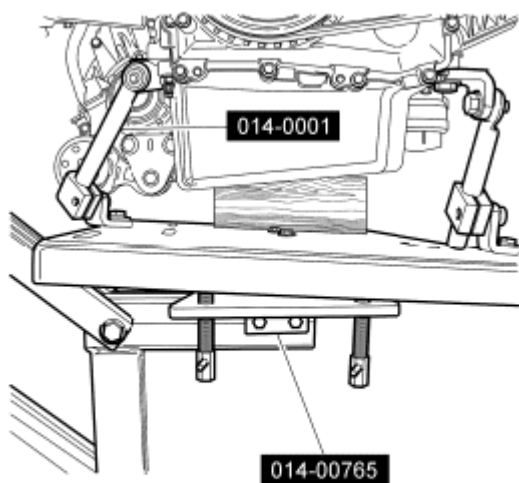


Fig. 300: Raising Engine & Transaxle
 Courtesy of FORD MOTOR CO.

59. Remove the 2 transaxle mount bolts.

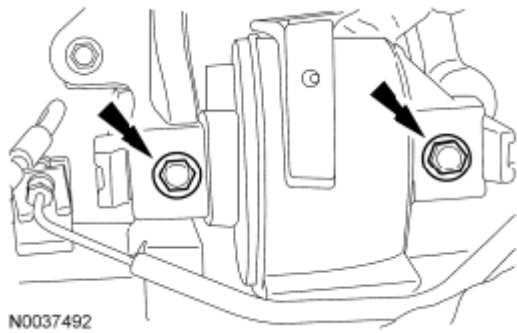


Fig. 301: Locating Transaxle Mount Bolts
Courtesy of FORD MOTOR CO.

60. Remove the bolt, 2 nuts and the motor mount bracket.

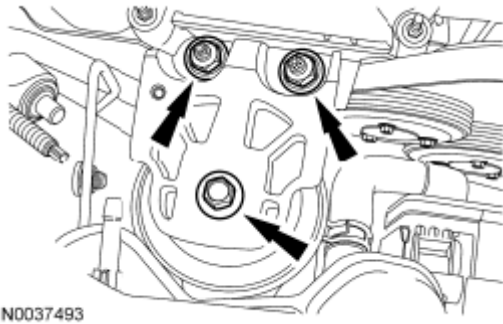


Fig. 302: Locating Bolt, Nuts & Motor Mount Bracket
Courtesy of FORD MOTOR CO.

61. Lower the engine and transaxle from the vehicle.
62. Disconnect the A/C compressor electrical connector.

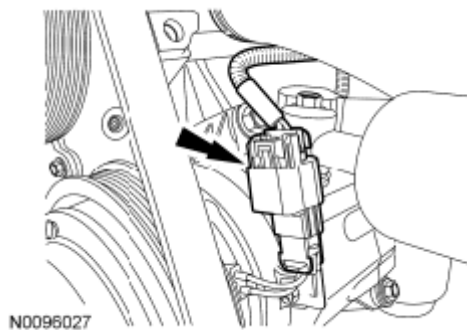


Fig. 303: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

63. Detach the A/C compressor wiring harness pin-type retainer from the intake manifold.

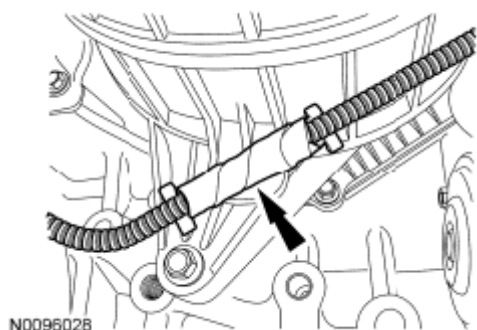


Fig. 304: Locating A/C Compressor Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

64. Remove the 2 nuts and disconnect the starter wires.

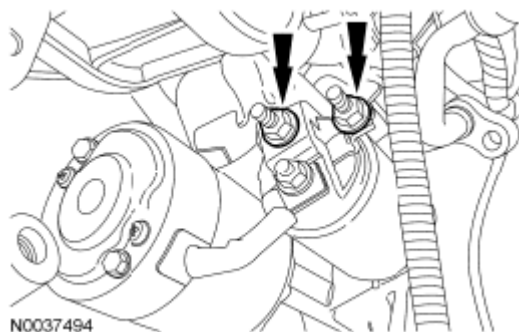


Fig. 305: Locating Starter Wires & Nuts
Courtesy of FORD MOTOR CO.

65. Remove the nut from the starter motor stud bolt.

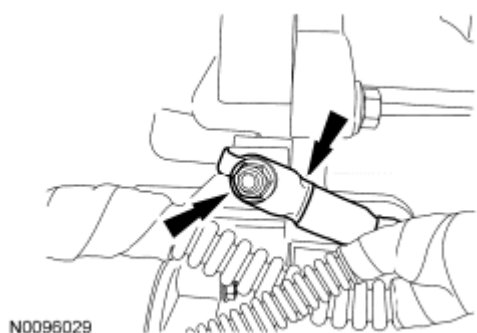


Fig. 306: Locating Nut & Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

66. Remove the bolt, stud bolt and the starter.

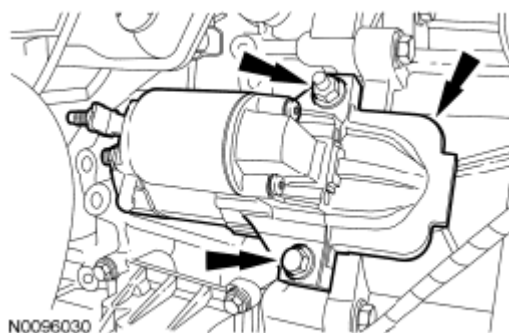


Fig. 307: Locating Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

67. Remove the starter motor isolator.

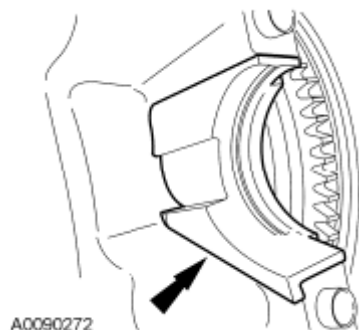


Fig. 308: Identifying Starter Motor Isolator
Courtesy of FORD MOTOR CO.

68. Press the locking tab to release the generator air duct and remove.

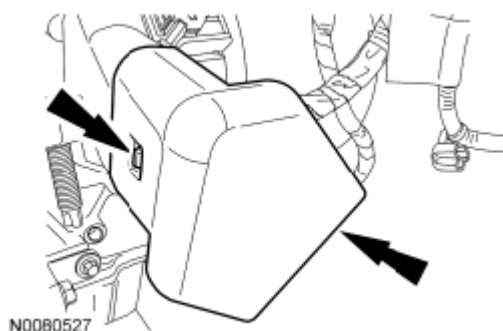


Fig. 309: Locating Locking Tab & Generator Air Duct
Courtesy of FORD MOTOR CO.

69. Disconnect the generator electrical connection.

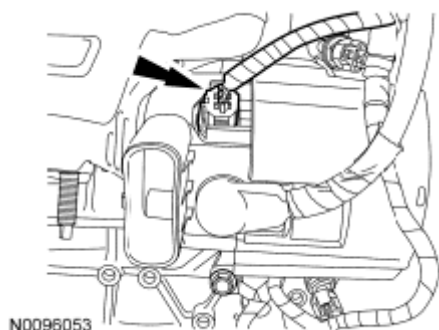


Fig. 310: Locating Generator Electrical Connection
Courtesy of FORD MOTOR CO.

70. Remove the nut and the generator wiring harness.



Fig. 311: Locating Nut & Generator Wiring Harness
Courtesy of FORD MOTOR CO.

71. Detach the 4 wiring harness retainers (3 shown) from the valve cover stud bolts.

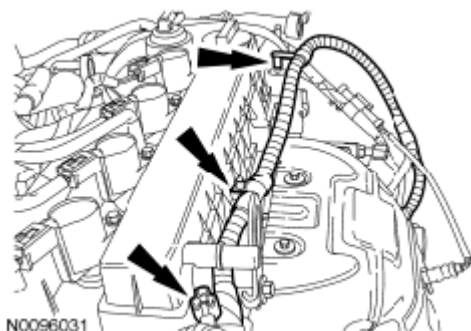


Fig. 312: Locating Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

72. Install the Heavy Duty Floor Crane and Spreader Bar and remove the engine and transaxle from the Powertrain Lift table.

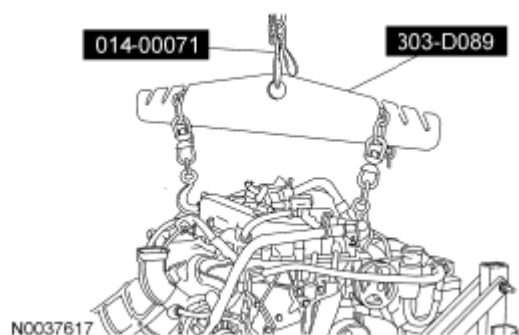


Fig. 313: Identifying Heavy Duty Floor Crane & Spreader Bar
Courtesy of FORD MOTOR CO.

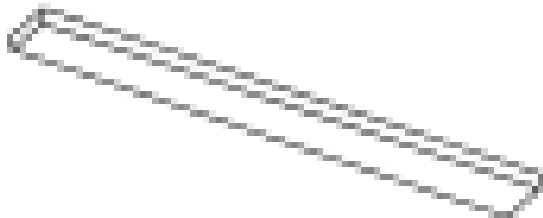
73. Remove the bellhousing-to-engine retainers.
 - Separate the engine and transaxle.

DISASSEMBLY

ENGINE

Special Tool(s)

SPECIAL TOOLS TABLE

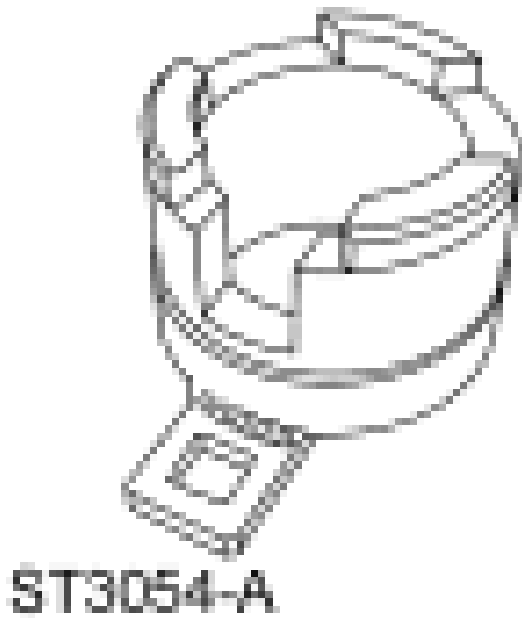
 ST2645-A	Alignment Plate, Camshaft 303-465 (T94P-6256-CH)

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



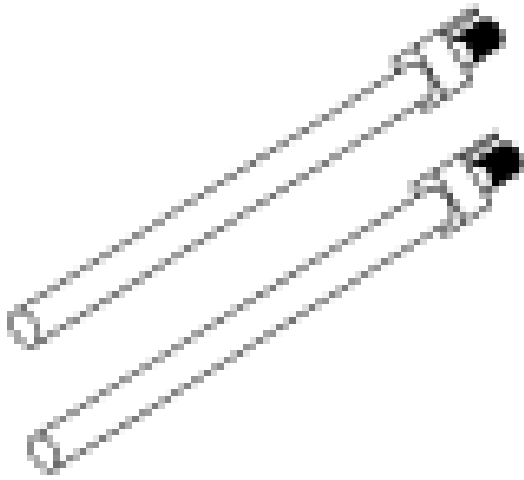
Engine Stand 014-00232 or equivalent



Holding Tool, Crankshaft Damper 303-1416

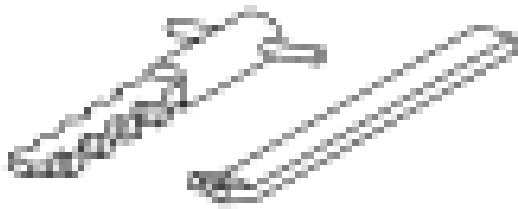
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1982-A

Installer, Connecting Rod 303-462 (T94P-6136-AH)



ST1385-A

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



ST2638-A

Timing Peg, Crankshaft TDC 303-507

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

NOTE: For additional information, refer to Engine .

Vehicles with manual transaxle

1. Remove the 6 bolts, clutch pressure plate and clutch disc.

WARNING: The clutch disc and clutch pressure plate are heavy and may fall if not held when the bolts are removed. Failure to follow this instruction may result in serious personal injury.

NOTE: Loosen the 6 bolts evenly to prevent pressure plate damage.

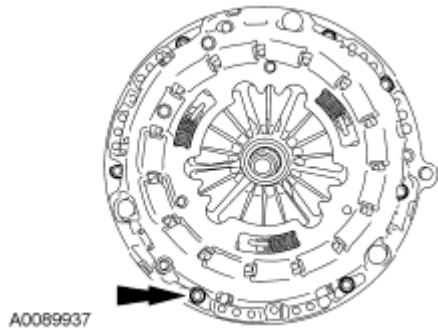


Fig. 314: Locating Clutch Pressure Plate Bolts
Courtesy of FORD MOTOR CO.

2. Remove the 6 bolts and the flywheel.

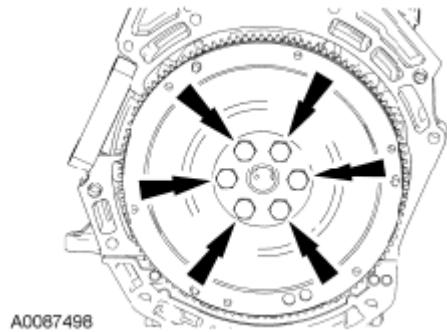


Fig. 315: Locating Flywheel Bolts
Courtesy of FORD MOTOR CO.

Vehicles with automatic transaxle

3. Remove the 6 bolts and the flexplate.

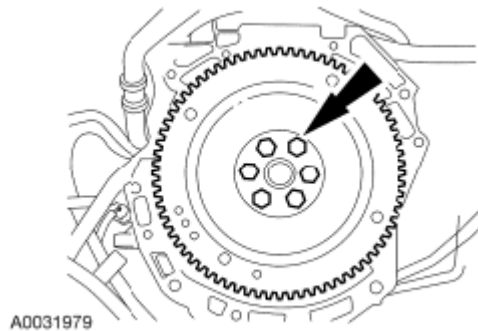


Fig. 316: Locating Flexplate Bolts

Courtesy of FORD MOTOR CO.

All vehicles

4. Mount the engine on a suitable Engine Stand.
5. Using the hex feature, rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt from the engine.

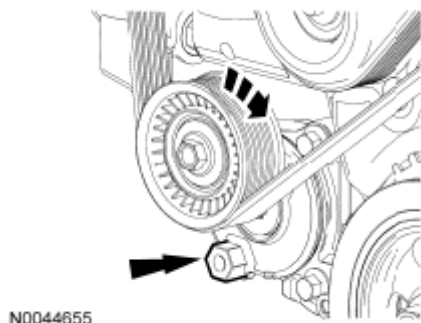


Fig. 317: Rotating Accessory Drive Belt Tensioner Clockwise
Courtesy of FORD MOTOR CO.

6. Remove the 2 bolts and the tensioner.

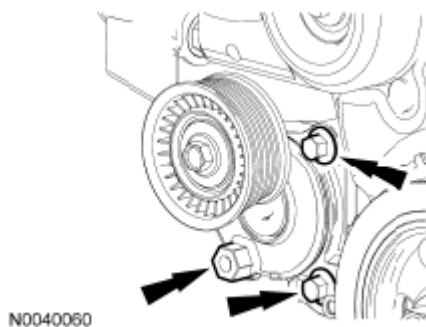


Fig. 318: Locating Bolts & Tensioner
Courtesy of FORD MOTOR CO.

7. Remove the bolt and the accessory drive belt idler pulley.

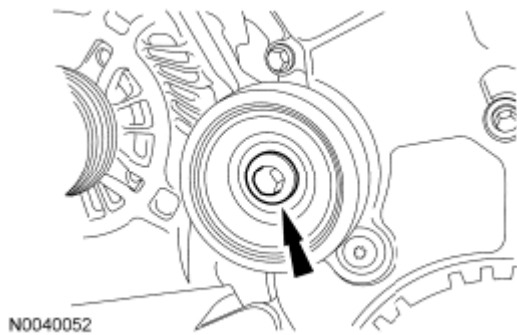


Fig. 319: Locating Accessory Drive Belt Idler Pulley Bolt
Courtesy of FORD MOTOR CO.

8. Remove the 3 bolts and the coolant pump pulley.

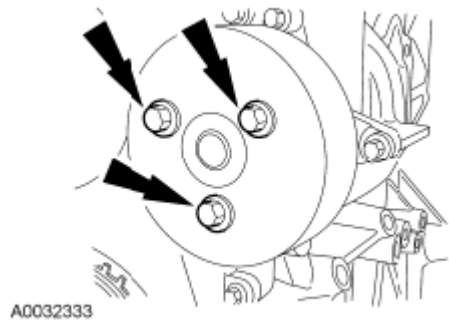


Fig. 320: Locating Coolant Pump Pulley Bolts
Courtesy of FORD MOTOR CO.

9. Remove the 3 bolts and the coolant pump.
 - Remove and discard the O-ring seal.

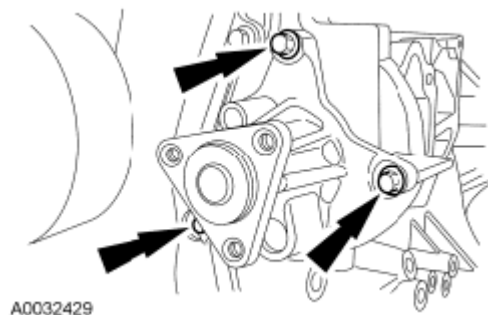


Fig. 321: Locating Coolant Pump Bolts
Courtesy of FORD MOTOR CO.

10. Disconnect the Knock Sensor (KS) electrical connector.

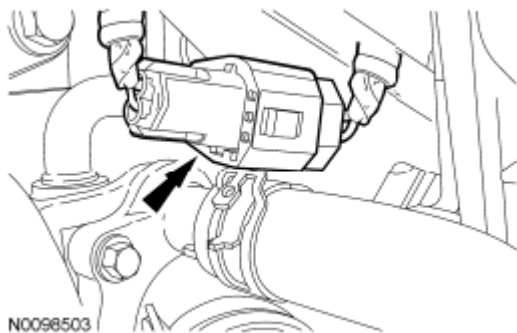


Fig. 322: Locating Knock Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

11. Remove the 2 bolts and the accessory drive belt idler pulley and bracket.

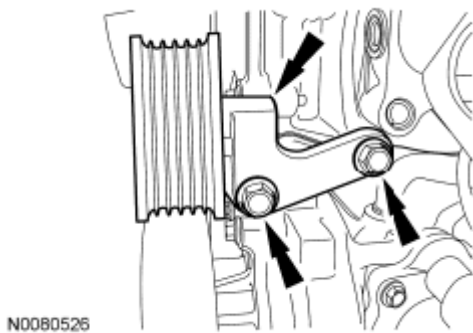


Fig. 323: Locating Accessory Drive Belt Idler Pulley Bracket Bolts
Courtesy of FORD MOTOR CO.

12. Disconnect the coolant hose from the EGR valve.

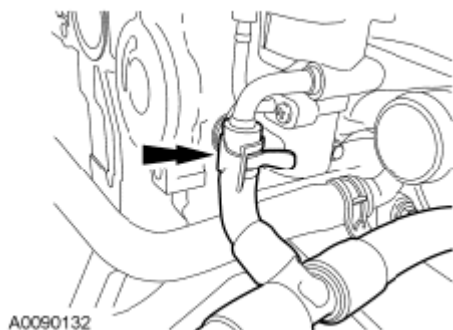


Fig. 324: Locating Coolant Hose
Courtesy of FORD MOTOR CO.

13. Remove the coolant tube retainer from the intake manifold.

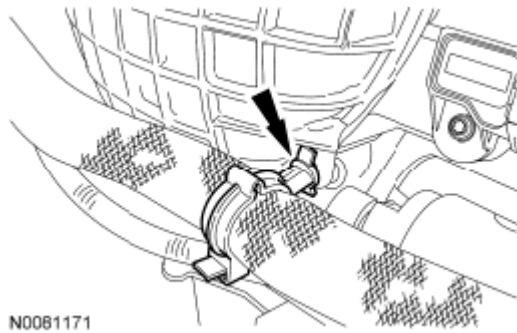


Fig. 325: Locating Coolant Tube Retainer
Courtesy of FORD MOTOR CO.

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

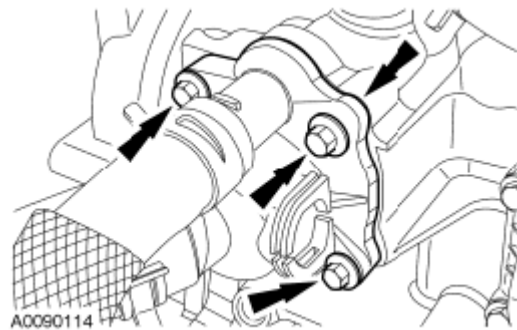


Fig. 326: Identifying Thermostat Housing & Bolts
Courtesy of FORD MOTOR CO.

15. Disconnect the Crankshaft Position (CKP) sensor electrical connector and detach the wiring harness pin-type retainer.

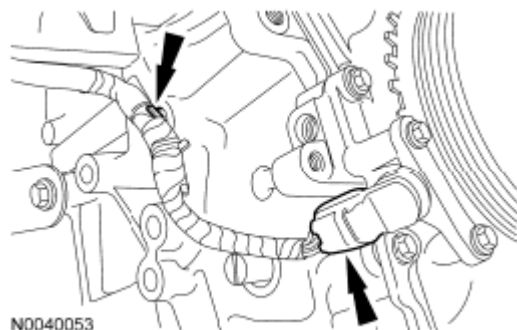
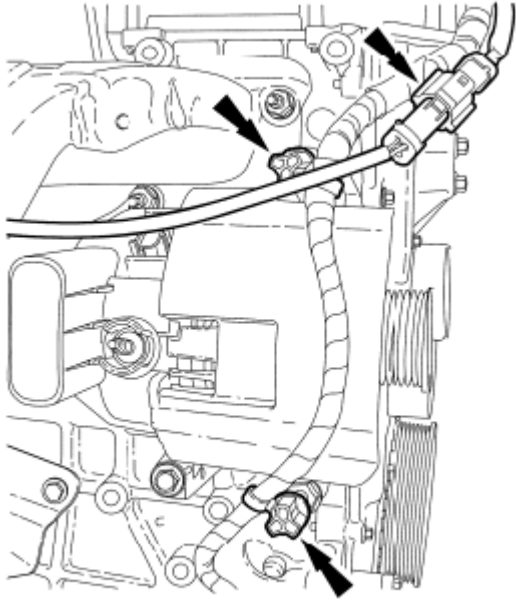


Fig. 327: Locating Crankshaft Position Sensor Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

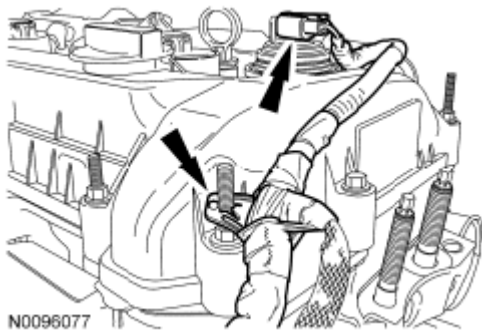
16. Disconnect the Heated Oxygen Sensor (HO2S) electrical connector and detach the 2 wiring harness retainers from the generator stud bolts.



N0096076

Fig. 328: Locating Heated Oxygen Sensor Electrical Connector & Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

17. Disconnect the Variable Camshaft Timing (VCT) electrical connector and detach the wiring harness retainer from the valve cover stud bolt.



N0096077

Fig. 329: Locating Variable Camshaft Timing Electrical Connector & Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

18. Remove the 2 nuts, 1 bolt and the generator.



Fig. 330: Locating Nuts, Bolt & Generator
Courtesy of FORD MOTOR CO.

19. Remove the 2 generator studs.

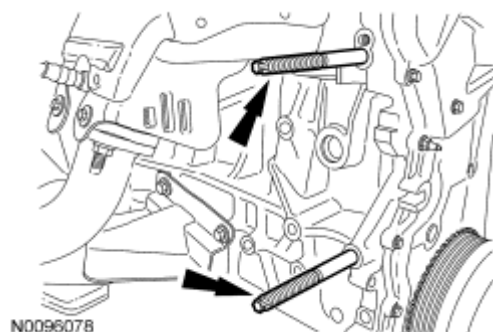


Fig. 331: Locating Generator Studs
Courtesy of FORD MOTOR CO.

20. Remove the 2 bolts and the exhaust flexible pipe bracket.

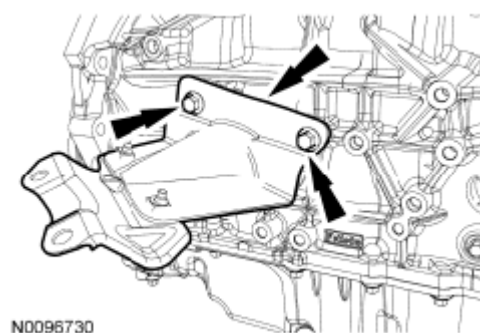


Fig. 332: Locating Bolts & Exhaust Flexible Pipe Bracket
Courtesy of FORD MOTOR CO.

21. Remove the 4 exhaust manifold heat shield bolts and the heat shield.

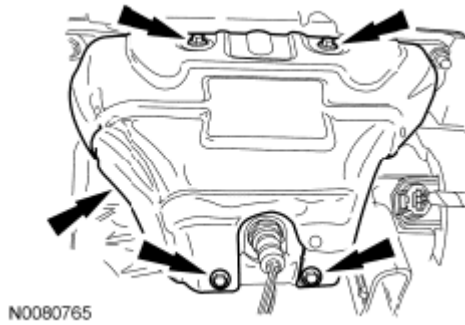


Fig. 333: Locating Exhaust Manifold Heat Shield Bolts & Heat Shield
Courtesy of FORD MOTOR CO.

22. Remove and discard the 7 exhaust manifold nuts.

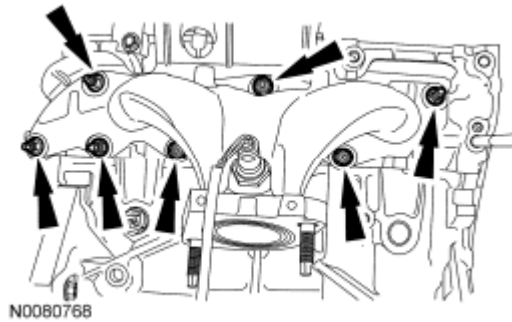


Fig. 334: Locating Exhaust Manifold Nuts
Courtesy of FORD MOTOR CO.

23. Remove the exhaust manifold and discard the exhaust manifold gasket.
24. Clean and inspect the exhaust manifold. For additional information, refer to **EXHAUST MANIFOLD CLEANING AND INSPECTION**.
25. Remove and discard the 7 cylinder head studs.

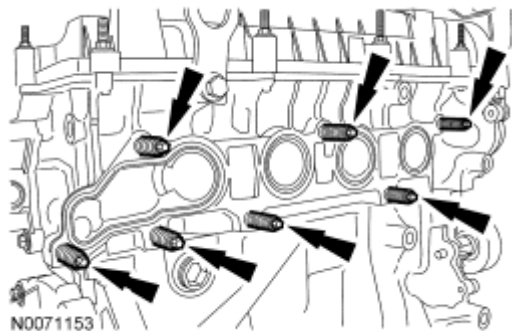


Fig. 335: Locating Cylinder Head Studs
Courtesy of FORD MOTOR CO.

26. Remove the bolt and the A/C manifold tube.
- Discard the 2 O-ring seals.

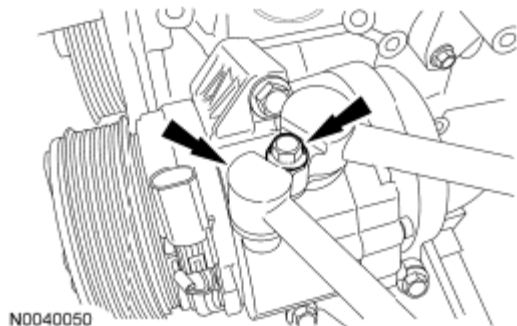


Fig. 336: Locating Bolt & A/C Manifold Tube
Courtesy of FORD MOTOR CO.

27. Remove the 3 bolts and the A/C compressor.

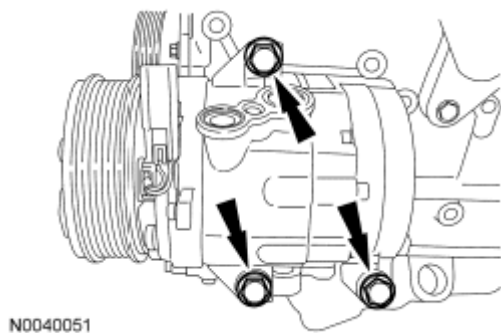


Fig. 337: Locating Bolts & A/C Compressor
Courtesy of FORD MOTOR CO.

28. Disconnect the Engine Oil Pressure (EOP) switch electrical connector.

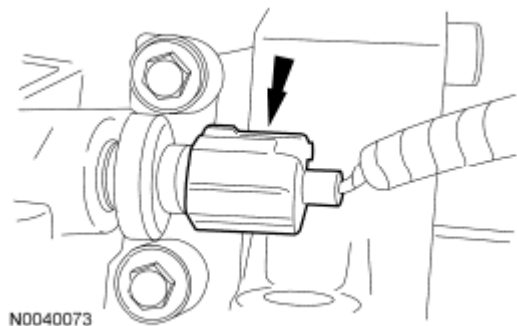


Fig. 338: Locating Engine Oil Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

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

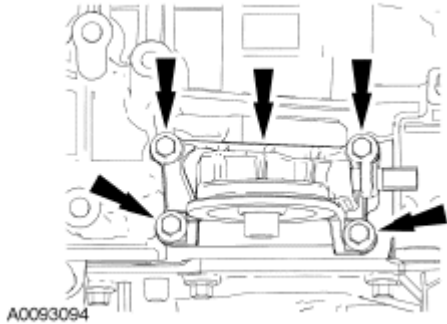


Fig. 339: Locating Bolts & Oil Filter Adapter
Courtesy of FORD MOTOR CO.

30. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector.

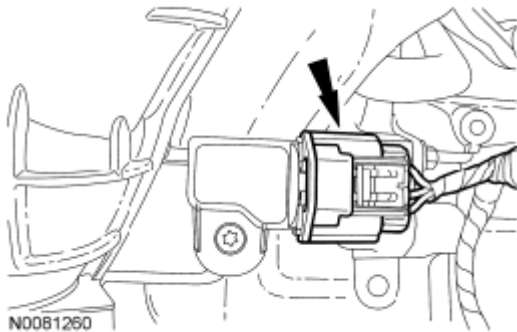


Fig. 340: Locating Manifold Absolute Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

31. Disconnect the electronic throttle control and Evaporative Emission (EVAP) canister purge valve electrical connectors.

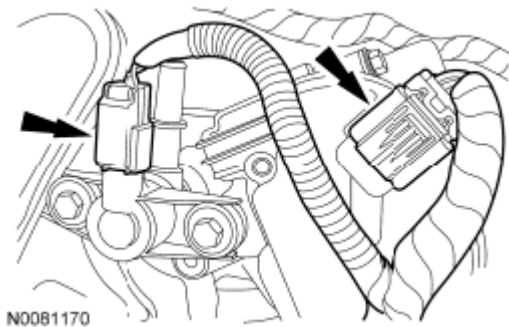
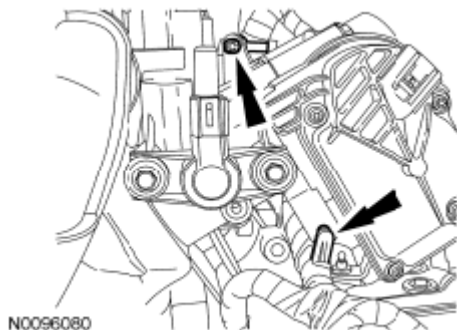


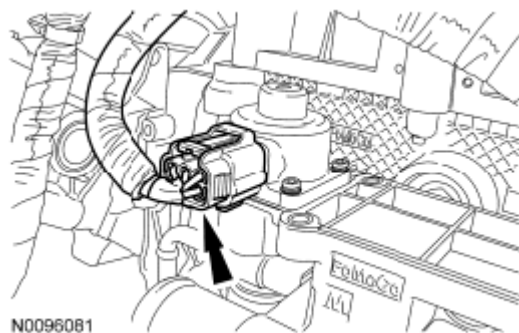
Fig. 341: Locating Electronic Throttle Control & Evaporative Emission Canister Purge Valve

Electrical Connectors**Courtesy of FORD MOTOR CO.**

32. Detach the 2 wiring harness retainers from the intake manifold.

**Fig. 342: Locating Wiring Harness Retainers****Courtesy of FORD MOTOR CO.**

33. Disconnect the EGR valve electrical connector.

**Fig. 343: Locating EGR Valve Electrical Connector****Courtesy of FORD MOTOR CO.**

34. Disconnect the radio capacitor electrical connector.



Fig. 344: Locating Radio Capacitor Electrical Connector
Courtesy of FORD MOTOR CO.

35. Disconnect the 4 fuel injector electrical connectors.
- Detach the 2 wiring harness retainers and remove the wiring harness assembly.

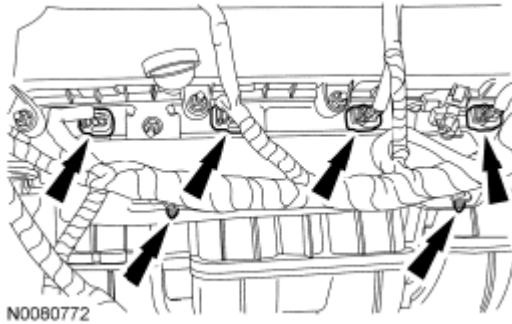


Fig. 345: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

36. Disconnect the 4 ignition coil-on-plugs and Camshaft Position (CMP) sensor electrical connectors.

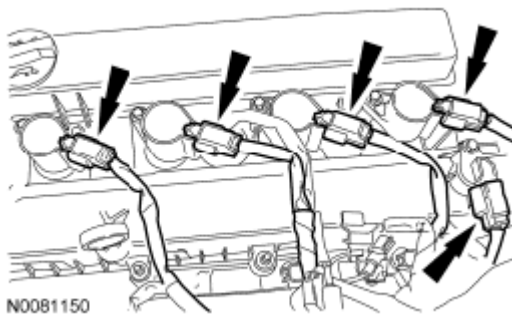


Fig. 346: Locating Ignition Coil-On-Plugs & Camshaft Position Sensor Electrical Connectors
Courtesy of FORD MOTOR CO.

37. Position the rubber boot aside and disconnect the Cylinder Head Temperature (CHT) sensor electrical connector and remove the wiring harness.

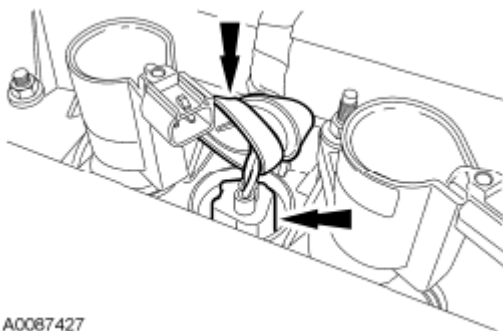


Fig. 347: Locating Rubber Boot & Cylinder Head Temperature Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

38. Remove the fuel rail insulator.

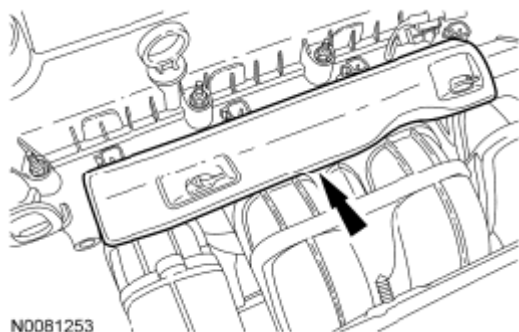


Fig. 348: Locating Fuel Rail Insulator
Courtesy of FORD MOTOR CO.

39. Remove the nut and the radio capacitor.

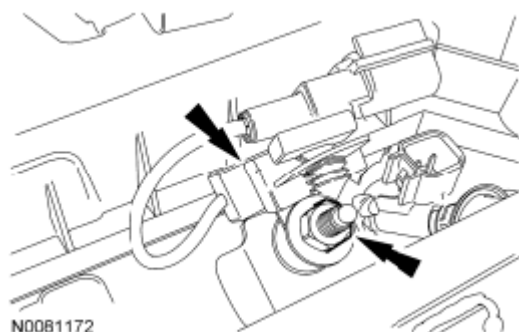


Fig. 349: Locating Nut & Radio Capacitor
Courtesy of FORD MOTOR CO.

40. Remove the 2 stud bolts, fuel rail and fuel injectors as an assembly.

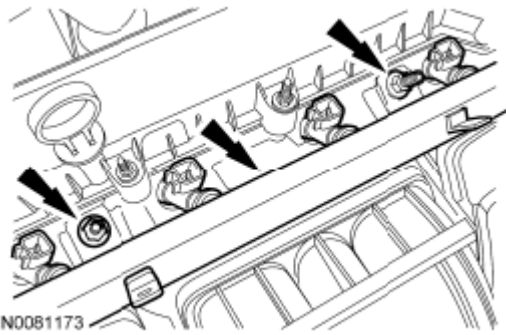


Fig. 350: Locating Stud Bolts, Fuel Rail & Fuel Injectors
Courtesy of FORD MOTOR CO.

41. Remove the 7 bolts (3 shown) and position the intake manifold aside.

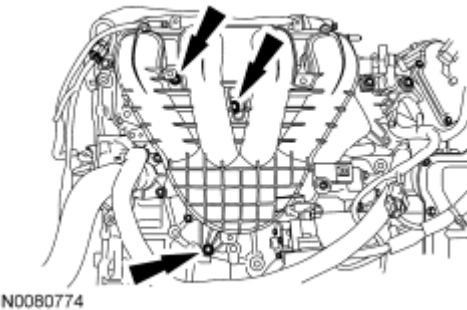


Fig. 351: Locating Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

42. Squeeze the 2 crankcase vent oil separator tube tabs and disconnect the tube from the intake manifold.

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

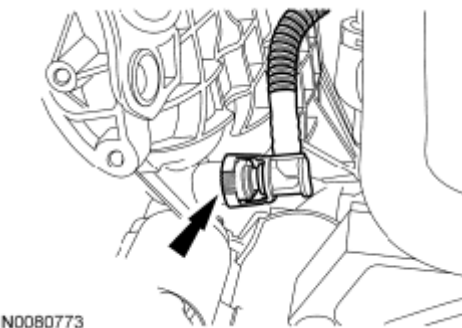


Fig. 352: Locating Crankcase Vent Oil Separator Tube

Courtesy of FORD MOTOR CO.

43. Remove the EGR tube.

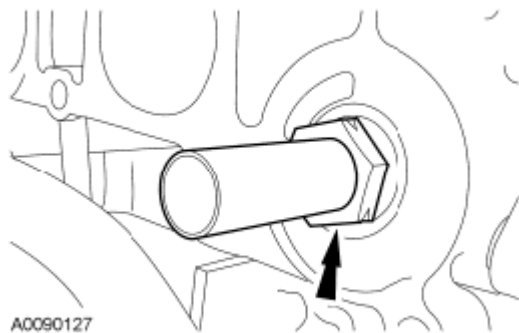


Fig. 353: Locating EGR Tube
Courtesy of FORD MOTOR CO.

44. Disconnect the bypass hose.

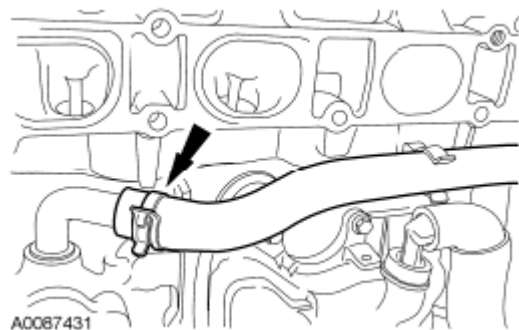


Fig. 354: Identifying Coolant Bypass Hose
Courtesy of FORD MOTOR CO.

45. Remove the bypass hose from the coolant outlet.

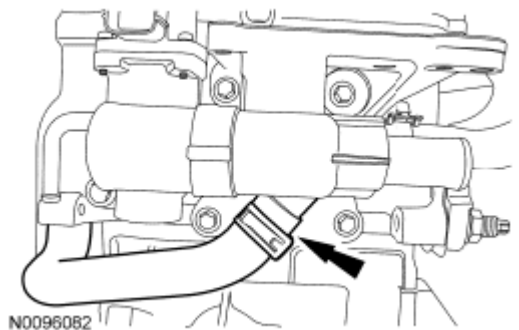


Fig. 355: Locating Coolant Bypass Hose

Courtesy of FORD MOTOR CO.

46. Remove the bolt and the KS.

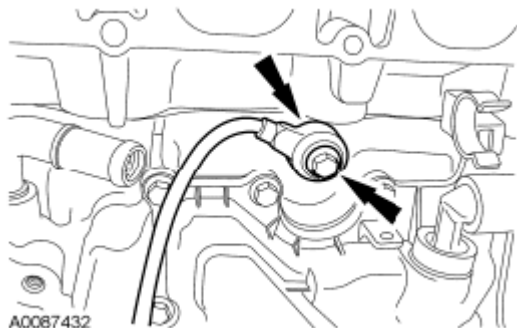


Fig. 356: Locating Bolt & Knock Sensor
Courtesy of FORD MOTOR CO.

47. Remove the 8 bolts and the crankcase vent oil separator.

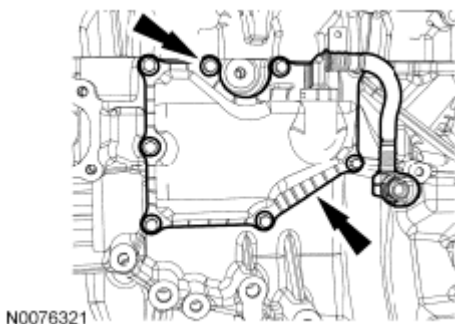


Fig. 357: Locating Bolts & Crankcase Vent Oil Separator
Courtesy of FORD MOTOR CO.

48. If equipped, remove the block heater.

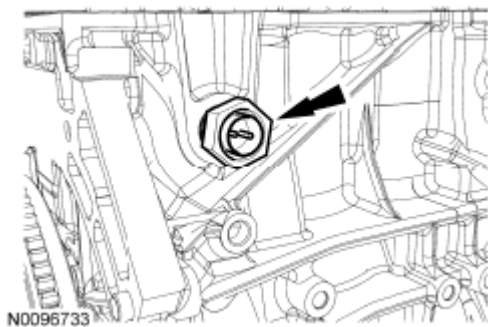


Fig. 358: Locating Block Heater
Courtesy of FORD MOTOR CO.

49. Remove the oil level indicator.

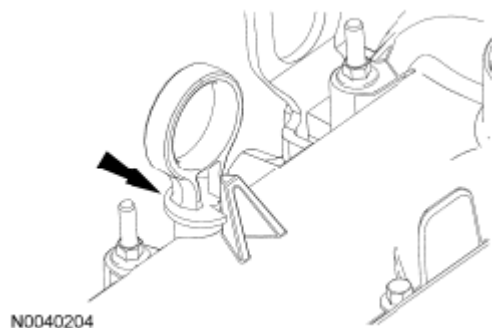


Fig. 359: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

50. Remove the 4 bolts and the 4 coil-on-plugs.

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

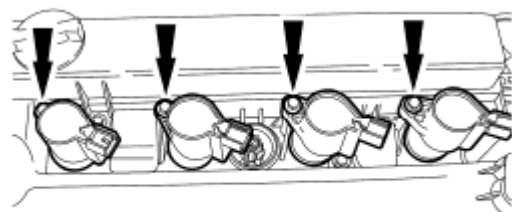


Fig. 360: Locating Bolts & Coil-On-Plugs
Courtesy of FORD MOTOR CO.

51. Remove the 14 retainers and the valve cover.

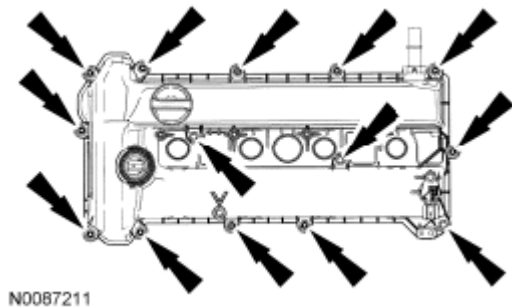


Fig. 361: Locating Retainers & Valve Cover
Courtesy of FORD MOTOR CO.

52. Remove the 2 bolts and the **CKP** sensor.

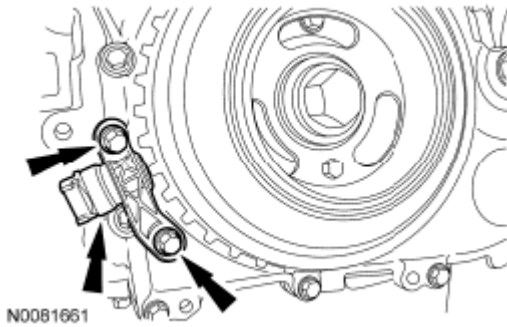


Fig. 362: Locating Bolts & CKP Sensor
Courtesy of FORD MOTOR CO.

53. Using the crankshaft pulley bolt, turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).
- The hole in the crankshaft pulley should be in the 6 o'clock position.

NOTE: Failure to position the No. 1 position at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

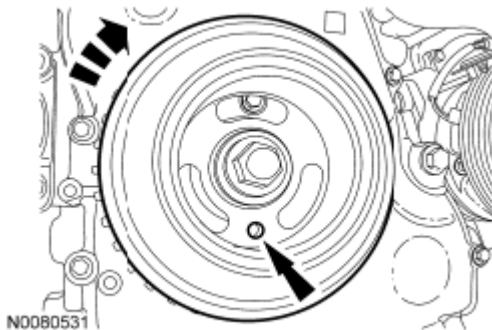


Fig. 363: Locating Crankshaft Pulley Hole
Courtesy of FORD MOTOR CO.

54. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this to prevent engine rotation can result in engine damage.

NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Plate cannot be installed, rotate the crankshaft one complete revolution clockwise to correctly position the camshafts.

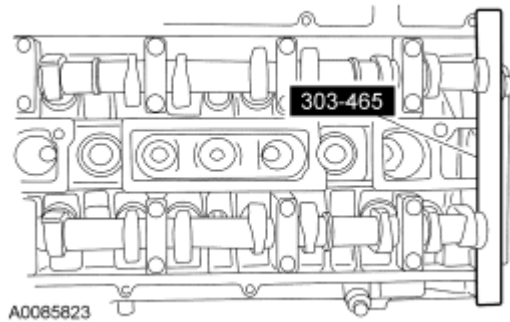


Fig. 364: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

55. Remove the engine plug bolt.

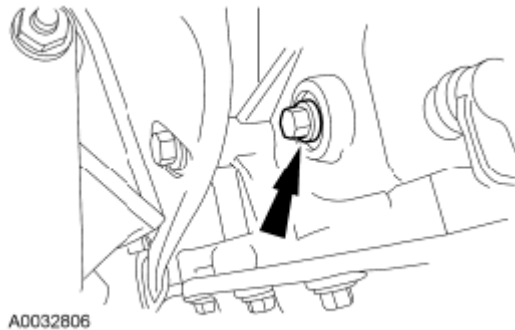


Fig. 365: Locating Engine Plug Bolt
Courtesy of FORD MOTOR CO.

56. Install the Crankshaft TDC Timing Peg.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC . However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during disassembly.

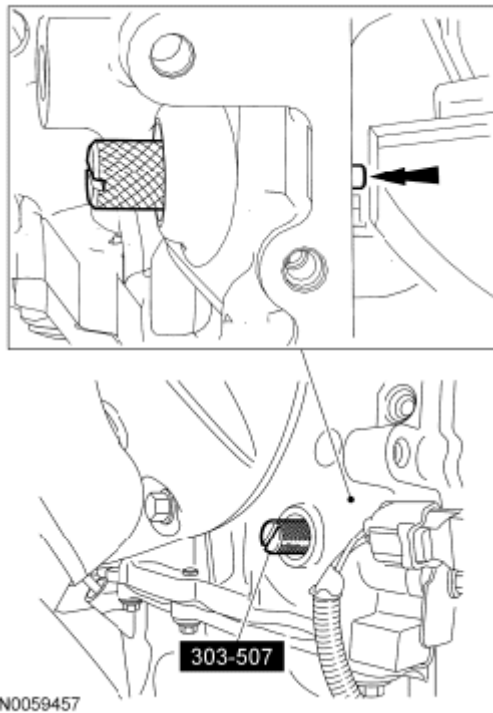


Fig. 366: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

57. Use the Crankshaft Damper Holding Tool and a suitable 1/2-in drive hand tool to hold the crankshaft pulley.

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during removal of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be removed using an air impact wrench (1/2-in drive minimum).

NOTE: The crankshaft sprocket diamond washer may come off with the crankshaft pulley. The diamond washer must be replaced, remove and discard the diamond washer. If the diamond washer is not installed, engine damage may occur.

Use an air impact wrench to remove the crankshaft pulley bolt.

- Remove and discard the crankshaft pulley bolt and washer.
- Remove the crankshaft pulley.
- Remove the diamond washer and discard.

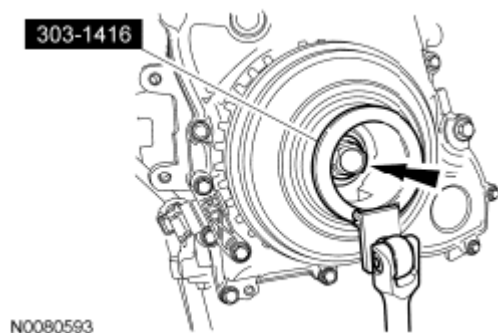


Fig. 367: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

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

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

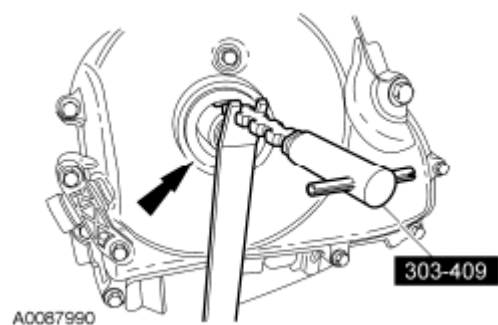
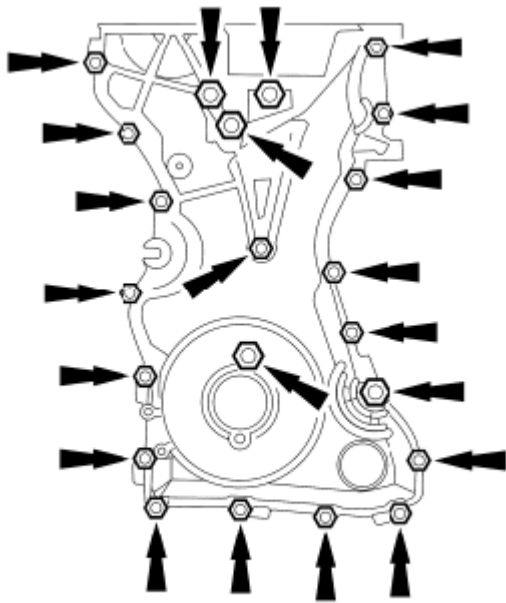


Fig. 368: Removing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

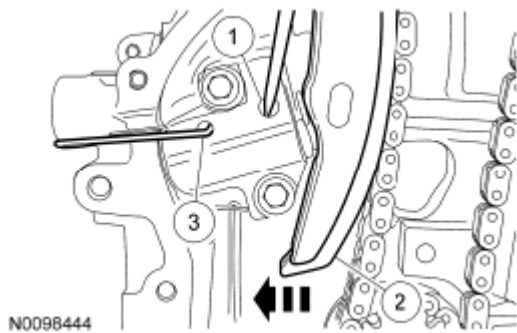
59. Remove the 22 bolts and the engine front cover.



A0087412

Fig. 369: Locating Engine Front Cover Bolts
 Courtesy of FORD MOTOR CO.

60. Compress the timing chain tensioner in the following sequence.
 1. Using a small pick, release and hold the ratchet mechanism.
 2. While holding the ratchet mechanism in the released position, compress the tensioner by pushing the timing chain arm toward the tensioner.
 3. Insert a paper clip into the hole to retain the tensioner.



N0098444

Fig. 370: Compressing Timing Chain Tensioner
 Courtesy of FORD MOTOR CO.

61. Remove the 2 bolts and timing chain tensioner.

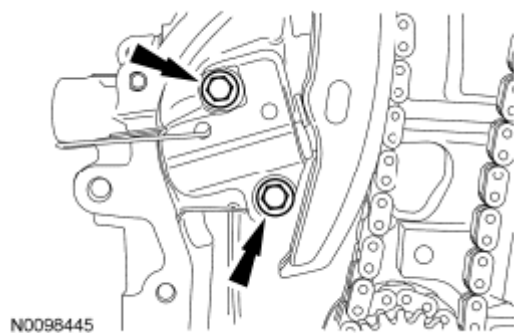


Fig. 371: Locating Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

62. Remove the RH timing chain guide.

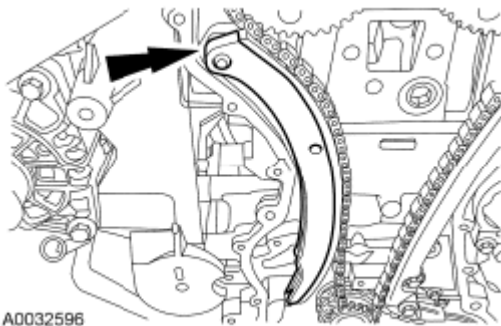


Fig. 372: Locating RH Timing Chain Guide
Courtesy of FORD MOTOR CO.

63. Remove the timing chain.

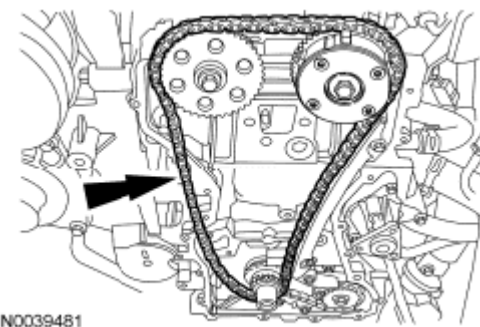


Fig. 373: Locating Timing Chain
Courtesy of FORD MOTOR CO.

64. Remove the 2 bolts and the LH timing chain guide.

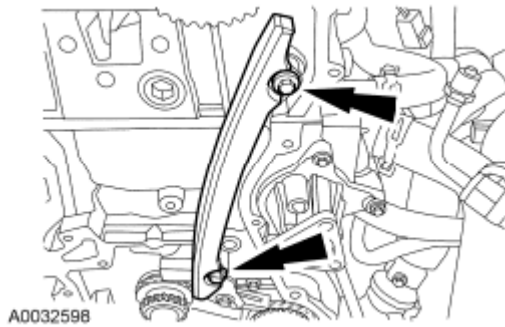


Fig. 374: Locating Bolts & Timing Chain Guide
Courtesy of FORD MOTOR CO.

65. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the exhaust camshaft sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

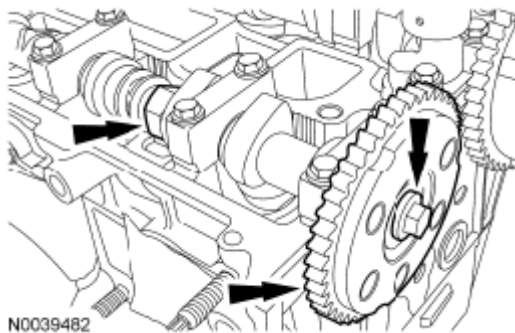


Fig. 375: Locating Flats On Camshaft, Bolt & Exhaust Camshaft Sprocket
Courtesy of FORD MOTOR CO.

66. Using the flats on the camshaft to prevent camshaft rotation, remove the bolt and the intake camshaft sprocket.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

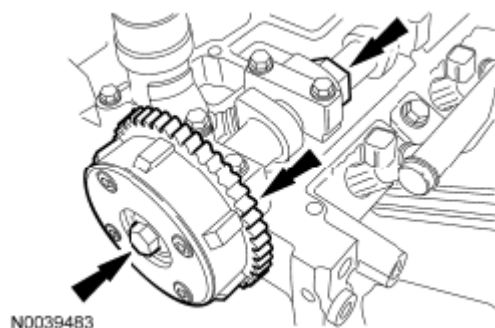


Fig. 376: Locating Flats On Camshaft, Bolt, Camshaft Phaser & Sprocket
Courtesy of FORD MOTOR CO.

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

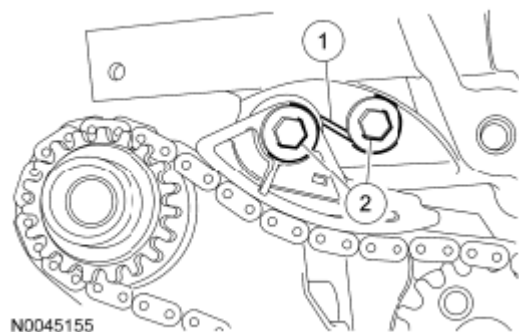


Fig. 377: Identifying Tensioner Spring & Shoulder Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: Remove and discard the crankshaft sprocket diamond washer located behind the crankshaft sprocket.

NOTE: The oil pump chain sprocket must be held in place.

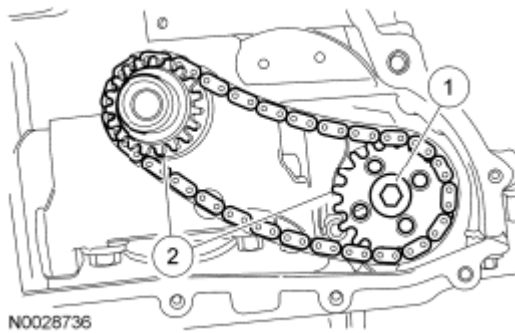


Fig. 378: Identifying Bolt & Sprockets
Courtesy of FORD MOTOR CO.

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

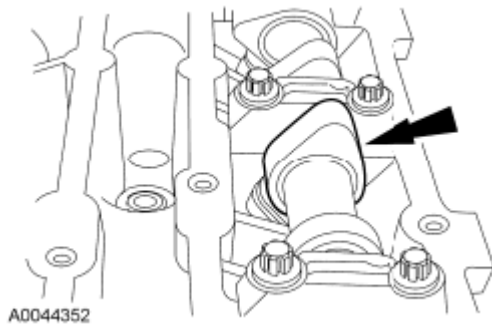


Fig. 379: Locating Camshaft Lobe Position On No. 1 Cylinder
Courtesy of FORD MOTOR CO.

70. Remove the bolt and the VCT solenoid.

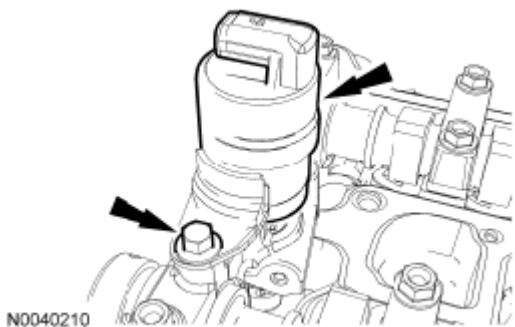


Fig. 380: Locating Bolt & Variable Camshaft Timing Solenoid
Courtesy of FORD MOTOR CO.

71. Remove the plug and the VCT system oil filter from the intake camshaft thrust cap.

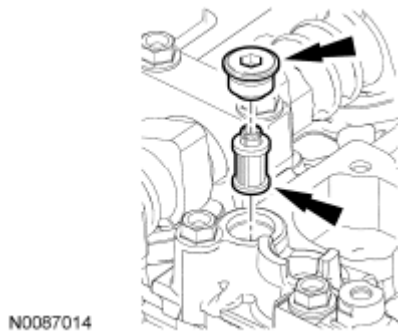


Fig. 381: Locating Plug & VCT System Oil Filter
Courtesy of FORD MOTOR CO.

72. Remove the camshafts from the engine.

- Loosen the camshaft bearing cap bolts, in the sequence shown, one turn at a time until all tension is released from the camshaft bearing caps.
- Remove the bolts and the camshaft bearing caps.
- Remove the camshafts.

NOTE: Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

NOTE: Mark the location and orientation of each camshaft bearing cap.

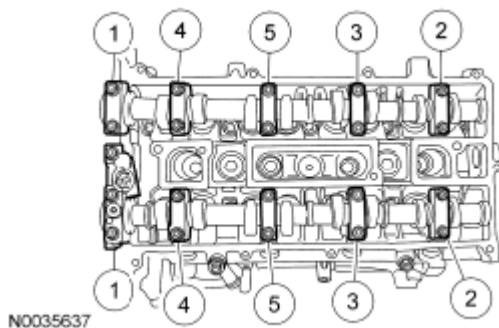


Fig. 382: Identifying Camshaft Bearing Cap Bolts Loosening Sequence
Courtesy of FORD MOTOR CO.

73. Remove and inspect the valve tappets. For additional information, refer to **VALVE TAPPET INSPECTION**.

NOTE: If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

NOTE: The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

74. Remove the cylinder head.
- Remove and discard the 10 cylinder head bolts.
 - Remove the cylinder head.
 - Remove and discard the cylinder head gasket.

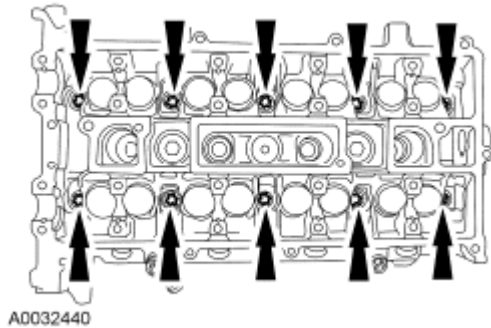


Fig. 383: Locating Cylinder Head Bolts
Courtesy of FORD MOTOR CO.

75. Support the cylinder head on a bench with the head gasket side up. Check the cylinder head distortion and the cylinder block distortion. For additional information, refer to **CYLINDER HEAD DISTORTION** and **CYLINDER BLOCK DISTORTION**.
76. Remove the 2 cylinder head alignment dowels.

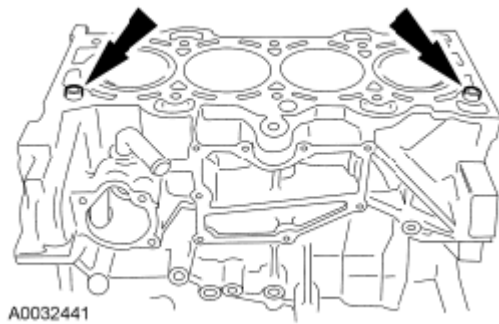


Fig. 384: Locating Cylinder Head Alignment Dowels
Courtesy of FORD MOTOR CO.

77. Remove the 13 bolts and the oil pan.

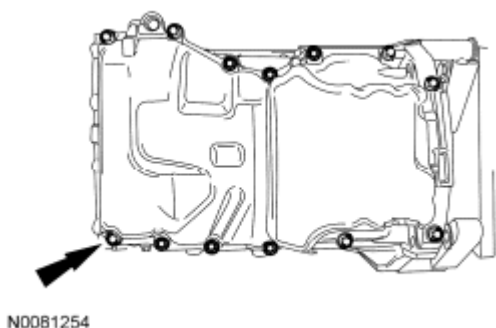


Fig. 385: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

78. Remove the 6 bolts and the rear crankshaft seal.

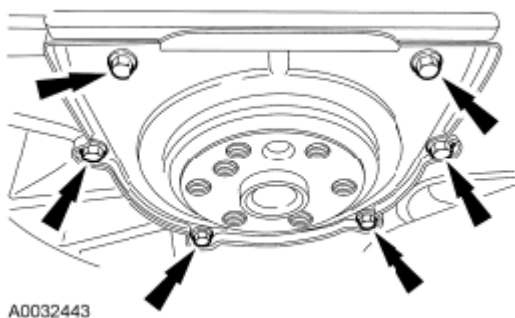


Fig. 386: Locating Bolts & Rear Crankshaft Seal
Courtesy of FORD MOTOR CO.

79. Remove the 2 bolts, oil pump pickup tube and gasket.

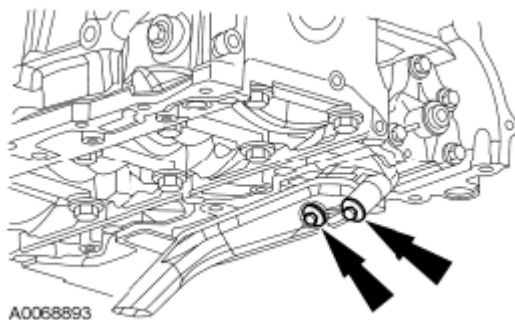


Fig. 387: Locating Oil Pump Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

80. Remove the 4 bolts and the oil pump.

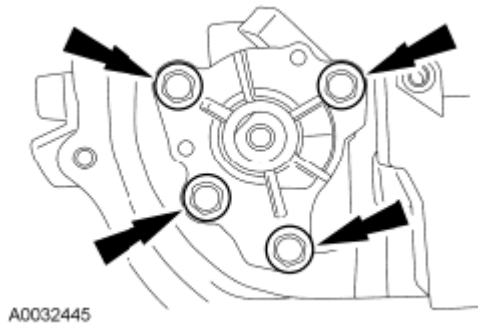


Fig. 388: Locating Oil Pump Assembly Bolts
Courtesy of FORD MOTOR CO.

81. Make sure the Crankshaft **TDC** Timing Peg is still installed and the engine is still at Top Dead Center (TDC).
 - Rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft **TDC** Timing Peg.

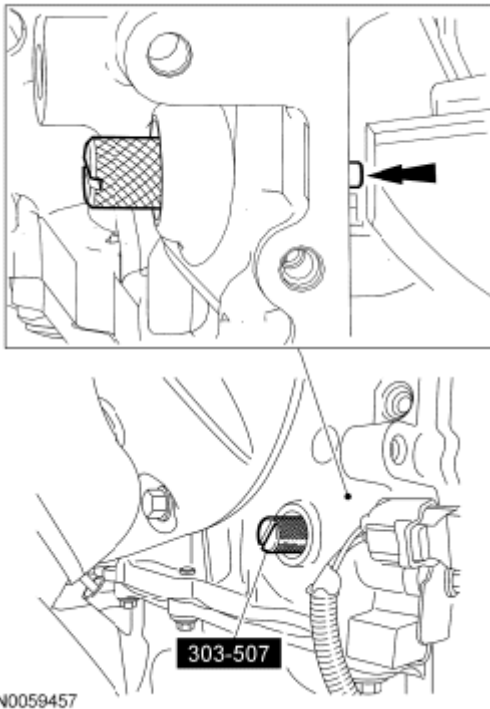


Fig. 389: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

82. Mark the balancer unit and shafts on the top for reference that the balancer unit is at **TDC** .

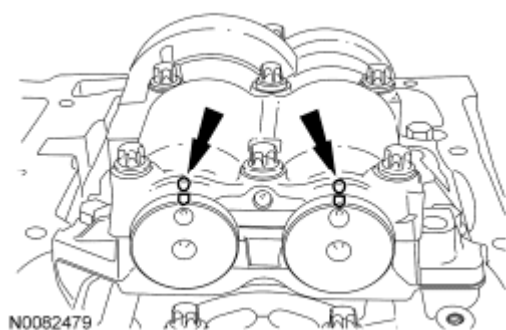


Fig. 390: Locating Balancer Unit & Shafts Reference Mark
Courtesy of FORD MOTOR CO.

83. Remove the 4 bolts and the balancer unit.

NOTE: Due to the precision interior construction of the balancer unit, it should not be disassembled.

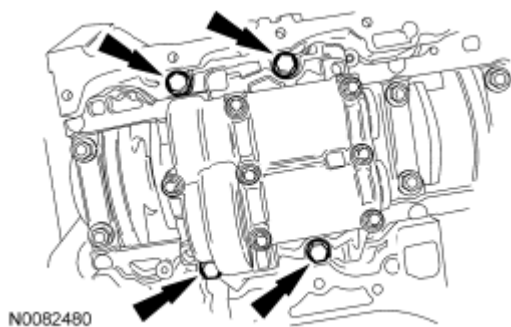


Fig. 391: Locating Balancer Unit Bolts
Courtesy of FORD MOTOR CO.

84. Remove the Crankshaft TDC Timing Peg.

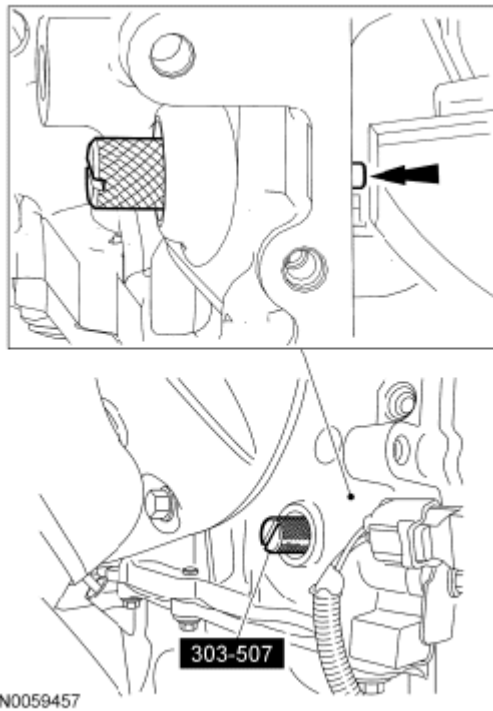


Fig. 392: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

85. Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad or equivalent, following manufacturer's instructions.
86. Remove the connecting rod cap bolts and cap.

NOTE: Clearly mark the connecting rods, connecting rod caps and connecting rod bearings in numerical order for correct orientation for reassembly.

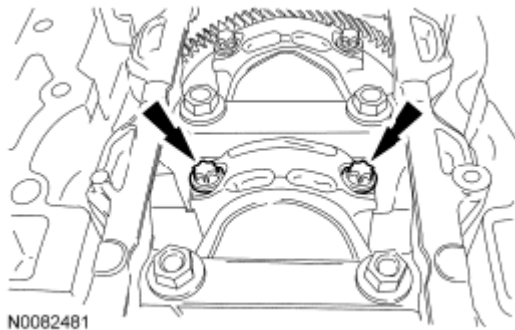


Fig. 393: Locating Connecting Rod Cap Bolts
Courtesy of FORD MOTOR CO.

87. Using the Connecting Rod Installer, remove the piston/rod assembly from the engine block.

- Repeat the previous 2 steps until all the piston/rod assemblies are removed from the engine block.

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

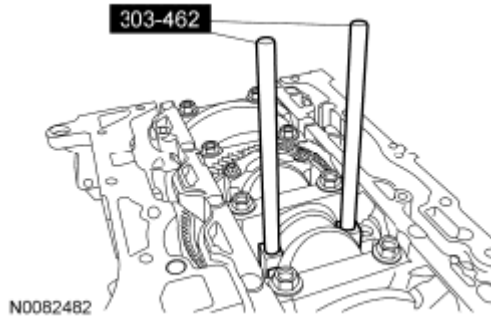


Fig. 394: Identifying Connecting Rod Installer
Courtesy of FORD MOTOR CO.

88. Remove the bolts in the sequence shown below.
- Remove the main bearing beam.
 - Discard the bolts.

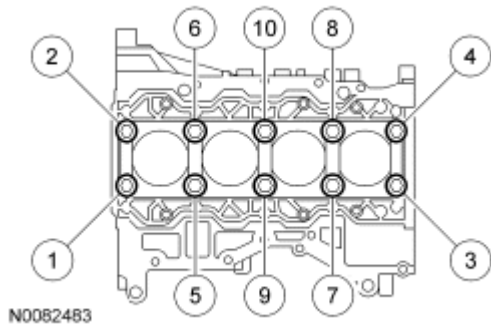


Fig. 395: Identifying Crankshaft Cap Bolts Removing Sequence
Courtesy of FORD MOTOR CO.

89. Remove the crankshaft from the engine block.

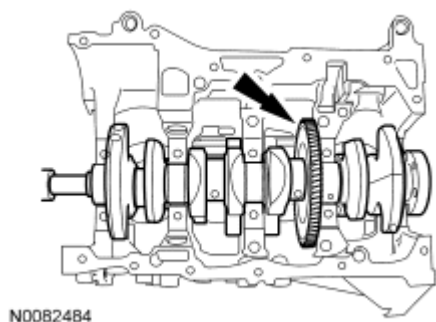


Fig. 396: Locating Crankshaft
Courtesy of FORD MOTOR CO.

90. Remove the main bearings from the main bearing beam.

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

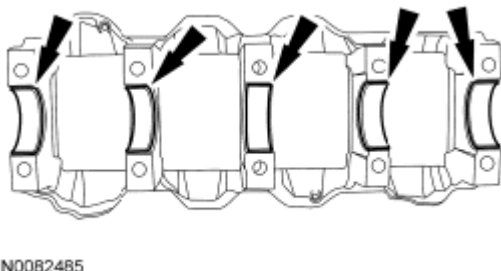


Fig. 397: Locating Main Bearings
Courtesy of FORD MOTOR CO.

91. Remove the main bearings from the cylinder block.

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

NOTE: The center bulkhead has the thrust bearing.

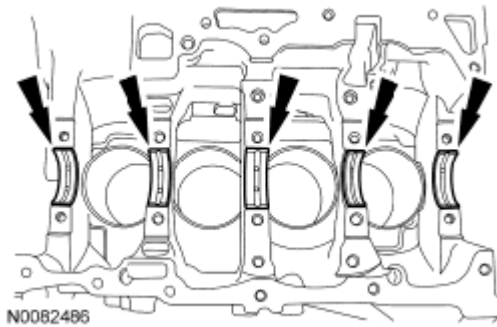


Fig. 398: Locating Main Bearings
Courtesy of FORD MOTOR CO.

92. Remove the 4 oil squirters.

NOTE: If the oil squirters are being reused, mark them in order for correct location during reassembly.

NOTE: The front bulkhead does not have an oil squirter.

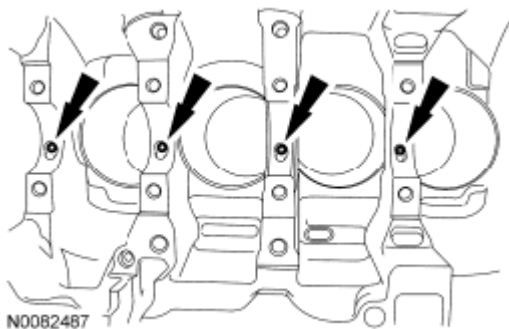


Fig. 399: Locating Oil Squirters
Courtesy of FORD MOTOR CO.

93. Inspect the cylinder block, main bearing beam, pistons and connecting rods. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION**.

DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

CYLINDER HEAD

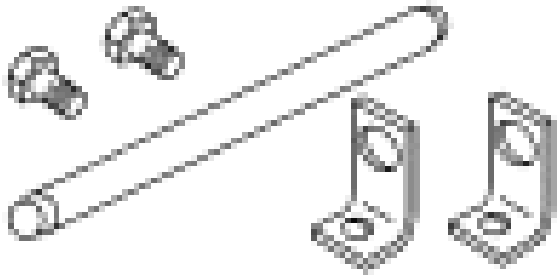
Special Tool(s)

SPECIAL TOOLS TABLE

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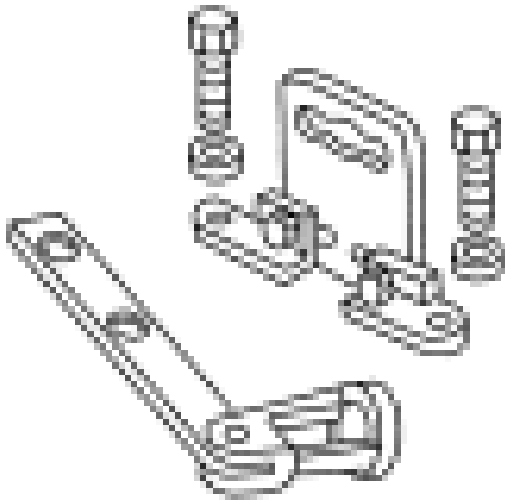
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1981-A

Compressor, Valve Spring 303-300 (T87C-6565-A)



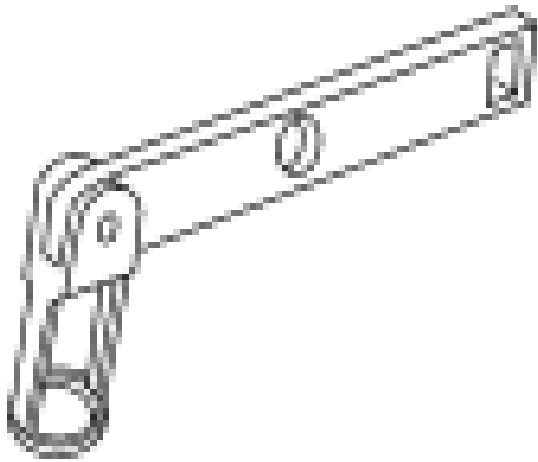
ST1907-A

Compressor, Valve Spring 303-350 (T89P-6565-A)

Compressor, Valve Spring 303-472 (T94P-6565-

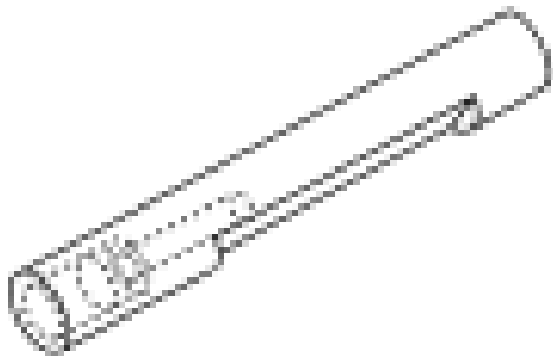
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1902-A

AH)



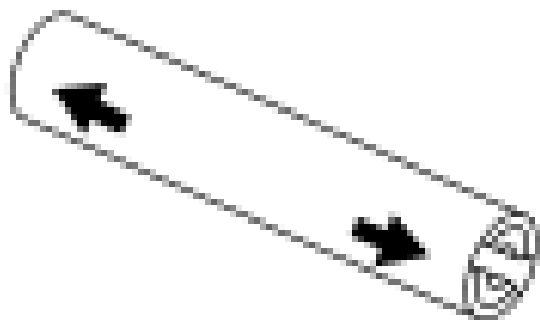
ST1908-A

Installer, Valve Stem Oil Seal 303-470 (T94P-6510-CH)

Remover, Valve Stem Oil Seal 303-468 (T94P-6510-AH)

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1904-A



ST1187-A

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

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B

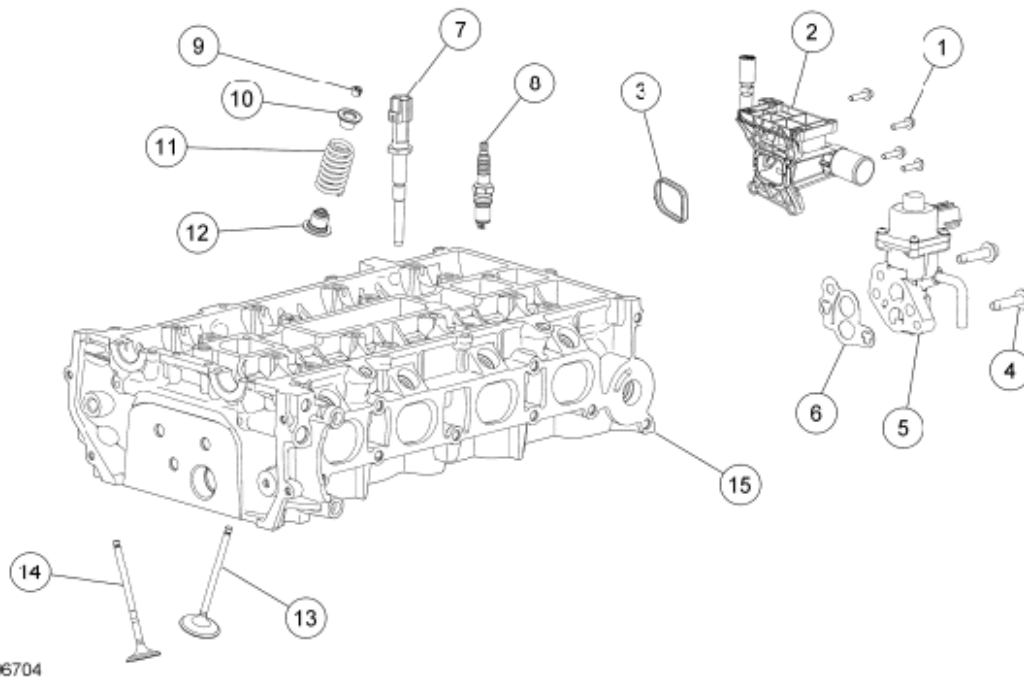


Fig. 400: Exploded View Of Cylinder Head Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	W500015	Coolant outlet bolt (4 required)
2	8K556	Coolant outlet
3	-	Coolant outlet gasket (part of 8K556)
4	W500225	EGR valve bolt (2 required)
5	9D475	EGR valve
6	9D476	EGR valve gasket
7	6G004	Cylinder Head Temperature (CHT) sensor
8	12405	Spark plug (4 required)
9	6518	Valve collet (16 required)
10	6514	Valve spring retainer (16 required)
11	6513	Valve spring (16 required)
12	6517	Valve seal (16 required)
13	6505	Intake valve (8 required)
14	6507	Exhaust valve (8 required)
15	6049	Cylinder head

Disassembly

NOTE: If the components are to be reinstalled, they must be installed in the same

positions. Mark the components removed for locations.

1. Remove the 4 bolts and the coolant outlet.
 - Discard the gasket.

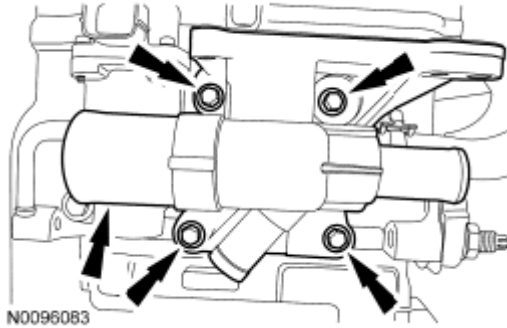


Fig. 401: Locating Coolant Outlet Bolts
Courtesy of FORD MOTOR CO.

2. Remove the 2 bolts and the EGR valve.
 - Discard the gasket.

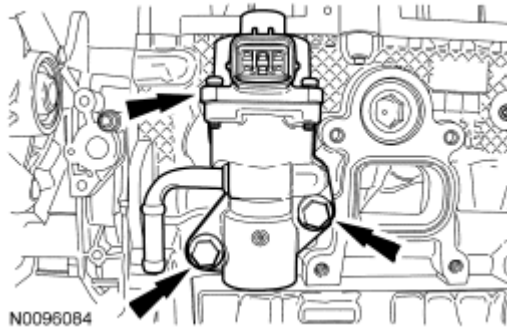


Fig. 402: Locating EGR Valve Bolts
Courtesy of FORD MOTOR CO.

3. Remove the Cylinder Head Temperature (CHT) sensor.
4. Remove the spark plugs.

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

5. Using the Valve Spring Compressors, compress the valve springs and remove the valve collets, valve spring retainers and the valve springs.

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

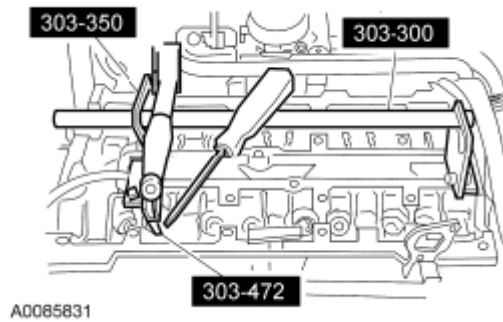


Fig. 403: Identifying Valve Spring & Valve Spring Retainer Special Tools
Courtesy of FORD MOTOR CO.

6. Inspect the components, if necessary. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION**.
7. Remove the valves.
8. Using the Valve Stem Oil Seal Remover and Slide Hammer, remove and discard the valve seals.

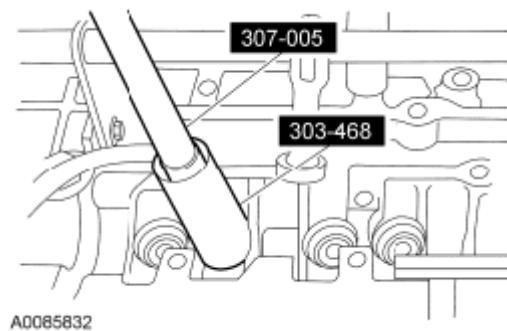


Fig. 404: Removing Valve Seal
Courtesy of FORD MOTOR CO.

9. Inspect the valves. For additional information, refer to **ENGINE SYSTEM - GENERAL INFORMATION**. Install new parts, as necessary.

Assembly

1. Install the valves.

NOTE: Coat the valve stems with clean engine oil.

2. Using the Valve Stem Oil Seal Installer, install the valve seals.

NOTE: Use the protector provided with the replacement kit to prevent damage to the valve seals. Lubricate the valve stems and guides with clean engine oil.

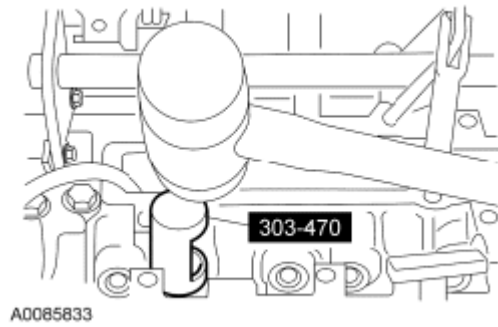


Fig. 405: Installing Valve Seals
Courtesy of FORD MOTOR CO.

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

NOTE: Check the seating of the valve collets.

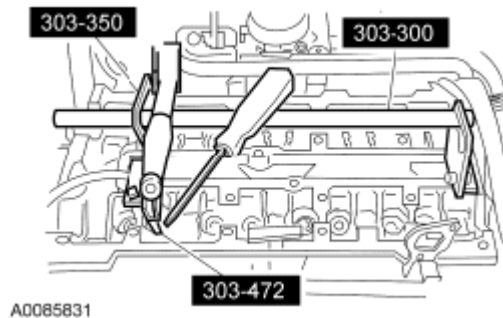


Fig. 406: Identifying Valve Spring & Valve Spring Retainer Special Tools
Courtesy of FORD MOTOR CO.

4. Install the spark plugs.
 - Tighten to 12 Nm (106 lb-in).

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

5. Install the CHT sensor.
 - Tighten to 12 Nm (106 lb-in).
6. Install the EGR valve, using a new gasket.
 - Tighten to 20 Nm (177 lb-in).

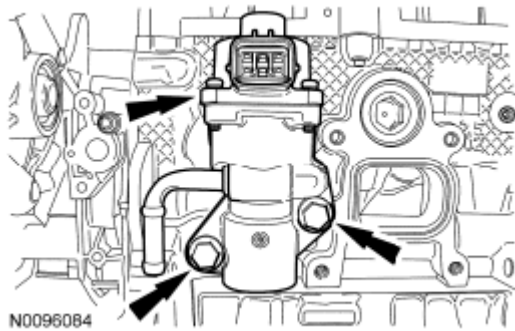


Fig. 407: Locating EGR Valve Bolts
Courtesy of FORD MOTOR CO.

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

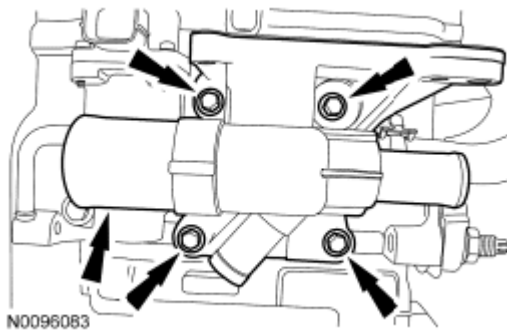


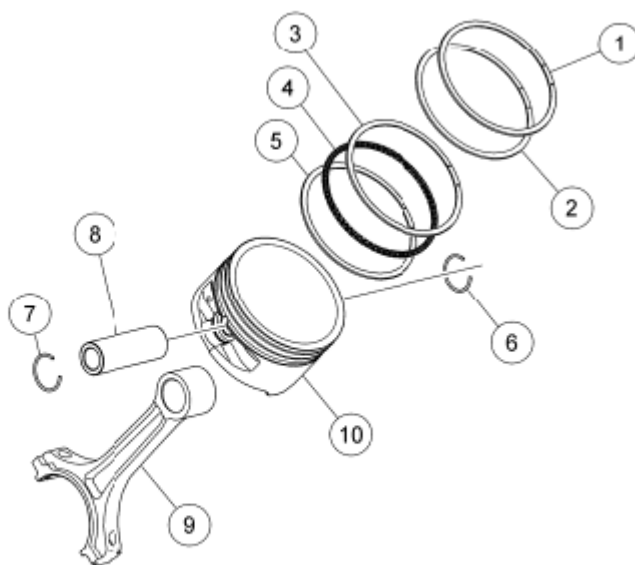
Fig. 408: Locating Coolant Outlet Bolts
Courtesy of FORD MOTOR CO.

PISTON

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A



N0010114

Fig. 409: Exploded View Of Piston
 Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

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

Disassembly

1. Remove the piston rings from the piston.
 - Discard the piston rings.
2. Remove the 2 piston pin retainers and the piston pin.
3. Separate the piston from the connecting rod.

NOTE: If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the

connecting rod for reassembly.

4. Clean and inspect the piston and connecting rod. For additional information, refer to **PISTON INSPECTION** and **CONNECTING ROD CLEANING**.

Assembly

1. Align the piston-to-connecting rod orientation marks, and position the connecting rod in the piston.

NOTE: The arrow on the top of the piston points towards the front of the engine.

2. Lubricate the piston pin and pin bore with clean engine oil.
3. Install the piston pin in the piston and connecting rod assembly.
4. Install the piston pin retaining clips in the piston.
5. Lubricate the piston and the new piston rings with clean engine oil.
6. Install the piston rings onto the piston as shown.
 1. Piston pin
 2. Upper oil control ring gap location
 3. Lower oil control ring gap location
 4. Center line of the piston pin bore and the expander gap

NOTE: The piston compression upper and lower ring should be installed with the paint mark on the outside diameter circumference of the ring to be positioned on the right side of the ring gap. The lower compression ring can also be installed with the undercut side downward.

NOTE: The upper and lower compression ring gaps are not controlled for installation.

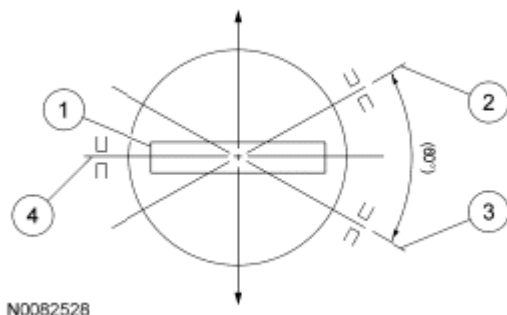


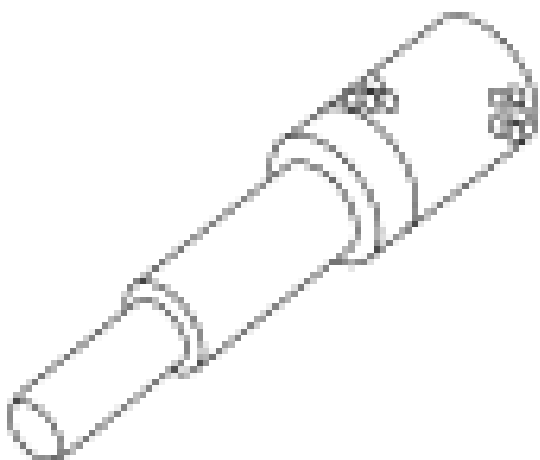
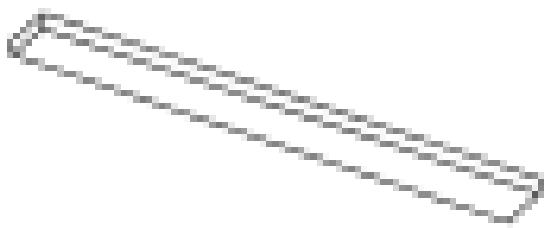
Fig. 410: Identifying Piston Ring Gap Location
Courtesy of FORD MOTOR CO.

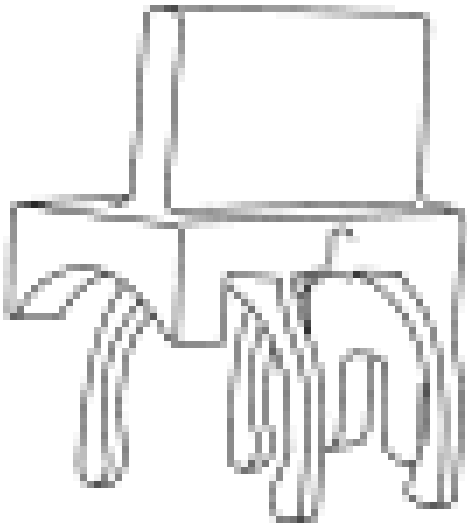
ASSEMBLY

ENGINE

Special Tool(s)

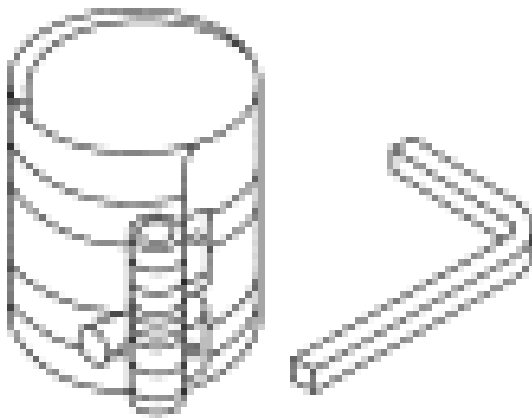
SPECIAL TOOLS TABLE

 ST1751-A	Aligner, Clutch Disc 308-006 (T71P-7137-H)
 ST2645-A	Alignment Plate, Camshaft 303-465 (T94P-6256-CH)



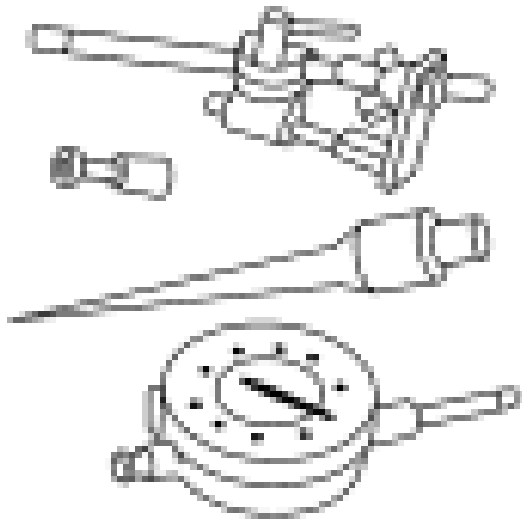
ST3055A

Aligner, Crankshaft Sensor 303-1417



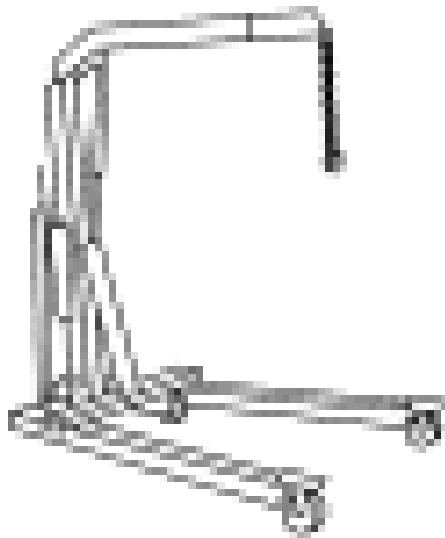
ST1376-A

Compressor, Piston Ring 303-D032 (D81L-6002-C)



ST1214-A

Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)



ST1341-A

Heavy Duty Floor Crane 014-00071 or equivalent

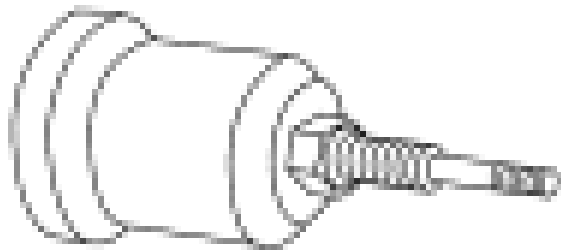
2010 Mercury Milan

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ST3054-A

Holding Tool, Crankshaft Damper 303-1416

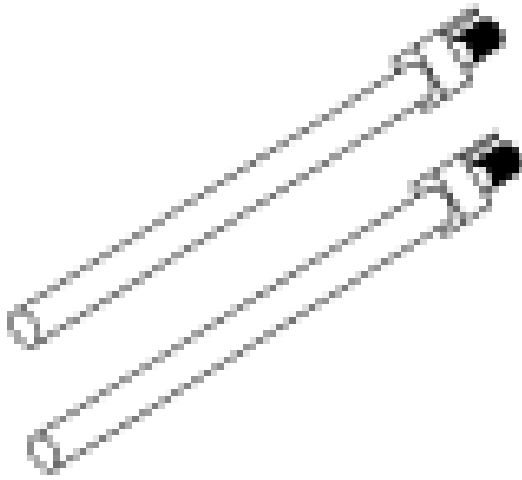


ST1917-A

Installer, Camshaft Front Oil Seal 303-096
(T74P-6150-A)

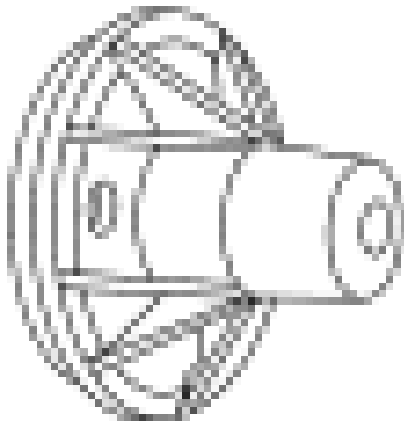
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1982-A

Installer, Connecting Rod 303-462 (T94P-6136-AH)

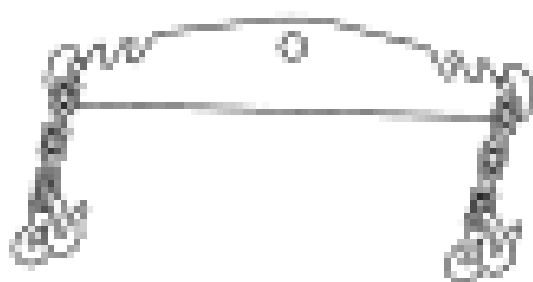


ST1506-A

Installer, Crankshaft Rear Main Oil Seal 303-328 (T88P-6701-B1)

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ST1602-A

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



ST2638-A

Timing Peg, Crankshaft TDC 303-507

General Equipment

GENERAL EQUIPMENT TABLE

6 mm x 18 mm bolt

Material

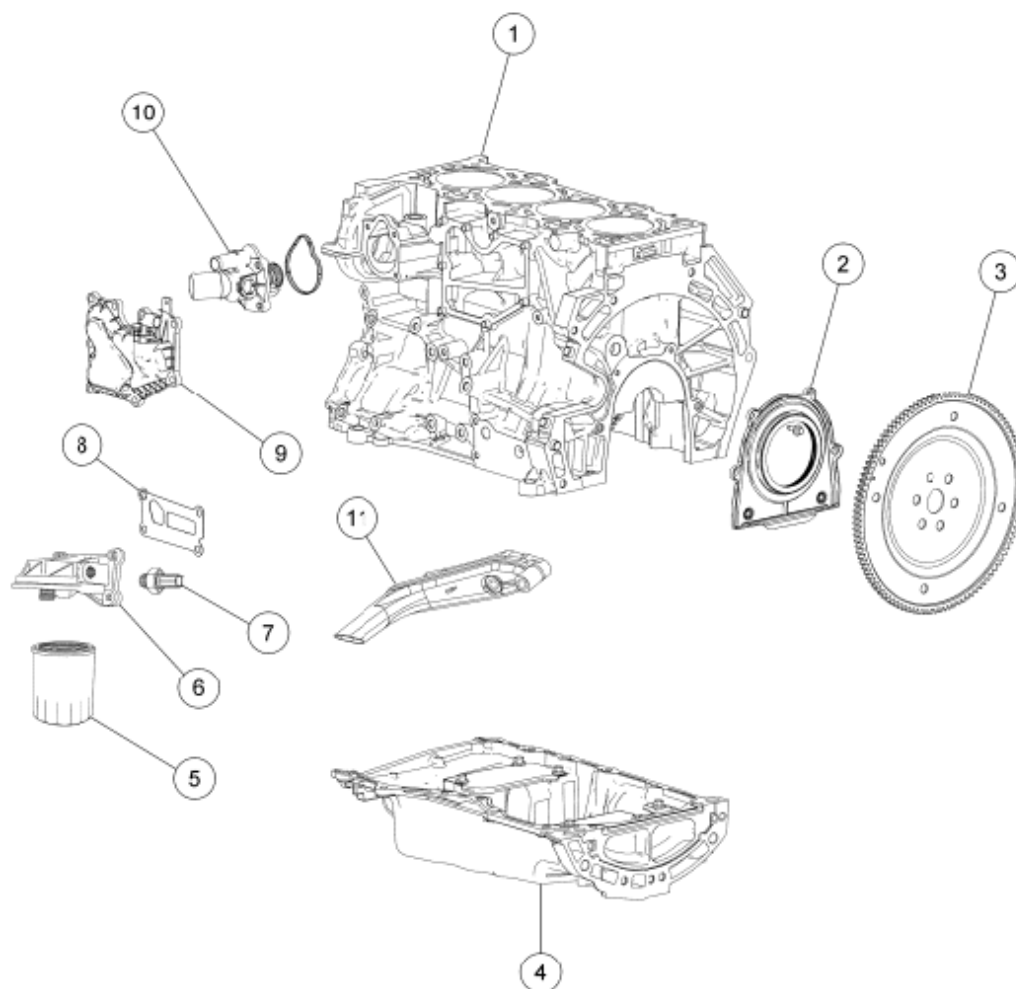
MATERIAL SPECIFICATIONS TABLE

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease XG-11	WSS-M1C267-A1
Motorcraft® Metal Surface Prep ZC-31-A	-
Motorcraft® Premium Gold Engine Coolant with Bittering Agent (US); Motorcraft® Premium Gold Engine Coolant (Canada) VC-7-B (US); CVC-7-A (Canada); or equivalent (yellow color)	WSS-M97B51-A1
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Motorcraft® Specialty Green Engine Coolant with Bittering Agent (US); Motorcraft® Specialty Green Engine Coolant (Canada) VC-10-A (US); CVC-10-A (Canada)	WSS-M97B55-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Silicone Gasket and Sealant TA-30	WSEM4G323-A4
Silicone Gasket Remover ZC-30	-

Lower Engine Block (View 1)



N0096729

Fig. 411: Identifying Lower Engine Block (View 1)

Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

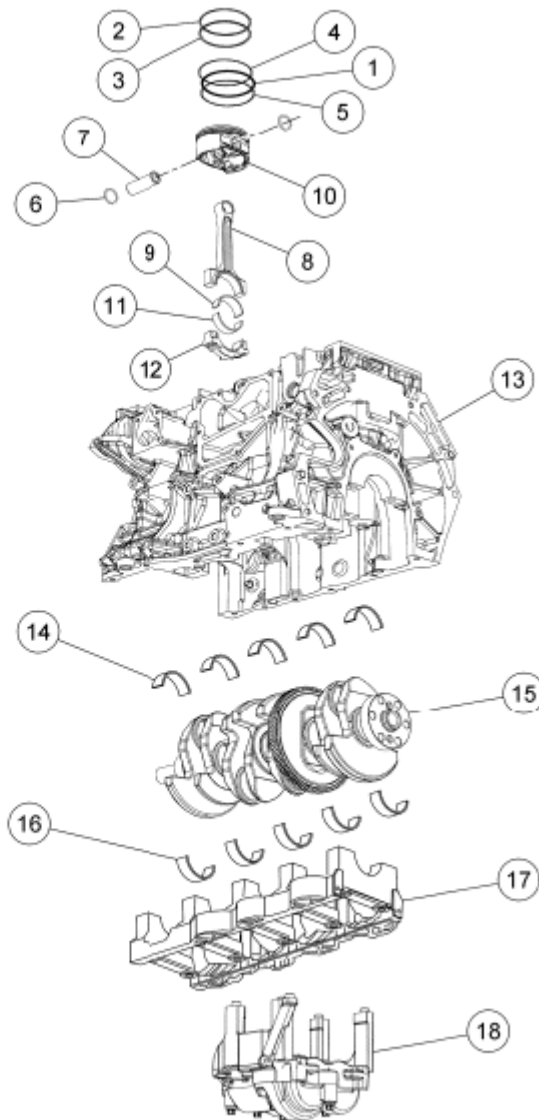
Item	Part Number	Description
1	6010	Cylinder block
2	6K318	Crankshaft rear oil seal and retainer
3	6477	Flywheel
4	6675	Oil pan
5	6714	Engine oil filter
6	6884	Oil filter adapter
7	9278	Engine Oil Pressure (EOP) switch
8	6A636	Oil filter adapter gasket
9	6A785	Crankcase vent oil separator

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10	8575	Thermostat assembly
11	6622	Oil pump screen and pickup tube

Lower Engine Block (View 2)



N0105927

Fig. 412: Identifying Lower Engine Block (View 2)
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

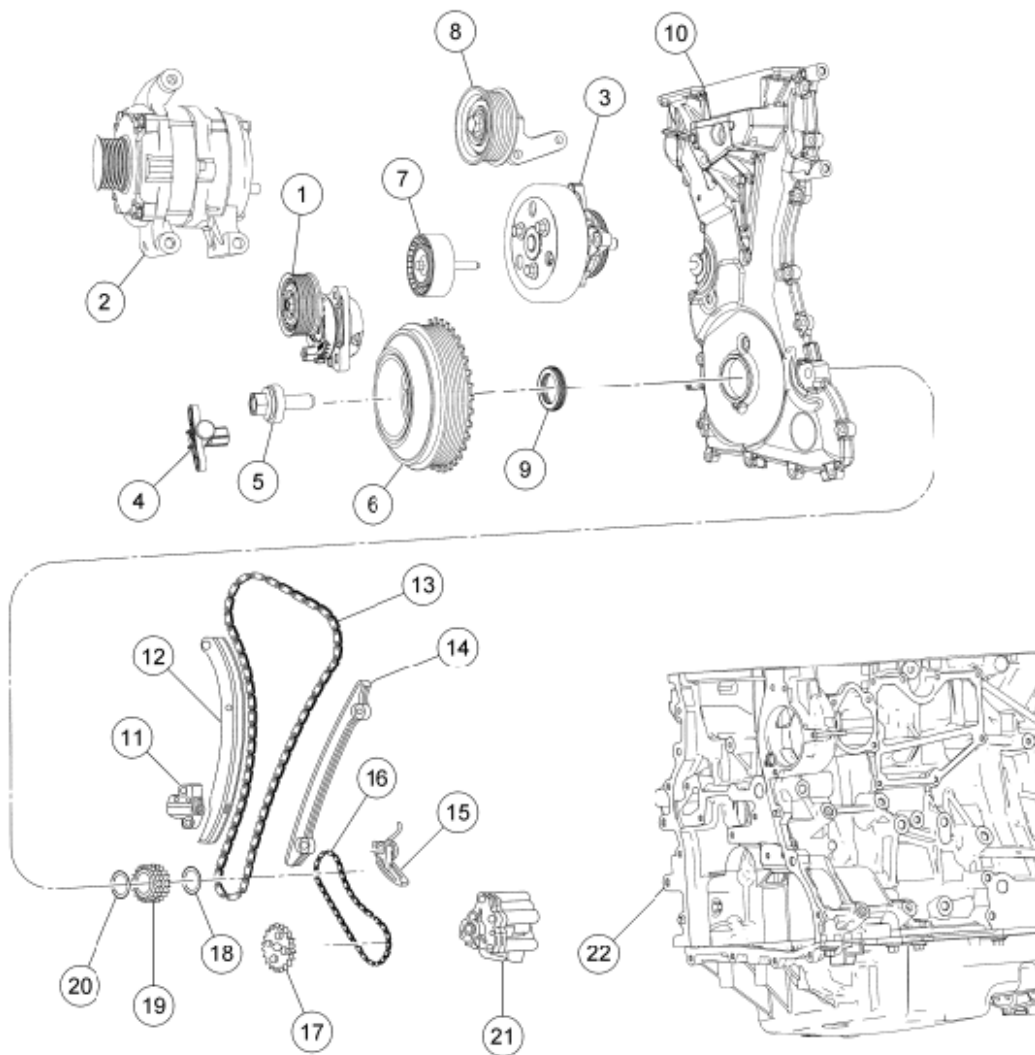
Item	Part Number	Description
1	6161	Piston oil control spacer (4 required)
2	6150	Piston compression upper ring (4 required)
3	6152	Piston compression lower ring (4 required)

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ

4	6159	Piston oil control upper segment ring (4 required)
5	6159	Piston oil control lower segment ring (4 required)
6	6140	Piston pin retainer (8 required)
7	6135	Piston pin (4 required)
8	6200	Connecting rod (4 required)
9	6211	Connecting rod upper bearing (4 required)
10	6110	Piston (4 required)
11	6211	Connecting rod lower bearing (4 required)
12	6210	Connecting rod cap (4 required)
13	6010	Cylinder block
14	6333	Cylinder block crankshaft main bearing (5 required)
15	6303	Crankshaft
16	6333	Crankshaft main bearing beam bearing (5 required)
17	6F098	Main bearing beam
18	6K360	Balance shaft assembly

Front Engine Block



N0085945

Fig. 413: Exploded View Of Front Engine Block Components
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

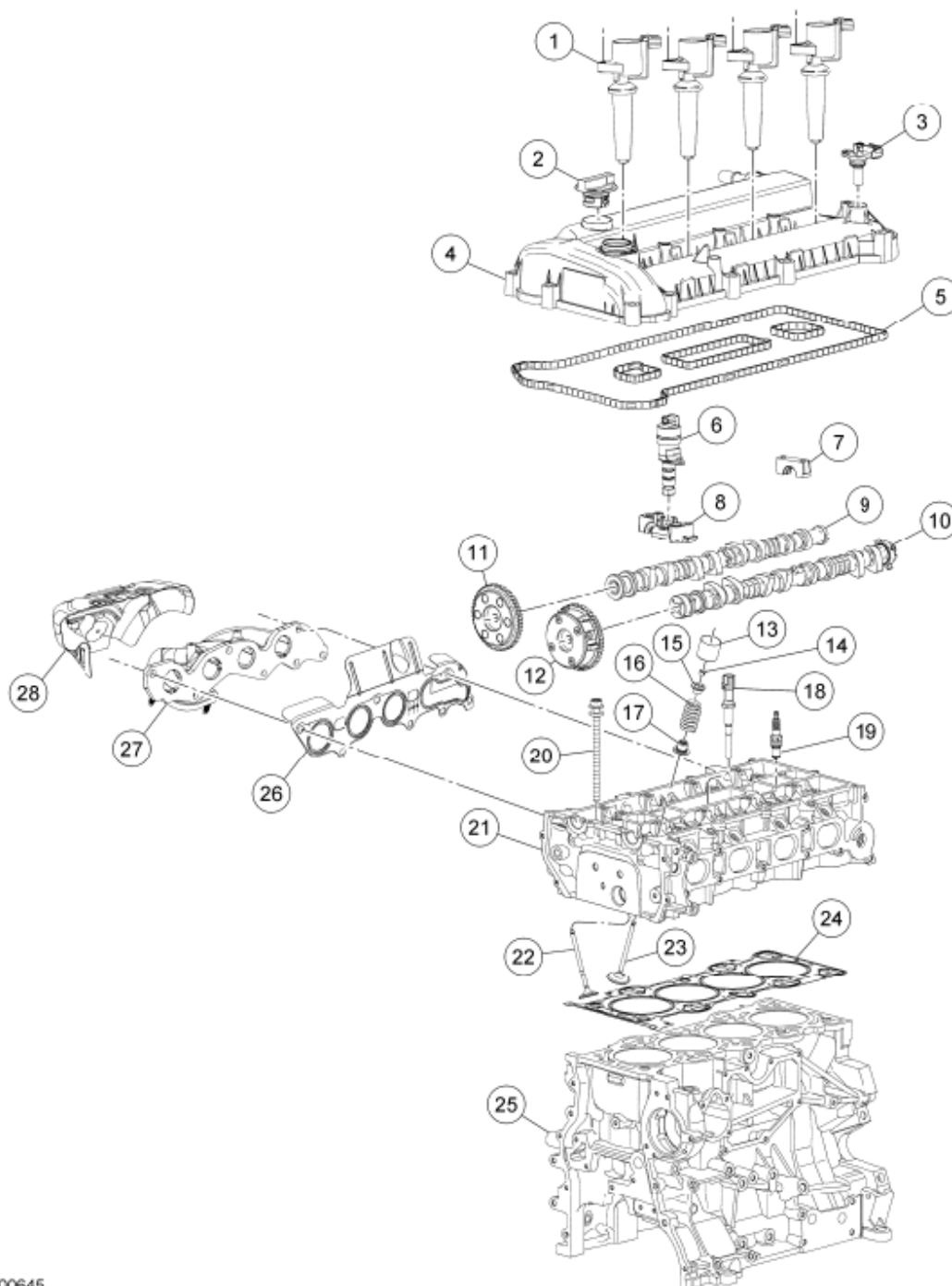
Item	Part Number	Description
1	6B209	Accessory drive belt tensioner
2	10300	Generator
3	8501	Coolant pump and pulley
4	6C315	Crankshaft Position (CKP) sensor
5	6A340	Crankshaft pulley bolt
6	6316	Crankshaft pulley
7	6C348	Smooth idler pulley
8	19A216	Idler pulley and bracket
9	6700	Crankshaft front seal

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1	6019	Engine front cover
10	6K254	Timing chain tensioner
11	6K255	Timing chain tensioner arm
13	6268	Timing chain
14	6K297	Timing chain guide
15	6C271	Oil pump chain tensioner
16	6A895	Oil pump chain
17	6652	Oil pump drive gear
18	6378	Diamond washer
19	6306	Crankshaft sprocket
20	6378	Diamond washer
21	6600	Oil pump
22	6010	Cylinder block

Cylinder Head



N0100645

Fig. 414: Exploded View Of Cylinder Head
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

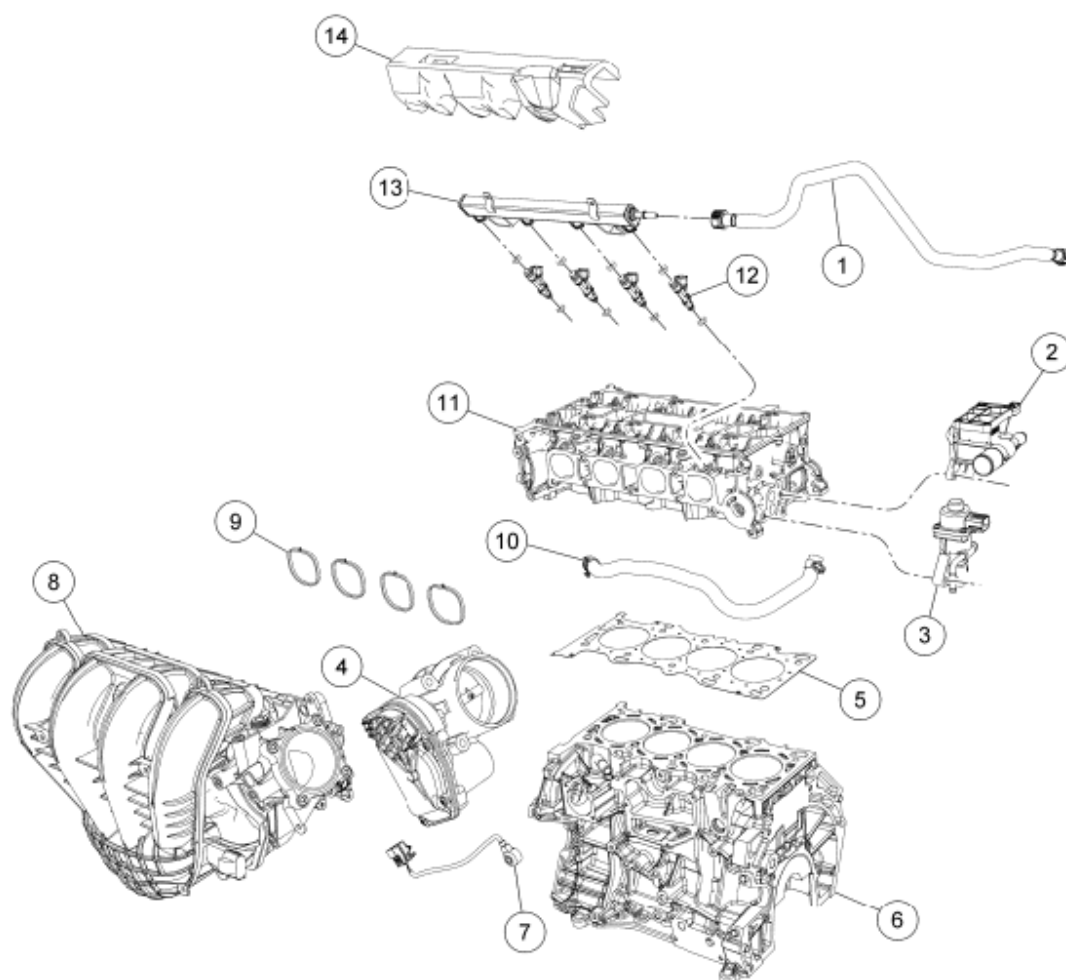
Item	Part Number	Description
1	12A366	Coil-on-plug assembly (4 required)
2	6766	Oil filler cap

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3	12K073	Camshaft Position (CMP) sensor
4	6M293	Valve cover
5	6M293	Valve cover gasket
6	6M280	Variable Camshaft Timing (VCT) solenoid
7	6A284	Camshaft bearing cap (9 required)
8	6A258	Camshaft bearing cap
9	6A272	Camshaft (exhaust)
10	6A271	Camshaft (intake)
11	6C251	Camshaft sprocket
12	6C525	VCT actuator
13	6500	Valve tappet (16 required)
14	6518	Valve collet (16 required)
15	6514	Valve spring retainer (16 required)
16	6513	Valve spring (16 required)
17	6A517	Valve stem seal (16 required)
18	6G004	Cylinder Head Temperature (CHT) sensor
19	12405	Spark plug (4 required)
20	6065	Cylinder head bolt (10 required)
21	6049	Cylinder head
22	6505	Exhaust valve (8 required)
23	6507	Intake valve (8 required)
24	6051	Head gasket
25	6010	Cylinder block
26	9448	Exhaust manifold gasket
27	9430	Exhaust manifold
28	9N454	Exhaust manifold heat shield

Intake Manifold



N0096727

Fig. 415: Exploded View Of Intake Manifold
Courtesy of FORD MOTOR CO.

ITEM DESCRIPTION TABLE

Item	Part Number	Description
1	9288	Fuel supply tube
2	8K556	Coolant outlet
3	9D475	EGR valve
4	9F991	Throttle Body (TB)
5	6051	Cylinder head gasket
6	6010	Cylinder block
7	12A699	Knock Sensor (KS)
8	9424	Intake manifold
9	9439	Intake manifold gasket
10	8A582	Coolant bypass hose
11	6049	Cylinder head

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12	9F593	Fuel injector (4 required)
13	9H487	Fuel rail
14	-	Fuel rail insulator

NOTE: Do not loosen or remove the crankshaft pulley bolt without first installing the special tools as instructed in this procedure. The crankshaft pulley and the crankshaft timing sprocket are not keyed to the crankshaft. The crankshaft, the crankshaft sprocket and the pulley are fitted together by friction, using diamond washers between the flange faces on each part. For that reason, the crankshaft sprocket is also unfastened if the pulley bolt is loosened. Before any repair requiring loosening or removal of the crankshaft pulley bolt, the crankshaft and camshafts must be locked in place by the special service tools, otherwise severe engine damage can occur.

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

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

NOTE: Assembly of the engine requires various inspections/measurements of the engine components (engine block, crankshaft, connecting rods, pistons and piston rings). These inspections/measurements will aid in determining if the engine components will require replacement. For additional information, refer to ENGINE SYSTEM - GENERAL INFORMATION.

All vehicles

1. Install the 4 oil squirters.
 - Tighten to 4 Nm (35 lb-in).

NOTE: If the oil squirters are being reused, they must be installed in the same location as marked during disassembly.

NOTE: The front bulkhead does not have an oil squirter.

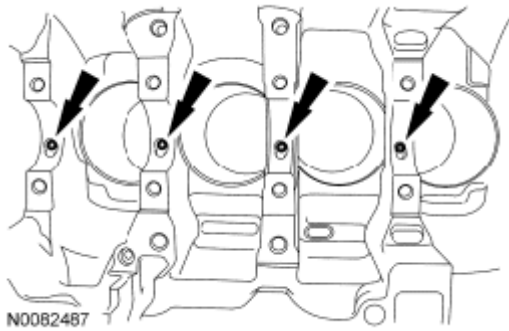


Fig. 416: Locating Oil Squirters
Courtesy of FORD MOTOR CO.

2. Measure each of the crankshaft main bearing journal diameters in at least 2 directions and record the smallest diameter for each journal.

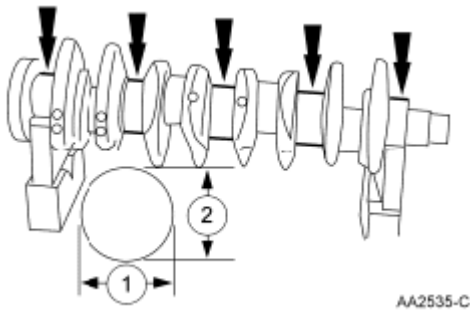


Fig. 417: Identifying Measuring Directions Of Crankshaft Main Bearing Journal Diameter
Courtesy of FORD MOTOR CO.

3. Position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear face of the engine block.

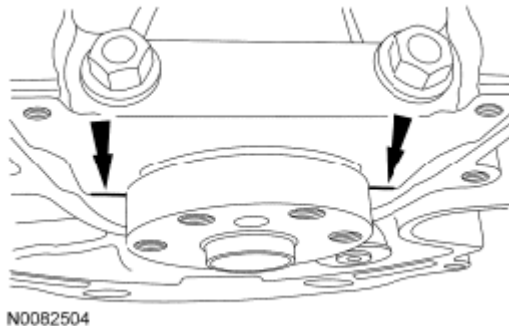


Fig. 418: Locating Main Bearing Beam
Courtesy of FORD MOTOR CO.

4. Using the original main bearing beam bolts, install and tighten the 10 main bearing beam bolts.

- Tighten the bolts in the sequence shown below in 3 stages.
- Stage 1: Tighten to 5 Nm (44 lb-in).
- Stage 2: Tighten to 25 Nm (18 lb-ft).
- Stage 3: Tighten an additional 90 degrees.

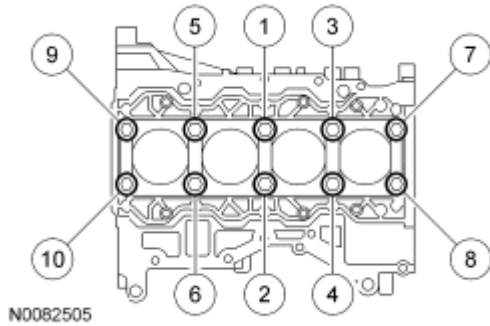


Fig. 419: Identifying Main Bearing Beam Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

5. Measure each crankshaft block main bearing bore diameter.
 - Remove the bolts and the main bearing beam.
 - Discard the main bearing beam bolts.

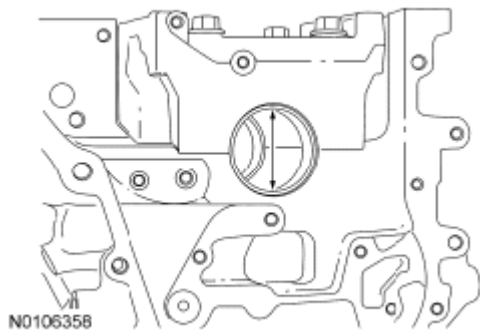


Fig. 420: Identifying Crankshaft Block Main Bearing Bore Diameter
Courtesy of FORD MOTOR CO.

6. Using the table below, select the crankshaft main bearings.

CRANKSHAFT BLOCK HOUSING (mm)

	57.018	.019	.020	.021	.022	.023	.024	.025	.026	.027	.028	.029	.030	.031	.032	.033	.034	.035	.036	.037	.038	.039	.040
5.978																							Upper: Blue + Green / 7
.979																							Lower: Blue + Green / 7
.980																							Upper: Blue + / 7 Green
.981																							Lower: Black / 6
.982																							Upper: Black / 6
.983																							Lower: Black / 6
.984																							Lower: Yellow / 5
.985																							Upper: Yellow / 5
.986																							Upper: Yellow / 5
.987																							Lower: Yellow / 5
.988																							Upper: Brown / 4
.989																							Lower: Brown / 4
.990																							Upper: Brown / 4
.991																							Lower: Red / 3
.992																							Upper: Red / 3
.993																							Lower: Red / 3
.994																							Upper: Blue / 2
.995																							Lower: Blue / 2
.996																							Upper: Blue / 2
.997																							Lower: Blue / 2
.998																							Upper: Green / 1
.999																							Lower: Green / 1
52.000																							Upper: Green / 1
.001																							Lower: Green / 1
.002																							

N0106488

Fig. 421: Crankshaft Main Bearings Table
Courtesy of FORD MOTOR CO.

7. Using the original connecting rod cap bolts, install the connecting caps and bolts.
 - Tighten the bolts in 2 stages.
 - Stage 1: Tighten to 29 Nm (21 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

8. Measure the connecting rod large end bore in 2 directions. Record the smallest measurement for each connecting rod.
 - Remove the bolts and the connecting rod cap.
 - Discard the connecting rod cap bolts.

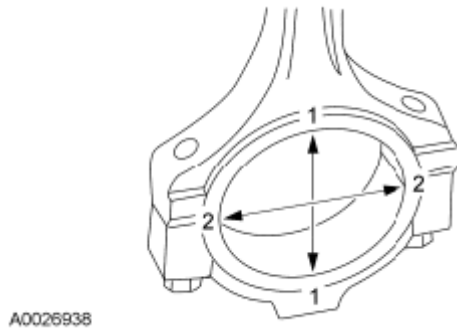


Fig. 422: Identifying Connecting Rod Large End Bore Measuring Directions
Courtesy of FORD MOTOR CO.

9. Measure each of the crankshaft connecting rod bearing journal diameters in at least 2 directions. Record the smallest measurement for each connecting rod journal.

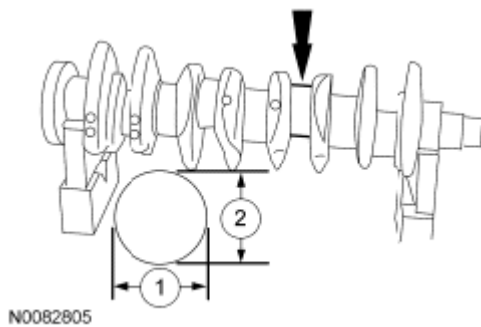


Fig. 423: Identifying Measuring Directions Of Crankshaft Connecting Rod Bearing Journal Diameters
Courtesy of FORD MOTOR CO.

10. Using the table below, select the correct connecting rod bearings for each crankshaft connecting rod journal.

CONNECTING ROD HOUSING (mm)

	53.023	53.024	53.025	53.026	53.027	53.028	53.029	53.030	53.031	53.032	53.033	53.034	53.035	53.036	53.037	53.038	53.039	53.040	53.041	53.042	53.043	53.044	53.045	53.046	53.047
49.978																									
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50.002																									

CRANKSHAFT (mm)

N0082501

Fig. 424: Connecting Rod Bearings Table
Courtesy of FORD MOTOR CO.

11. Lubricate the upper crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the cylinder block.

NOTE: Before assembling the cylinder block, all sealing surfaces must be free of chips, dirt, paint and foreign material. Also, make sure the coolant and oil passages are clear.

NOTE: If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.

NOTE: The center bulkhead is the thrust bearing.

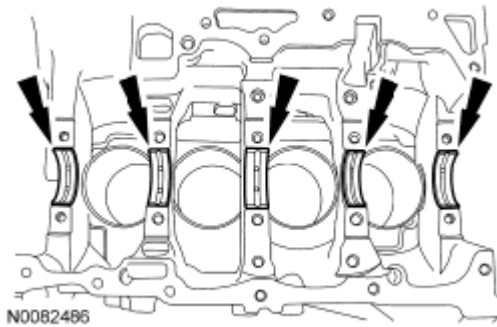


Fig. 425: Locating Upper Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

12. Lubricate the crankshaft main bearings with clean engine oil and install the 5 crankshaft main bearings in the main bearing beam.

NOTE: If reusing the crankshaft main bearings, install them in their original positions and orientation as noted during disassembly.

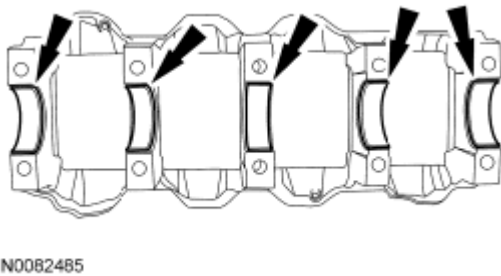


Fig. 426: Locating Crankshaft Main Bearings
Courtesy of FORD MOTOR CO.

13. Lubricate journals on the crankshaft with clean engine oil.
14. Position the crankshaft in the cylinder block.

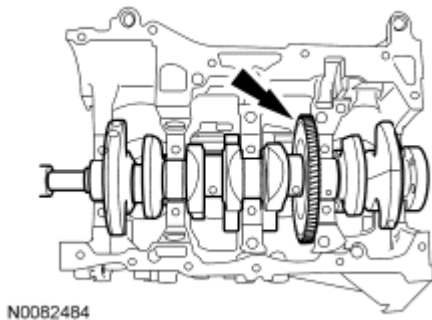


Fig. 427: Locating Crankshaft
Courtesy of FORD MOTOR CO.

15. Lubricate the 10 main bearing beam side fit surfaces (front 2 shown) with clean engine oil.

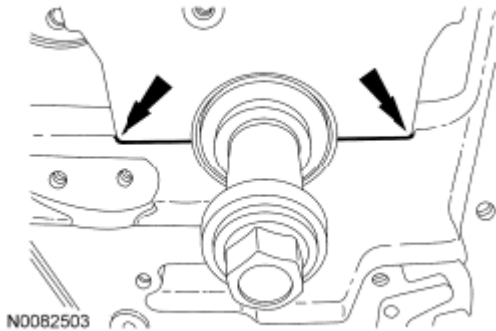


Fig. 428: Locating Main Bearing Beam Side Fit Surfaces
Courtesy of FORD MOTOR CO.

16. Lubricate the crankshaft bearing journals on the main bearing beam with clean engine oil. Then position the main bearing beam in the engine block with the main bearing beam mounted flush with the rear face of the engine block.

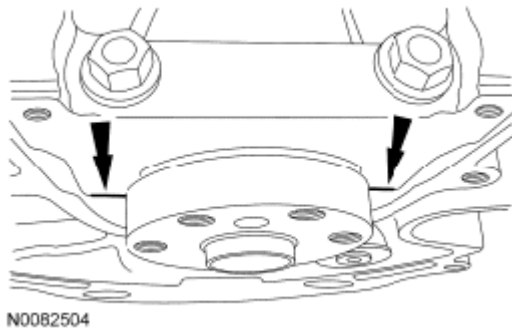


Fig. 429: Locating Main Bearing Beam
Courtesy of FORD MOTOR CO.

17. Install and tighten the 10 new main bearing beam bolts.
- Tighten the bolts in the sequence shown in 3 stages.
 - Stage 1: Tighten to 5 Nm (44 lb-in).
 - Stage 2: Tighten to 25 Nm (18 lb-ft).
 - Stage 3: Tighten an additional 90 degrees.

NOTE: Lubricate the main bearing beam bolts threads and under the bolt heads with clean engine oil.

NOTE: Position the crankshaft to the rear of the cylinder block, then position the crankshaft to the front of the cylinder block before tightening the main bearing beam bolts.

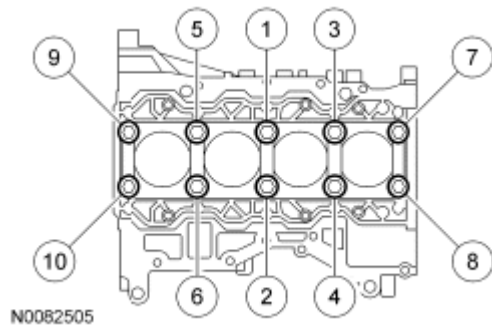


Fig. 430: Identifying Main Bearing Beam Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

18. Using the Dial Indicator Gauge with Holding Fixture, measure crankshaft end play.
 - Position the crankshaft to the rear of the cylinder block.
 - Zero the Dial Indicator Gauge with Holding Fixture.
 - Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.
 - Acceptable crankshaft end play is 0.22-0.43 mm (0.008-0.016 in). If the crankshaft end play exceeds the specified range, install new parts as necessary.

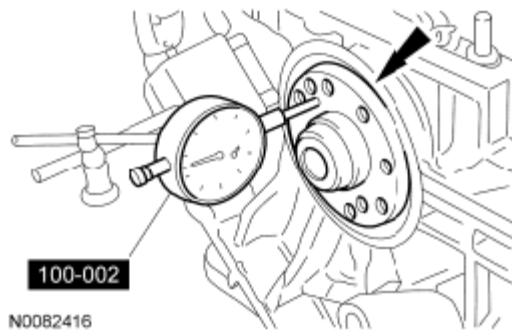


Fig. 431: Measuring Crankshaft End Play
Courtesy of FORD MOTOR CO.

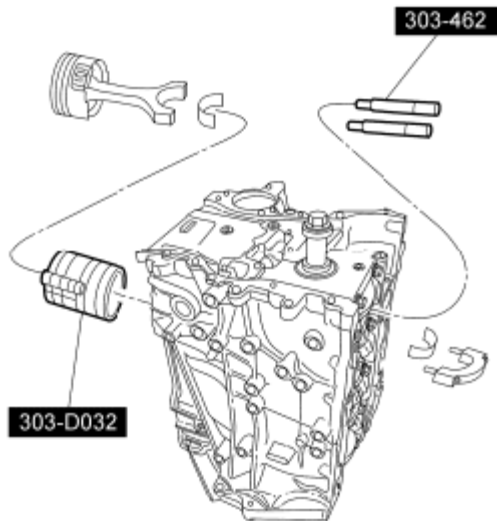
19. Using the Piston Ring Compressor and the Connecting Rod Installer, install the piston and connecting rod assemblies.
 - When installing the pistons and connecting rod assemblies, the oil ring gaps must be positioned 60 degrees apart from each other and a minimum of 90 degrees from the expander gap.
 - The position of the upper and lower compression ring gaps are not controlled for installation.

NOTE: Be sure not to scratch the cylinder wall or crankshaft journal with the connecting rod. Push the piston down until the connecting rod bearing seats on the crankshaft journal.

NOTE: Lubricate the pistons, piston rings, connecting rod bearings and the entire

cylinder bores with clean engine oil.

NOTE: Make sure the piston arrow on top is facing toward the front of the engine.



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Fig. 432: Identifying Piston Ring Compressor & Connecting Rod Installer
Courtesy of FORD MOTOR CO.

20. Install the connecting rod caps and the new bolts.

- Tighten the bolts in 2 stages.
- Stage 1: Tighten to 29 Nm (21 lb-ft).
- Stage 2: Tighten an additional 90 degrees.

NOTE: The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

NOTE: Install connecting rod caps and bolts on the connecting rods for cylinders 1 and 4 first and tighten. Then rotate crankshaft 180 degrees and install connecting rod caps and bolts on connecting rods for cylinders 2 and 3 and tighten.

NOTE: After installation of each connecting rod cap, rotate the crankshaft to verify smooth operation.

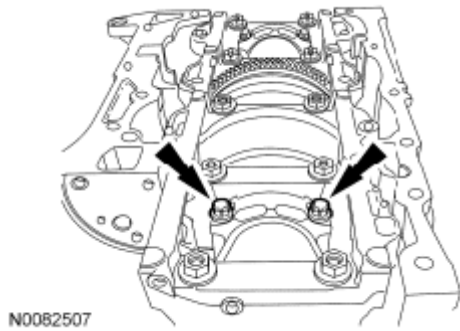


Fig. 433: Locating Connecting Rod Cap Bolts
Courtesy of FORD MOTOR CO.

21. Install the Crankshaft **TDC** Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft **TDC** Timing Peg. The engine is now at Top Dead Center (TDC).

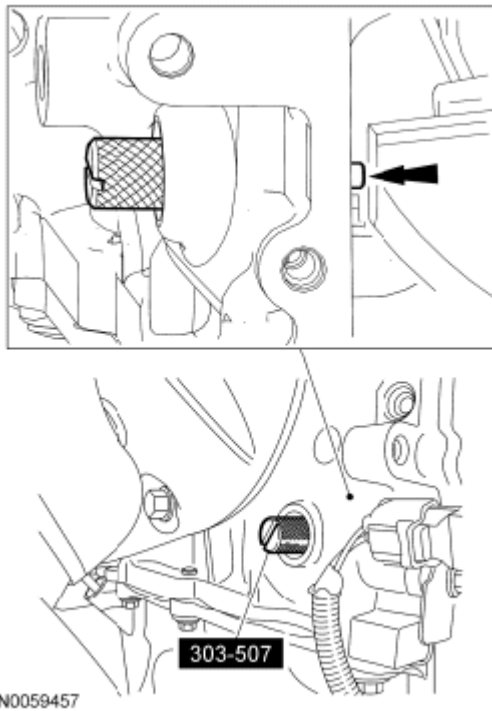


Fig. 434: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

22. Install the adjustment shims in their original position on the seat faces of the balancer unit.

NOTE: Due to the precision interior construction of the balancer unit, it should not be disassembled.

NOTE: The original adjustment shims must be installed in their original position.

NOTE: Confirm by visual inspection that there is no damage to the balancer unit gear and verify that the shaft turns smoothly. If there is any damage or malfunction, replace the balancer unit.

23. With the balancer unit shaft marks in the **TDC** position, slowly install the balancer unit to the cylinder block to avoid interference between the crankshaft drive gear and the balancer unit driven gear.

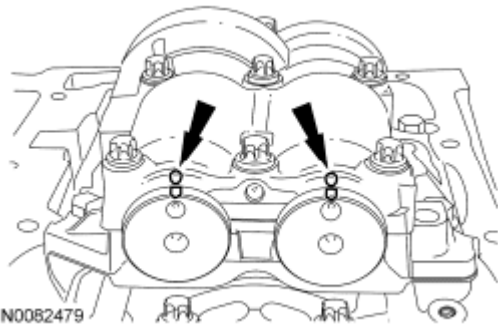


Fig. 435: Locating Balancer Unit & Shafts Reference Mark
Courtesy of FORD MOTOR CO.

24. Install the balancer unit bolts.
- Tighten in the sequence shown below in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten to 50 Nm (37 lb-ft).

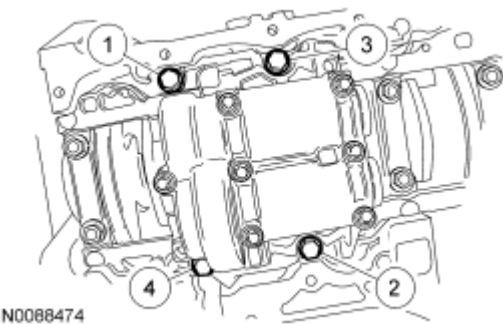


Fig. 436: Identifying Balancer Unit Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

25. Remove the Crankshaft **TDC** Timing Peg.

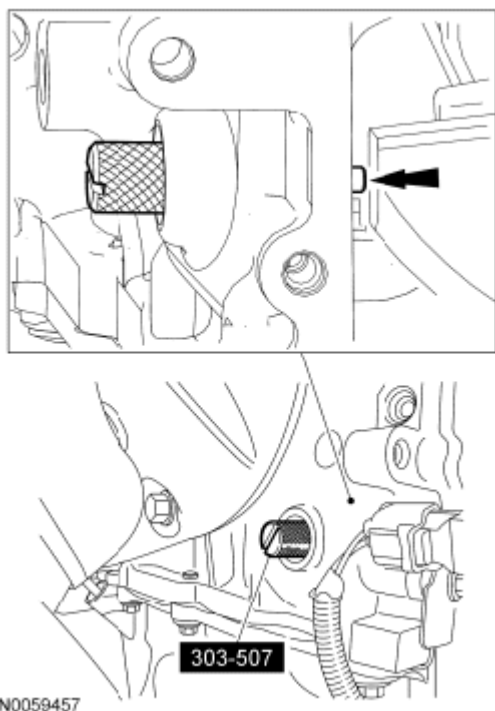


Fig. 437: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

26. Rotate the crankshaft to confirm that there are no meshing problems between the balancer unit gear and the crankshaft gear.
27. Install the Crankshaft **TDC** Timing Peg and rotate the crankshaft slowly clockwise until the crankshaft balance weight is up against the Crankshaft **TDC** Timing Peg.
 - Remove the Crankshaft **TDC** Timing Peg.

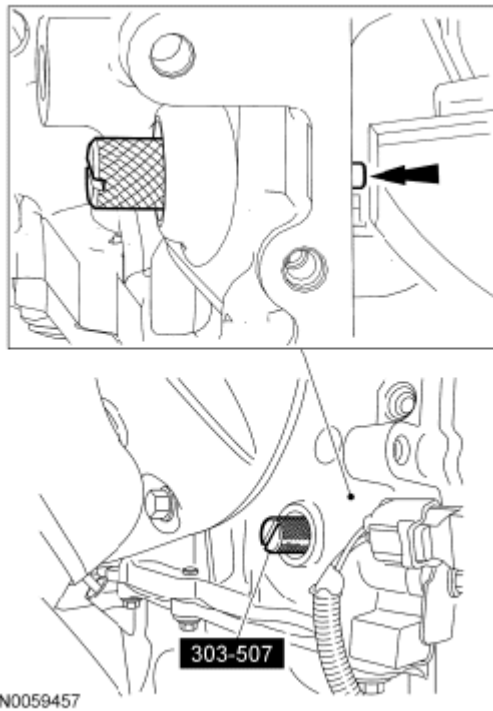


Fig. 438: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

28. Position the Dial Indicator Gauge with Holding Fixture as shown. Measure the gear backlash.
- Position the Dial Indicator Gauge with Holding Fixture (1) on the Allen wrench 80 mm (3.149 in) above the driven gear shaft center (2) on the balancer unit.
 - Rotate the crankshaft clockwise and measure the backlash at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees.
 - Backlash specifications are 0.005 to 0.101 mm (0.00019 to 0.0039 in).
 - If the backlash exceeds the specified range, carry out the balance shaft backlash procedure. For additional information, refer to **BALANCE SHAFT BACKLASH** procedure.

NOTE: Measure the backlash and verify that it is within specified range at all of the following 6 positions: 10 degrees, 30 degrees, 100 degrees, 190 degrees, 210 degrees and 280 degrees. It will be necessary to reset the measuring equipment between measurements.

NOTE: The measurement must be taken with the Dial Indicator Gauge with Holding Fixture, a 5-mm Allen wrench and worm clamp set up as shown. Mark the Allen wrench with a file 80 mm (3.149 in) above the driven gear shaft center. Make sure the worm clamp and Allen wrench are not touching the balance shaft housing.

NOTE: For an accurate measurement while measuring the gear backlash, insert a

screwdriver as shown into the crankshaft No. 1 crankweight area and set both the rotation and the thrust direction with the screwdriver, using a prying action as shown.

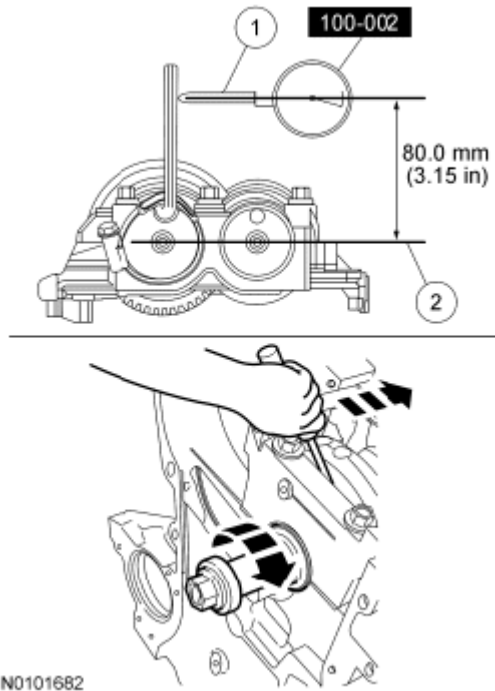


Fig. 439: Measuring Gear Backlash
Courtesy of FORD MOTOR CO.

29. Turn the crankshaft clockwise to position the No. 1 piston at Top Dead Center (TDC).

NOTE: Failure to position the No. 1 piston at Top Dead Center (TDC) can result in damage to the engine. Turn the engine in the normal direction of rotation only.

30. Install the Crankshaft TDC Timing Peg.

NOTE: The Crankshaft TDC Timing Peg will contact the crankshaft and prevent it from turning past TDC . However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position until the timing drive components and crankshaft pulley are installed.

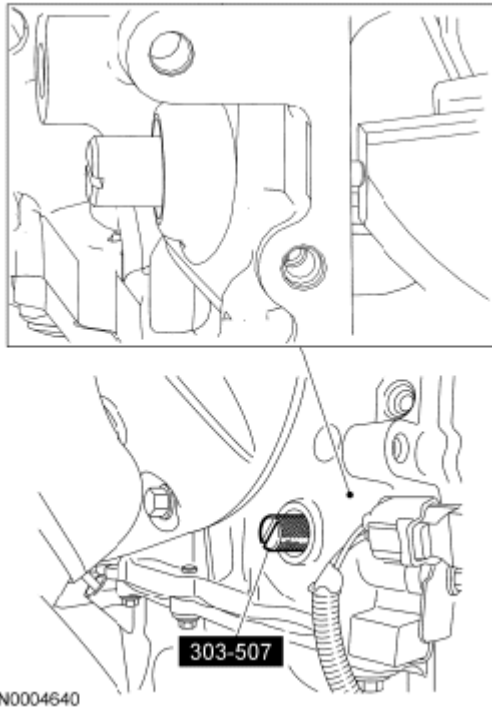


Fig. 440: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

31. Install the oil pump assembly. Tighten the 4 bolts in the sequence shown below in 2 stages:
- Stage 1: Tighten to 10 Nm (89 lb-in).
 - Stage 2: Tighten to 20 Nm (177 lb-in).

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

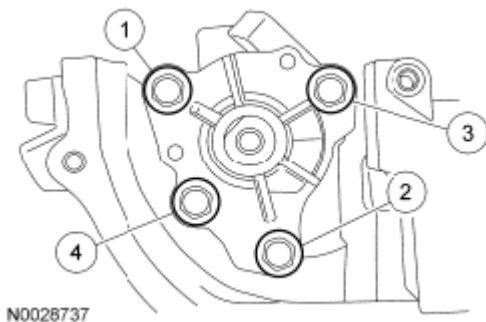


Fig. 441: Identifying Oil Pump Assembly Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

32. Install a new gasket, oil pump pickup tube and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).

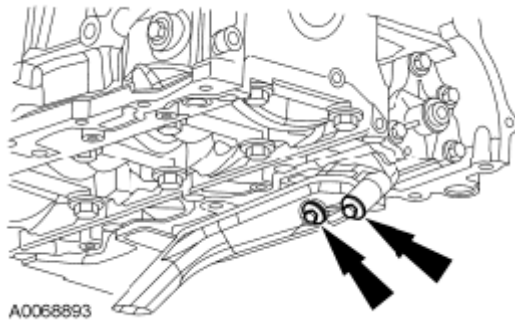


Fig. 442: Locating Oil Pump Pickup Tube Bolts
Courtesy of FORD MOTOR CO.

33. Using the Crankshaft Rear Main Oil Seal Installer, install the crankshaft rear main oil seal.

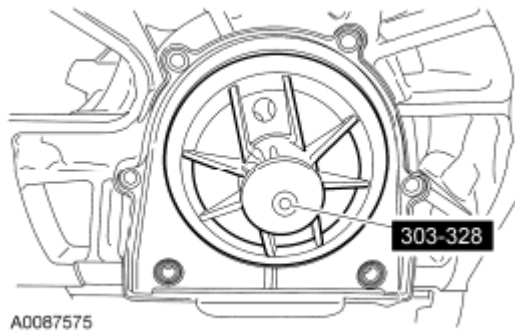


Fig. 443: Identifying Crankshaft Rear Main Oil Seal Installer
Courtesy of FORD MOTOR CO.

34. Tighten the 6 crankshaft rear main oil seal retainer plate bolts in the sequence shown below.
- To install, tighten to 10 Nm (89 lb-in).

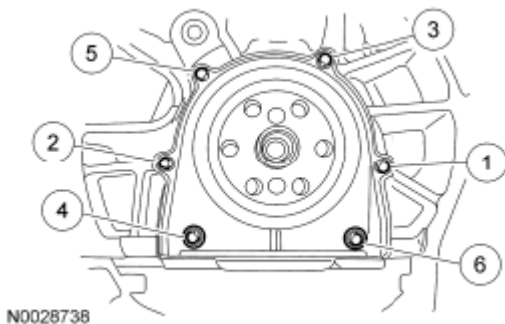


Fig. 444: Identifying Crankshaft Rear Oil Seal Retainer Plate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

35. Clean and inspect all mating surfaces.

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

36. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the oil pan.
- Position the oil pan onto the engine and install the 2 rear oil pan bolts finger-tight.

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

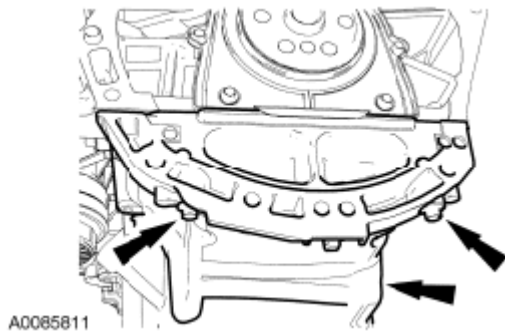
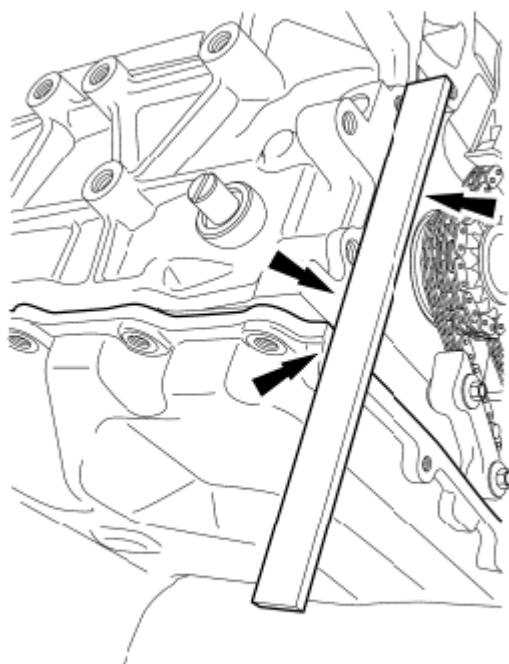


Fig. 445: Locating Oil Pan Bolts
Courtesy of FORD MOTOR CO.

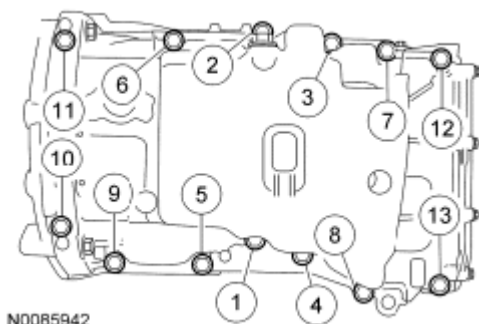
37. Using a suitable straight edge, align the front surface of the oil pan flush with the front surface of the engine block.



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Fig. 446: Aligning Front Surface Of Oil Pan Flush With Front Surface Of Engine Block
Courtesy of FORD MOTOR CO.

38. Install the remaining oil pan bolts.
 - Tighten in the sequence shown below to 20 Nm (177 lb-in).



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Fig. 447: Identifying Oil Pan Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

39. Install the 2 cylinder head alignment dowels. Dowels must be fully seated in the cylinder block.

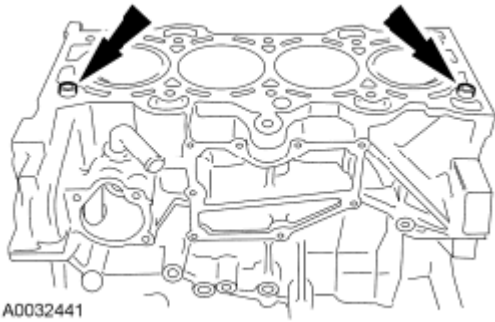


Fig. 448: Locating Cylinder Head Alignment Dowels
Courtesy of FORD MOTOR CO.

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

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

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

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

41. Apply silicone gasket and sealant to the locations shown.



Fig. 449: Locating Silicone Gasket & Sealant Application Points
Courtesy of FORD MOTOR CO.

42. Install a new head gasket.

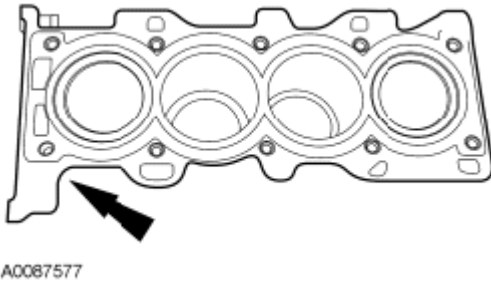


Fig. 450: Locating Head Gasket
Courtesy of FORD MOTOR CO.

43. Install the cylinder head and 10 new bolts. Tighten the bolts in the sequence shown in 5 stages:
- Stage 1: Tighten to 7 Nm (62 lb-in).
 - Stage 2: Tighten to 15 Nm (133 lb-in).
 - Stage 3: Tighten to 45 Nm (33 lb-ft).
 - Stage 4: Turn 90 degrees.
 - Stage 5: Turn an additional 90 degrees.

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

NOTE: Lubricate the bolts with clean engine oil prior to installation.

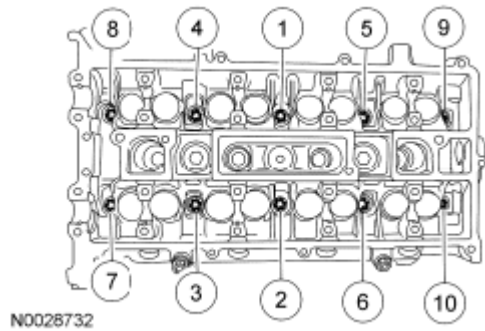


Fig. 451: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

44. Install the valve tappets.

NOTE: Coat the valve tappets with clean engine oil prior to installation.

45. Install the camshafts and bearing caps in their original locations and orientation. Tighten the bearing caps in the sequence shown in 3 stages:

- Stage 1: Tighten the camshaft bearing cap bolts until finger-tight.
- Stage 2: Tighten to 7 Nm (62 lb-in).
- Stage 3: Tighten to 16 Nm (142 lb-in).

NOTE: Install the camshafts with the alignment slots in the camshafts lined up so the Camshaft Alignment Plate can be installed without rotating the camshafts. Make sure the lobes on the No. 1 cylinder are in the same position as noted in the removal procedure. Rotating the camshafts when the timing chain is removed, or installing the camshafts 180 degrees out of position can cause severe damage to the valves and pistons.

NOTE: Lubricate the camshaft journals and bearing caps with clean engine oil.

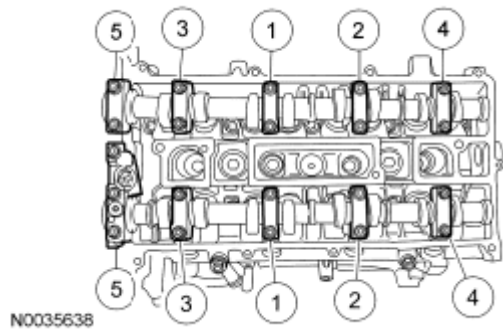


Fig. 452: Identifying Camshaft Bearing Cap Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

46. Install the Variable Camshaft Timing (VCT) system oil filter and the plug in the intake camshaft thrust cap.
- Tighten to 17 Nm (150 lb-in).

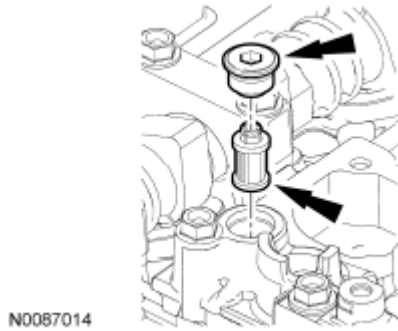


Fig. 453: Locating Plug & VCT System Oil Filter
Courtesy of FORD MOTOR CO.

47. Install the Variable Camshaft Timing (VCT) solenoid and the bolt.
- Tighten to 10 Nm (89 lb-in).

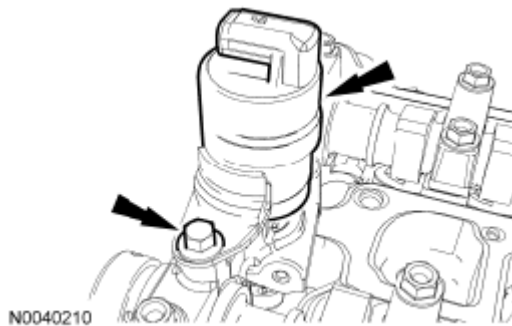


Fig. 454: Locating Bolt & Variable Camshaft Timing Solenoid
Courtesy of FORD MOTOR CO.

48. Install the crankshaft sprocket and new crankshaft sprocket diamond washers.
- The crankshaft sprocket flange must be facing away from the engine block.

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

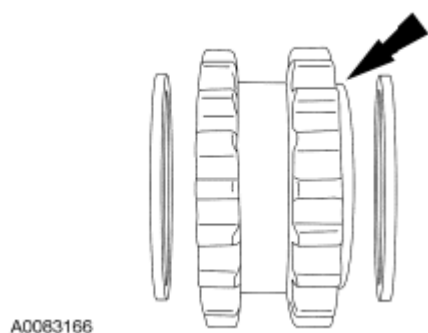


Fig. 455: Locating Crankshaft Sprocket & Diamond Washers
Courtesy of FORD MOTOR CO.

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

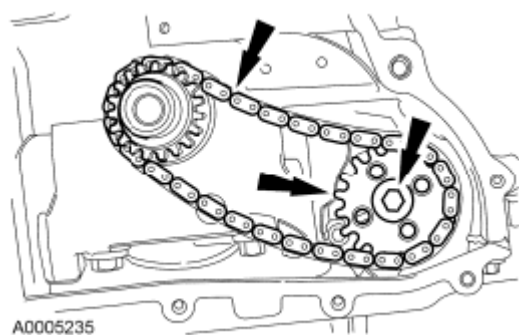


Fig. 456: Locating Oil Pump Drive Chain, Sprocket & Bolt
Courtesy of FORD MOTOR CO.

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

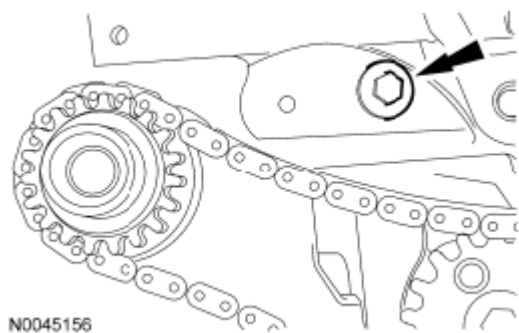


Fig. 457: Locating Oil Pump Drive Chain Tensioner Shoulder Bolt
Courtesy of FORD MOTOR CO.

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

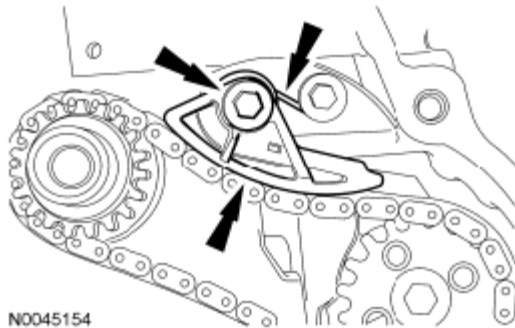


Fig. 458: Locating Oil Pump Drive Chain Tensioner, Bolt & Tensioner Spring
Courtesy of FORD MOTOR CO.

52. Install the Camshaft Alignment Plate in the slots on the rear of both camshafts.

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

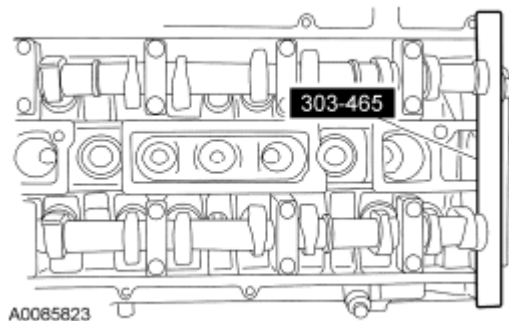


Fig. 459: Identifying Camshaft Alignment Plate In Slots On Rear Of Both Camshafts
Courtesy of FORD MOTOR CO.

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

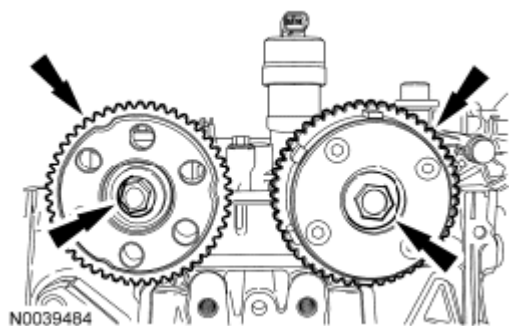


Fig. 460: Locating Camshaft Sprockets & Bolts
Courtesy of FORD MOTOR CO.

54. Install the timing chain guide and the 2 bolts.
 - Tighten to 10 Nm (89 lb-in).

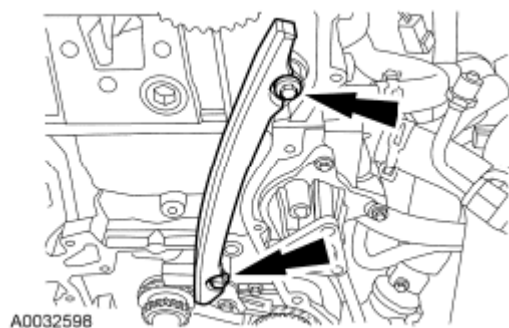


Fig. 461: Locating Bolts & Timing Chain Guide
Courtesy of FORD MOTOR CO.

55. Install the timing chain.

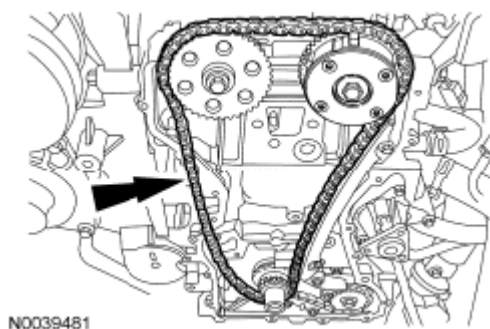


Fig. 462: Locating Timing Chain
Courtesy of FORD MOTOR CO.

56. Install the timing chain tensioner arm.

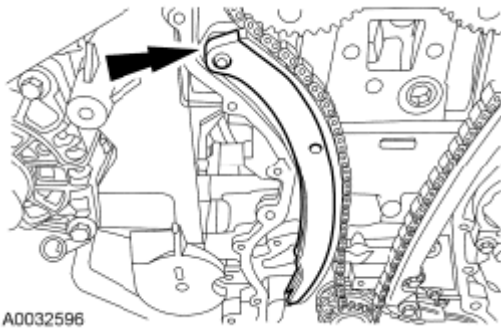


Fig. 463: Locating Timing Chain Tensioner Arm
Courtesy of FORD MOTOR CO.

NOTE: If the timing chain tensioner plunger and ratchet assembly are not pinned in the compressed position, follow the next 4 steps.

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

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

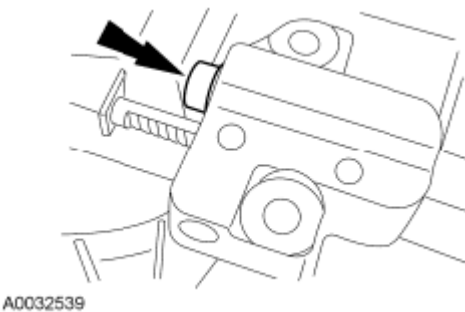


Fig. 464: Compressing Timing Chain Tensioner Plunger
Courtesy of FORD MOTOR CO.

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

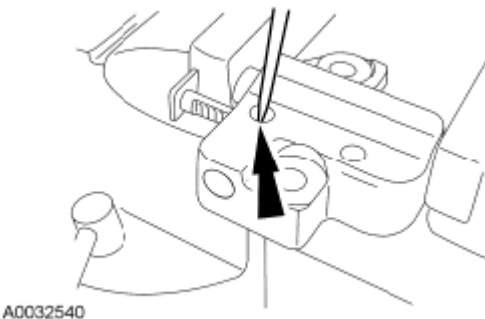


Fig. 465: Holding Ratchet Mechanism Using Small Pick
Courtesy of FORD MOTOR CO.

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

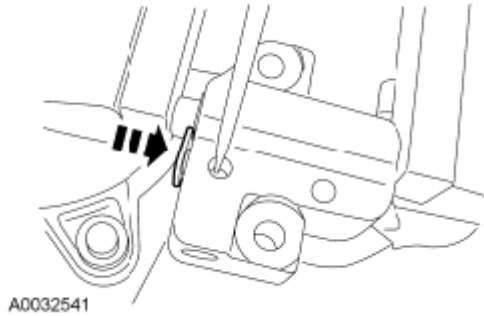


Fig. 466: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

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

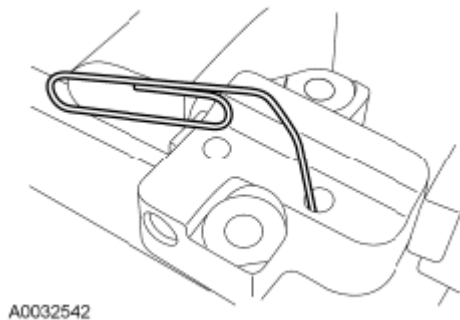


Fig. 467: Installing Paper Clip Into Hole In Tensioner Housing
Courtesy of FORD MOTOR CO.

61. Install the timing chain tensioner and the 2 bolts. Remove the paper clip to release the piston.
- Tighten to 10 Nm (89 lb-in).

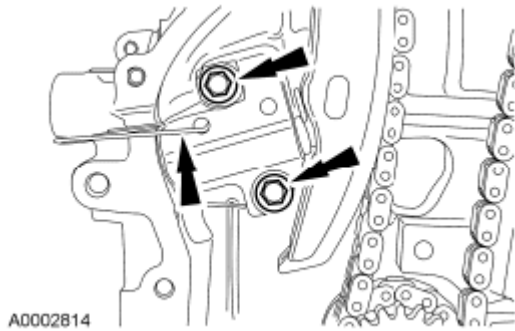


Fig. 468: Identifying Timing Chain Tensioner Bolts
Courtesy of FORD MOTOR CO.

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

NOTE: The Camshaft Alignment Plate is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

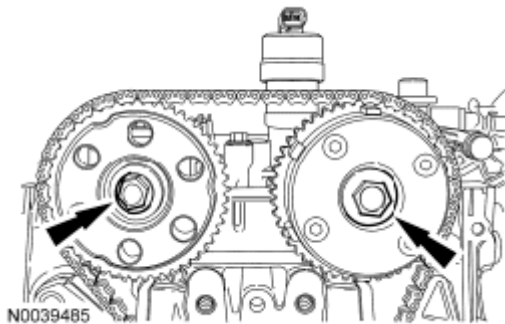


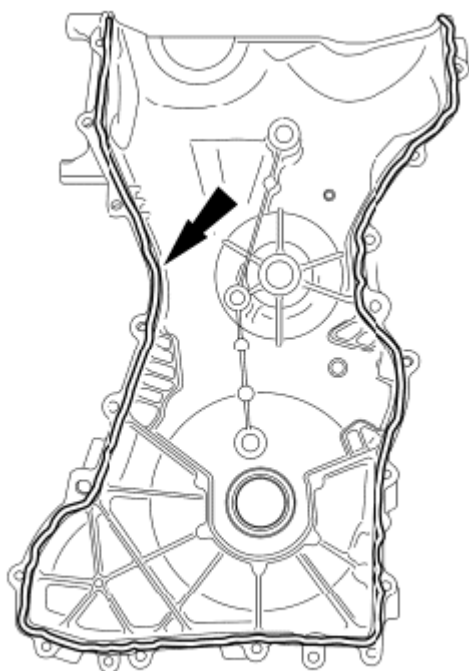
Fig. 469: Locating Camshaft Sprocket Bolts
Courtesy of FORD MOTOR CO.

63. Clean and inspect the mounting surfaces of the engine and the front cover.

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

64. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the cylinder head and oil pan joint areas. Apply a 2.5 mm (0.09 in) bead of silicone gasket and sealant to the front cover.

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



A0032803

Fig. 470: Locating Silicone Gasket & Sealant On Engine Front Cover
Courtesy of FORD MOTOR CO.

65. Install the engine front cover. Tighten the 22 bolts in the sequence shown below, to the following specifications:
- Tighten the 8-mm bolts to 10 Nm (89 lb-in).
 - Tighten the 13-mm bolts to 48 Nm (35 lb-ft).

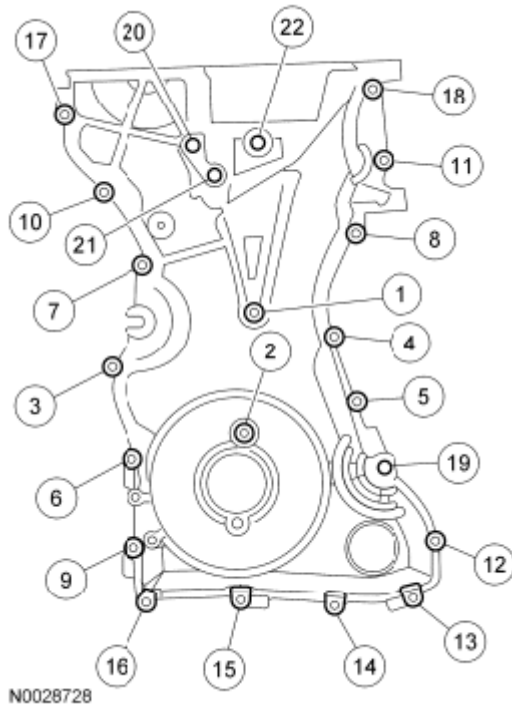


Fig. 471: Identifying Engine Front Cover Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

66. Using the Camshaft Front Oil Seal Installer, install a new crankshaft front oil seal.

NOTE: Remove the through bolt from the Camshaft Front Oil Seal Installer.

NOTE: Lubricate the oil seal with clean engine oil.

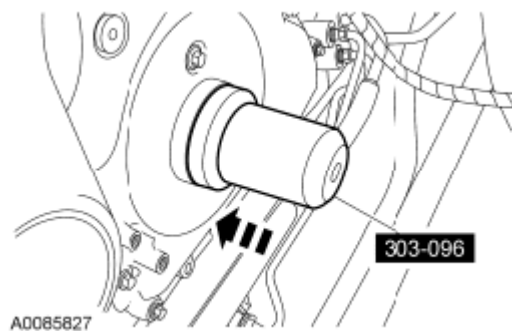


Fig. 472: Installing Crankshaft Front Oil Seal
Courtesy of FORD MOTOR CO.

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

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

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

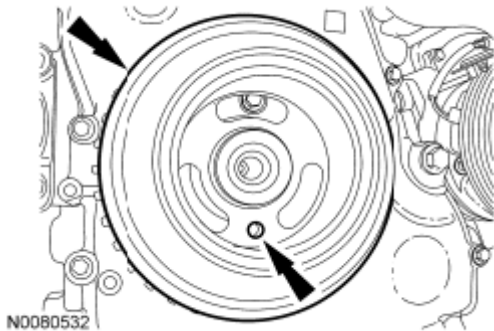


Fig. 473: Positioning Crankshaft Pulley Hole At 6 O'Clock Position
Courtesy of FORD MOTOR CO.

68. Install a standard 6 mm x 18 mm bolt through the crankshaft pulley and thread it into the front cover.

NOTE: Only hand-tighten the 6 mm bolt or damage to the front cover can occur.

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

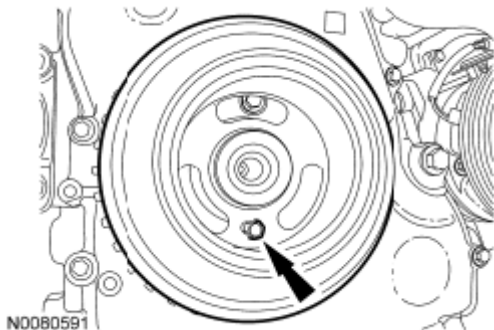


Fig. 474: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

69. Install a new crankshaft pulley bolt. Using the Crankshaft Damper Holding Tool to hold the crankshaft pulley in place, tighten the crankshaft pulley bolt in 2 stages:
- Stage 1: Tighten to 100 Nm (74 lb-ft).
 - Stage 2: Tighten an additional 90 degrees (one-fourth turn).

NOTE: The crankshaft must remain in the Top Dead Center (TDC) position during installation of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the Crankshaft Damper Holding Tool and the bolt should be installed using hand tools only.

NOTE: Do not reuse the crankshaft pulley bolt.

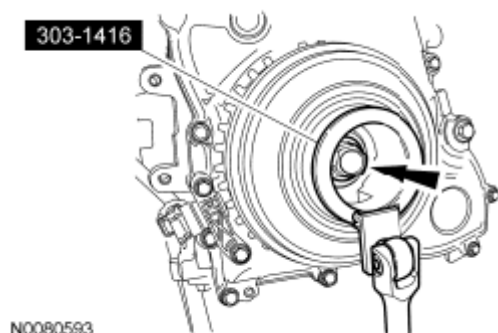


Fig. 475: Locating Crankshaft Pulley Bolt
Courtesy of FORD MOTOR CO.

70. Remove the 6 mm x 18 mm bolt.

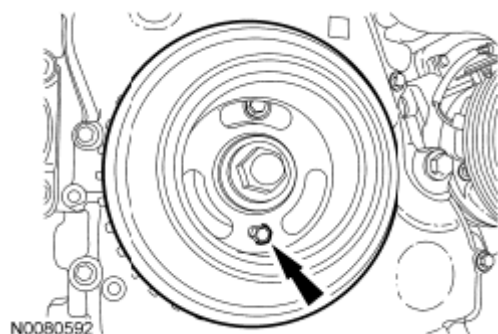


Fig. 476: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
Courtesy of FORD MOTOR CO.

71. Remove the Crankshaft TDC Timing Peg.



Fig. 477: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

72. Remove the Camshaft Alignment Plate.

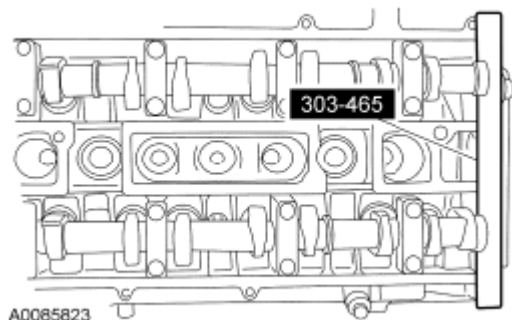


Fig. 478: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

73. Turn the crankshaft clockwise one and three-fourths turns.

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

74. Install the Crankshaft TDC Timing Peg.

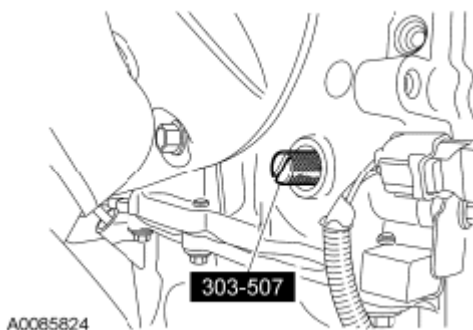
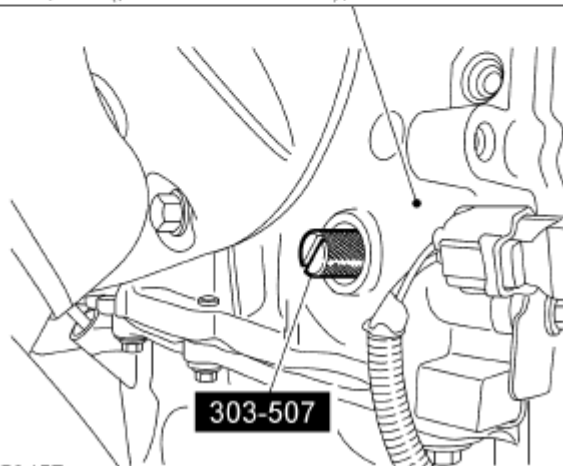
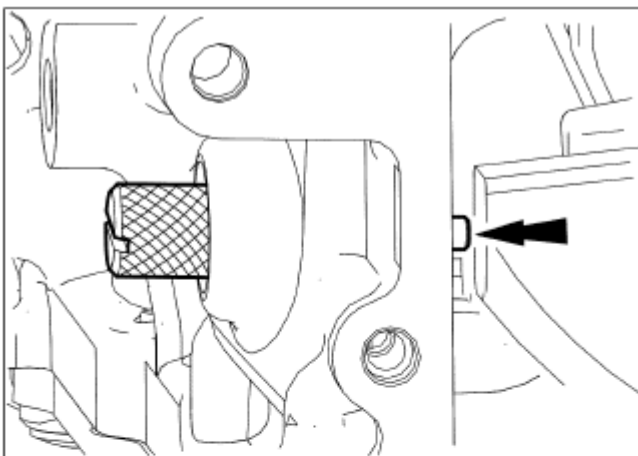


Fig. 479: Identifying Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

75. Turn the crankshaft clockwise until the crankshaft contacts the Crankshaft TDC Timing Peg.

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

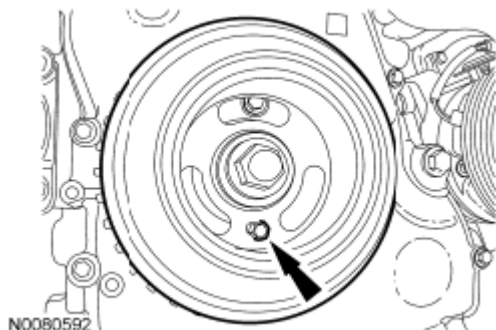


N0059457

Fig. 480: Installing Crankshaft TDC Timing Peg
Courtesy of FORD MOTOR CO.

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

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



N0080592

Fig. 481: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)

Courtesy of FORD MOTOR CO.

77. Install the Camshaft Alignment Plate to check the position of the camshafts.
- If it is not possible to install the Camshaft Alignment Plate, the engine valve timing must be corrected.

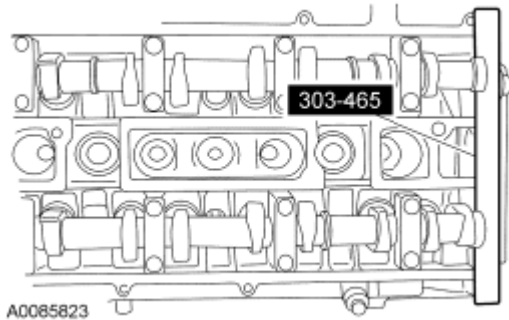


Fig. 482: Identifying Camshaft Alignment Plate In Slots On Rear Of Both Camshafts
Courtesy of FORD MOTOR CO.

78. Remove the Camshaft Alignment Plate.

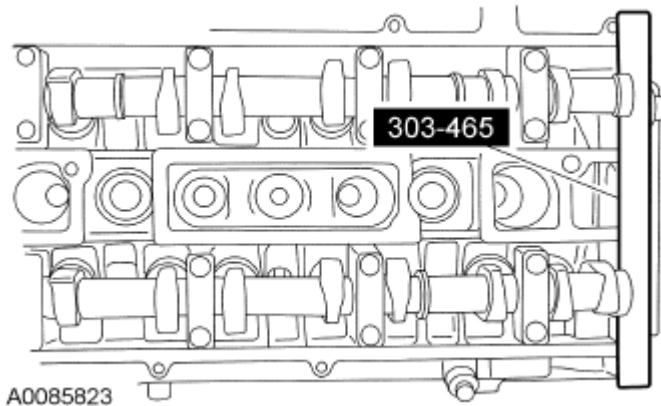


Fig. 483: Identifying Camshaft Alignment Plate
Courtesy of FORD MOTOR CO.

79. Install the Crankshaft Position (CKP) sensor and the 2 bolts.
- Do not tighten the bolts at this time.

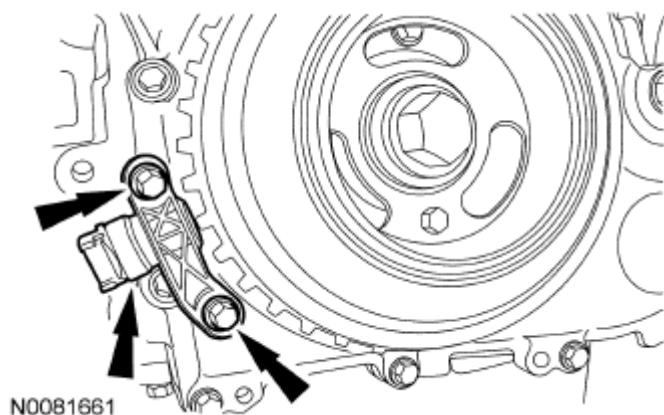


Fig. 484: Locating Bolts & CKP Sensor
Courtesy of FORD MOTOR CO.

80. Using the Crankshaft Sensor Aligner, adjust the **CKP** sensor.
 - Tighten the 2 **CKP** bolts to 7 Nm (62 lb-in).

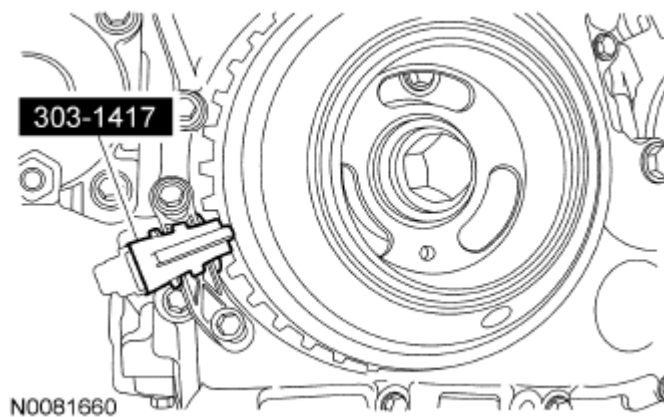


Fig. 485: Identifying Crankshaft Sensor Aligner
Courtesy of FORD MOTOR CO.

81. Remove the 6 mm x 18 mm bolt.

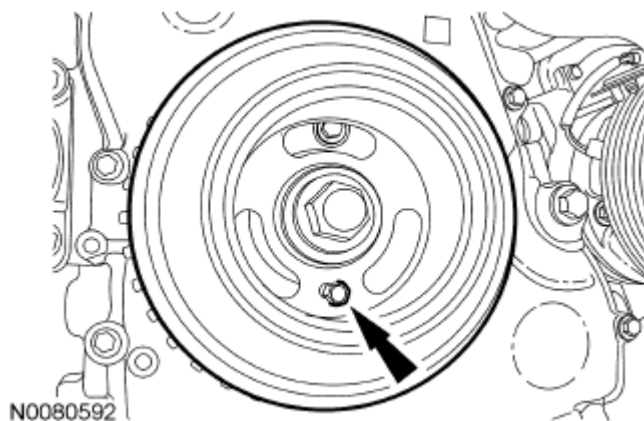


Fig. 486: Locating Crankshaft Pulley Hole Bolt (6 mm x 18 mm)
 Courtesy of FORD MOTOR CO.

82. Remove the Crankshaft TDC Timing Peg.

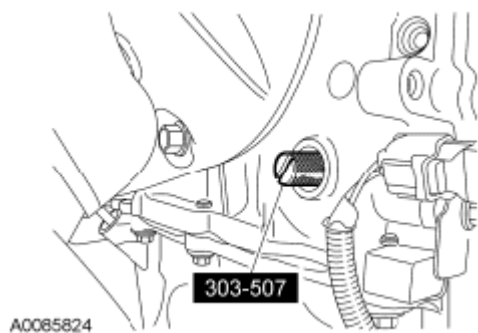


Fig. 487: Removing Crankshaft TDC Timing Peg
 Courtesy of FORD MOTOR CO.

83. Install the engine plug bolt.
- Tighten to 20 Nm (177 lb-in).

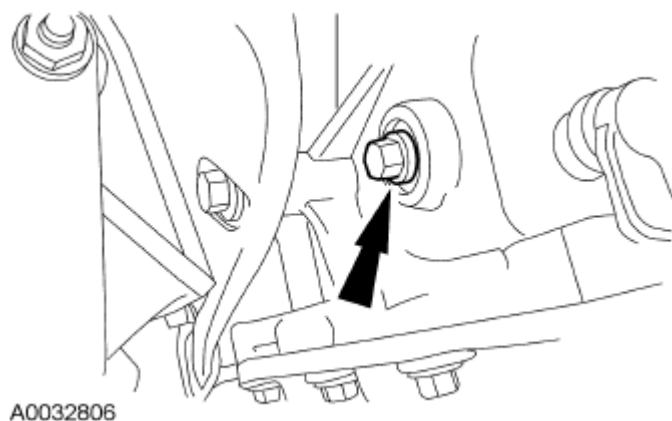


Fig. 488: Locating Engine Plug Bolt

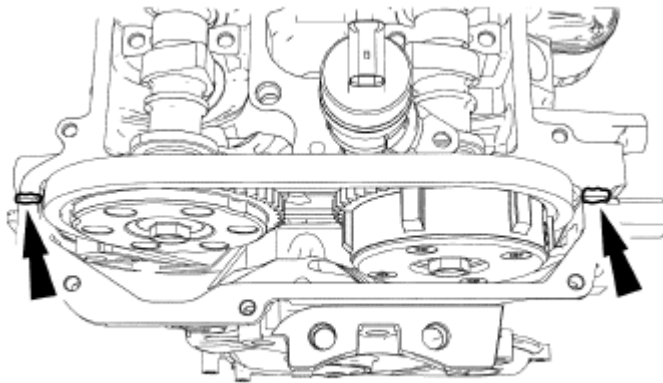
Courtesy of FORD MOTOR CO.

84. Clean the valve cover gasket surface with metal surface prep.

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

85. Apply silicone gasket and sealant to the locations shown below.

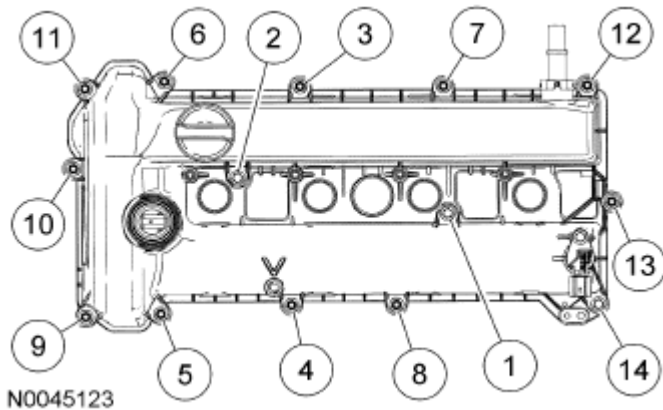
NOTE: The valve cover must be secured within 4 minutes of silicone gasket application. If the valve cover is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned with metal surface prep.



N0045151

Fig. 489: Locating Silicone Gasket & Sealant Applying Locations
Courtesy of FORD MOTOR CO.

86. Install the valve cover.
- Tighten the bolts in the sequence shown below to 10 Nm (89 lb-in).



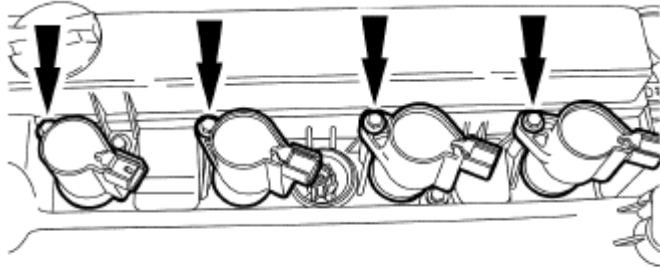
N0045123

Fig. 490: Identifying Valve Cover Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

87. Install the 4 coil-on-plugs and the 4 bolts.

- Tighten to 8 Nm (71 lb-in).

NOTE: Apply dielectric compound to the inside of the coil-on-plug boots.

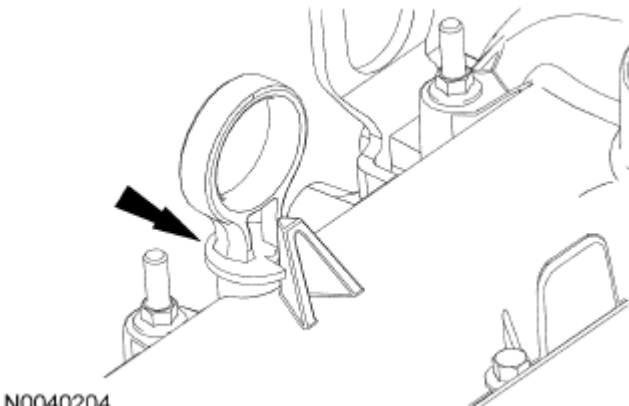


N0081185

Fig. 491: Locating Bolts & Coil-On-Plugs
Courtesy of FORD MOTOR CO.

88. Install the oil level indicator.

NOTE: Make sure the notch on the oil level indicator is aligned with the V-shaped boss on the valve cover and fully engaged into the valve cover.



N0040204

Fig. 492: Locating Oil Level Indicator
Courtesy of FORD MOTOR CO.

89. If equipped, install the block heater.

- Tighten to 40 Nm (30 lb-ft).

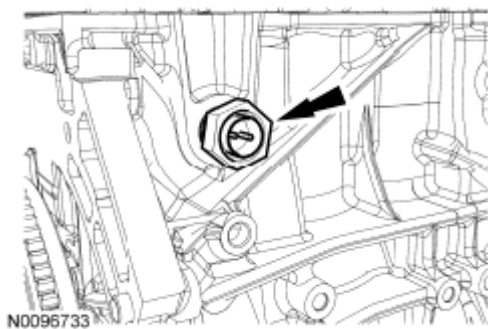


Fig. 493: Locating Block Heater
Courtesy of FORD MOTOR CO.

90. Install the crankcase vent oil separator and the 8 bolts.
- Tighten to 10 Nm (89 lb-in).

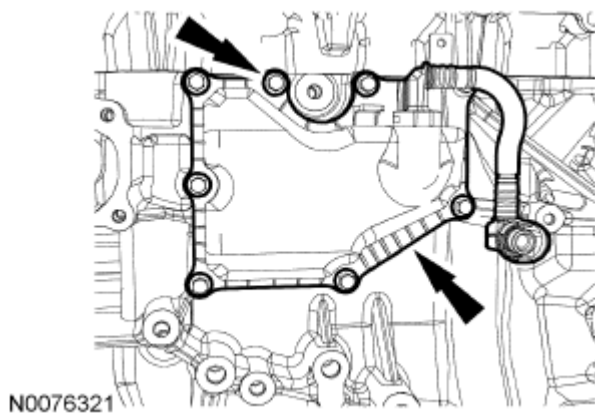


Fig. 494: Locating Bolts & Crankcase Vent Oil Separator
Courtesy of FORD MOTOR CO.

91. Install the KS and the bolt.
- Tighten to 20 Nm (177 lb-in).

NOTE: The Knock Sensor (KS) must not touch the crankcase vent oil separator.

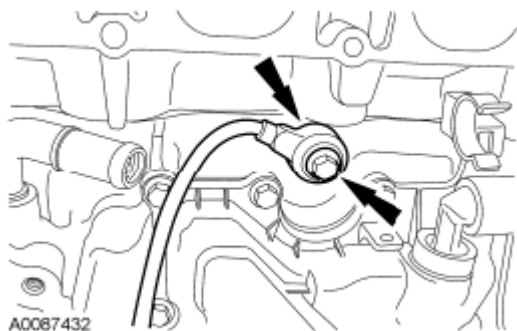


Fig. 495: Locating KS & Bolt
Courtesy of FORD MOTOR CO.

92. Install the coolant bypass hose on the coolant outlet.

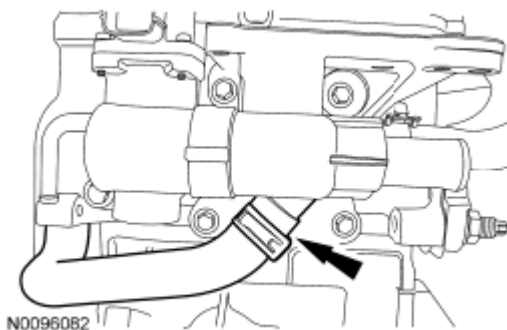


Fig. 496: Locating Coolant Bypass Hose On Coolant Outlet
Courtesy of FORD MOTOR CO.

93. Connect the coolant bypass hose.

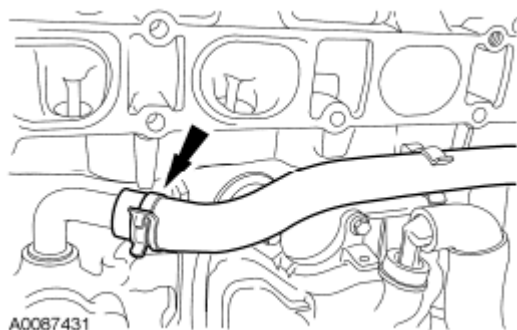


Fig. 497: Locating Coolant Bypass Hose
Courtesy of FORD MOTOR CO.

94. Install the EGR tube.
 - Tighten to 55 Nm (41 lb-ft).

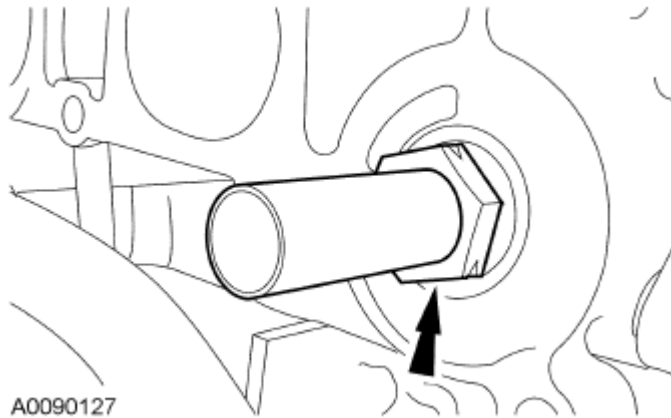


Fig. 498: Locating EGR Tube
Courtesy of FORD MOTOR CO.

95. Position the intake manifold and connect the crankcase vent oil separator tube.

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

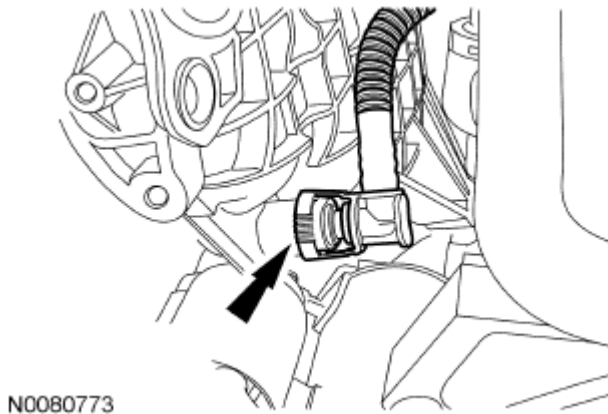


Fig. 499: Locating Crankcase Vent Oil Separator Tube
Courtesy of FORD MOTOR CO.

96. Install the intake manifold gaskets, intake manifold and the 7 bolts (3 shown).
- Tighten to 18 Nm (159 lb-in).

NOTE: Inspect and install new intake manifold gaskets, if necessary.

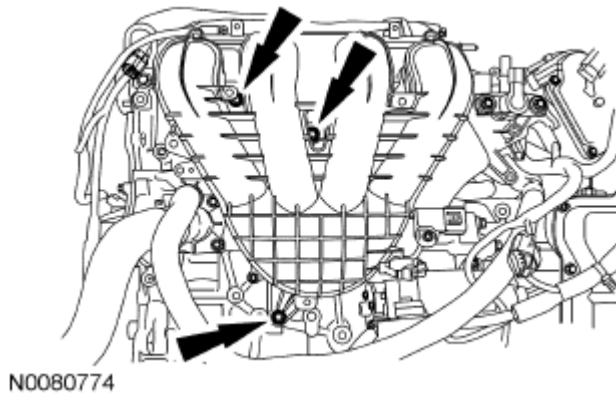


Fig. 500: Locating Intake Manifold Bolts
Courtesy of FORD MOTOR CO.

97. Install new fuel injector O-rings.
 - Separate the fuel injectors from the fuel rail.
 - Remove and discard the fuel injector O-rings.
 - Install new O-rings and lubricate with clean engine oil.
 - Install the fuel injectors onto the fuel rail.

NOTE: Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings can cause the fuel system to leak. Do not reuse the O-ring seals.

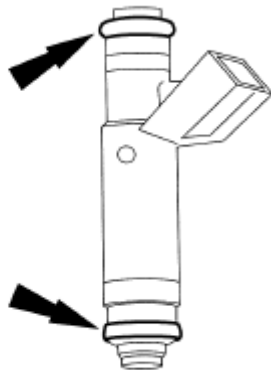


Fig. 501: Locating Fuel Injector O-Ring Seals
Courtesy of FORD MOTOR CO.

98. Install the fuel rail and injector assembly and the 2 stud bolts.
 - Tighten to 23 Nm (17 lb-ft).

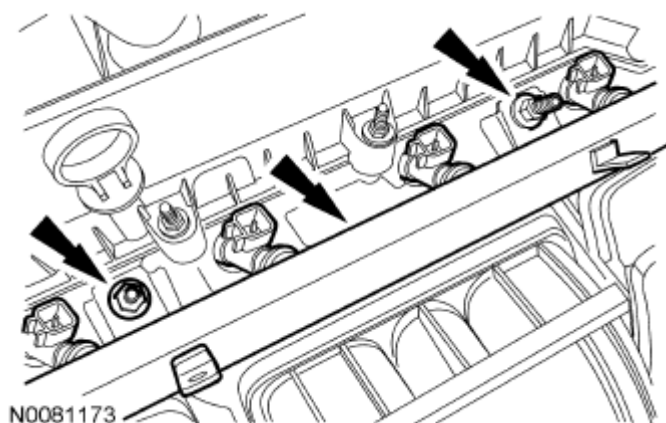


Fig. 502: Locating Stud Bolts, Fuel Rail & Fuel Injectors
Courtesy of FORD MOTOR CO.

99. Install the radio capacitor and nut.
- Tighten to 10 Nm (89 lb-in).

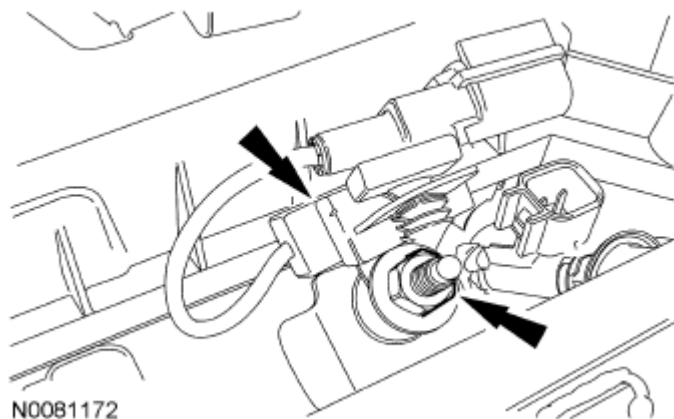


Fig. 503: Locating Nut & Radio Capacitor
Courtesy of FORD MOTOR CO.

100. Install the fuel rail insulator.

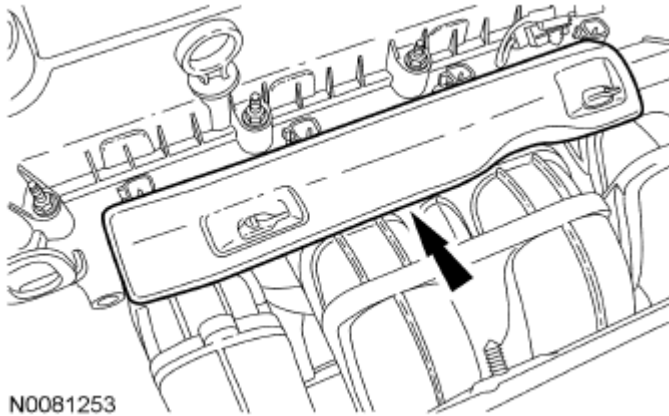


Fig. 504: Locating Fuel Rail Insulator
 Courtesy of FORD MOTOR CO.

101. Position the engine control wiring harness on the engine and connect the **CHT** sensor and install the rubber boot.

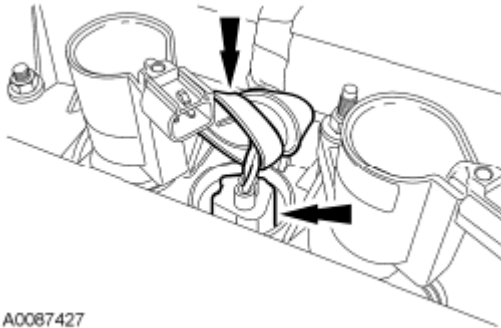


Fig. 505: Locating CHT Sensor & Rubber Boot
 Courtesy of FORD MOTOR CO.

102. Connect the 4 ignition coil-on-plugs and Camshaft Position (CMP) sensor electrical connectors.

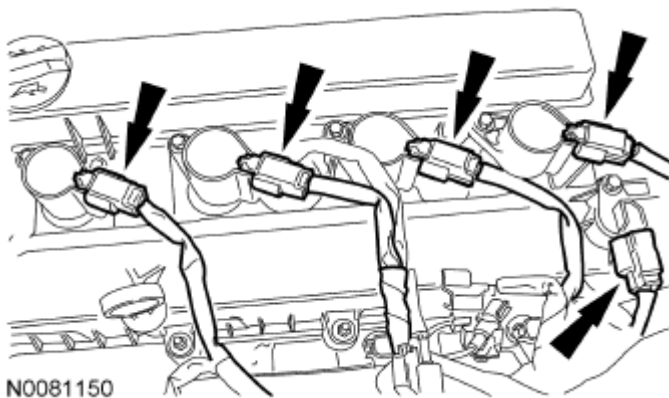


Fig. 506: Locating Ignition Coil-On-Plugs & Camshaft Position Sensor Electrical Connectors

Courtesy of FORD MOTOR CO.

103. Connect the 4 fuel injector electrical connectors.
- Attach the 2 wiring harness retainers.

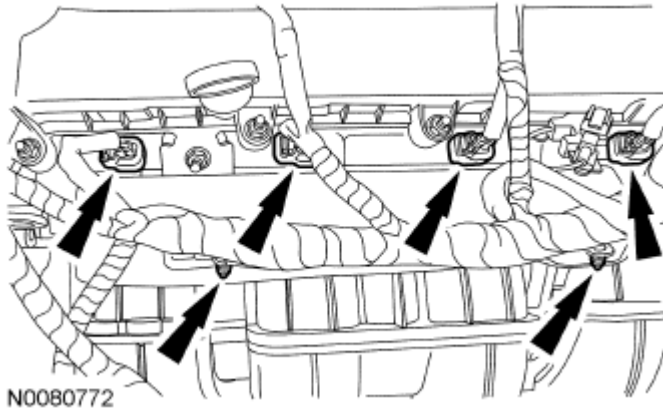


Fig. 507: Locating Fuel Injector Electrical Connectors
Courtesy of FORD MOTOR CO.

104. Connect the radio capacitor electrical connector.

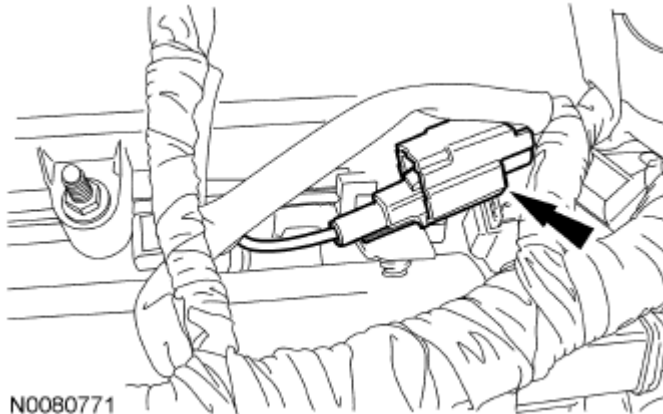


Fig. 508: Locating Radio Capacitor Electrical Connector
Courtesy of FORD MOTOR CO.

105. Connect the EGR valve electrical connector.

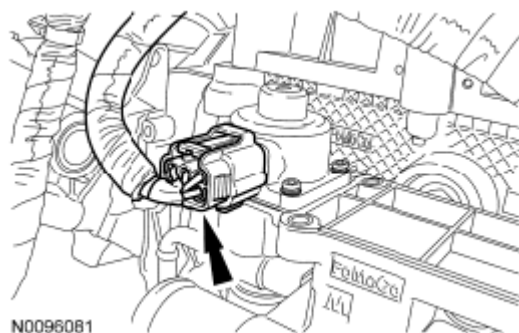


Fig. 509: Locating EGR Valve Electrical Connector
Courtesy of FORD MOTOR CO.

106. Attach the 2 wiring harness retainers to the intake manifold.

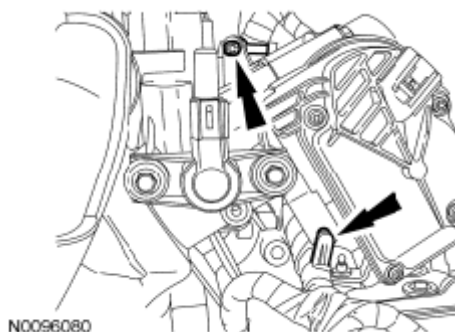


Fig. 510: Locating Intake Manifold Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

107. Connect the electronic throttle control and Evaporative Emission (EVAP) canister purge valve electrical connectors.

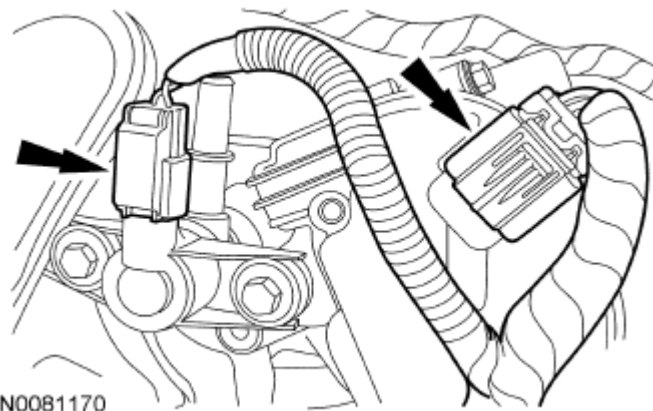


Fig. 511: Locating Electronic Throttle Control & Evaporative Emission Canister Purge Valve Electrical Connectors
Courtesy of FORD MOTOR CO.

108. Connect the Manifold Absolute Pressure (MAP) sensor electrical connector.

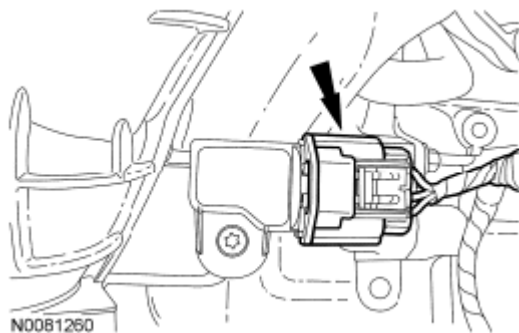


Fig. 512: Locating Manifold Absolute Pressure Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

109. Using a new gasket install the oil filter adapter and the 4 bolts.
- Tighten to 25 Nm (18 lb-ft).

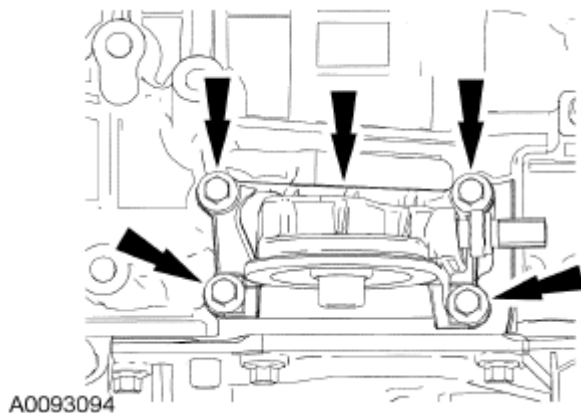


Fig. 513: Locating Bolts & Oil Filter Adapter
Courtesy of FORD MOTOR CO.

110. Connect the Engine Oil Pressure (EOP) switch electrical connector.

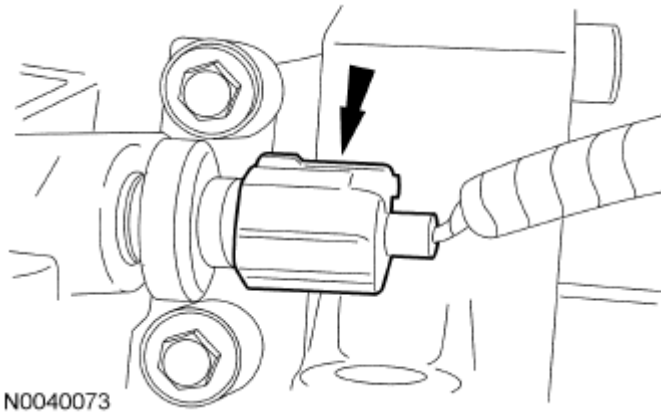


Fig. 514: Locating Engine Oil Pressure Switch Electrical Connector
Courtesy of FORD MOTOR CO.

111. Install the A/C compressor and the 3 bolts.
- Tighten to 25 Nm (18 lb-ft).

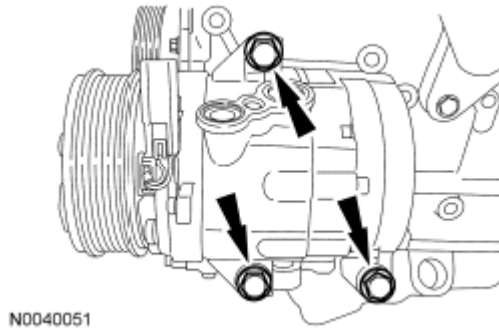


Fig. 515: Locating Bolts & A/C Compressor
Courtesy of FORD MOTOR CO.

112. Using new O-ring seals, install the A/C manifold tube and the bolt.
- Tighten to 25 Nm (18 lb-ft).

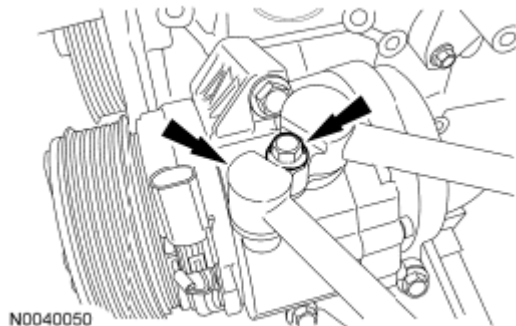


Fig. 516: Locating Bolt & A/C Manifold Tube

Courtesy of FORD MOTOR CO.

113. Install 7 new cylinder head studs.
- Tighten to 17 Nm (150 lb-in).

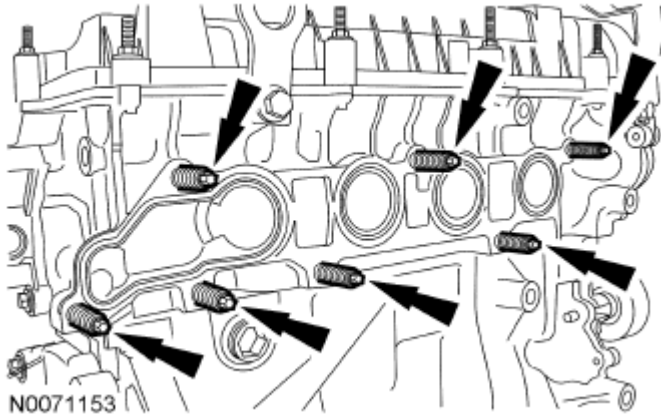


Fig. 517: Locating Cylinder Head Studs
Courtesy of FORD MOTOR CO.

114. Install the new exhaust manifold gasket on the engine.
115. Position the exhaust manifold and tighten the 7 new exhaust manifold nuts in the sequence shown below in 2 stages:
- Stage 1: Tighten to 48 Nm (35 lb-ft).
 - Stage 2: Tighten to 48 Nm (35 lb-ft).

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

NOTE: Make sure to tighten the nuts in the sequence in 2 stages.

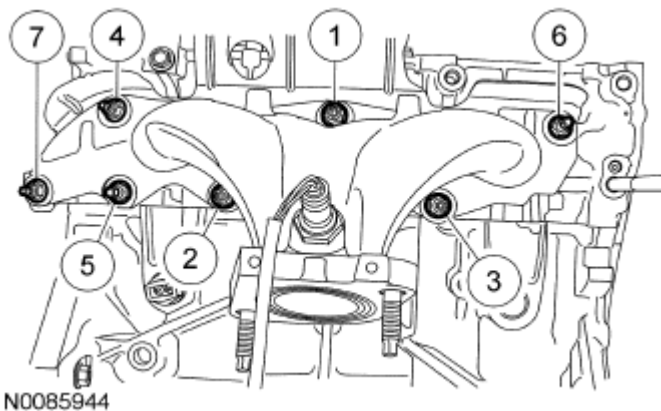


Fig. 518: Identifying Exhaust Manifold Nuts Tightening Sequence
Courtesy of FORD MOTOR CO.

116. Install the exhaust manifold heat shield and the 4 bolts.

- Tighten to 10 Nm (89 lb-in).

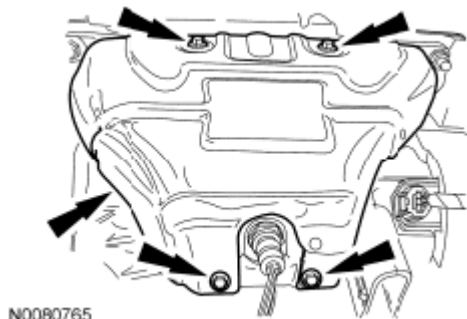


Fig. 519: Locating Exhaust Manifold Heat Shield & Bolts
Courtesy of FORD MOTOR CO.

117. Install the exhaust flexible pipe bracket and the 2 bolts.

- Tighten to 35 Nm (26 lb-ft).

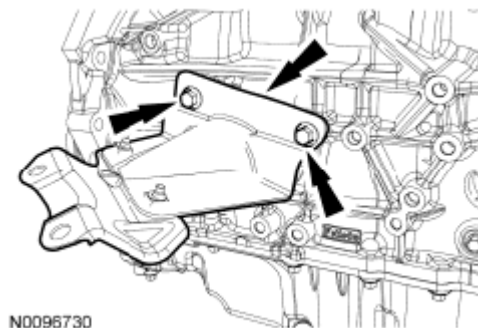


Fig. 520: Locating Bolts & Exhaust Flexible Pipe Bracket
Courtesy of FORD MOTOR CO.

118. Install the 2 generator studs.

- Tighten to 24 Nm (18 lb-ft).

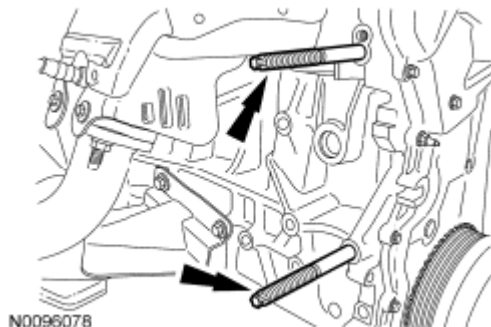


Fig. 521: Locating Generator Studs
Courtesy of FORD MOTOR CO.

119. Install the generator, 2 nuts and 1 bolt.
- Tighten to 47 Nm (35 lb-ft).



Fig. 522: Locating Nuts, Bolt & Generator
Courtesy of FORD MOTOR CO.

120. Connect the Variable Camshaft Timing (VCT) electrical connector and attach the wiring harness retainer to the valve cover stud bolt.

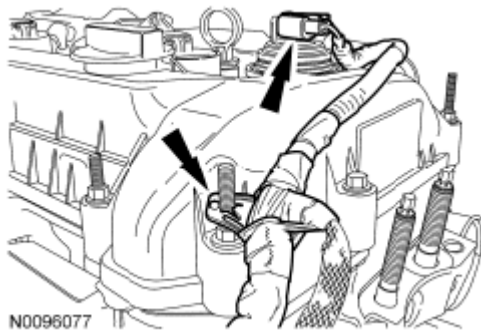
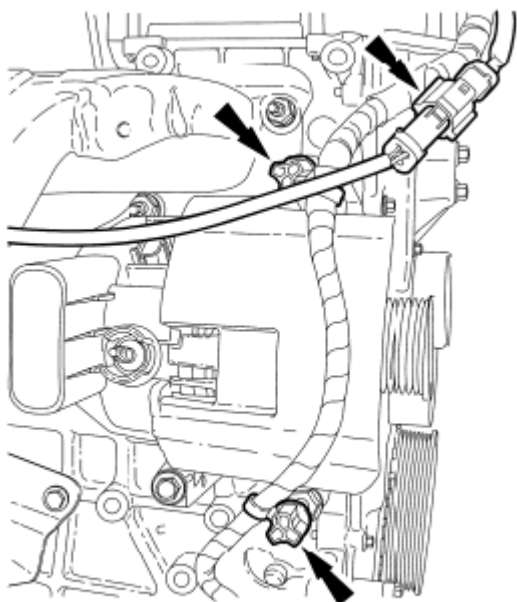


Fig. 523: Locating Variable Camshaft Timing Electrical Connector & Wiring Harness Retainer
Courtesy of FORD MOTOR CO.

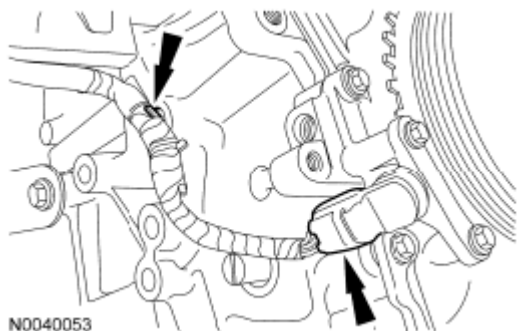
121. Connect the Heated Oxygen Sensor (HO2S) electrical connector and attach the 2 wiring harness retainers to the generator stud bolts.



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Fig. 524: Locating Heated Oxygen Sensor Electrical Connector & Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

122. Connect the **CKP** sensor electrical connector and attach the wiring harness pin-type retainer.



N0040053

Fig. 525: Locating Crankshaft Position Sensor Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

123. Install the thermostat housing and the 3 bolts.
- Tighten to 10 Nm (89 lb-in).

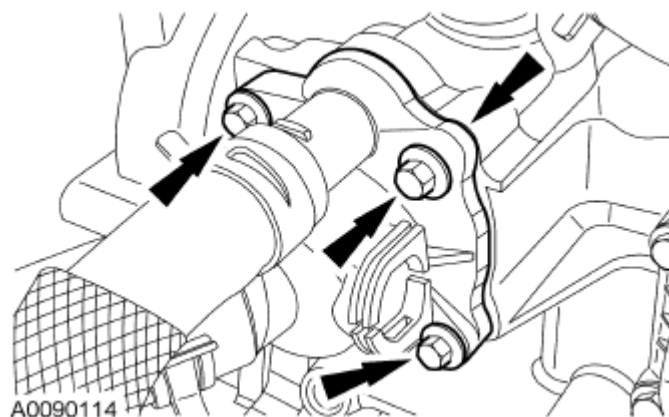


Fig. 526: Identifying Thermostat Housing & Bolts
Courtesy of FORD MOTOR CO.

124. Install the coolant tube retainer to the intake manifold.

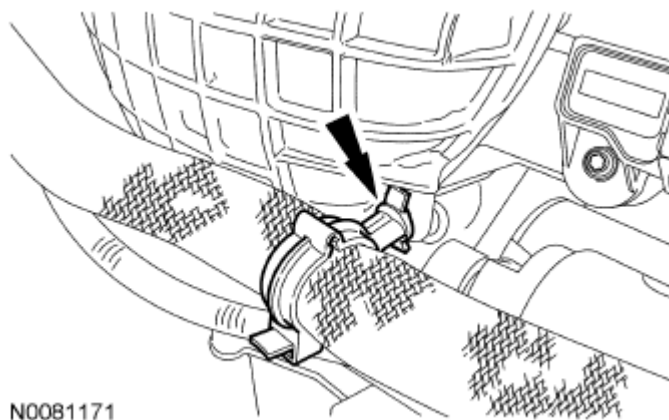


Fig. 527: Locating Coolant Tube Retainer
Courtesy of FORD MOTOR CO.

125. Connect the coolant hose to the EGR.

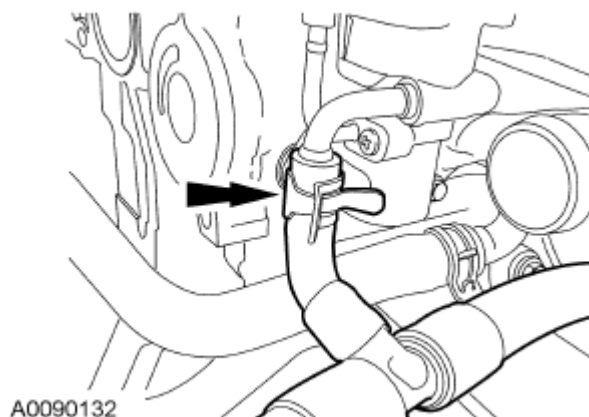


Fig. 528: Locating EGR Coolant Hose
Courtesy of FORD MOTOR CO.

126. Install the accessory drive belt idler pulley and bracket and the 2 bolts.
- Tighten to 25 Nm (18 lb-ft).

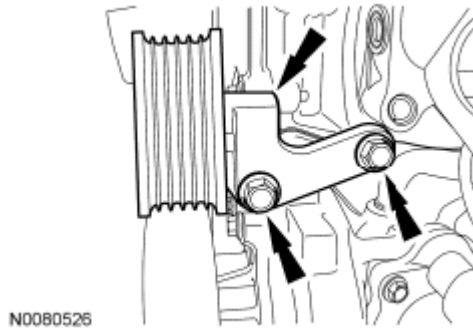


Fig. 529: Locating Accessory Drive Belt Idler Pulley Bracket & Bolts
Courtesy of FORD MOTOR CO.

127. Connect the KS electrical connector and attach the wiring harness pin-type retainer.

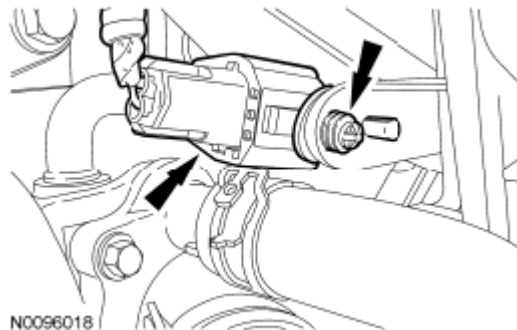


Fig. 530: Locating KS Electrical Connector & Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

128. Install the new O-ring, coolant pump and the 3 bolts.
- Tighten to 10 Nm (89 lb-in).

NOTE: Make sure the coolant pump is correctly seated to the engine block before installing and tightening the fasteners, or damage to the coolant pump may occur.

NOTE: Clean the coolant pump mating surface with metal surface prep.

NOTE: Lubricate the new coolant pump O-ring with clean engine coolant.

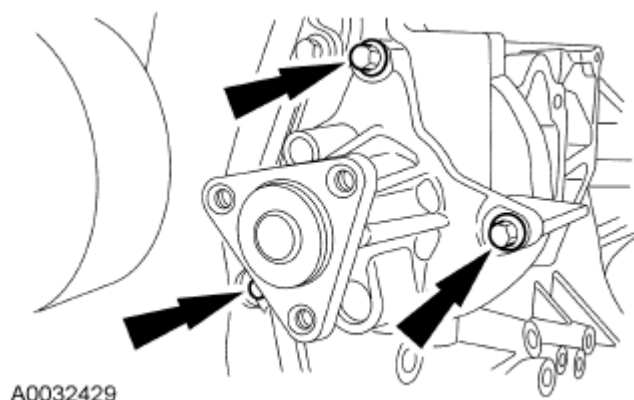


Fig. 531: Locating Bolts & Coolant Pump
Courtesy of FORD MOTOR CO.

129. Install the coolant pump pulley and the 3 bolts.
 - Tighten to 20 Nm (177 lb-in).

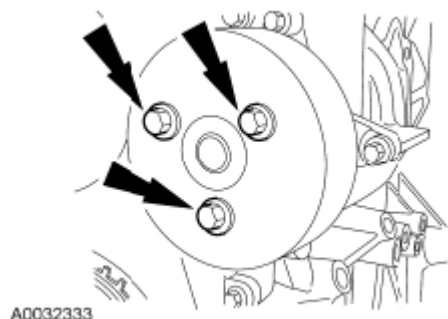


Fig. 532: Locating Coolant Pump Pulley & Bolts
Courtesy of FORD MOTOR CO.

130. Install the accessory drive belt idler pulley.
 - Tighten to 25 Nm (18 lb-ft).

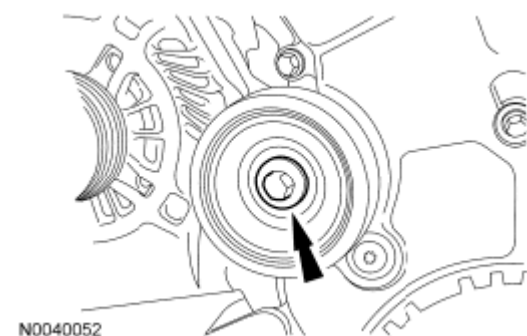


Fig. 533: Locating Accessory Drive Belt Idler Pulley Bolt
Courtesy of FORD MOTOR CO.

131. Install the accessory drive belt tensioner and the 2 bolts.

- Tighten to 25 Nm (18 lb-ft).

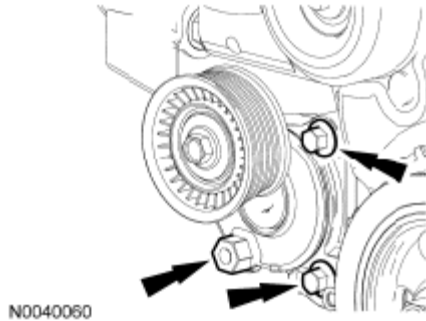


Fig. 534: Locating Accessory Drive Belt Tensioner & Bolts
Courtesy of FORD MOTOR CO.

132. Position the accessory drive belt onto the tensioner and all of the accessory drive pulleys except the coolant pump pulley.
133. Using the hex feature, rotate the accessory drive belt tensioner clockwise and install the accessory drive belt onto the coolant pump pulley.

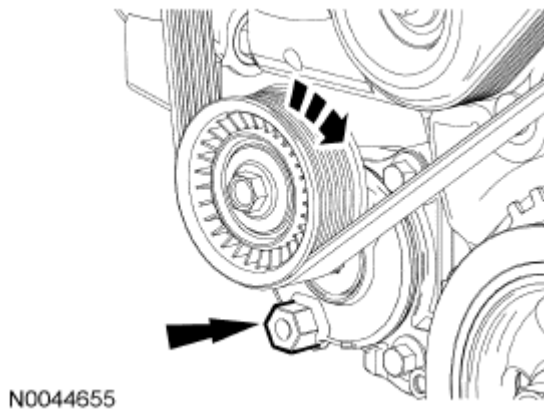


Fig. 535: Rotating Accessory Drive Belt Tensioner Clockwise
Courtesy of FORD MOTOR CO.

134. Using the Heavy Duty Floor Crane and Spreader Bar, remove the engine from the engine stand.

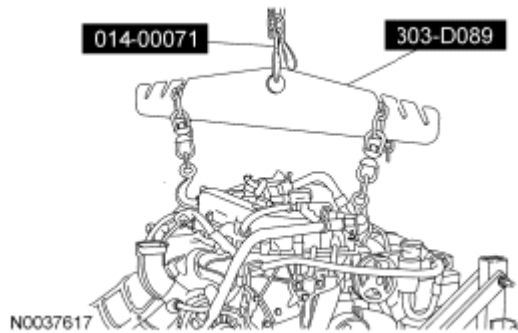


Fig. 536: Identifying Heavy Duty Floor Crane And Spreader Bar
Courtesy of FORD MOTOR CO.

Vehicles with automatic transaxle

135. Install the flexplate and the 6 bolts. Tighten the 6 bolts in the sequence shown in 3 stages:
- Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

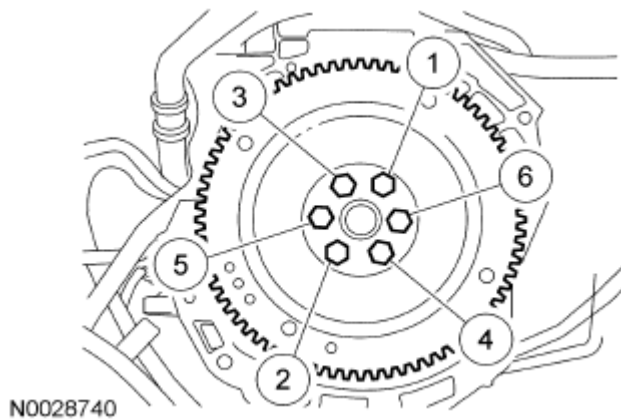


Fig. 537: Identifying Flexplate Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

Vehicles with manual transaxle

136. Install the flywheel and the 6 bolts. Tighten the 6 bolts in the sequence shown below in 3 stages:
- Stage 1: Tighten to 50 Nm (37 lb-ft).
 - Stage 2: Tighten to 80 Nm (59 lb-ft).
 - Stage 3: Tighten to 112 Nm (83 lb-ft).

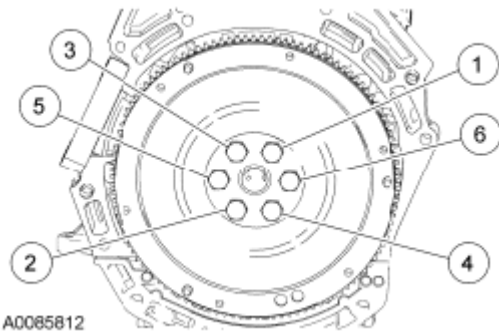


Fig. 538: Identifying Flywheel Bolts Tightening Sequence
Courtesy of FORD MOTOR CO.

137. Lubricate the transaxle input shaft pilot bearing with front axle grease.

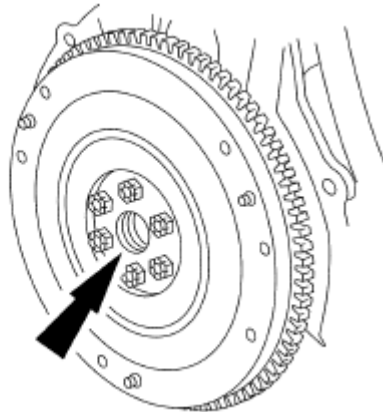


Fig. 539: Locating Transaxle Input Shaft Pilot Bearing
Courtesy of FORD MOTOR CO.

138. Using the Clutch Disc Aligner, position the clutch disc on the flywheel.

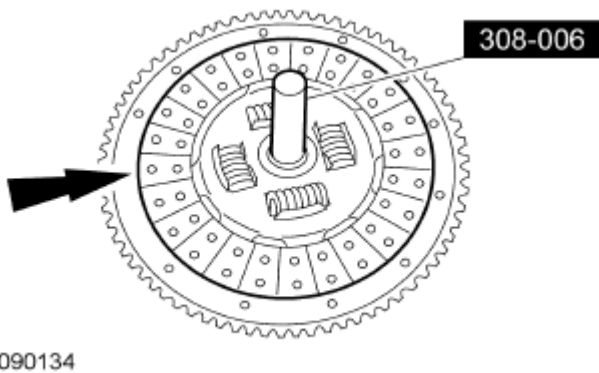


Fig. 540: Locating Clutch Disk Aligner & Clutch Disc
Courtesy of FORD MOTOR CO.

139. Position the clutch pressure plate and install the 6 bolts.
- Tighten to 29 Nm (21 lb-ft) in a star pattern sequence.

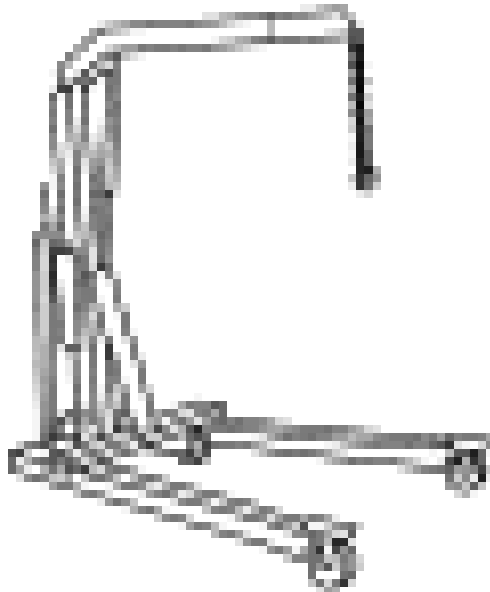
NOTE: If reusing the clutch pressure plate and flywheel, align the marks made during removal.

INSTALLATION

ENGINE - AUTOMATIC TRANSAXLE

Special Tool(s)

SPECIAL TOOLS TABLE

 ST1341-A	Heavy Duty Floor Crane 014-00071 or equivalent

2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1293-A

Powertrain Lift 014-00765 or equivalent

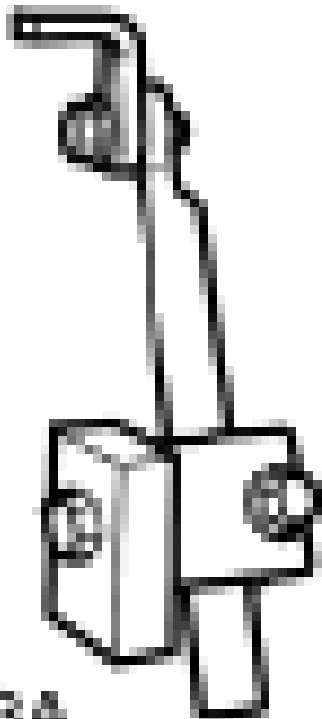


ST1292-A

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

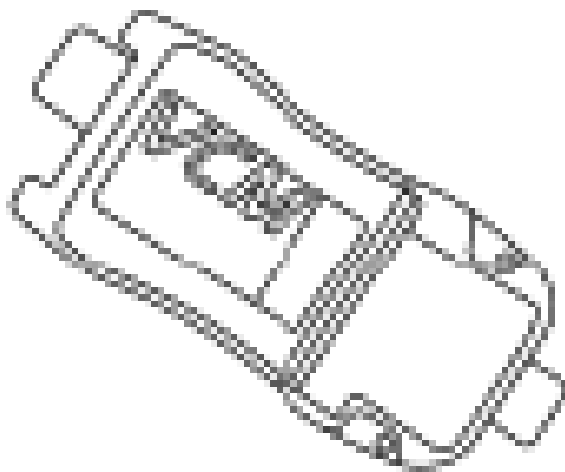
2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST2743A

Universal Adapter Brackets 014-0001 or equivalent



ST2834-A

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

Material

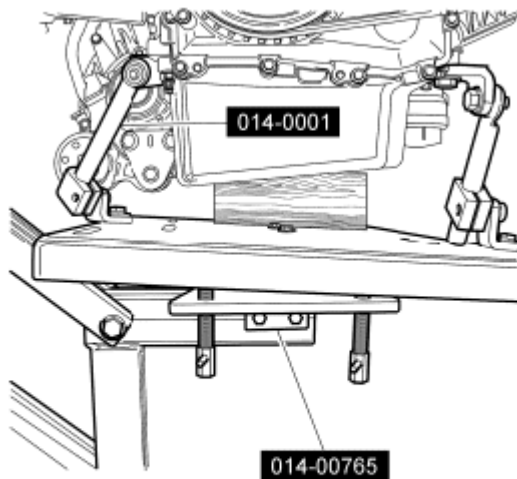
MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A

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

1. Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle together. Install the bellhousing-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).
2. Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle onto the Powertrain Lift table.
3. Install the Powertrain Lift and Universal Adapter Brackets onto the engine.

NOTE: Position a suitable block of wood under the transaxle.



N0096020

Fig. 541: Positioning Suitable Block Of Wood Under Transaxle
Courtesy of FORD MOTOR CO.

4. Install the 4 new torque converter nuts.
 - Tighten to 35 Nm (26 lb-ft).

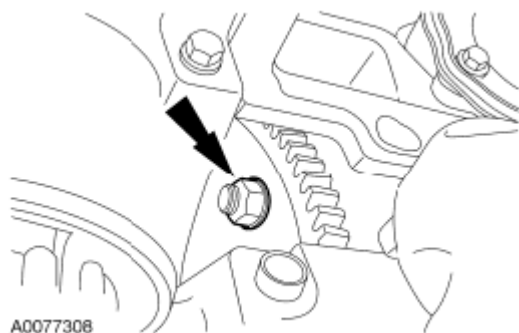


Fig. 542: Locating Torque Converter Nuts
Courtesy of FORD MOTOR CO.

5. Position the generator wiring harness and attach the 4 wiring harness retainers (3 shown) to the valve cover stud bolts.

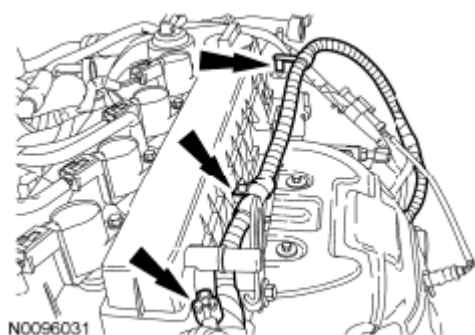


Fig. 543: Locating Generator Wiring Harness Retainers
Courtesy of FORD MOTOR CO.

6. Connect the generator B+ wiring harness and install the nut.
 - Tighten to 12 Nm (106 lb-in).



Fig. 544: Locating Generator B+ Wiring Harness & Nut
Courtesy of FORD MOTOR CO.

7. Connect the generator electrical connection.

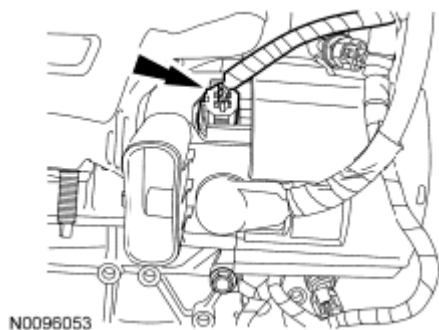


Fig. 545: Locating Generator Electrical Connection
Courtesy of FORD MOTOR CO.

8. Install the generator air duct.

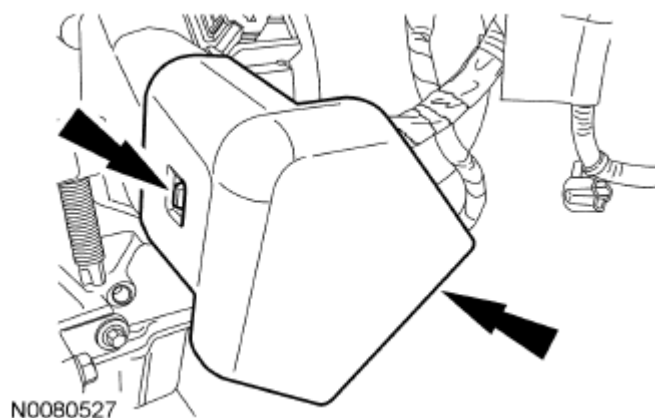


Fig. 546: Locating Locking Tab & Generator Air Duct
Courtesy of FORD MOTOR CO.

9. Install the starter motor isolator.

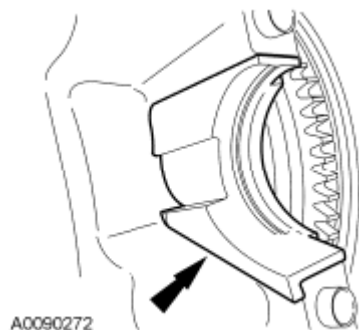


Fig. 547: Locating Starter Motor Isolator

Courtesy of FORD MOTOR CO.

10. Install the starter, bolt and the stud bolt.
 - Tighten to 25 Nm (18 lb-ft).

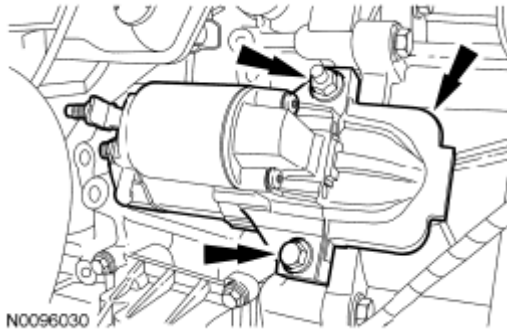


Fig. 548: Locating Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

11. Position the wiring harness and install the ground wire to the starter motor stud bolt and install the nut.
 - Tighten to 18 Nm (159 lb-in).

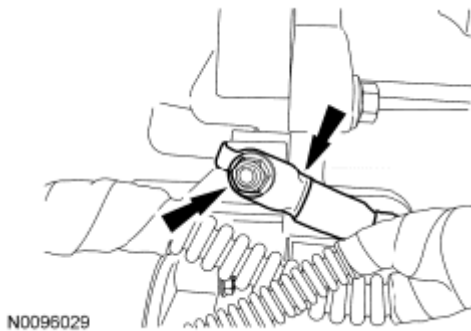


Fig. 549: Locating Nut & Starter Motor Stud Bolt
Courtesy of FORD MOTOR CO.

12. Connect the starter wires and install the 2 nuts.
 - Tighten the large starter motor B+ wire nut to 12 Nm (106 lb-in).
 - Tighten the small starter motor solenoid wire nut to 5 Nm (44 lb-in).

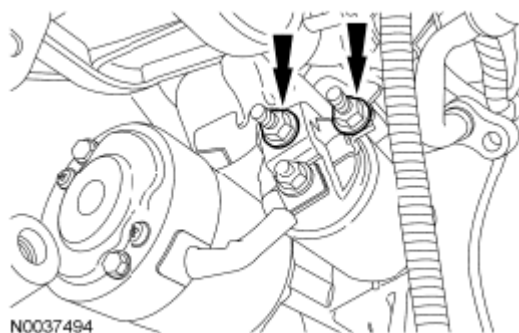


Fig. 550: Locating Starter Wires & Nuts
Courtesy of FORD MOTOR CO.

13. Attach the A/C compressor wiring harness pin-type retainer to the intake manifold.

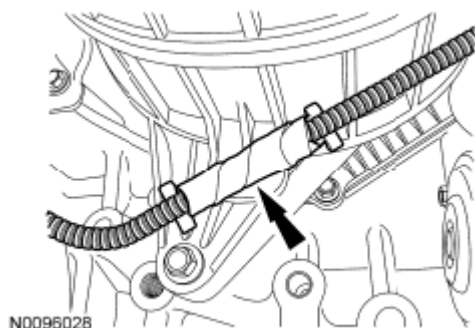


Fig. 551: Locating A/C Compressor Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

14. Connect the A/C compressor electrical connector.

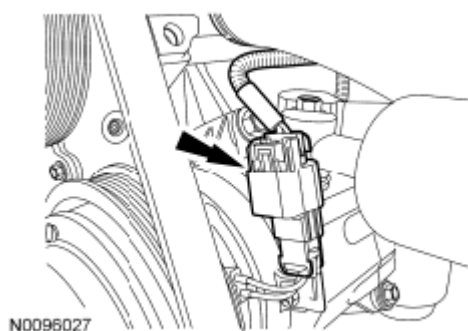


Fig. 552: Locating A/C Compressor Electrical Connector
Courtesy of FORD MOTOR CO.

15. Raise the engine and transaxle into the vehicle.
16. Install the transaxle mount through bolt and nut.

- Tighten to 90 Nm (66 lb-ft).

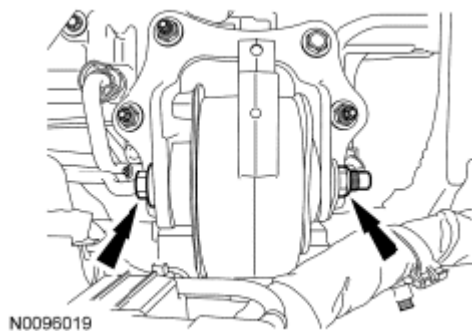


Fig. 553: Locating Transaxle Mount Through Bolt & Nut
Courtesy of FORD MOTOR CO.

17. Install the engine mount bracket, 2 nuts and the bolt.
 - Tighten the nuts to 103 Nm (76 lb-ft).
 - Tighten the bolt to 115 Nm (85 lb-ft).

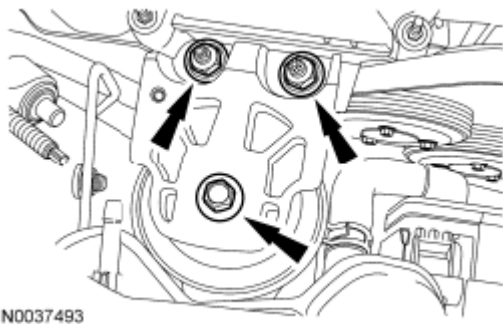


Fig. 554: Locating Bolt, Nuts & Engine Mount Bracket
Courtesy of FORD MOTOR CO.

18. Install the 2 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).

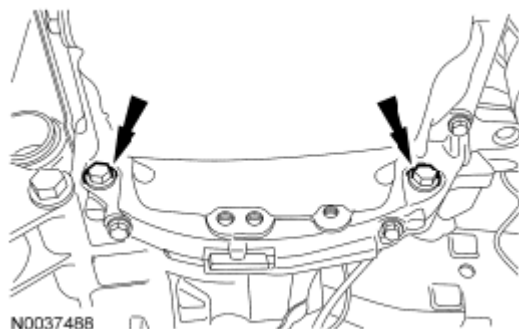


Fig. 555: Locating Oil Pan-To-Bellhousing Bolts
Courtesy of FORD MOTOR CO.

19. Install the 2 bellhousing-to-oil pan bolts.
 - Tighten to 48 Nm (35 lb-ft).

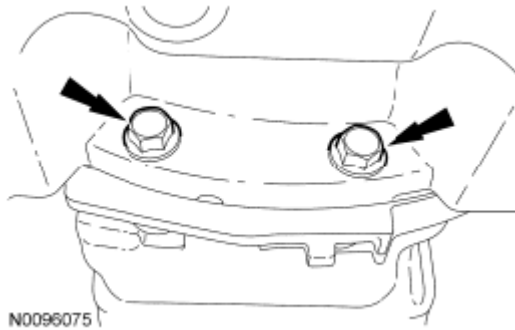


Fig. 556: Locating Bellhousing-To-Oil Pan Bolts
Courtesy of FORD MOTOR CO.

20. Attach the lower radiator hose pin-type retainer to the cooling fan shroud.

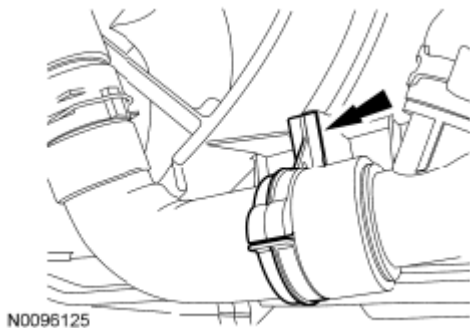


Fig. 557: Locating Lower Radiator Hose Pin-Type Retainer
Courtesy of FORD MOTOR CO.

21. If equipped, connect the block heater electrical connector and position back the block heater shield.
 - Attach the 8 block heater wiring harness retainers (1 shown).

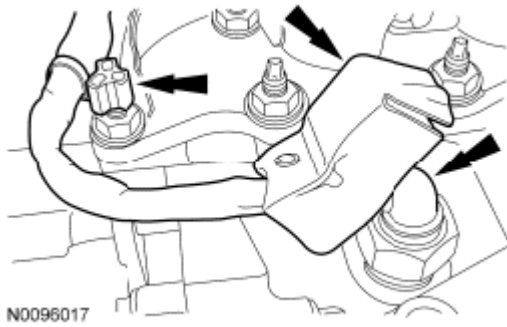


Fig. 558: Locating Block Heater Wiring Harness & Retainers
Courtesy of FORD MOTOR CO.

22. Install the lower radiator hose to the thermostat housing.

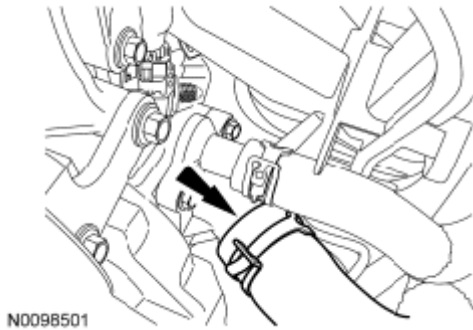


Fig. 559: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

23. Attach the Knock Sensor (KS) electrical connector to the intake manifold.

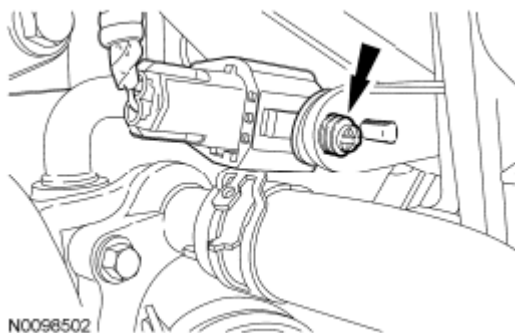


Fig. 560: Locating Knock Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Install a new O-ring seal and connect the upper A/C tube to the condenser and install the nut.
- Tighten to 8 Nm (71 lb-in).

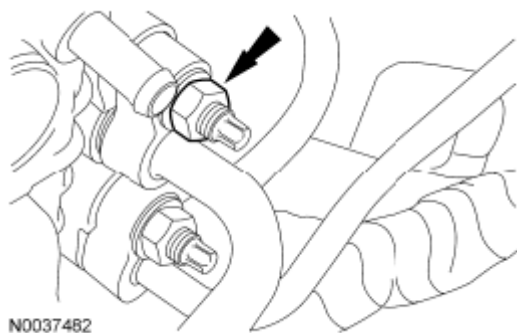


Fig. 561: Locating Upper A/C Tube Nut
Courtesy of FORD MOTOR CO.

25. Attach the coolant vent hose retaining clip to the A/C tube.

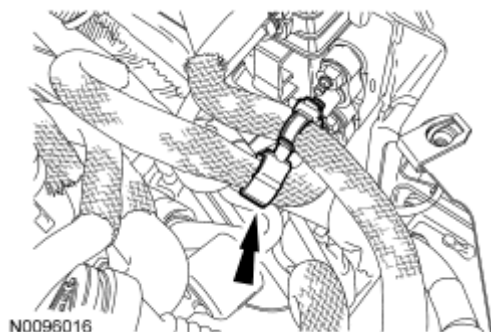


Fig. 562: Locating Coolant Vent Hose Retaining Clip
Courtesy of FORD MOTOR CO.

26. Install a new O-ring seal and connect the A/C tube and install the nut.
 - Tighten to 8 Nm (71 lb-in).

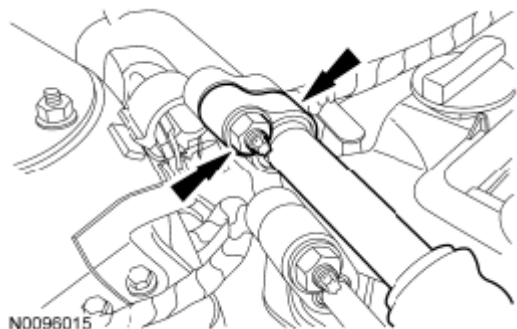


Fig. 563: Locating Nut & A/C Tube
Courtesy of FORD MOTOR CO.

27. Install the windshield washer reservoir/A/C tube bracket bolt.

- Tighten to 7 Nm (62 lb-in).

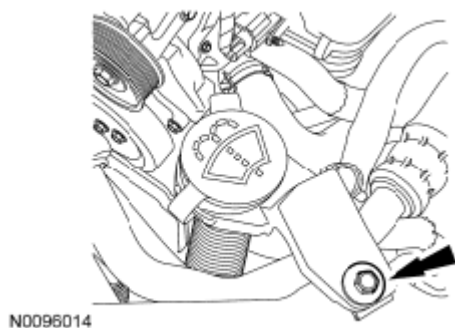


Fig. 564: Locating A/C Tube/Windshield Washer Reservoir Bracket Bolt
Courtesy of FORD MOTOR CO.

28. Install the ground wire on the engine mount and the bolt.
- Tighten to 10 Nm (89 lb-in).

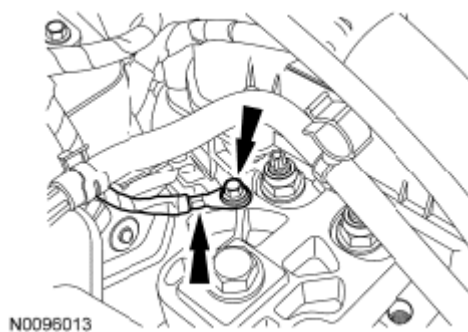


Fig. 565: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

29. Connect the 2 transaxle fluid cooler tubes.

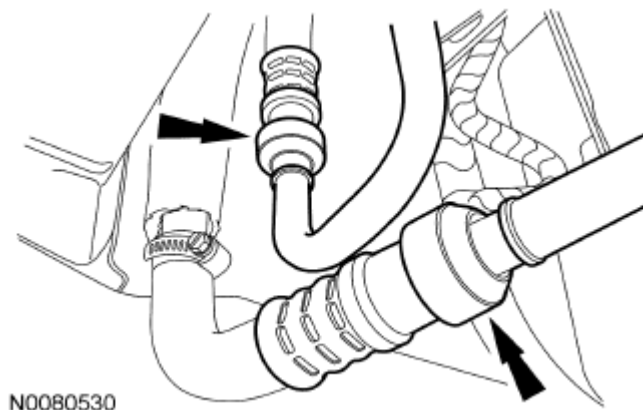


Fig. 566: Locating Transaxle Fluid Cooler Tubes
Courtesy of FORD MOTOR CO.

30. Install the 2 secondary latches to the transaxle fluid cooler tubes.

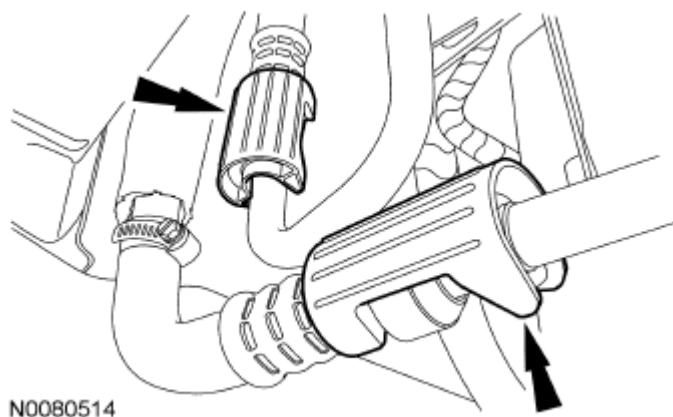


Fig. 567: Locating Secondary Latches
Courtesy of FORD MOTOR CO.

31. Connect the transaxle shift cable to the bracket and attach the shift cable to the transaxle manual lever.

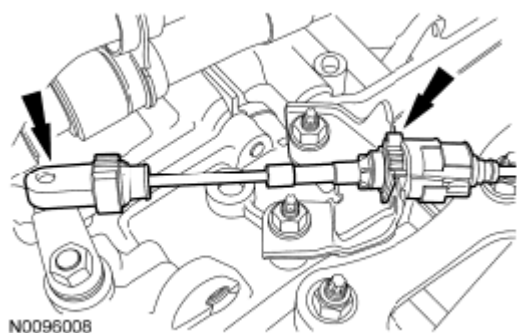


Fig. 568: Locating Transaxle Shift Cable
Courtesy of FORD MOTOR CO.

32. Connect the heater hose in-line connector and connect the upper radiator and heater hoses to the coolant outlet.

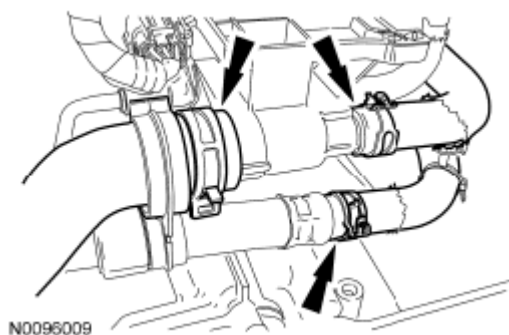


Fig. 569: Locating Heater Hoses & Heater Hose In-Line Connector
Courtesy of FORD MOTOR CO.

33. Attach the coolant hoses retainer.

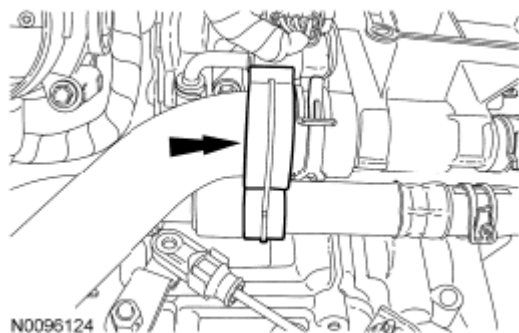


Fig. 570: Locating Coolant Hoses Retainer
Courtesy of FORD MOTOR CO.

34. Connect the fuel supply tube quick connect coupling. For additional information, refer to **QUICK CONNECT COUPLING**.

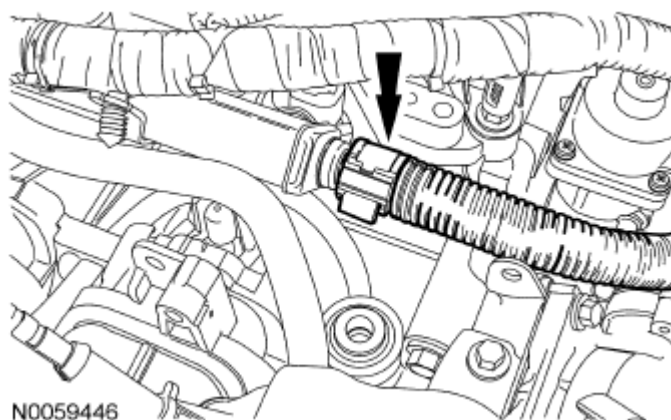


Fig. 571: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

35. Connect the fuel vapor return tube.

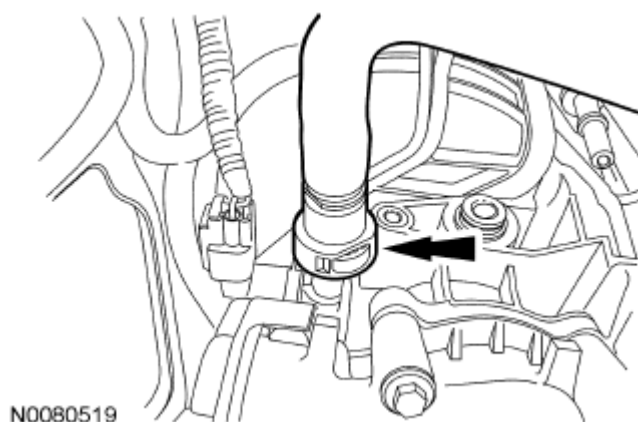


Fig. 572: Locating Fuel Vapor Return Tube
Courtesy of FORD MOTOR CO.

36. Insert the brake booster vacuum supply tube into the locking ring on the intake manifold.

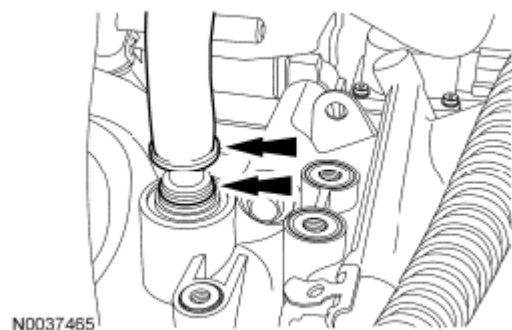


Fig. 573: Locating Brake Booster Vacuum Supply Tube & Locking Ring
Courtesy of FORD MOTOR CO.

37. Connect the crankcase vent tube to the valve cover.

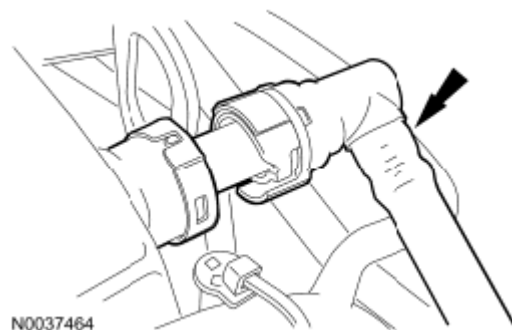


Fig. 574: Connecting Crankcase Vent Tube To Valve Cover

Courtesy of FORD MOTOR CO.

38. Install the exhaust flexible pipe. For additional information, refer to **INSTALLATION** .
39. Install the engine oil filter.
 - Lubricate the engine oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.
40. Place the subframe assembly on the Powertrain Lift and raise the subframe into the installed position.

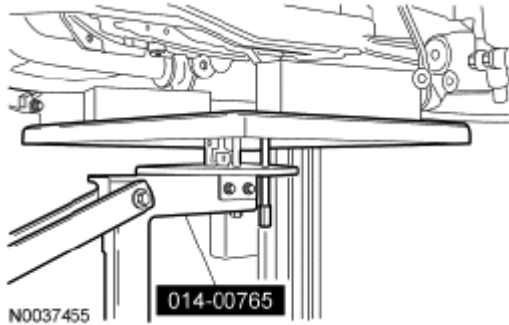


Fig. 575: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

41. Install the front subframe nuts.
 - Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown, RH similar.

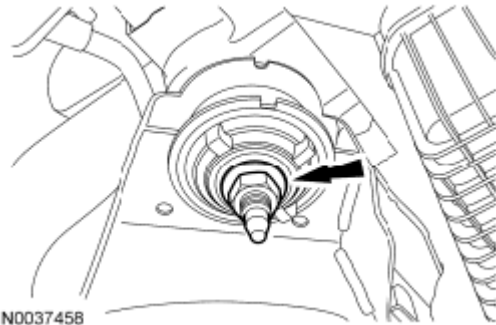


Fig. 576: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

42. Position the subframe brackets and install the bolts finger-tight.

NOTE: LH shown, RH similar.

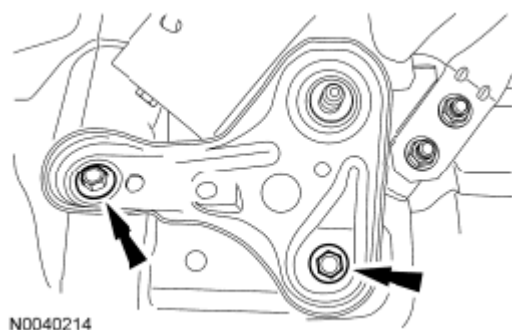


Fig. 577: Locating Subframe Brackets Bolts
Courtesy of FORD MOTOR CO.

43. Install the subframe nuts.
 - Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown, RH similar.

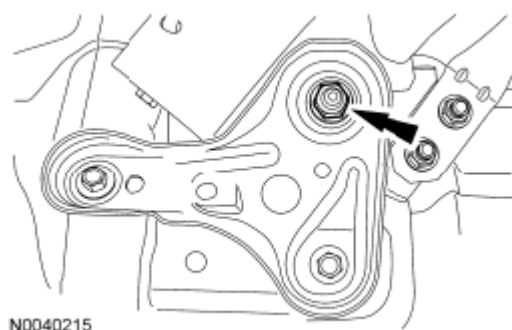


Fig. 578: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

44. Tighten the subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

NOTE: LH shown, RH similar.

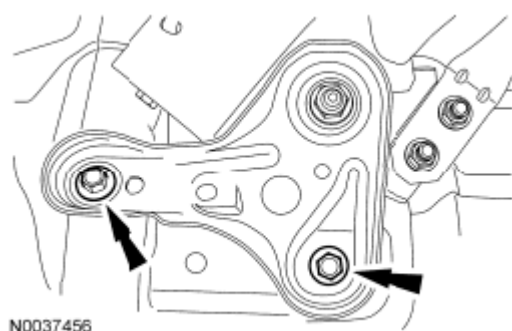


Fig. 579: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

45. Install the sway bar links and nuts to the struts.
 - Tighten to 40 Nm (30 lb-ft).

NOTE: LH shown, RH similar.

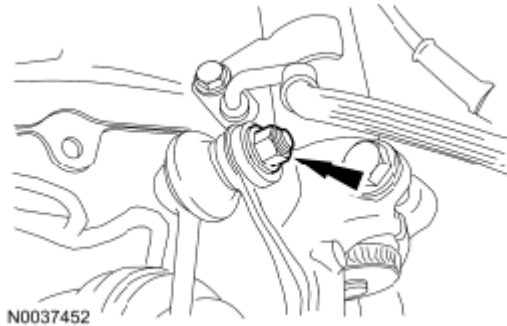


Fig. 580: Locating Sway Bar Links & Nuts
Courtesy of FORD MOTOR CO.

46. Install tie-rod ends and nuts.
 - Tighten to 48 Nm (35 lb-ft).
 - Install the cotter pin.

NOTE: LH shown, RH similar.

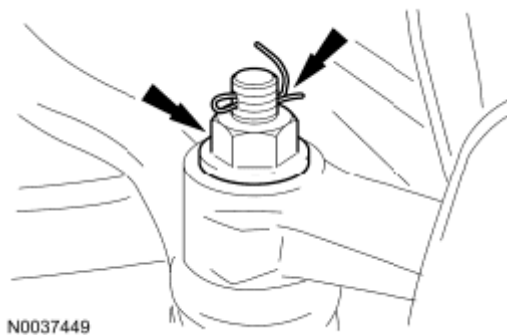


Fig. 581: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

47. Install the Electronic Power Assist Steering (EPAS) system wiring harness ground and the bolt.
 - 12 Nm (106 lb-in).

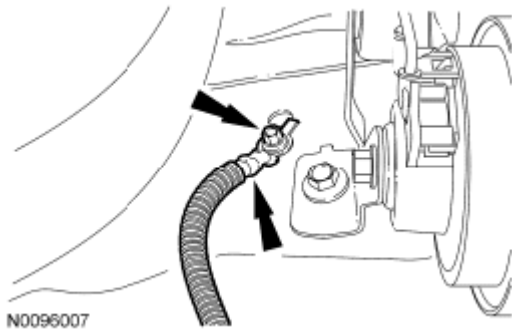


Fig. 582: Locating Electronic Power Assist Steering System Wiring Harness Ground & Bolt
Courtesy of FORD MOTOR CO.

48. Attach the EPAS system wiring harness pin-type retainer to the subframe under the LH fender splash shield.

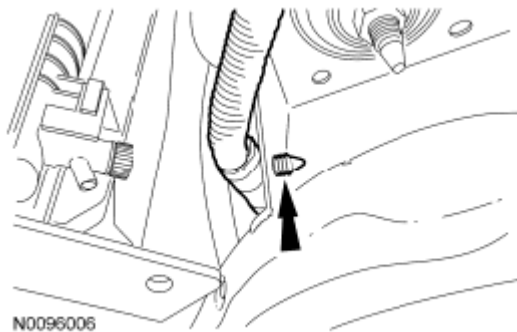


Fig. 583: Locating EPAS System Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

49. Attach the 2 EPAS system wiring harness pin-type retainers to the subframe.

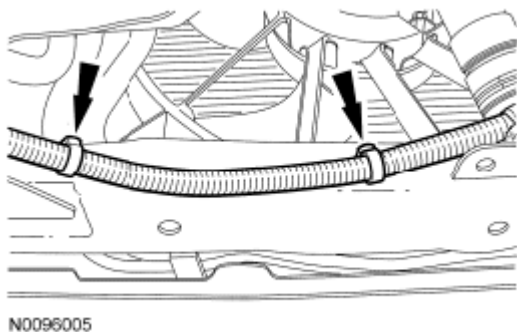


Fig. 584: Locating EPAS System Wiring Harness Pin-Type Retainers
Courtesy of FORD MOTOR CO.

50. Connect the 2 EPAS system electrical connectors.

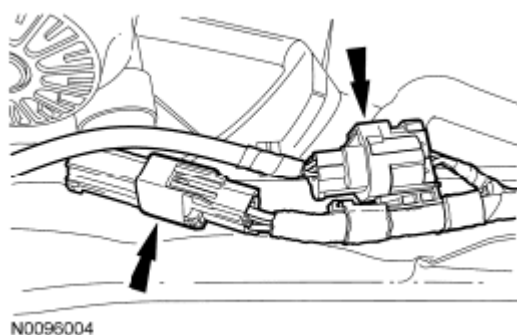


Fig. 585: Locating EPAS System Electrical Connectors
Courtesy of FORD MOTOR CO.

51. Install the LH halfshaft and the intermediate shaft. For additional information, refer to **INSTALLATION**.
52. Install the LH splash shield and the 6 pin-type retainers (4 shown).

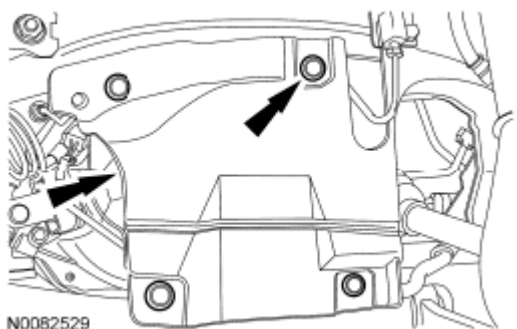


Fig. 586: Locating LH Splash Shield & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

53. Position the LH fender splash shield and install the 4 screws.

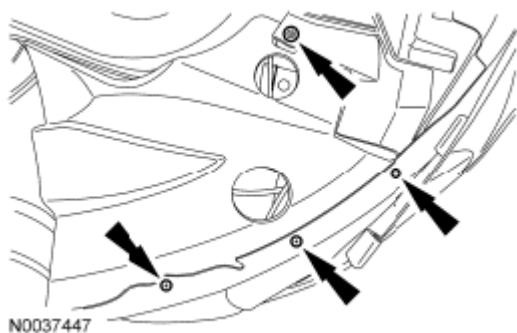


Fig. 587: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

54. Install the RH splash shield and the 6 pin-type retainers (4 shown).

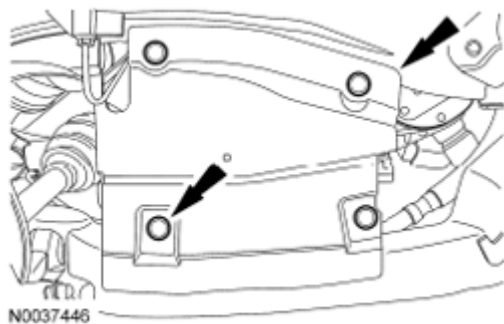


Fig. 588: Locating RH Splash Shield & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

55. Position the RH fender splash shield and install the 4 screws.

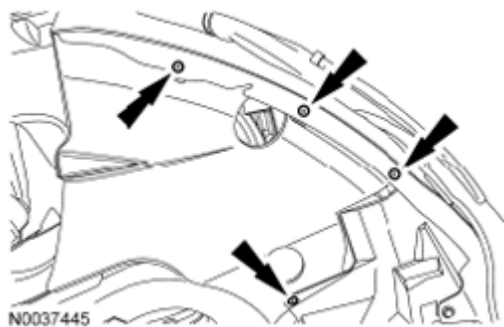


Fig. 589: Locating RH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

56. Install the engine roll restrictor bolt.
- Tighten to 90 Nm (66 lb-ft).

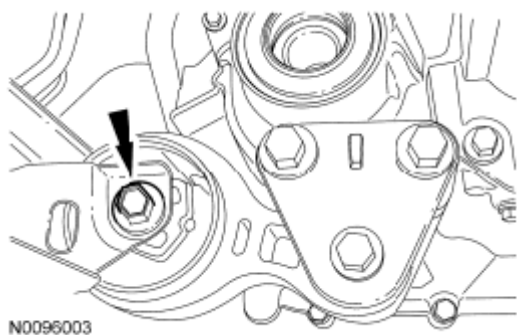


Fig. 590: Locating Engine Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

57. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips (2 shown) into the body.
- From under the vehicle, verify that the seal is correctly installed on the steering gear and the retaining clips are fully engaged into the dash.

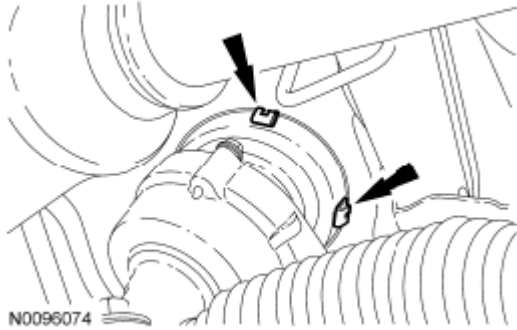


Fig. 591: Locating Steering Gear-To-Dash Seal Retaining Clips
Courtesy of FORD MOTOR CO.

58. If equipped, install the 7 screws and the underbody cover.

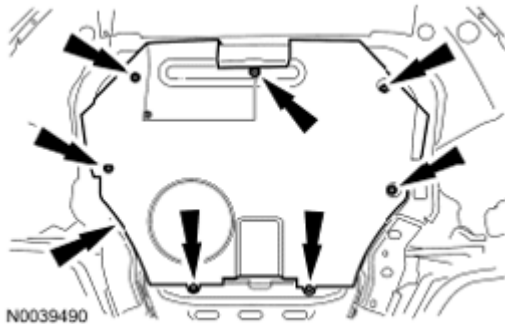


Fig. 592: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

59. Install the steering column shaft onto the steering gear and install the bolt.
- Tighten to 20 Nm (177 lb-in).



Fig. 593: Locating Steering Column Shaft Bolt
Courtesy of FORD MOTOR CO.

60. Install the steering joint cover and the 2 nuts.

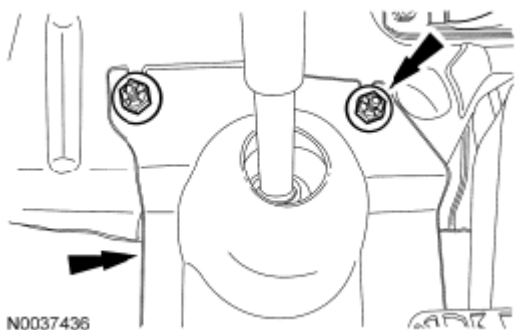


Fig. 594: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

61. Connect the 2 engine harness electrical connectors.

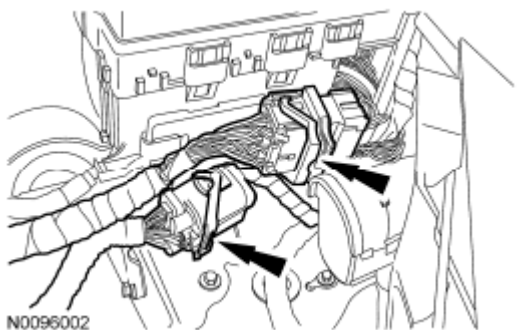


Fig. 595: Locating Engine Harness Electrical Connectors
Courtesy of FORD MOTOR CO.

62. Attach the 2 negative battery cable pin-type retainers to the transaxle mount and battery tray bracket.

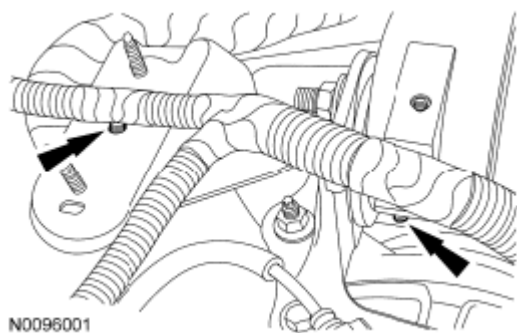


Fig. 596: Locating Negative Battery Cable Pin-Type Retainers
Courtesy of FORD MOTOR CO.

63. Install the ground wire-to-body and the bolt.
- Tighten to 12 Nm (106 lb-in).

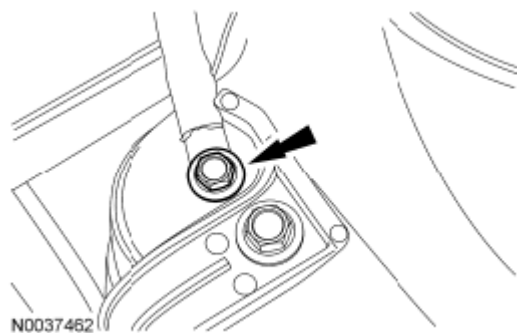


Fig. 597: Locating Ground Wire-To-Body & Bolt
Courtesy of FORD MOTOR CO.

64. Connect the engine wiring harness electrical connector.



Fig. 598: Locating Engine Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

65. Install the 2 battery cables to the positive battery cable and the 2 nuts.

- Tighten to 9 Nm (80 lb-in).

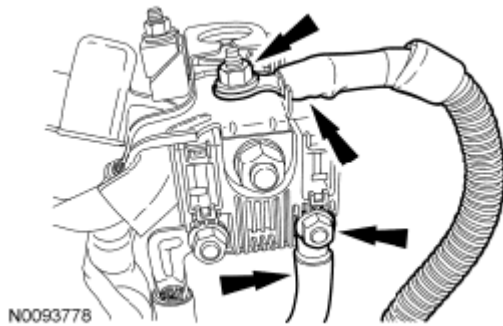


Fig. 599: Locating Battery Cables & Nuts
Courtesy of FORD MOTOR CO.

66. Install the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
67. Install the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
68. Fill the engine with clean engine oil.
69. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** .
70. Fill the transaxle. For additional information, refer to **TRANSMISSION FLUID DRAIN AND REFILL** .
71. Recharge the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** .
72. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure following the on-screen instructions.

ENGINE - MANUAL TRANSAXLE

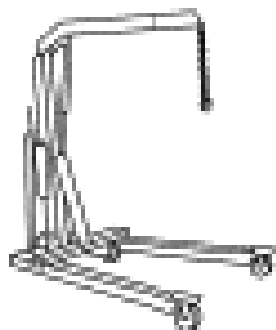
Special Tool(s)

SPECIAL TOOLS TABLE

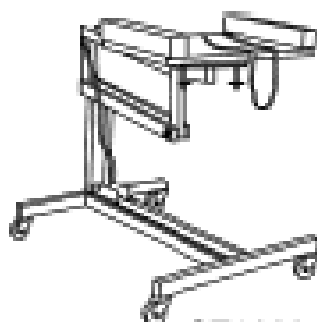
	Heavy Duty Floor Crane 014-00071 or equivalent
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2010 Mercury Milan

2010 ENGINE Engine Mechanical - 2.5L (Except Hybrid) - Fusion, Milan & MKZ



ST1341-A



ST1293-A

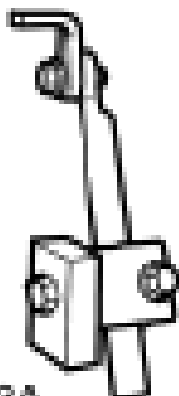
Powertrain Lift 014-00765 or equivalent



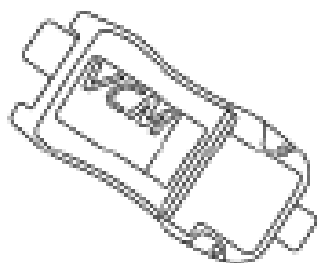
ST1602-A

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

Universal Adapter Brackets 014-0001 or equivalent



ST2743A



ST2834-A

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

Material

MATERIAL SPECIFICATIONS TABLE

Item	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft® SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSSM2C930-A

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

- Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle together. Install the bellhousing-to-engine bolts.
 - Tighten to 48 Nm (35 lb-ft).
- Using the Heavy Duty Floor Crane and Spreader Bar, position the engine and transaxle onto the Powertrain Lift table.

NOTE: Position a suitable block of wood under the transaxle.

3. Install the Powertrain Lift and Universal Adapter Brackets onto the engine.

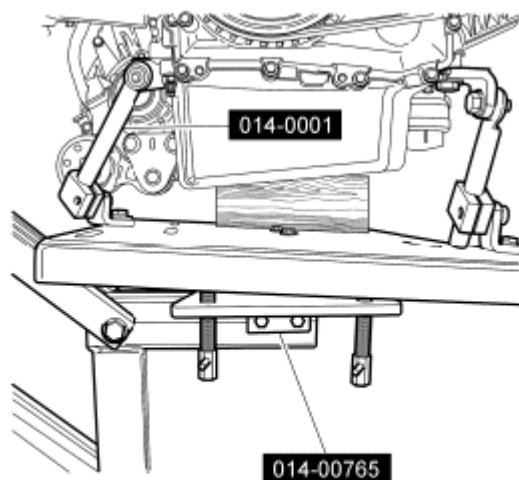


Fig. 600: Positioning Suitable Block Of Wood Under Transaxle
Courtesy of FORD MOTOR CO.

4. Position the generator wiring harness and attach the 4 wiring harness retainers (3 shown) to the valve cover stud bolts.

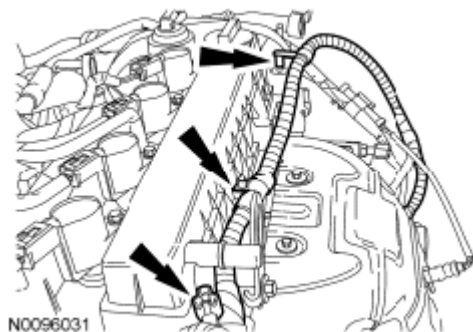


Fig. 601: Locating Generator Wiring Harness & Retainers
Courtesy of FORD MOTOR CO.

5. Connect the generator B+ wiring harness and install the nut.
 - Tighten to 12 Nm (106 lb-in).



Fig. 602: Locating Generator B+ Wiring Harness & Nut
Courtesy of FORD MOTOR CO.

6. Connect the generator electrical connection.

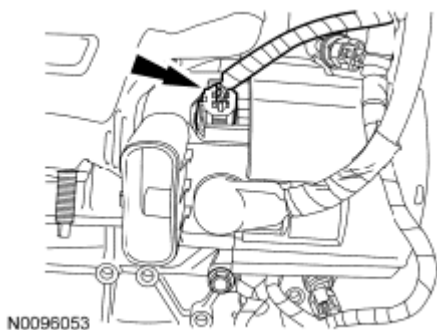


Fig. 603: Locating Generator Electrical Connection
Courtesy of FORD MOTOR CO.

7. Install the generator air duct.

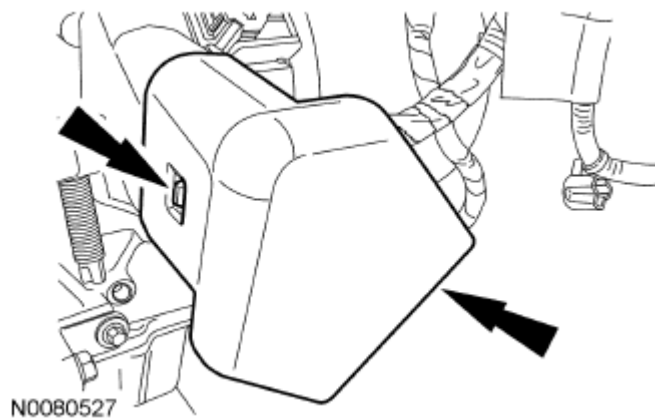


Fig. 604: Locating Locking Tab & Generator Air Duct
Courtesy of FORD MOTOR CO.

8. Install the starter motor isolator.

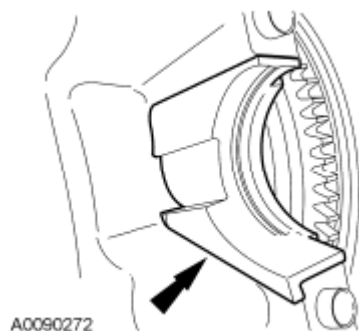


Fig. 605: Locating Starter Motor Isolator
Courtesy of FORD MOTOR CO.

9. Install the starter, bolt and stud bolt.
 - Tighten to 25 Nm (18 lb-ft).

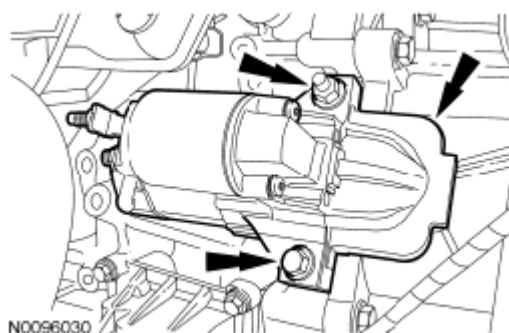


Fig. 606: Locating Bolt, Stud Bolt & Starter
Courtesy of FORD MOTOR CO.

10. Position the wiring harness and install the ground wire to the starter motor stud bolt and install the nut.
 - Tighten to 18 Nm (159 lb-in).

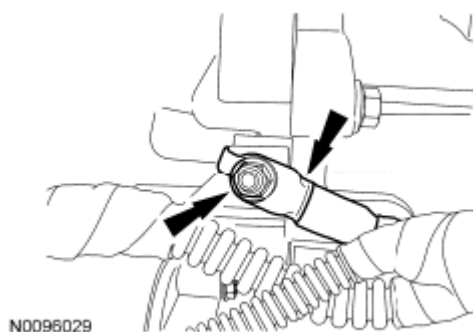


Fig. 607: Locating Ground Wire & Starter Motor Stud Nut
Courtesy of FORD MOTOR CO.

11. Connect the starter wires and install the 2 nuts.
 - Tighten the large starter motor B+ wire nut to 12 Nm (106 lb-in).
 - Tighten the small starter motor solenoid wire nut to 5 Nm (44 lb-in).

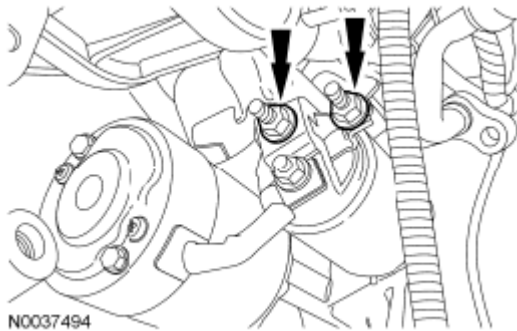


Fig. 608: Locating Starter Wires & Nuts
Courtesy of FORD MOTOR CO.

12. Attach the A/C compressor wiring harness pin-type retainer to the intake manifold.

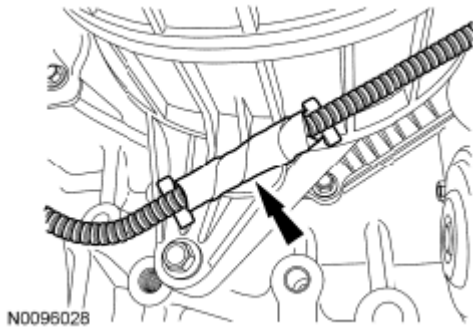


Fig. 609: Locating A/C Compressor Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

13. Connect the A/C compressor electrical connector.

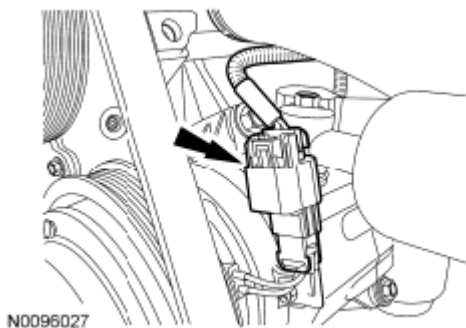


Fig. 610: Locating A/C Compressor Electrical Connector

Courtesy of FORD MOTOR CO.

14. Raise the engine and transaxle into the vehicle.
15. Raise the engine and transaxle into the vehicle.
16. Install the 2 transaxle mount bolts.
 - Tighten to 90 Nm (66 lb-ft).

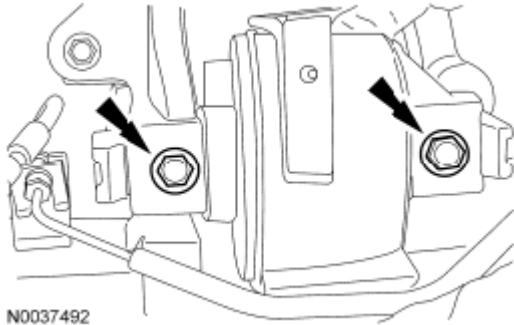


Fig. 611: Locating Transaxle Mount Bolts
Courtesy of FORD MOTOR CO.

17. Install the engine mount bracket, 2 nuts and the bolt.
 - Tighten the nuts to 103 Nm (76 lb-ft).
 - Tighten the bolt to 115 Nm (85 lb-ft).

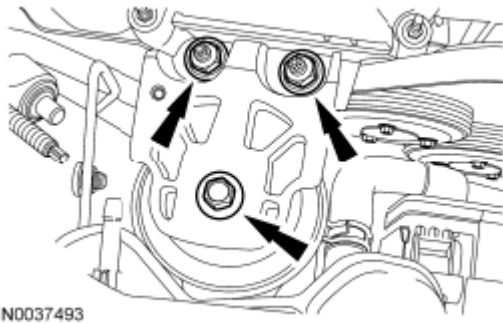


Fig. 612: Locating Bolt, Nuts & Motor Mount Bracket
Courtesy of FORD MOTOR CO.

18. Install the 2 oil pan-to-bellhousing bolts.
 - Tighten to 48 Nm (35 lb-ft).

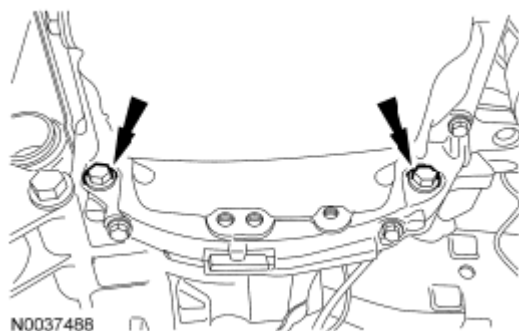


Fig. 613: Locating Oil Pan-To-Bellhousing Bolts
Courtesy of FORD MOTOR CO.

19. Install the bellhousing-to-oil pan bolt.
 - Tighten to 48 Nm (35 lb-ft).

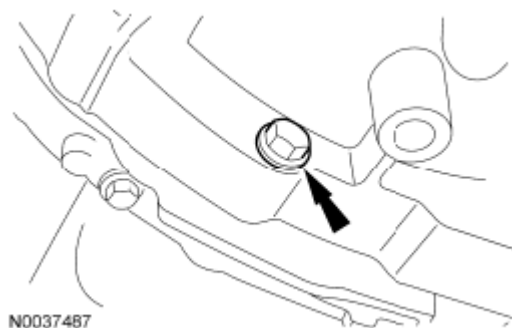


Fig. 614: Locating Bellhousing-To-Oil Pan Bolt
Courtesy of FORD MOTOR CO.

20. Attach the lower radiator hose pin-type retainer to the cooling fan shroud.



Fig. 615: Locating Lower Radiator Hose Pin-Type Retainer
Courtesy of FORD MOTOR CO.

21. If equipped, connect the block heater electrical connector and position back the block heater shield.

- Attach the 8 block heater wiring harness retainers (1 shown).

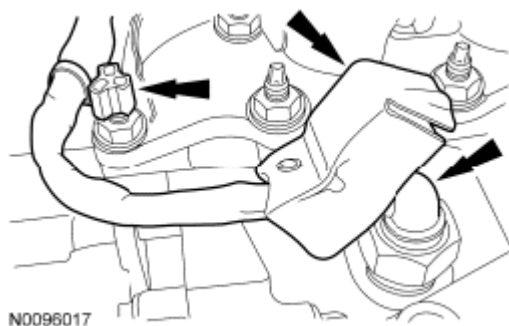


Fig. 616: Locating Block Heater Wiring Harness & Retainers
Courtesy of FORD MOTOR CO.

22. Install the lower radiator hose to the thermostat housing.

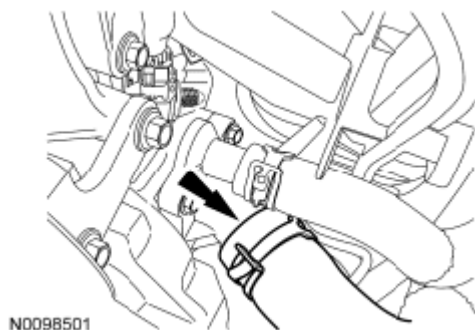


Fig. 617: Locating Lower Radiator Hose
Courtesy of FORD MOTOR CO.

23. Attach the Knock Sensor (KS) electrical connector to the intake manifold.

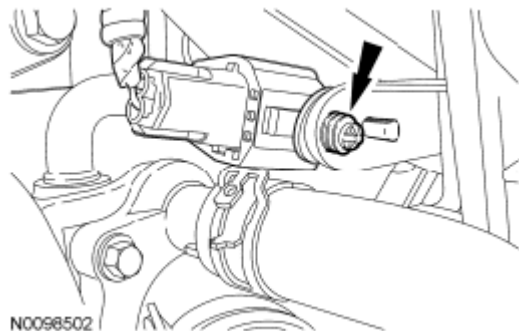


Fig. 618: Locating Knock Sensor Electrical Connector
Courtesy of FORD MOTOR CO.

24. Install a new O-ring seal and connect the upper A/C tube to the condenser and install the nut.
- Tighten to 8 Nm (71 lb-in).

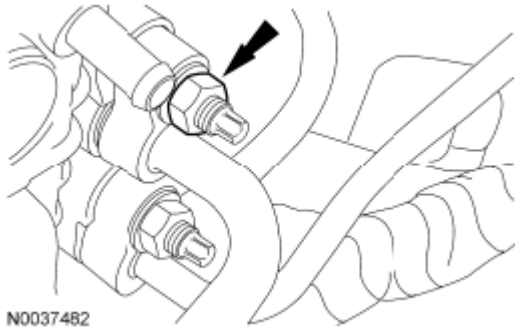


Fig. 619: Locating Upper A/C Tube Nut
Courtesy of FORD MOTOR CO.

25. Attach the coolant vent hose retaining clip to the A/C tube.

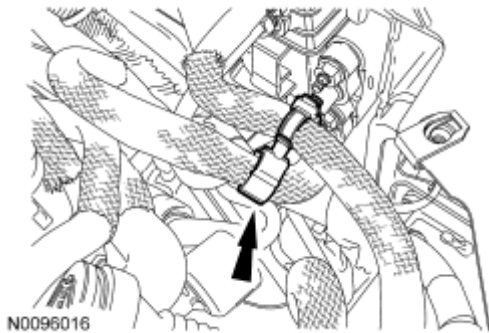


Fig. 620: Locating Coolant Vent Hose Retaining Clip
Courtesy of FORD MOTOR CO.

26. Install a new O-ring seal and connect the upper A/C tube and install the nut.
- Tighten to 8 Nm (71 lb-in).

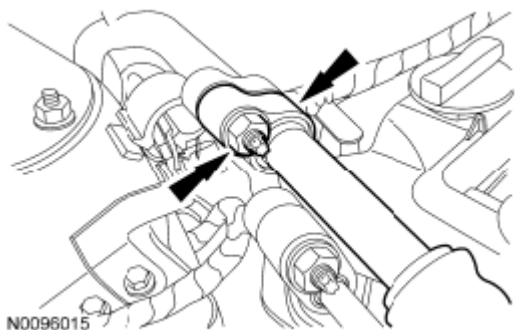


Fig. 621: Locating Nut & A/C Tube

Courtesy of FORD MOTOR CO.

27. Install the A/C tube/windshield washer reservoir bracket bolt.
- Tighten to 7 Nm (62 lb-in).

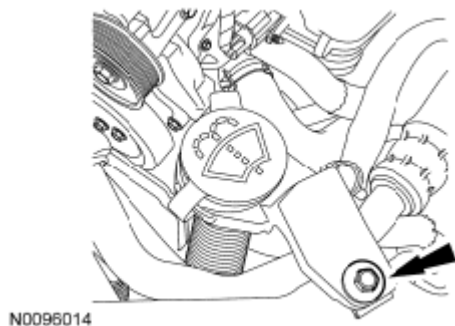


Fig. 622: Locating A/C Tube/Windshield Washer Reservoir Bracket Bolt
Courtesy of FORD MOTOR CO.

28. Install the ground wire on the engine mount and the bolt.
- Tighten to 10 Nm (89 lb-in).

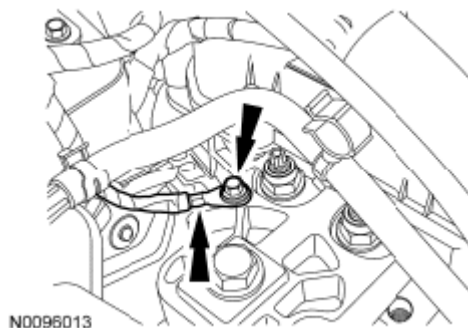


Fig. 623: Locating Ground Wire & Bolt
Courtesy of FORD MOTOR CO.

29. Attach the transaxle control cables to the bracket.
- Connect the control cables to the control levers.

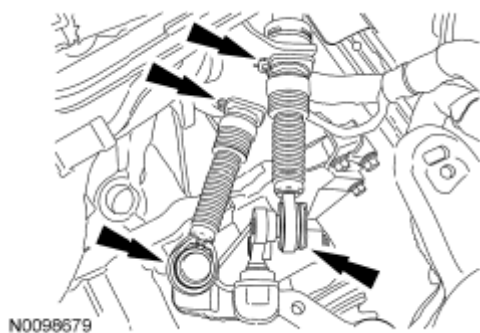


Fig. 624: Locating Transaxle Control Cables
Courtesy of FORD MOTOR CO.

30. Install the clutch slave cylinder and the 2 bolts.
- Tighten to 22 Nm (16 lb-ft).

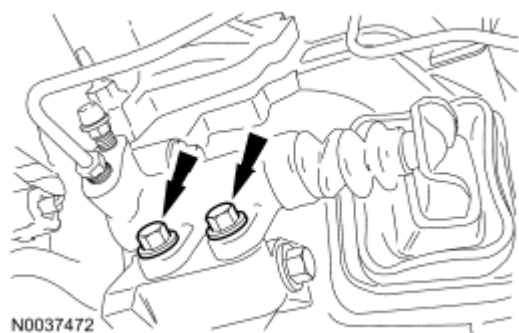


Fig. 625: Locating Clutch Slave Cylinder Bolts
Courtesy of FORD MOTOR CO.

31. Install the 2 clutch tube bracket bolts.
- Tighten to 22 Nm (16 lb-ft).

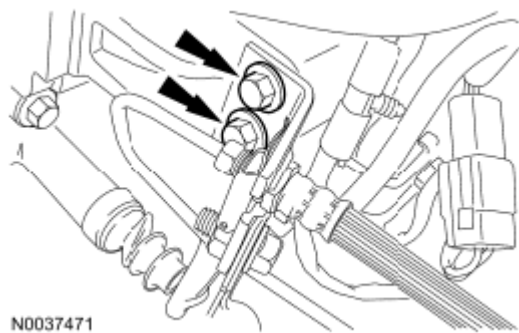


Fig. 626: Locating Clutch Tube Bracket Bolts
Courtesy of FORD MOTOR CO.

32. Connect the heater hose in-line connector and connect the upper radiator and heater hoses to the coolant outlet.

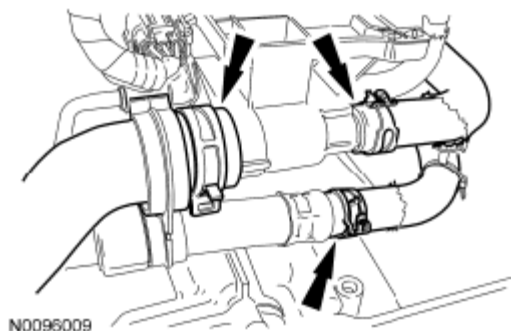


Fig. 627: Locating Heater Hoses & Heater Hose In-Line Connector
Courtesy of FORD MOTOR CO.

33. Attach the coolant hoses retainer.

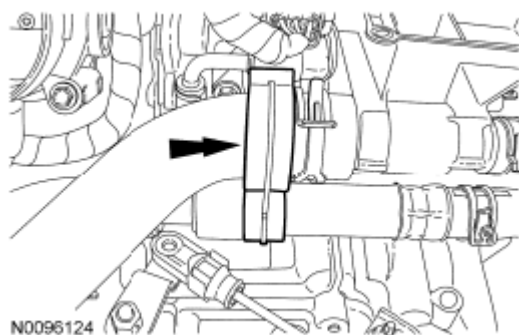


Fig. 628: Locating Coolant Hoses Retainer
Courtesy of FORD MOTOR CO.

34. Connect the fuel supply tube quick connect coupling. For additional information, refer to **QUICK CONNECT COUPLING**.

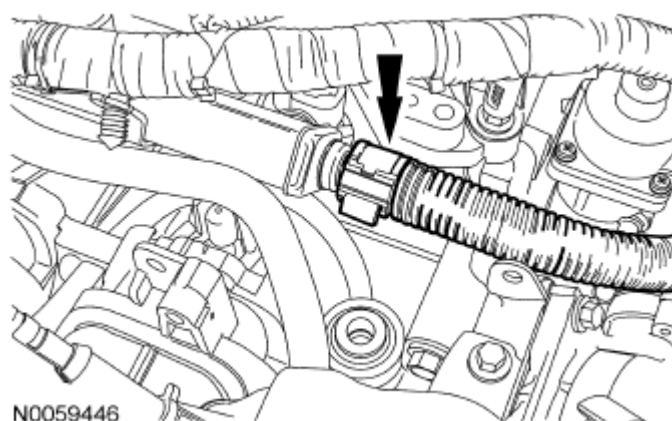


Fig. 629: Locating Fuel Supply Tube Quick Connect Coupling
Courtesy of FORD MOTOR CO.

35. Connect the fuel vapor return tube.

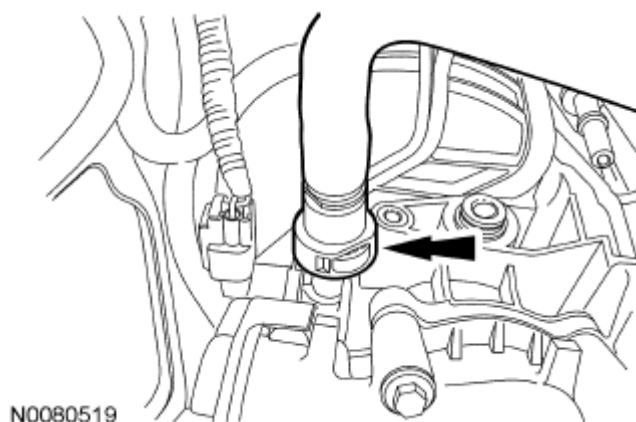


Fig. 630: Locating Fuel Vapor Return Tube
Courtesy of FORD MOTOR CO.

36. Insert the brake booster vacuum supply tube into the locking ring on the intake manifold.

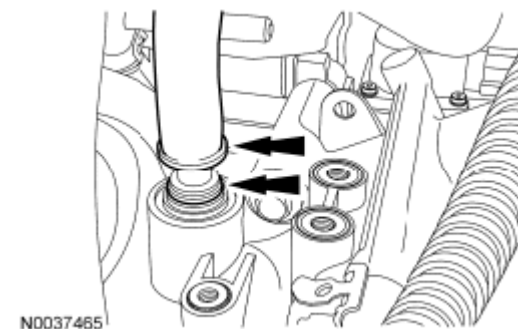


Fig. 631: Locating Brake Booster Vacuum Supply Tube & Locking Ring
Courtesy of FORD MOTOR CO.

37. Connect the crankcase vent tube to the valve cover.

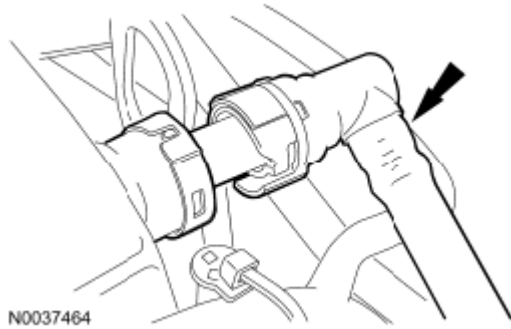


Fig. 632: Connecting Crankcase Vent Tube To Valve Cover
Courtesy of FORD MOTOR CO.

38. Install the exhaust flexible pipe. For additional information, refer to **INSTALLATION**.
39. Install the engine oil filter.
 - Lubricate the engine oil filter gasket with clean engine oil and tighten the oil filter three-fourths turn after the oil filter gasket makes contact with the oil filter adapter.
40. Place the subframe assembly on the Powertrain Lift and raise the subframe into the installed position.

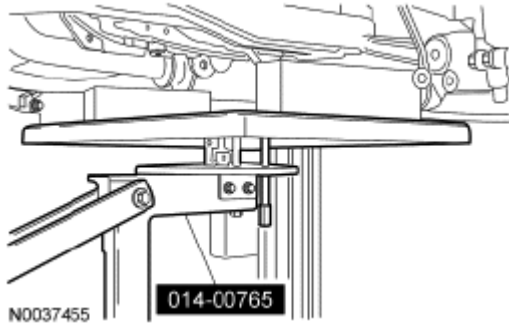


Fig. 633: Positioning Powertrain Lift Under Subframe Assembly
Courtesy of FORD MOTOR CO.

41. Install the front subframe nuts.
 - Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown, RH similar.

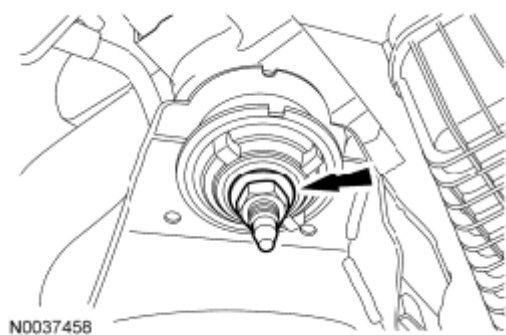


Fig. 634: Locating Front Subframe Nuts
Courtesy of FORD MOTOR CO.

42. Position the subframe brackets and install the bolts finger-tight.

NOTE: LH shown, RH similar.

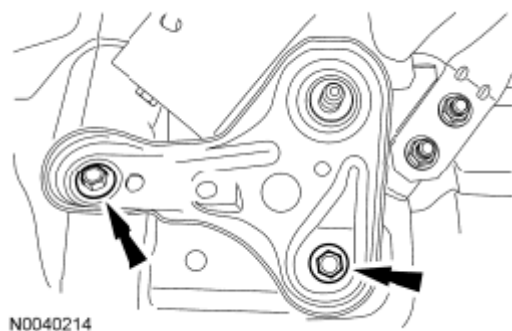


Fig. 635: Locating Subframe Brackets & Bolts
Courtesy of FORD MOTOR CO.

43. Install the subframe nuts.
- Tighten to 150 Nm (111 lb-ft).

NOTE: LH shown, RH similar.

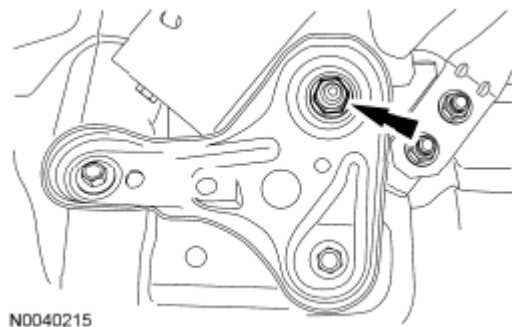


Fig. 636: Locating Subframe Nuts
Courtesy of FORD MOTOR CO.

44. Tighten the subframe bracket-to-body bolts to 103 Nm (76 lb-ft).

NOTE: LH shown, RH similar.

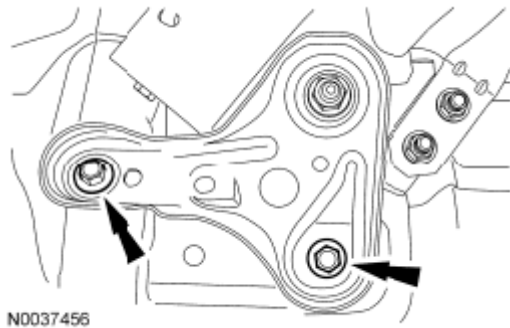


Fig. 637: Locating Subframe Bracket-To-Body Bolts
Courtesy of FORD MOTOR CO.

45. Install the sway bar links and nuts to the struts.
- Tighten to 40 Nm (30 lb-ft).

NOTE: LH shown, RH similar.



Fig. 638: Locating Sway Bar Links & Nuts
Courtesy of FORD MOTOR CO.

46. Install tie-rod ends and nuts.
- Tighten to 48 Nm (35 lb-ft).
 - Install the cotter pin.

NOTE: LH shown, RH similar.

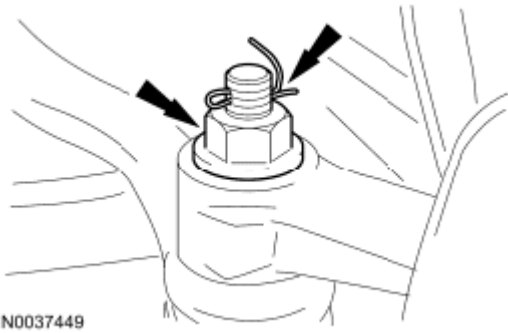


Fig. 639: Locating Tie-Rod Ends & Nuts
Courtesy of FORD MOTOR CO.

47. Install the Electronic Power Assist Steering (EPAS) system wiring harness ground and the bolt.
 - Tighten to 12 Nm (106 lb-in).

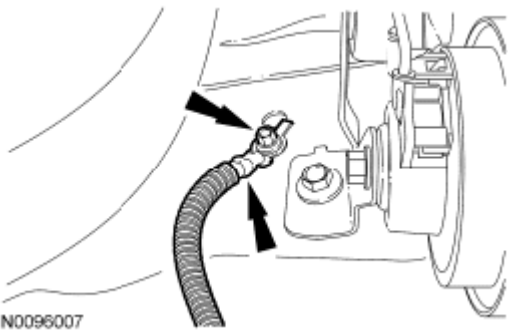


Fig. 640: Locating Electronic Power Assist Steering System Wiring Harness Ground & Bolt
Courtesy of FORD MOTOR CO.

48. Attach the EPAS system wiring harness pin-type retainer to the subframe under the LH fender splash shield.

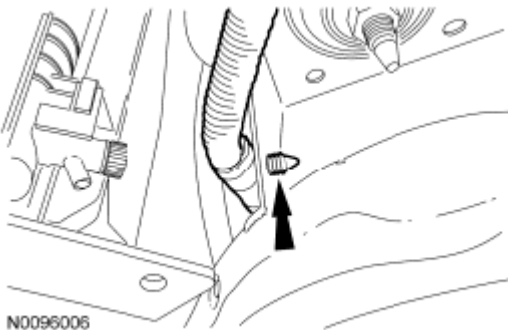


Fig. 641: Locating EPAS System Wiring Harness Pin-Type Retainer
Courtesy of FORD MOTOR CO.

49. Attach the 2 EPAS system wiring harness pin-type retainers to the subframe.

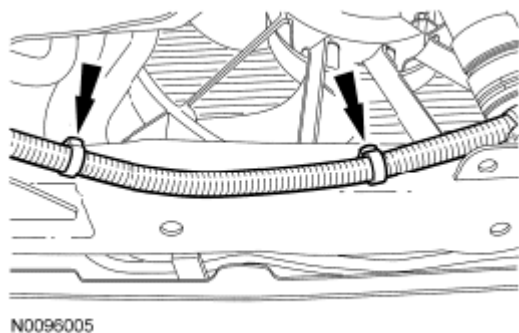


Fig. 642: Locating EPAS System Wiring Harness Pin-Type Retainers
Courtesy of FORD MOTOR CO.

50. Connect the 2 EPAS system electrical connectors.

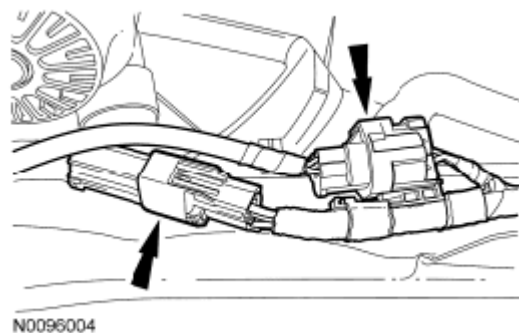


Fig. 643: Locating EPAS System Electrical Connectors
Courtesy of FORD MOTOR CO.

51. Install the LH halfshaft and the intermediate shaft. For additional information, refer to **INSTALLATION**.
52. Install the LH splash shield and the 6 pin-type retainers (4 shown).

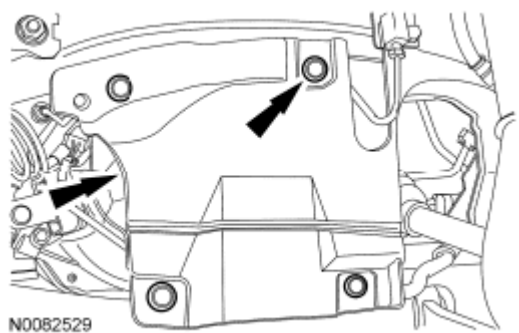


Fig. 644: Locating LH Splash Shield & Pin-Type Retainers

Courtesy of FORD MOTOR CO.

53. Position the LH fender splash shield and install the 4 screws.

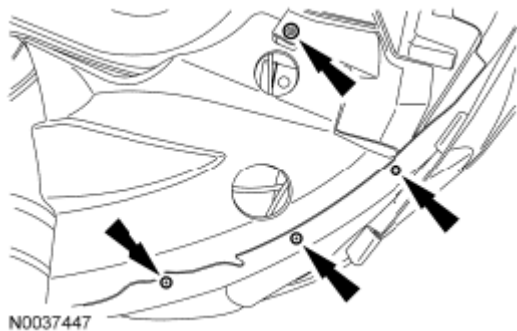


Fig. 645: Locating LH Fender Splash Shield Screws
Courtesy of FORD MOTOR CO.

54. Install the RH splash shield and the 6 pin-type retainers (4 shown).

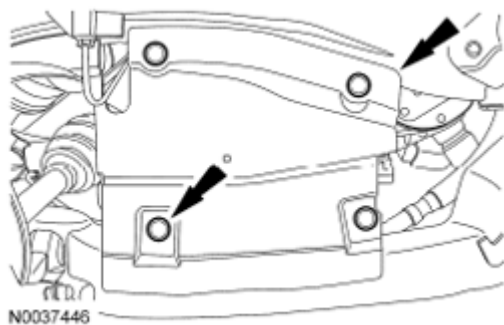


Fig. 646: Locating RH Splash Shield & Pin-Type Retainers
Courtesy of FORD MOTOR CO.

55. Position the RH fender splash shield and install the 4 screws.

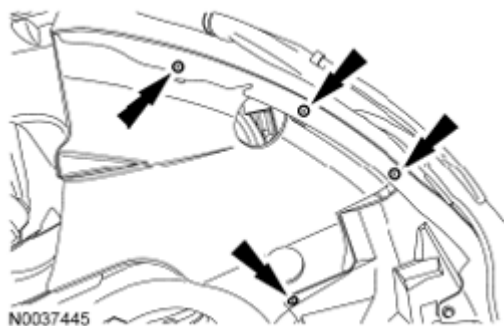


Fig. 647: Locating RH Fender Splash Shield & Screws
Courtesy of FORD MOTOR CO.

56. Install the engine roll restrictor bolt.

- Tighten to 90 Nm (66 lb-ft).

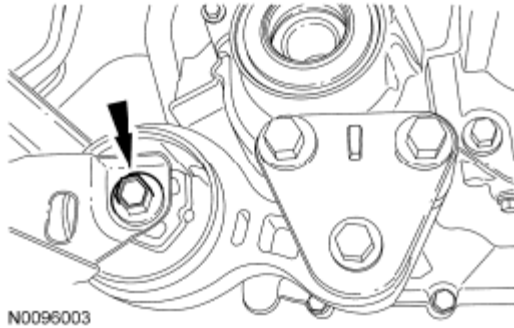


Fig. 648: Locating Engine Roll Restrictor Bolt
Courtesy of FORD MOTOR CO.

57. Slide the steering gear-to-dash seal onto the steering gear and engage the 4 retaining clips (2 shown) into the body.

- From under the vehicle, verify that the seal is correctly installed on the steering gear and the retaining clips are fully engaged into the dash.

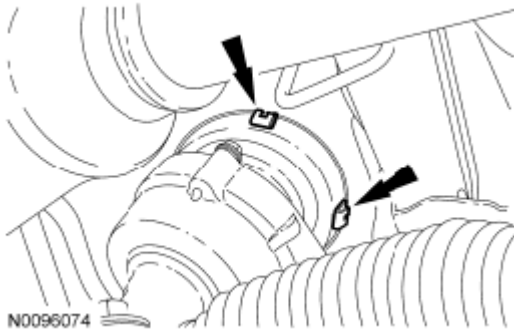


Fig. 649: Locating Steering Gear-To-Dash Seal Retaining Clips
Courtesy of FORD MOTOR CO.

58. If equipped, install the 7 screws and the underbody cover.

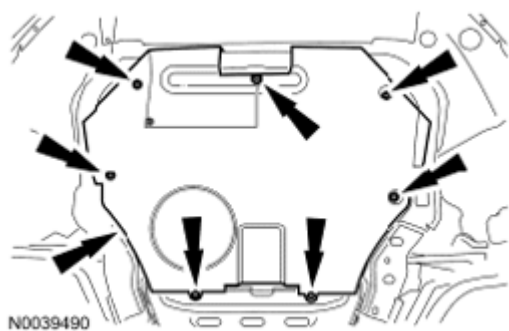


Fig. 650: Locating Underbody Cover & Screws
Courtesy of FORD MOTOR CO.

59. Install the steering column shaft onto the steering gear and install the bolt.
- Tighten to 20 Nm (177 lb-in).



Fig. 651: Locating Steering Column Shaft Bolt
Courtesy of FORD MOTOR CO.

60. Install the steering joint cover and the 2 nuts.

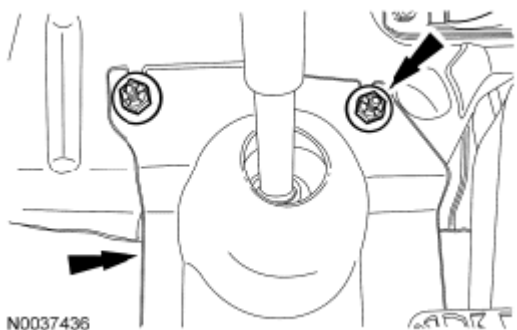


Fig. 652: Locating Steering Joint Cover & Nuts
Courtesy of FORD MOTOR CO.

61. Connect the 2 engine harness electrical connectors.

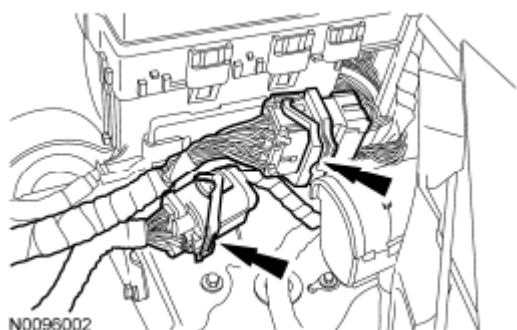


Fig. 653: Locating Engine Harness Electrical Connectors
 Courtesy of FORD MOTOR CO.

62. Attach the 2 negative battery cable pin-type retainers to the transaxle mount and battery tray bracket.

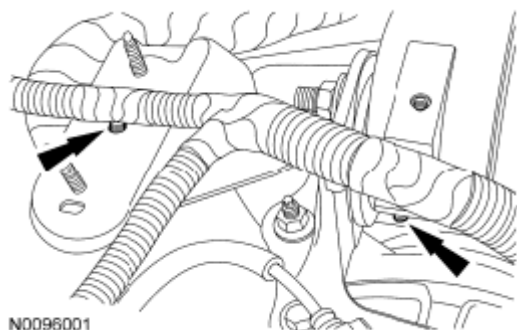


Fig. 654: Locating Negative Battery Cable Pin-Type Retainers
 Courtesy of FORD MOTOR CO.

63. Install the ground wire-to-body and the bolt.
- Tighten to 12 Nm (106 lb-in).

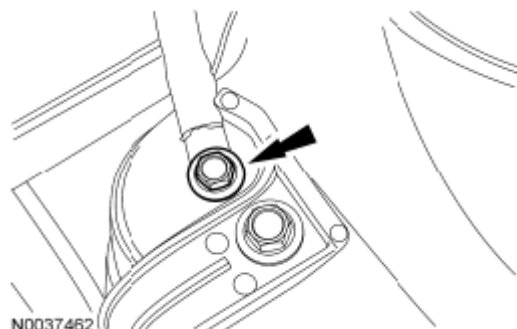


Fig. 655: Locating Ground Wire-To-Body Bolt
 Courtesy of FORD MOTOR CO.

64. Connect the engine wiring harness electrical connector.

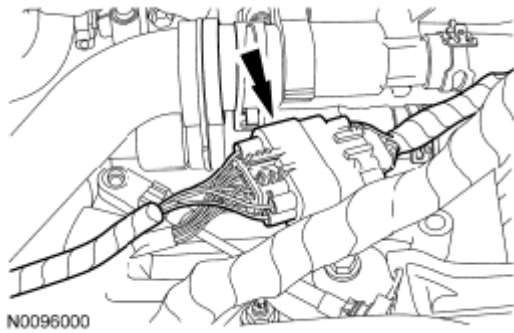


Fig. 656: Locating Engine Wiring Harness Electrical Connector
Courtesy of FORD MOTOR CO.

65. Install the 2 battery cables to the positive battery cable and the 2 nuts.
 - Tighten to 9 Nm (80 lb-in).

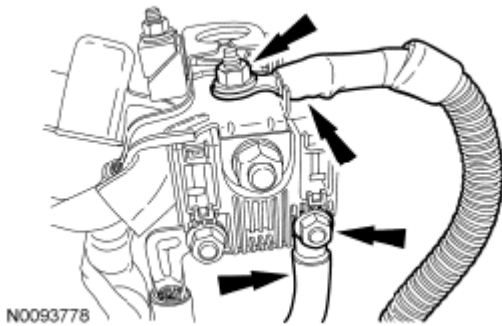


Fig. 657: Locating Battery Cables & Nuts
Courtesy of FORD MOTOR CO.

66. Install the battery tray. For additional information, refer to **REMOVAL AND INSTALLATION** .
67. Install the engine Air Cleaner (ACL) and ACL outlet pipe. For additional information, refer to **REMOVAL AND INSTALLATION** .
68. Fill the engine with clean engine oil.
69. Fill and bleed the cooling system. For additional information, refer to **COOLING SYSTEM DRAINING, FILLING AND BLEEDING** .
70. Recharge the A/C system. For additional information, refer to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS** .
71. If the engine was disassembled, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure following the on-screen instructions.