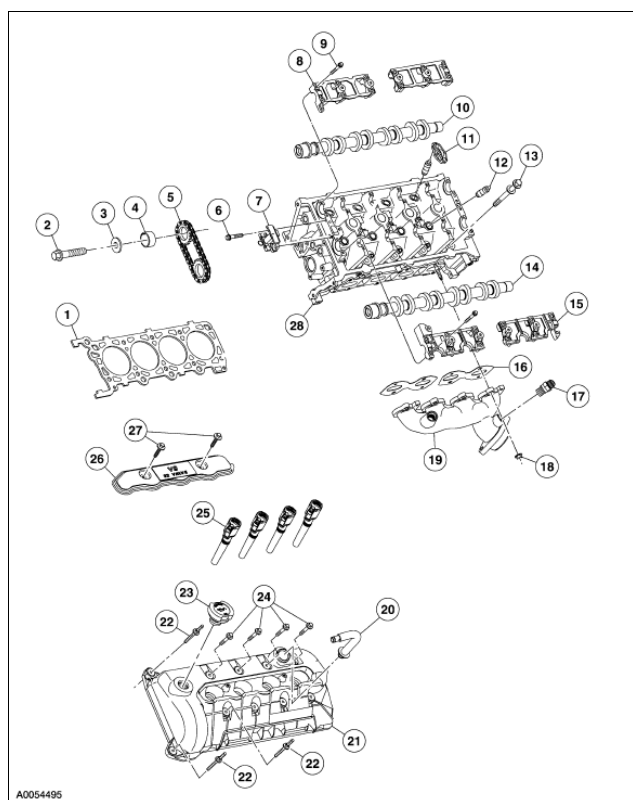


Item	Part Number	Description
1	W705654	Bolt
2	N807309	Bolt (2 req'd)
3	9F460	Bracket
4	N807071	Bolt (5 req'd)
5	9A448	Intake manifold (upper)
6	9E498	Vacuum harness
7	9F792	Fuel injection supply manifold
8	N811449	Stud (4 req'd)
9	9F907	Fuel injector anti-rotation clip (8 req'd)
10	9F593	Fuel injector (8 req'd)
11	8548	Water crossover
12		Fuel injector O-ring seal (8 req'd)
13	W704682	Bolt (10 req'd)
14	95455	Intake manifold (lower)

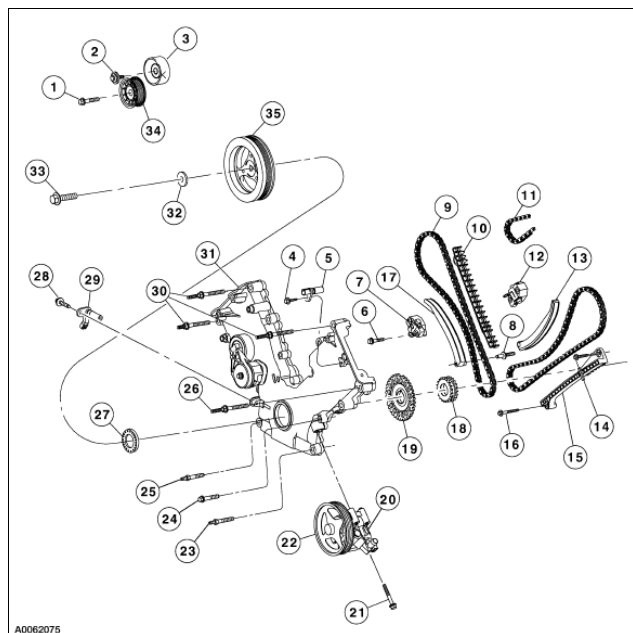
Cylinder Head Components



Item	Part Number	Description
1	6083	Cylinder head gasket
2	N811085	Bolt (2 req'd)
3	N806164	Washer (2 req'd)
4	6265	Spacer
5	6268	Secondary timing chain (2 req'd)
6	W500215	Screw and washer (2 req'd)
7	6C271	Timing chain vibration damper
8	6B277	Camshaft bearing cap
9	N807352	Bolt (19 req'd)
10	6A271	Camshaft (intake)
11	6529	Roller follower (32 req'd)
12	6C501	Hydraulic lash adjuster
13	6065	Bolt (10 req'd)
14	6A273	Camshaft (exhaust)
15	6B278	Camshaft bearing cap (8 req'd)
16	9Y431	Exhaust manifold gasket (2 req'd)
17	9F485	EGR valve tube to manifold connector
18	W701706	Nut (16 req'd)
19	9431	Exhaust manifold
20	6758	Crankcase vent tube and connector
21	6A505	Valve cover
22	W708441	Bolt (6 req'd)
23	6766	Oil filler cap
24	W705438	Bolt (6 req'd)

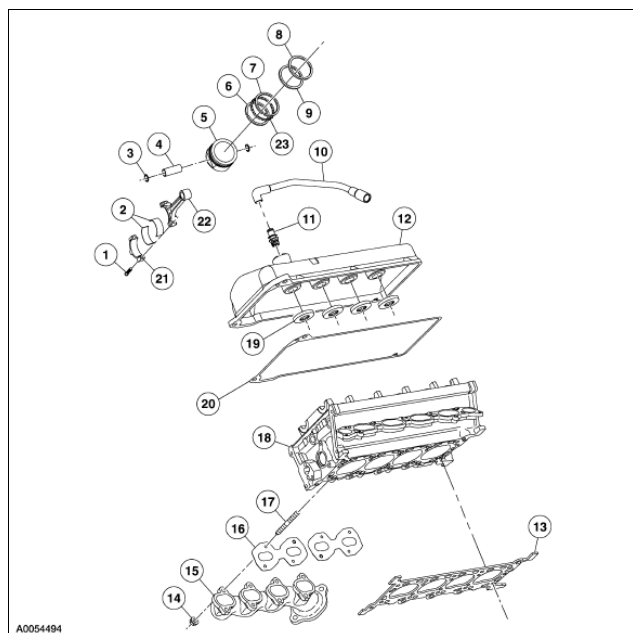
25	12A366	Ignition coils
26	6P067	Ignition coil cover
27	N807309	Bolt (2 req'd)
28	6050	Cylinder head

Front Cover and Timing Drive Components



Item	Part Number	Description
1	N808102	Bolt
2	N808102	Bolt
3	19A216	Belt idler pulley
4	N806155	Bolt
5	6B288	Camshaft position sensor
6	N606543	Bolt (4 req'd)
7	6L266	Timing chain tensioner
8	W705803	Stud
9	6268	Timing chain (2 req'd)
10	6M256	Timing chain guide
11	6268	Secondary timing chain (2 req'd)
12	6M269	Timing chain tensioner
13	6L253	Timing chain tensioner arm
14	N605893	Bolt (2 req'd)
15	6B274	Timing chain guide
16	N606529	Bolt (2 req'd)
17	6L253	Timing chain tensioner arm
18	6306	Crankshaft sprocket
19	12A227	Ignition pulse ring
20	3A696	Power steering pump
21	W560315	Bolt (4 req'd)
22	3D673	Power steering pump pulley

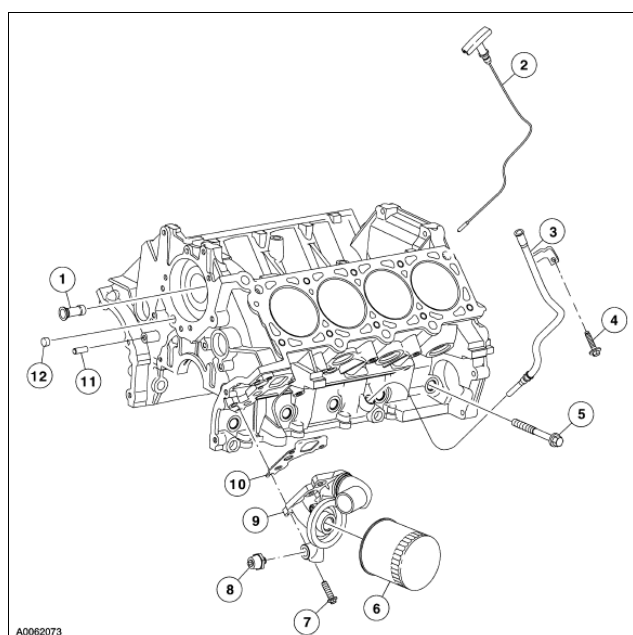
23	W706508	Stud
24	N806177	Bolt (8 req'd)
25	N808586	Stud
26	N806300	Stud (2 req'd)
27	6700	Crankshaft front seal
28	N806155	Bolt
29	6C315	Crankshaft position sensor
30	W706560	Stud (3 req'd)
31	6C086	Engine front cover
32	N806165	Washer
33	W701512	Bolt
34	19A216	Belt idler pulley
35	6316	Crankshaft pulley

Piston and Connecting Rod, Cylinder Head Components

Item	Part Number	Description
1	6214	Bolt (16 req'd)
2	6211	Connecting rod bearing (16 req'd)
3	6140	Piston pin retainer (16 req'd)
4	6135	Piston pin (8 req'd)
5	6110	Piston (8 req'd)
6	6159	Piston ring (8 req'd)
7	6159	Piston ring (8 req'd) (part of 6100)
8	6150	Piston ring (8 req'd) (part of 6100)
9	6152	Piston ring (8 req'd)
10	6K817	PCV tube
11	6A666	PCV valve
12	6582	Valve cover
13	6051	Cylinder head gasket

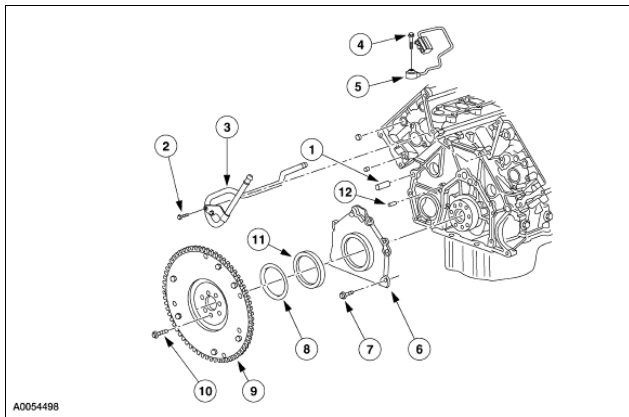
14	W701706	Nut (16 req'd)
15	9430	Exhaust manifold
16	9448	Exhaust manifold gasket
17	N811313	Stud (16 req'd)
18	6049	Cylinder head
19	6C527	Spark plug gasket (8 req'd)
20	6051	Cylinder head gasket
21	6200	Connecting rod (8 req'd)
22	6200	Connecting rod (8 req'd)
23	6161	Piston ring (8 req'd)

Cylinder Block and Oil Filter Assembly



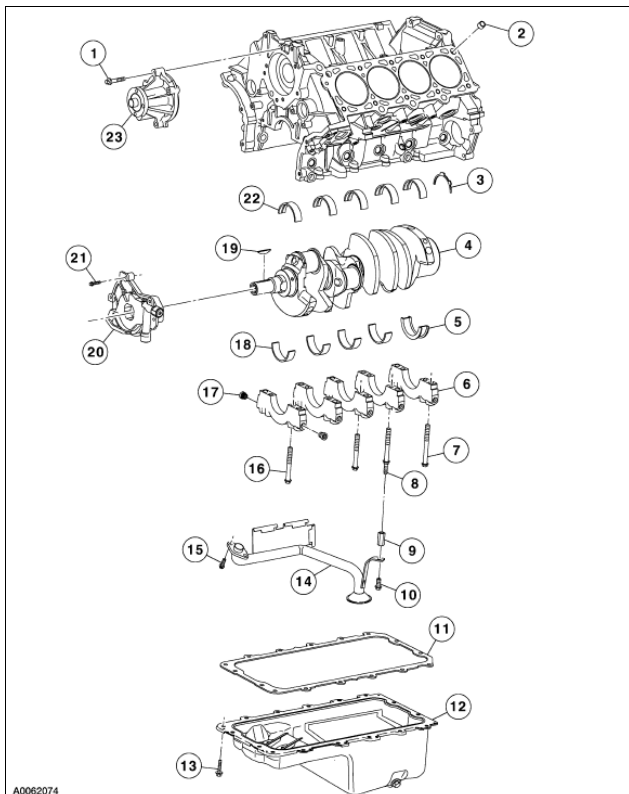
Item	Part Number	Description
1	18B402	Water bypass tube
2	6750	Oil level indicator
3	6754	Oil level indicator tube
4	N806155	Bolt
5	6C358	Bolt (10 req'd)
6	6714	Oil filter
7	W705128	Bolt (4 req'd)
8	9278	Oil pressure sender
9	6881	Oil filter adapter
10	6A636	Oil filter adapter gasket
11	W701228	Dowel
12	87836	Plug

Cylinder Block and Flexplate Assembly



Item	Part Number	Description
1	N807198	Dowel pin (2 req'd)
2	N807959	Bolt
3	18663	Heater water hose
4	W500110	Bolt (2 req'd)
5	12A699	Knock sensor (2 req'd)
6	6K318	Crankshaft rear retainer
7	N806155	Bolt (6 req'd)
8	6310	Crankshaft oil slinger
9	6375	Flexplate
10	N808139	Bolt (8 req'd)
11	6701	Crankshaft rear oil seal
12	N806007	Dowel pin (2 req'd)

Cylinder Block and Lower End Components



Item	Part Number	Description
1	N806177	Bolt (4 req'd)
2	W704594	Dowel (4 req'd)
3	6A341	Thrust washer
4	6303	Crankshaft
5	6A339	Thrust bearing
6	6325	Main bearing cap (5 req'd)
7	6345	Bolt (10 req'd)
8	6K258	Bolt (4 req'd)
9	N806180	Spacer
10	N605904	Bolt
11	6710	Oil pan gasket
12	6675	Oil pan
13	W701605	Bolt (16 req'd)
14	6622	Oil pump screen and pickup tube
15	N806155	Bolt (2 req'd)
16	6345	Bolt (6 req'd)
17	6C360	Main bearing cap adjusting screw (10 req'd)
18	6A338	Crankshaft main bearing (4 req'd)
19	N806201	Woodruff key
20	6621	Oil pump
21	N806183	Bolt (3 req'd)
22	6333	Crankshaft main bearing
23	8501	Water pump

DIAGNOSIS AND TESTING

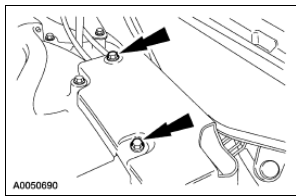
Engine

Refer to Section 303-00 for basic mechanical concerns or refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for driveability concerns.

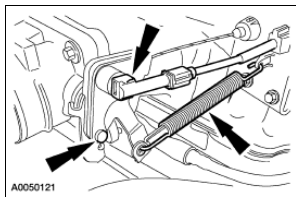
Upper Intake Manifold

Removal

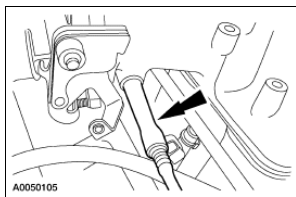
1. Partially drain the cooling system.
2. Disconnect the battery ground cable. For additional information, refer to [Section 414-01](#) .
3. Remove the air cleaner outlet pipe. For additional information, refer to [Section 303-12](#) .
4. Remove the accelerator control splash shield.



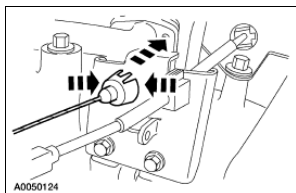
5. Disconnect the accelerator cable, the speed control cable and the return spring.



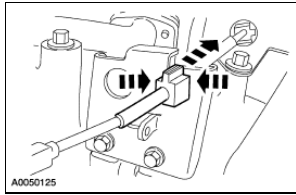
6. Disconnect the fuel vapor hose.



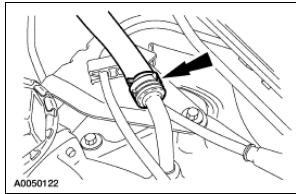
7. Remove the accelerator control cable from the bracket.



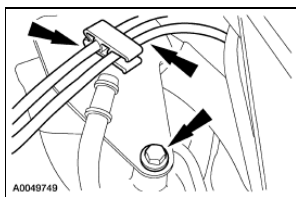
8. Remove the speed control cable from the bracket.



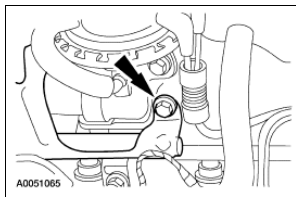
9. Disconnect the vacuum hose.



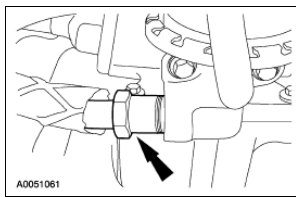
10. Remove the bolt, disconnect the acceleration control cables and position them aside.



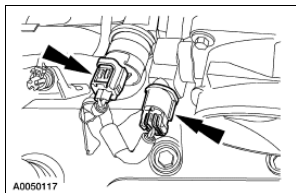
11. Remove the bolt and the bracket.



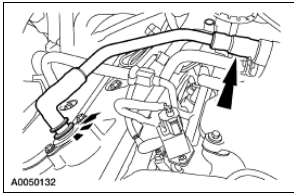
12. Disconnect the exhaust gas recirculation (EGR) system module tube from the EGR system module.



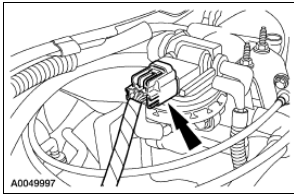
13. Disconnect the throttle position (TP) sensor and the idle air control (IAC) sensor electrical connectors.



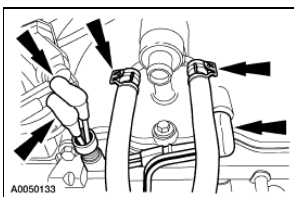
14. Disconnect the positive crankcase ventilation (PVC) tube.



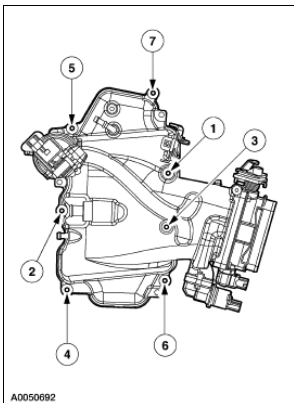
15. Disconnect the EGR system module electrical connector.



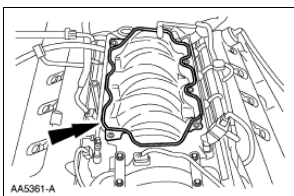
16. Disconnect the vacuum hoses and the positive crankcase ventilation (PCV) coolant hoses.



17. Remove the upper intake manifold assembly bolts in the sequence shown. Remove the intake manifold assembly.

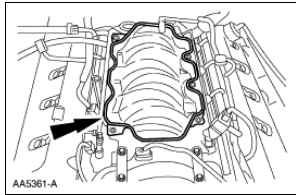


18. Inspect and clean the sealing surfaces.

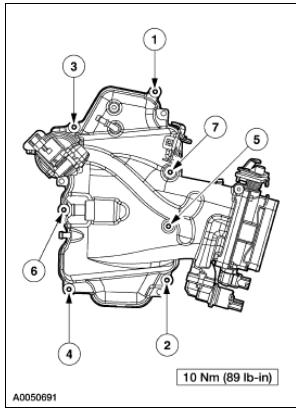


Installation

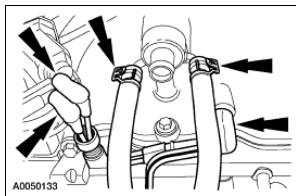
1. Install a new upper intake manifold gasket.



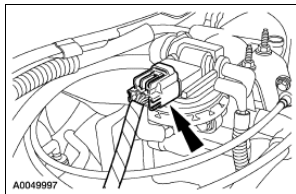
2. Install the upper intake manifold and bolts in the sequence shown.



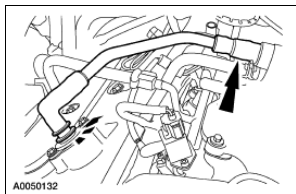
3. Connect the vacuum hoses and the PCV coolant hoses.



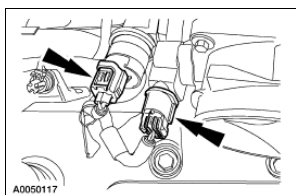
4. Connect the EGR system module electrical connector.



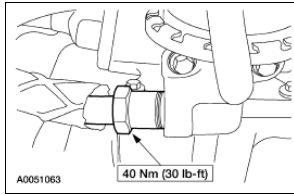
5. Connect the positive crankcase ventilation (PVC) tube.



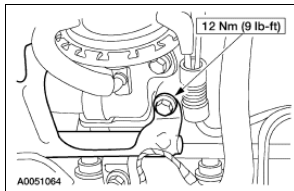
6. Connect the throttle position (TP) sensor and the idle air control (IAC) sensor electrical connectors.



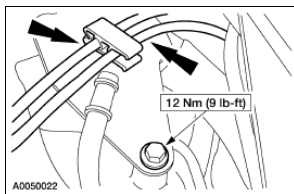
7. Connect the exhaust gas recirculation (EGR) system module tube from the EGR system module.



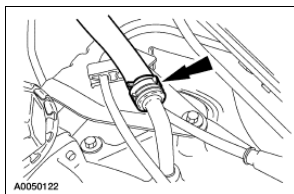
8. Install the bracket and the bolt.



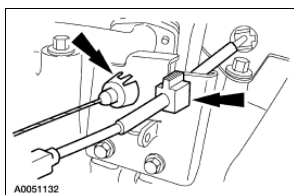
9. Install the bolt, and connect the acceleration control cables.



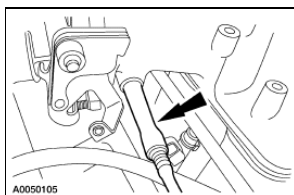
10. Connect the vacuum hose.



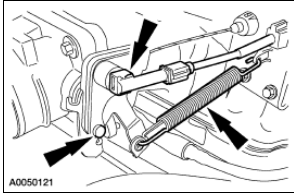
11. Install the accelerator control cables.



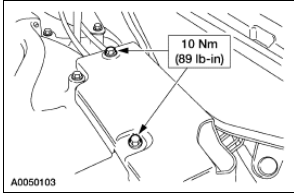
12. Connect the fuel vapor hose.



13. Connect the accelerator cable, the speed control cable and the return spring.



14. Install the accelerator control splash shield.



15. Install the air cleaner outlet tube. For additional information, refer to [Section 303-12](#) .

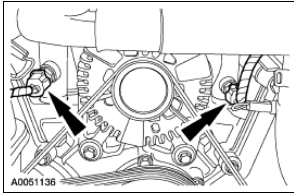
16. Connect the battery ground cable. For additional information, refer to [Section 414-01](#) .

17. Partially fill and bleed the cooling system. For additional information, refer to [Section 303-03](#) .

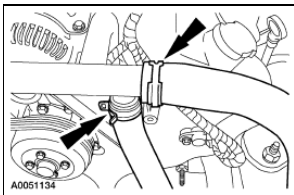
Lower Intake Manifold

Removal

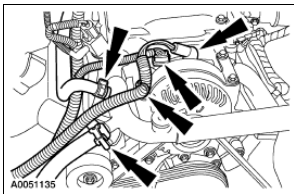
1. Drain the engine cooling system. For additional information, refer to [Section 303-03](#).
2. Remove the upper intake manifold. For additional information, refer to [Upper Intake Manifold](#) in this section.
3. Disconnect the fuel line spring lock coupling. For additional information, refer to [Section 310-00A](#).
4. Disconnect the engine coolant temperature (ECT) sensor electrical connectors.



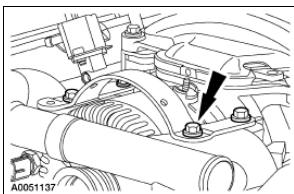
5. Disconnect the coolant hoses.



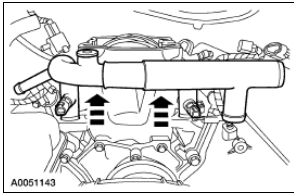
6. Disconnect the coolant hoses, the electrical connectors, and the wiring harness retainer.



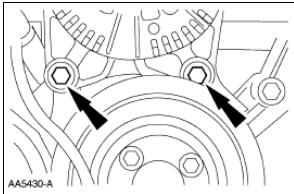
7. Remove the accessory drive belt. For additional information, refer to [Section 303-05](#).
8. Remove the bolts and the generator support bracket.



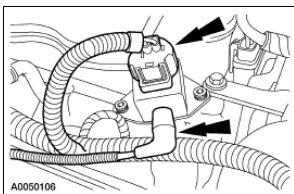
9. Remove the crossover tube.



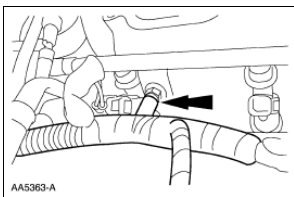
10. Remove the bolts and the generator.



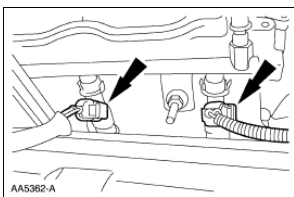
11. Disconnect the electrical connector and the vacuum hose from the fuel pressure sensor.



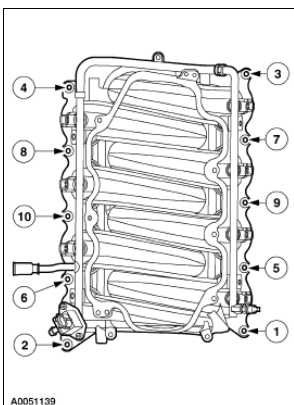
12. Separate the wiring harness from the fuel injection supply manifold studs in four places.



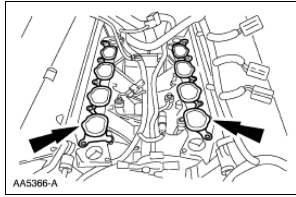
13. Disconnect the eight fuel injector electrical connectors.



14. Remove the ten bolts in the sequence shown, and raise the lower intake manifold slightly.

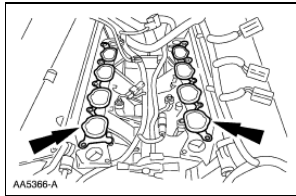


15. Disconnect the fuel charging wiring harness from the rear of the lower intake manifold.
 - Remove the manifold.
16. Remove the intake manifold gaskets.
 - Clean and inspect the sealing surfaces.

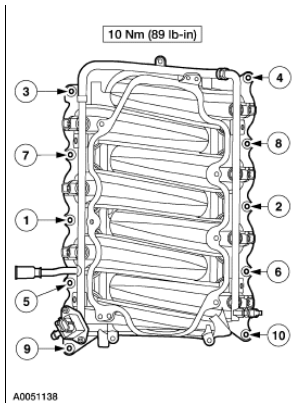


Installation

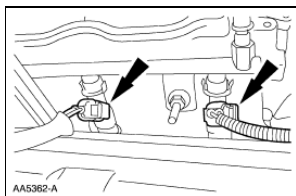
1. Install the lower intake manifold gaskets.
 - Inspect the gaskets, install new gaskets if necessary.



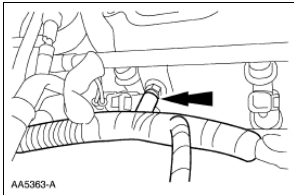
2. Install the intake manifold fasteners and tighten in the sequence shown.



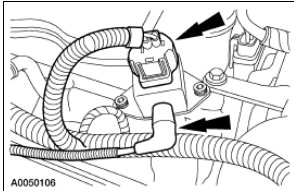
3. Connect the fuel charging wiring harness to the rear of the lower intake manifold.
 - Install the manifold.
4. Connect the eight fuel injector electrical connectors.



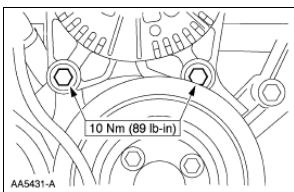
5. Position the fuel charging wiring and connect to the fuel injection supply manifold in four places.



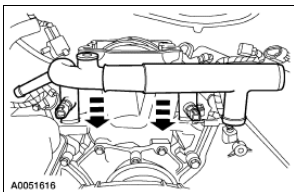
6. Connect the electrical connector and the vacuum hose to the fuel pressure sensor.



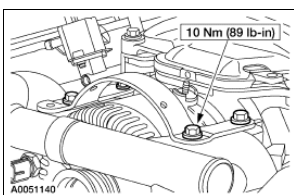
7. Install the generator and the bolts.



8. Install the crossover tube pipe.
• Inspect and install new O-ring seals if necessary.

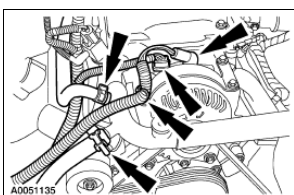


9. Install the generator support bracket and the four bolts.

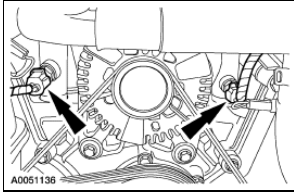


10. Install the accessory drive belt. For additional information, refer to [Section 303-05](#).

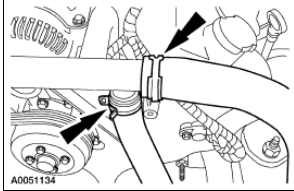
11. Connect the coolant hoses, electrical connectors, and the wiring harness retainer.



12. Connect the engine coolant temperature (ECT) sensor electrical connectors.



13. Connect the coolant hoses.



14. Connect the fuel hose spring lock coupling. For additional information, refer to [Section 310-00A](#) .

15. Install the upper intake manifold. For additional information, refer to [Upper Intake Manifold](#) in this section.

16. Fill and bleed the engine cooling system. For additional information, refer to [Section 303-03](#) .

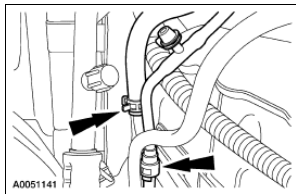
Valve Cover RH

Material

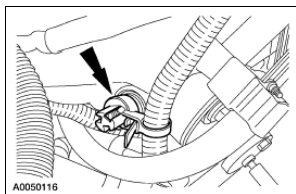
Item	Specification
Silicone Gasket and Sealant F7AZ-19554-EA	WSE-M4G323-A4
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A

Removal and Installation

1. Drain the engine cooling system. For additional information, refer to [Section 303-03](#) .
2. Disconnect the fuel hose spring lock coupling. For additional information, refer to [Section 310-00A](#) .
3. Disconnect the coolant hose and the evaporative emissions (EVAP) tube, and position aside.

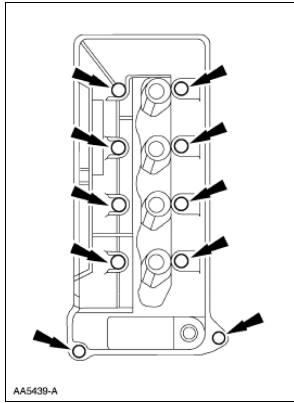


4. Disconnect the engine wiring harness retainer.

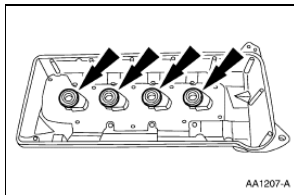


5. Remove the RH ignition coils. For additional information, refer to [Section 303-07B](#) .
6. Remove the RH valve cover.
 - **⚠ CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Remove and discard the gasket, clean and inspect the sealing surfaces.



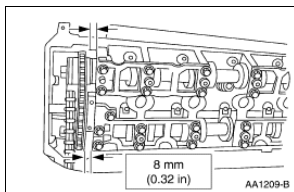
7. Inspect the valve cover spark plug hole gaskets. Install new gaskets, if necessary. Make sure the gaskets are correctly seated on the valve cover.



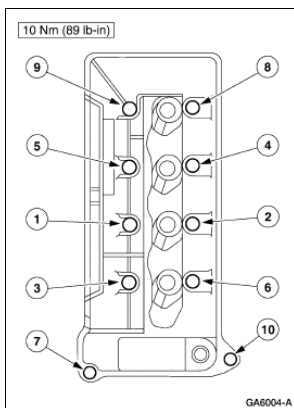
8. **NOTE:** If the valve cover is not secured within four minutes, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or four minutes, whichever is longer. Failure to follow this procedure can result in future oil leakage.

To install, reverse the removal procedure.

- Apply silicone gasket and sealant as shown.



9. Tighten the valve cover fasteners in the sequence shown.



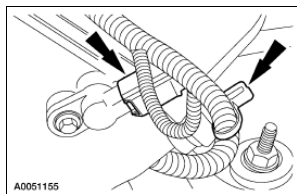
Valve Cover LH

Material

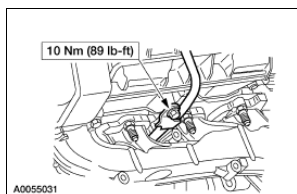
Item	Specification
Ford Silicone Gasket and Sealant F7AZ-19554-EA or equivalent	WSE-M4G323-A4
Metal Surface Cleaner F4AZ-19A536-RA	WSE-M5B392-A

Removal and Installation

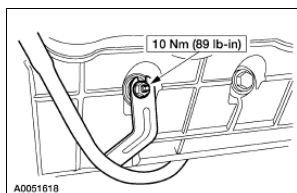
1. Remove the throttle body (TB). For additional information, refer to [Section 303-04B](#) .
2. Remove the LH ignition coils. For additional information, refer to [Section 303-07B](#) .
3. Disconnect the camshaft position (CMP) sensors, and the engine wiring harness retainers.



4. Remove the bolt.



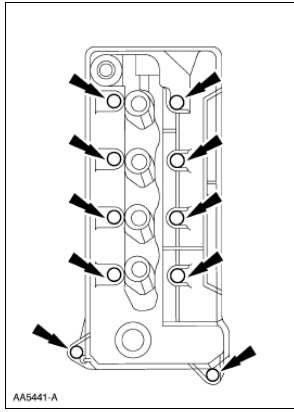
5. Remove the nut and position the oil level indicator tube aside.



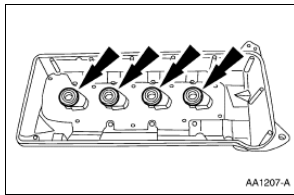
6. **⚠ CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.**

Remove the LH valve cover.

- Remove and discard the gasket, clean and inspect the sealing surfaces.



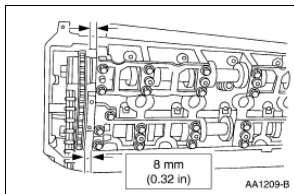
7. Inspect the valve cover spark plug hole gaskets. Install new gaskets, if necessary. Make sure the gaskets are correctly seated on the valve cover.



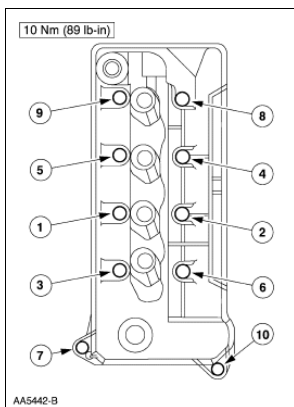
8. **NOTE:** If the valve cover is not secured within four minutes, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or four minutes, whichever is longer. Failure to follow this procedure can result in future oil leakage.

To install, reverse the removal procedure.

- Apply silicone gasket and sealant as shown.

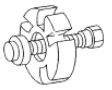



9. Tighten the valve cover fasteners in the sequence shown.



Crankshaft Pulley

Special Tool(s)

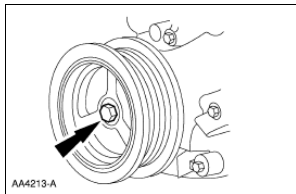
 <p>ST1296-A</p>	<p>Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)</p>
 <p>ST1297-A</p>	<p>Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)</p>

Material

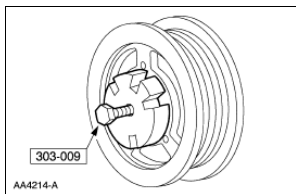
Item	Specification
<p>Silicone Gasket and Sealant F7AZ-19554-EA</p>	<p>WSE-M4G323-A4</p>

Removal

1. Remove the drive belt. For additional information, refer to [Section 303-05](#) .
2. Raise and support the vehicle. For additional information, refer to [Section 100-02](#) .
3. Remove the bolt.



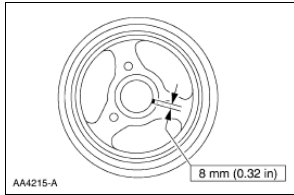
4. Using the special tool, remove the crankshaft pulley.



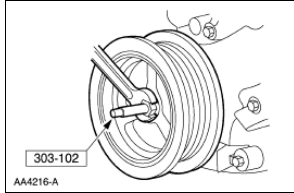
Installation

1. **NOTE:** The crankshaft pulley must be installed within four minutes after applying the silicone.

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

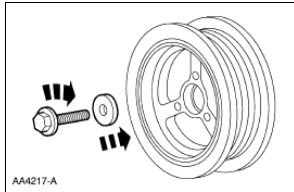


2. Using the special tool, install the crankshaft pulley.



3. Install the bolt and washer. Tighten the bolt in four stages.

- Stage 1: Tighten the bolt to 90 Nm (66 lb-ft).
- Stage 2: Loosen the bolt one full turn.
- Stage 3: Tighten the bolt to 50 Nm (37 lb-ft).
- Stage 4: Tighten the bolt an additional 85 to 95 degrees.


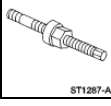


4. Lower the vehicle.

5. Install the drive belt. For additional information, refer to [Section 303-05](#).

Crankshaft Front Seal

Special Tool(s)

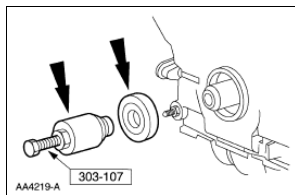
 ST1328-A	Installer, Front Cover Seal 303-335 (T88T-6701-A)
 ST1288-A	Remover, Crankshaft Front Seal 303-107 (T74P-6700-A)
 ST2197-A	Installer, Crankshaft Front Seal 303-635
 ST1287-A	Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)

Material

Item	Specification
SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP or equivalent	WSS-M2C153-H

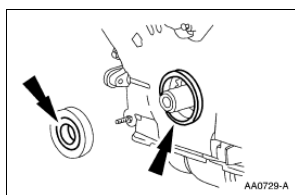
Removal

1. Remove the crankshaft pulley. For additional information, refer to [Crankshaft Pulley](#) in this section.
2. Using the special tool, remove the front cover seal.

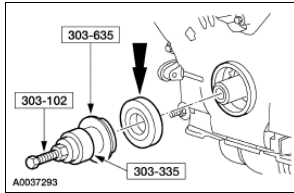


Installation

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



2. Using the special tool, install the front oil seal.



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

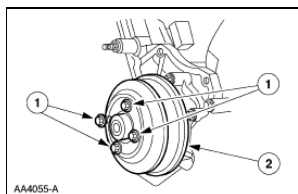
Engine Front Cover

Material

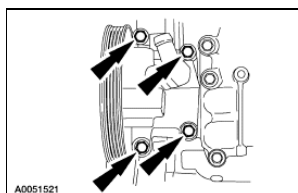
Item	Specification
Metal Surface Cleaner F4AZ-19A536-RA or equivalent	WSE-M5B392-A
Silicone Gasket and Sealant F7AZ-19554-EA or equivalent	WSE-M4G323-A4
SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP or equivalent	WSS-M2C153-H

Removal

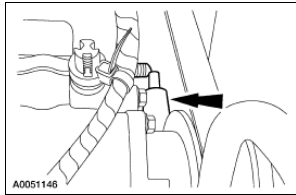
1. Remove the left and right valve covers. For additional information, refer to Valve Cover LH and Valve Cover RH in this section.
2. Remove the cooling fan. For additional information, refer to Section 303-03 .
3. Remove the water pump pulley.
 1. Remove the bolts.
 2. Remove the water pump pulley.



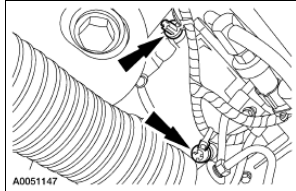
4. Remove the crankshaft front seal. For additional information, refer to Crankshaft Front Seal in this section.
5. Remove the bolts and position the power steering pump aside.



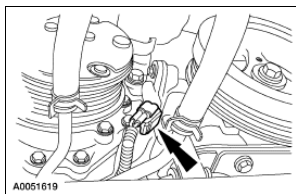
6. Disconnect the A/C compressor electrical connector.



7. Disconnect the engine wiring harness retainers from the A/C compressor.

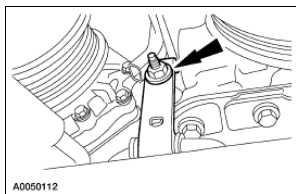


8. Disconnect the crankshaft position (CKP) sensor electrical connector.

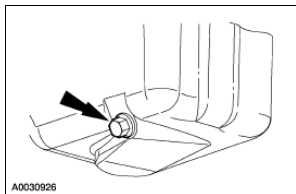


9. Remove the A/C compressor and position aside.

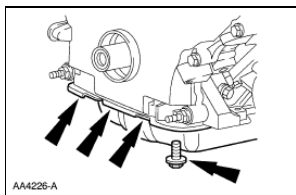
10. Remove the nut and the bracket.



11. Remove the drain plug and drain the engine oil.

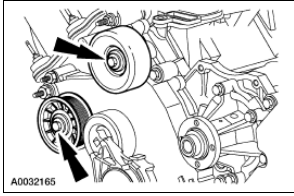


12. Remove the four front bolts.

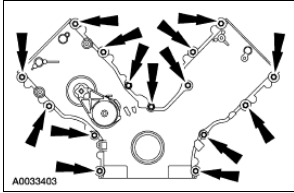


13. Lower the vehicle.

14. Remove the belt idler pulleys.



15. Remove the bolts and the studs, and the engine front cover.



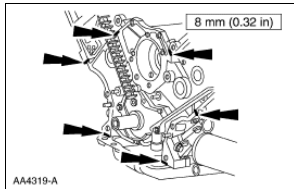
16. **⚠ CAUTION:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

Remove and discard the gasket, clean and inspect the sealing surfaces.

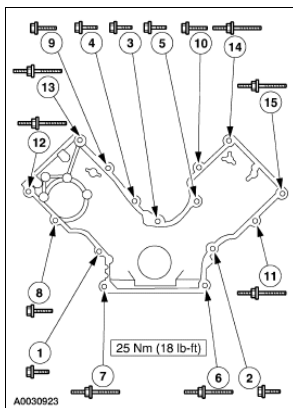
Installation

1. **NOTE:** If the valve cover is not secured within four minutes, the sealant must be removed and the sealing area cleaned with metal surface cleaner. Allow to dry until there is no sign of wetness, or four minutes, whichever is longer. Failure to follow this procedure can result in future oil leakage.

Apply silicone gasket and sealant in the locations shown.



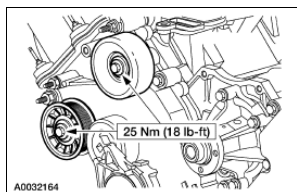
2. Install the engine front cover.
Tighten the fasteners in the sequence shown.



Item	Part Number	Description
1	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
2	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53

3	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
4	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
5	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
6	W706508	Stud, Hex Shldr Pilot, M8 x 1.25 x 50 M6 x 1 x 10
7	N808586	Stud and Washer, Hex Head Pilot, M8 x 1.25 x 60 M6 x 1 x 26
8	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
9	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
10	N806177	Bolt, Hex Flange Head Pilot, M8 x 1.25 x 53
11	N806300	Stud, Hex Shldr Pilot, M8 x 1.25 x 65 M8 x 1.25 x 26
12	W706560	Stud, Hex Head Pilot, M8 x 1.25 x 65 M8 x 1.25 x 16
13	W706560	Stud, Hex Shldr Pilot, M8 x 1.25 x 65 M8 x 1.25 x 26
14	W706560	Stud, Hex Shldr Pilot, M8 x 1.25 x 65 M8 x 1.25 x 26
15	N806300	Stud, Hex Shldr Pilot, M8 x 1.25 x 65 M8 x 1.25 x 26

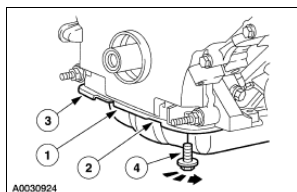
3. Install the belt idler pulleys.



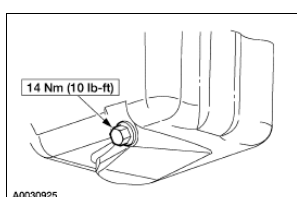
4. Raise the vehicle. For additional information, refer to [Section 100-02](#) .

5. Tighten the bolts in three stages, in the sequence shown.

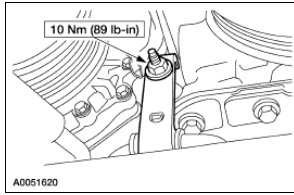
- Stage 1: Tighten to 2 Nm (18 lb-in).
- Stage 2: Tighten to 20 Nm (15 lb-ft).
- Stage 3: Tighten an additional 60 degrees.



6. Install the drain plug.

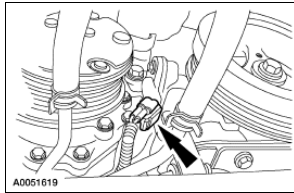


7. Install the bracket and the nut.

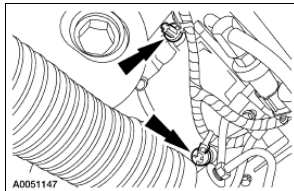


8. Remove the A/C compressor and position aside.

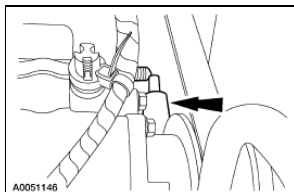
9. Connect the crankshaft position (CKP) sensor electrical connector.



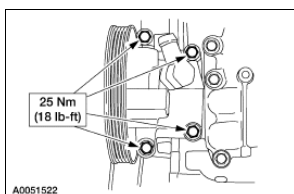
10. Connect the engine wiring harness retainers to the A/C compressor.



11. Connect the A/C compressor electrical connector.

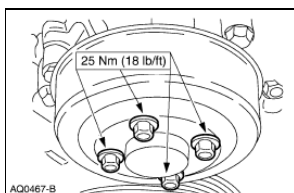


12. Position the power steering pump and install the bolts.



13. Install the crankshaft front seal. For additional information, refer to [Crankshaft Front Seal](#) in this section.

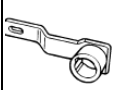
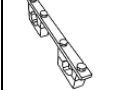
14. Install the water pump pulley.



15. Install the cooling fan. For additional information, refer to Section 303-03 .
 16. Install the left and right valve cover. For additional information, refer to Valve Cover LH and Valve Cover RH in this section.
 17. Fill the crankcase with clean engine oil.
-

Timing Drive Components

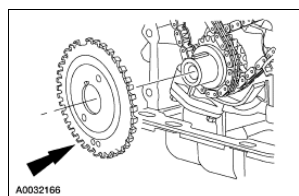
Special Tool(s)

 <p>ST1335-A</p>	Holding Tool, Crankshaft 303-448 (T93P-6303-A)
 <p>ST1715-A</p>	Holding Tool, Camshaft 303-446 (T93P-6256-AHR)

Removal

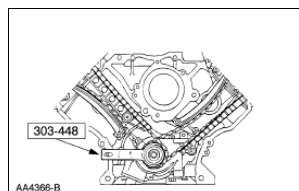
⚠ CAUTION: Since the engine is not free-wheeling, timing procedures must be followed exactly or piston and valve damage can occur.

1. Remove the engine front cover. For additional information, refer to Engine Front Cover in this section.
2. Remove the roller followers. For additional information, refer to Camshaft Roller Follower in this section.
3. Remove the crankshaft sensor ring from the crankshaft.

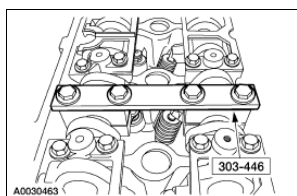


4. **⚠ CAUTION:** Unless otherwise instructed, at no time when the timing chains are removed and the cylinder heads are installed is the crankshaft or the camshaft to be rotated. Severe piston and valve damage will occur.

Using the special tool, position the crankshaft with the keyway at the 12 o'clock position.

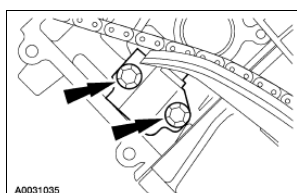


5. Install the special tools on the camshaft.



6. Remove the timing chain tensioning system from both timing chains.

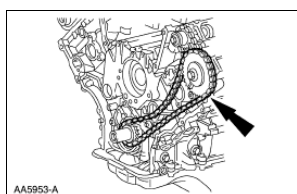
- Remove the bolts.
- Remove the timing chain tensioners.
- Remove the timing chain tensioner arms.



7. **⚠ CAUTION:** Unless otherwise instructed, at no time when the timing chains are removed and the cylinder heads are installed is the crankshaft or the camshaft to be rotated. Severe piston and valve damage will occur.

Remove the RH and LH timing chains and the crankshaft sprocket.

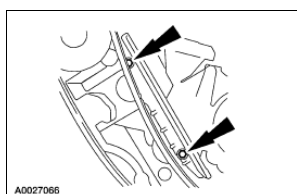
- Remove the RH timing chain from camshaft sprocket.
- Remove the RH timing chain from the crankshaft sprocket.
- Remove the LH timing chain from the camshaft sprocket.
- Remove the LH timing chain and crankshaft sprocket.



8. **⚠ CAUTION:** The bolts are different lengths and must be returned to their original location.

NOTE: RH shown; LH similar.

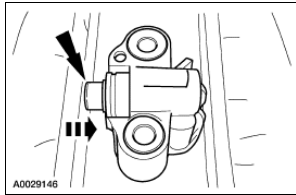
Remove the bolts and the timing chain guides.



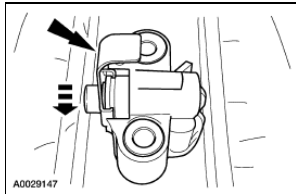
Installation

1. **⚠ CAUTION:** Timing chain procedures must be followed exactly or damage to the pistons or valves will result.

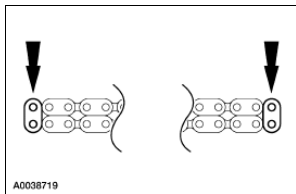
Compress the tensioner plunger, using a soft-jawed vise.



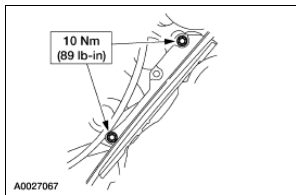
2. Install a retaining clip on the tensioner to hold the plunger in during installation.
 - Remove the tensioner from the vise.



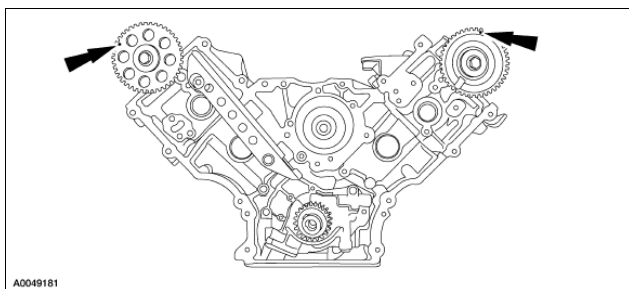
3. If the copper links are not visible, mark one link on one end and one link on the other end, and use as timing marks.



4. Install the timing chain guides.



5. Rotate the LH camshaft sprocket until the timing mark is approximately at the 12 o' clock position.
Rotate the RH camshaft timing sprocket until the timing mark is approximately in the 11 o' clock position.

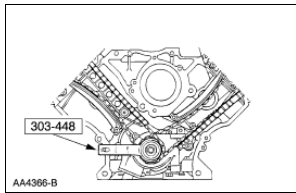


6. **⚠ CAUTION: Unless otherwise instructed, at no time when the timing chains are removed and the cylinder heads are installed is the crankshaft or the camshaft to be rotated. Severe piston and valve damage will occur.**

⚠ CAUTION: Rotate the crankshaft counterclockwise only. Do not rotate past position shown or severe piston or valve damage will occur.

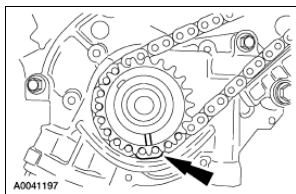
NOTE: The number one cylinder is at top dead center (TDC) when the stud on the engine block fits into the slot in the handle of the special tool.

Using the special tool, position the crankshaft so the number one cylinder is at TDC.

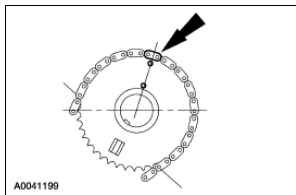


7. Remove the special tool.

8. Position the LH (inner) timing chain on the crankshaft sprocket, aligning the copper (marked) link with the timing mark on the sprocket.

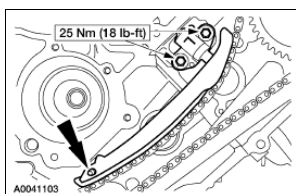


9. Install the LH timing chain onto the crankshaft sprocket, aligning the copper (marked) link with the timing marks on the sprocket.

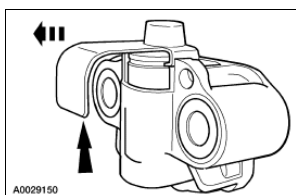


10. **NOTE:** The LH timing chain tensioner arm has a bump near the dowel hole for identification.

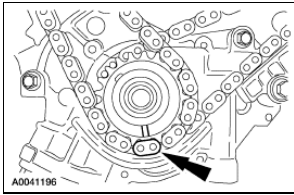
Position the LH timing chain tensioner arm on the dowel pin and install the LH timing chain tensioner.



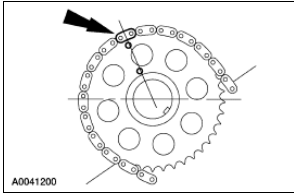
11. Remove the retaining clips from the LH timing chain tensioner.



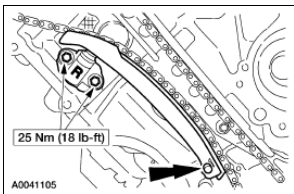
12. Position the RH (outer) timing chain on the crankshaft sprocket, aligning the copper (marked) link with the timing mark on the sprocket.



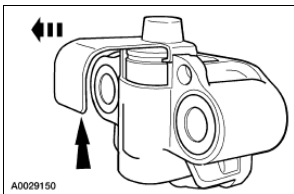
13. Install the RH timing chain onto the crankshaft sprocket, aligning the copper (marked) link with the timing marks on the sprocket.



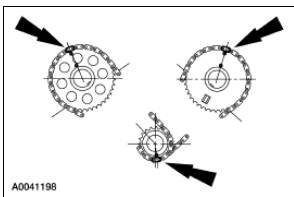
14. Position the RH timing chain tensioner arms on the dowel pin and install the RH timing chain tensioner.



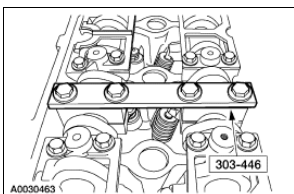
15. Remove the retaining clips from the RH timing chain tensioner.



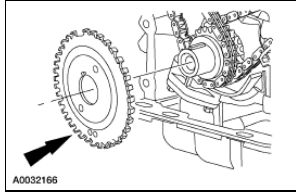
16. Make sure that the copper (marked) chain links are lined up with the dots on the crankshaft sprockets and the camshaft sprocket.



17. Remove the special tools from the camshaft.



18. Position the crankshaft sensor ring on the crankshaft.



19. Install the camshaft roller followers. For additional information, refer to Camshaft Roller Follower in this section.
 20. Install the engine front cover. For additional information, refer to Engine Front Cover in this section.
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