



Specifications

Engine

Item	Specification
Displacement	4.957 L (302 CID)
No. of cylinders	8
Bore	92.2 mm (3.629 in)
Stroke	92.7 mm (3.649 in)
Firing order	1-5-4-8-6-3-7-2
Spark plug	12405
Spark plug gap	1.25-1.35 mm (0.049-0.053 in)
Compression ratio	11.0:1
Engine weight (without accessory drive components)	431.0 lb (195.5 kg)

Lubricants

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

Engine Oil Capacity

Item	Specification
Service fill including oil filter	8.0 qt (7.6 L)

Oil Pressure

Item	Specification
Oil pressure @ idle with engine at normal operating temperature	10–15 psi (69–103 kPa)
Oil pressure @ 2,000 rpm with engine at normal operating temperature	30–40 psi (207–276 kPa)

Cylinder Head and Valve Train

Item	Specification
Combustion chamber volume	3.33–3.51 in ³ (54.5–57.5 cm ³)
Valve stem diameter - intake	0.2368–0.2380 in (6.015–6.044 mm)
Valve stem diameter - exhaust	0.2368–0.2380 in (6.015–6.044 mm)
Valve stem-to-guide clearance - intake	0.0008–0.0027 in (.02–.069 mm)
Valve stem-to-guide clearance - exhaust	0.0018–0.0037 in (.045–.094 mm)
Valve head diameter - intake	1.46 in (37 mm)
Valve head diameter - exhaust	1.22 in (31 mm)
Valve face runout	0.0020 in (.05 mm)
Valve face angle	3 angle
Valve seat width - intake	0.051–0.059 in (1.3–1.5 mm)
Valve seat width - exhaust	0.055–0.063 in (1.4–1.6 mm)
Valve seat runout	0.0016 in (.04 mm)
Valve seat angle	121/91/61 degrees
Valve spring free length - intake	2.020 in (51.32 mm)
Valve spring free length - exhaust	2.020 in (51.32 mm)
Valve spring perpendicularity - intake	0.118 in (3 mm)
Valve spring perpendicularity - exhaust	0.118 in (3 mm)
Valve spring compression force - intake	650 N
Valve spring compression force - exhaust	650 N
Valve spring installed height - intake	1.5748 in (40 mm)
Valve spring installed height - exhaust	1.5748 in (40 mm)
Valve spring installed force - intake	265 N
Valve spring installed force - exhaust	265 N
Roller follower ratio	2:1
Cylinder head gasket surface flatness	0.025 mm (0.001 in) in any 25 mm (1 in) x 25 mm (1 in) area; 0.050 mm (0.002 in) in any 150 mm (6 in) x 150 mm (6 in) area; 0.1 mm (0.004 in) overall

Hydraulic Lash Adjuster

Item	Specification
Diameter — intake	0.472 in (12 mm)
Diameter — exhaust	0.472 in (12 mm)
Clearance-to-bore	0.0007–0.0020 in (.018–.05 mm)
Hydraulic leakdown rate — intake	0.45-3 seconds ^a
Hydraulic leakdown rate — exhaust	0.45-3 seconds ^a
Collapsed lash adjuster gap	0.0138–0.0335 in (.35–.85 mm)

Camshaft

Item	Specification
Lobe lift - intake	0.2348 in (5.963 mm)
Lobe lift - exhaust	0.2161 in (5.488 mm)
Journal diameter	1.1268 in (28.62 mm)
Journal bore inside diameter	1.1292–1.1282 in (28.682–28.657 mm)
Journal-to-bearing clearance	0.0010–0.0030 in (.025–.075 mm)
Runout	0.0016 in (.04 mm)
End play	0.0059 in (.15 mm)

Cylinder Block

Item	Specification
Cylinder bore diameter	3.6299–3.6307 in (92.2–92.22 mm)
Cylinder bore maximum taper	0.0005 in (.013 mm)
Cylinder bore maximum out-of-round	0.0004 in (.01 mm)
Main bearing bore inside diameter	2.850–2.851 in (72.4–72.424 mm)
Head gasket surface flatness	0.0254 mm (0.001 in) across any 38.1 mm (1.5 in) square

Crankshaft

Item	Specification
Main bearing journal diameter	2.657–2.658 in (67.481–67.505 mm)
Main bearing journal maximum taper	0.0002 in (.004 mm)
Main bearing journal maximum out-of-round	0.0002 in (.006 mm)
Main bearing journal-to-main bearing clearance	0.0010–0.0018 in (.025–.045 mm)
Connecting rod journal diameter	2.086–2.087 in (52.983–53.003 mm)
Connecting rod journal maximum taper	0.0002 in (.004 mm)

Item	Specification
Connecting rod journal maximum out-of-round	0.0002 in (.006 mm)
Crankshaft maximum end play	0.0110 in (.28 mm)

Piston and Connecting Rod

Item	Specification
Piston diameter - single grade	3.6284–3.6289 in (92.161–92.175 mm)
Piston-to-cylinder bore clearance (at grade size) ^b	0.0010–0.0023 in (.025–.059 mm)
Piston ring end gap - top	0.0059–0.0098 in (.15–.25 mm)
Piston ring end gap - intermediate	0.0118–0.0217 in (.3–.55 mm)
Piston ring end gap — oil control	0.0059–0.0177 in (.15–.45 mm)
Piston ring groove width - top	0.0480–0.0492 in (1.22–1.25 mm)
Piston ring groove width - intermediate	0.0480–0.0488 in (1.22–1.24 mm)
Piston ring groove width— oil control	0.0996–0.1004 in (2.53–2.55 mm)
Piston ring width - top	0.0461–0.0469 in (1.17–1.19 mm)
Piston ring width - intermediate	0.0461–0.0469 in (1.17–1.19 mm)
Piston ring-to-groove clearance - top	0.0012–0.0031 in (.03–.08 mm)
Piston ring-to-groove clearance - intermediate	0.0012–0.0028 in (.03–.07 mm)
Piston pin bore diameter	0.8663–0.8665 in (22.004–22.01 mm)
Piston pin diameter	0.8660–0.8661 in (21.997–22 mm)
Piston pin length	2.390–2.402 in (60.7–61 mm)
Piston pin-to-piston fit (clearance)	0.0002–0.0005 in (.004–.013 mm)
Connecting rod-to-pin clearance	0.0001–0.0007 in (.003–.018 mm)
Connecting rod pin bore diameter	0.8663–0.8667 in (22.003–22.015 mm)
Connecting rod length (center-to-center)	5.93 in (150.7 mm)
Connecting rod maximum allowed bend	0.0015 in (.038 mm)
Connecting rod maximum allowed twist	0.0020 in (.05 mm)
Connecting rod bearing-to-crankshaft clearance	0.0011–0.0027 in (.028–.069 mm)
Connecting rod side clearance (as assembled to crank) — standard play	0.0128 in (.325 mm)
Connecting rod side clearance (as assembled to crank) — max. play	0.0197 in (.5 mm)

- Time required for the plunger to leak down 1.6 mm of travel with 222 N force and leakdown fluid in the lash adjuster
- Before Grafal coating.



Engine - Overview

Base Part Number: [6L084](#)

Overview

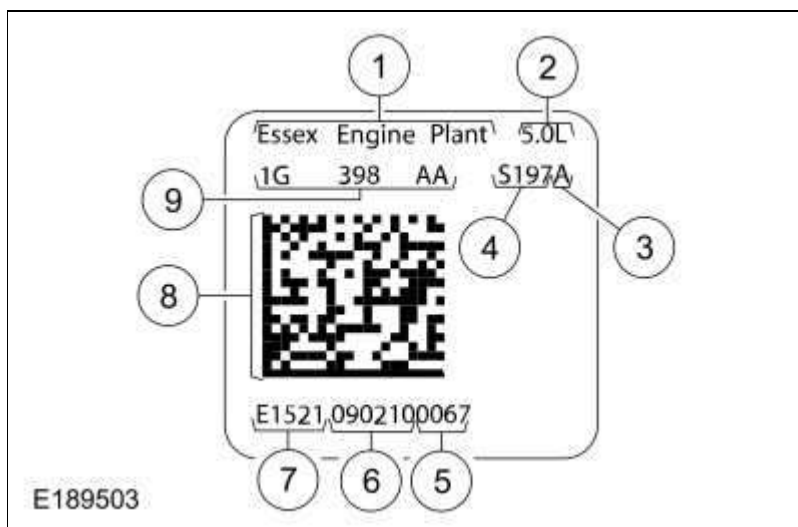
The 5.0L (302 CID) is a V-8 engine with the following features:

- Dual overhead camshafts
- Four valves per cylinder
- SFI
- Aluminum cylinder heads
- Aluminum, 90-degree V-cylinder block
- Twin independent VCT system
- Individually chain-driven camshafts with a hydraulic timing chain tensioner on each timing chain
- Electronic ignition system with 8 ignition coils

Engine Identification

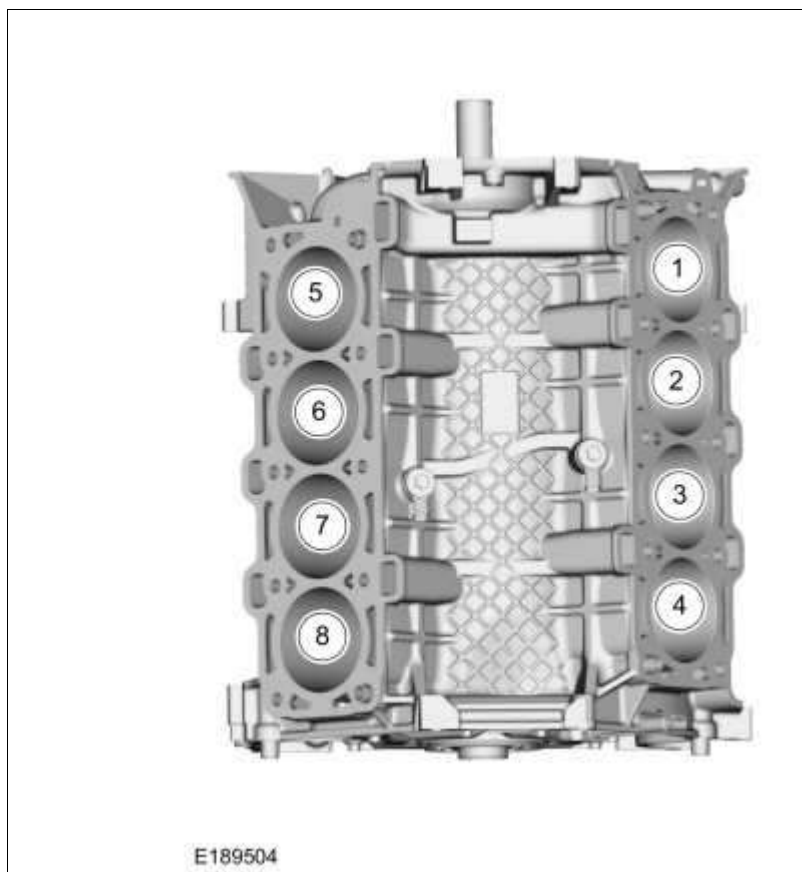
Always refer to these labels when installation of new parts is necessary or when checking engine calibrations. The engine parts often differ within a CID family. Verification of the identification codes will make sure the correct parts are obtained. The codes contain all the pertinent information relating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

Engine Code Information Label

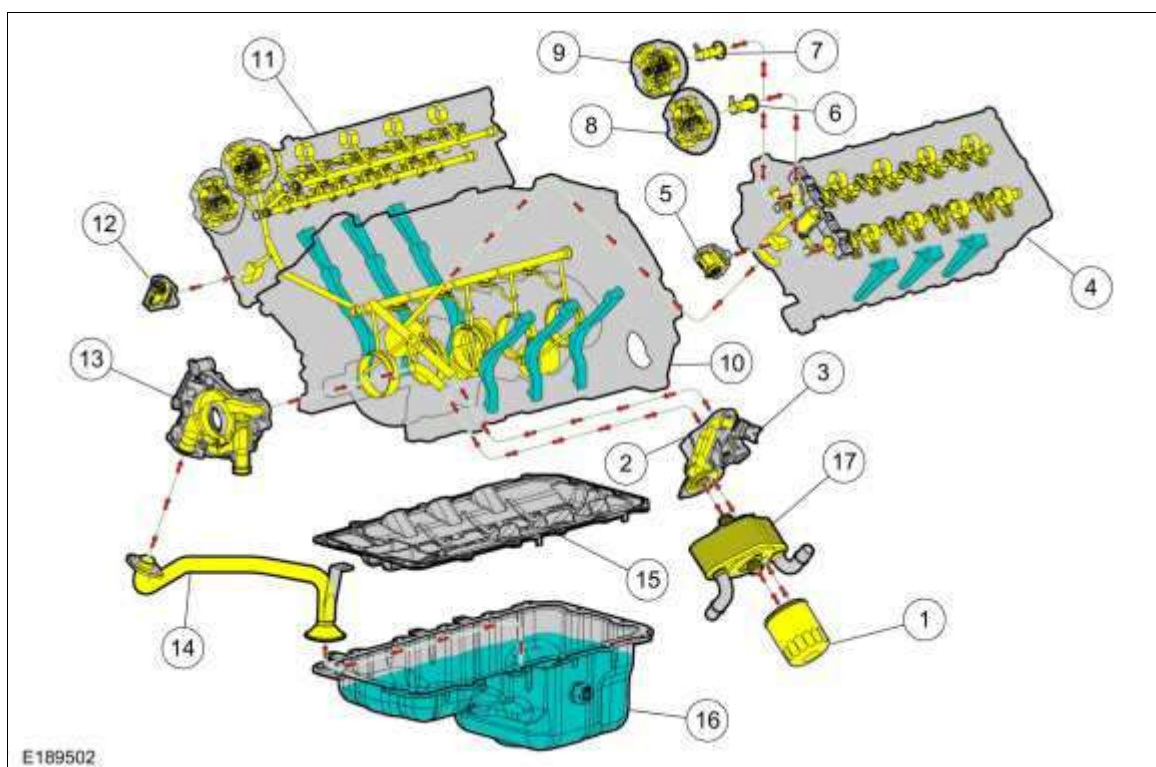


Item	Description
1	Essex engine plant
2	Engine displacement
3	Transmission
4	Vehicle line
5	Sequential number
6	Engine build date (DDMMYY)
7	Essex engine plant
8	Bar code
9	Engine part number

Engine Cylinder Identification



Engine Oil Flow Illustration



Item	Description
1	Oil filter
2	Oil filter adapter
3	EOP switch
4	Cylinder head — LH

5	Timing chain tensioner — LH
6	Exhaust camshaft
7	Intake camshaft
8	Exhaust <u>VCT</u> unit
9	Intake <u>VCT</u> unit
10	Cylinder block
11	Cylinder head — RH
12	Timing chain tensioner — RH
13	Oil pump
14	Oil pump screen and pickup tube
15	Oil pan baffle and gasket
16	Oil pan
17	Oil Cooler

Lubrication System

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the:

- crankshaft main bearings.
- crankshaft thrust main bearing.
- connecting rod bearings.
- oil galleries.

All other parts are lubricated by splash of the oil.

The lubrication system of the 5.0L (4V) engine is designed to provide optimum oil flow to critical components of the engine through its entire operating range. The heart of the system is a positive displacement internal gear oil pump using top seal rotors.

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

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

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

Valve Train

The valves are actuated by a hydraulic lash adjuster and roller follower. The hydraulic lash adjusters and roller followers:

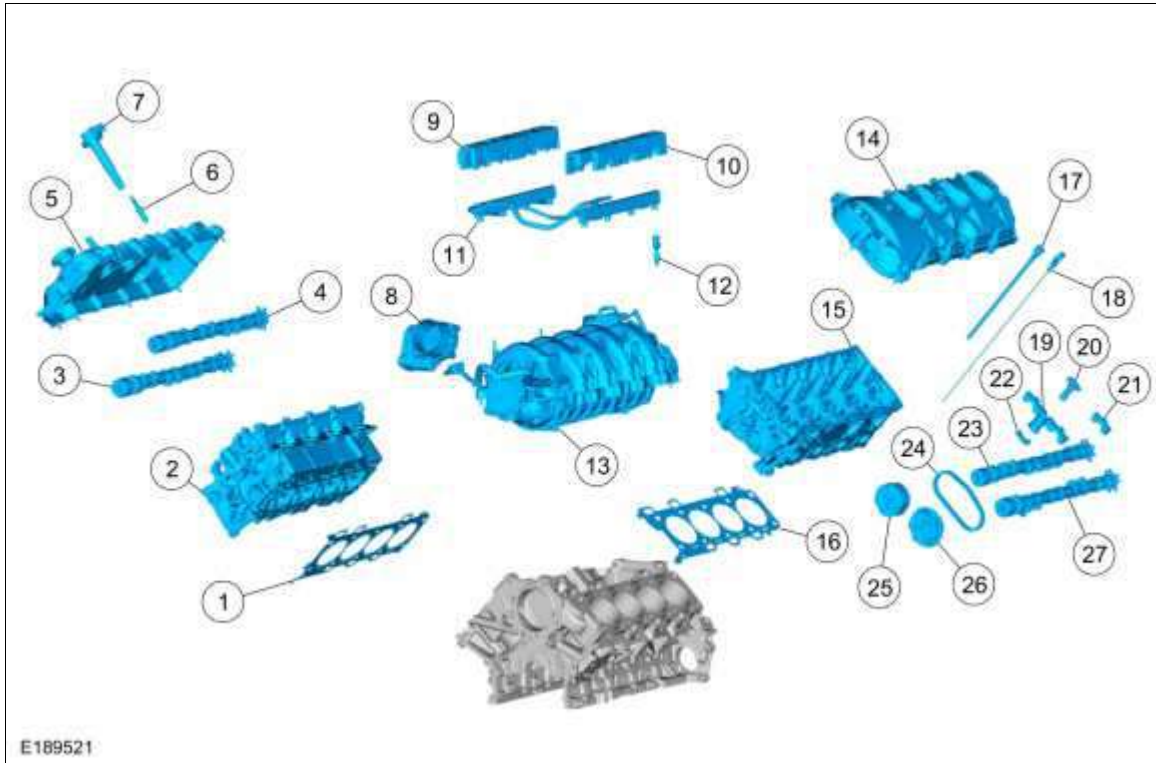
- provide hydraulic lash adjustment.
- ride on the camshaft lobes.

Twin Independent VCT System

The twin independent VCT system allows variable control of the valves which optimizes combustion at full load providing improved power and low speed torque (broadening the torque curve) which enables variable valve overlap which provides better fuel economy and emissions and provides optimized cold start operation with improved exhaust emissions.

Engine Component View

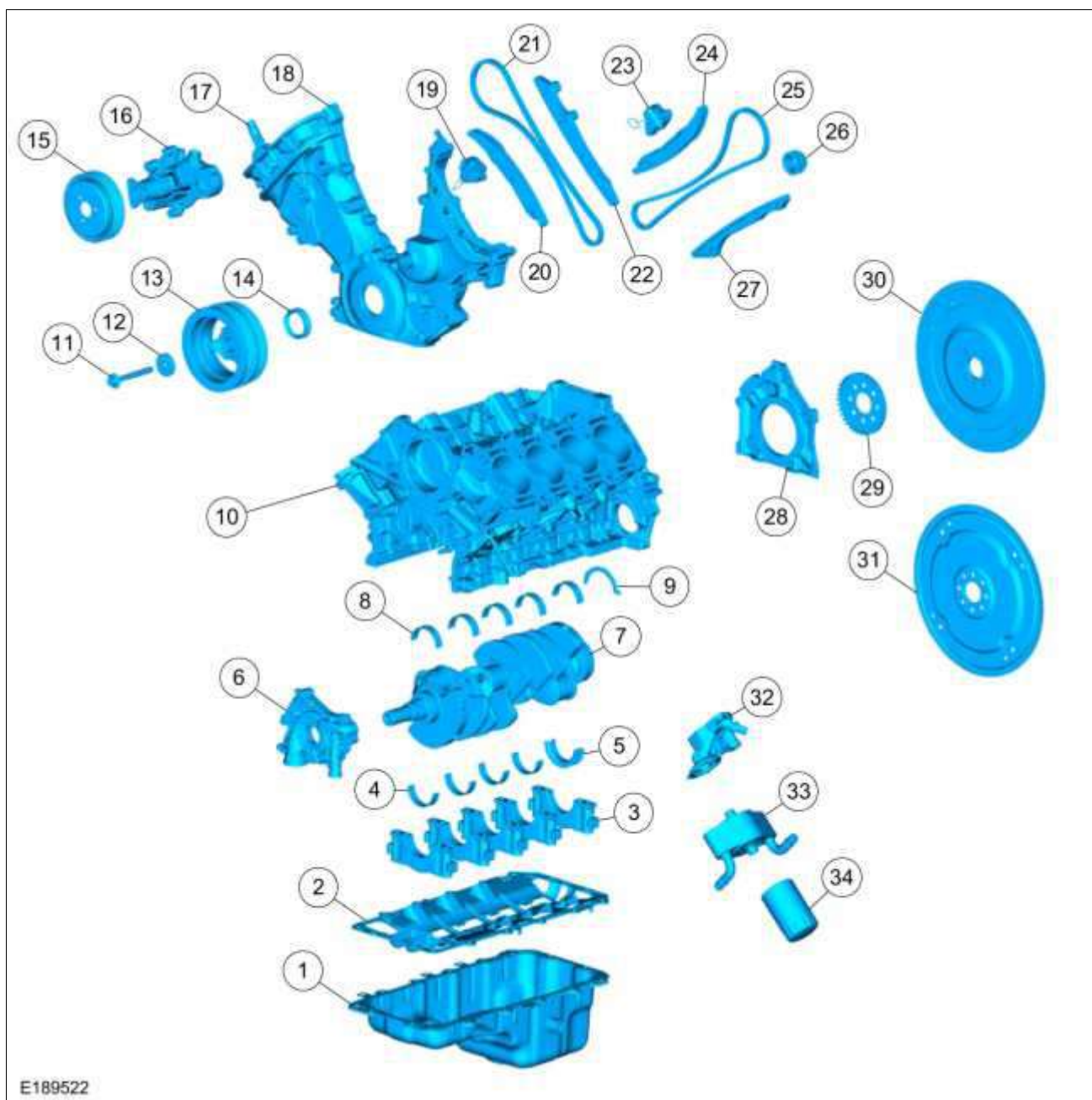
Engine — Upper Components



Item	Part Number	Description
1	6051	RH cylinder head gasket
2	6049	RH cylinder head
3	6250	RH exhaust camshaft
4	6250	RH intake camshaft
5	6582	RH valve cover
6	12405	Spark plug (8 required)
7	12029	Ignition coil on plug (8 required)
8	9F991	Throttle body
9	6P013	RH fuel injector insulator shield
10	6P013	LH fuel injector insulator shield
11	9F792	Fuel rail
12	9F593	Fuel injector (8 required)
13	9424	Intake manifold
14	6582	LH valve cover
15	6049	LH cylinder head
16	6051	LH cylinder head gasket
17	6754	Oil indicator tube
18	6750	Oil indicator

19	—	Camshaft bearing cap (part of 6049) (2 required)
20	6K254	Secondary tensioner (2 required)
21	—	Camshaft bearing cap (part of 6049) (16 required)
22	6K297	Secondary tensioner shoe (2 required)
23	6250	LH intake camshaft
24	6268	Secondary timing chain (2 required)
25	6256	Intake camshaft Variable Camshaft Timing (VCT) (2 required)
26	6256	Exhaust camshaft Variable Camshaft Timing (VCT) (2 required)
27	6250	LH exhaust camshaft

Engine — Lower Components



Item	Part Number	Description
1	6675	Oil pan
2	6C878	Oil pan baffle and gasket
3	—	Crankshaft main bearing cap (part of 6010) (5 required)
4	6A338	Crankshaft lower main bearing (4 required)
5	6A339	Crankshaft lower thrust main bearing
6	6600	Oil pump
7	6303	Crankshaft
8	6333	Crankshaft upper main bearing (5 required)
9	6A341	Thrust washer
10	6010	Cylinder block
11	6A340	Crankshaft pulley bolt
12	N807033	Crankshaft pulley washer
13	6316	Crankshaft pulley
14	6700	Crankshaft front oil seal
15	8509	Coolant pump pulley
16	8501	Coolant pump
17	6B297	Variable Camshaft Timing (VCT) variable force solenoid (4 required)
18	6019	Engine front cover
19	6L266	RH primary timing chain tensioner
20	6K255	RH timing chain tensioner arm
21	6268	RH primary timing chain
22	6M256	RH timing chain guide
23	6L266	LH primary timing chain tensioner
24	6K255	LH timing chain tensioner arm
25	6268	LH primary timing chain
26	6306	Crankshaft sprocket
27	6B274	LH timing chain guide
28	6K318	Crankshaft rear seal retainer plate
29	12A227	Crankshaft sensor ring
30	6375	Flywheel (manual transmission)
31	6375	Flexplate (automatic transmission)
32	6881	Oil filter adapter
33	6A642	Oil cooler
34	6731	Oil filter



Engine

Base Part Number: [6L084](#)

1. For basic mechanical concerns.

REFER to: [Engine](#) (303-00 Engine System - General Information, Diagnosis and Testing).

For driveability concerns. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.



Camshaft LH

Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

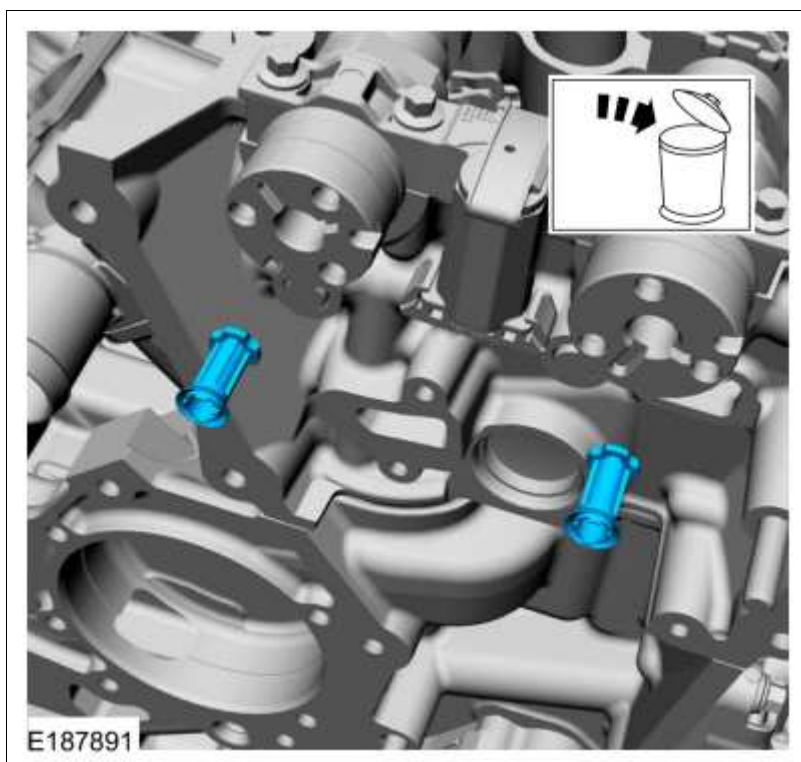
Removal

NOTICE: 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: If the RH camshafts are being serviced at the same time as the LH camshafts, remove the RH camshafts first. Refer to the procedure in this section.

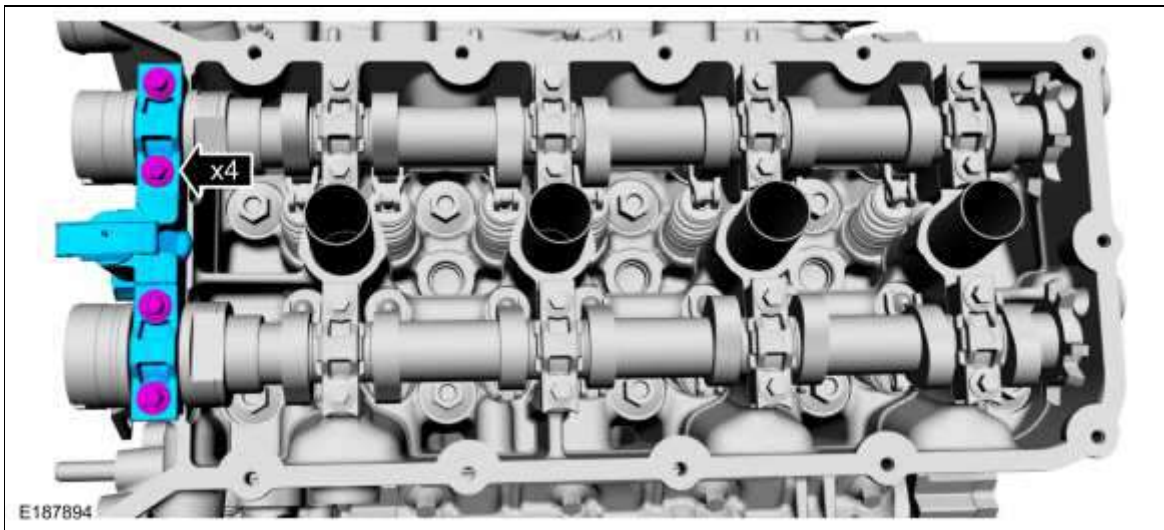
NOTE: If the components are to be reinstalled, they must be installed in their original locations.

1. Remove the LH VCT units.
Refer to: [Variable Camshaft Timing \(VCT\) Unit](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Remove and discard the VCT system oil filters.

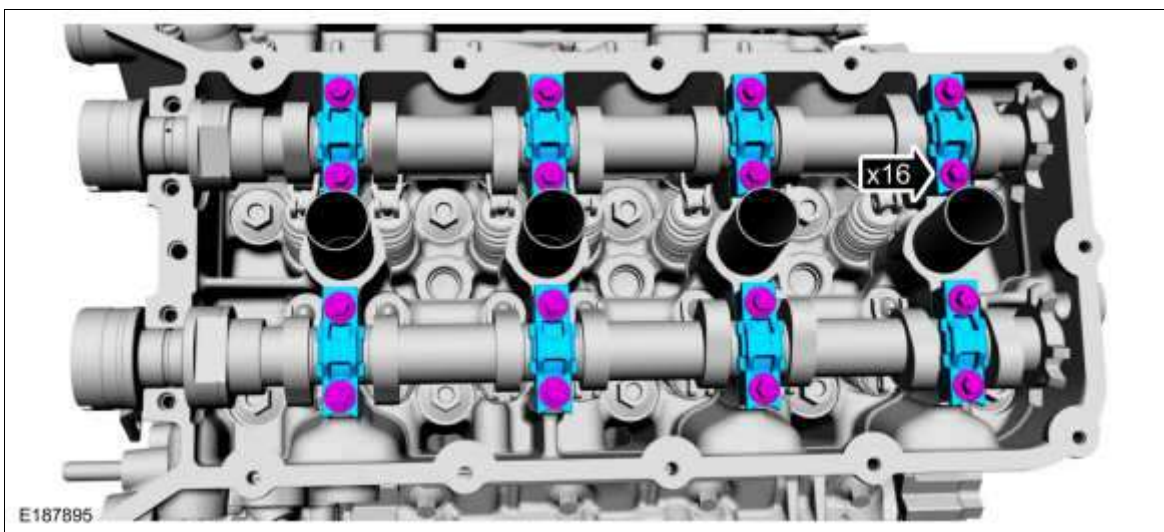


3. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

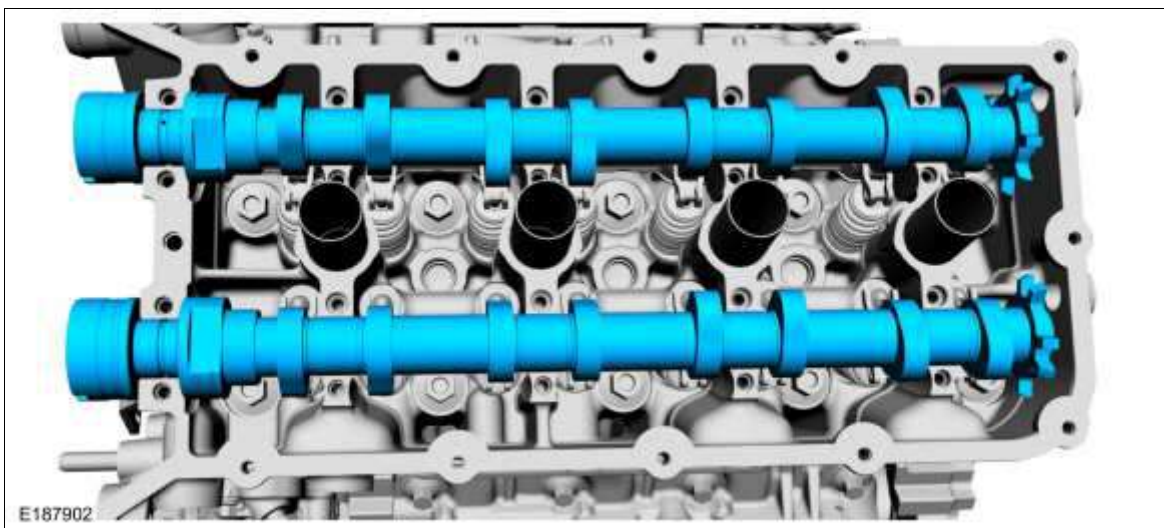
Remove the bolts and the front camshaft bearing mega cap.



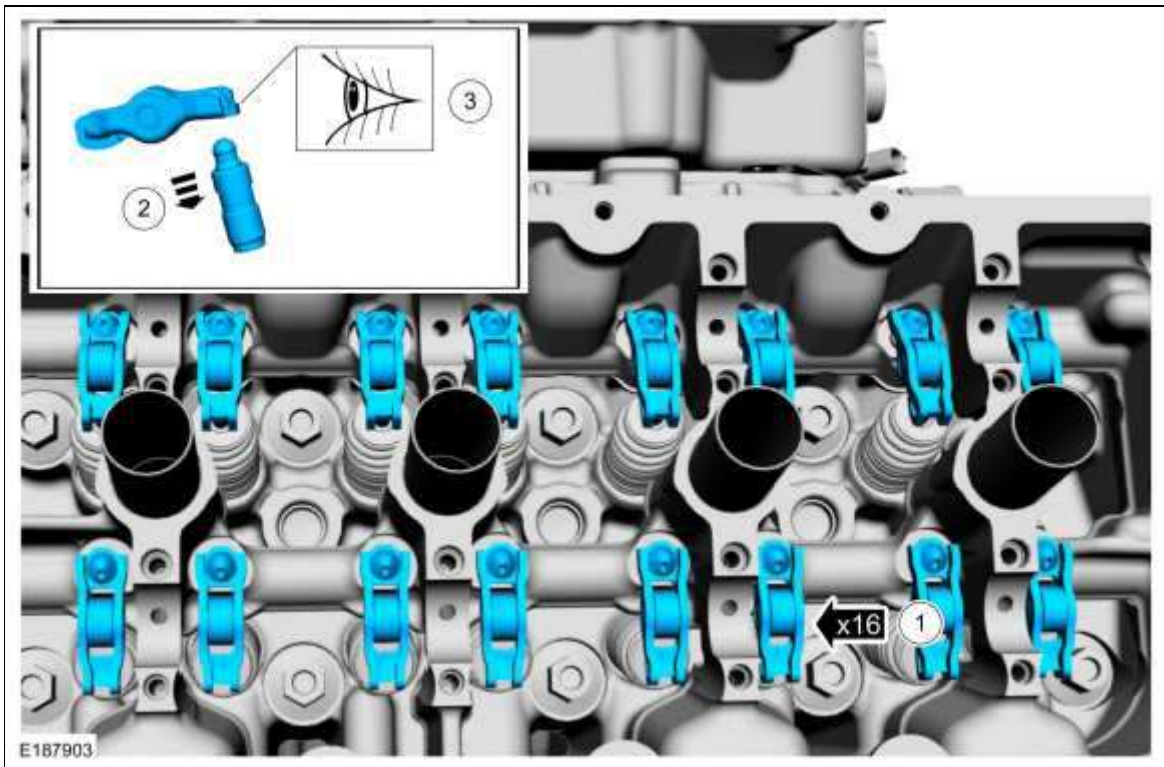
4. Remove the bolts and the camshaft bearing caps.



5. Remove the intake and exhaust camshafts.



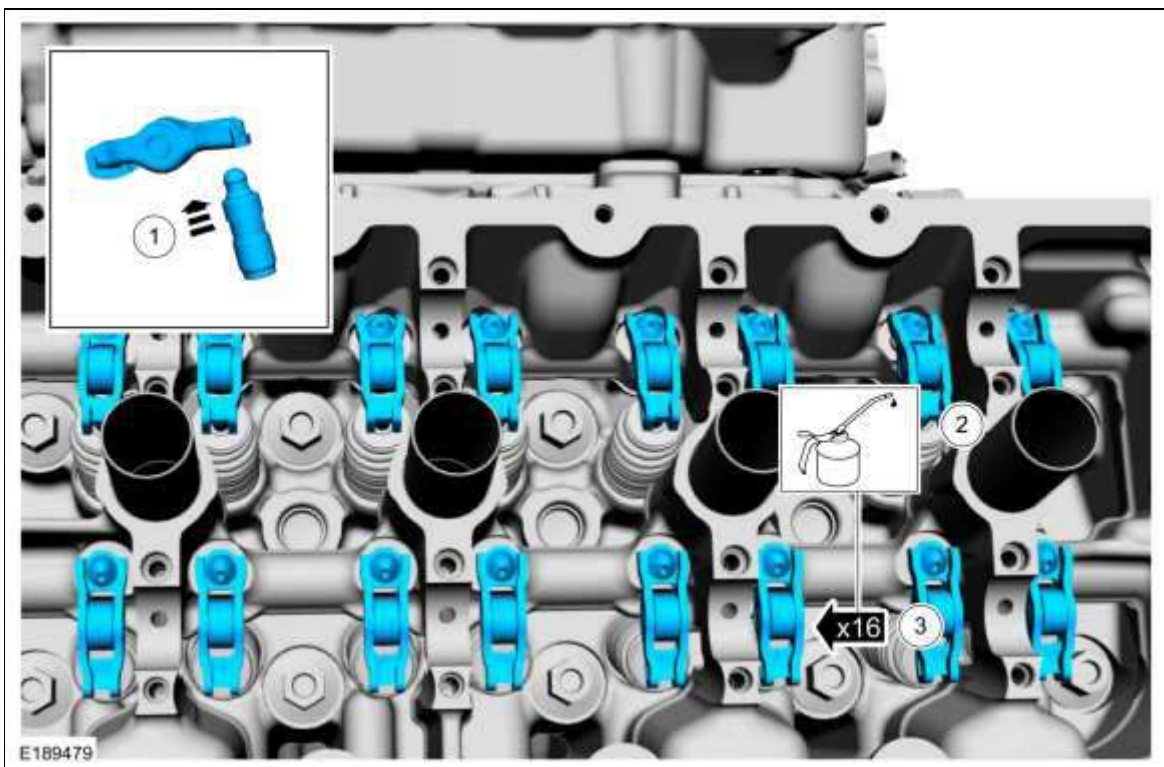
6.
 1. Remove the camshaft roller follower and hydraulic lash adjuster assemblies.
 2. Separate the hydraulic lash adjusters from the spring clips on the camshaft roller followers.
 3. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage. Replace damaged components as necessary.



Installation

1. **NOTE:** If the components are to be reinstalled, they must be installed in their original locations.

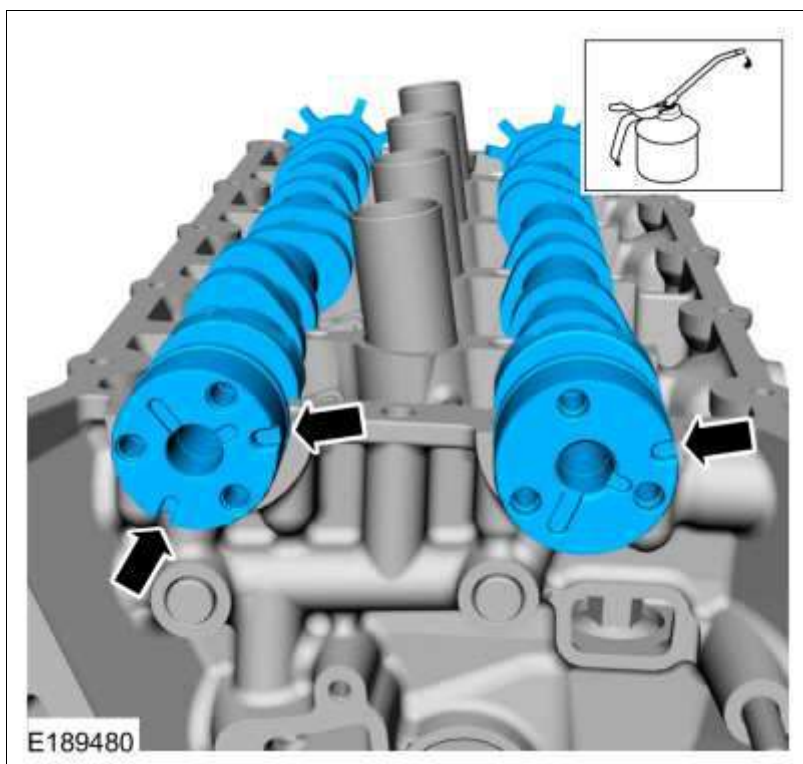
1. Assemble the hydraulic lash adjusters onto the spring clips on the camshaft roller followers.
2. Lubricate the camshaft roller follower and hydraulic lash adjuster assemblies with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)
3. Install the camshaft roller follower and hydraulic lash adjuster assemblies.



2. **NOTE:** Lubricate the camshafts with clean engine oil prior to installation.

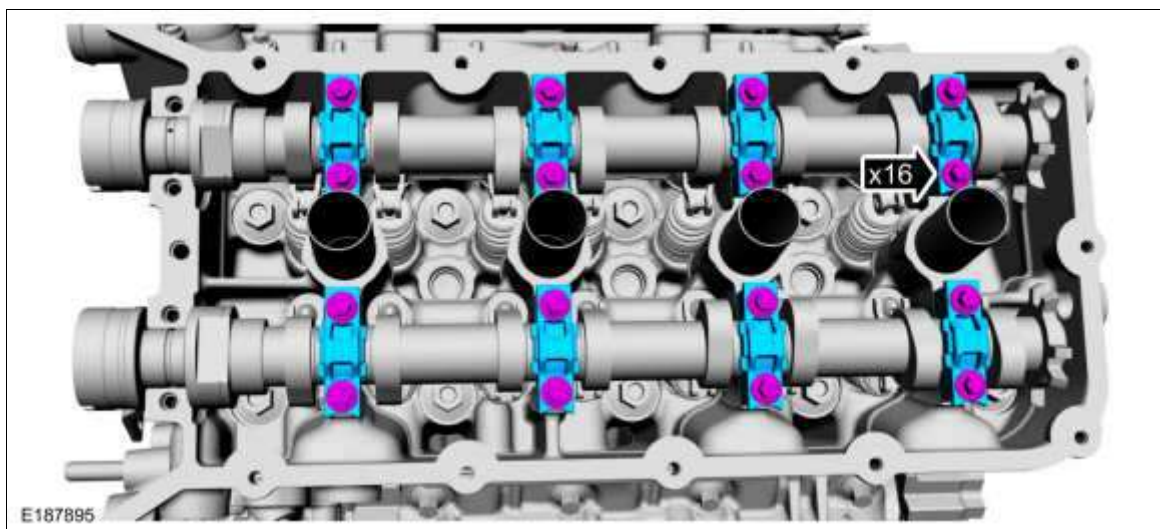
Install the intake and exhaust camshafts in the neutral position. Align the D-slots as shown in the illustration.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.)

(WSS-M2C945-A)



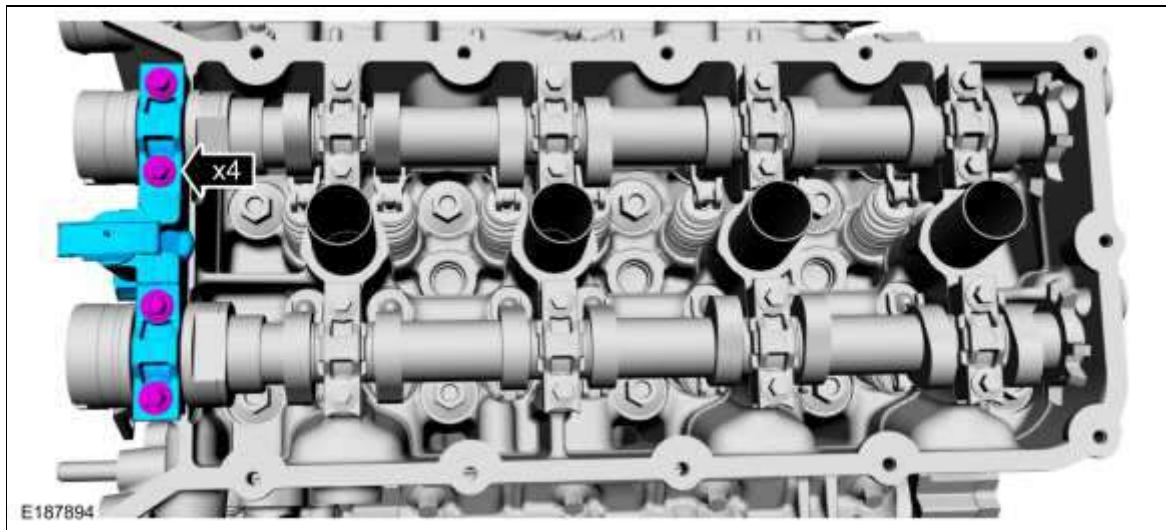
3. **NOTE:** Do not tighten at this time.

Install the camshaft bearing caps and the bolts.



4. **NOTE:** Do not tighten at this time.

Install the front camshaft bearing mega cap and the bolts.

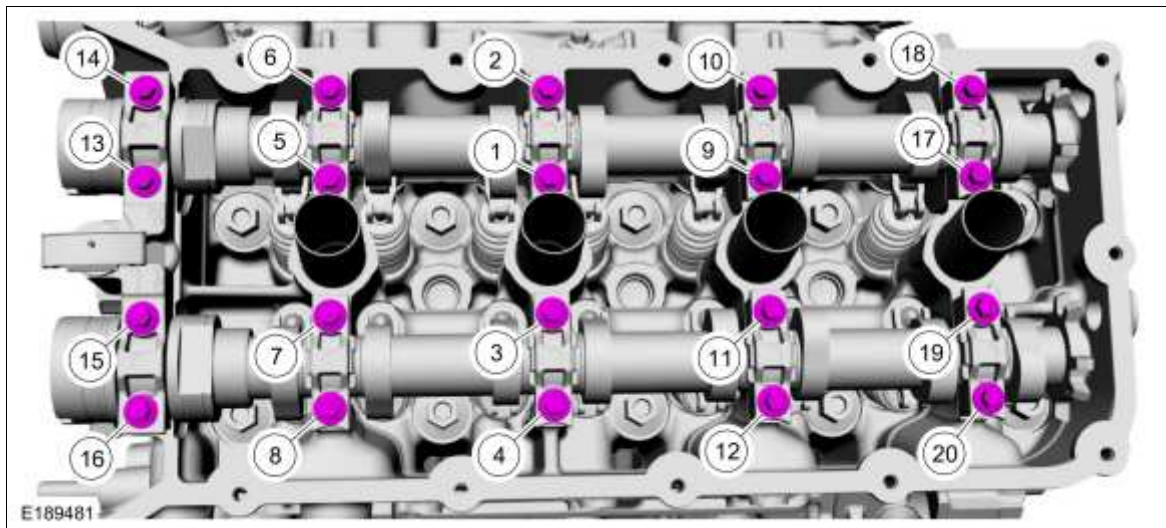


5. Tighten the bolts.

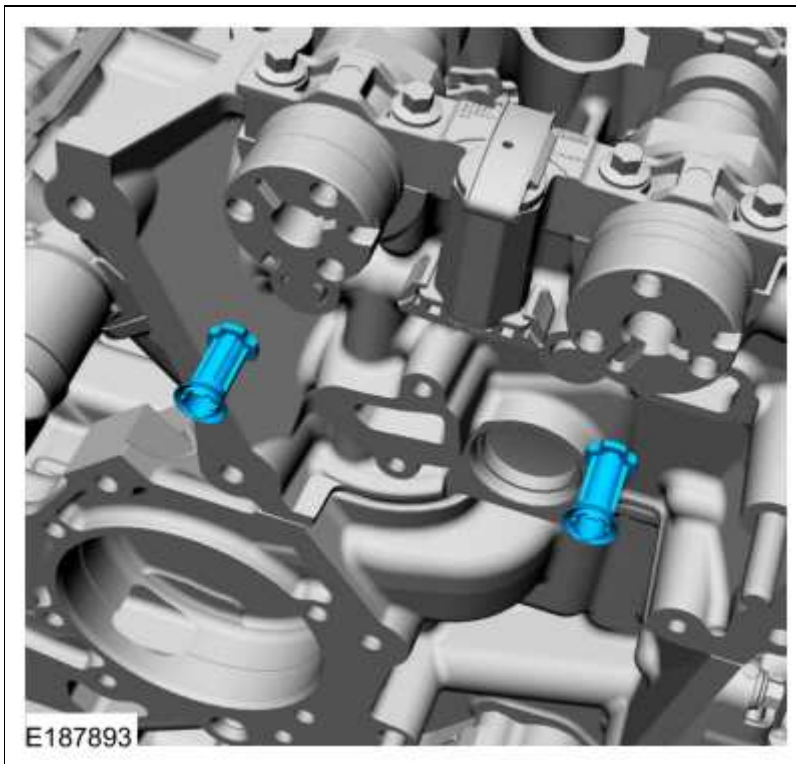
Torque:

Stage 1: 53 lb.in (6 Nm)

Stage 2: 45°



6. Install new VCT system oil filters into the camshafts.



7. Install the LH VCT units.

Refer to: [Variable Camshaft Timing \(VCT\) Unit](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).



Camshaft RH

Materials

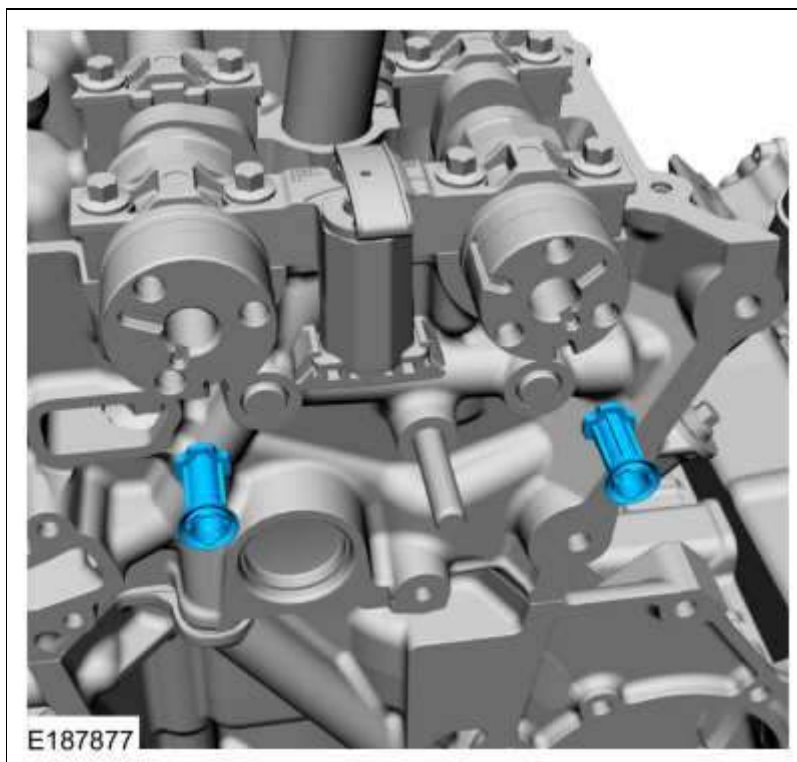
Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

Removal

NOTICE: 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.

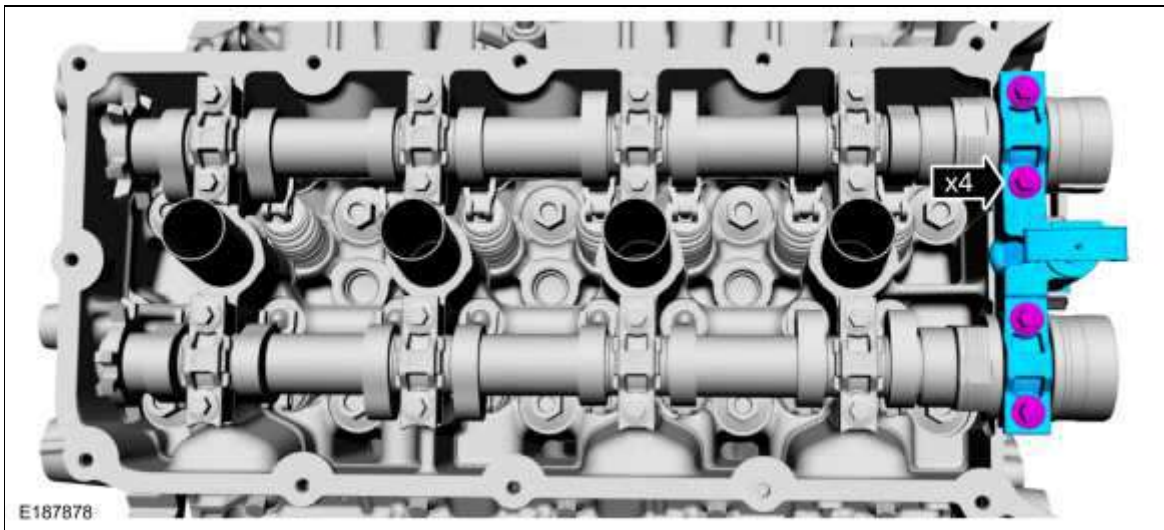
NOTE: If the components are to be reinstalled, they must be installed in their original locations.

1. Remove the RH VCT units.
Refer to: [Variable Camshaft Timing \(VCT\) Unit](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Remove the VCT system oil filters from the camshafts.

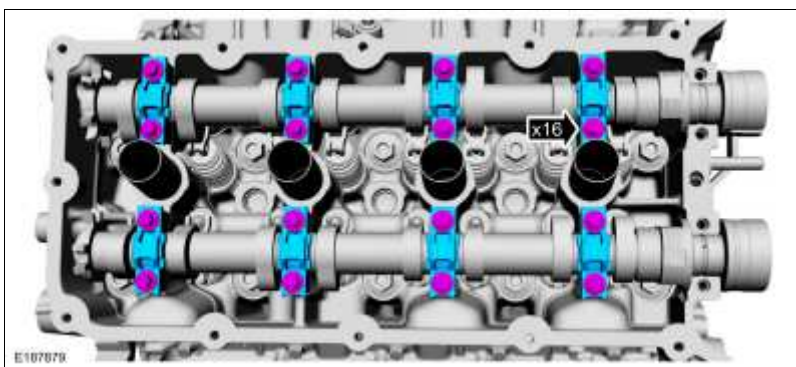


3. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

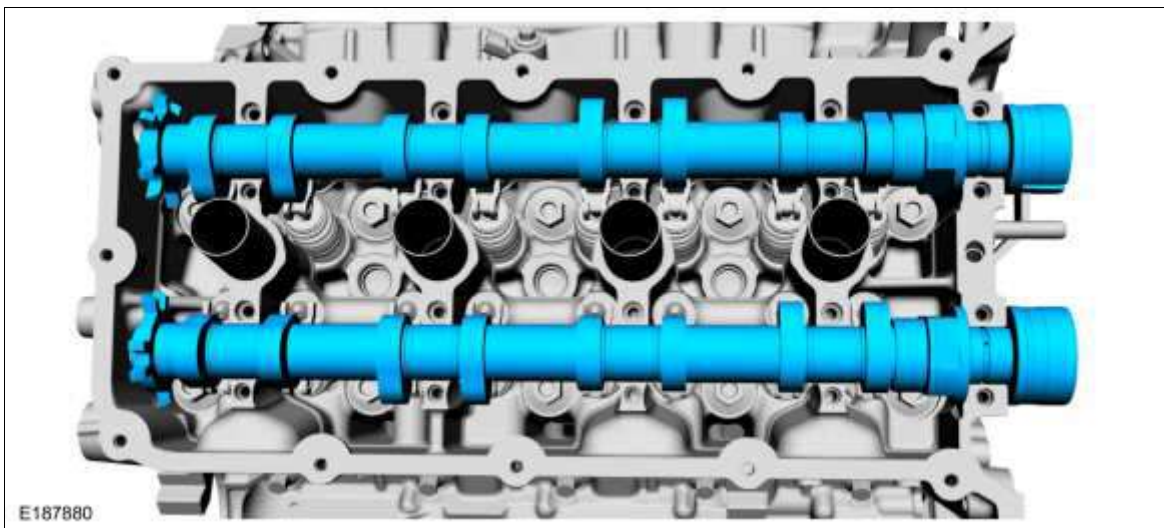
Remove the bolts and the front camshaft bearing mega cap.



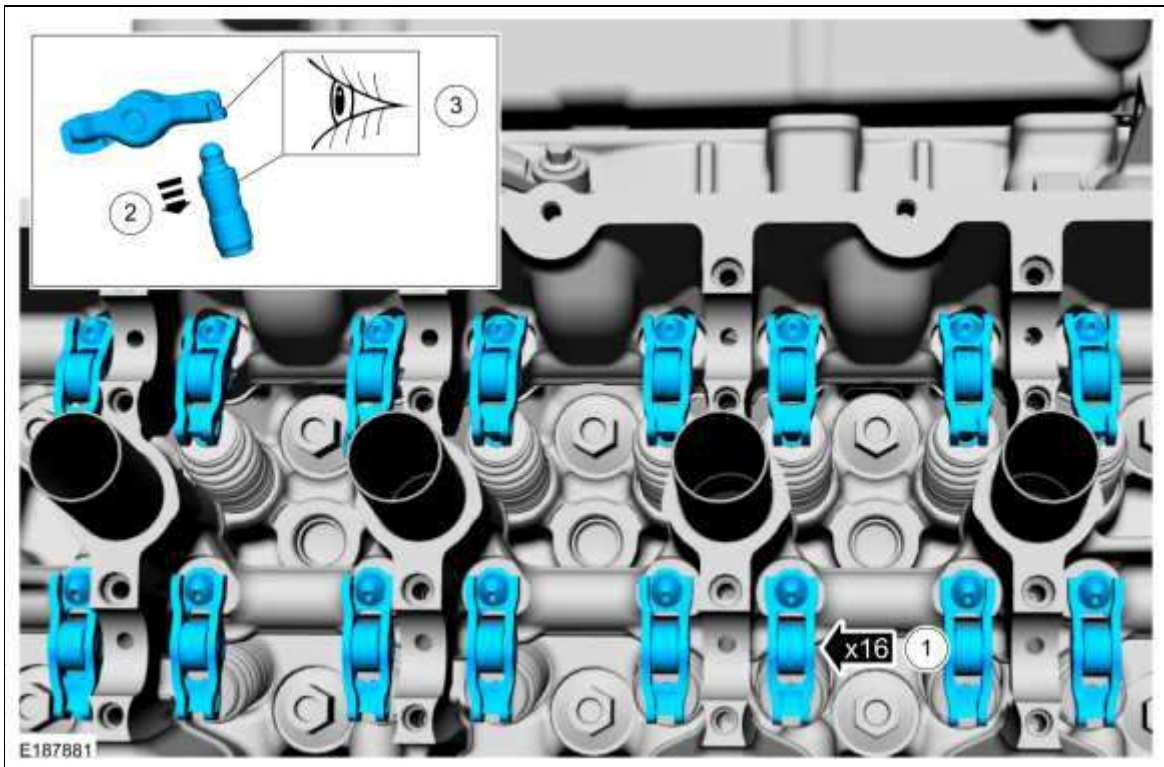
4. Remove the bolts and the camshaft bearing caps.



5. Remove the intake and exhaust camshafts.



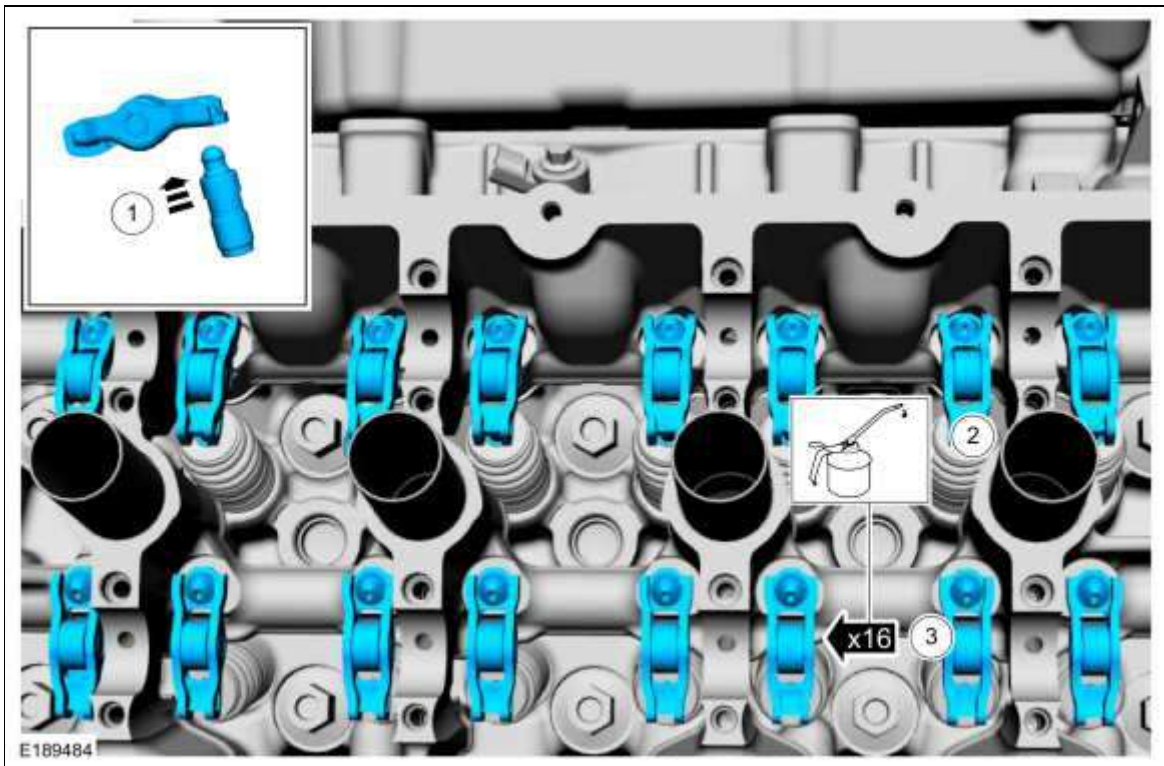
6.
 1. Remove the camshaft roller follower and hydraulic lash adjuster assemblies.
 2. Separate the hydraulic lash adjusters from the spring clips on the camshaft roller followers.
 3. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage. Replace damaged components as necessary.



Installation

1. **NOTE:** If the components are to be reinstalled, they must be installed in their original locations.

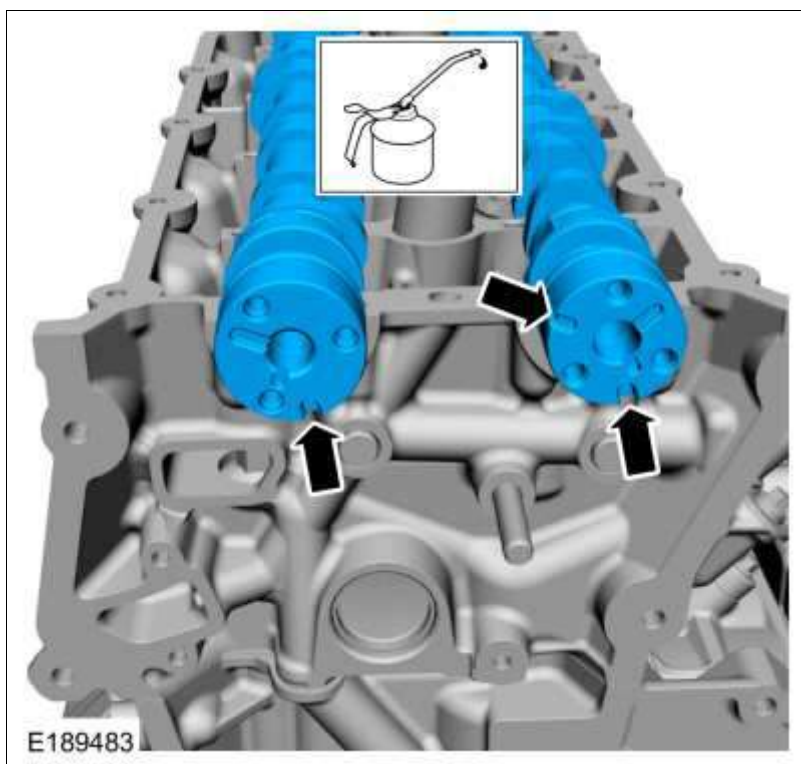
1. Assemble the hydraulic lash adjusters onto the spring clips on the camshaft roller followers.
2. Lubricate the camshaft roller follower and hydraulic lash adjuster assemblies with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)
3. Install the camshaft roller follower and hydraulic lash adjuster assemblies.



2. **NOTE:** Lubricate the camshafts with clean engine oil prior to installation.

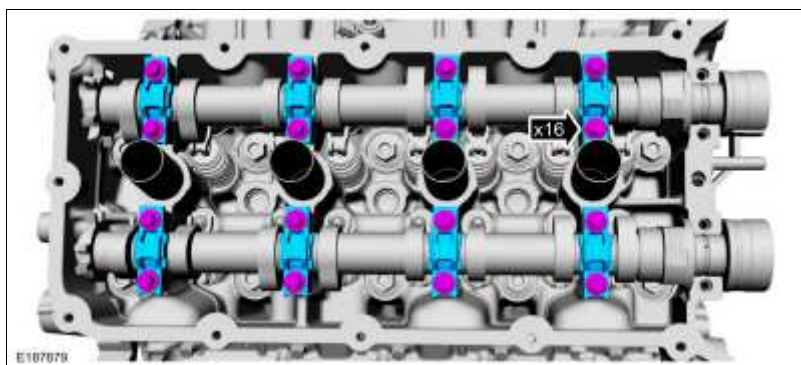
Install the intake and exhaust camshafts in the neutral position. Align the D-slots as shown in the illustration.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.)

(WSS-M2C945-A)



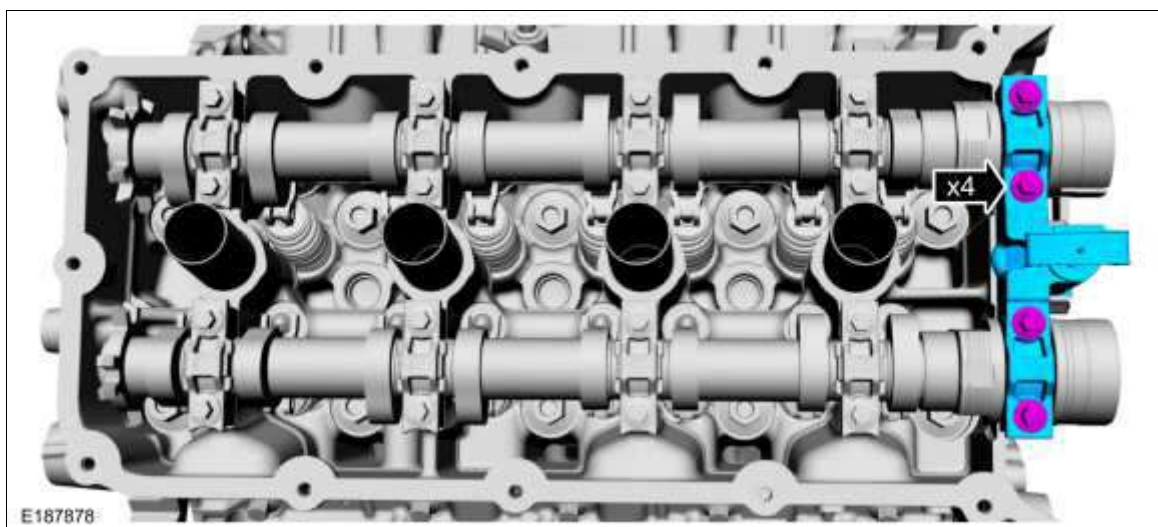
3. **NOTE:** Do not tighten at this time.

Install the camshaft bearing caps and the bolts.



4. **NOTE:** Do not tighten at this time.

Install the front camshaft bearing mega cap and the bolts.

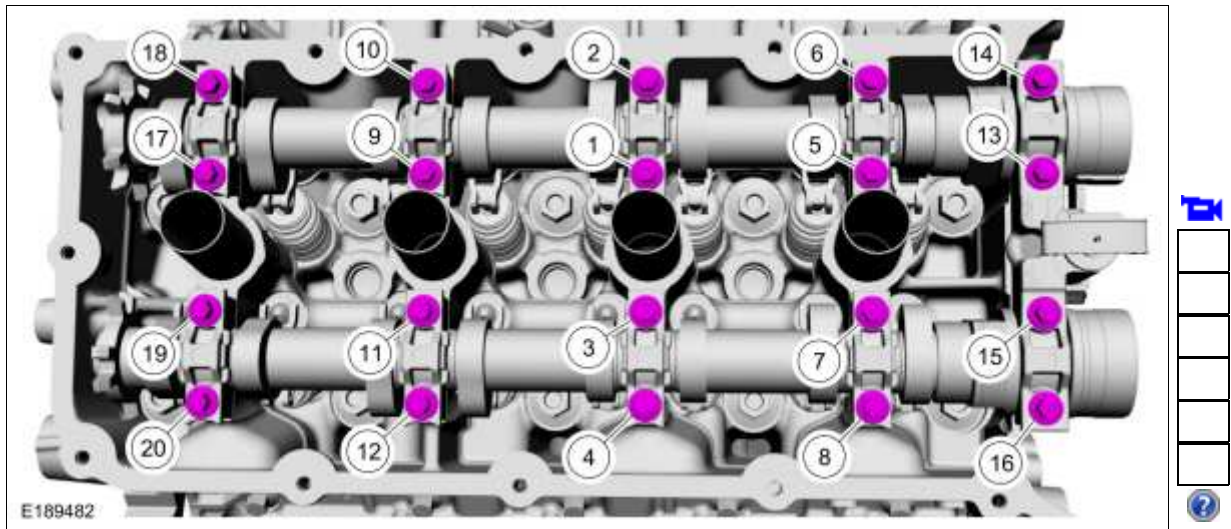


5. Tighten the bolts.

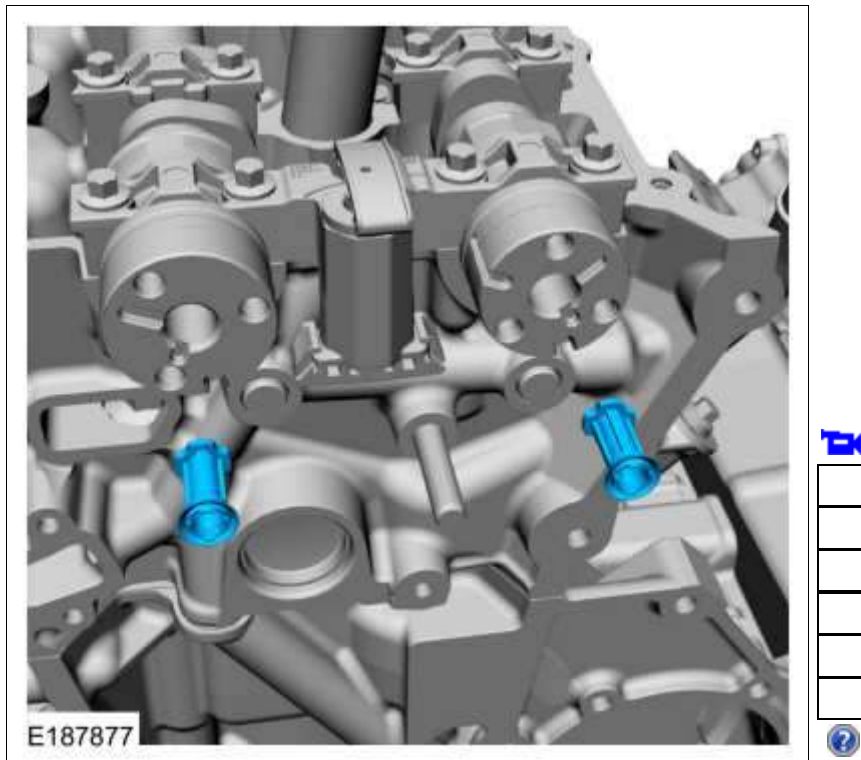
Torque:

Stage 1: 53 lb.in (6 Nm)

Stage 2: 45°



6. Install the VCT system oil filters into the camshafts.



7. Install the RH VCT units.

Refer to: [Variable Camshaft Timing \(VCT\) Unit](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).



Crankshaft Front Seal

Base Part Number: [6700](#)

Special Tool(s) / General Equipment

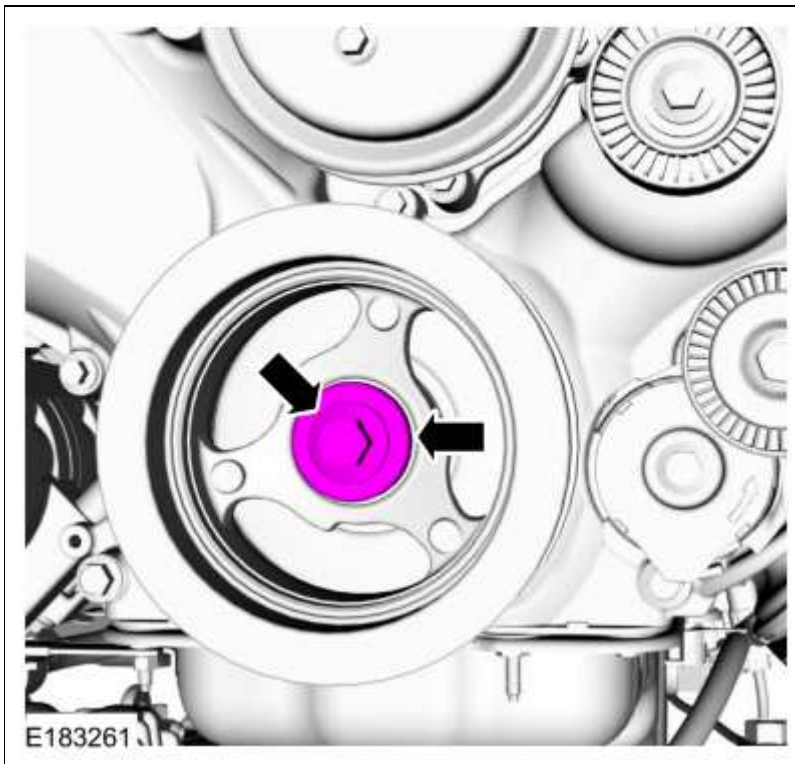
	303-1531 Installer, Front Crank Seal and Damper
	303-335 (T88T-6701-A) Installer, Front Cover Oil Seal TKIT-1988-F TKIT-1988-FLM
	303-409 (T92C-6700-CH) Remover, Crankshaft Seal TKIT-1992-FH/FMH/FLMH TKIT-1993-LMH/MH
Strap Wrench	
Three Leg Puller	

Materials

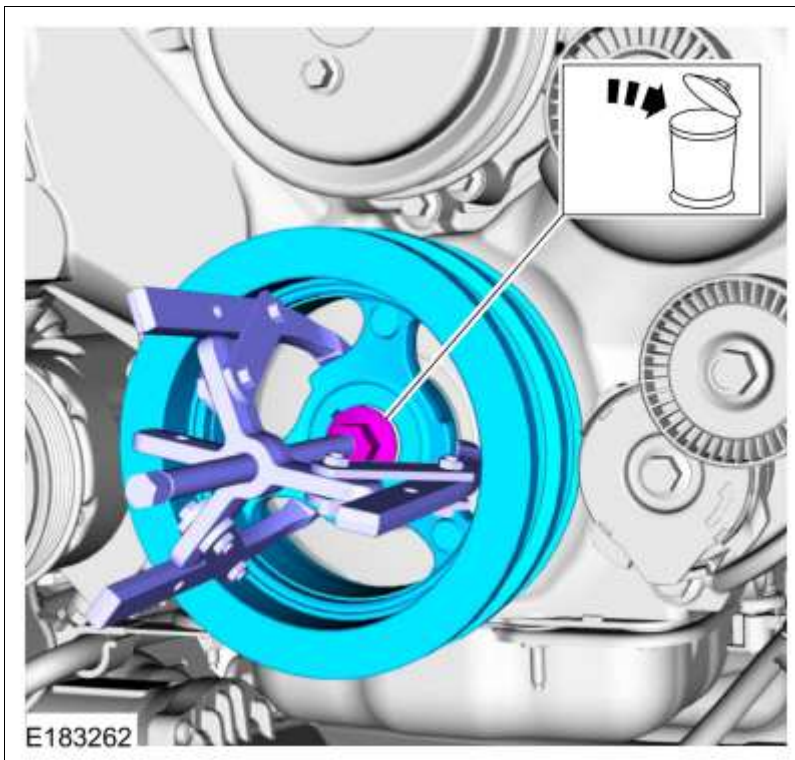
Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Removal

1. Remove the following items:
 1. Refer to: [Cooling Fan Motor and Shroud](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 2. Refer to: [Accessory Drive Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 3. Refer to: [Air Conditioning \(A/C\) Compressor Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Remove the crankshaft pulley bolt and washer.



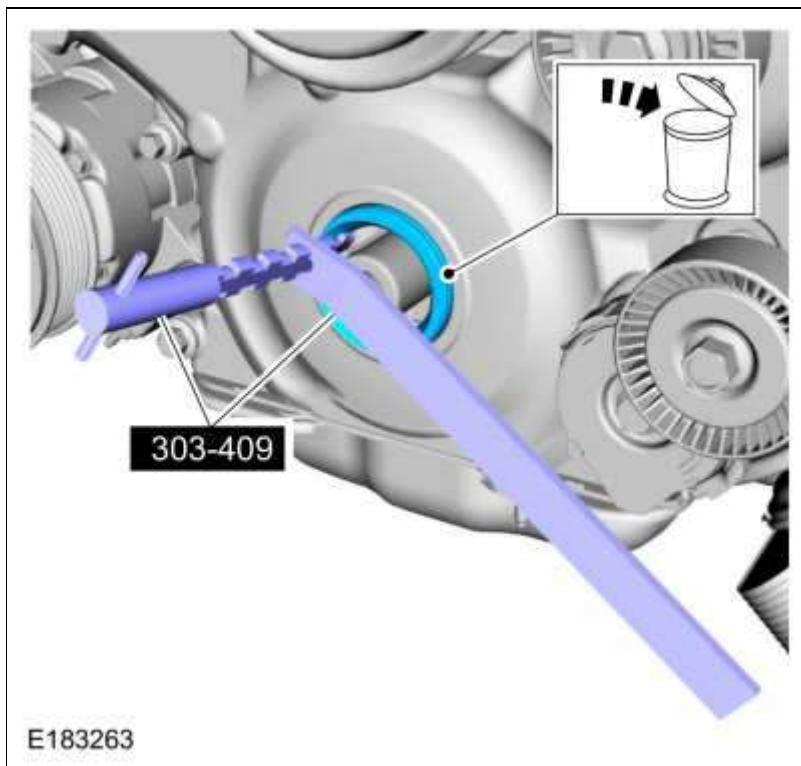
3.
 - Using the 3 Leg Puller and the crankshaft pulley bolt, remove the crankshaft pulley.
 - Use the General Equipment: Three Leg Puller
 - Discard the crankshaft pulley bolt.



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

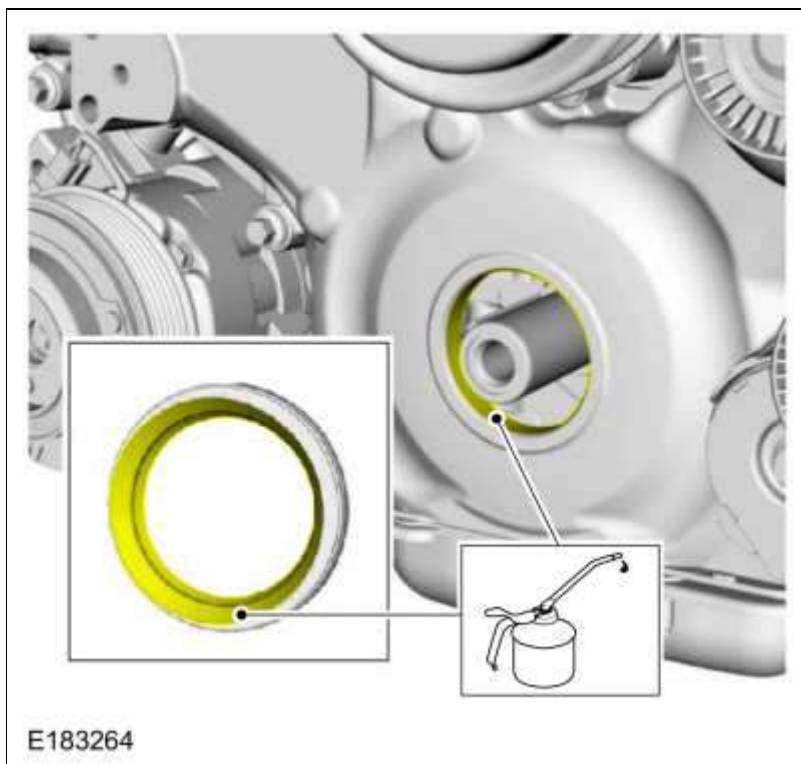
Using the special tool, remove and discard the crankshaft front oil seal.

Use Special Service Tool: [303-409 \(T92C-6700-CH\) Remover, Crankshaft Seal](#).

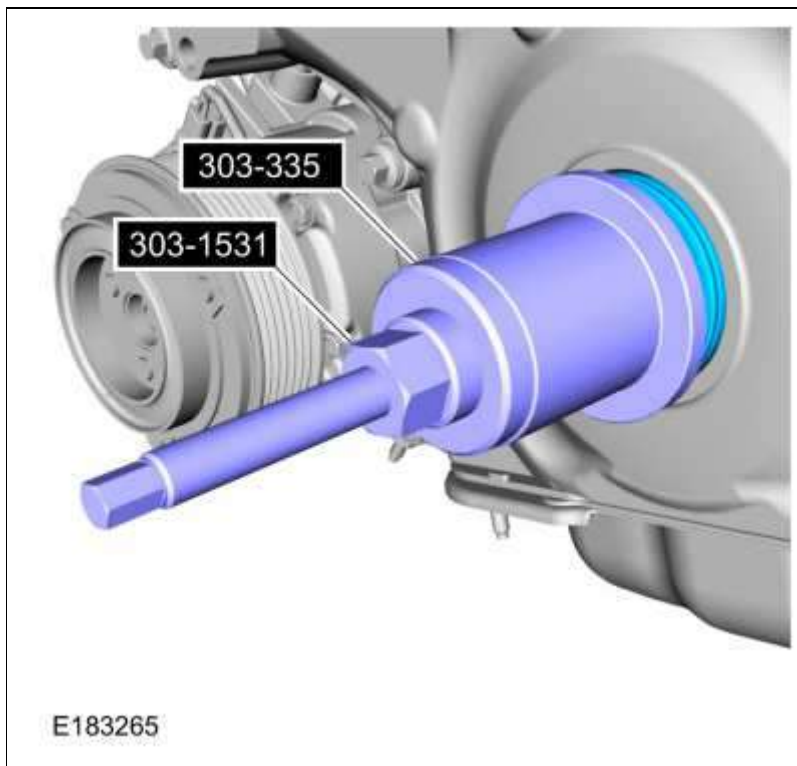


Installation

1. Lubricate the engine front cover bore and the crankshaft front oil seal inner lip with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



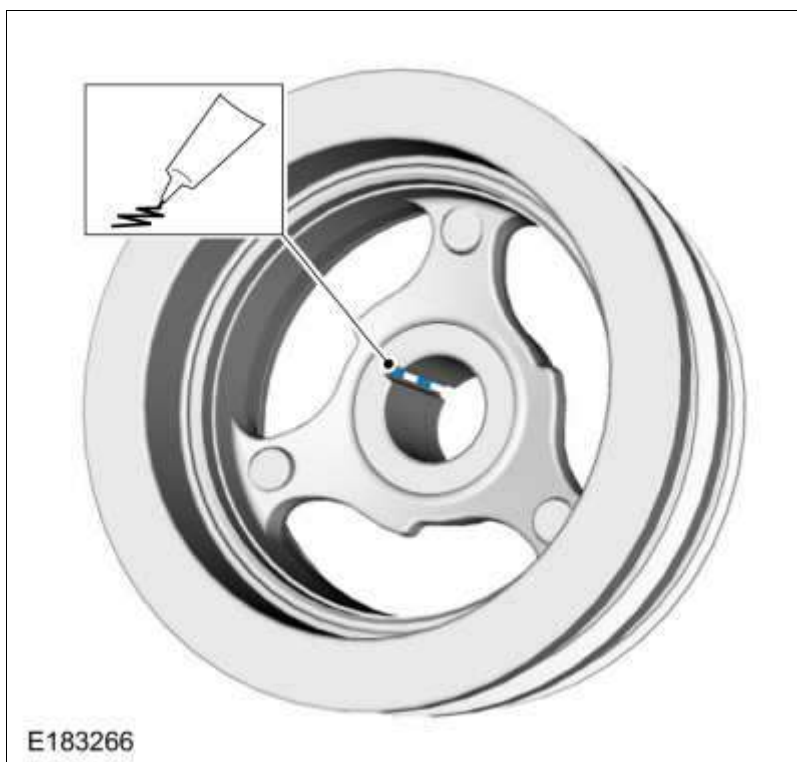
2. Using the special tools, install the new crankshaft front oil seal.
 Use Special Service Tool: [303-335 \(T88T-6701-A\) Installer, Front Cover Oil Seal.](#) , [303-1531 Installer, Front Crank Seal and Damper.](#)



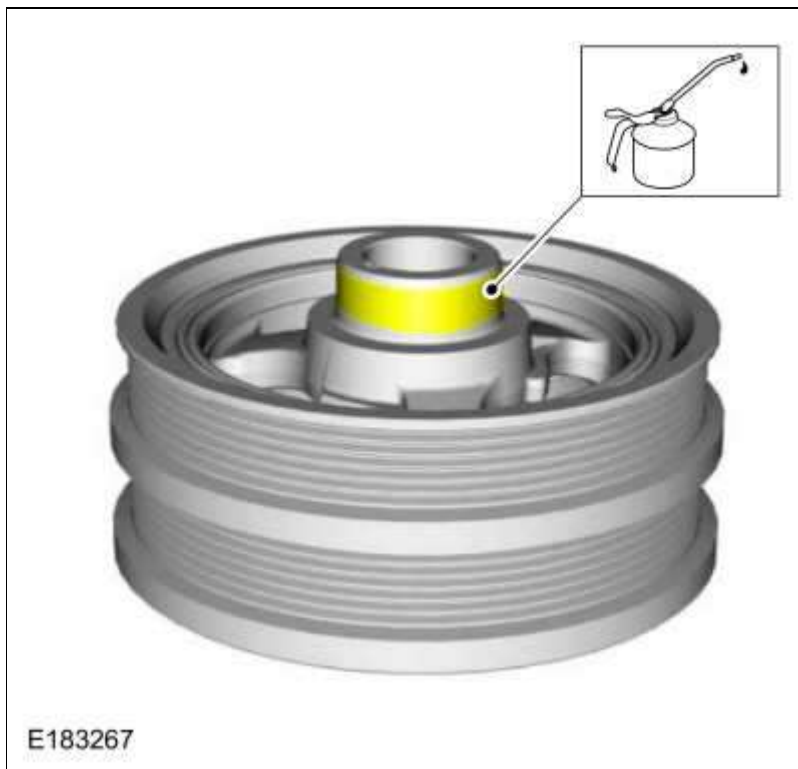
3. **NOTE:** If not secured within 5 minutes, the sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

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

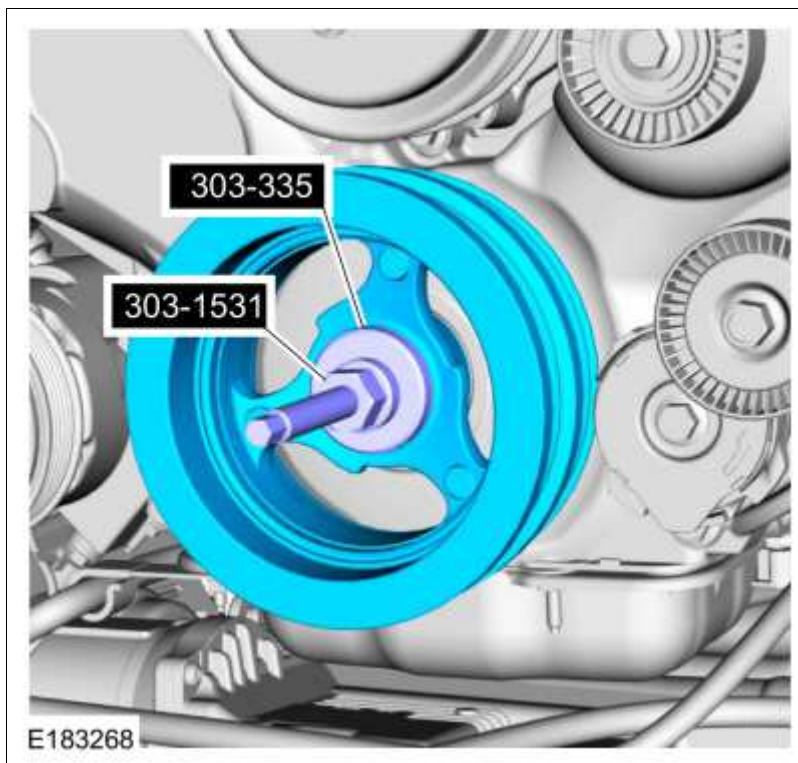
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



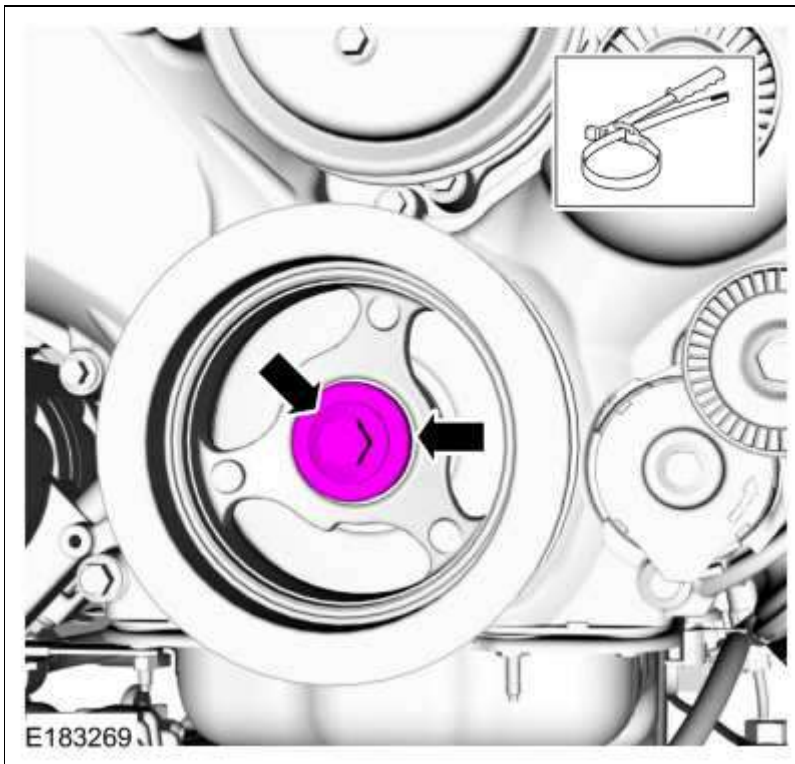
4. Lubricate the crankshaft pulley sealing surface with clean engine oil prior to installation.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



5. Using the special tools, install the crankshaft pulley.
 Use Special Service Tool: [303-335 \(T88T-6701-A\) Installer, Front Cover Oil Seal.](#) , [303-1531 Installer, Front Crank Seal and Damper.](#)



6. Using the Strap Wrench, install a new crankshaft pulley bolt and the original washer.
 Use the General Equipment: Strap Wrench
Torque:
 Stage 1: 103 lb.ft (140 Nm)
 Stage 2: Loosen: 360°
 Stage 3: 74 lb.ft (100 Nm)
 Stage 4: 90°



7. Install the following items:

1. Refer to: [Air Conditioning \(A/C\) Compressor Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Accessory Drive Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Cooling Fan Motor and Shroud](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

8. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.



Crankshaft Rear Seal

Base Part Number: [6701](#)

Special Tool(s) / General Equipment

 E129694	100-001 (T50T-100-A) Slide Hammer
 E133913	205-153 (T80T-4000-W) Handle
 ST2980-A	303-1250 Seal Installer, Rear Main TKIT-2006UFFLM
	303-519 (T95P-6701-EH) Remover, Crankshaft Rear Oil Seal TKIT-1995-FH/FLMH TKIT-1995-LMH/MH

Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

Removal

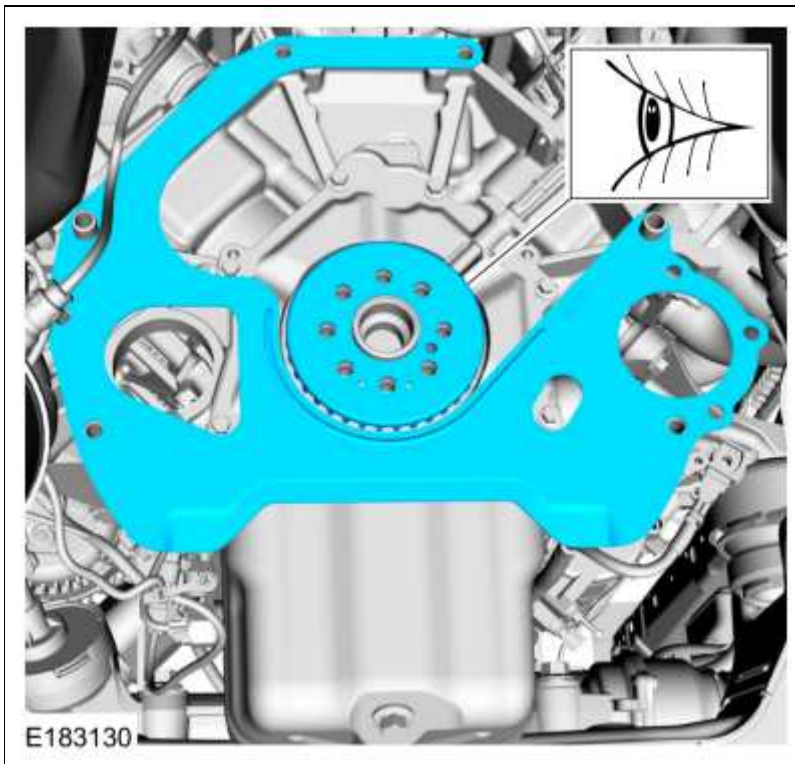
1. Remove the flexplate or flywheel.

Refer to: [Flexplate](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

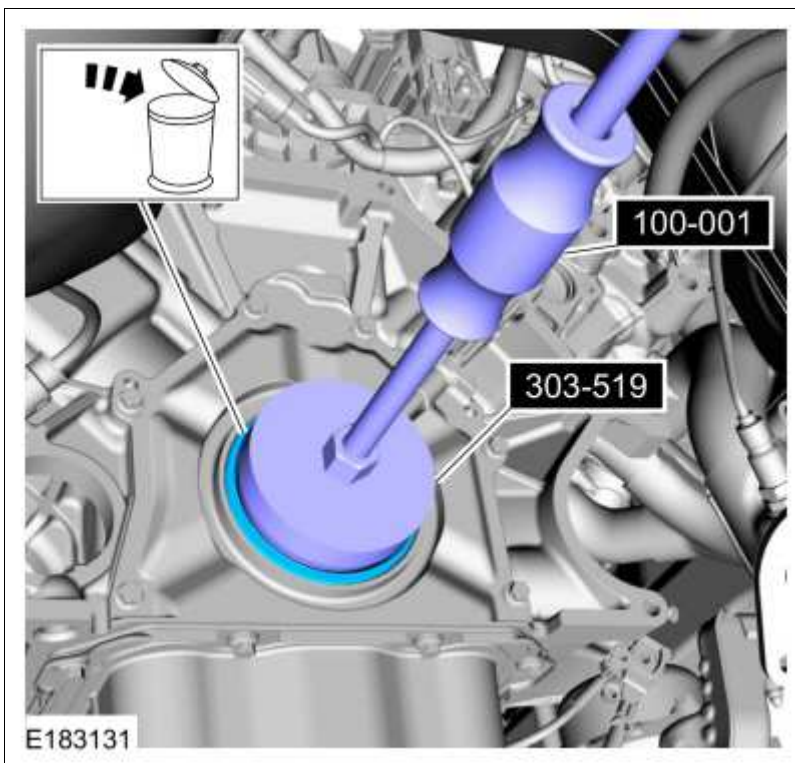
Refer to: [Flywheel](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

2. **NOTE:** Automatic transmission spacer plate shown, manual transmission similar.

- Remove the crankshaft sensor ring and the engine-to-transmission spacer plate.
- Inspect the crankshaft sensor ring for damage. If the crankshaft sensor ring has been dropped or has any visual damage, it must be discarded.

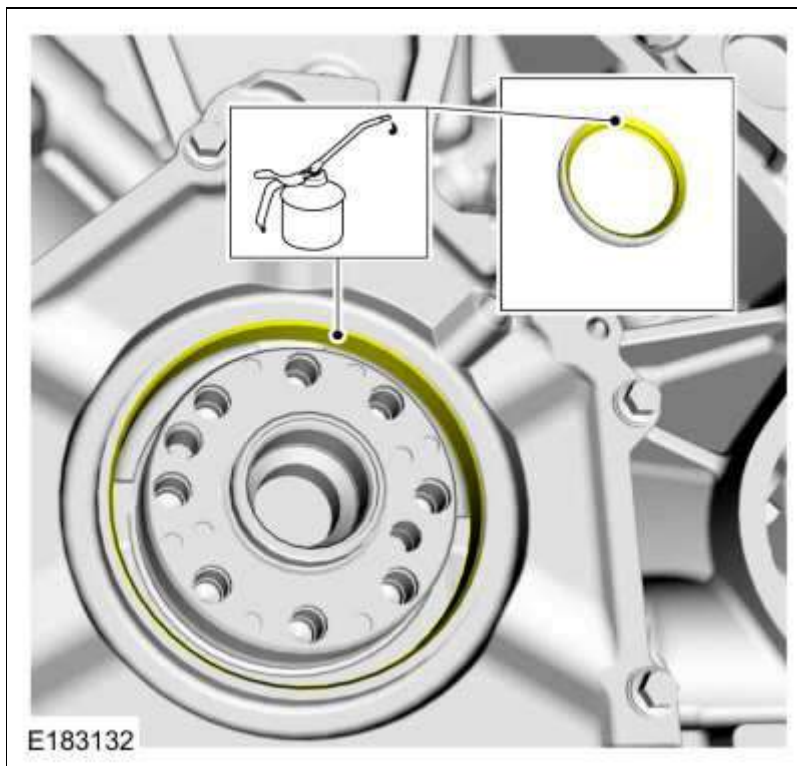


3. Using the special tools, remove and discard the crankshaft rear seal.
Use Special Service Tool: [303-519 \(T95P-6701-EH\) Remover, Crankshaft Rear Oil Seal.](#) , [100-001 \(T50T-100-A\) Slide Hammer.](#)

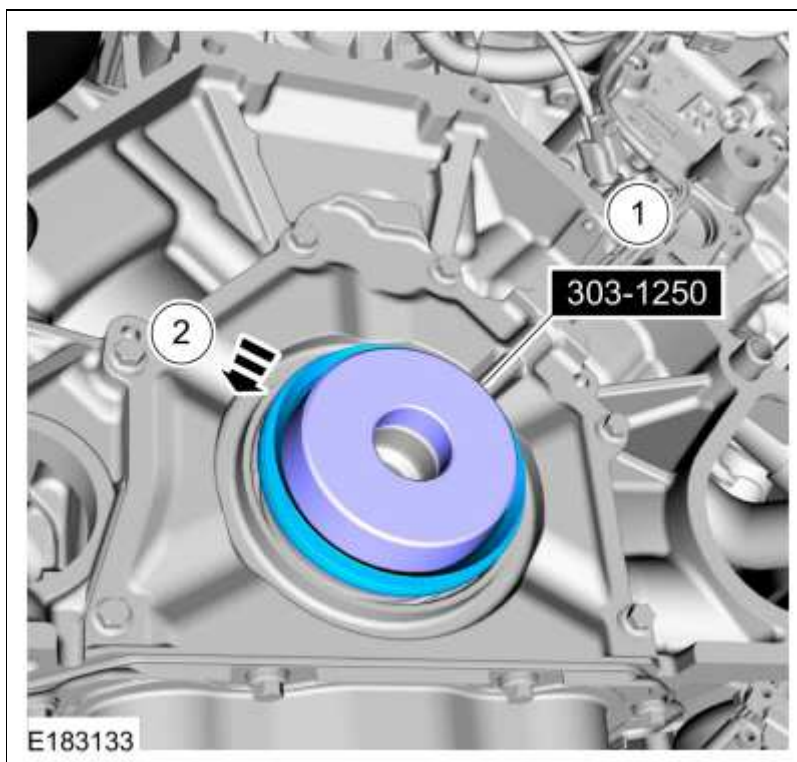


Installation

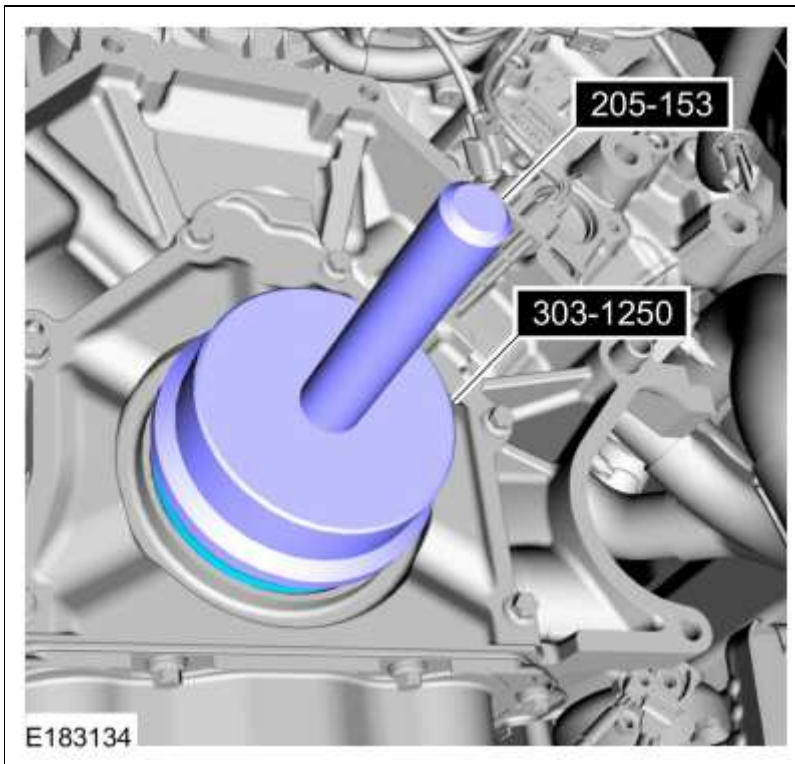
1. Lubricate the seal bore and the seal lips with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



2.
 - Position the special tool onto the end of the crankshaft.
Use Special Service Tool: [303-1250 Seal Installer, Rear Main.](#)
 - Slide the new crankshaft rear seal onto the tool.



3. Using the special tools, install the crankshaft rear seal.
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1250 Seal Installer, Rear Main.](#)



4. **NOTE:** Automatic transmission spacer plate shown, manual transmission similar.

Install the crankshaft sensor ring and the engine-to-transmission spacer plate.



5. Install the flexplate or flywheel.

Refer to: [Flexplate](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

Refer to: [Flywheel](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

**Crankshaft Rear Seal with Retainer Plate**Base Part Number: [6K301](#)**Special Tool(s) / General Equipment**

 E129694	100-001 (T50T-100-A) Slide Hammer
 E133913	205-153 (T80T-4000-W) Handle
 ST2980-A	303-1250 Seal Installer, Rear Main TKIT-2006UFFLM
	303-519 (T95P-6701-EH) Remover, Crankshaft Rear Oil Seal TKIT-1995-FH/FLMH TKIT-1995-LMH/MH
Plastic Scraper	

Materials

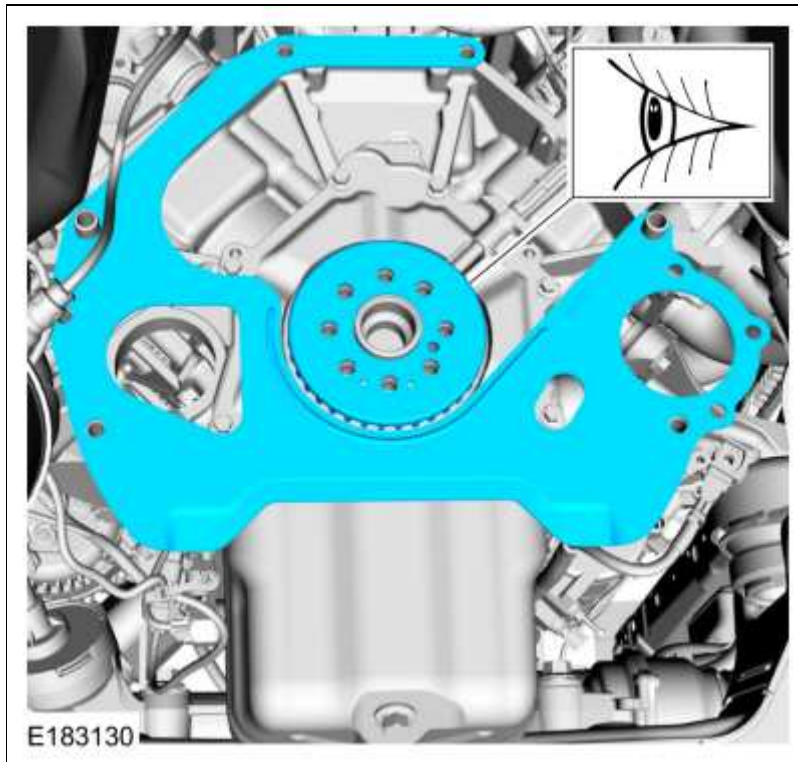
Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Motorcraft® Metal Surface Prep ZC-31-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

Removal

1. Remove the flexplate or flywheel.
Refer to: [Flexplate](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
Refer to: [Flywheel](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

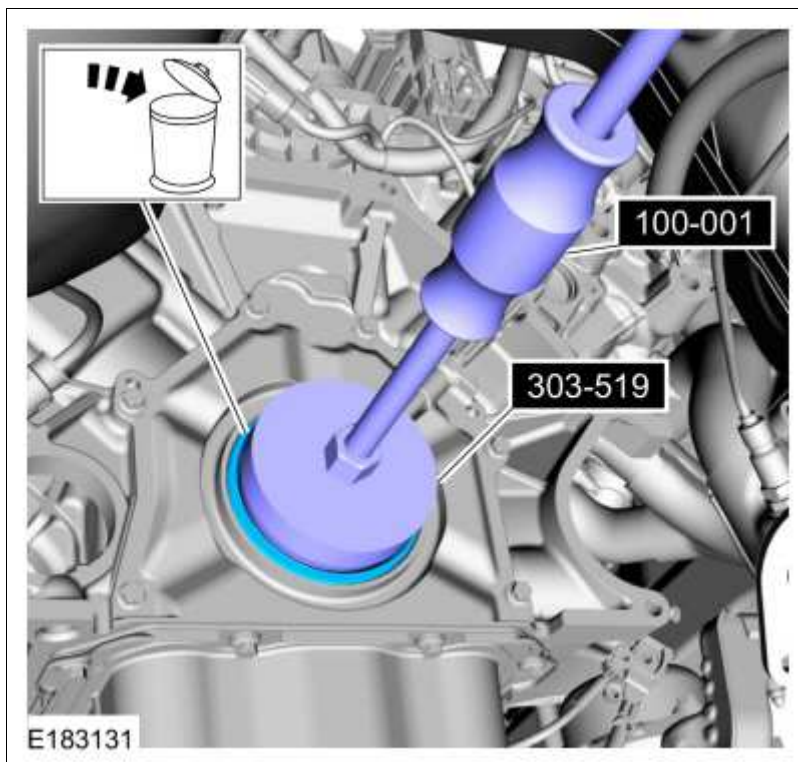
2. **NOTE:** Automatic transmission spacer plate shown, manual transmission similar.

- Remove the crankshaft sensor ring and the engine-to-transmission spacer plate.
- Inspect the crankshaft sensor ring for damage. If the crankshaft sensor ring has been dropped or has any visual damage, it must be discarded.

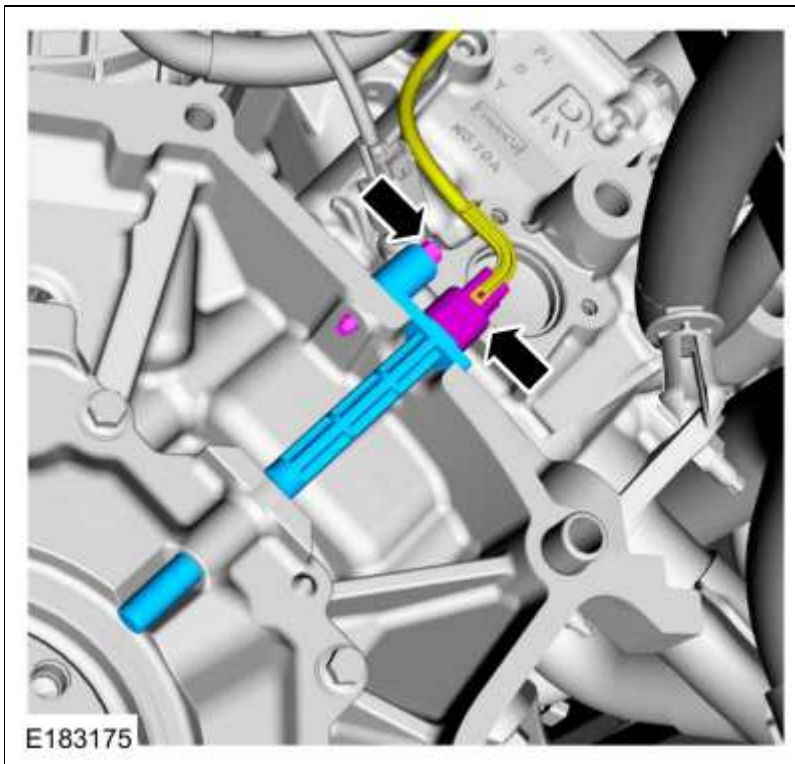


3. Using the special tools, remove and discard the crankshaft rear seal.

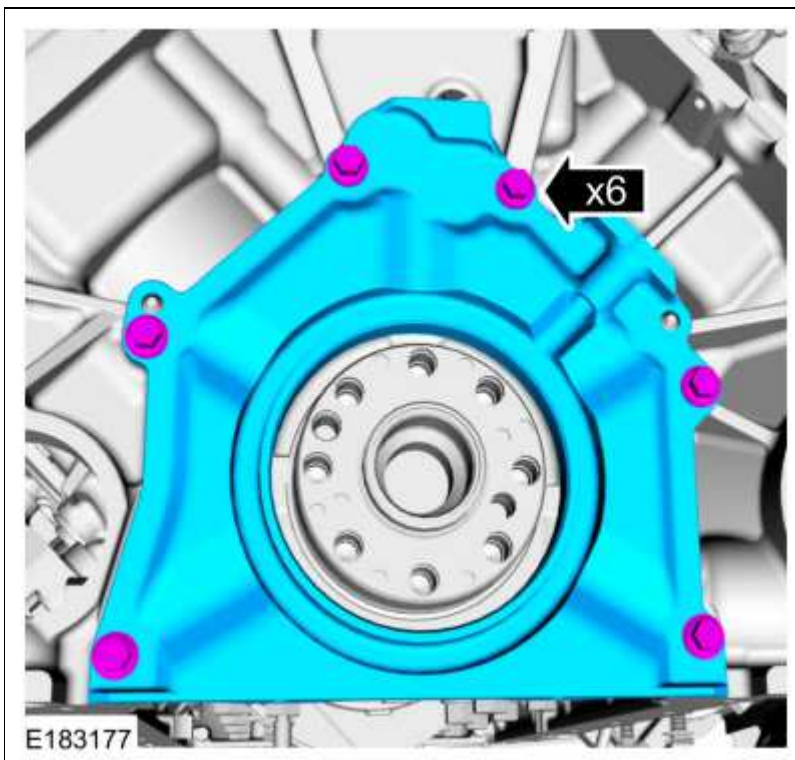
Use Special Service Tool: [303-519 \(T95P-6701-EH\) Remover, Crankshaft Rear Oil Seal](#) , [100-001 \(T50T-100-A\) Slide Hammer](#).



- 4.
- Disconnect the CKP sensor electrical connector.
 - Remove the bolt and the CKP sensor.



5. Remove the oil pan.
Refer to: [Oil Pan](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
6. Remove the bolts and the crankshaft rear seal retainer plate.



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

Clean and inspect the mating surface.

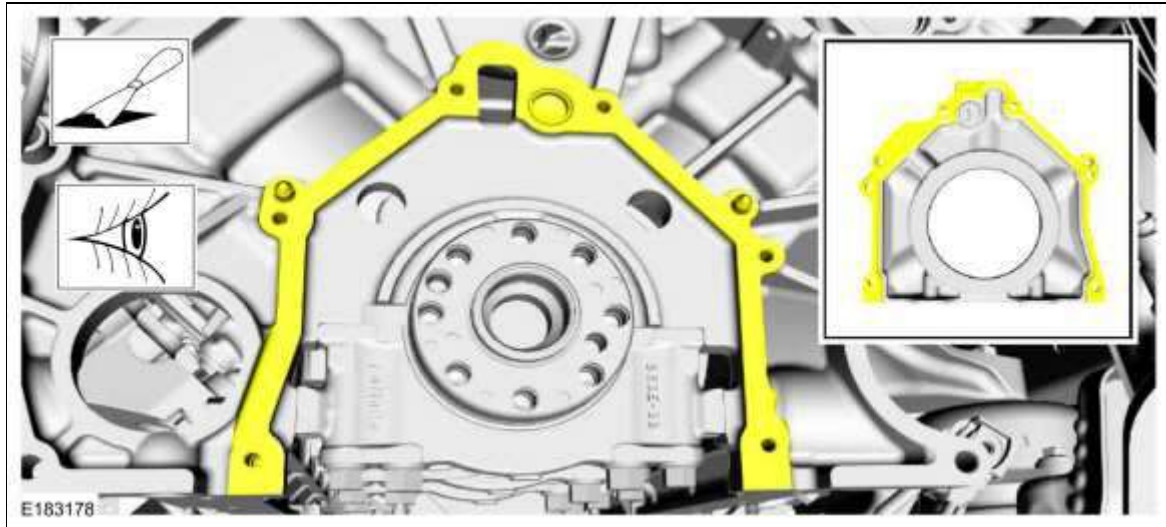
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

Material: Motorcraft® Metal Surface Prep / ZC-31-B

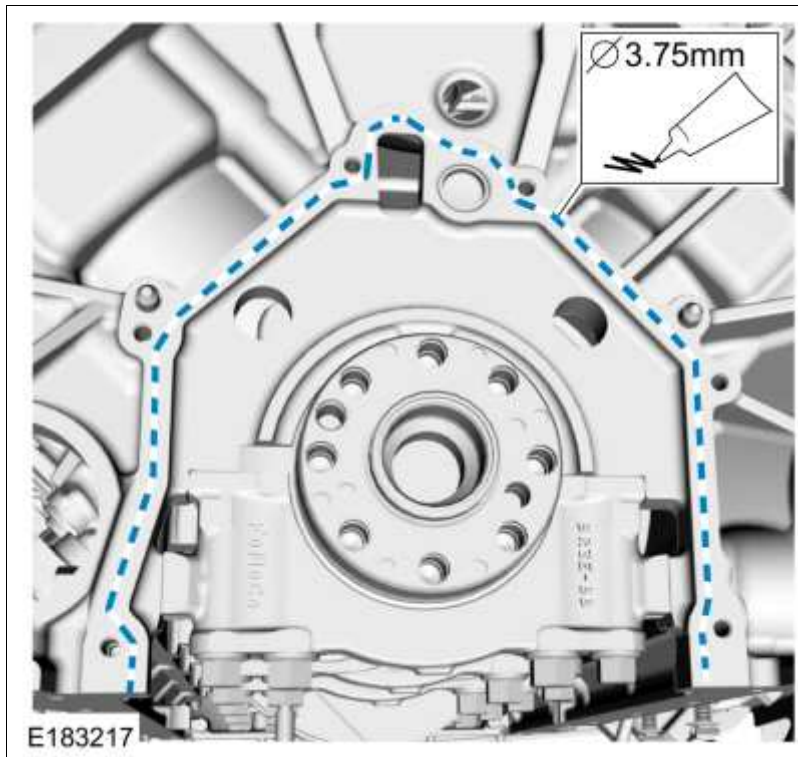


Installation

1. **NOTE:** If the rear crankshaft seal retaining plate is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. Failure to follow this procedure may cause future oil leaks.

Apply a 3.75 mm (0.147 in) bead of silicone gasket and sealant to the rear crankshaft seal retainer mating surface on the engine block.

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)

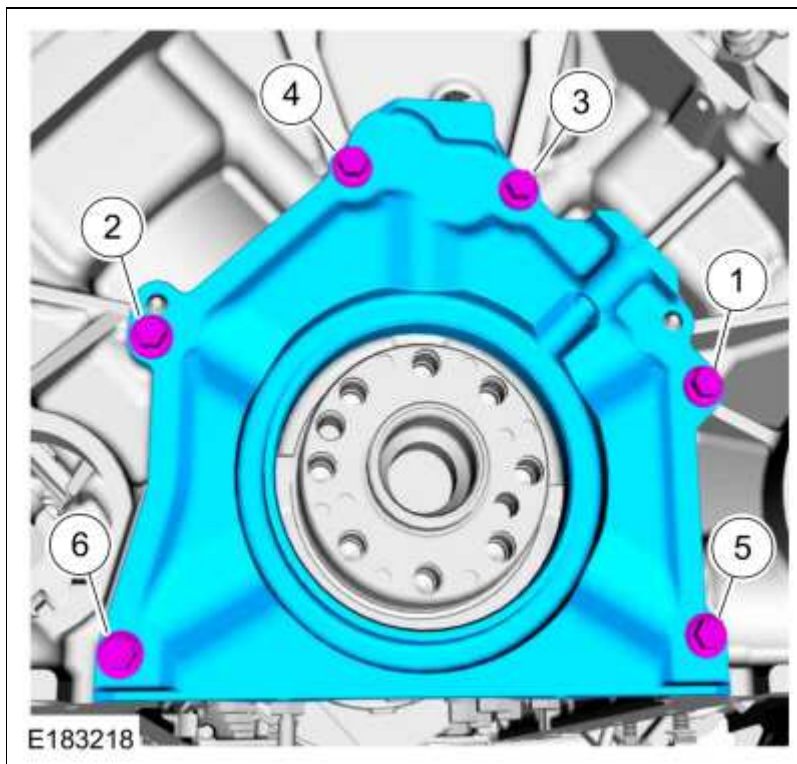


2. Install the crankshaft rear seal retainer plate and the bolts.

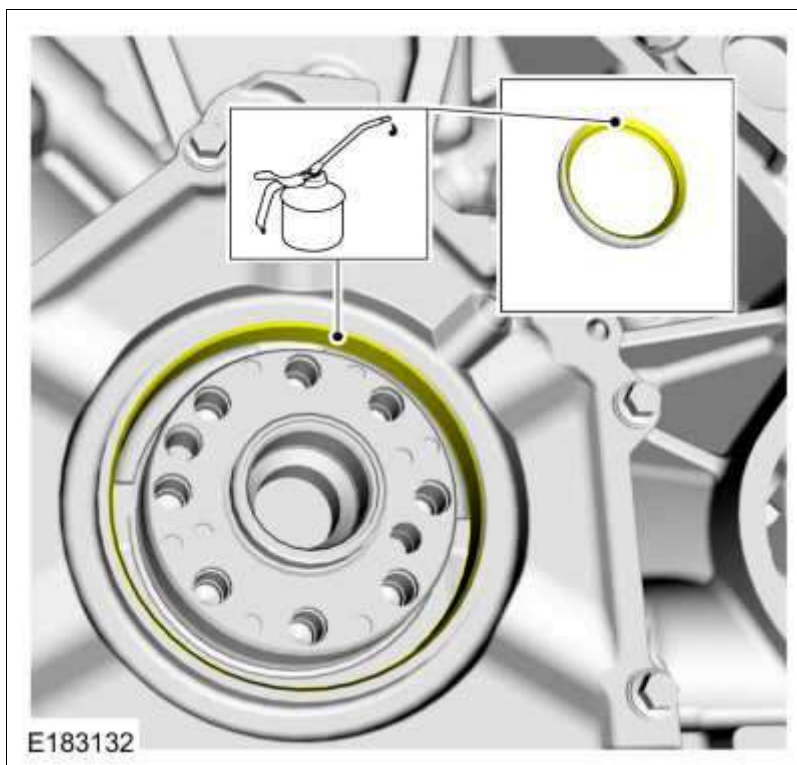
Torque:

Stage 1: 89 lb.in (10 Nm)

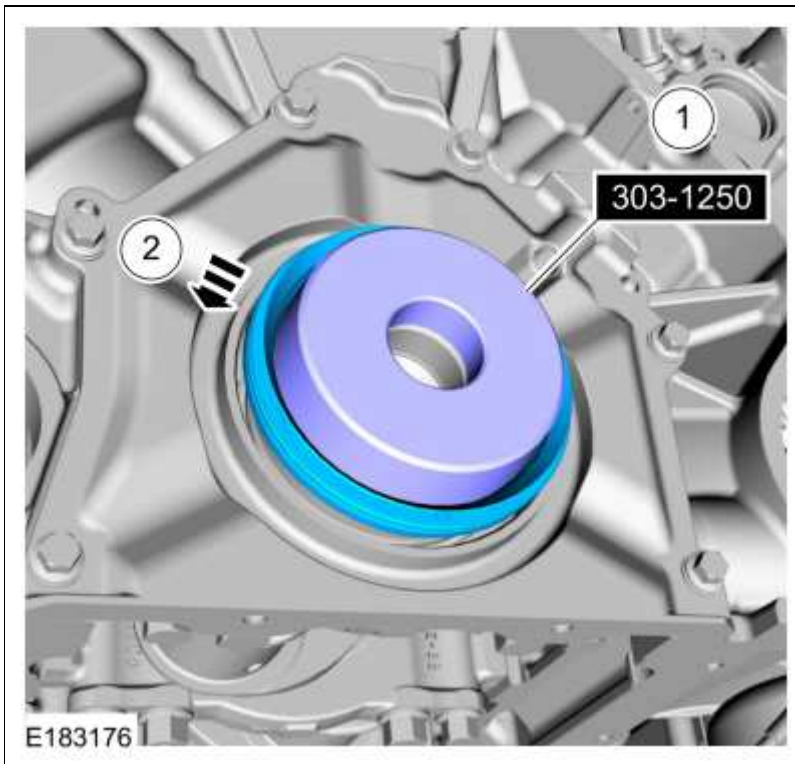
Stage 2: 45°



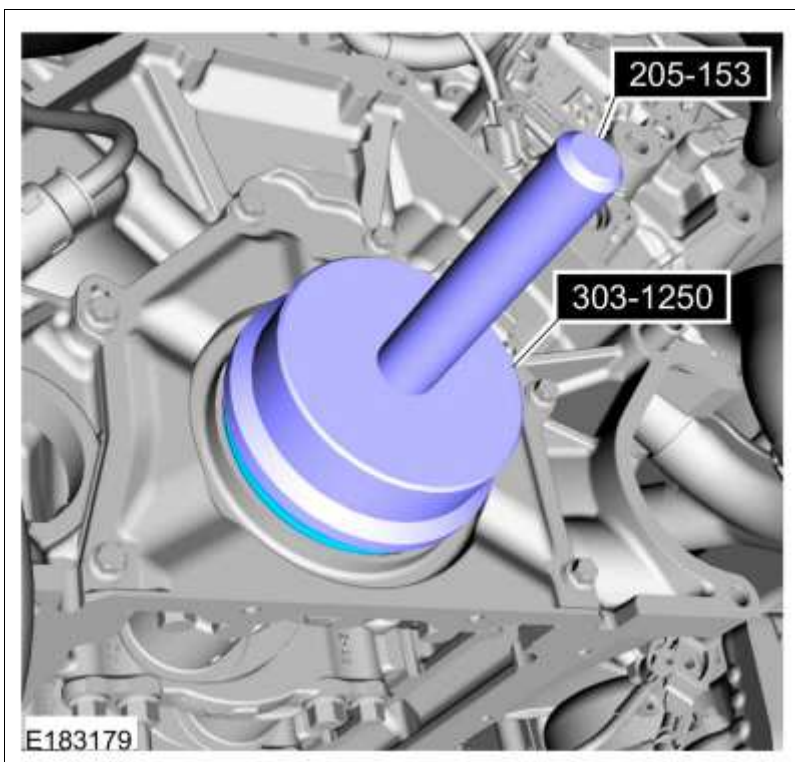
3. Lubricate the crankshaft rear seal bore and the seal lips with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



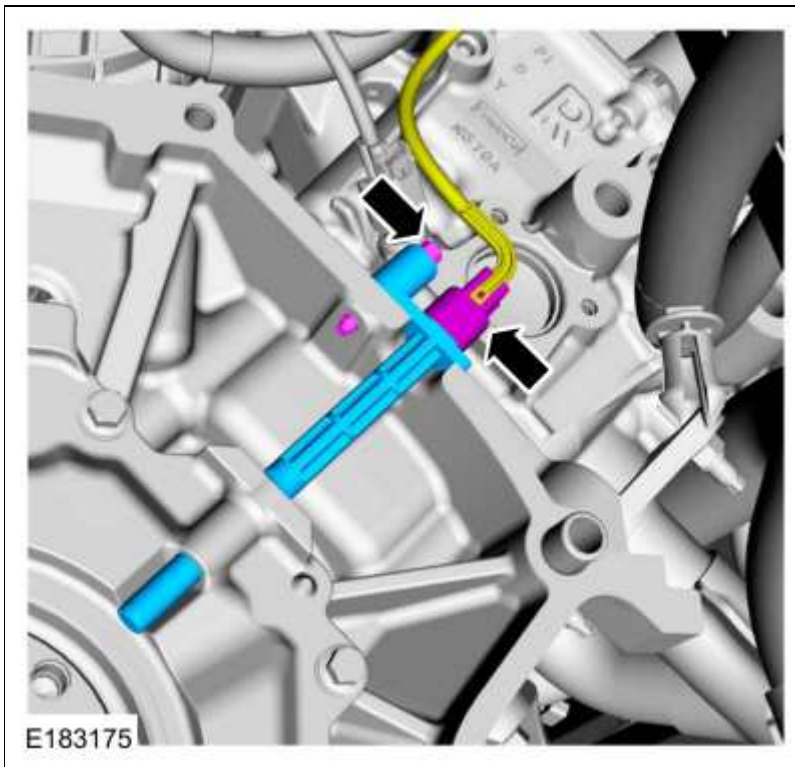
- 4.
- Position the special tool onto the end of the crankshaft.
 Use Special Service Tool: [303-1250 Seal Installer, Rear Main.](#)
 - Slide the new crankshaft rear seal onto the tool.



5. Using the special tools, install the crankshaft rear seal.
 Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1250 Seal Installer, Rear Main](#).



6. • Install the CKP sensor and the bolt.
Torque: 89 lb.in (10 Nm)
 • Connect the CKP sensor electrical connector.



7. Install the oil pan.

Refer to: [Oil Pan](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

8. **NOTE:** Automatic transmission spacer plate shown, manual transmission similar.

Install the crankshaft sensor ring and the engine-to-transmission spacer plate.



9. Install the flexplate or flywheel.

Refer to: [Flexplate](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

Refer to: [Flywheel](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).



Cylinder Head LH

Special Tool(s) / General Equipment

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine
Oil Drain Equipment	

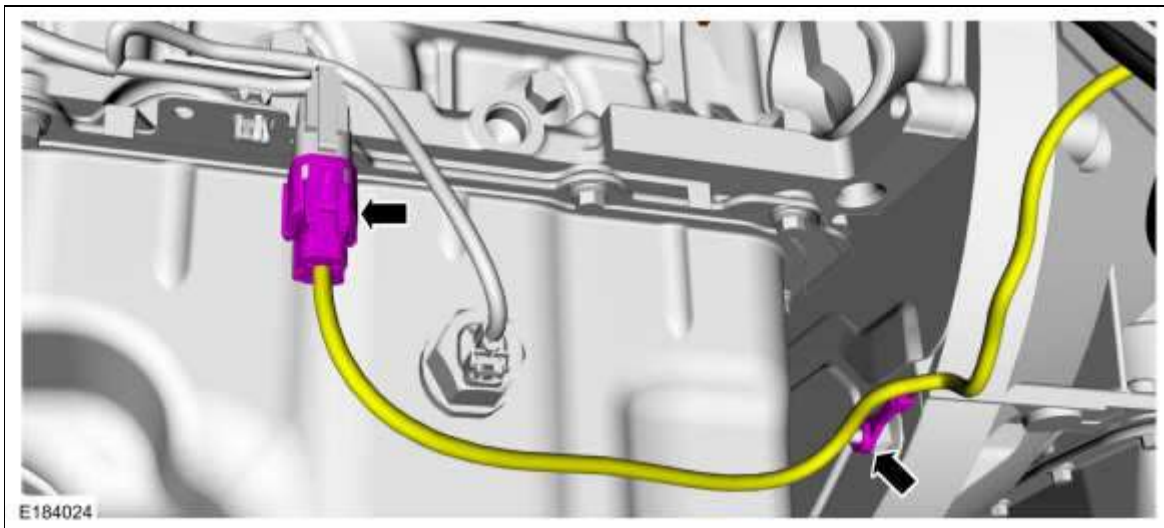
Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

Removal

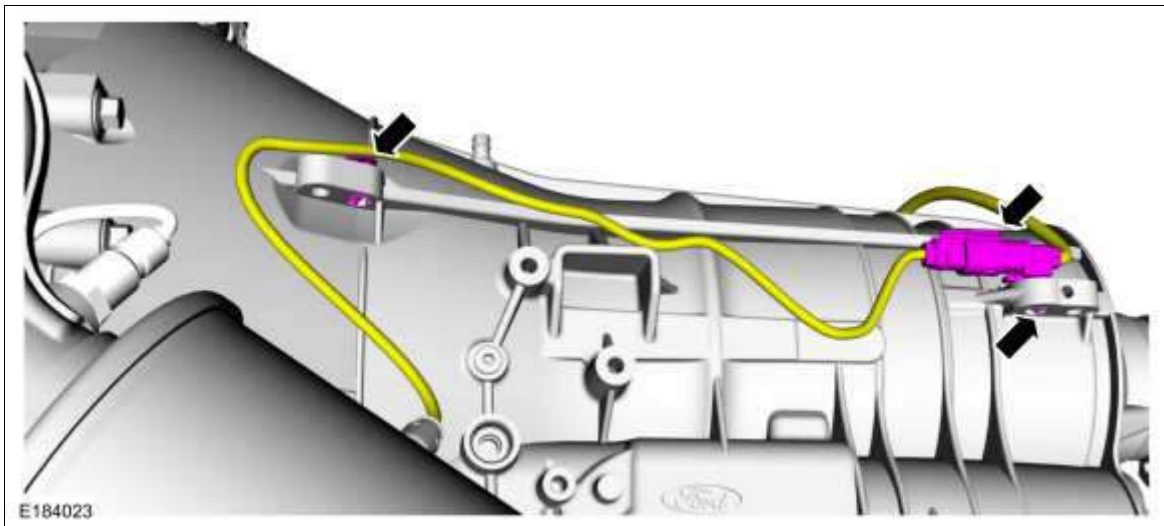
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
3. Drain the engine cooling system.
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
4. Disconnect the LH HO2S electrical connector and detach the harness retainer.



5. **NOTE:** Automatic transmission shown, manual transmission similar.

Disconnect the LH catalyst monitor sensor electrical connector and detach the harness retainers.

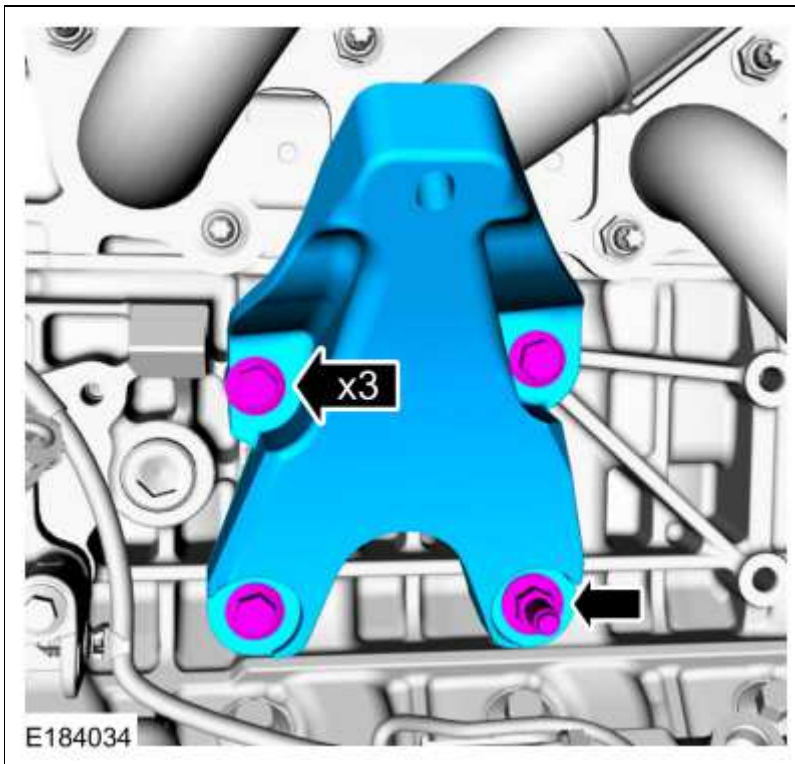


6. Remove the following items:

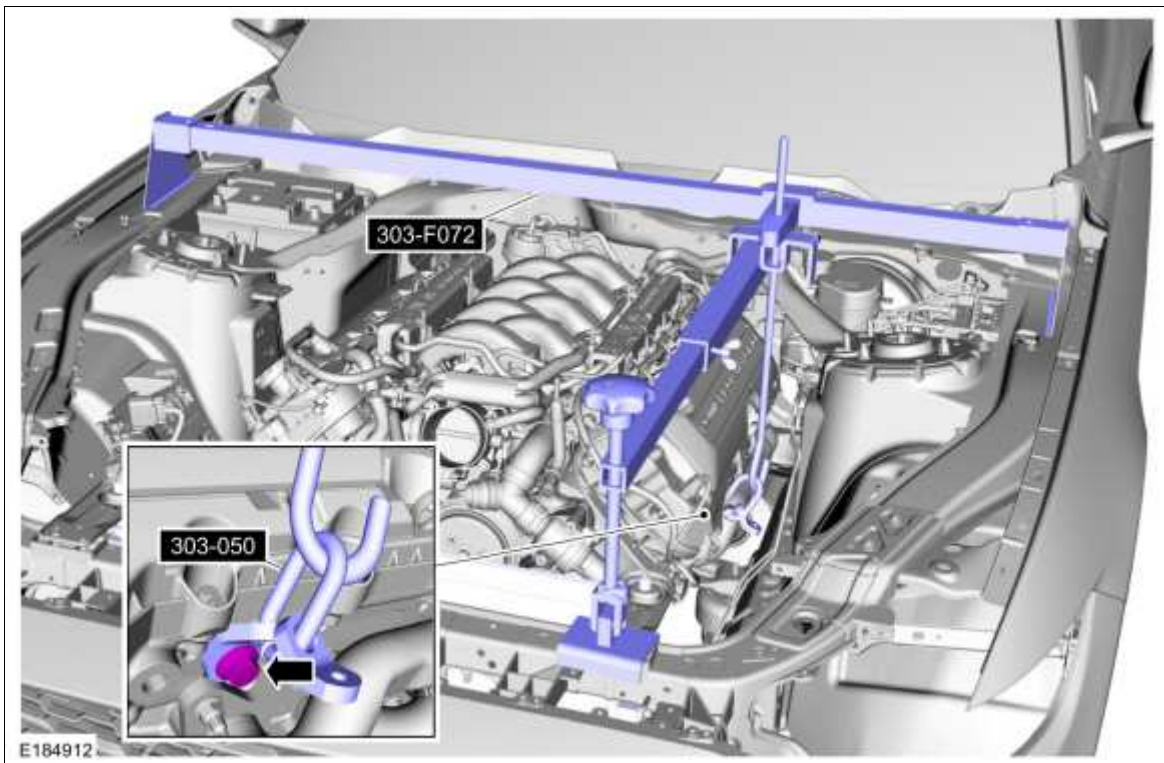
1. Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Camshaft LH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Catalytic Converter LH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

7. Install the LH engine mount bracket, bolts and stud bolt.

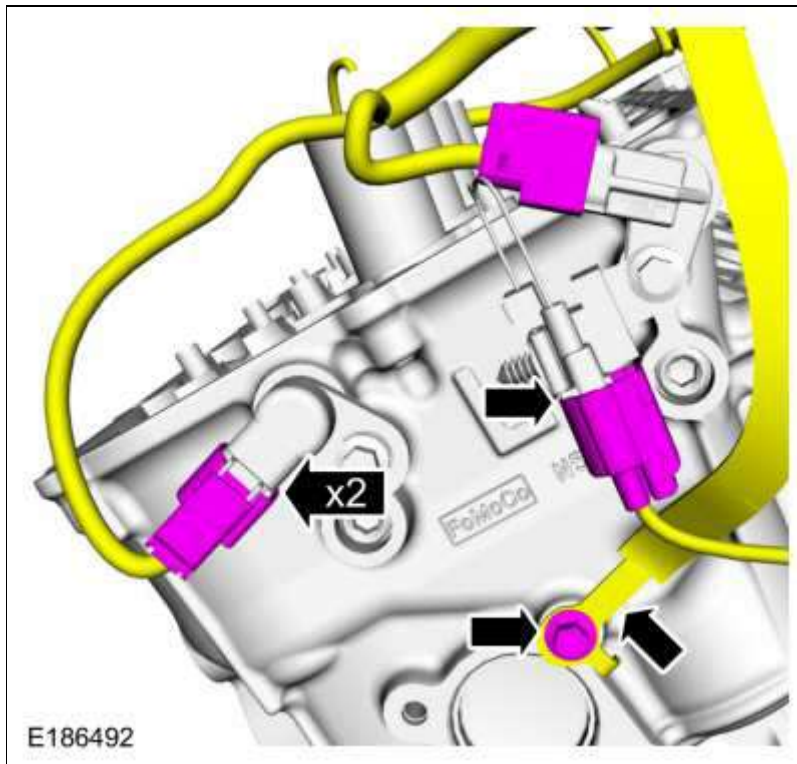
Torque: 41 lb.ft (55 Nm)



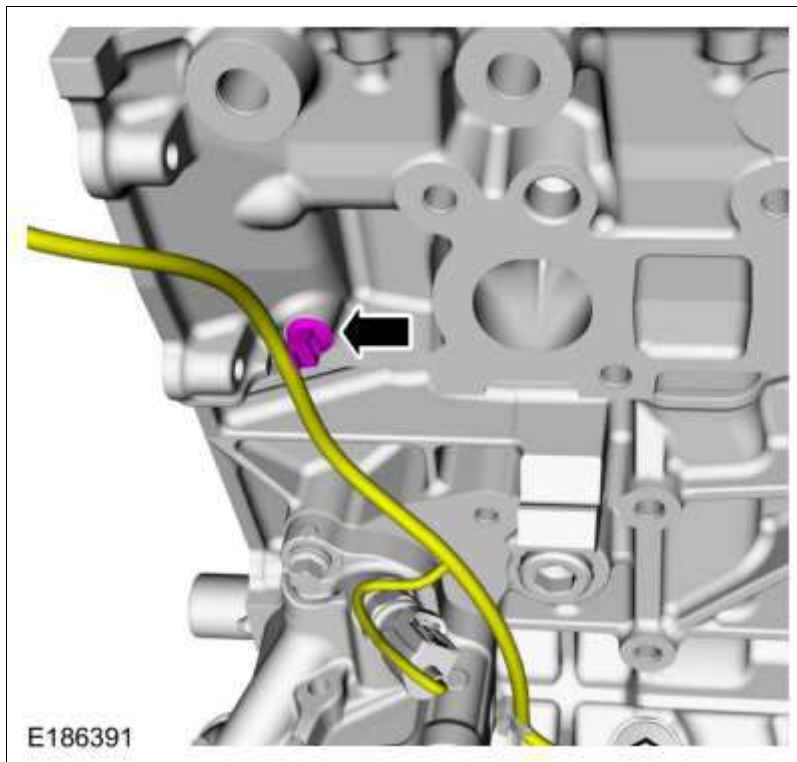
- 8.
- Using the special tools, lower the engine onto the LH engine mount.
 - Remove Special Service Tool: [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#) , [303-F072 Support Bar, Engine.](#)



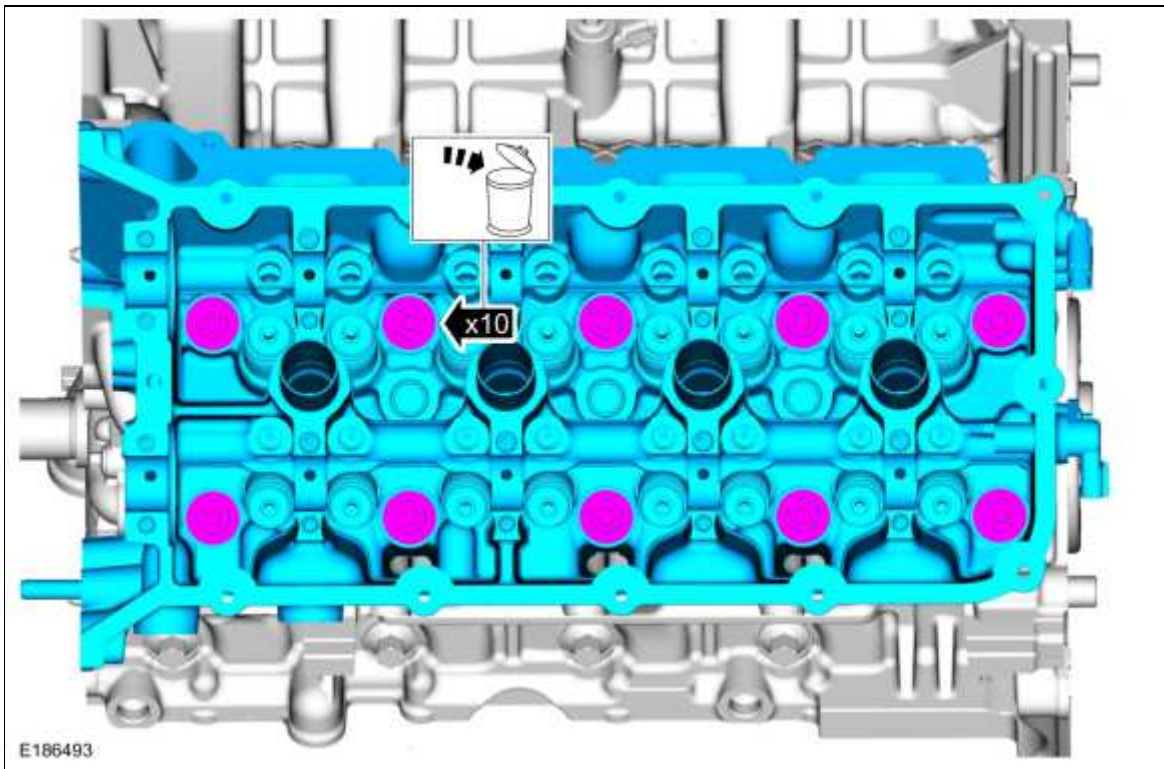
- 9.
- Disconnect the Camshaft Position (CMP) sensors and the ignition interference capacitor electrical connectors.
 - Remove the bolt and position the ground wire aside.



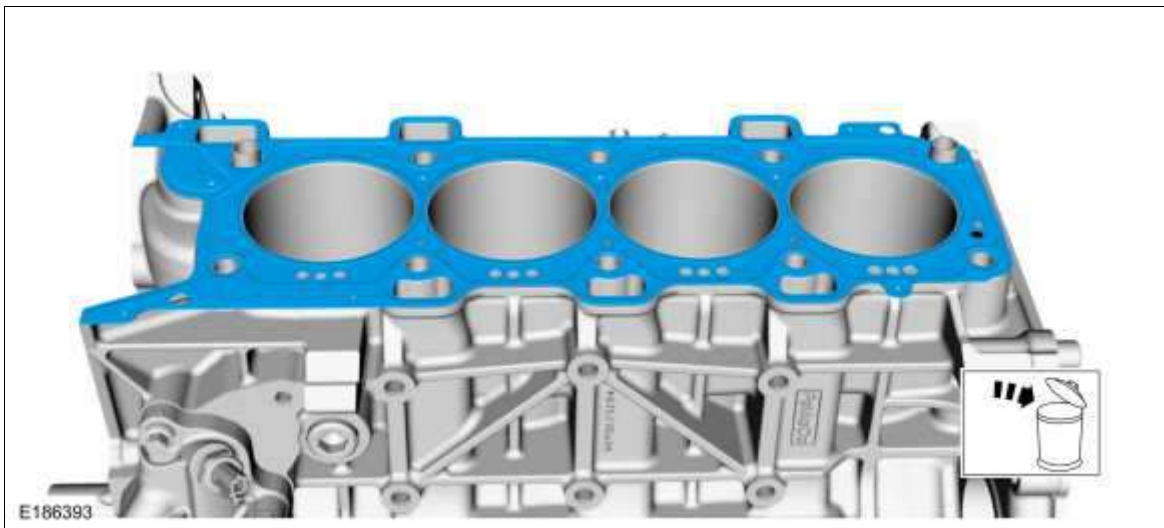
10. Detach the wiring harness retainer from the cylinder head.



- 11.
- Remove and discard the bolts.
 - Remove the cylinder head.



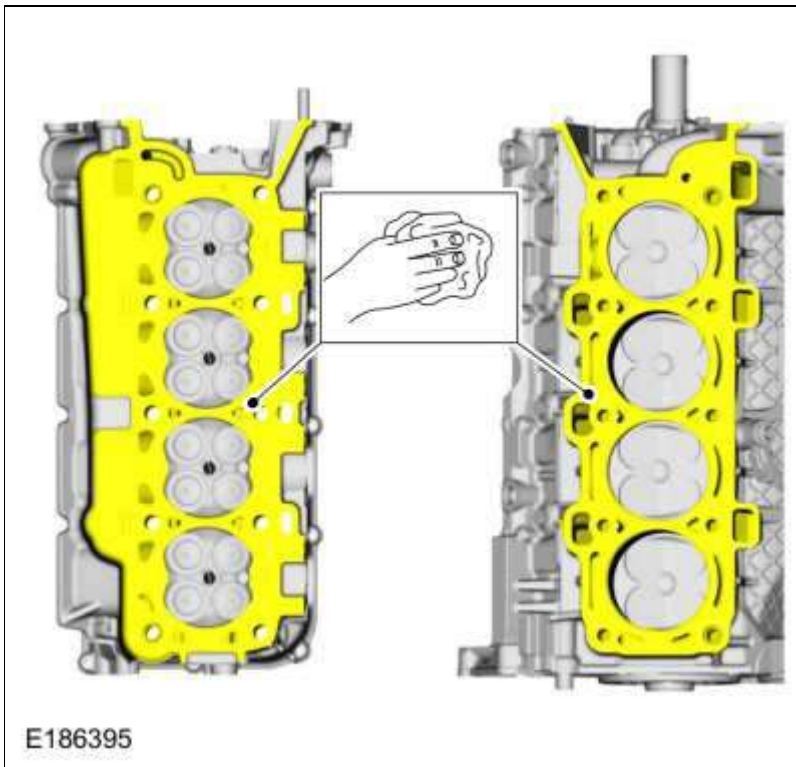
12. Discard the cylinder head gasket.



13. **NOTICE:** 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.

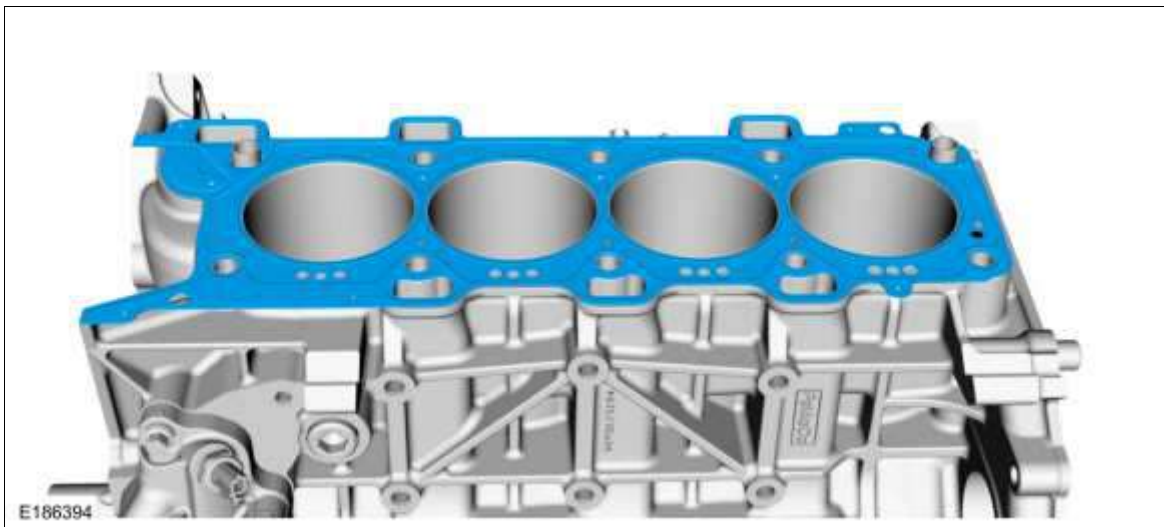
NOTE: Clean the cylinder head bolt holes in the cylinder block using compressed air. Make sure all coolant, oil or other foreign material is removed.

- Clean and inspect the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block
- Refer to: [Cylinder Head Distortion](#) (303-00 Engine System - General Information, General Procedures).
- Refer to: [Cylinder Block Distortion](#) (303-00 Engine System - General Information, General Procedures).



Installation

1. Install the cylinder head gasket.

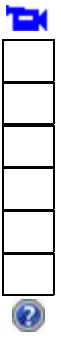
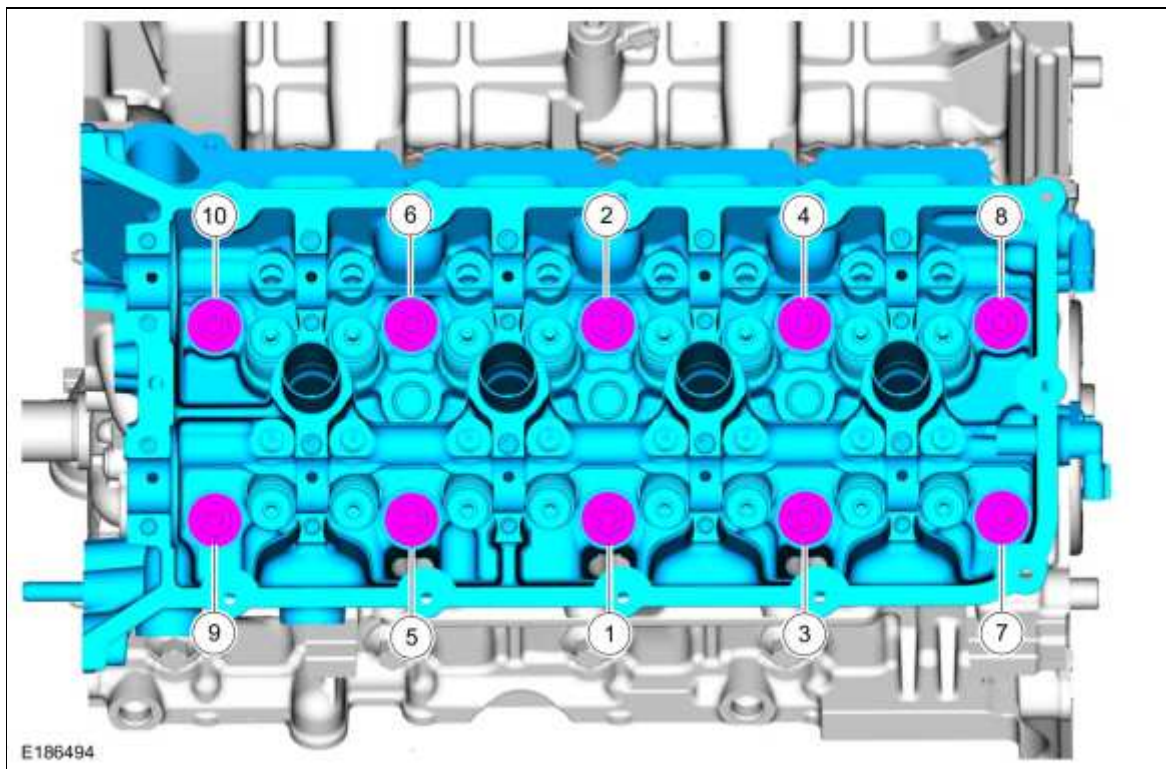


2. **NOTE:** The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

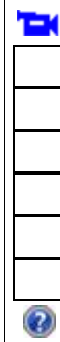
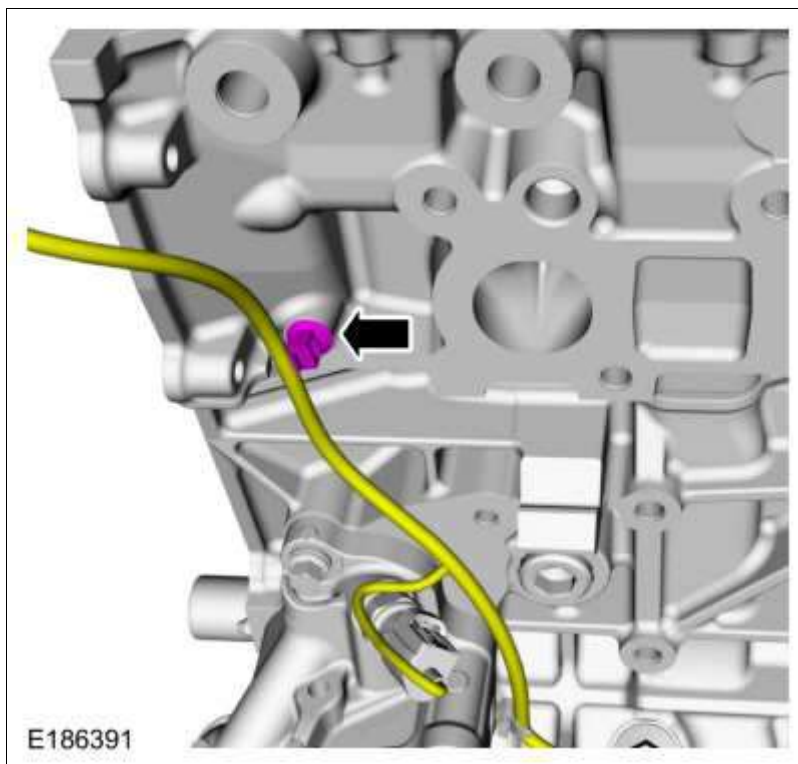
Install the cylinder head and the new bolts.

Torque:

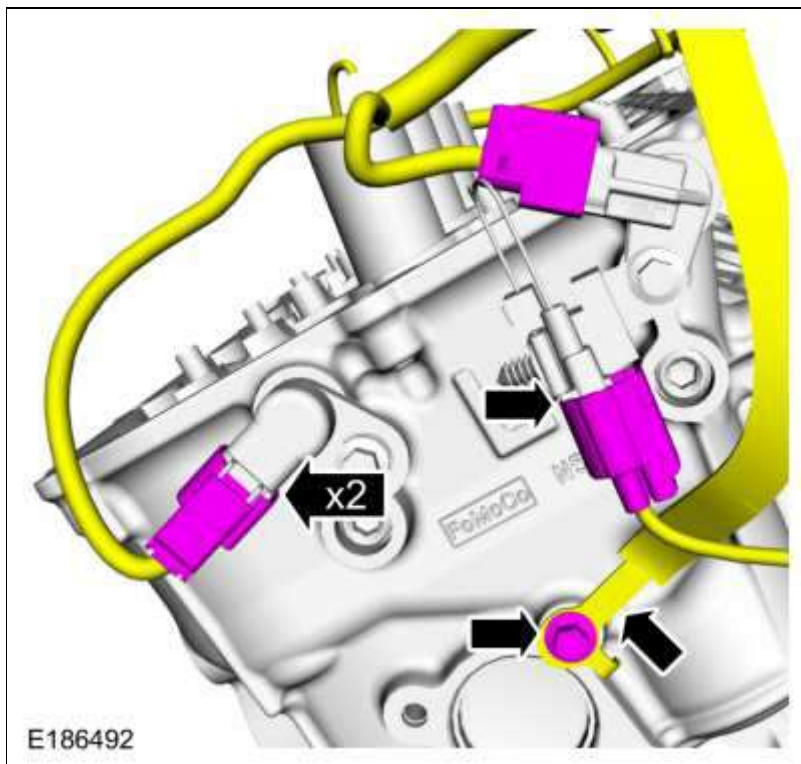
- Stage 1: 18 lb.ft (25 Nm)
- Stage 2: 55 lb.ft (75 Nm)
- Stage 3: Loosen: 180°
- Stage 4: 18 lb.ft (25 Nm)
- Stage 5: 26 lb.ft (35 Nm)
- Stage 6: 90°
- Stage 7: 90°



3. Attach the wiring harness retainer to the cylinder head.

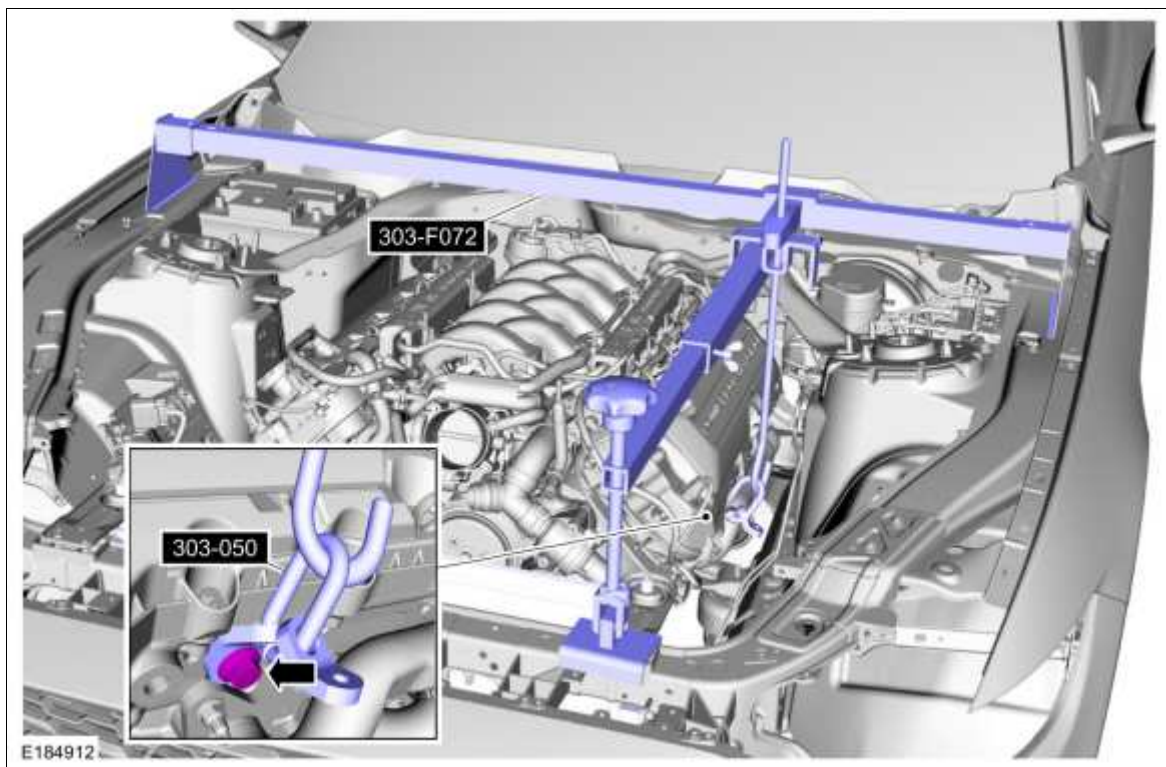


4.
 - Install the ground wire and bolt.
Torque: 106 lb.in (12 Nm)
 - Connect the Camshaft Position (CMP) sensors and the ignition interference capacitor electrical connectors.

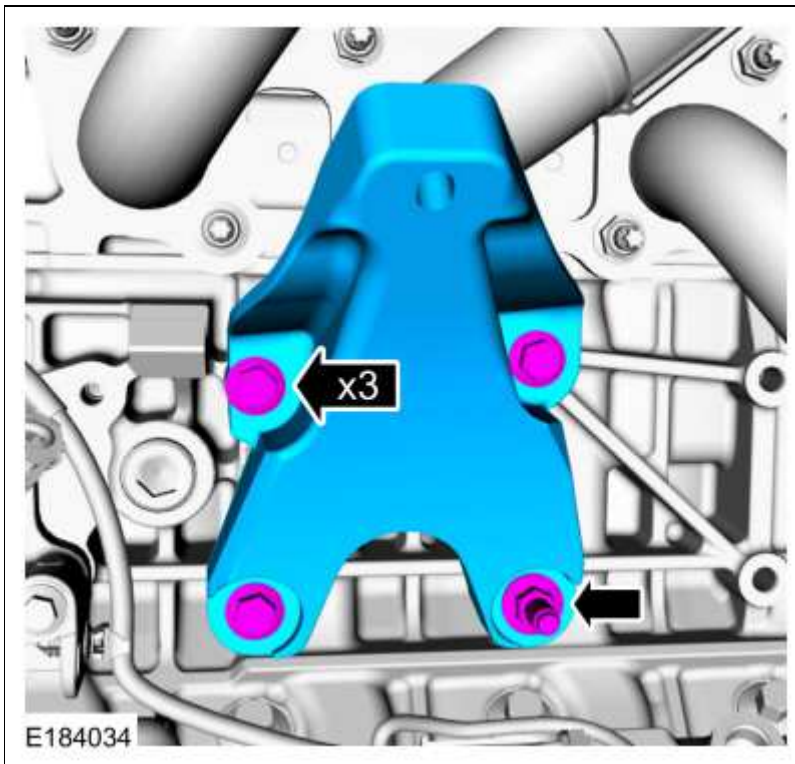


5. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

- Install Special Service Tool: [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#) , [303-F072 Support Bar, Engine.](#)
- Using the special tools raise the LH side of the engine 25 mm (1 inch).



6. Remove the bolts, stud bolt and the LH engine mount bracket.

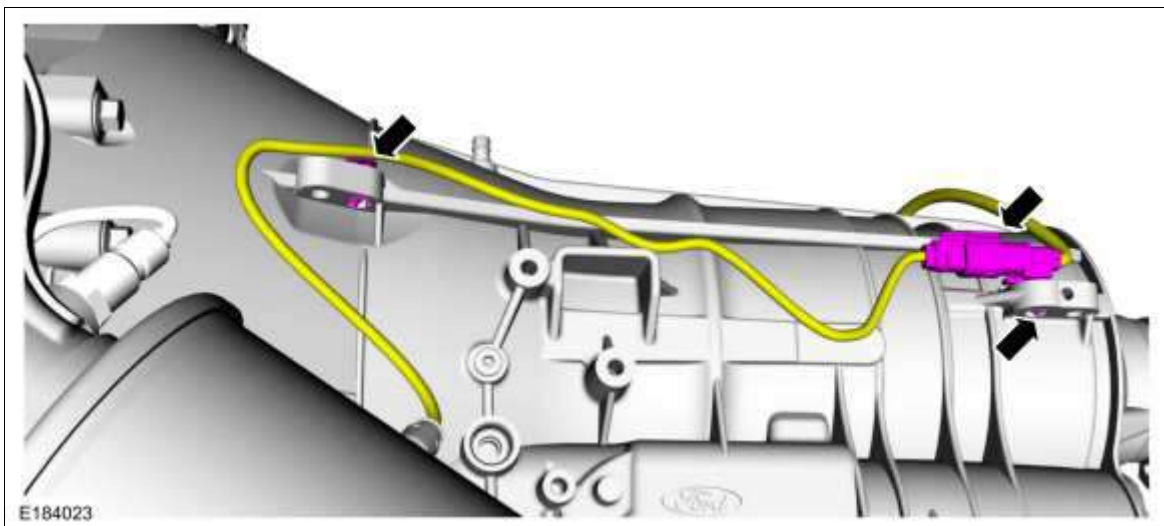


7. Install the following items:

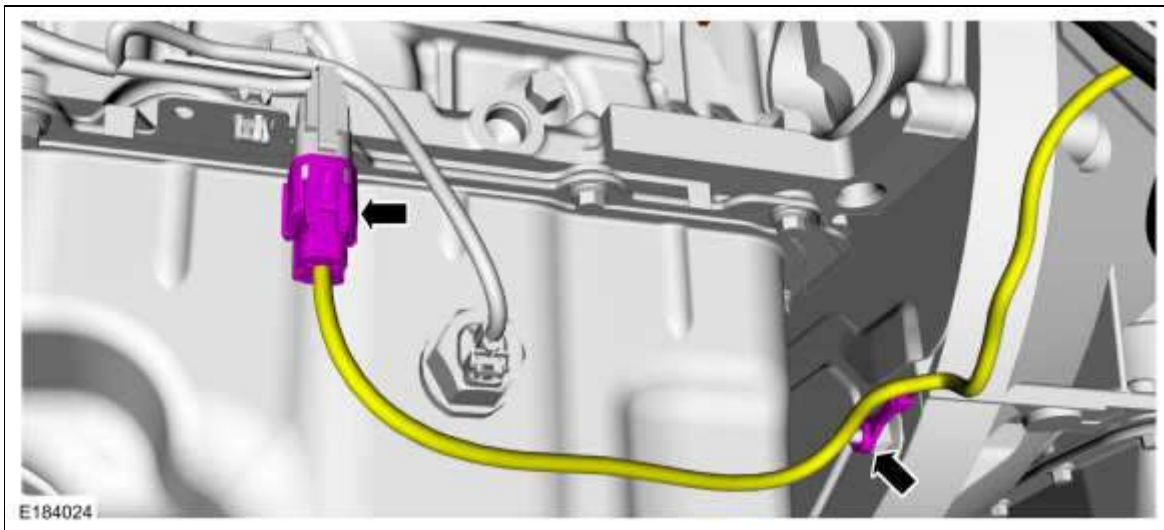
1. Refer to: [Catalytic Converter LH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Camshaft LH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

8. **NOTE:** Automatic transmission shown, manual transmission similar.

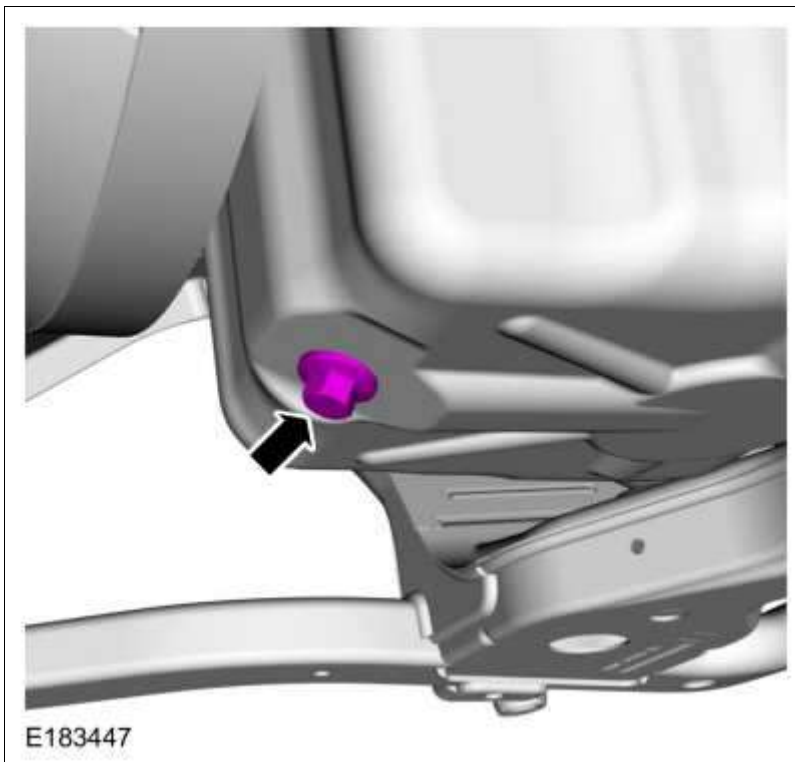
Connect the LH catalyst monitor sensor electrical connector and attach the harness retainers.



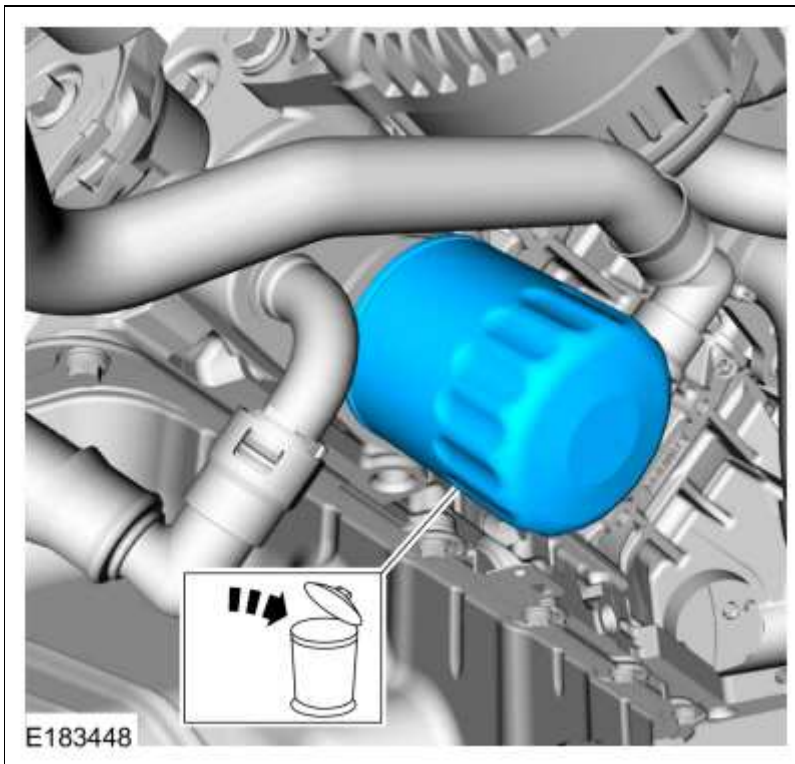
9. Connect the LH HO2S electrical connector and attach the harness retainer.



10.
 - Remove the oil pan drain plug and drain the engine oil.
Use the General Equipment: Oil Drain Equipment
 - Install the oil pan drain plug.
Torque: 19 lb.ft (26 Nm)



11. Remove and discard the engine oil filter.



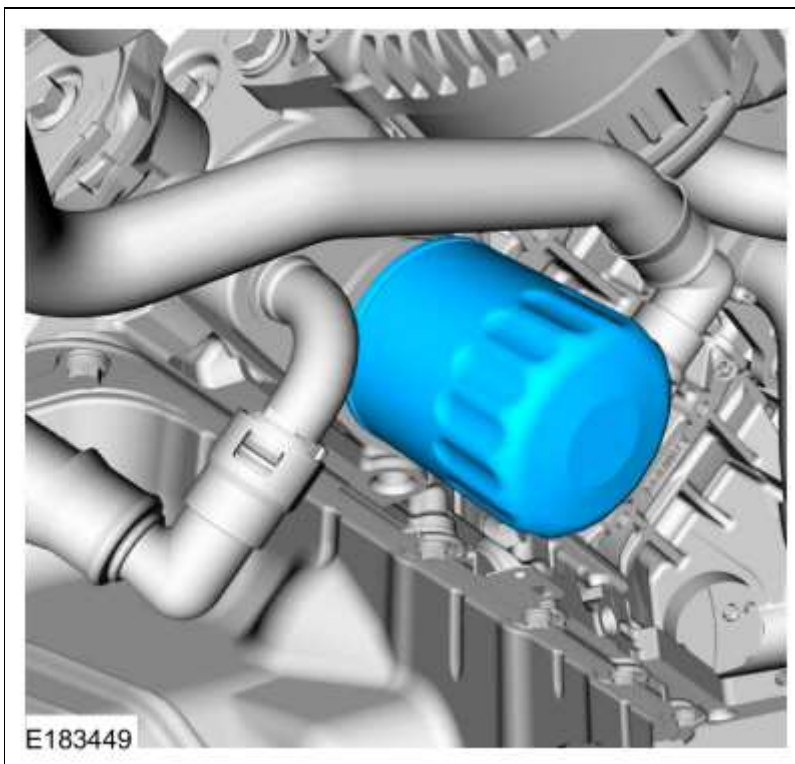
12. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

Torque:

Stage 1: 44 lb.in (5 Nm)

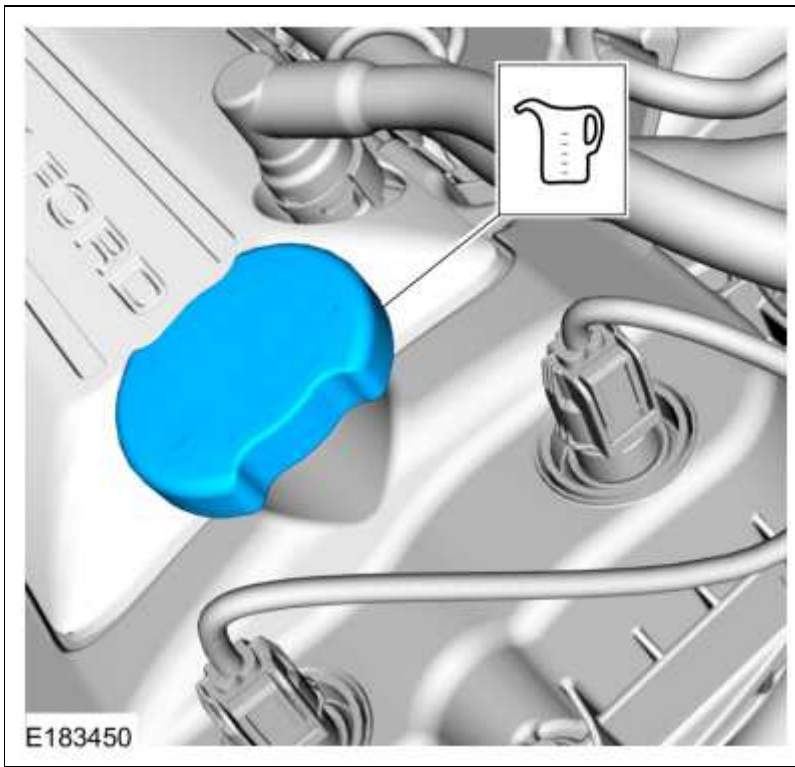
Stage 2: 180°



13. Fill the engine with clean engine oil.

Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



14. Fill and bleed the engine cooling system.

Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



Cylinder Head RH

Special Tool(s) / General Equipment

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine
Oil Drain Equipment	

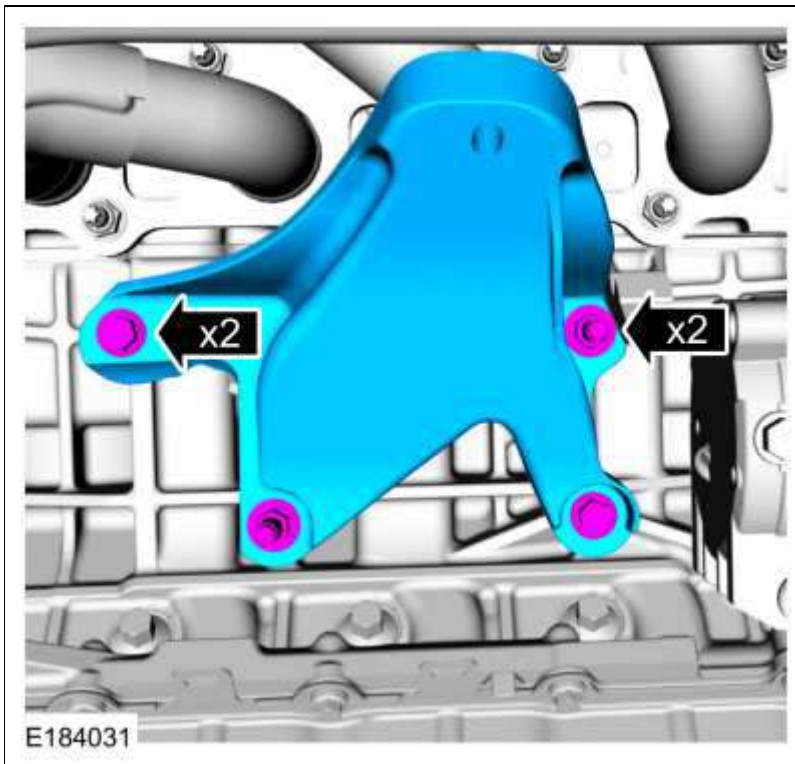
Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

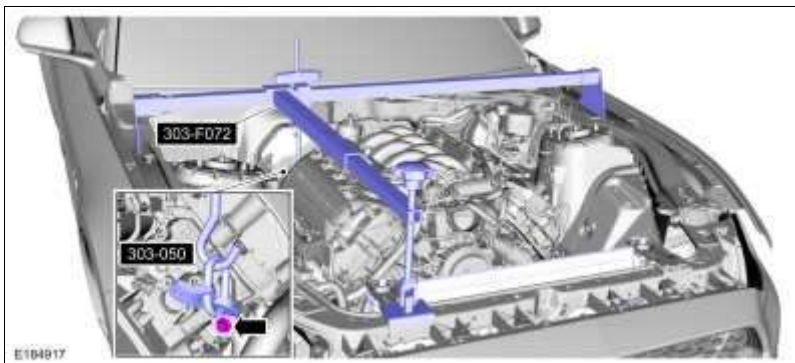
Removal

NOTICE: 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.

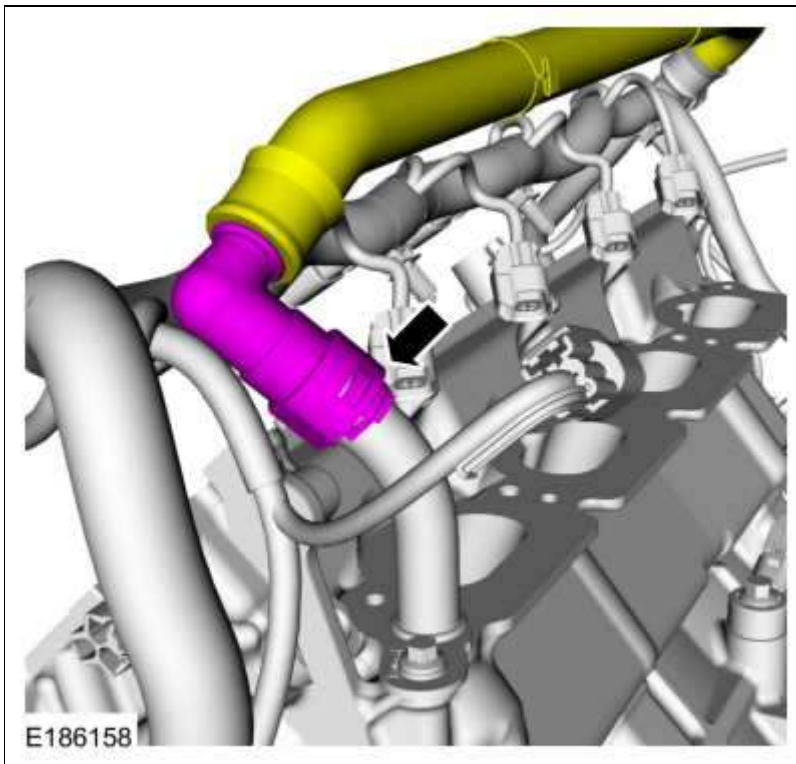
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
3. Drain the engine cooling system.
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
4. Remove the following items:
 1. Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 2. Refer to: [Camshaft RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 3. Refer to: [Exhaust Manifold RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
5. Install the RH engine mount bracket, bolts and stud bolts.
Torque: 41 lb.ft (55 Nm)



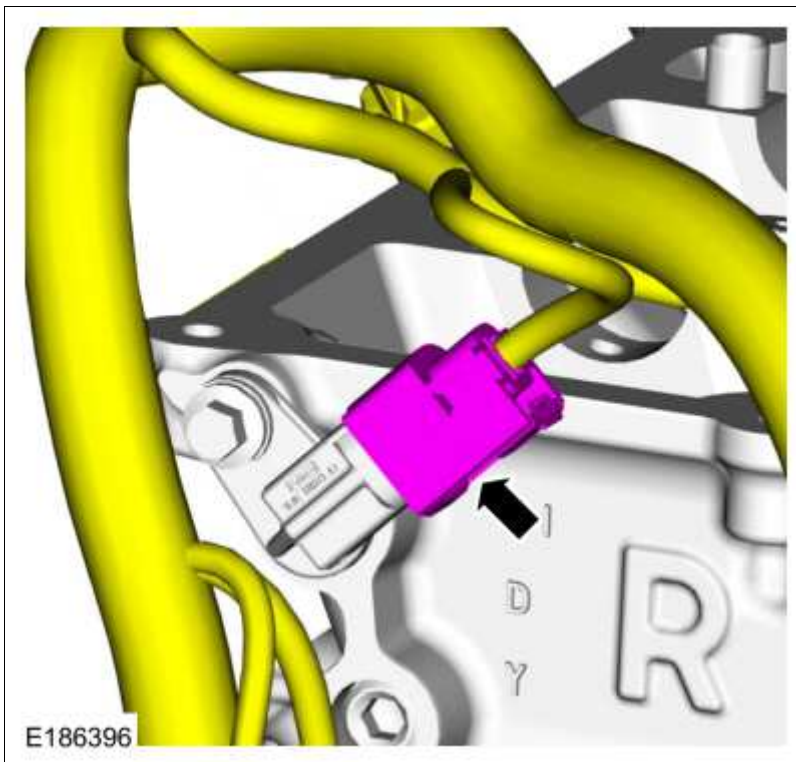
- 6.
- Using the special tools, lower the engine onto the RH engine mount.
 - Remove Special Service Tool: [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#) , [303-F072 Support Bar, Engine.](#)



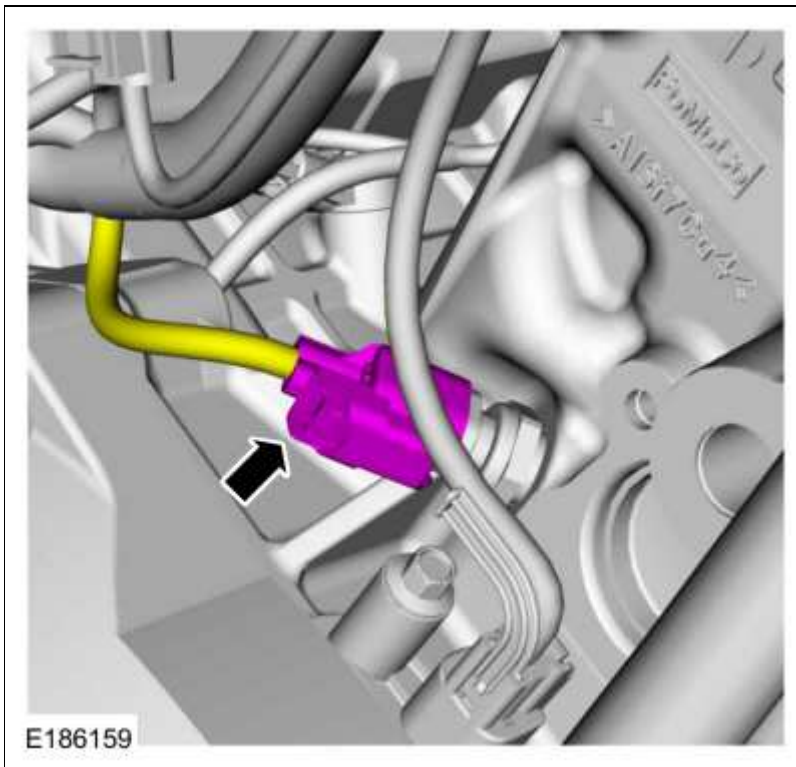
7. Disconnect the heater hose.



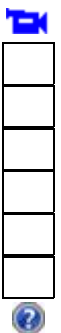
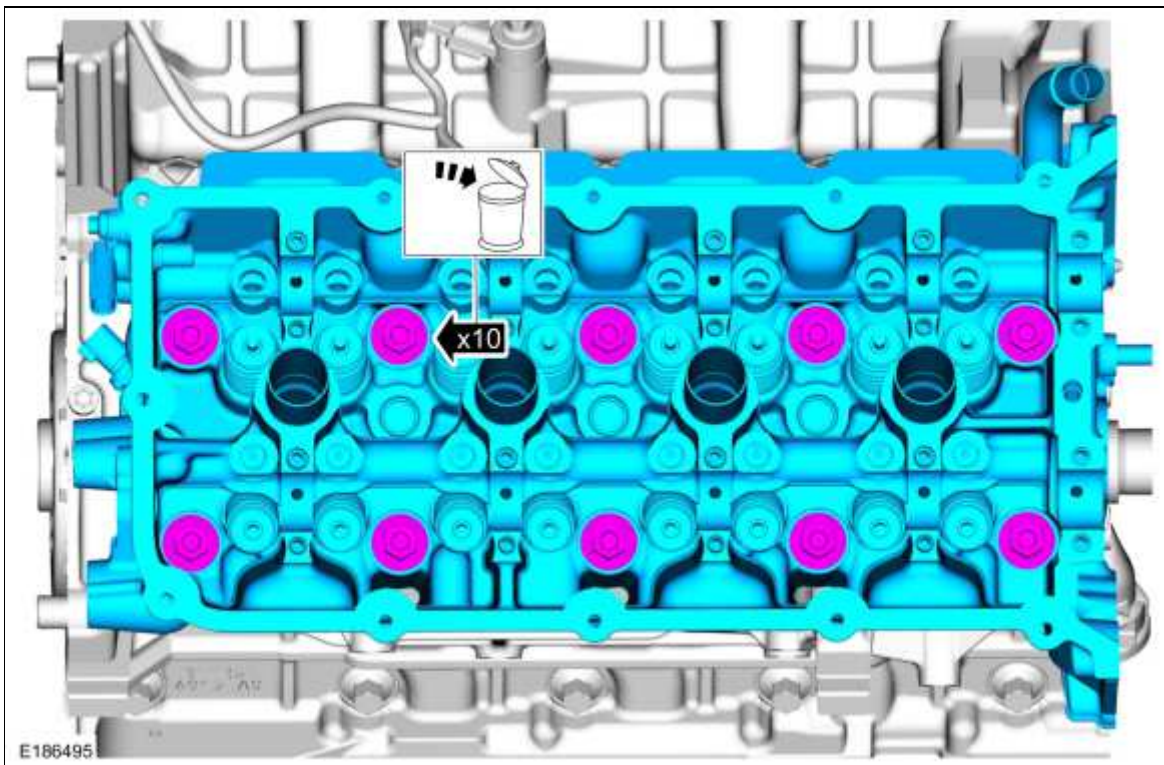
8. Disconnect the camshaft position sensor electrical connector.



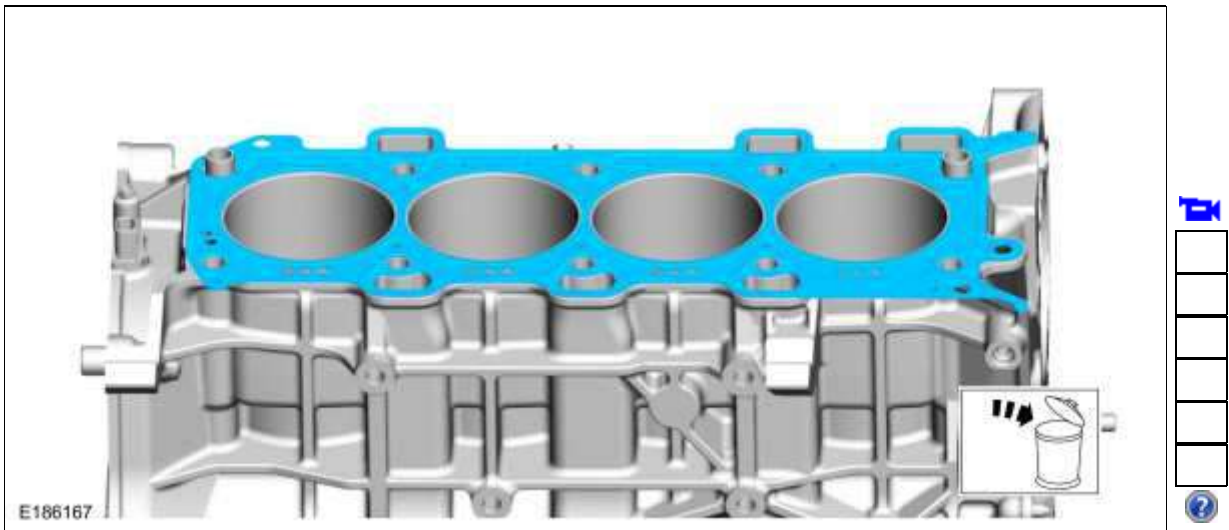
9. Disconnect the CHT electrical connector.



10.
 - Remove and discard the bolts.
 - Remove the cylinder head.



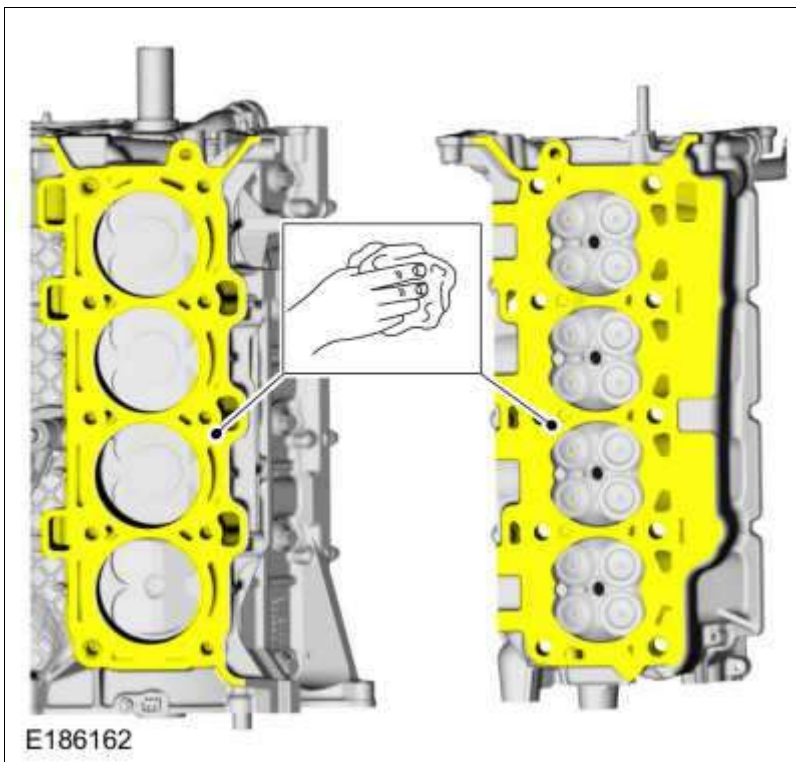
11. Remove and discard the cylinder head gasket.



12. **NOTICE:** 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.

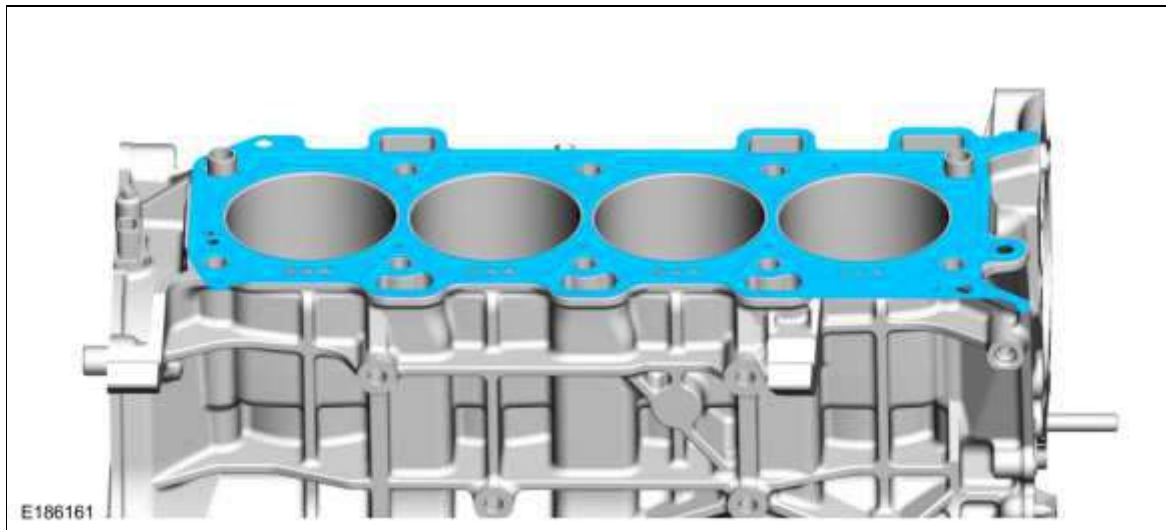
NOTE: Clean the cylinder head bolt holes in the cylinder block using compressed air. Make sure all coolant, oil or other foreign material is removed.

- Clean and inspect the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block
- Refer to: [Cylinder Head Distortion](#) (303-00 Engine System - General Information, General Procedures).
- Refer to: [Cylinder Block Distortion](#) (303-00 Engine System - General Information, General Procedures).



Installation

1. Install the new cylinder head gasket.

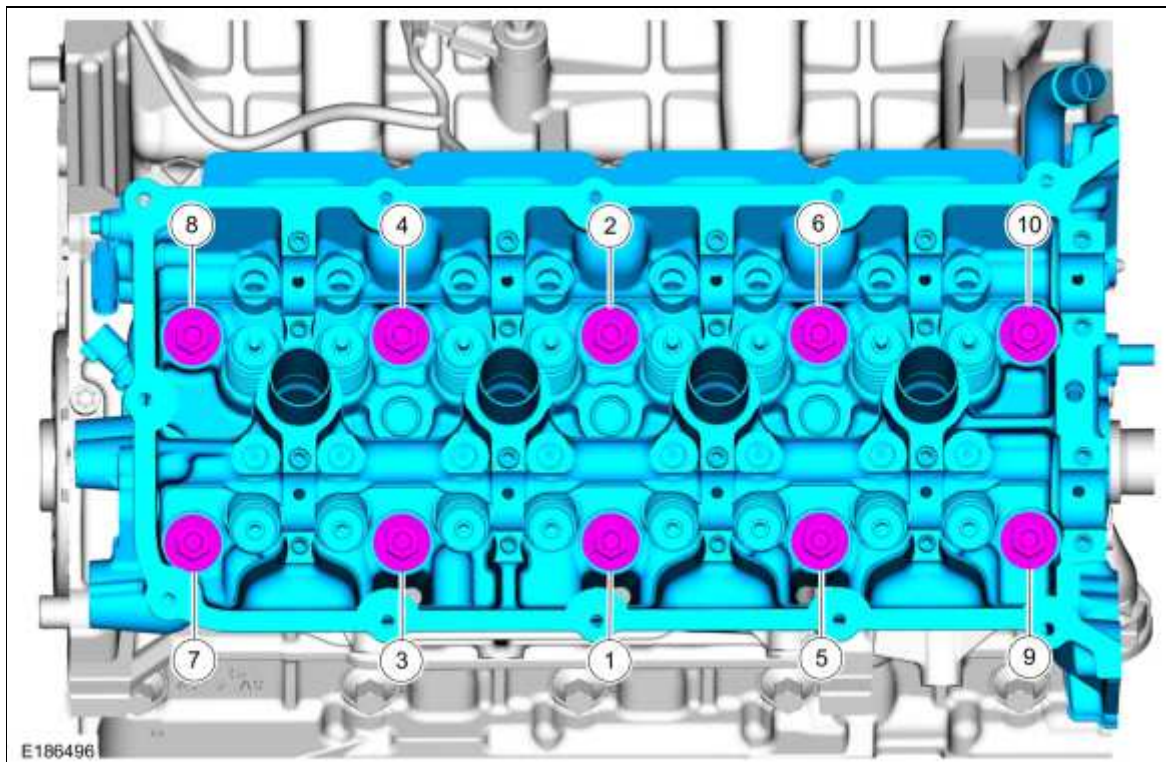


2. **NOTE:** The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

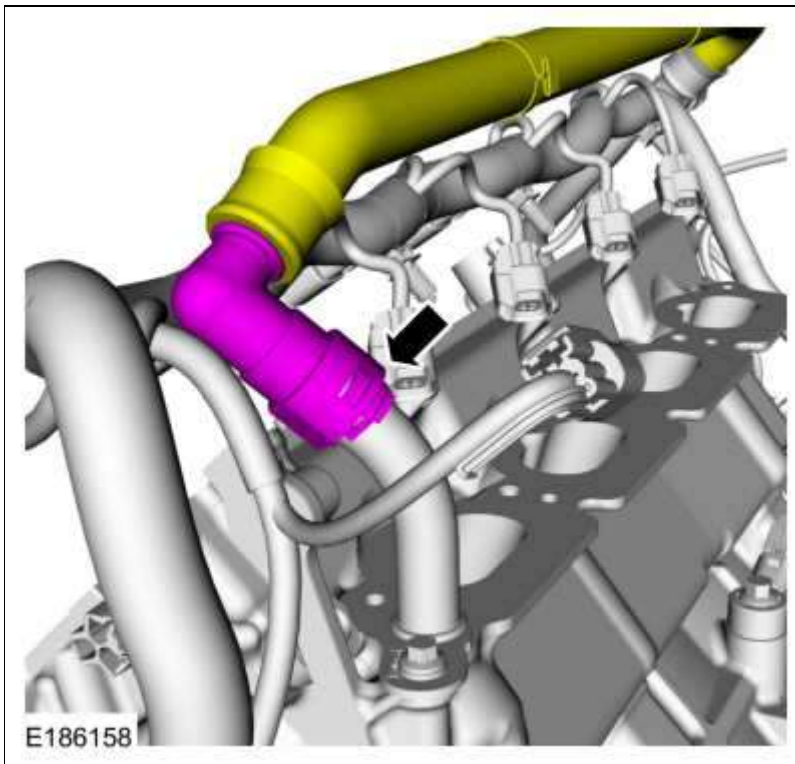
Install the cylinder head and the new bolts.

Torque:

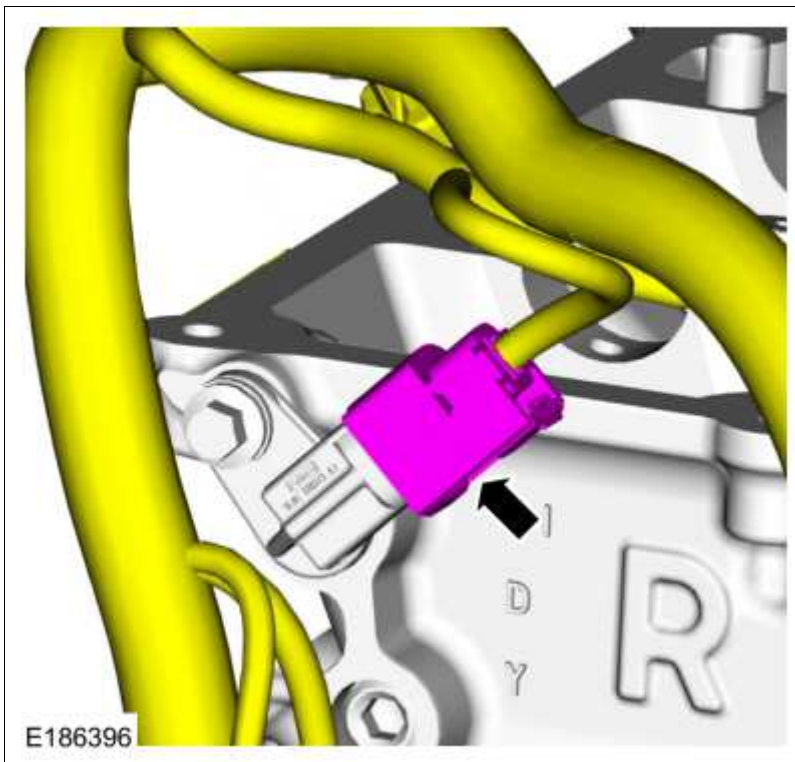
- Stage 1: 18 lb.ft (25 Nm)
- Stage 2: 55 lb.ft (75 Nm)
- Stage 3: Loosen: 180°
- Stage 4: 18 lb.ft (25 Nm)
- Stage 5: 26 lb.ft (35 Nm)
- Stage 6: 90°
- Stage 7: 90°



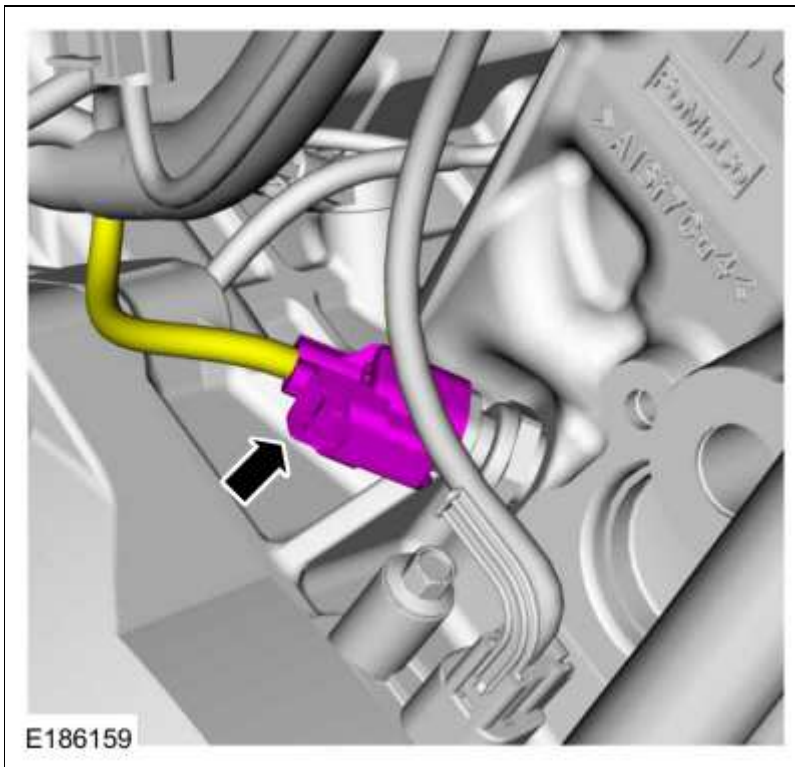
3. Connect the heater hose.



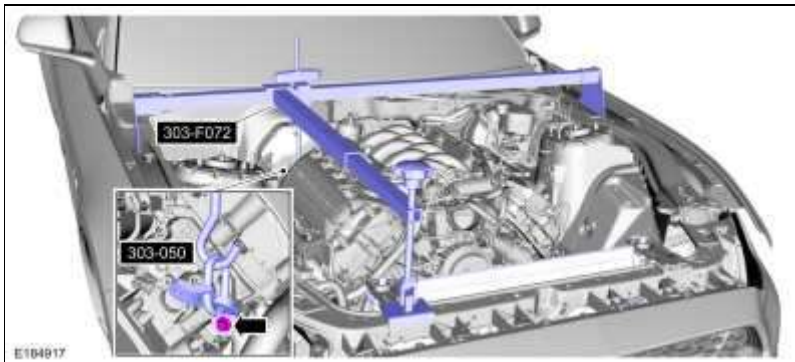
4. Connect the camshaft position sensor electrical connector.



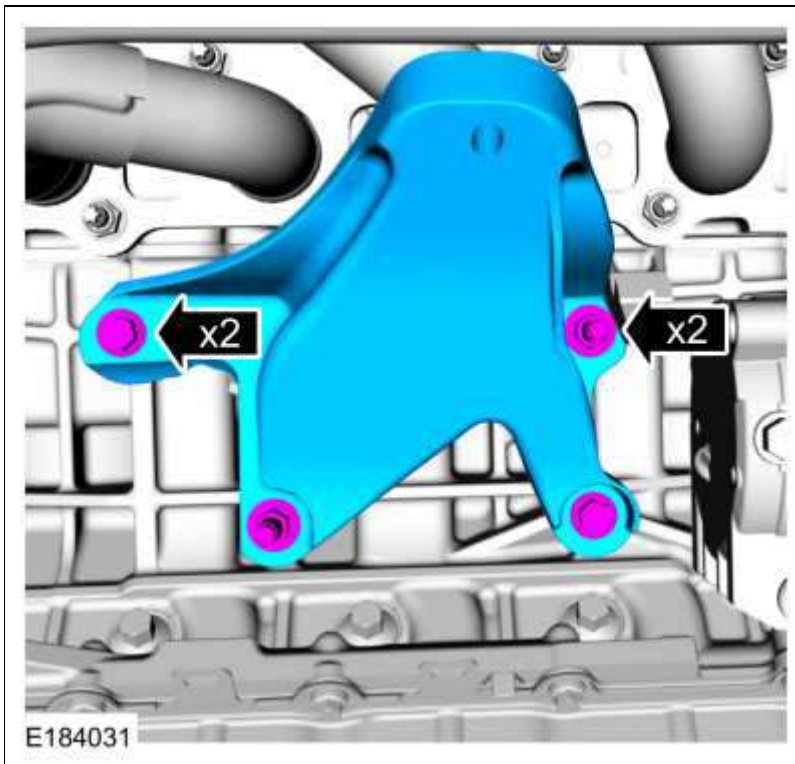
5. Connect the CHT electrical connector.



- 6.
- Install Special Service Tool: [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#) , [303-F072 Support Bar, Engine.](#)
 - Using the special tools raise the RH side of the engine 25 mm (1 inch).



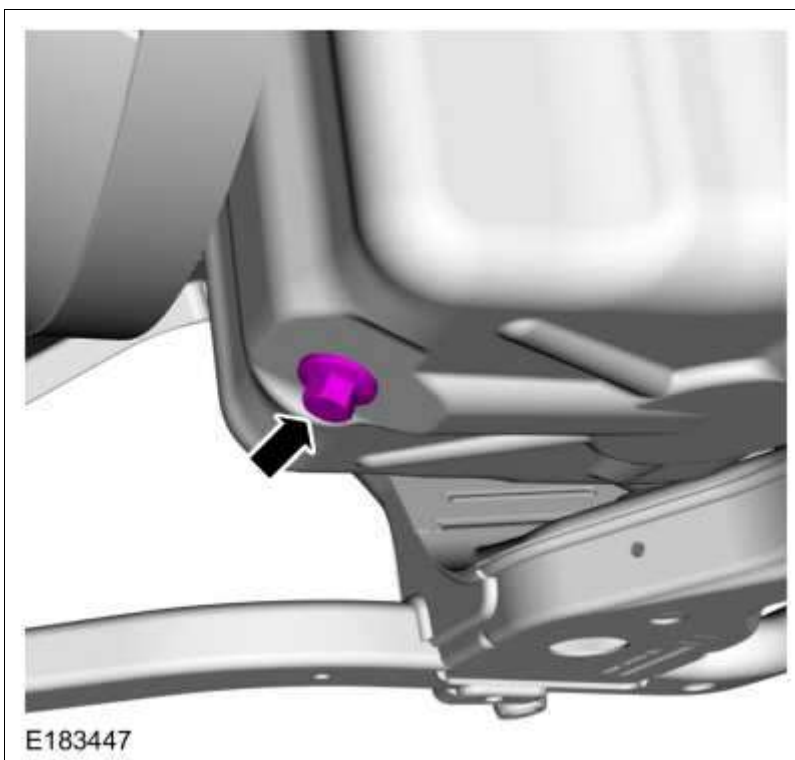
7. Remove the bolts, stud bolts and the RH engine mount bracket.



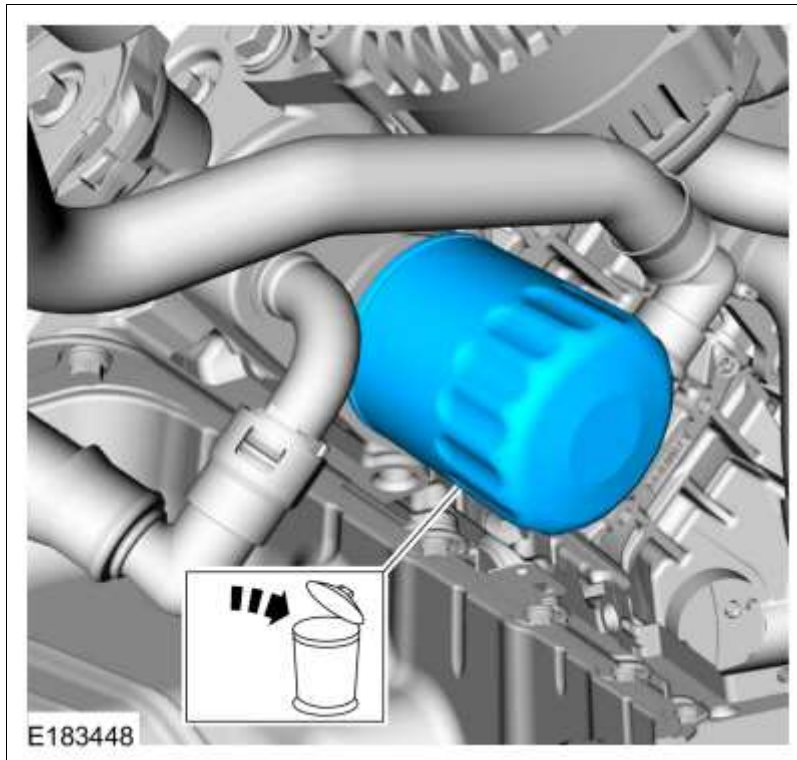
8. Install the following items:

1. Refer to: [Exhaust Manifold RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Camshaft RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

9.
 - Remove the oil pan drain plug and drain the engine oil.
Use the General Equipment: Oil Drain Equipment
 - Install the oil pan drain plug.
Torque: 19 lb.ft (26 Nm)



10. Remove and discard the engine oil filter.



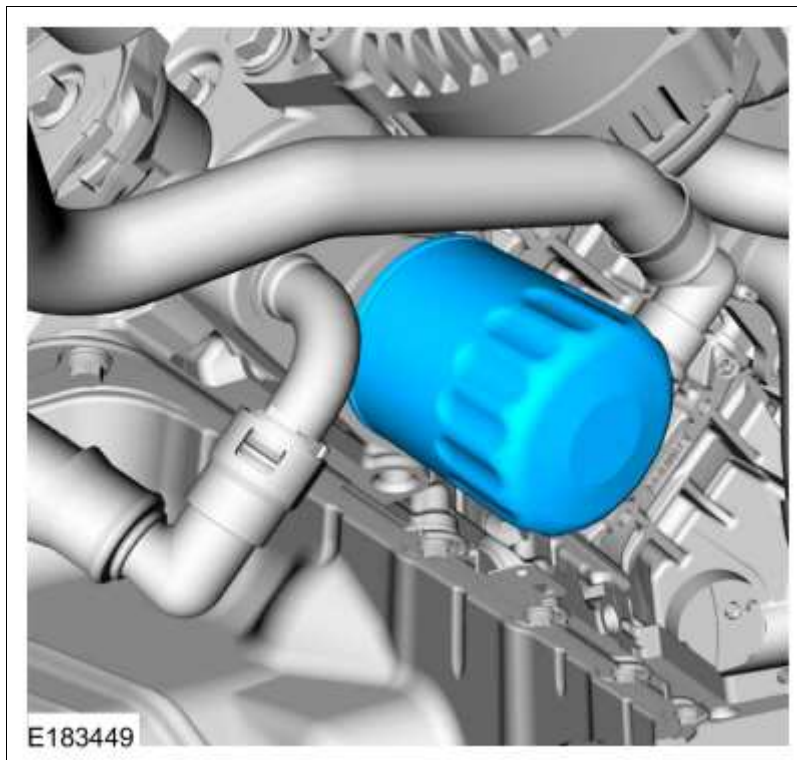
11. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

Torque:

Stage 1: 44 lb.in (5 Nm)

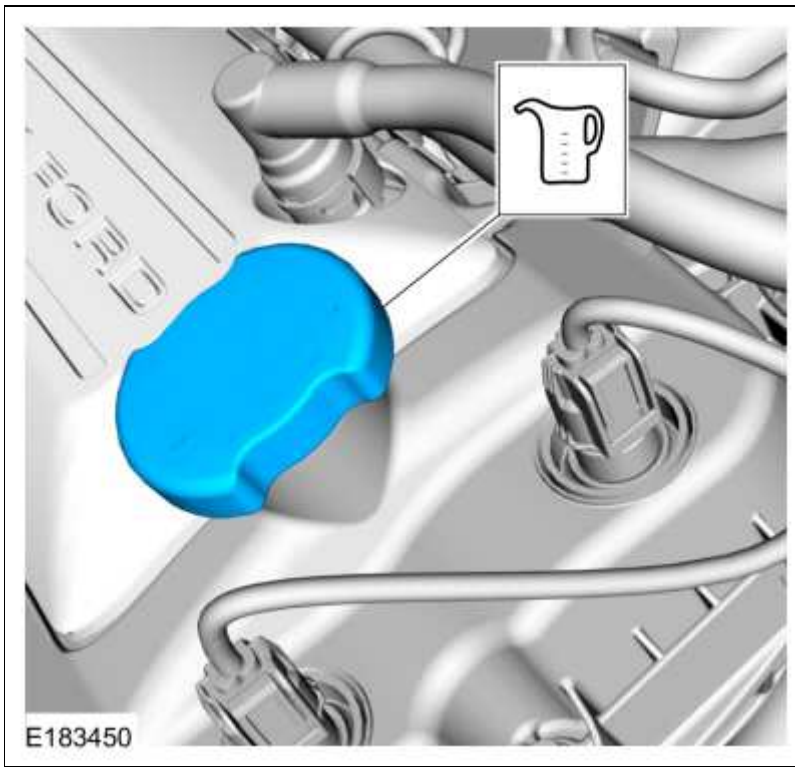
Stage 2: 180°



12. Fill the engine with clean engine oil.

Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



13. Fill and bleed the engine cooling system.

Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



Engine Front Cover

Base Part Number: [6C086](#)

Special Tool(s) / General Equipment

Plastic Scraper
Oil Drain Equipment

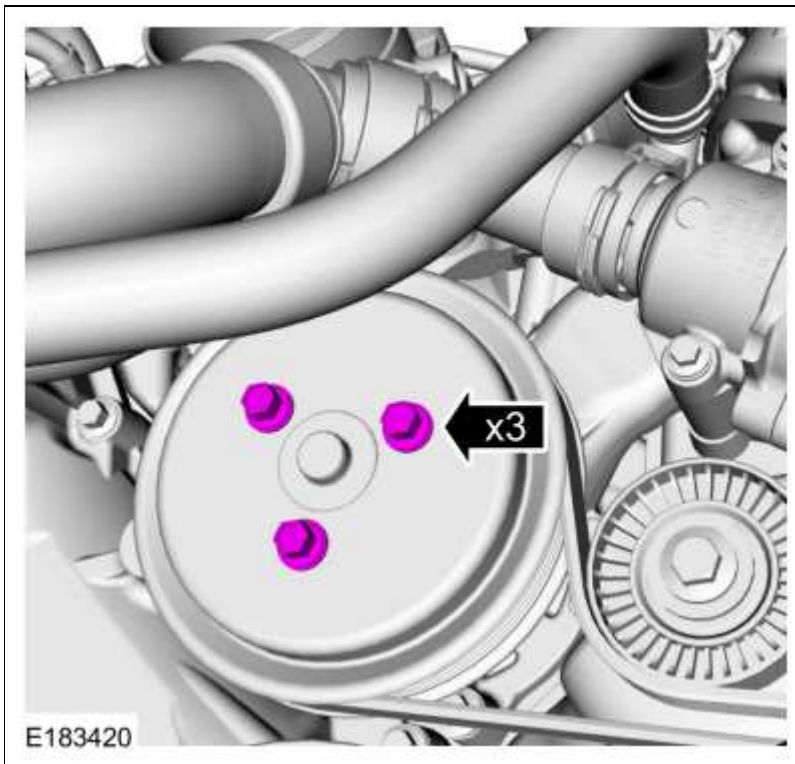
Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Motorcraft® Metal Surface Prep ZC-31-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) VC-3-B (U.S.)	WSS-M97B44-D
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

Removal

NOTICE: 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.

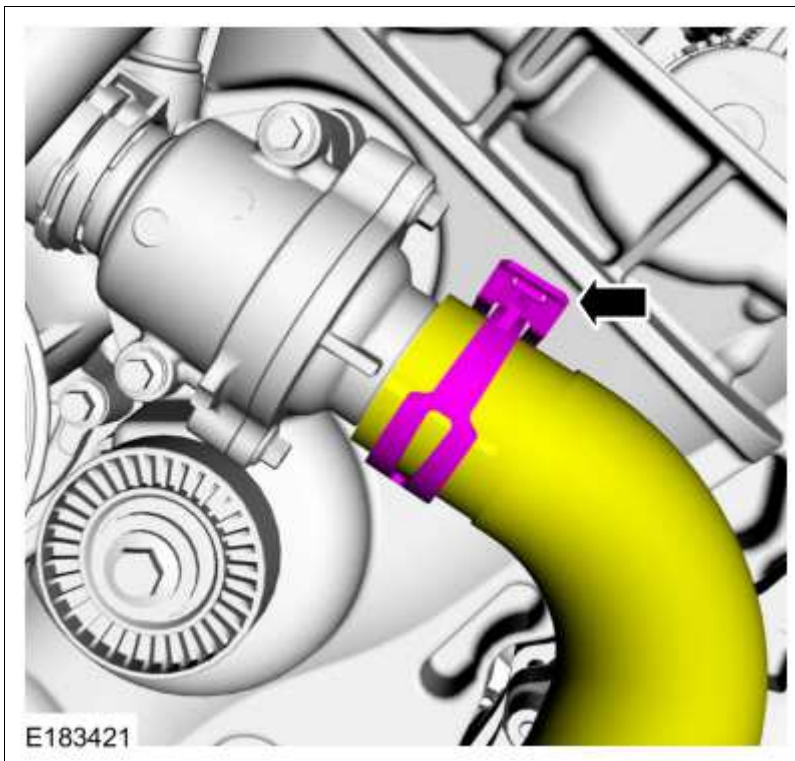
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
3. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Drain the engine cooling system.
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
5. Remove the following items:
 1. Refer to: [Degas Bottle](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 3. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
6. Loosen the coolant pump pulley bolts.



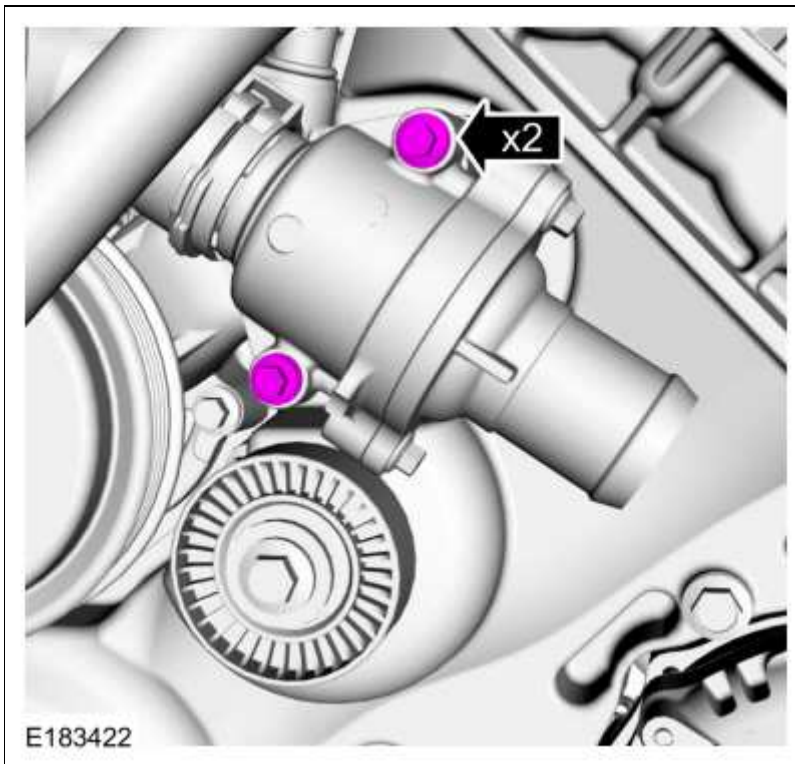
7. Remove the following items:

1. Refer to: [Crankshaft Front Seal](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Valve Cover RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Valve Cover LH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

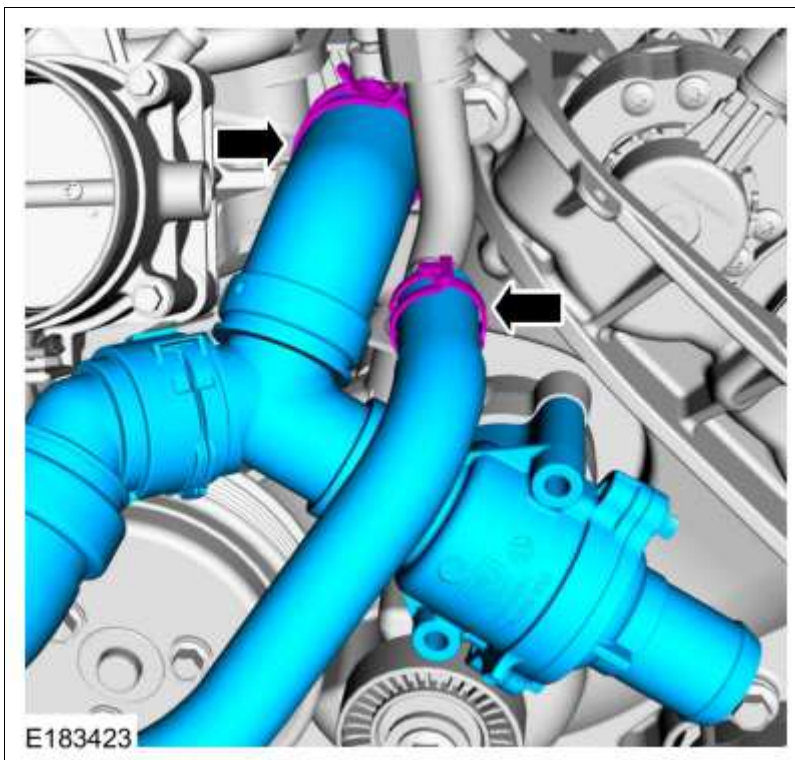
8. Disconnect the lower radiator hose from the thermostat housing assembly.



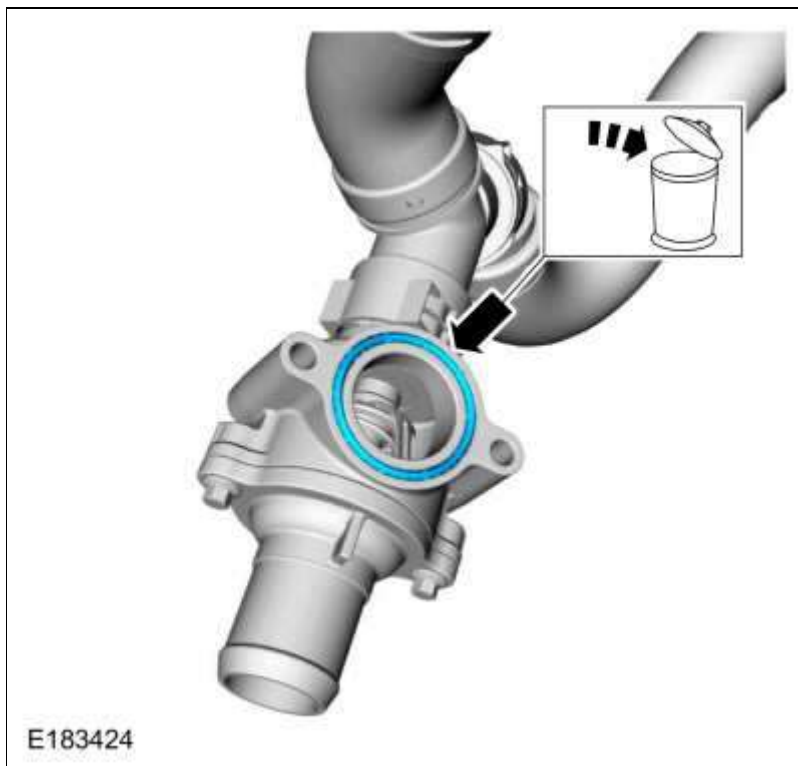
9. Remove the thermostat housing bolts.



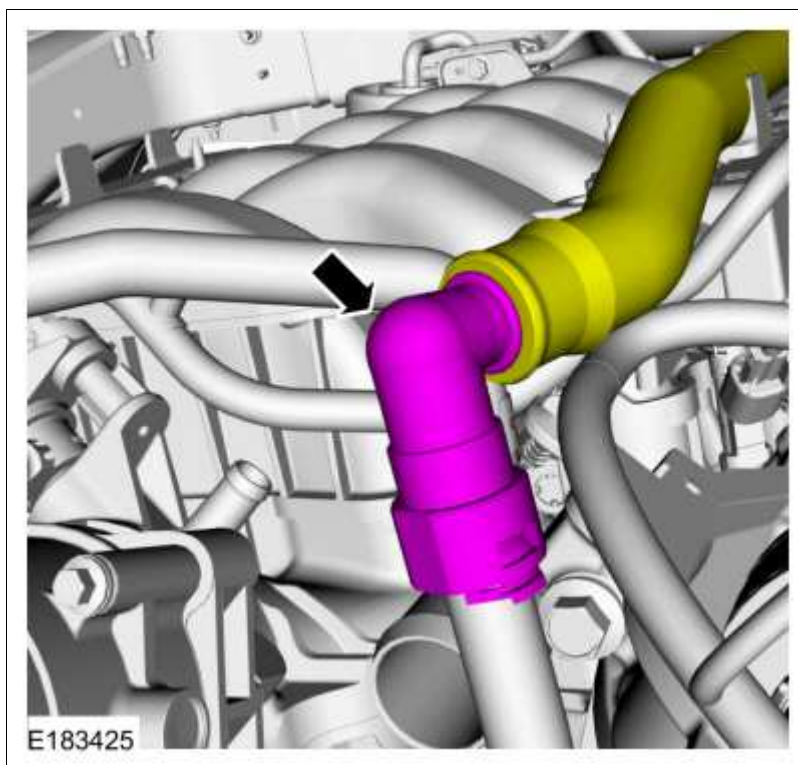
- 10.
- Release the clamp and remove the upper radiator hose T-connector/thermostat housing assembly.
 - Release the clamp and remove the degas bottle coolant hose.



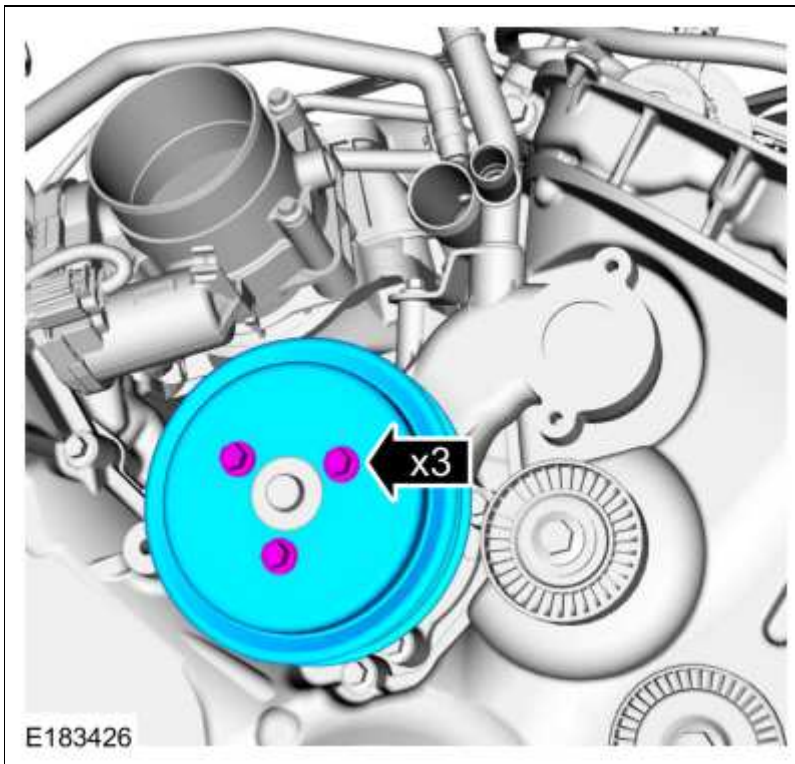
11. Remove and discard the thermostat housing O-ring seal.



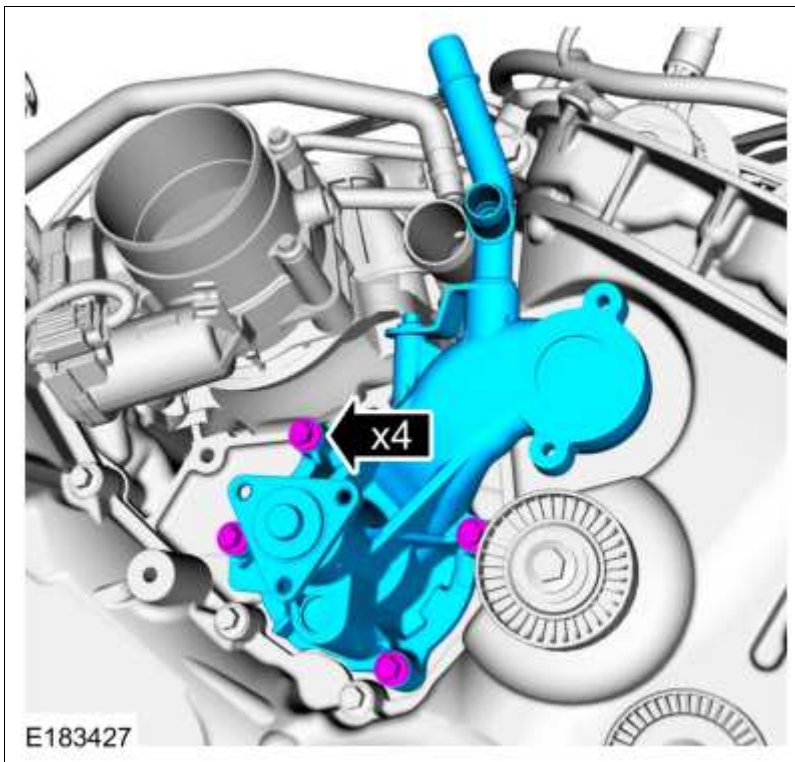
12. Disconnect the heater hose.



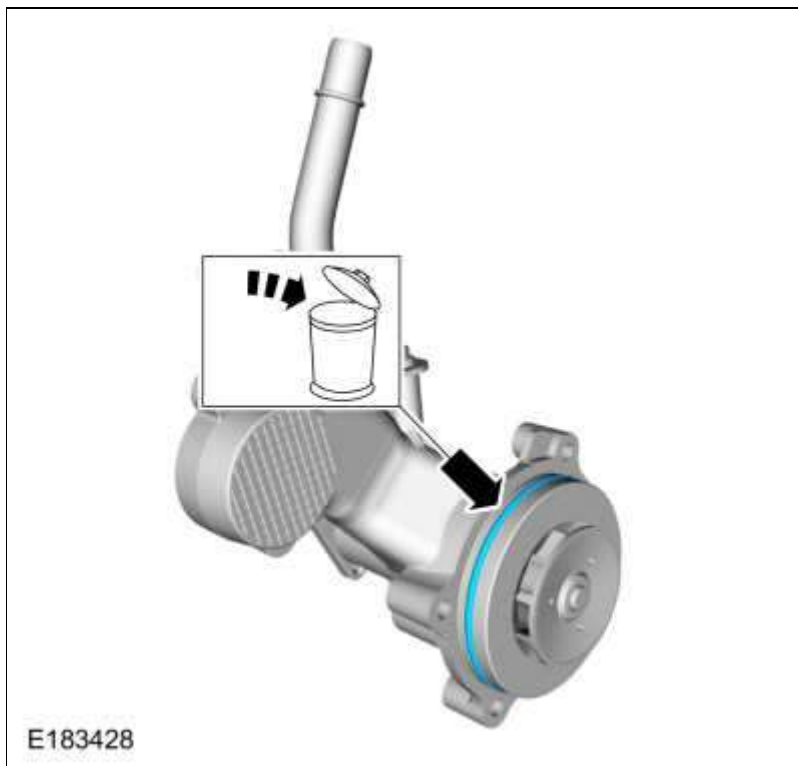
13. Remove the bolts and the coolant pump pulley.



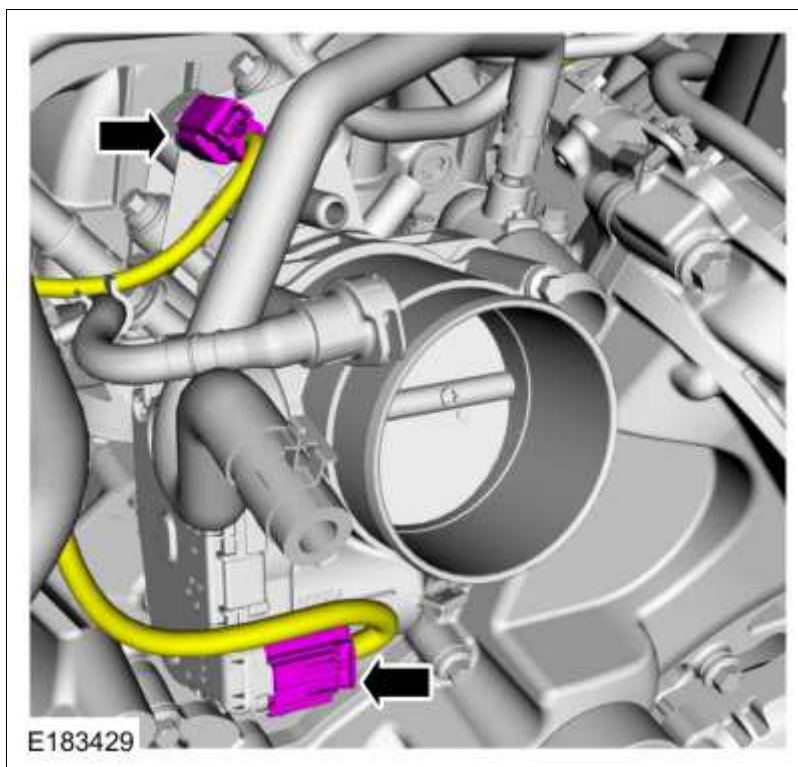
14. Remove the bolts and the coolant pump.



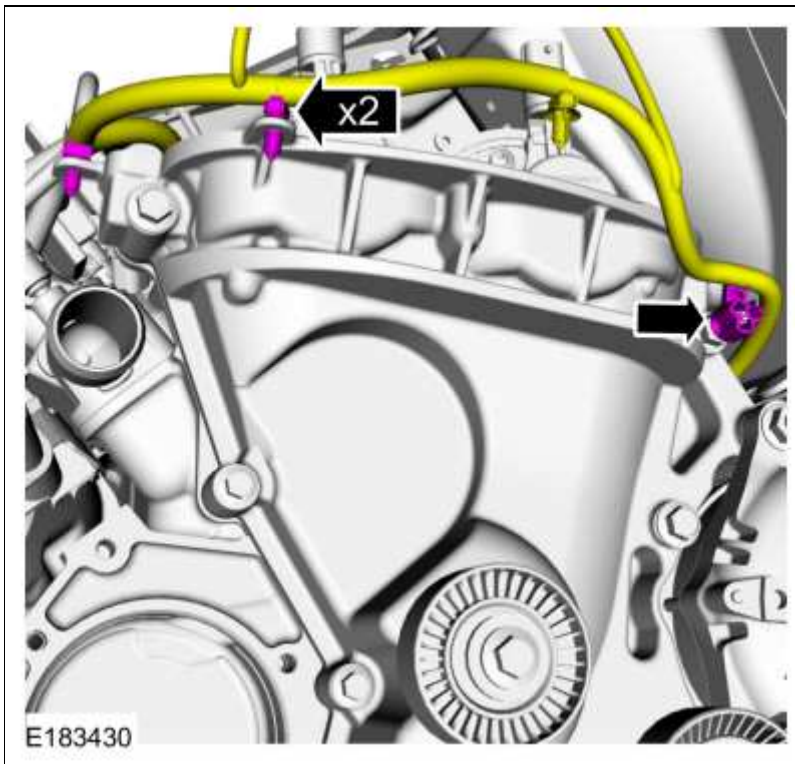
15. Remove and discard the coolant pump O-ring seal.



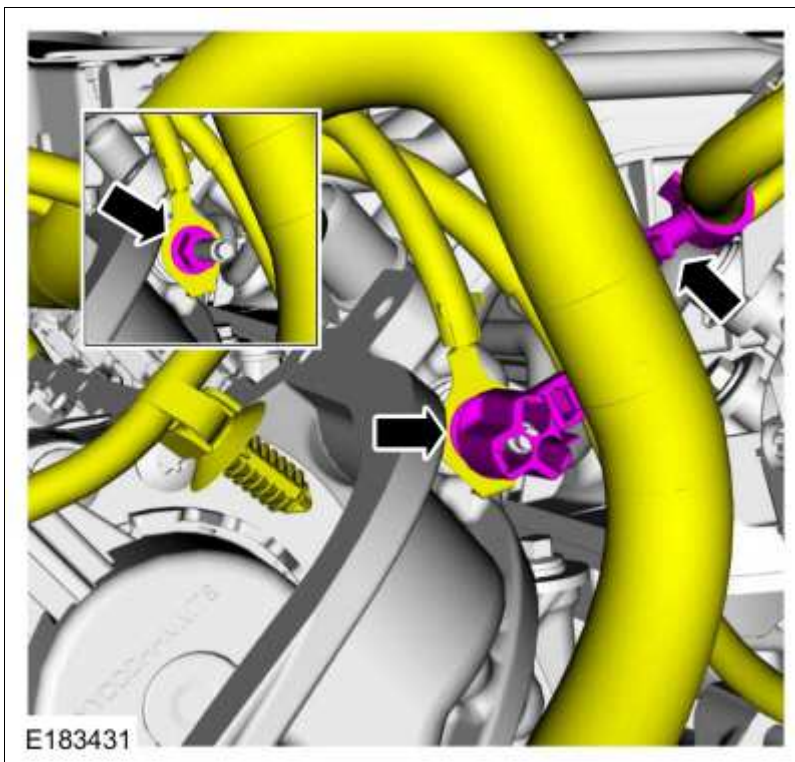
16. Disconnect the throttle body and EVAP purge valve electrical connectors.



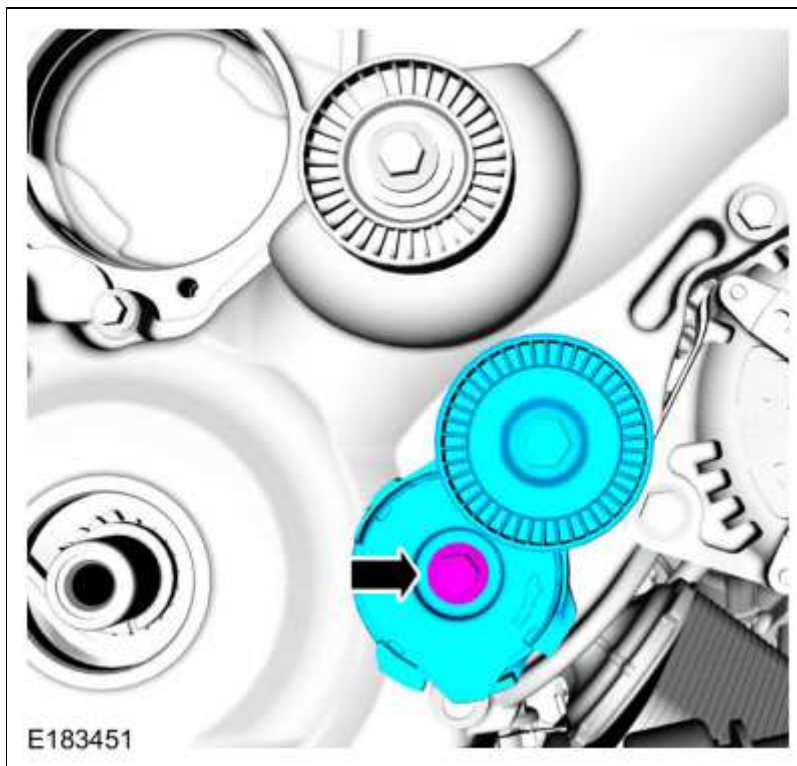
17. Detach the wiring harness retainers from the engine front cover and stud bolt.



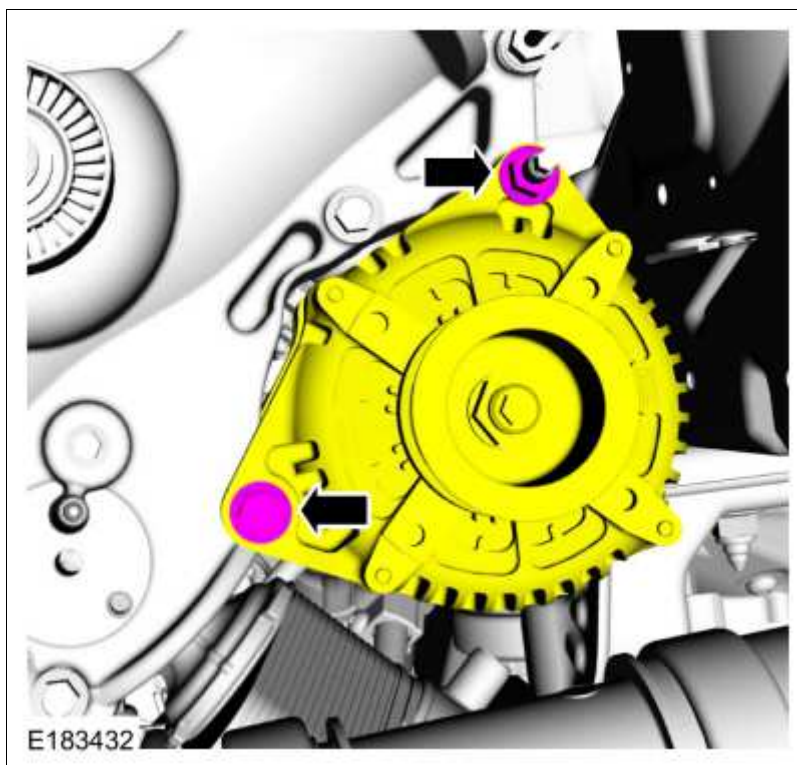
18.
 - Remove the wiring harness retainers.
 - Remove the nut and ground wire.



19. Remove the bolt and the accessory drive belt tensioner.

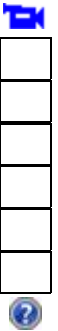
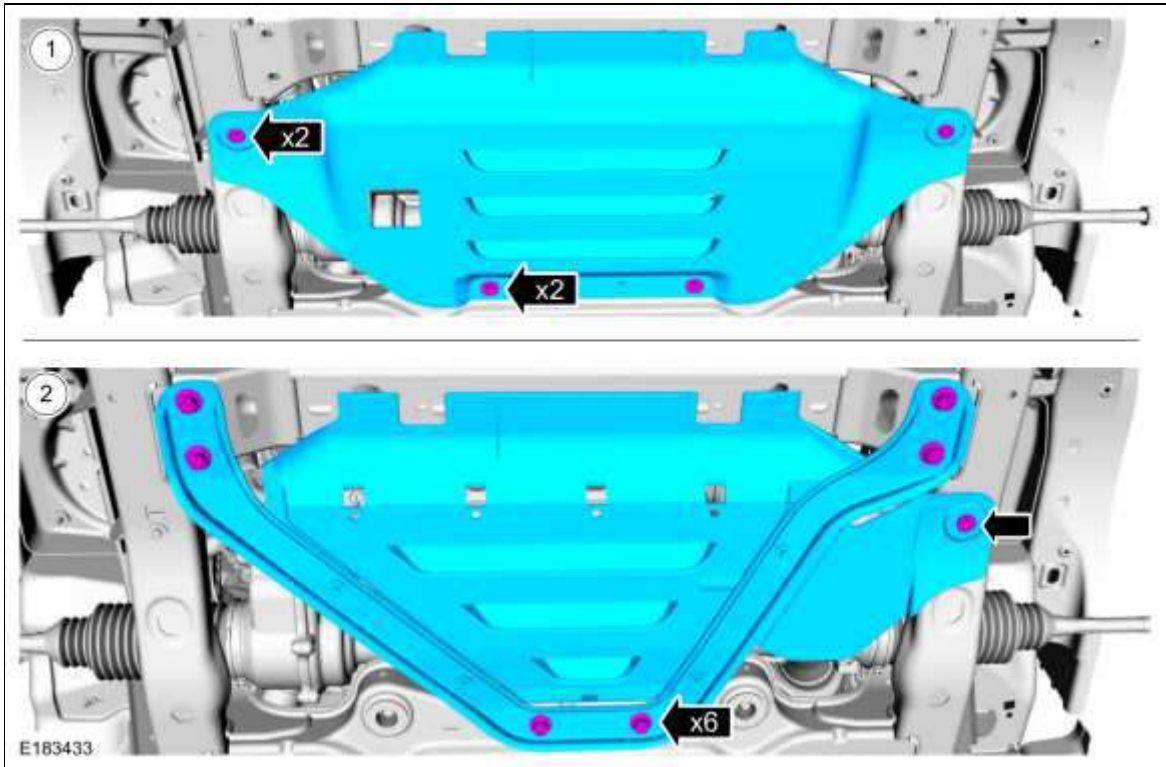


20. Remove the nut, the bolt and position the generator aside.



21. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

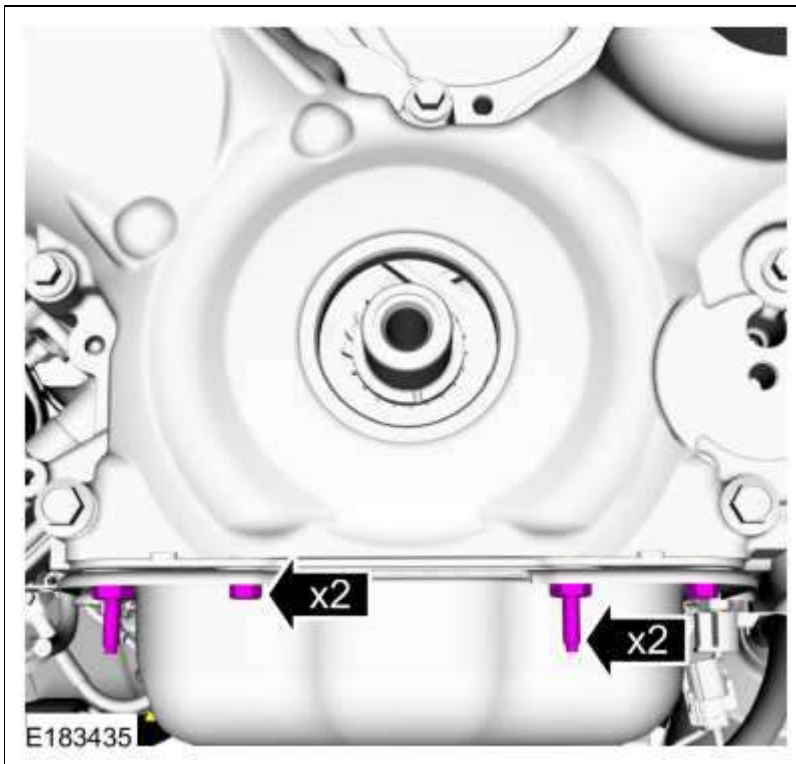
1. Remove the bolts and the underbody shield.
2. Remove the bolts and the subframe bracket and underbody shield assembly.



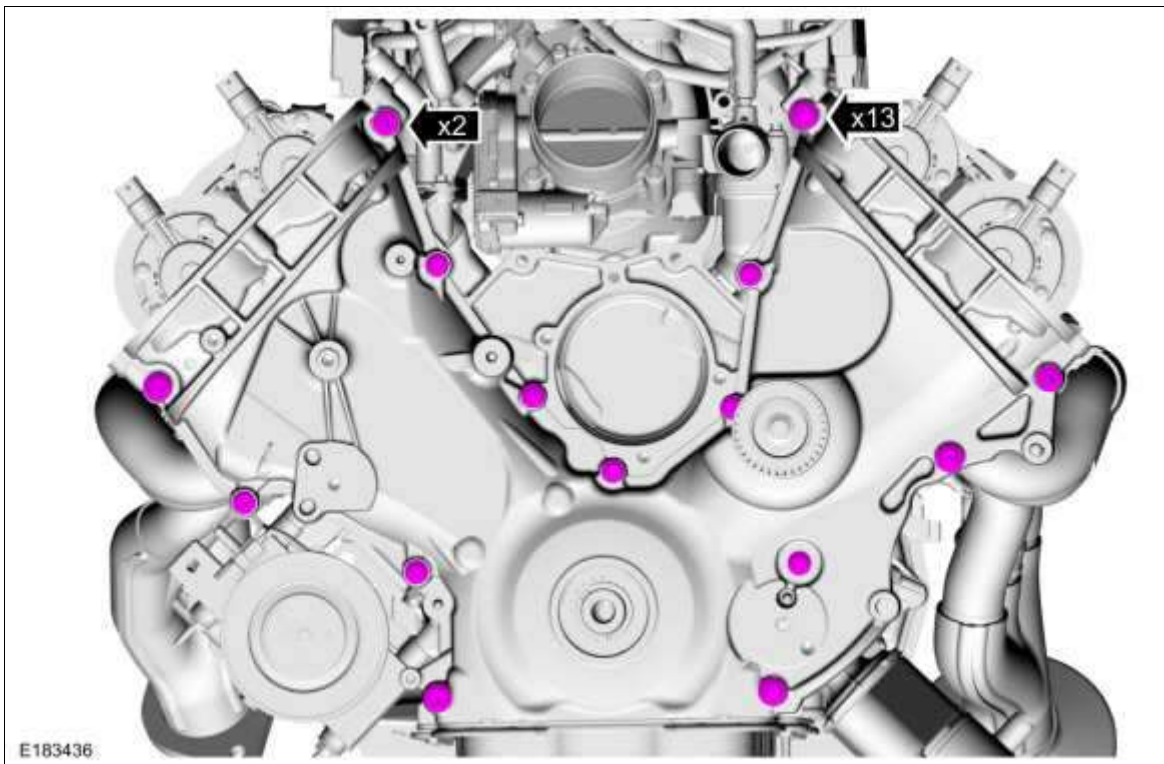
22. Remove the nut and the wiring harness retainer.



23. Remove the bolts and stud bolts.

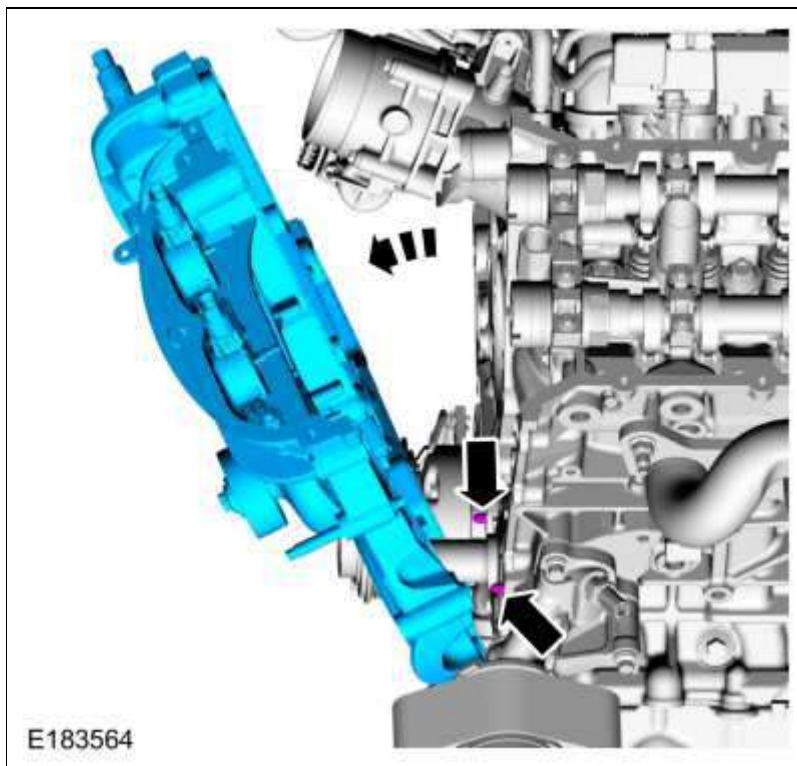


24. Remove the bolts and stud bolts.

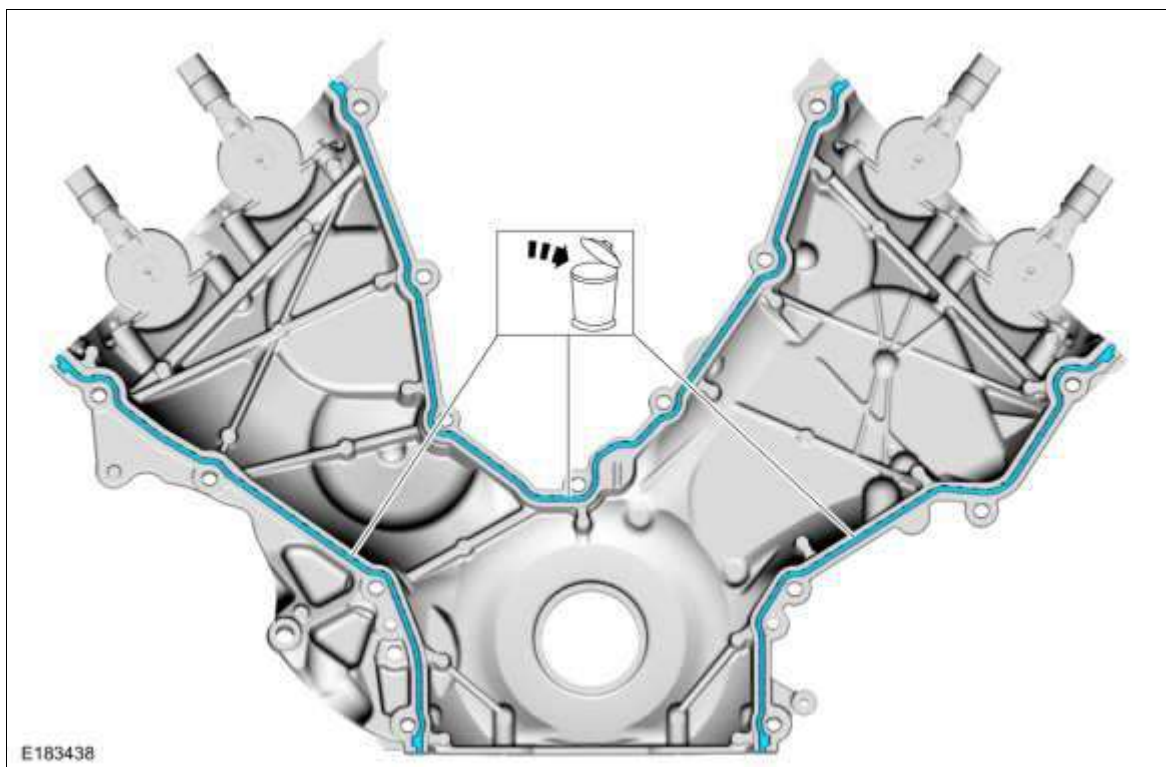


25. **NOTE:** Timing drive components removed from view for clarity.

Remove the engine front cover from the front cover to cylinder block dowels.



26. Remove and discard the gaskets.



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

Clean and inspect the mating surface.

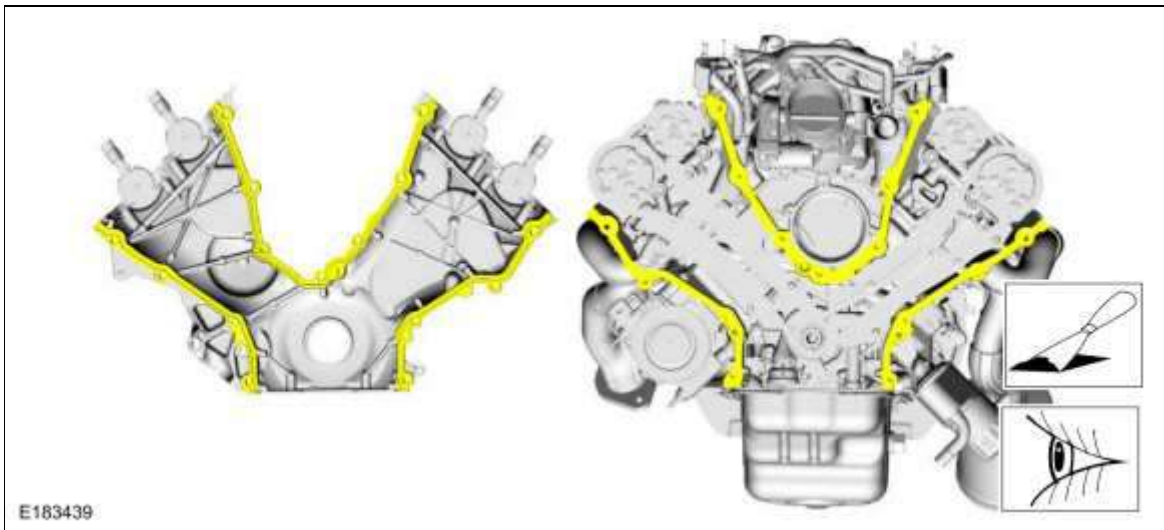
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

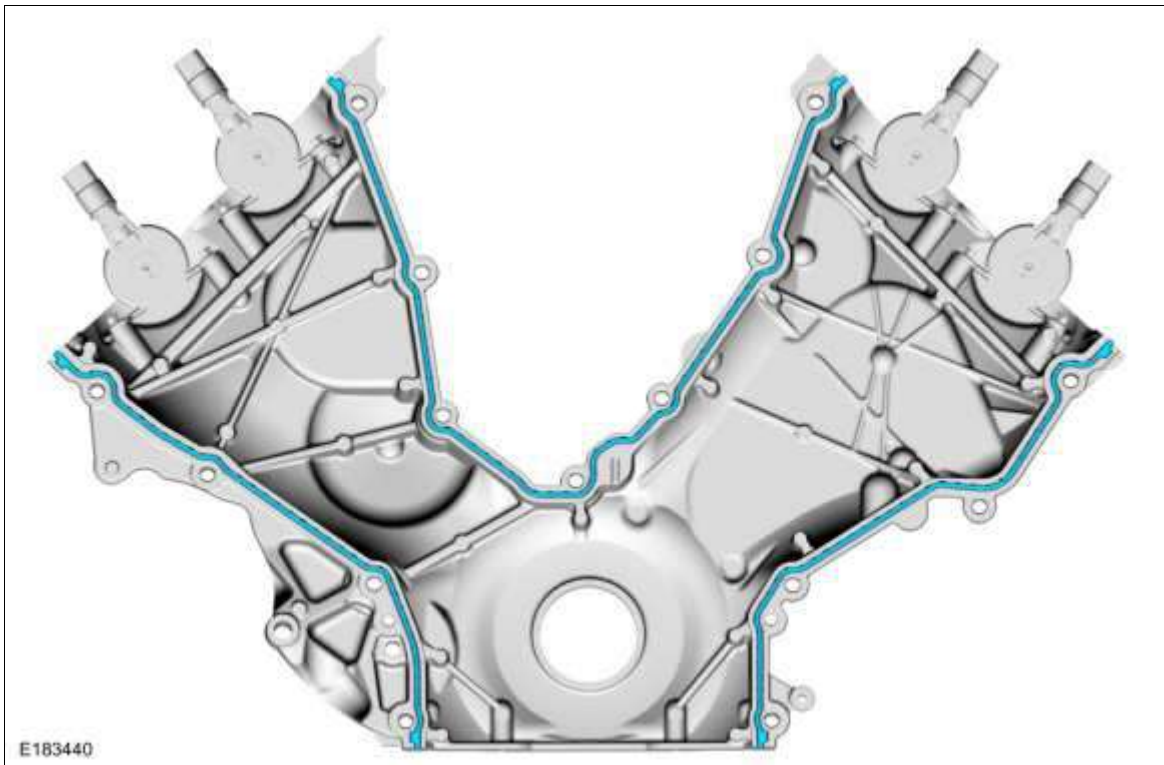
Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

Material: Motorcraft® Metal Surface Prep / ZC-31-B



Installation

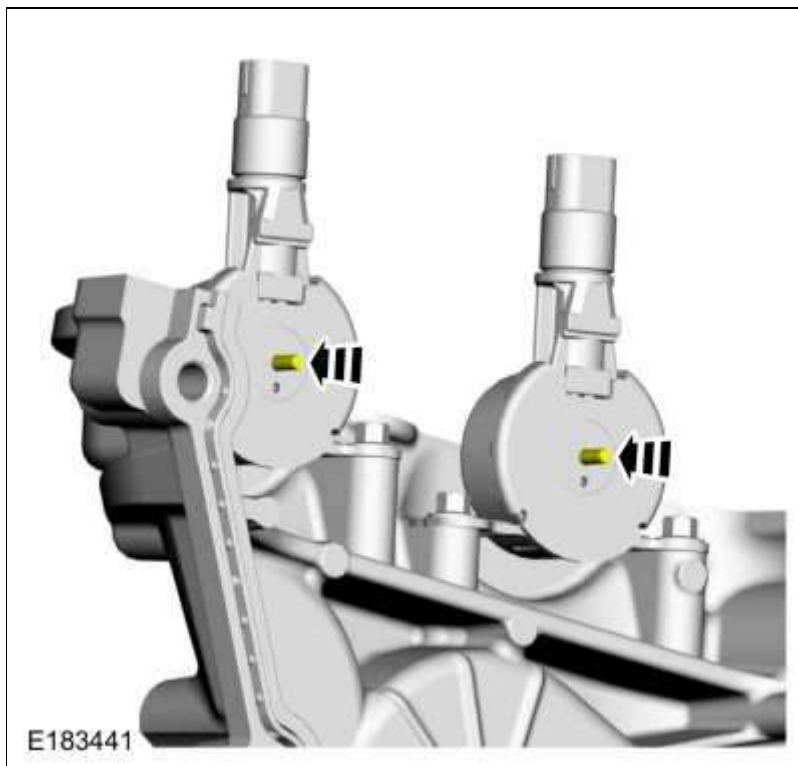
1. Install new gaskets on the engine front cover.



2. **NOTICE:** The VCT variable force solenoid pins must be fully depressed to avoid interference with the VCT valve tips when installing the engine front cover. Failure to follow these instructions can result in damage to the engine.

NOTE: *RH* shown, *LH* similar.

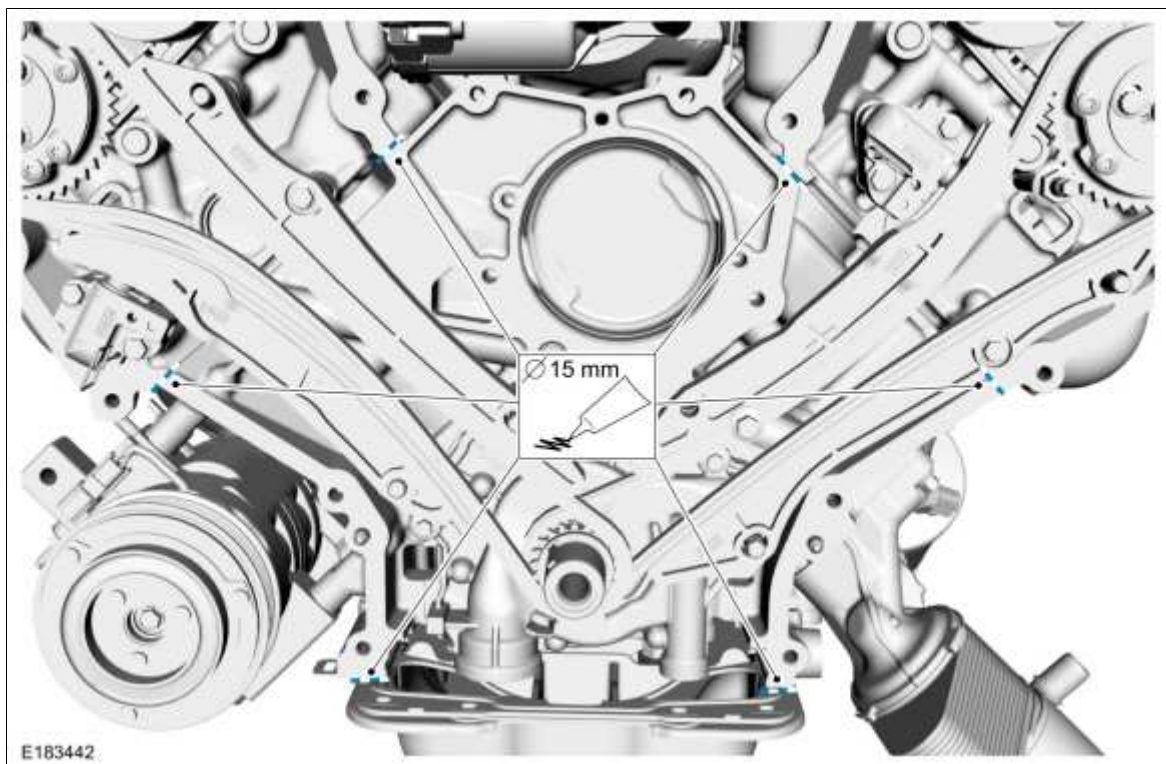
Fully depress the VCT variable force solenoid pins.



3. **NOTICE:** The engine front cover must be installed and all fasteners final tightened within 5 minutes of applying the sealer. If this cannot be accomplished, install the engine front cover and tighten fasteners 6, 7, 8, 9, 10 and 11 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer. All of the fasteners must then be final tightened within 1 hour of applying the sealer. If this time limit is exceeded, all sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

Apply a 15 mm (0.59 in) diameter drop of silicone gasket and sealant to the cylinder head-to-cylinder block joints and the oil pan-to-cylinder block joints.

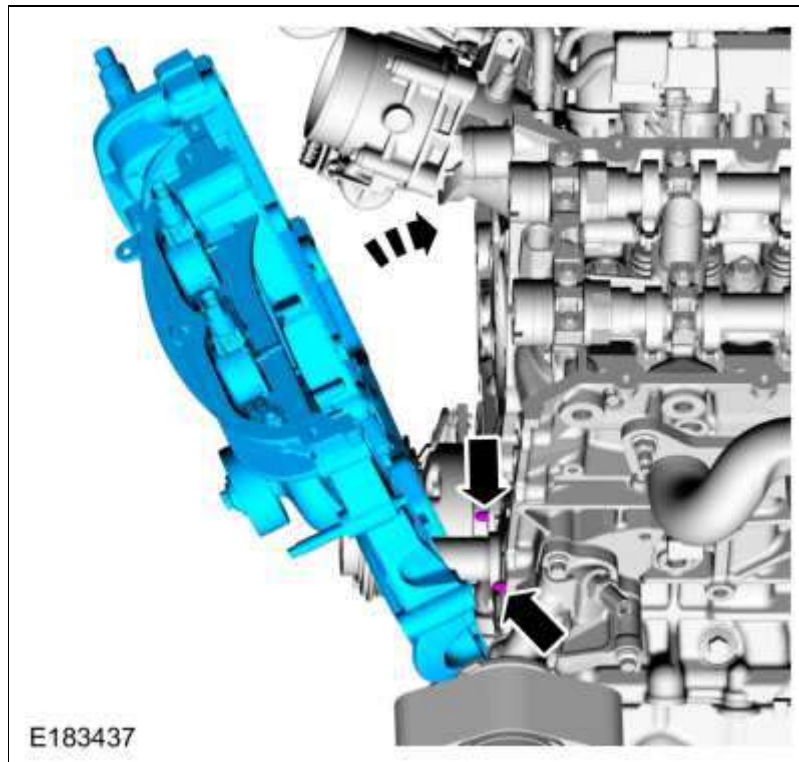
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



4. **NOTE:** Make sure that the engine front cover gaskets are in place on the engine front cover before installation.

NOTE: Timing drive components removed from view for clarity.

Position the engine front cover onto the dowels.

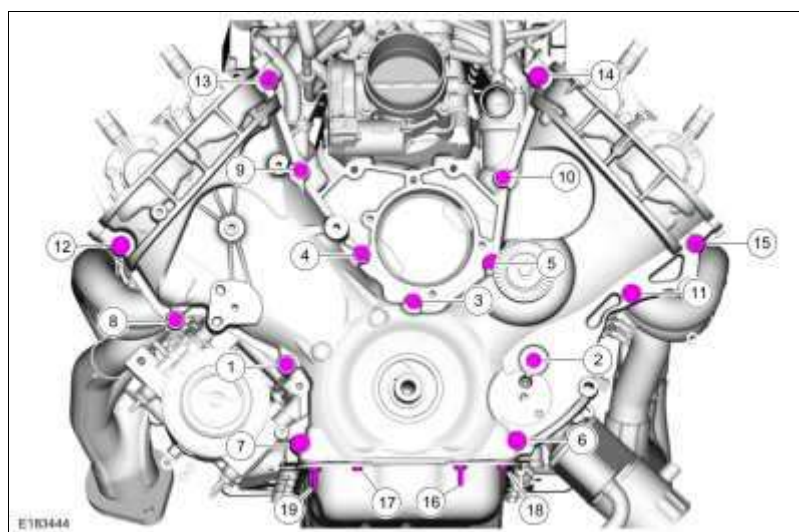


5. **NOTICE:** The engine front cover must be installed and all fasteners final tightened within 5 minutes of applying the sealer. If this cannot be accomplished, install the engine front cover and tighten fasteners 6, 7, 8, 9, 10 and 11 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer. All of the fasteners must then be final tightened within 1 hour of applying the sealer. If this time limit is exceeded, all sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

Install the bolts and stud bolts.

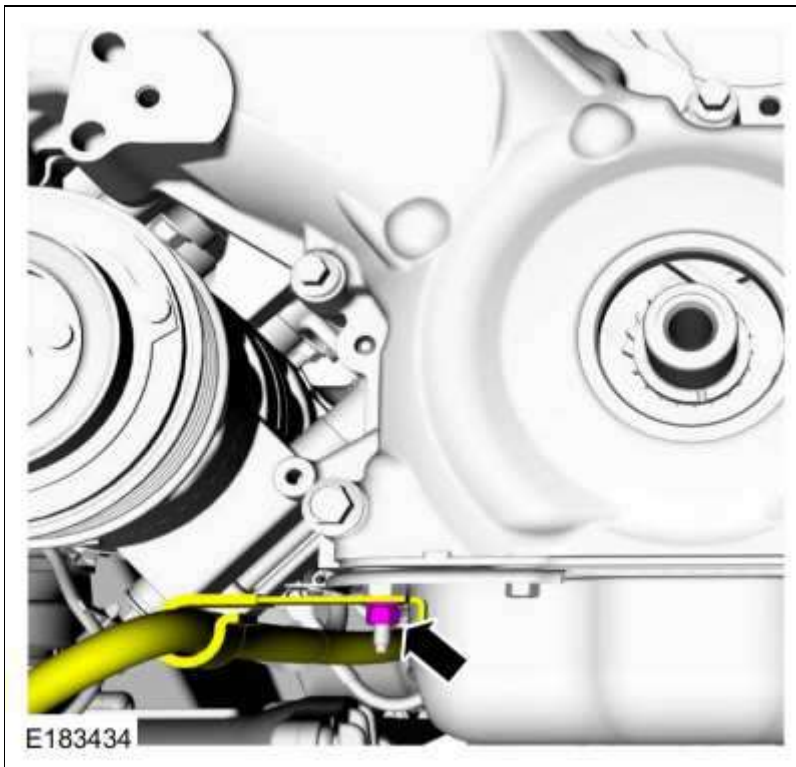
Torque:

- Stage 1: Fasteners 1-15 : 18 lb.ft (25 Nm)
Stage 2: Fasteners 16-19 : 89 lb.in (10 Nm)
Stage 3: Fasteners 1-15 : 60°
Stage 4: Fasteners 16-19 : 45°

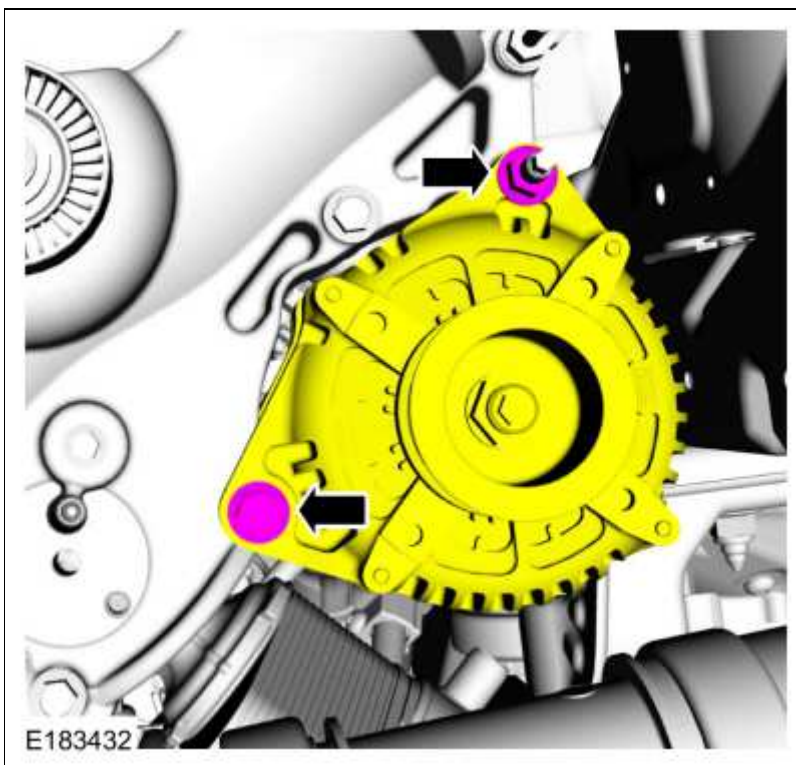


6. Install the wiring harness retainer and the nut.

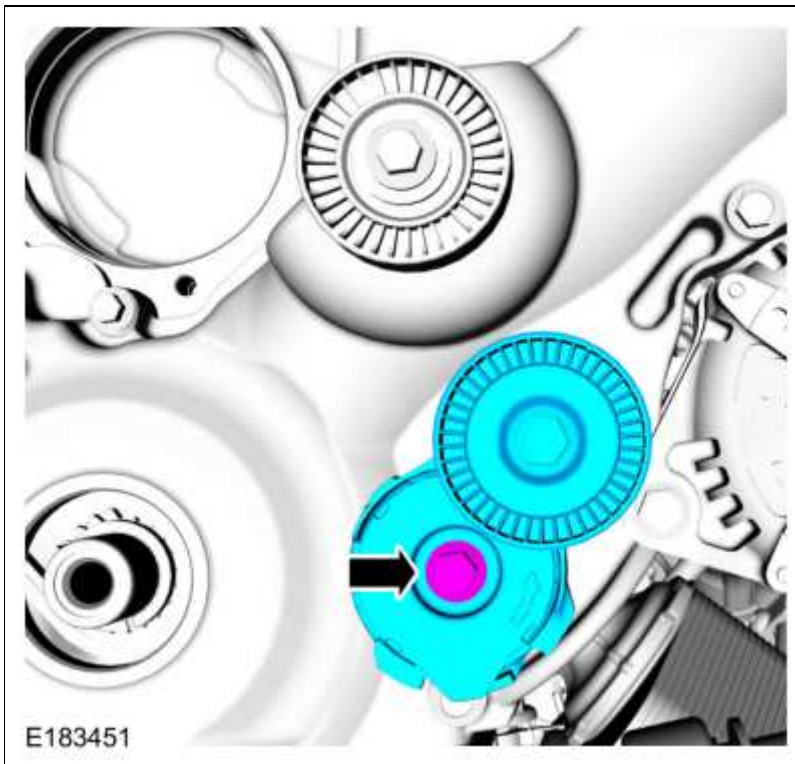
Torque: 71 lb.in (8 Nm)



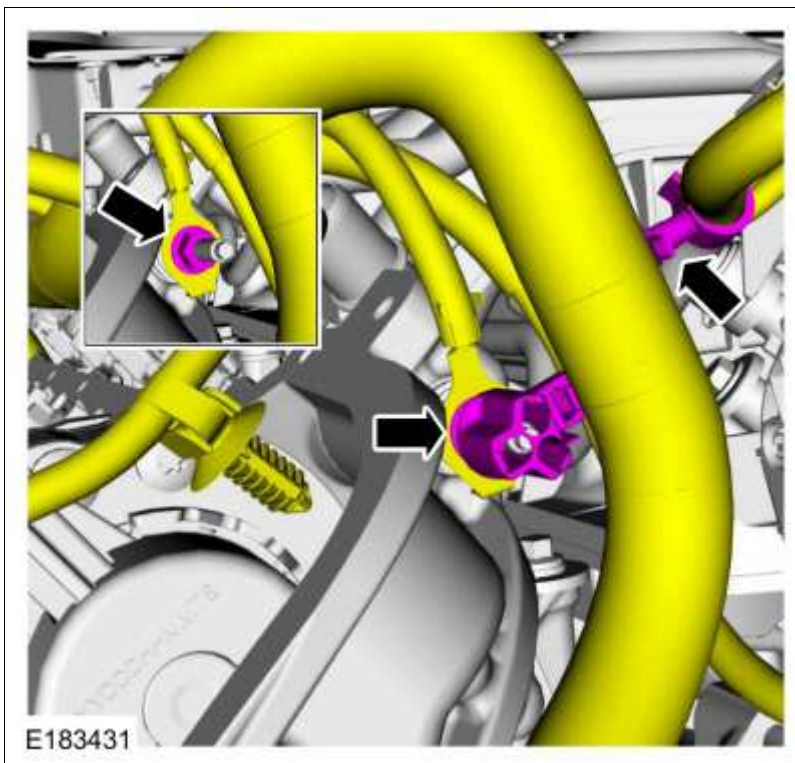
7. Install the generator, the bolt and the nut.
Torque: 35 lb.ft (48 Nm)



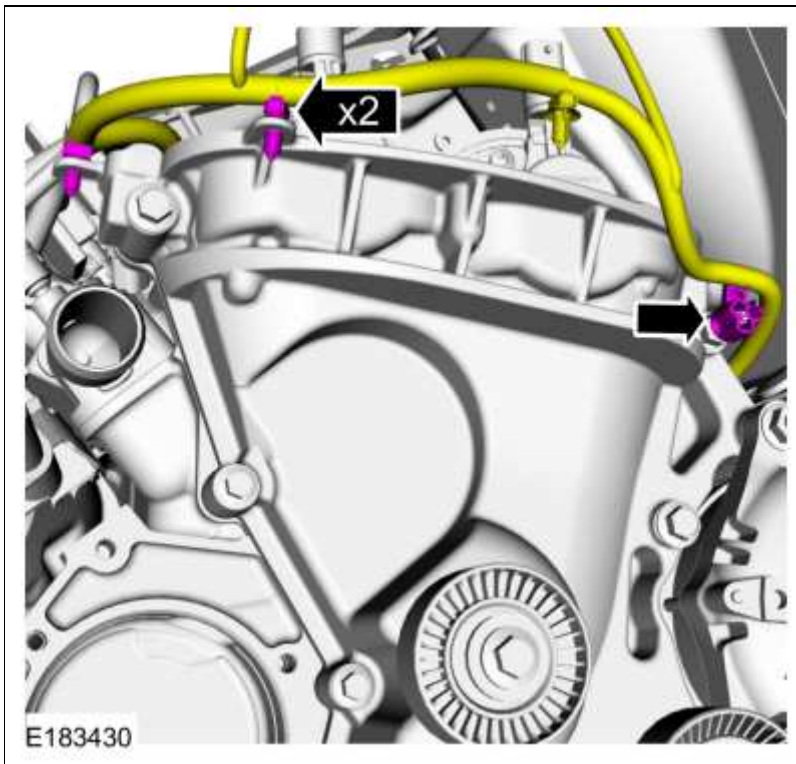
8. Install the accessory drive belt tensioner and bolt.
Torque: 35 lb.ft (48 Nm)



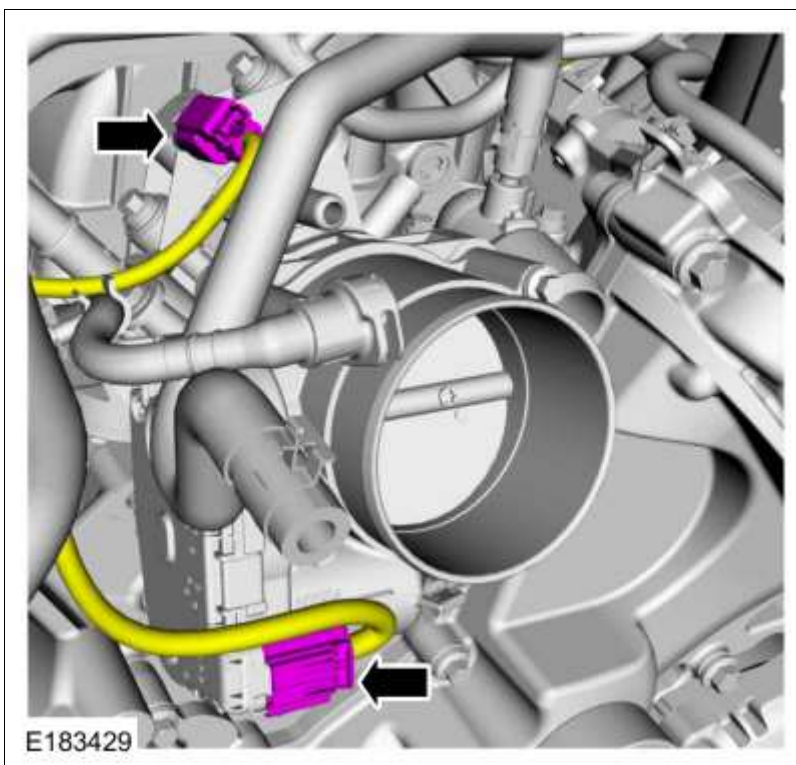
9.
 - Install the ground wire and nut.
Torque: 89 lb.in (10 Nm)
 - Install the wiring harness retainers.



10. Attach the wiring harness retainers to the engine front cover and stud bolt.

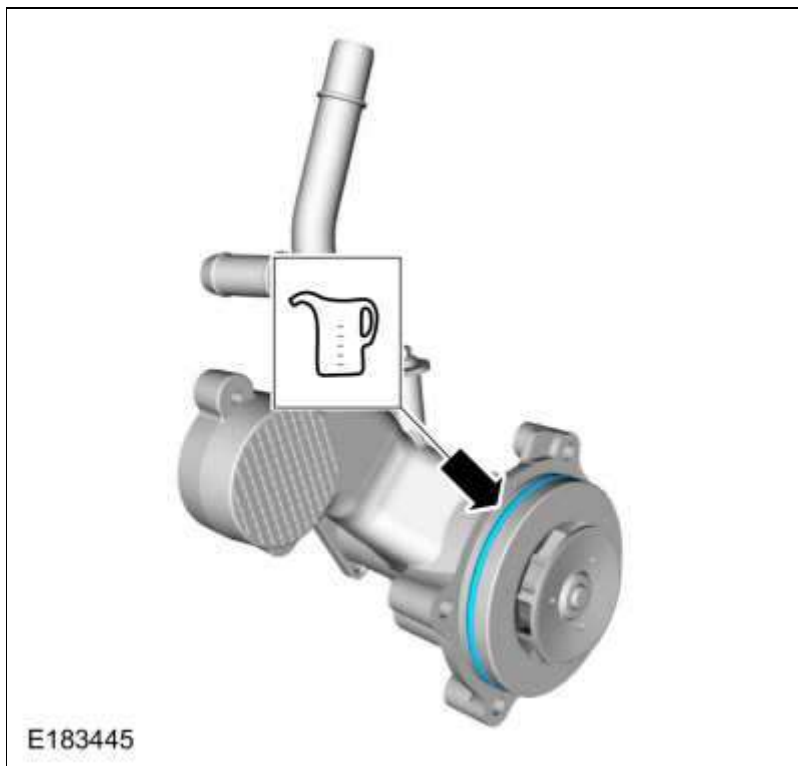


11. Connect the throttle body and EVAP purge valve electrical connectors.



12. Install a new coolant pump O-ring seal and lubricate with clean engine coolant.

Material: Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) / VC-3-B (U.S.) (WSS-M97B44-D)

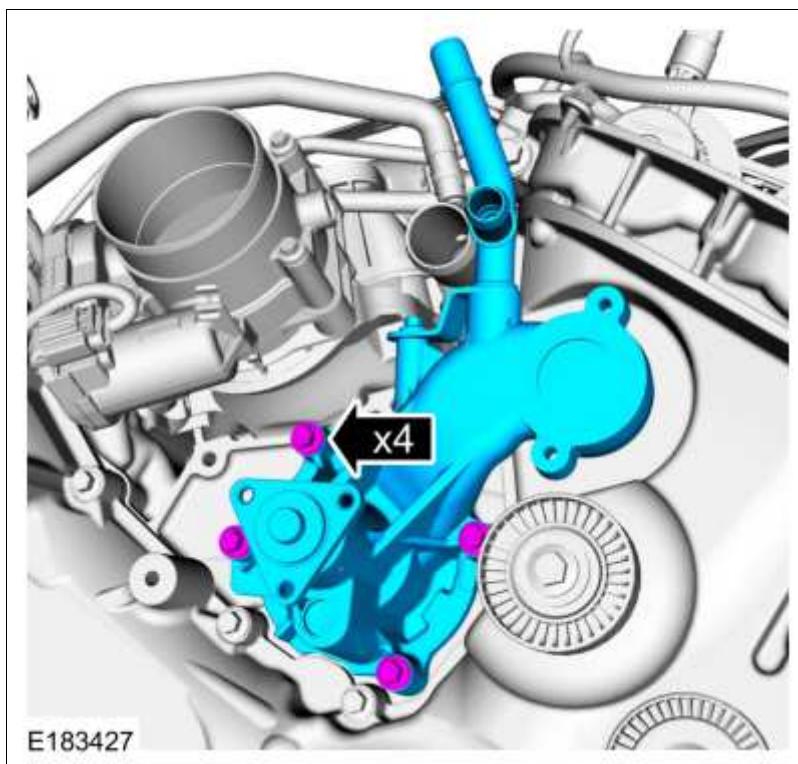


13. Install the coolant pump and bolts.

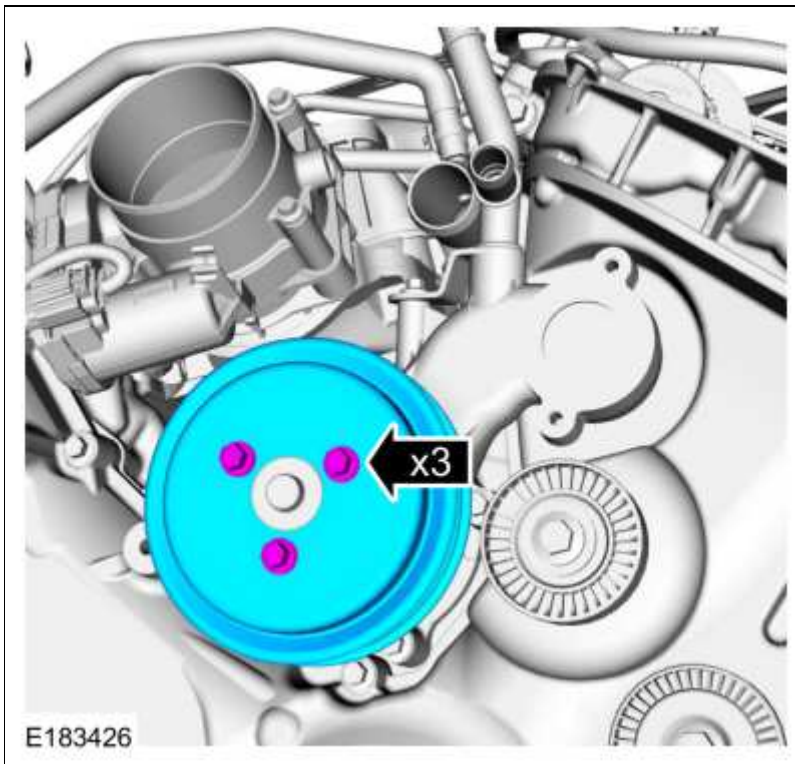
Torque:

Stage 1: 177 lb.in (20 Nm)

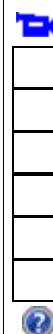
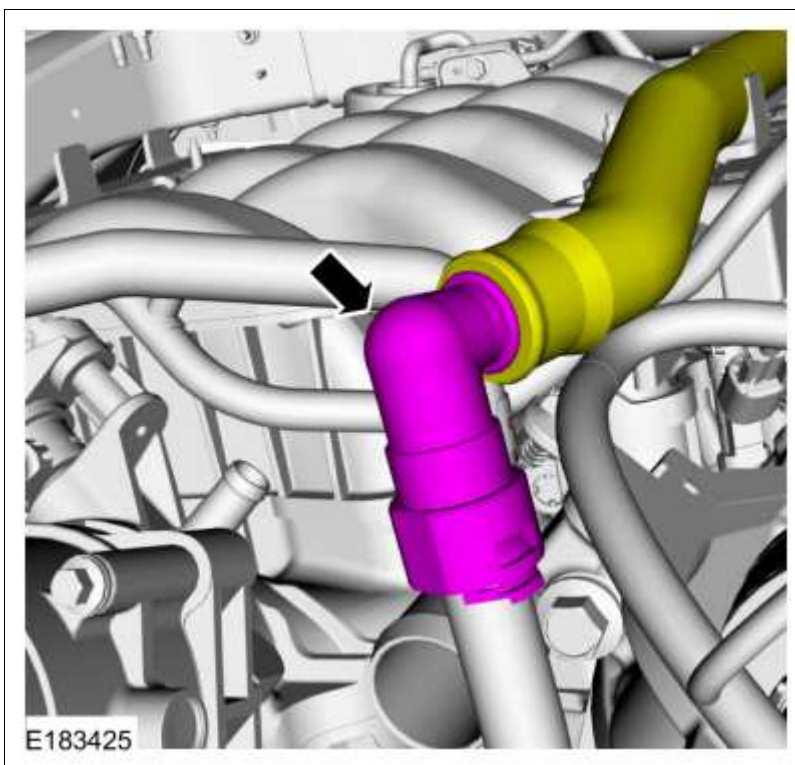
Stage 2: 60°



14. Install the coolant pump pulley and the bolts.

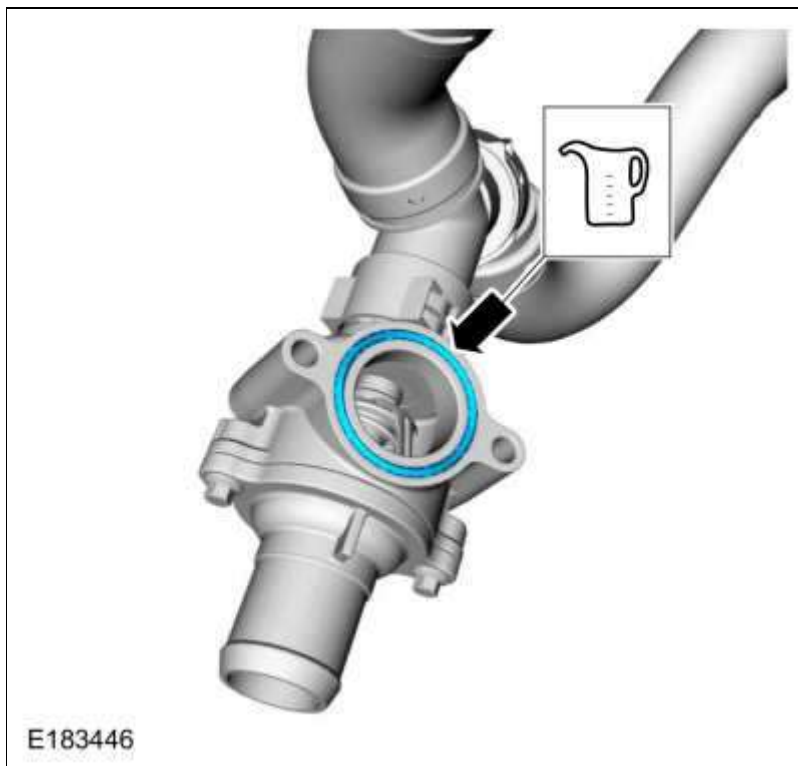


15. Connect the heater hose.

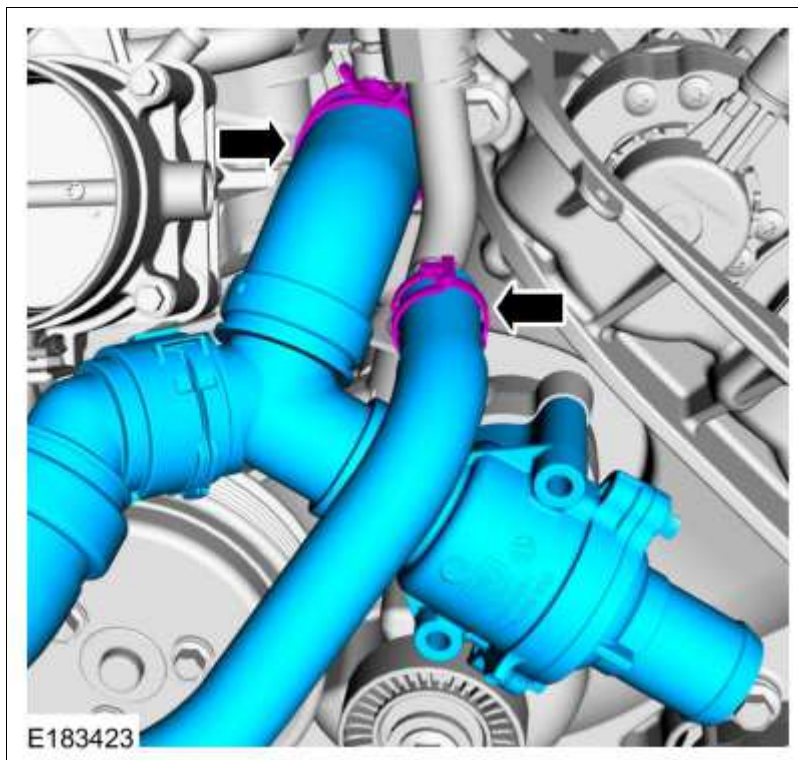


16. Install a new thermostat housing O-ring seal and lubricate with clean engine coolant.

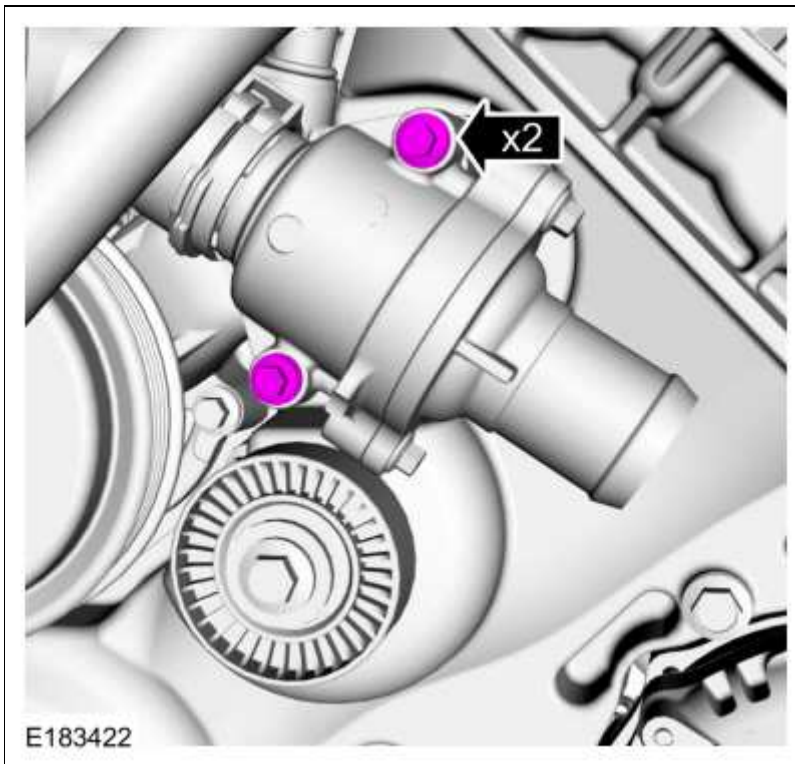
Material: Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) / VC-3-B (U.S.) (WSS-M97B44-D)



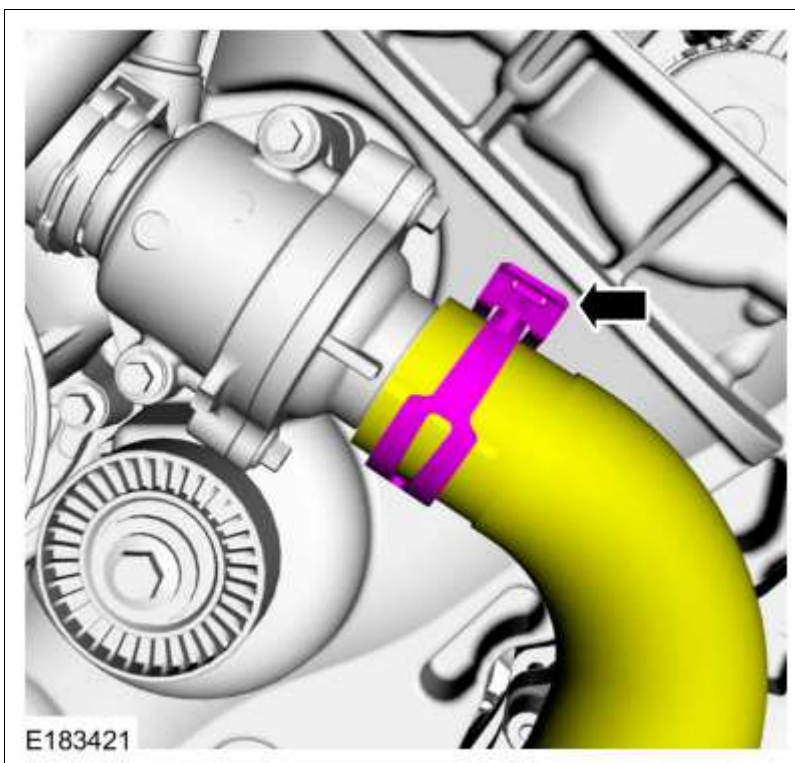
17.
 - Install the upper radiator hose T-connector/thermostat housing assembly and clamp.
 - Install the degas bottle coolant hose and clamp.



18. Install the thermostat housing bolts.
Torque: 89 lb.in (10 Nm)



19. Connect the lower radiator hose to the thermostat housing assembly.

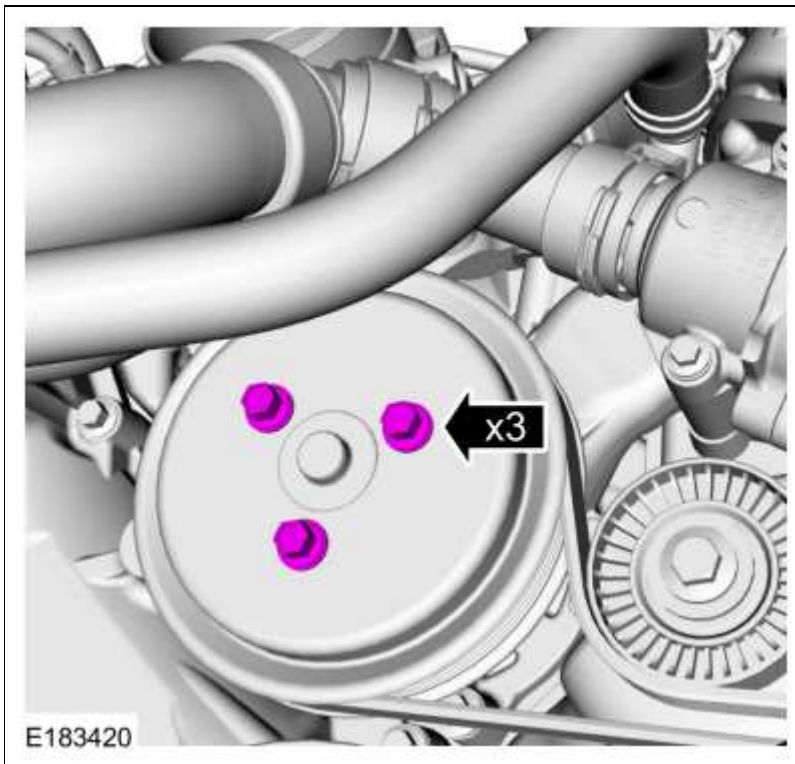


20. Install the following items:

1. Refer to: [Valve Cover LH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Valve Cover RH](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Crankshaft Front Seal](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

21. Tighten.

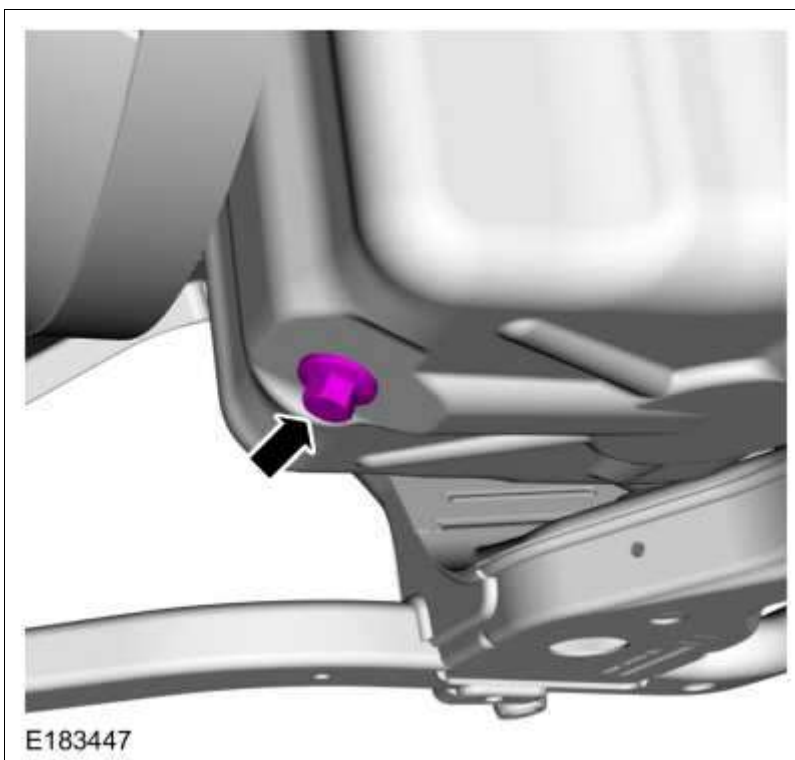
Torque: 18 lb.ft (25 Nm)



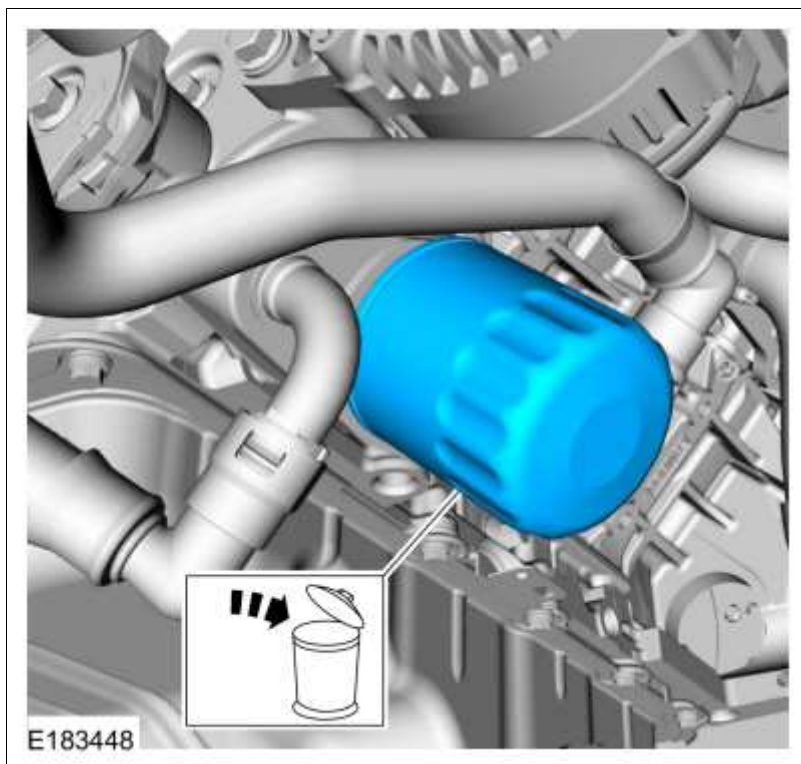
22. Install the following items:

1. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Degas Bottle](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

- 23.
- Remove the oil pan drain plug and drain the engine oil.
Use the General Equipment: Oil Drain Equipment
 - Install the oil pan drain plug.
Torque: 19 lb.ft (26 Nm)



24. Remove and discard the engine oil filter.



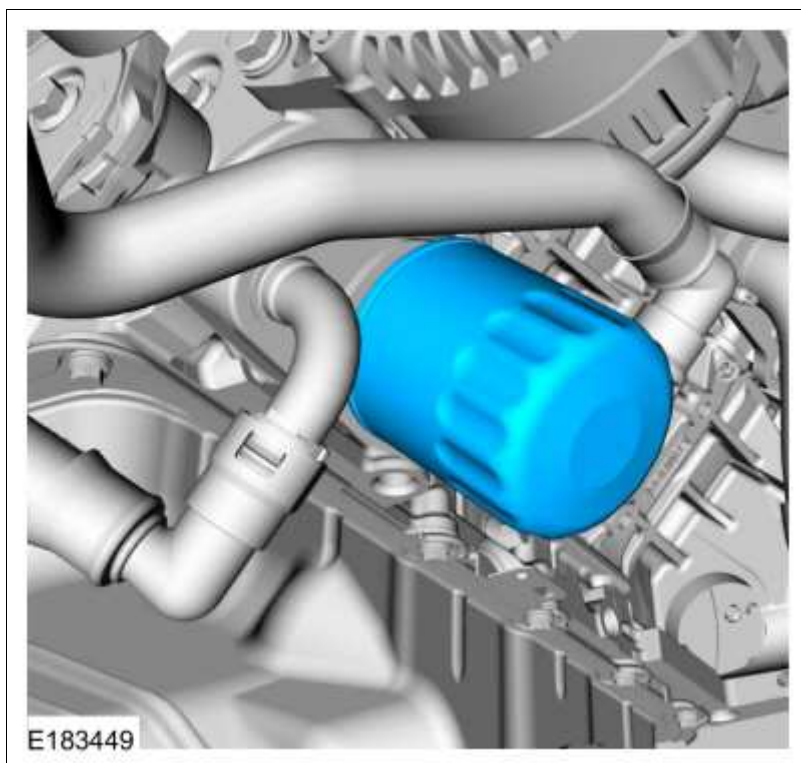
25. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

Torque:

Stage 1: 44 lb.in (5 Nm)

Stage 2: 180°



26. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

1. Install the underbody shield and the bolts.

Torque:

A: 97 lb.in (11 Nm)

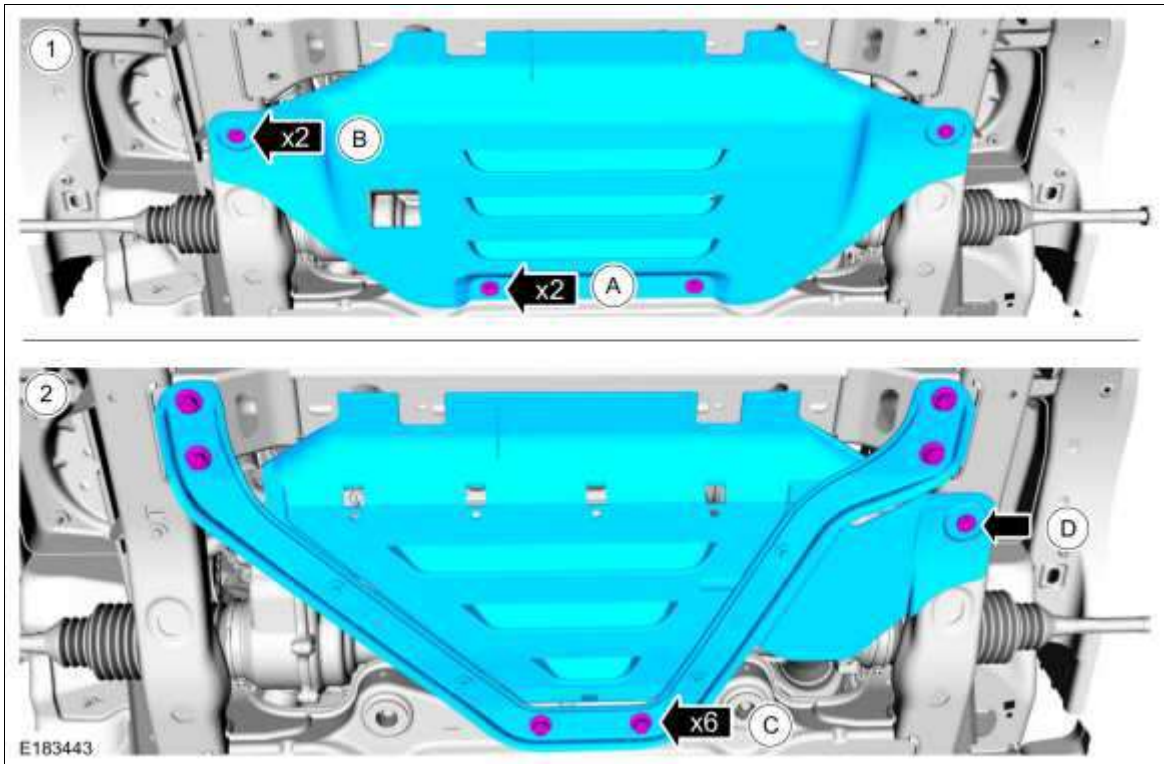
B: 18 lb.in (2 Nm)

2. Install the subframe bracket and underbody shield assembly and the bolts.

Torque:

C: 46 lb.ft (63 Nm)

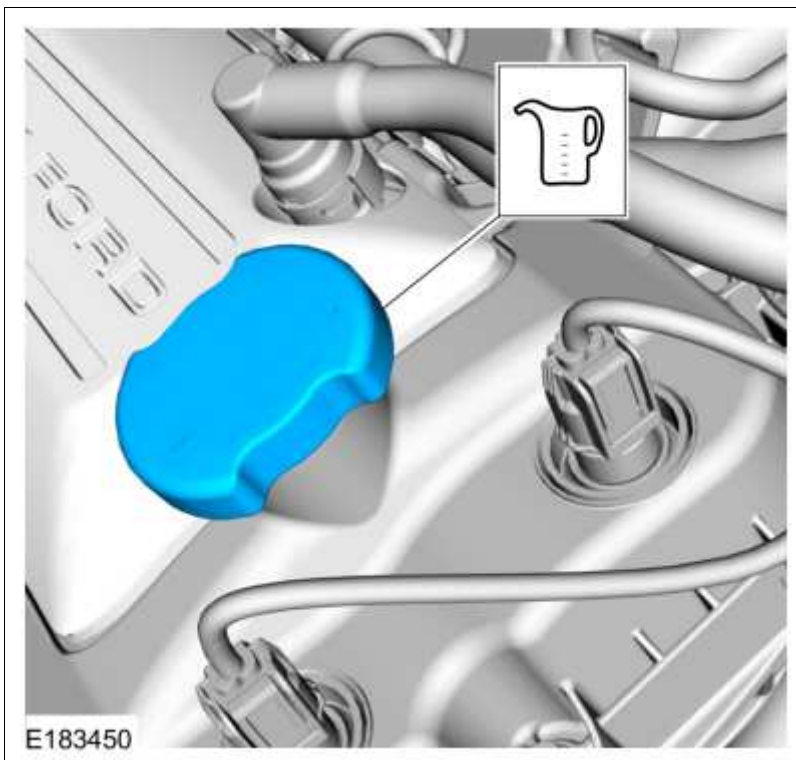
D: 18 lb.in (2 Nm)



27. Fill the engine with clean engine oil.

Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



28. Connect the battery positive and ground cables.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

29. Fill and bleed the engine cooling system.

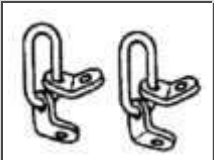
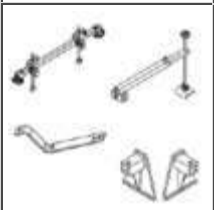
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).

30. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

Engine Mount LH

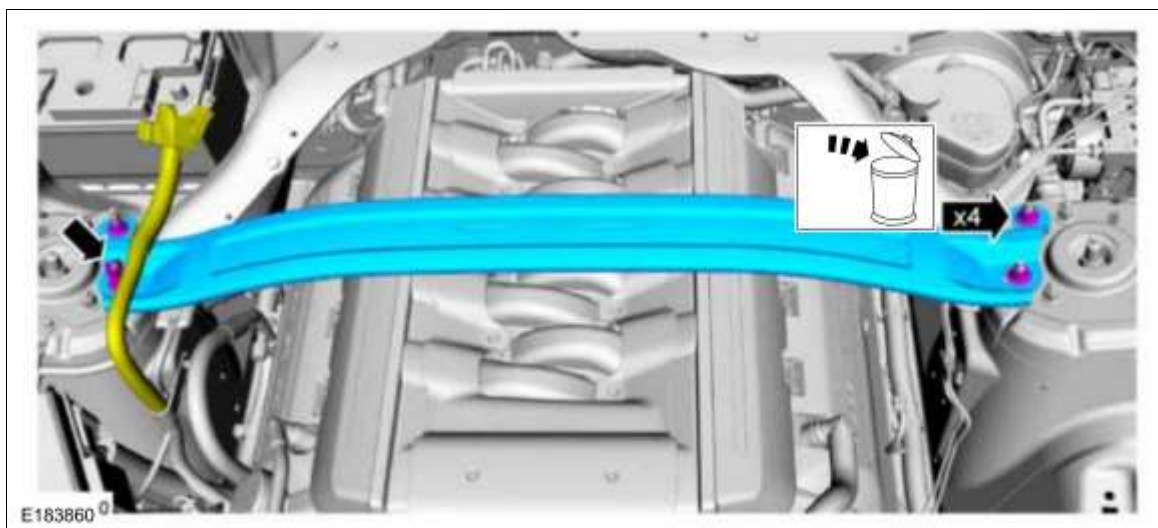
Base Part Number: [6038](#)

Special Tool(s) / General Equipment

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine

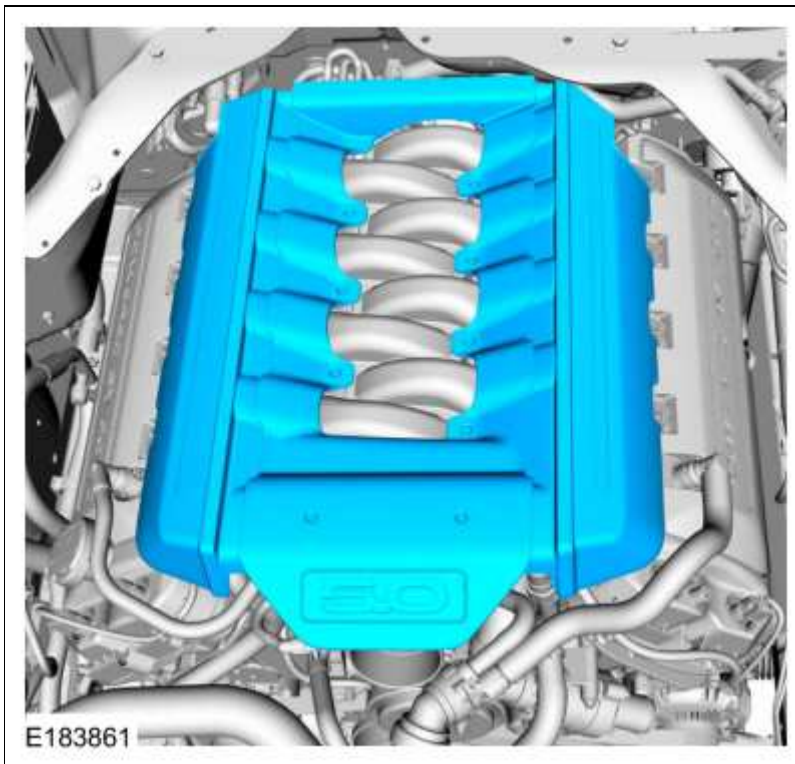
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.

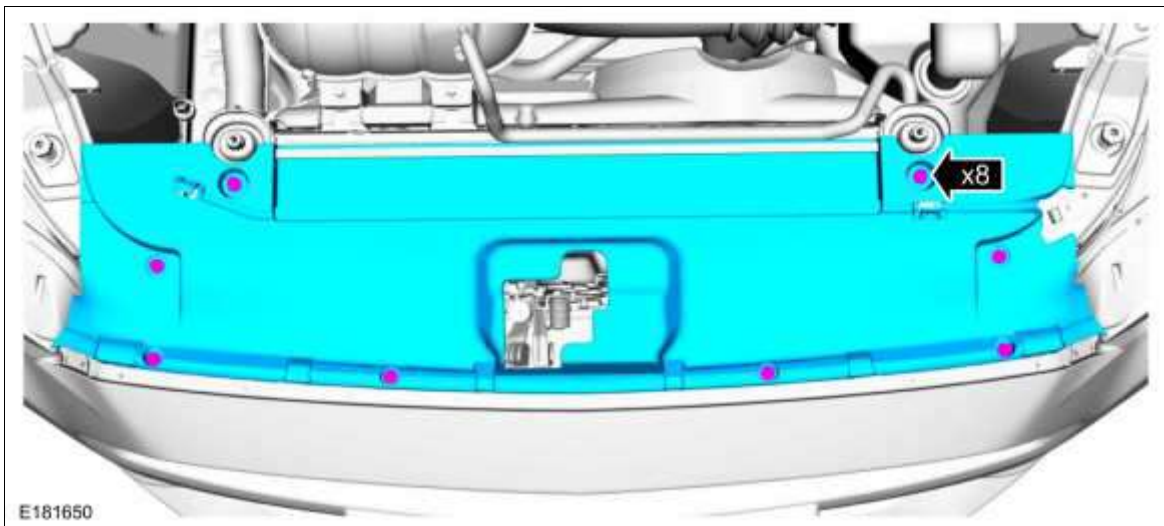


4. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Remove the engine appearance cover.



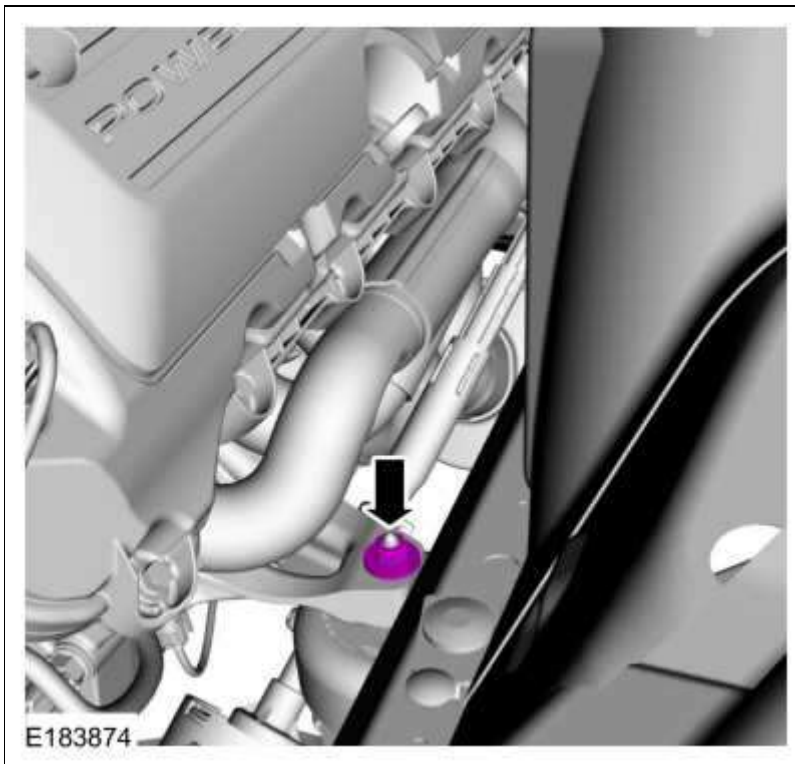
5. Remove the retainers and the radiator top shield.



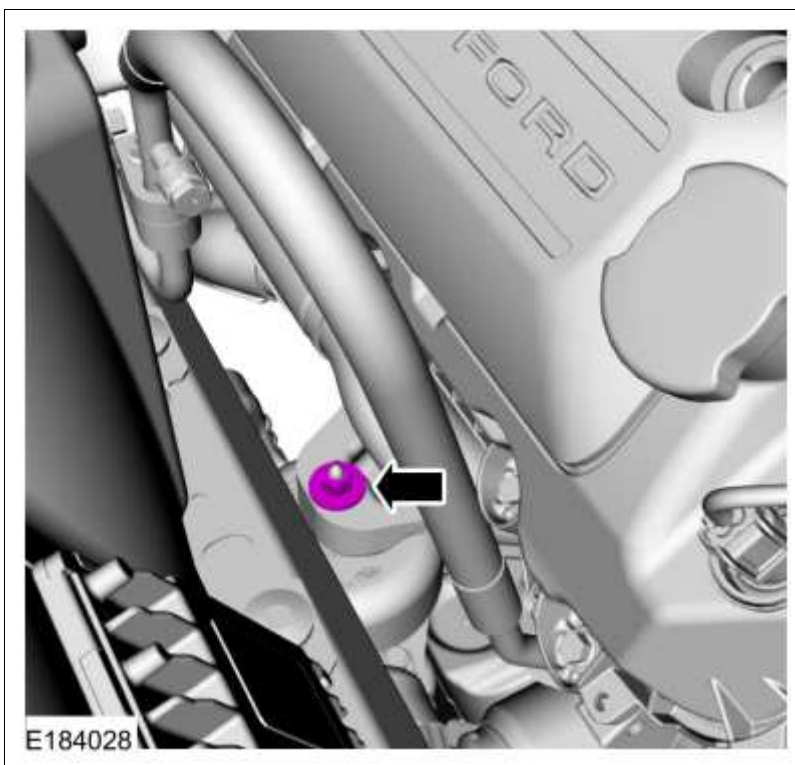
6. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

7. Remove the LH engine mount nut.



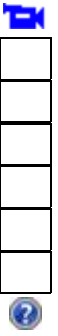
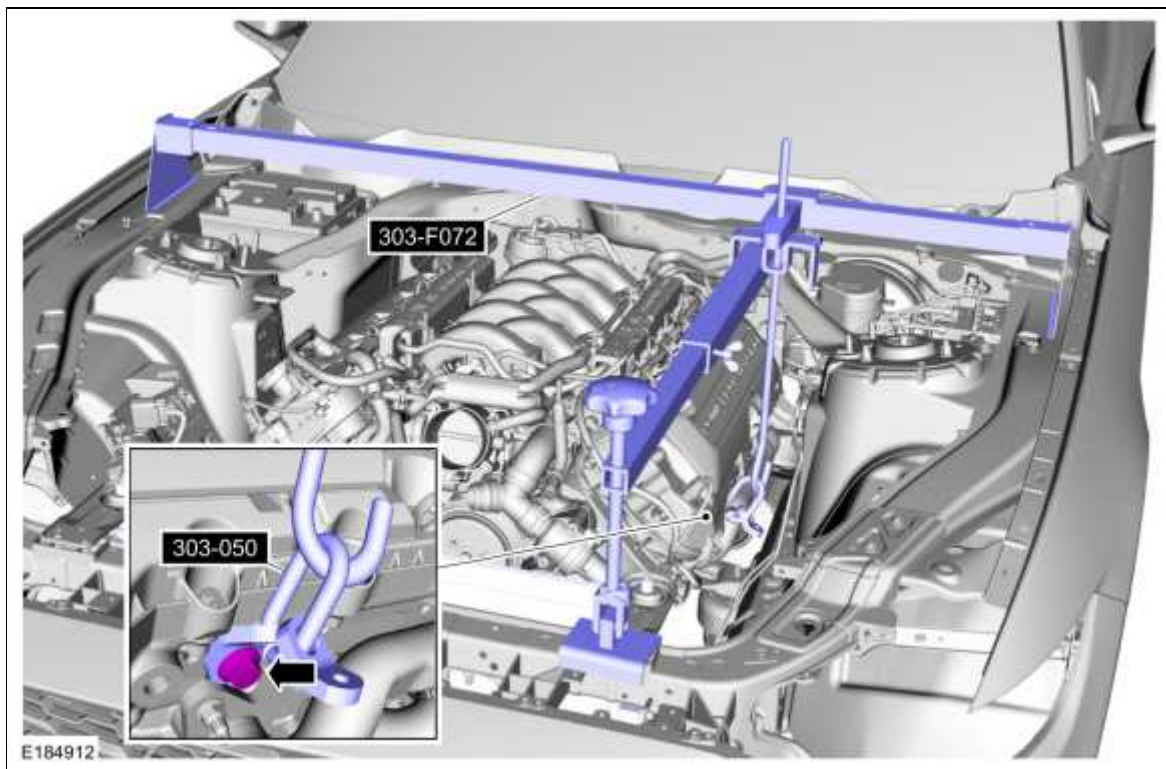
8. Remove the RH engine mount nut.



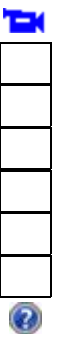
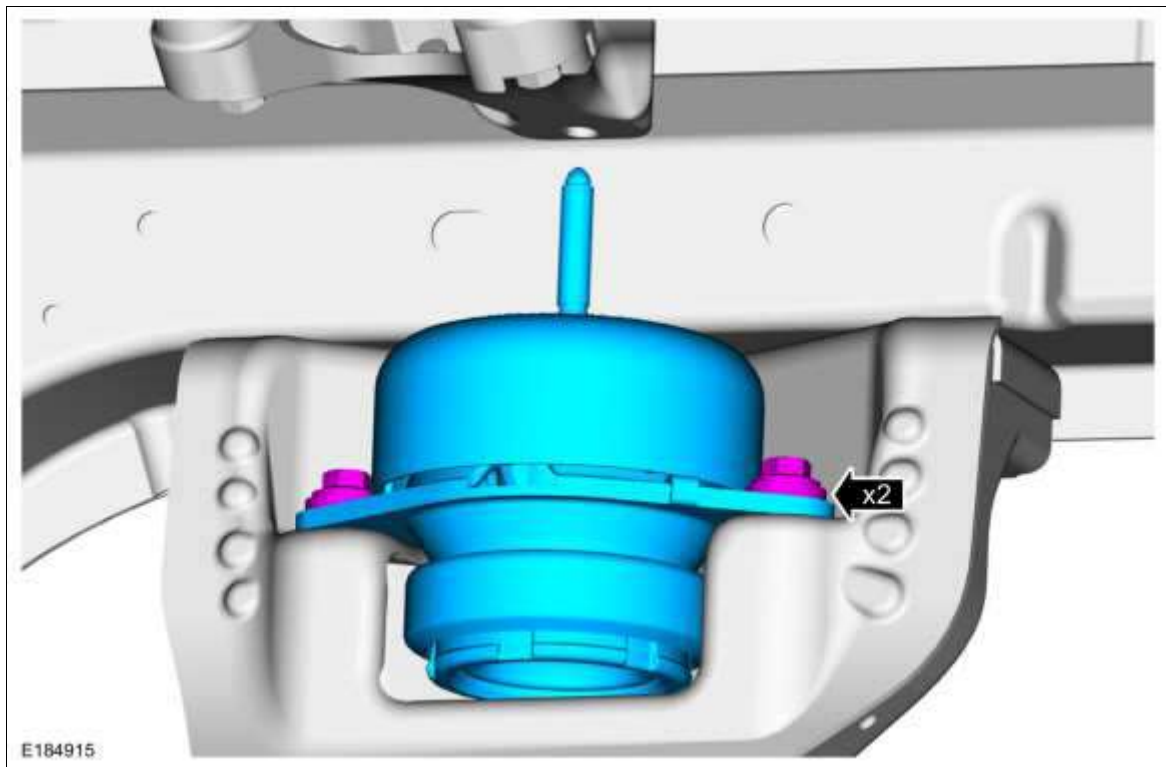
9. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

Install the special tools and raise the engine 50 mm (2 inch).

Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)

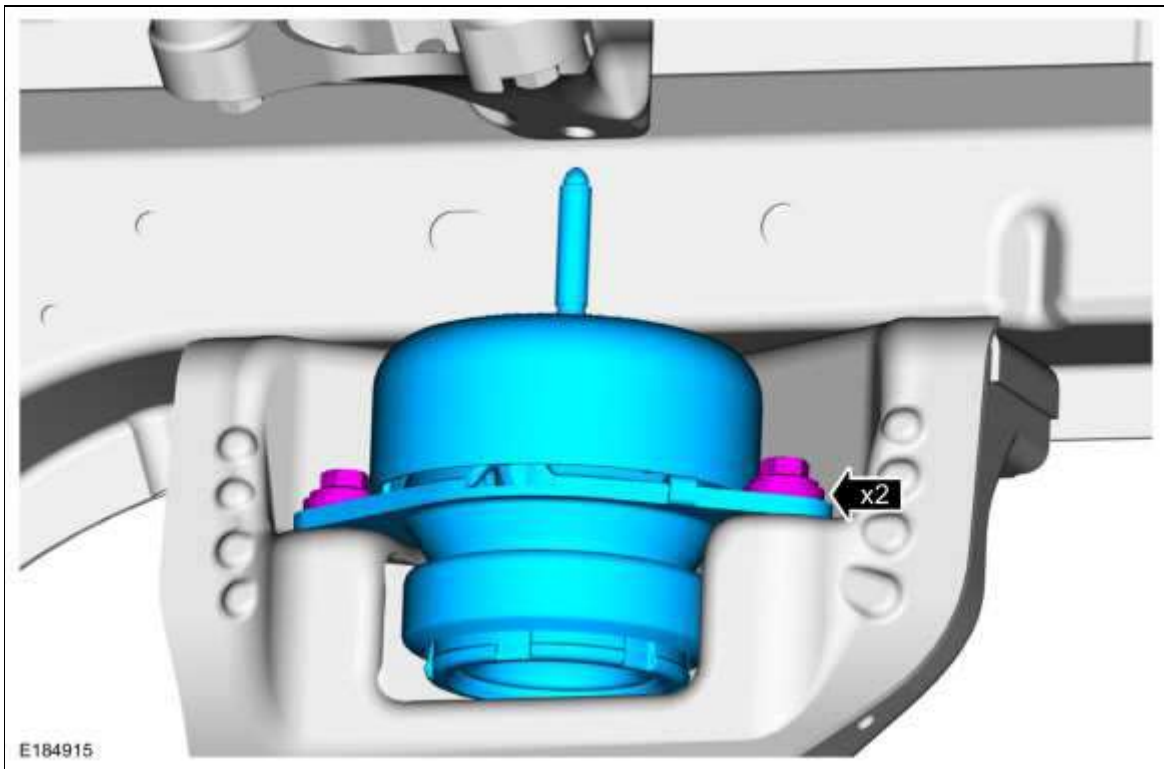


10. Remove the bolts and the engine mount.

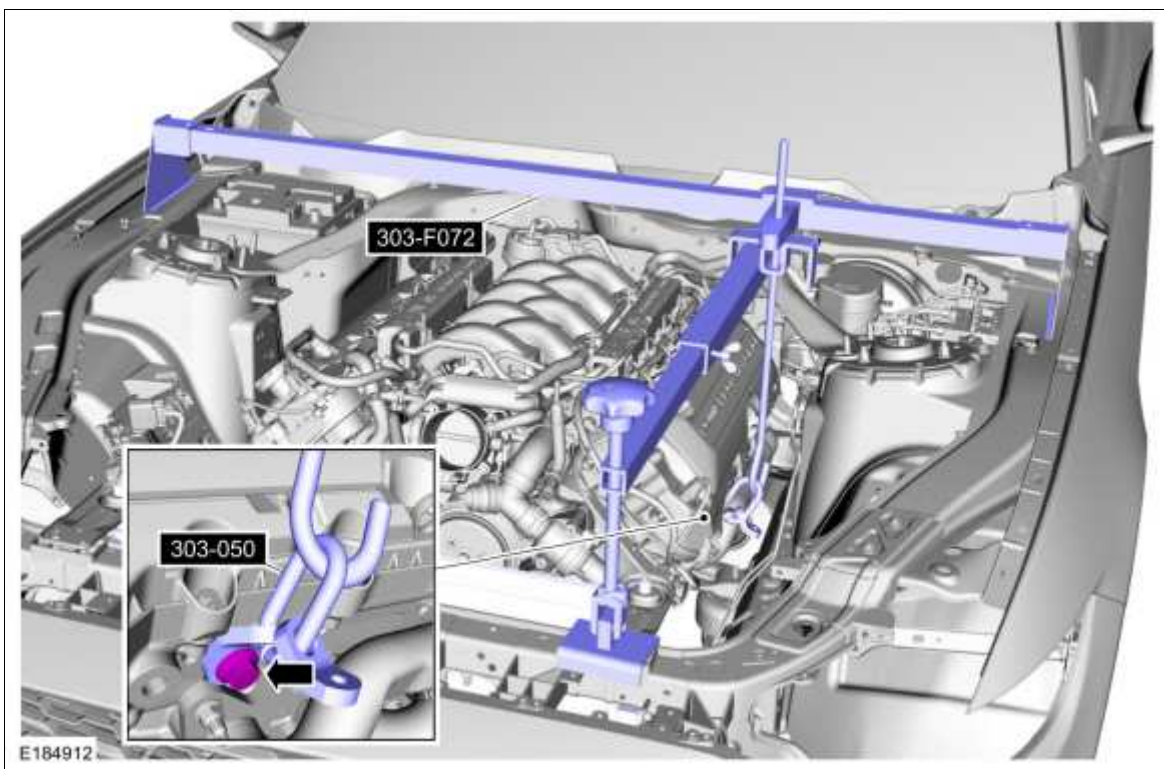


Installation

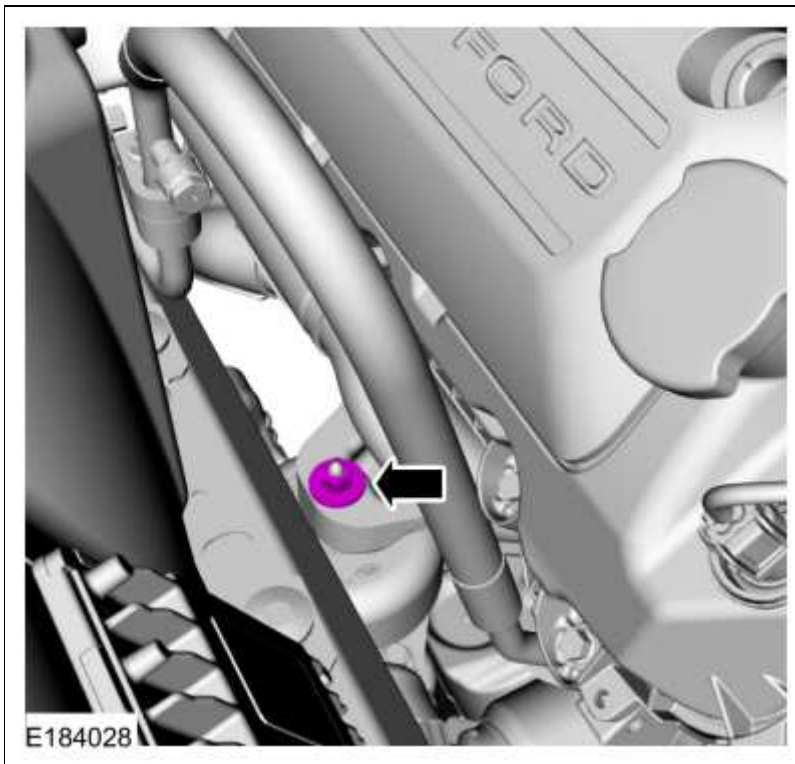
1. Install the engine mount and the bolts.
Torque: 52 lb.ft (70 Nm)



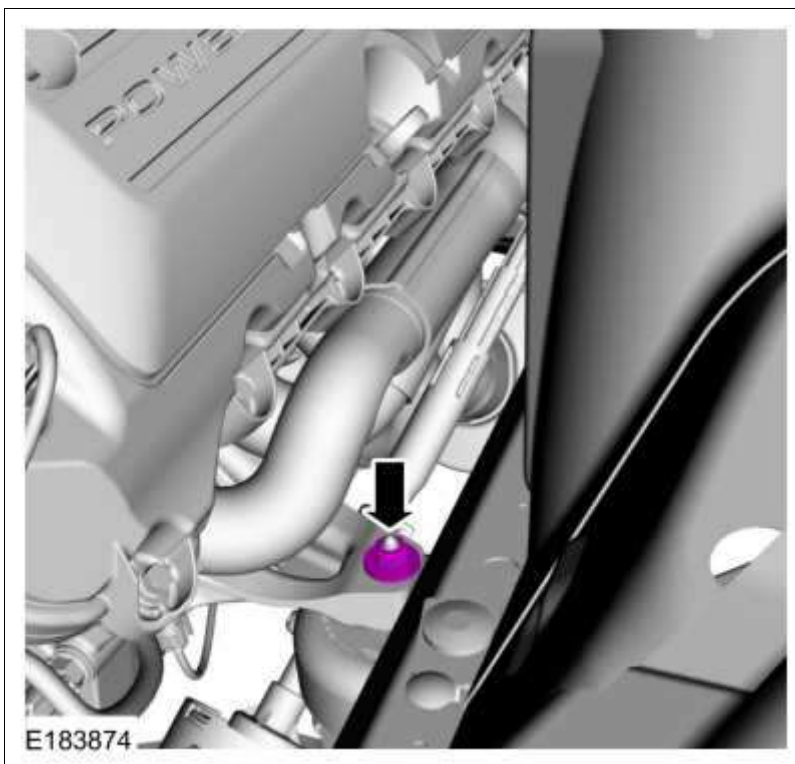
2. Lower the engine onto the engine mounts and remove the special tools
 Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)



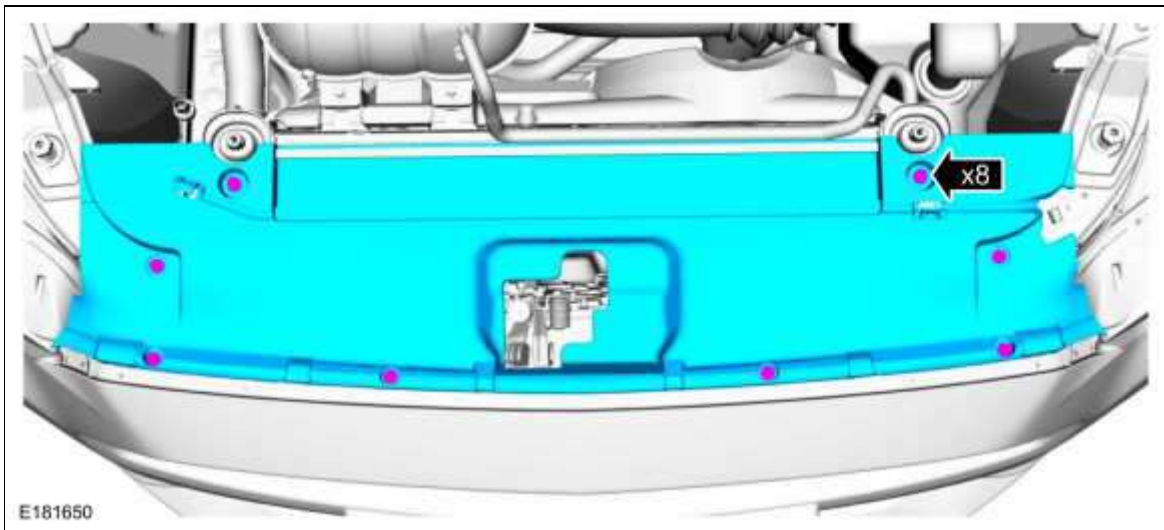
3. Install the RH engine mount nut.
 Torque: 46 lb.ft (63 Nm)



4. Install the LH engine mount nut.
Torque: 46 lb.ft (63 Nm)

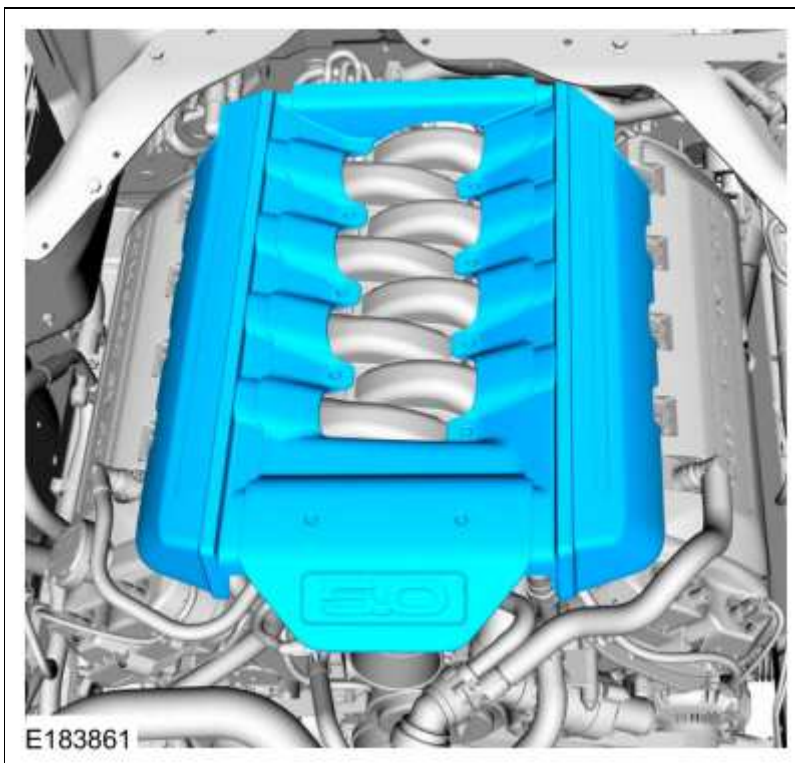


5. Install the following items:
1. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
6. Install the radiator top shield and the retainers.

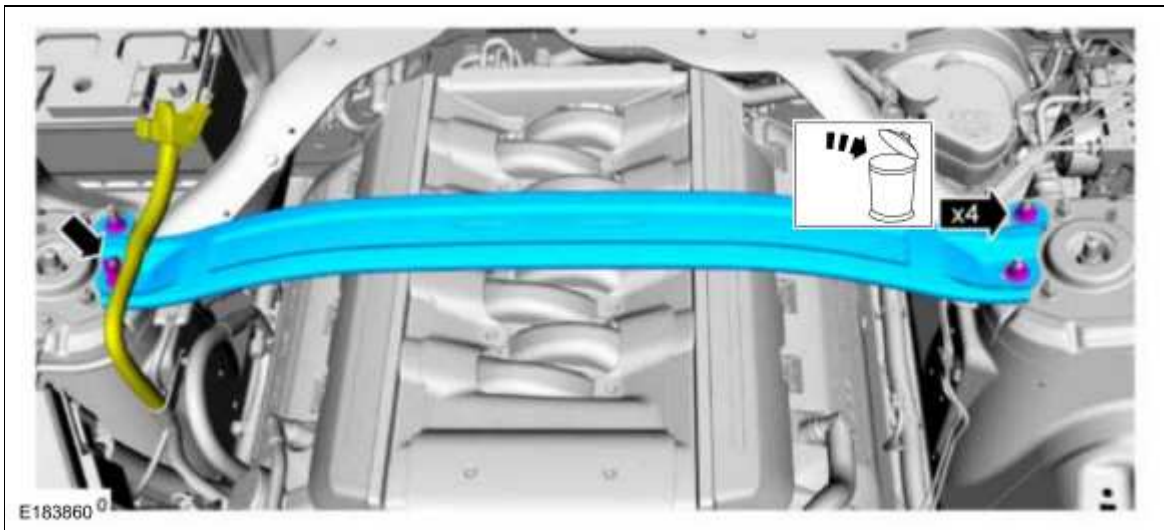


7. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.



- 8.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



9. Connect the battery ground and positive cables.

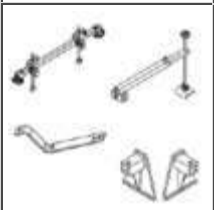
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

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Engine Mount RH

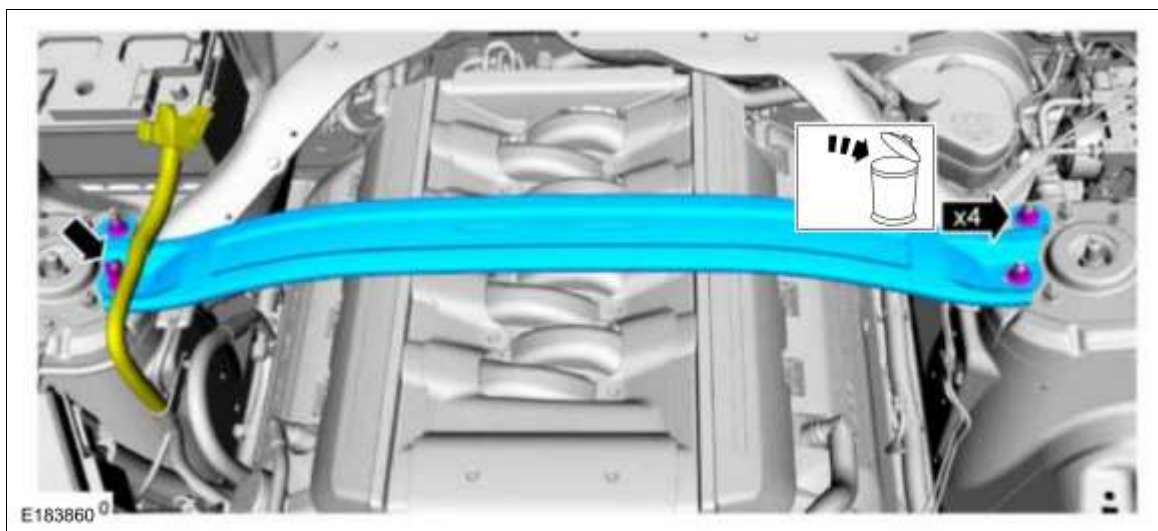
Base Part Number: [6038](#)

Special Tool(s) / General Equipment

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine

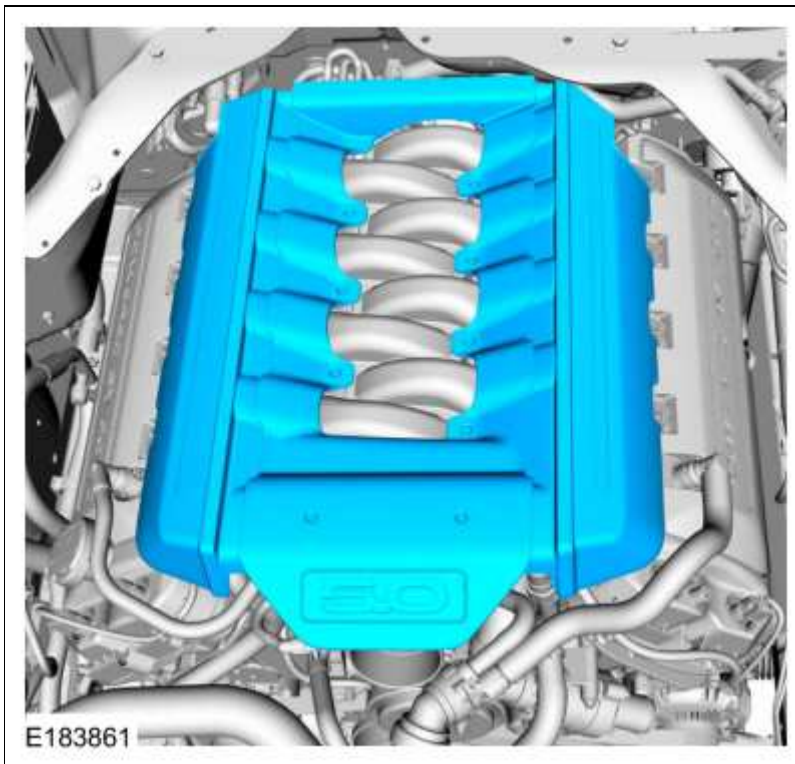
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.

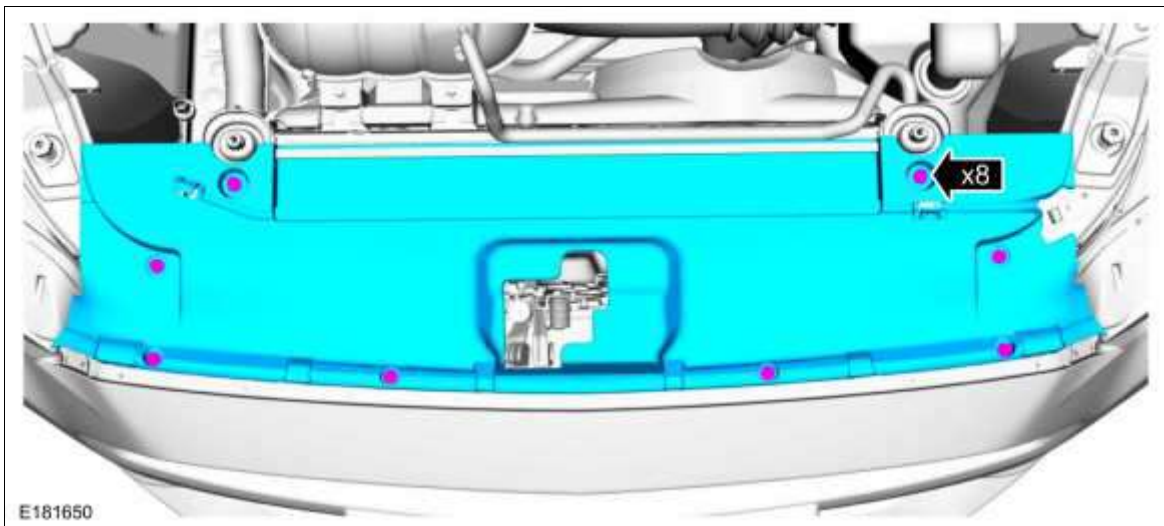


4. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Remove the engine appearance cover.



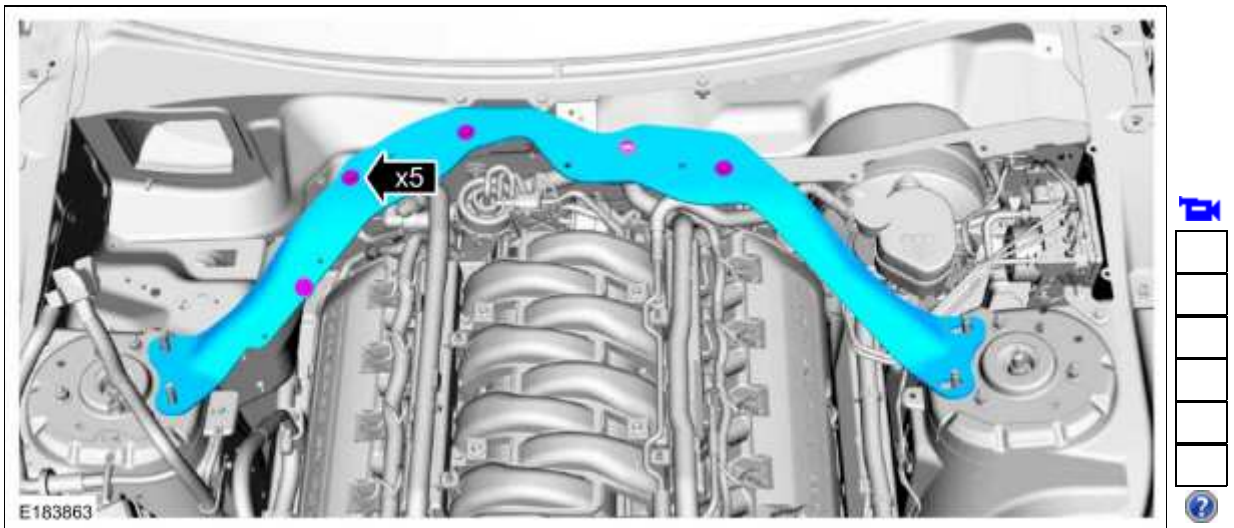
5. Remove the retainers and the radiator top shield.



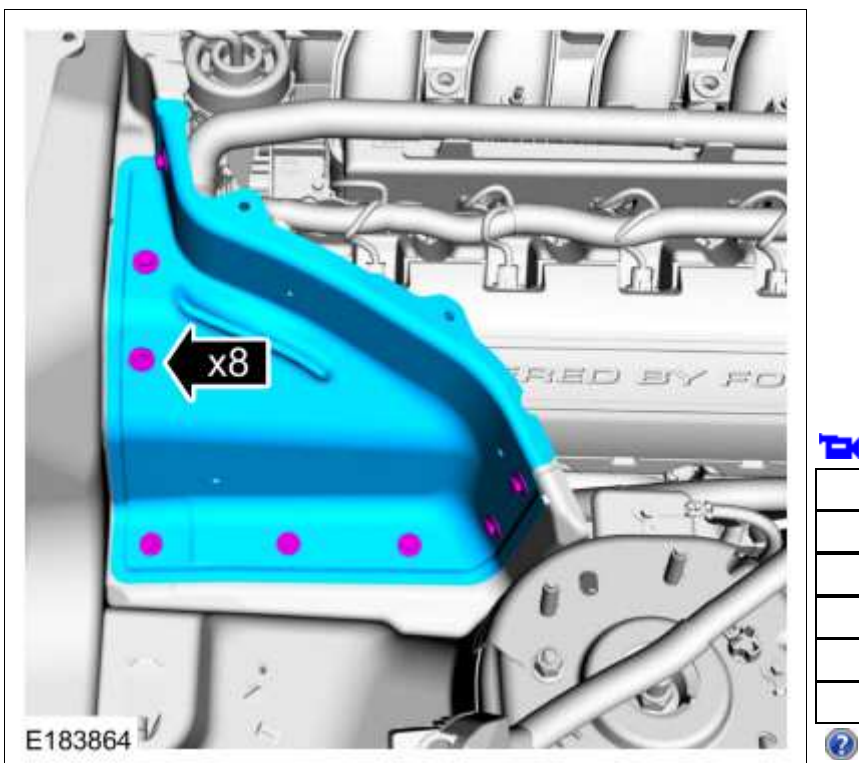
6. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

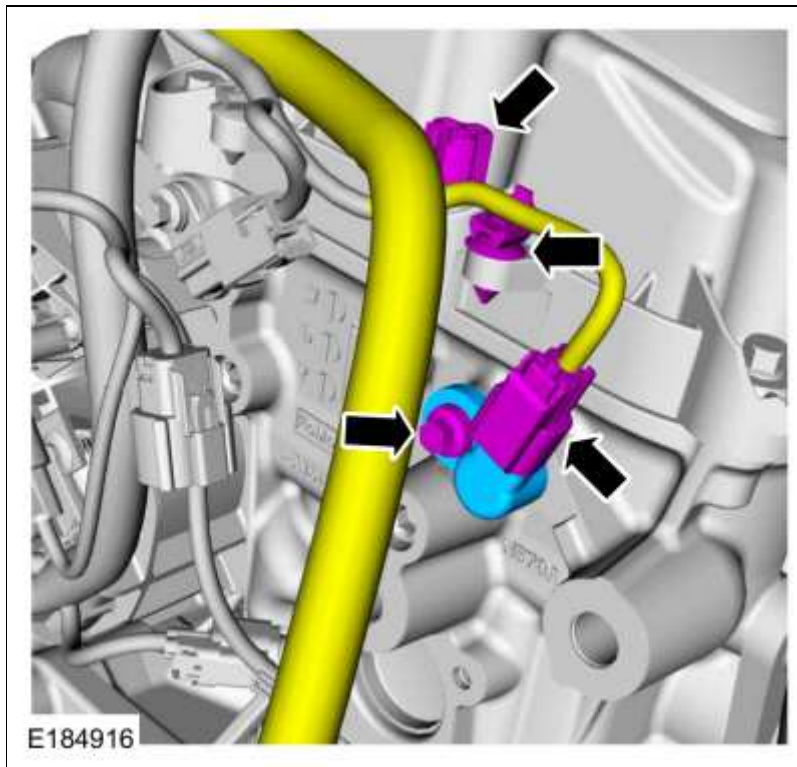
7. Remove the fasteners and the cowl extension.



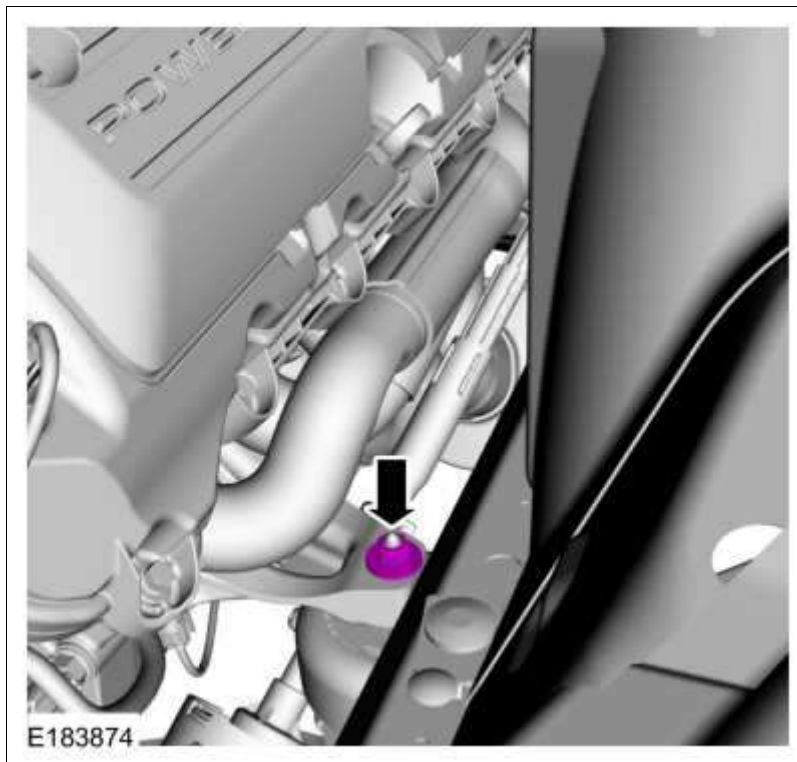
8. Remove the fasteners and the battery heat shield.



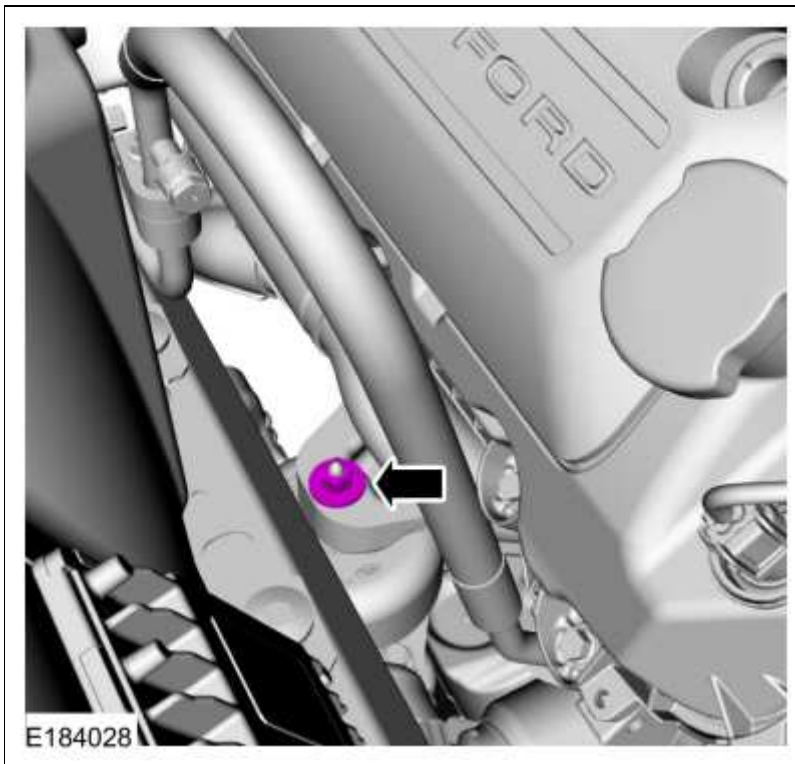
9.
 - Disconnect the CMP sensor electrical connector, the wiring harness retainers and position the harness aside.
 - Remove the bolt and the CMP sensor.



10. Remove the LH engine mount nut.



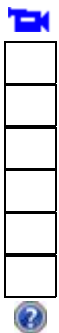
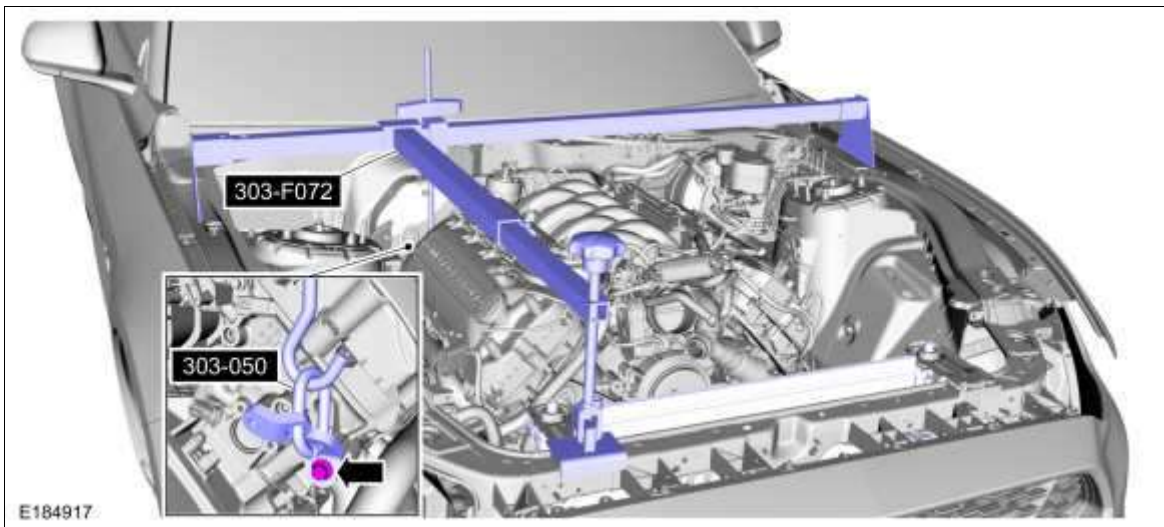
11. Remove the RH engine mount nut.



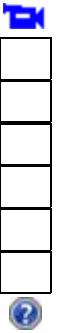
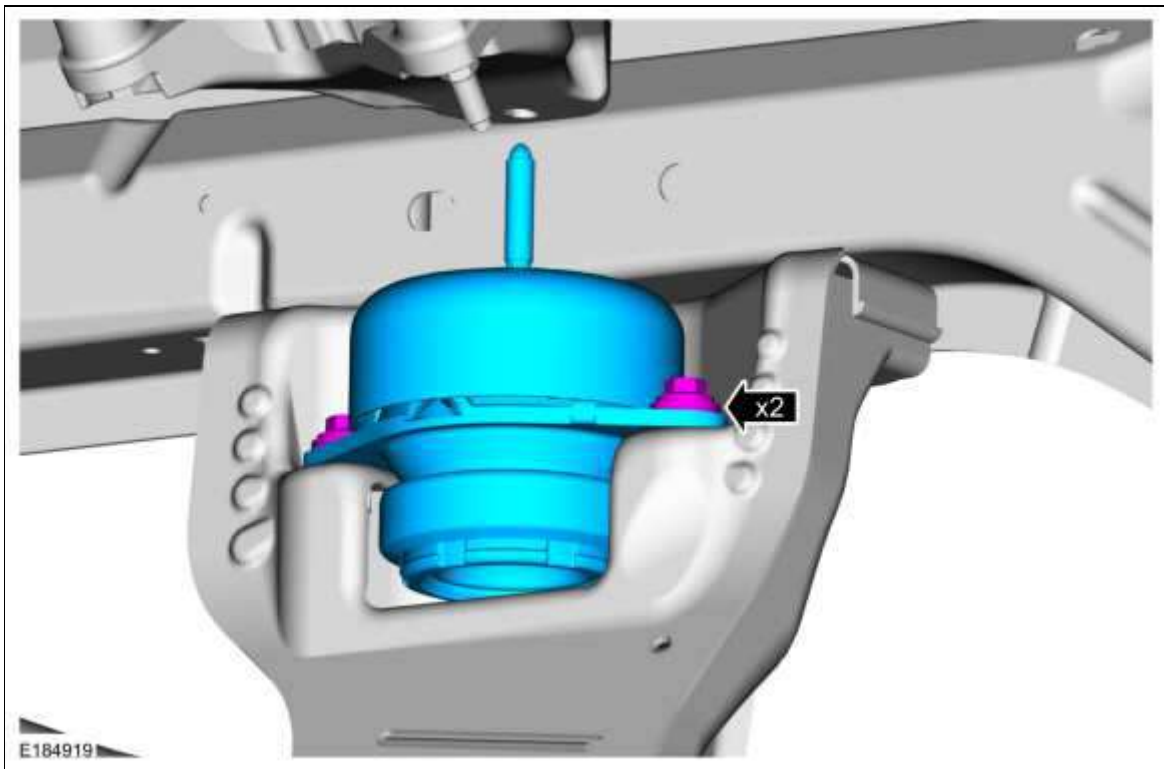
12. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

Install the special tools and raise the engine 50 mm (2 inch).

Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)

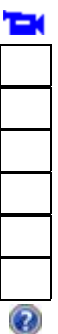
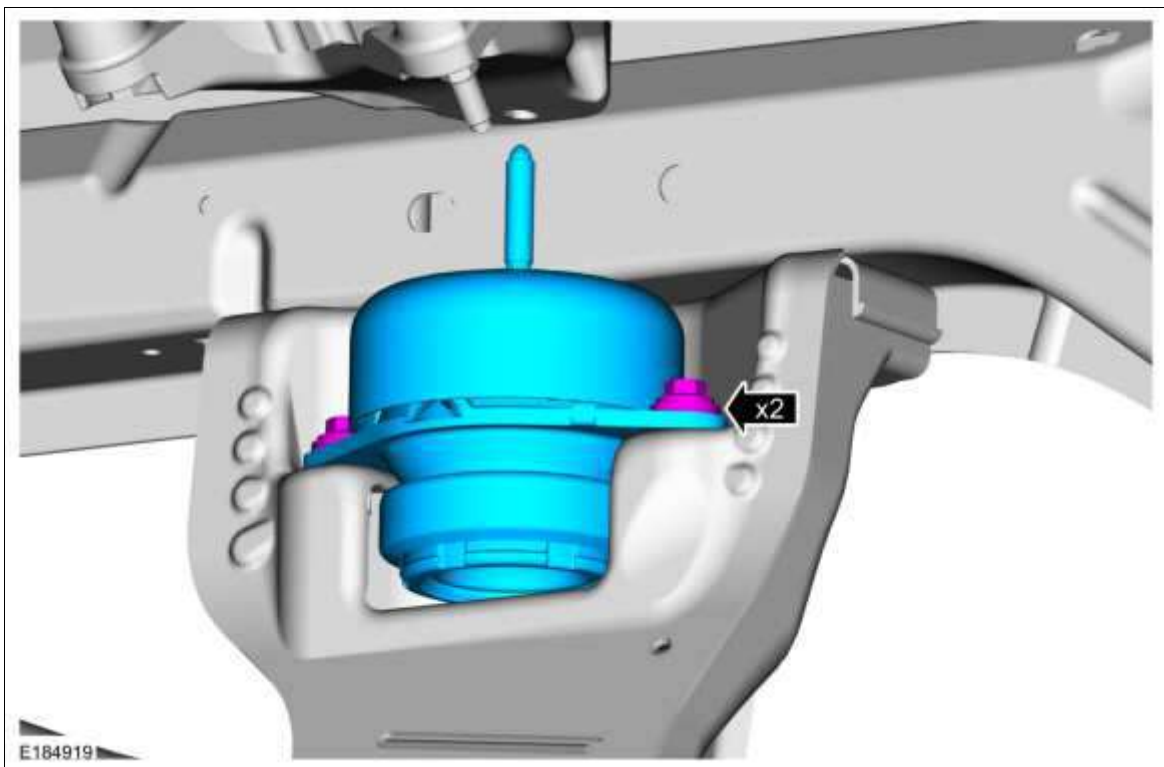


13. Remove the bolts and the engine mount.

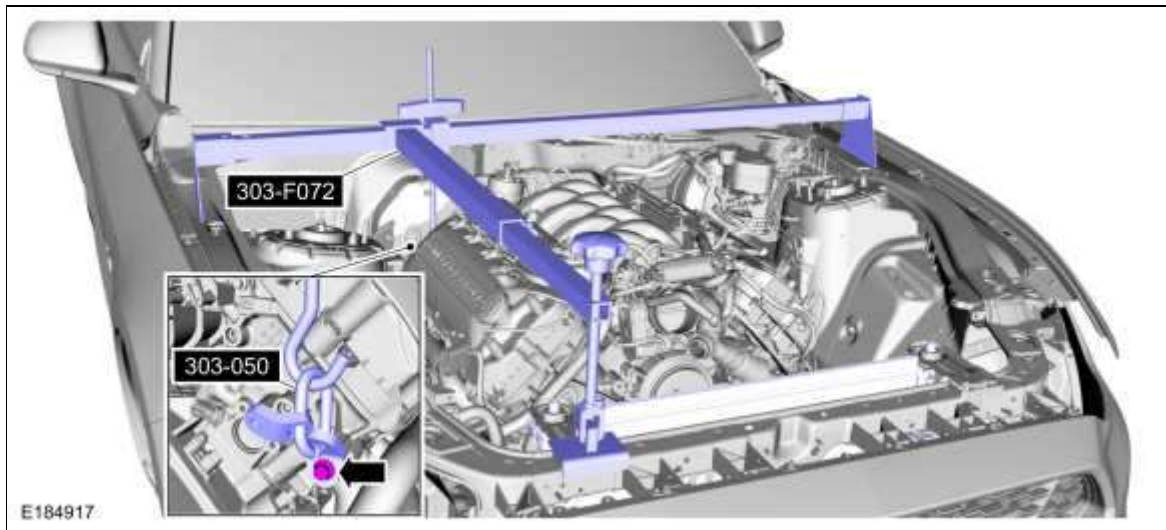


Installation

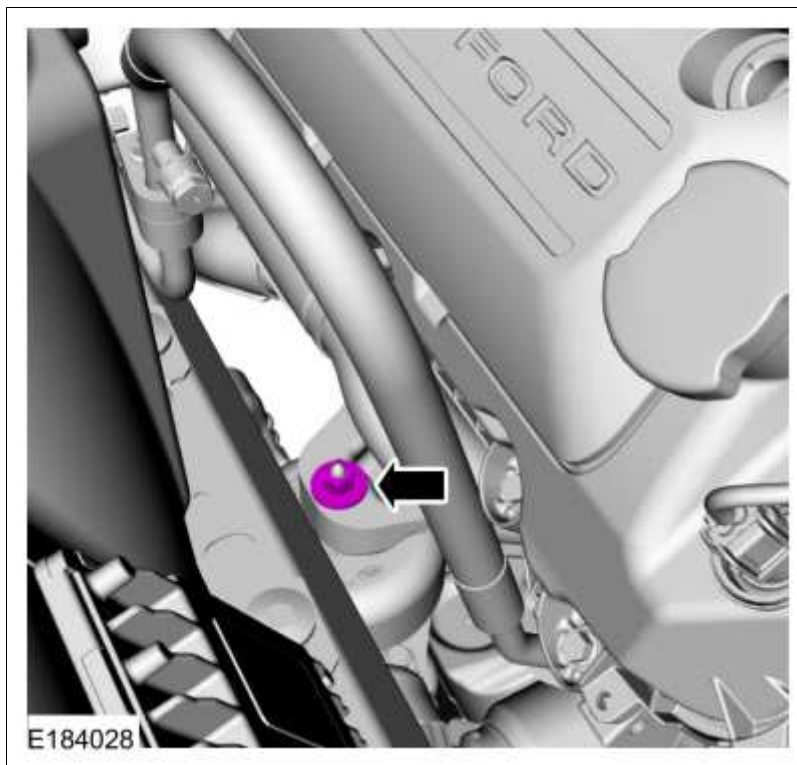
1. Install the engine mount and bolts.
Torque: 52 lb.ft (70 Nm)



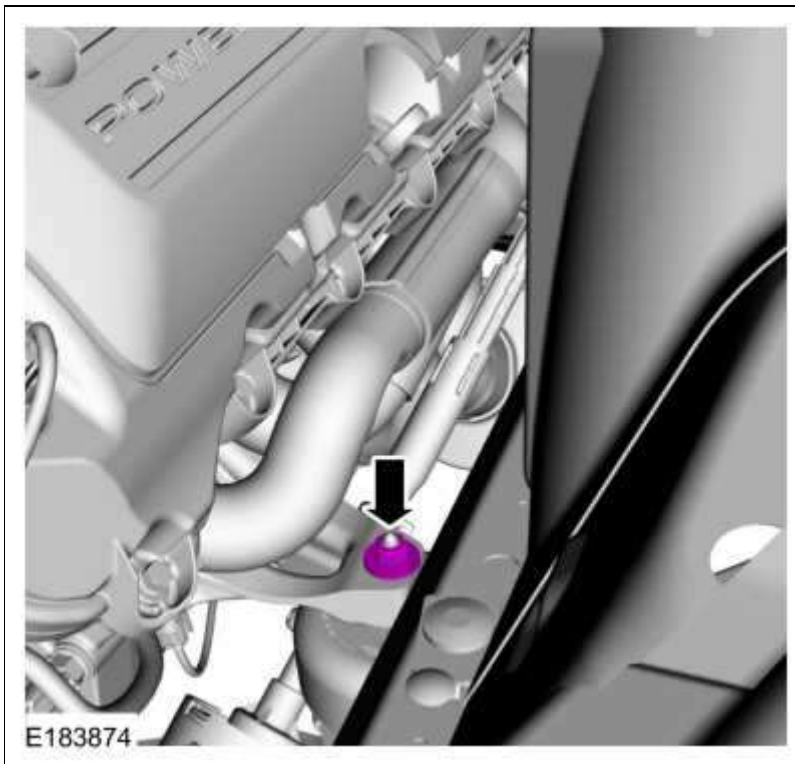
2. Lower the engine onto the engine mounts and remove the special tools
Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)



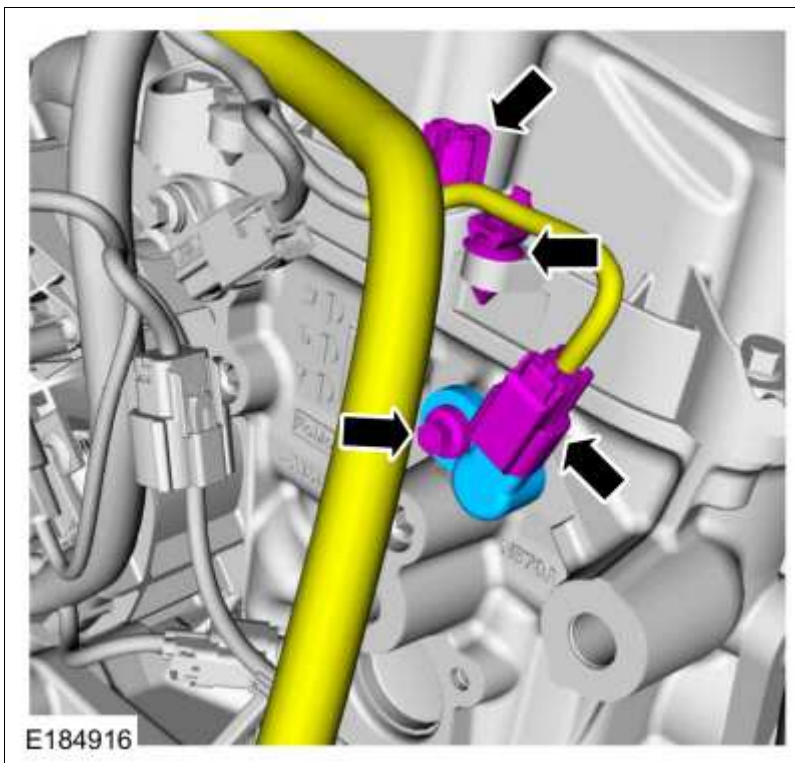
3. Install the RH engine mount nut.
Torque: 46 lb.ft (63 Nm)



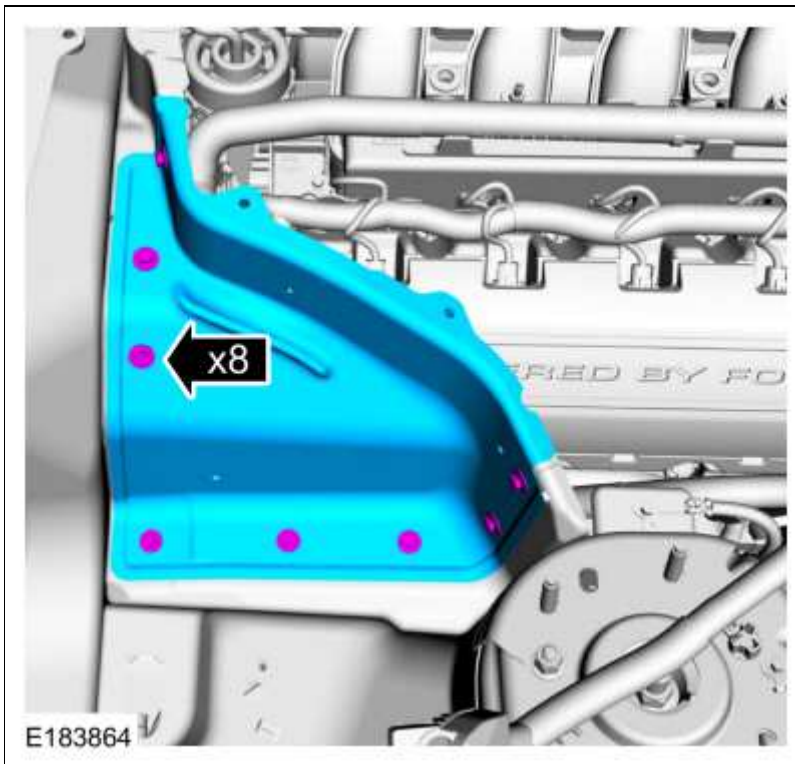
4. Install the LH engine mount nut.
Torque: 46 lb.ft (63 Nm)



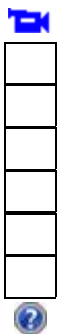
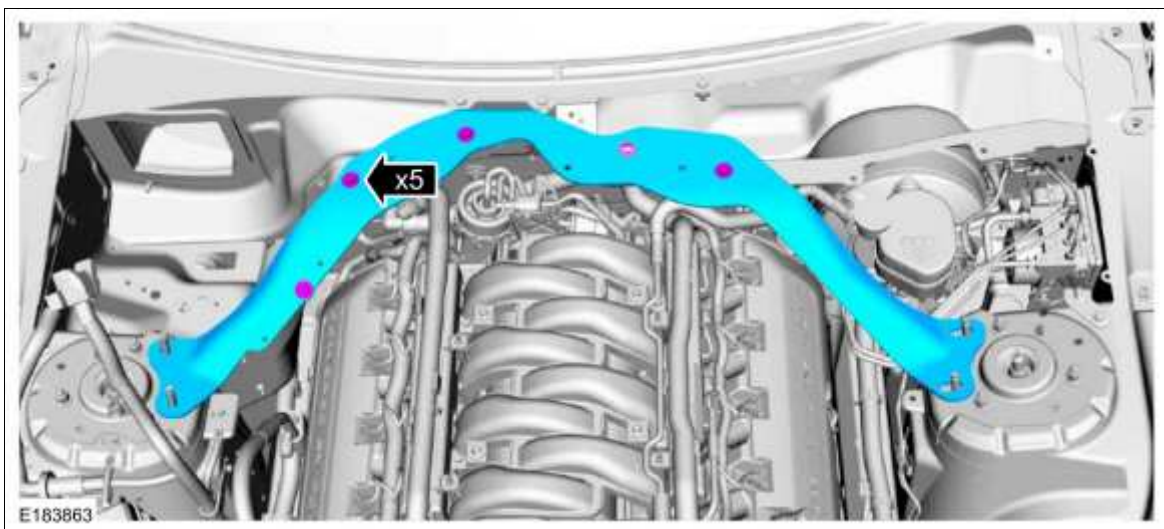
5.
 - Install the CMP sensor and the bolt.
Torque: 89 lb.in (10 Nm)
 - Connect the CMP sensor electrical connector and the wiring harness retainers.



6. Install the battery heat shield and fasteners.
Torque: 80 lb.in (9 Nm)

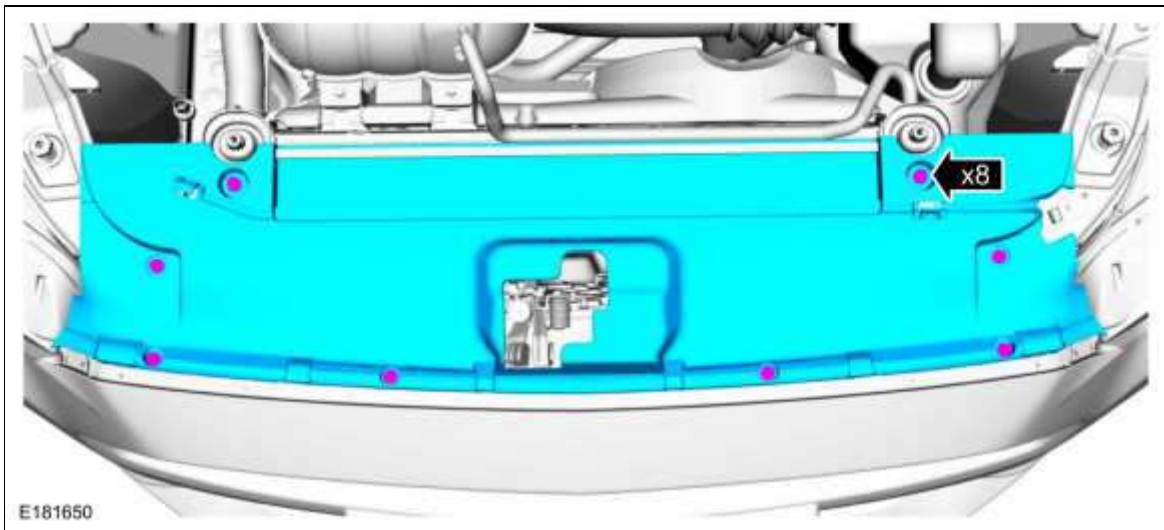


7. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)



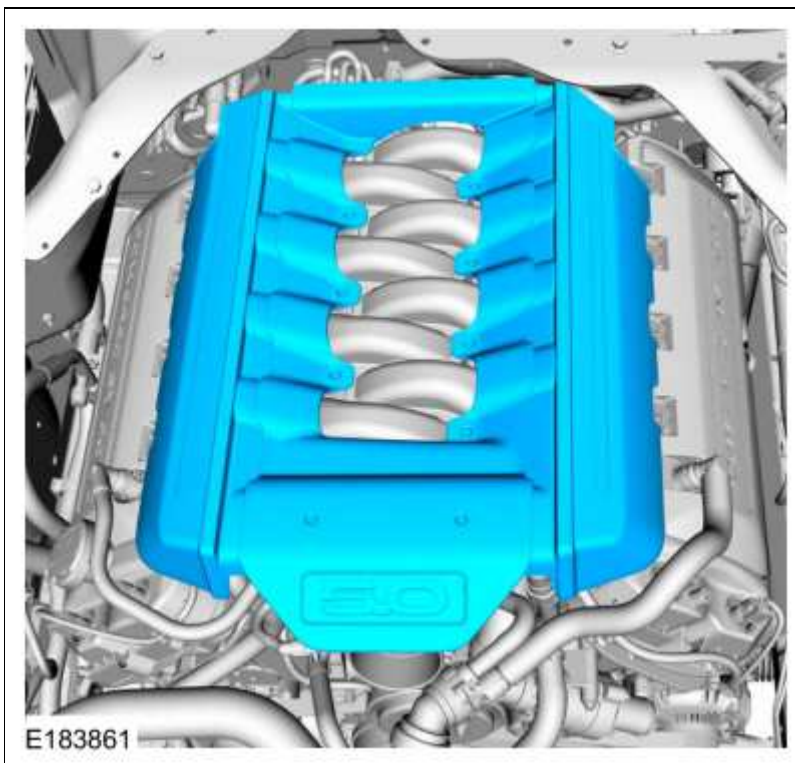
8. Install the following items:
1. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
 2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
 3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

9. Install the radiator top shield and the retainers.

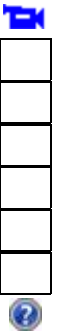
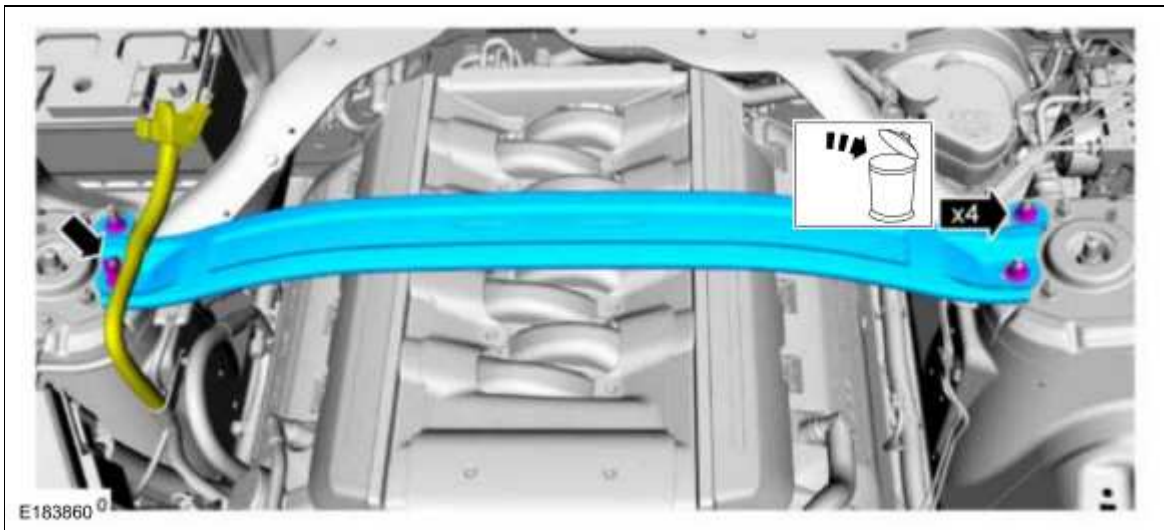


10. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.



- 11.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



12. Connect the battery ground and positive cables.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

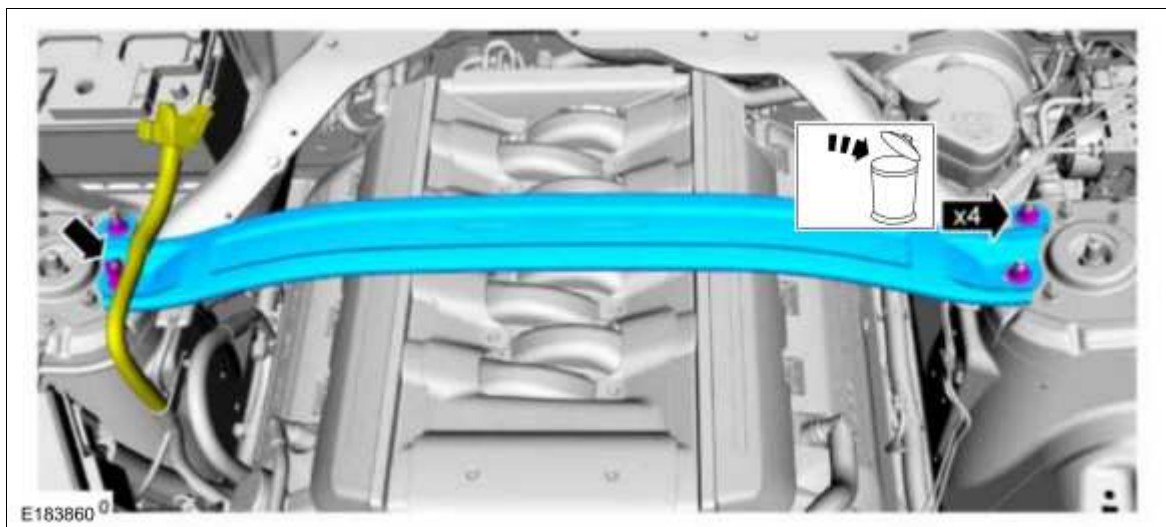
Copyright © 2016 Ford Motor Company

**Exhaust Manifold RH**Base Part Number: [9431](#)**Special Tool(s) / General Equipment**

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine

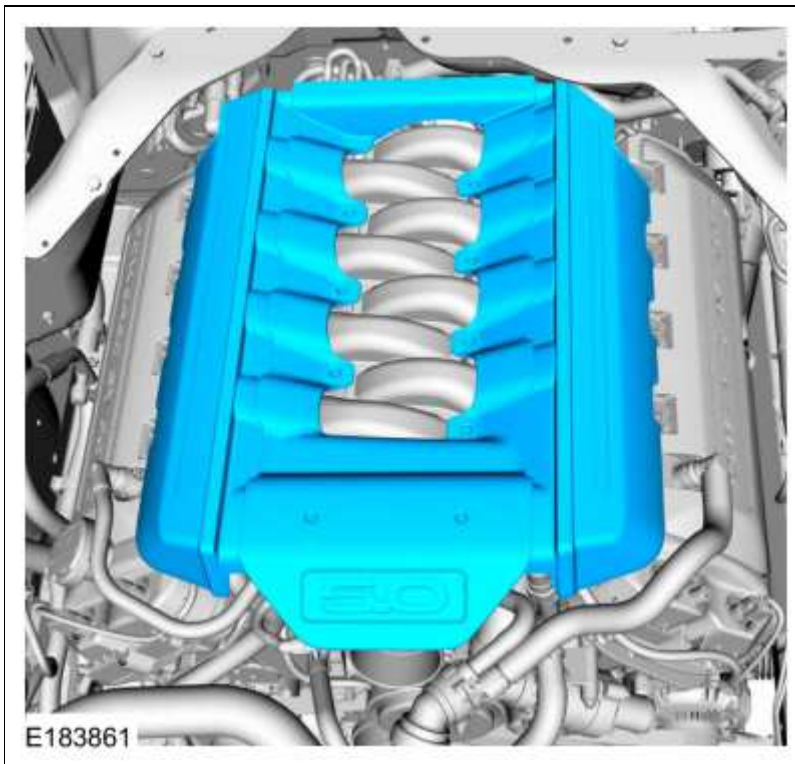
Removal**6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82**

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Recover the refrigerant.
Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
3. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.

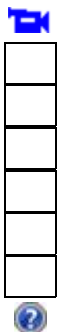
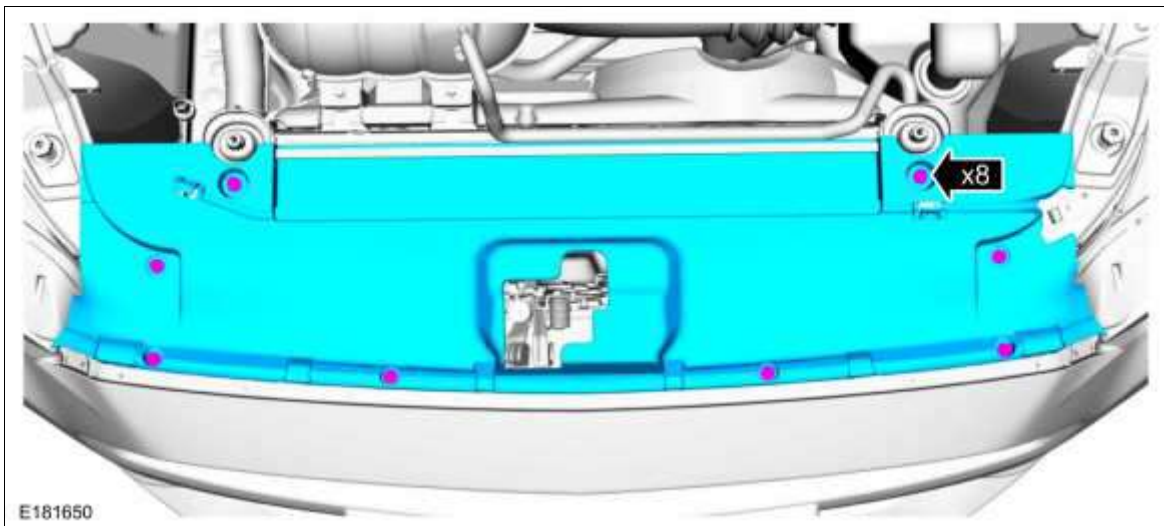


5. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Remove the engine appearance cover.

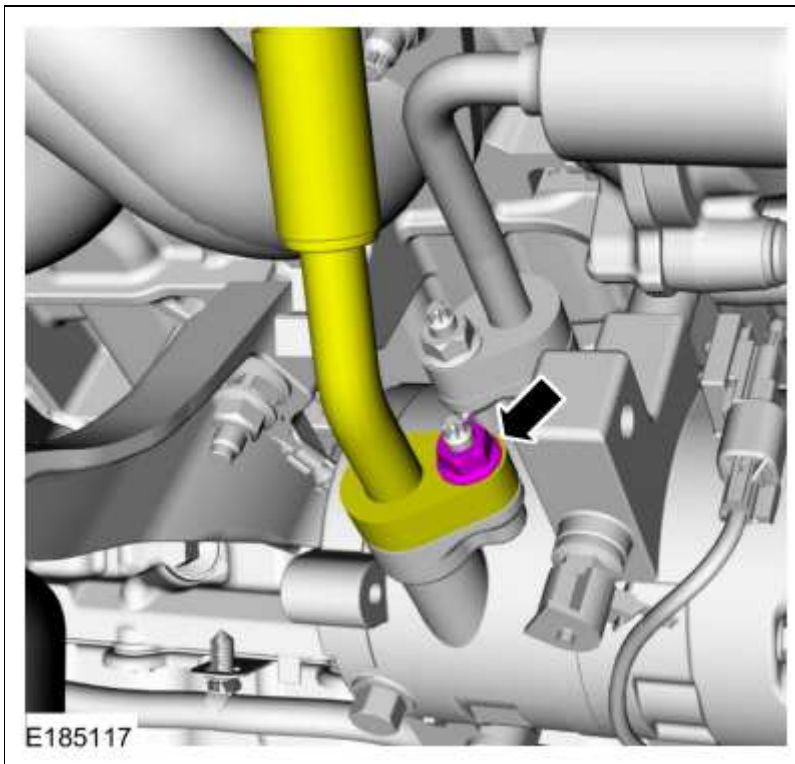


6. Remove the retainers and the radiator top shield.



7. **NOTE:** Discard the O-ring seal and gasket.

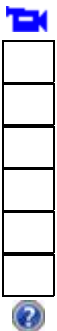
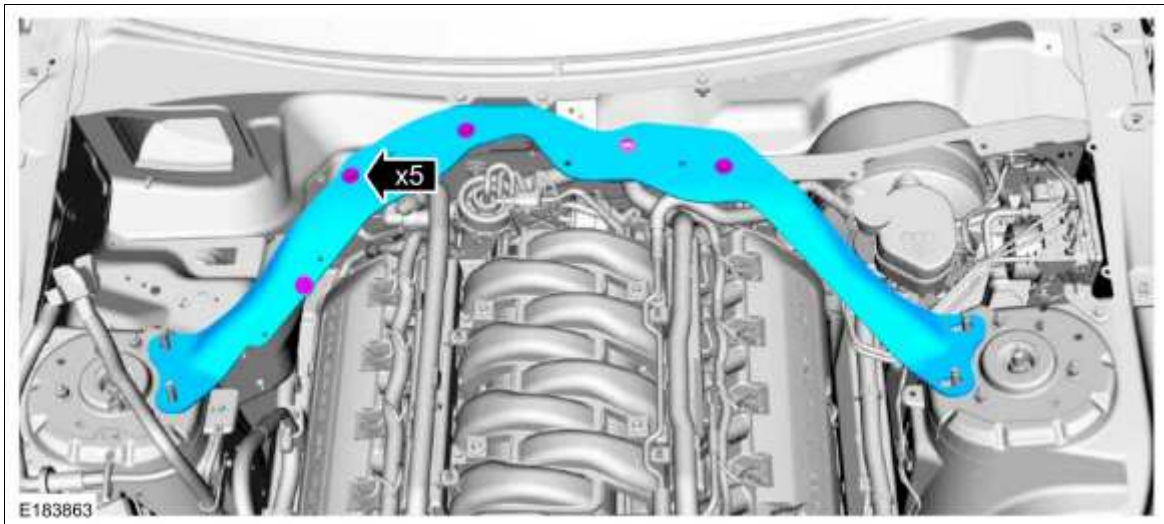
Remove the nut and disconnect the A/C compressor fitting.



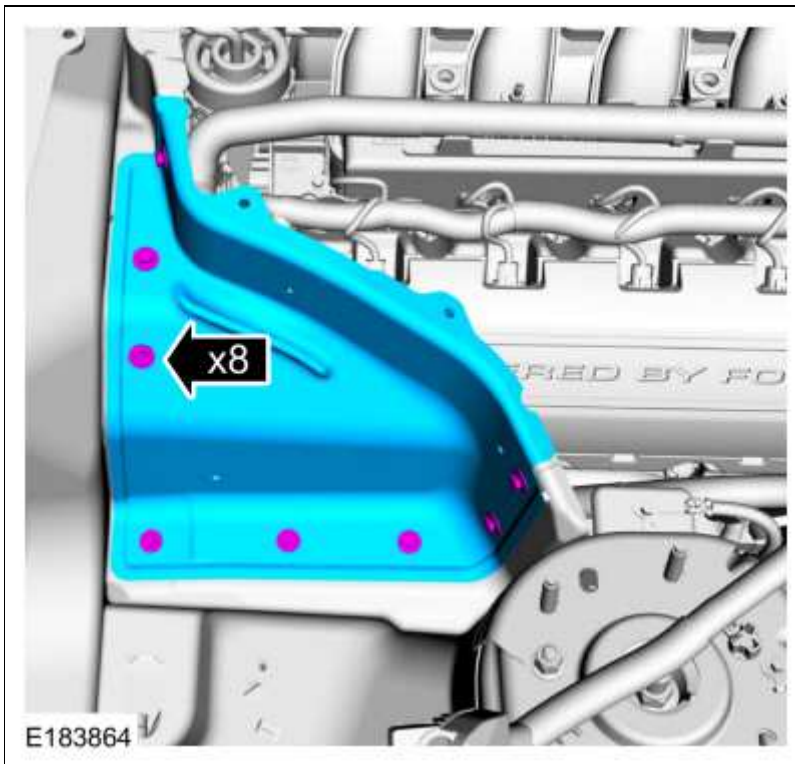
8. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

9. Remove the fasteners and the cowl extension.

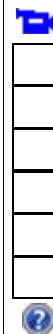
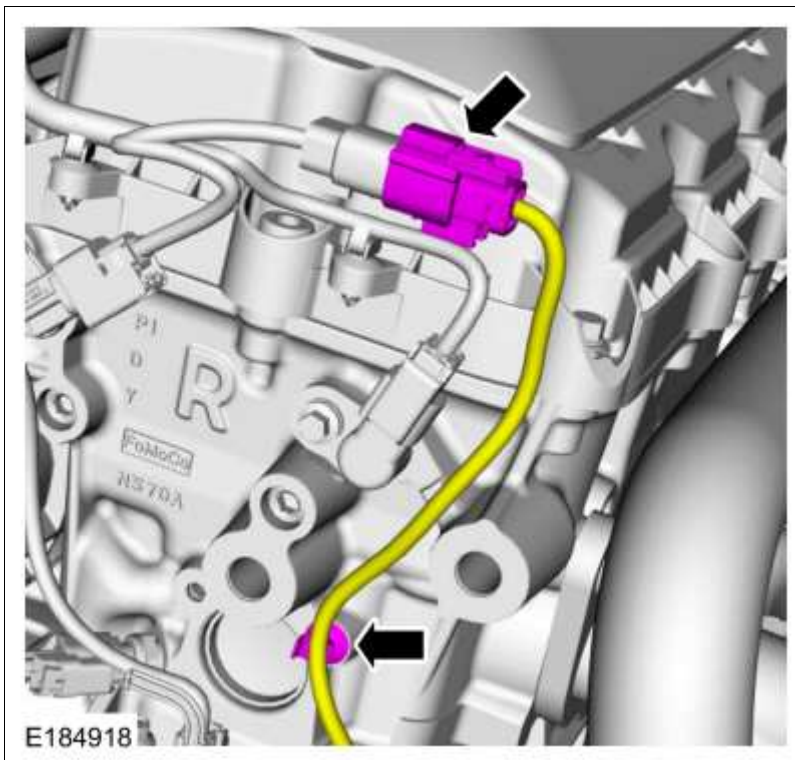


10. Remove the fasteners and the battery heat shield.



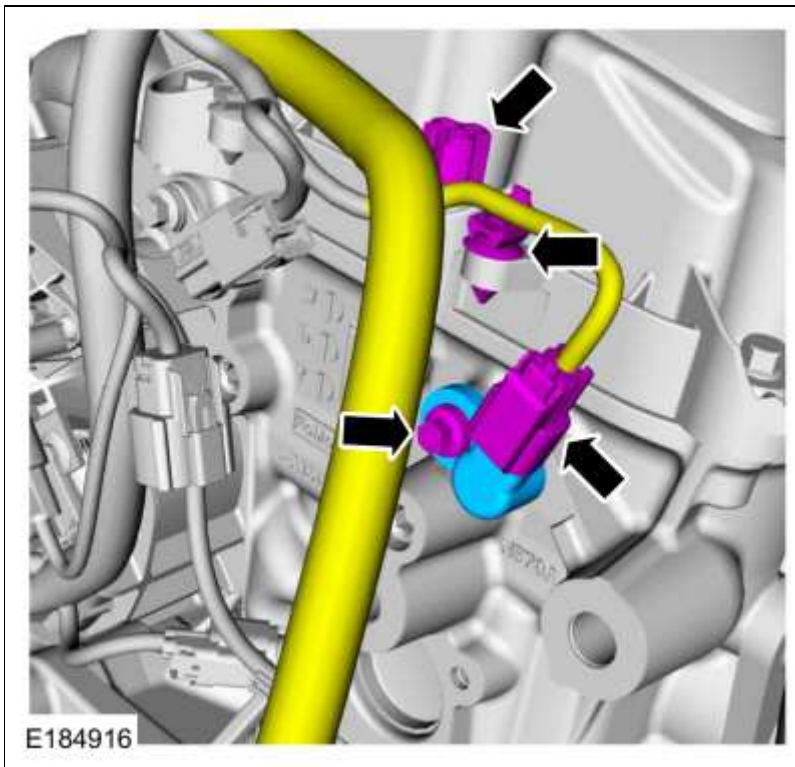
6-Speed Manual Transmission - MT82

11. Disconnect the HO2S electrical connector and wiring harness retainer.

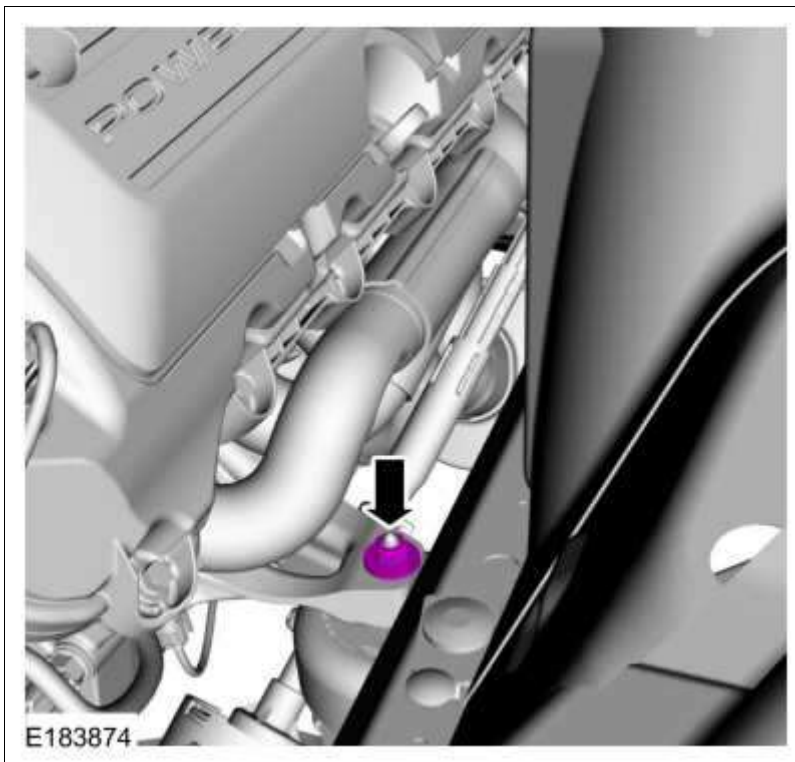


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

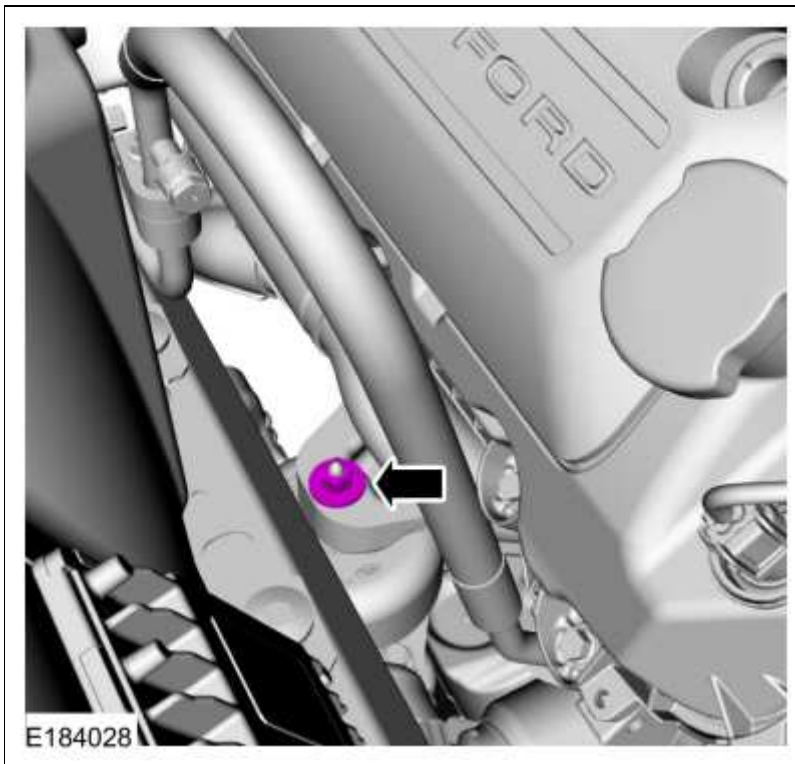
12.
 - Disconnect the CMP sensor electrical connector, the wiring harness retainers and position the harness aside.
 - Remove the bolt and the CMP sensor.



13. Remove the LH engine mount nut.



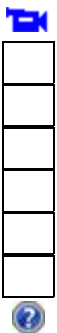
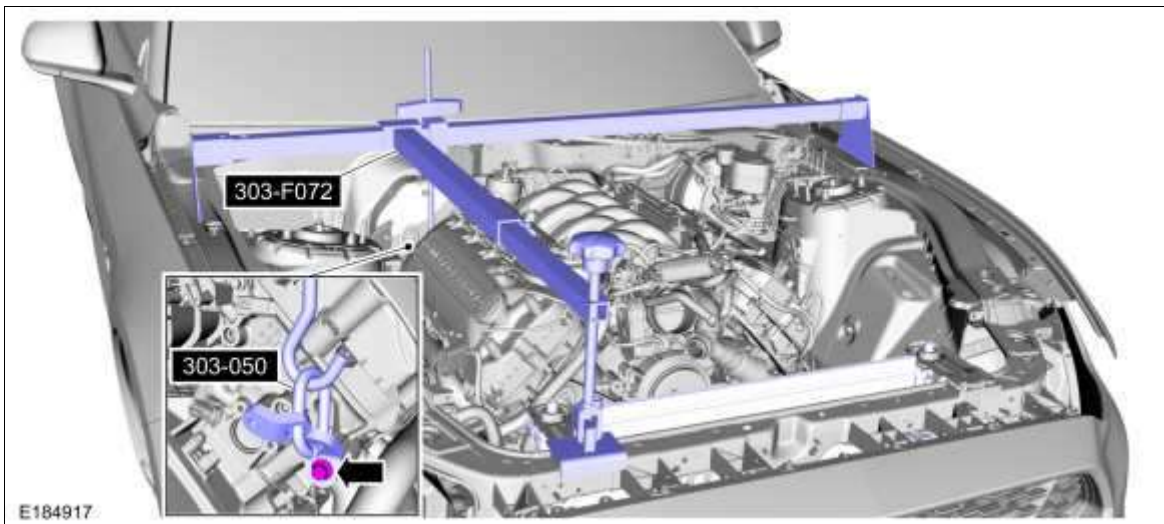
14. Remove the RH engine mount nut.



15. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

Install the special tools and raise the engine 50 mm (2 inch).

Use Special Service Tool: [303-F072 Support Bar, Engine](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine](#).

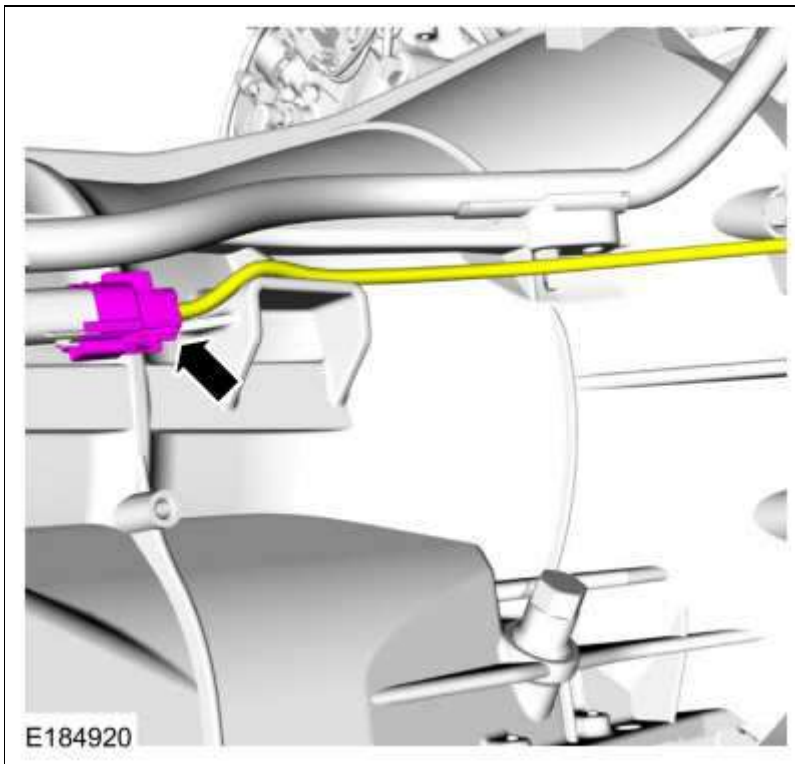


16. Remove the following items:

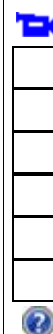
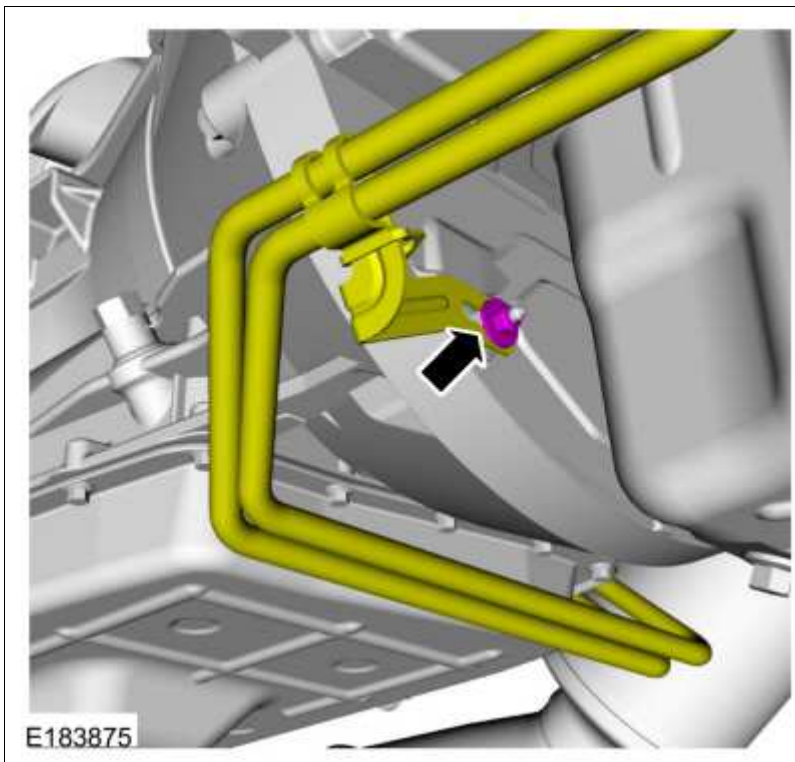
1. Refer to: [Catalytic Converter RH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Starter Motor](#) (303-06C Starting System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

6-Speed Automatic Transmission - 6R80

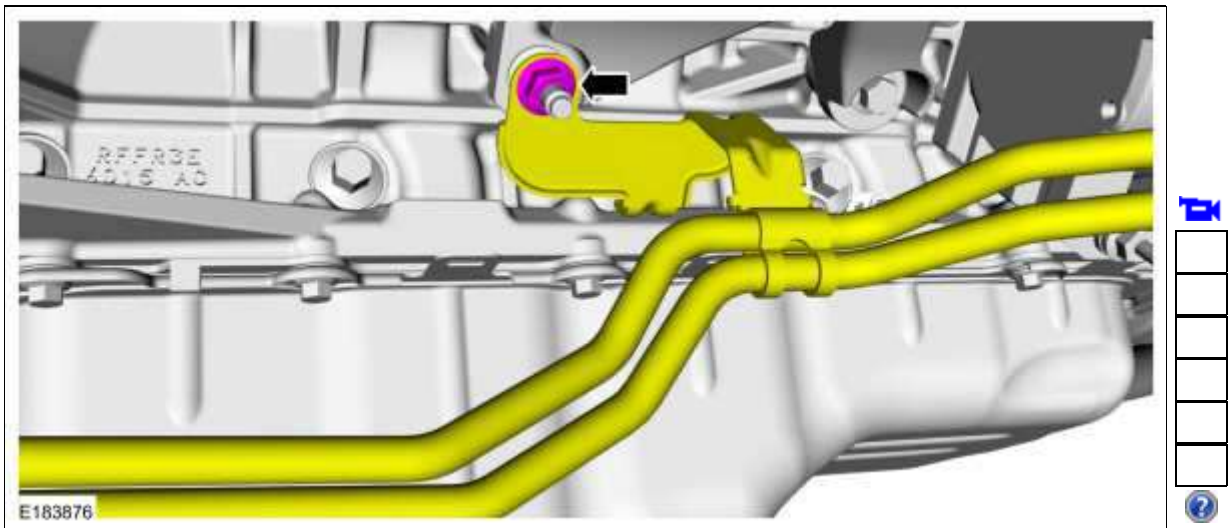
17. Disconnect the HO2S electrical connector.



18. Remove the transmission cooling tube nut and bracket from the flexplate inspection cover stud bolt.

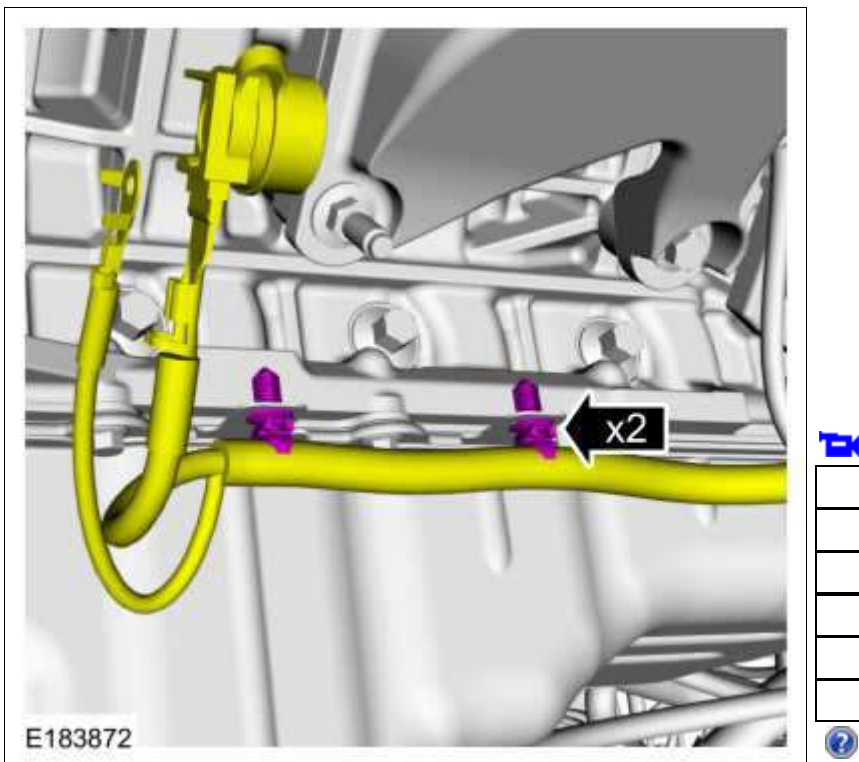


19. Remove the transmission cooling tube bracket nut and position the bracket and tubes aside.

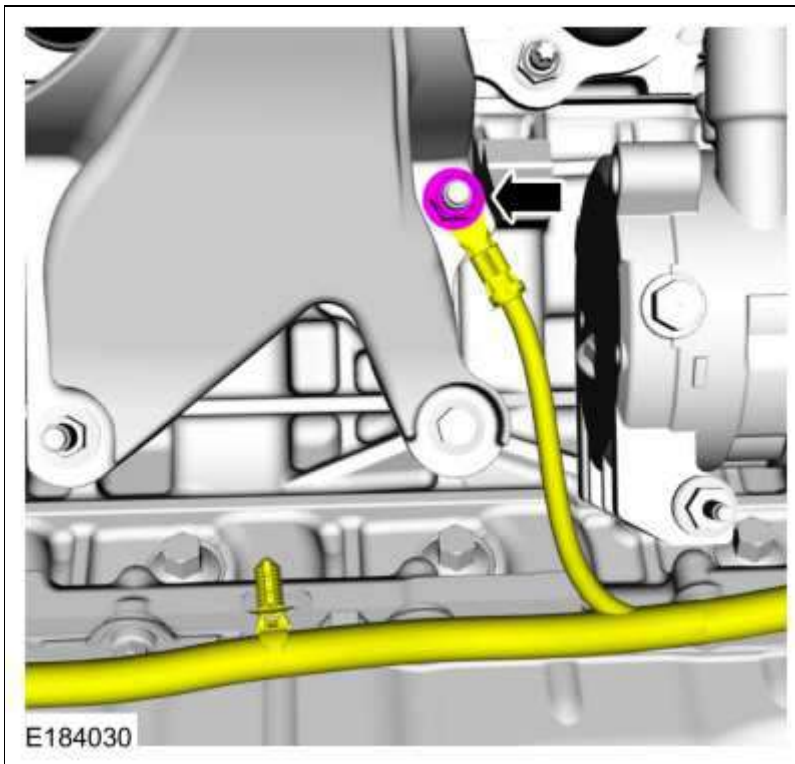


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

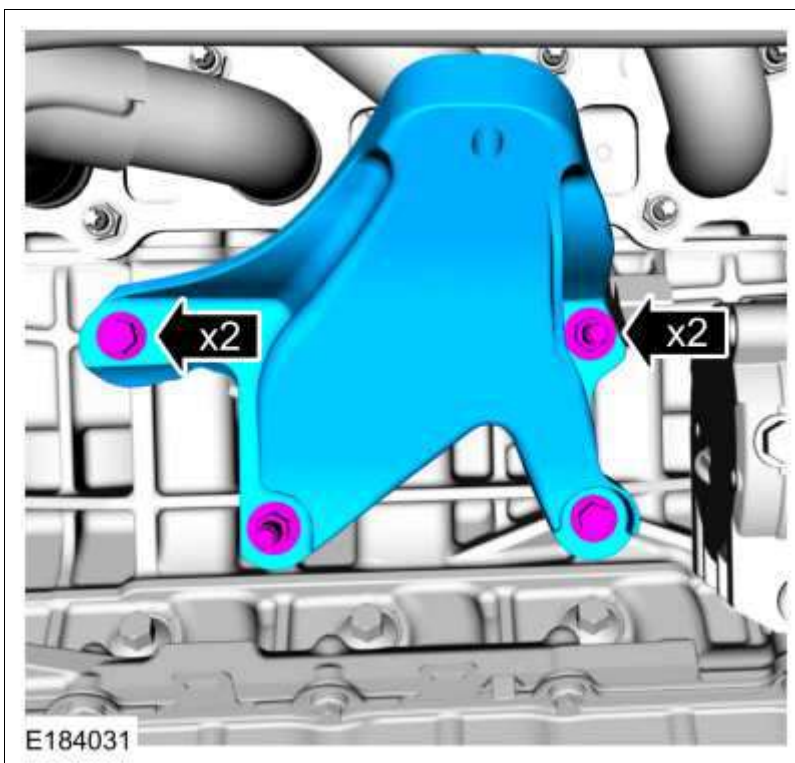
20. Detach the wiring harness retainers from the oil pan.



21. Remove the nut and ground strap from the RH engine mount bracket stud bolt.



22. Remove the bolts, the stud bolts and the RH engine mount bracket.

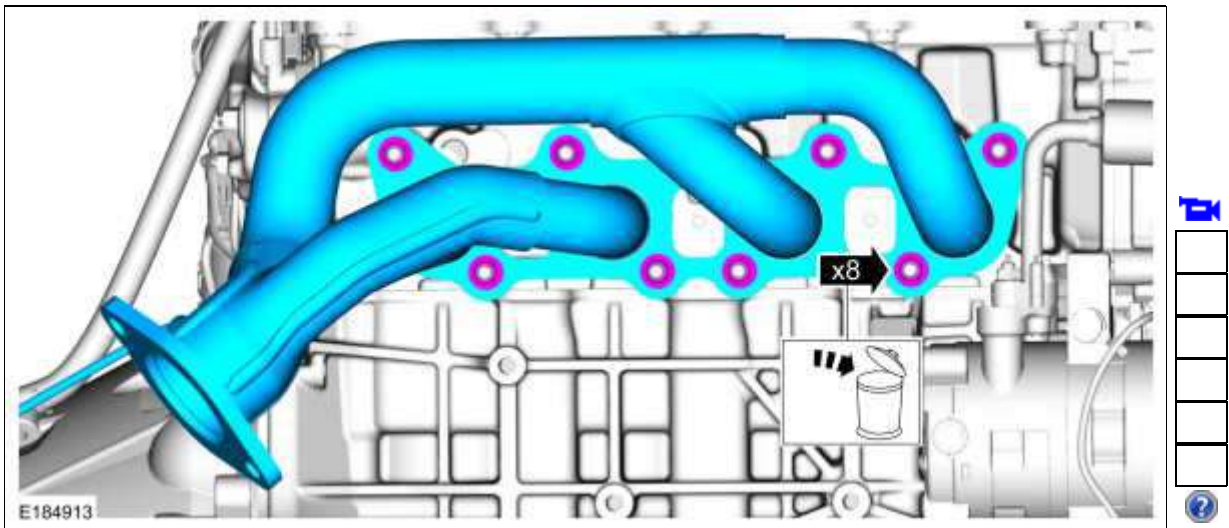


23.

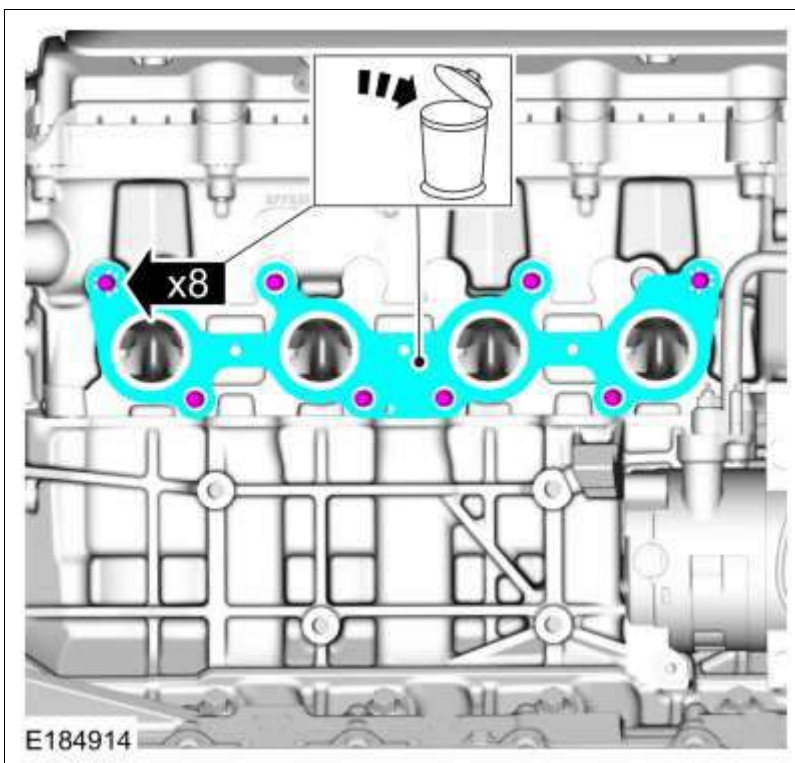
Remove and discard the nuts.

- Remove the exhaust manifold.
- Clean and inspect the exhaust manifold.

Refer to: [Exhaust Manifold Cleaning and Inspection](#) (303-00 Engine System - General Information, General Procedures).



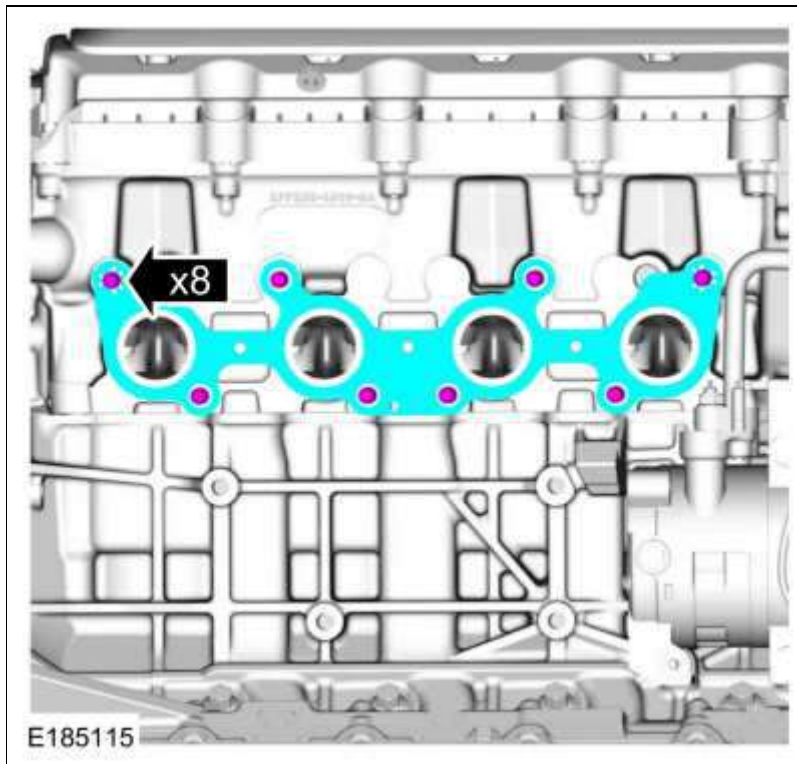
24. Remove and discard the gasket and studs.



Installation

6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

1. Install new studs and new gasket.
Torque: 18 lb.ft (25 Nm)

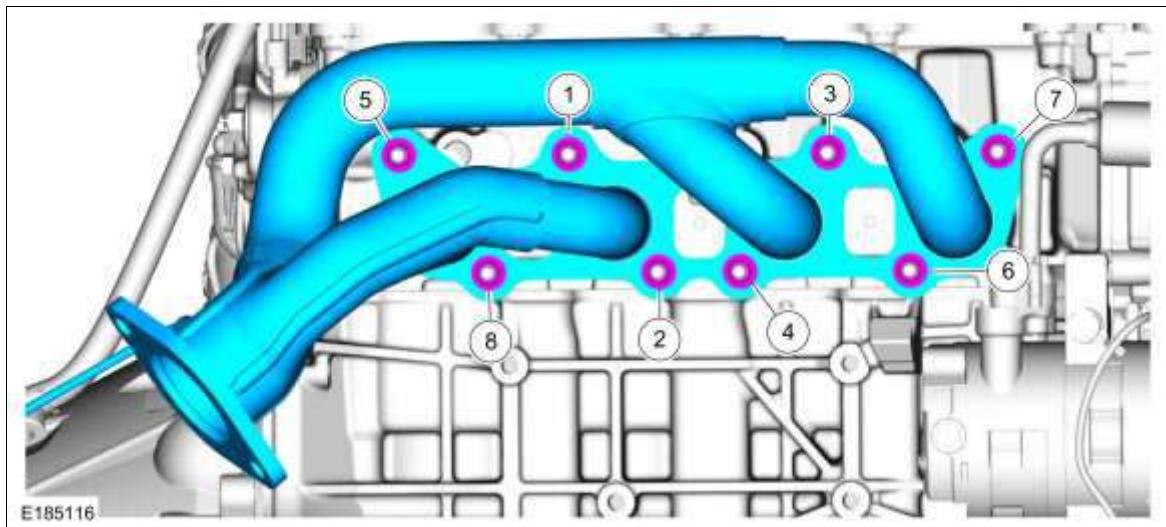


2. Install the exhaust manifold.
 - Install the new nuts.

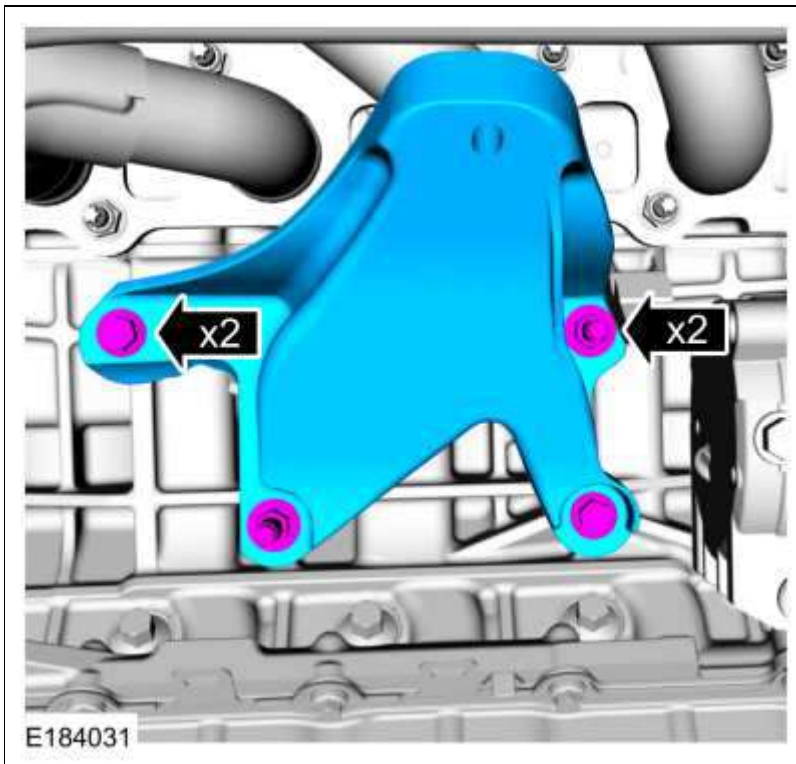
Torque:

Stage 1: 18 lb.ft (24 Nm)

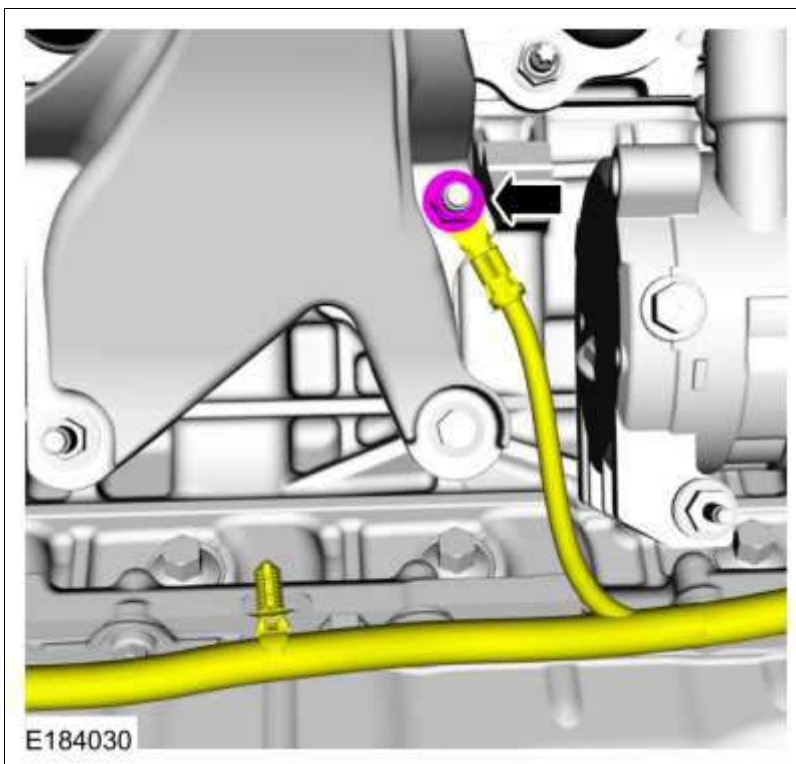
Stage 2: 24 lb.ft (32 Nm)



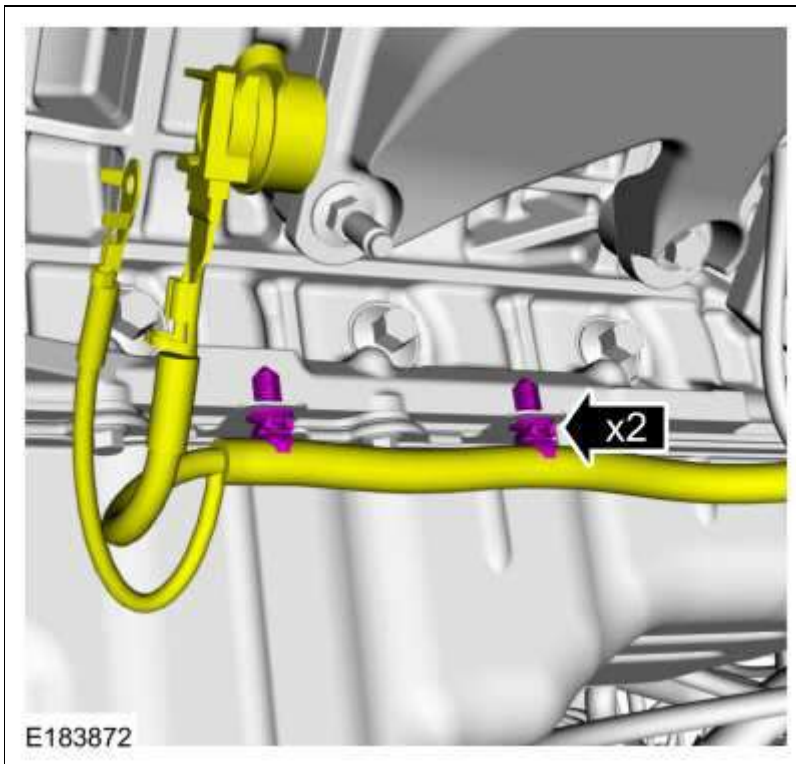
3. Install the RH engine mount bracket, bolts and stud bolts.
- Torque:* 41 lb.ft (55 Nm)



4. Install the ground strap and nut onto the RH engine mount bracket stud bolt.
Torque: 35 lb.ft (48 Nm)

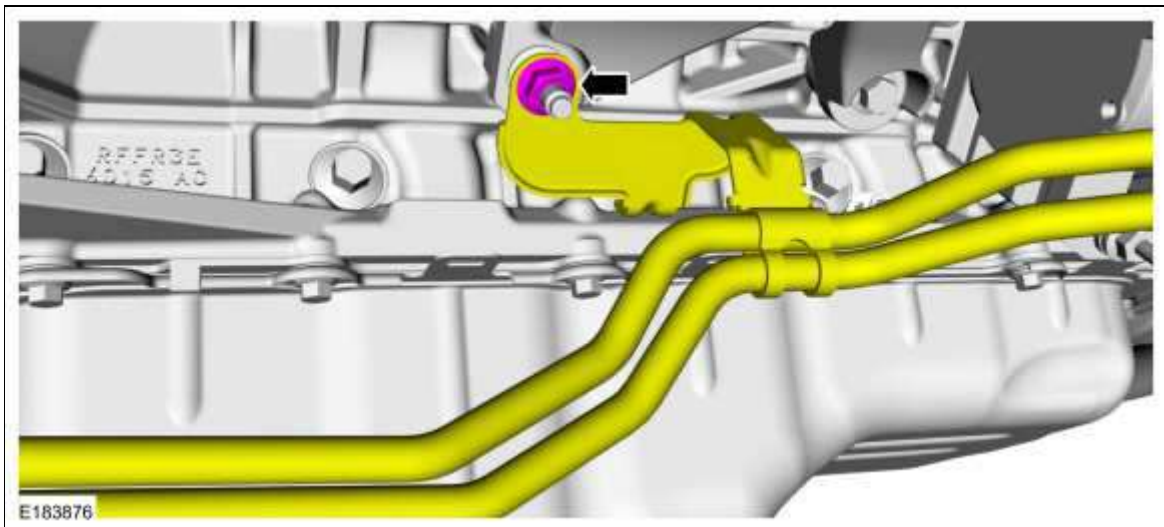


5. Attach the wiring harness retainers to the oil pan.

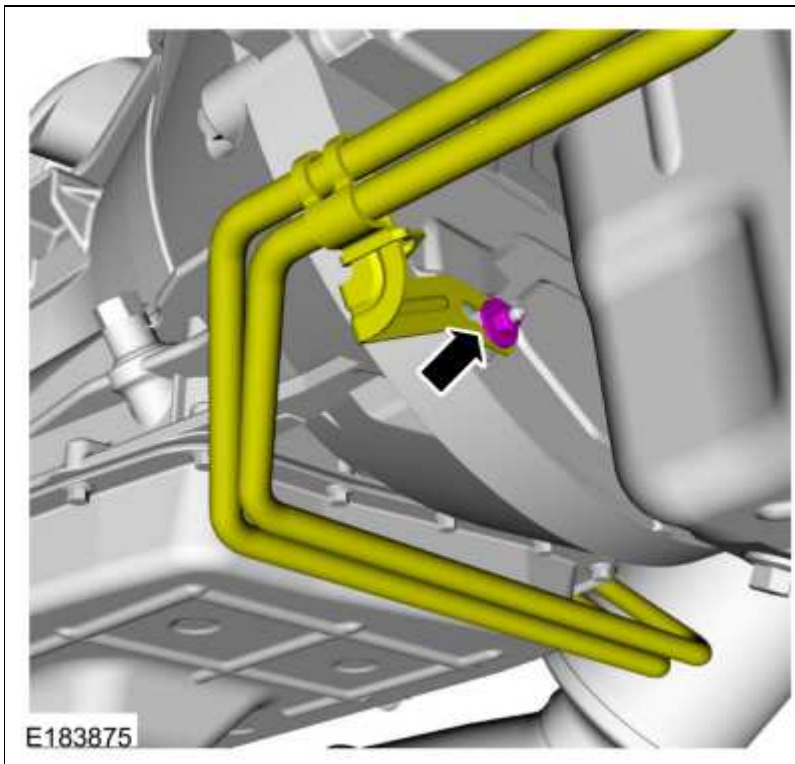


6-Speed Automatic Transmission - 6R80

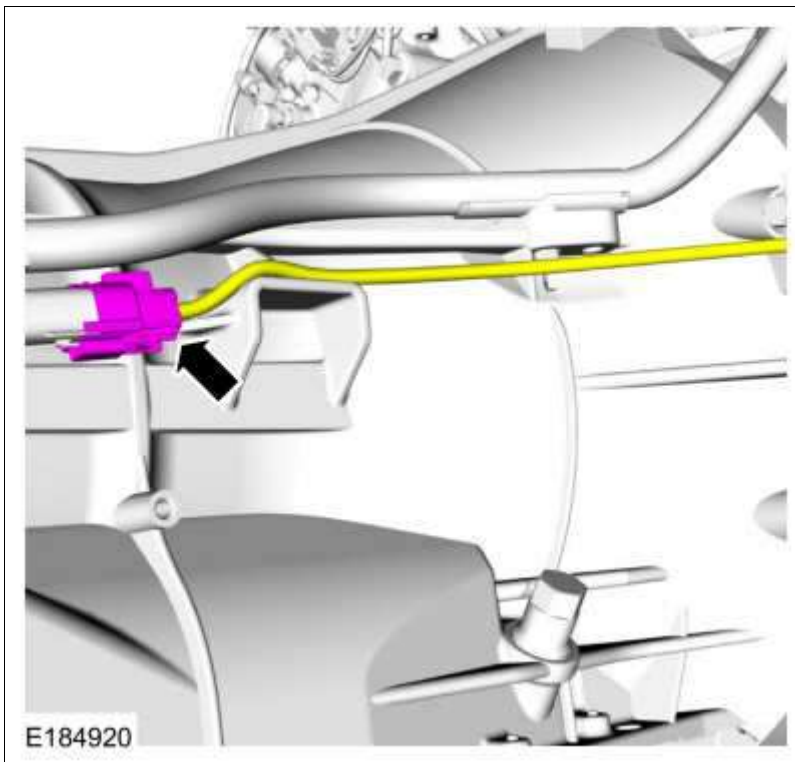
6. Install the transmission cooling tube bracket and nut.
Torque: 35 lb.ft (48 Nm)



7. Install the transmission cooling tube bracket and nut.
Torque: 124 lb.in (14 Nm)



8. Connect the HO2S electrical connector.



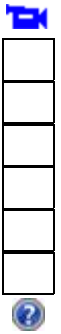
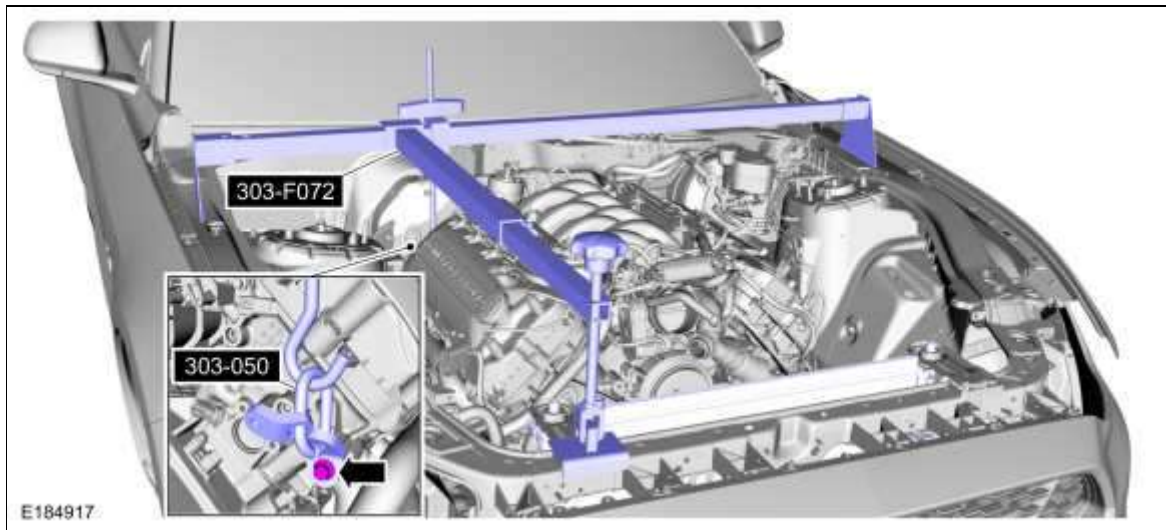
6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

9. Install the following items:

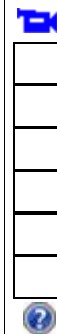
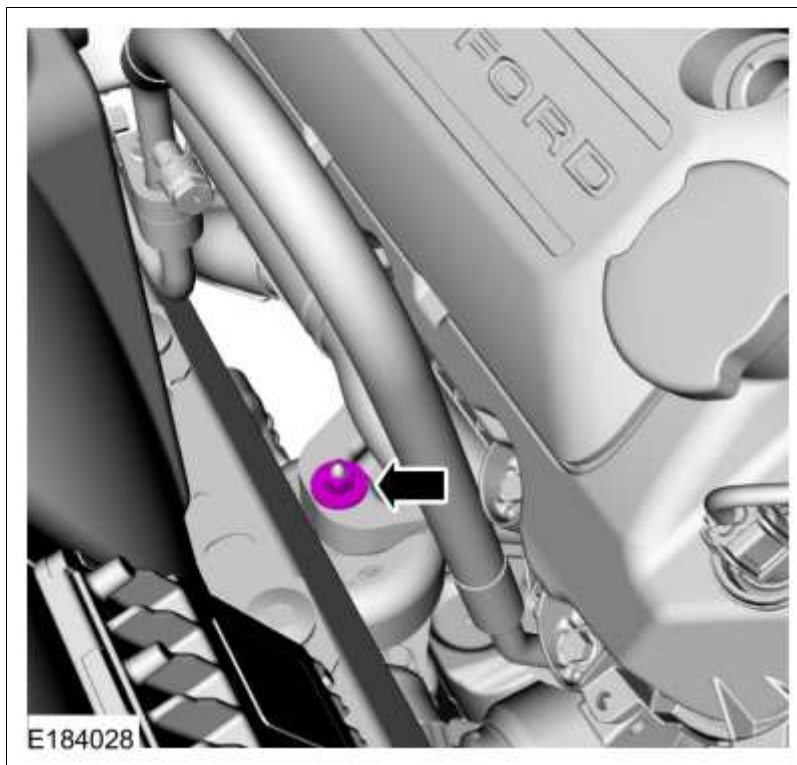
1. Refer to: [Starter Motor](#) (303-06C Starting System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Catalytic Converter RH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

10. Lower the engine onto the engine mounts and remove the special tools

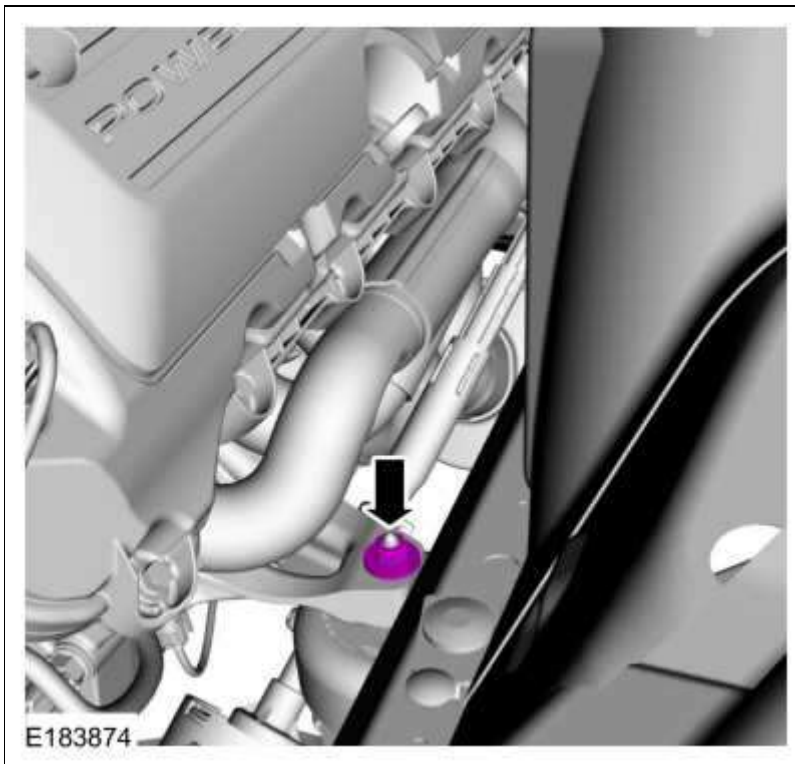
Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)



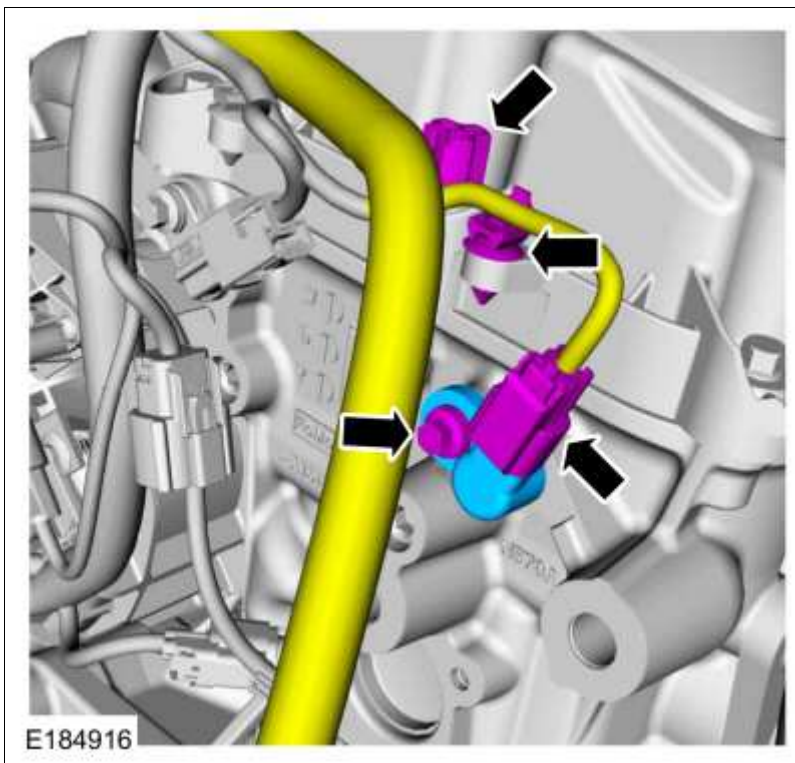
11. Install the RH engine mount nut.
Torque: 46 lb.ft (63 Nm)



12. Install the LH engine mount nut.
Torque: 46 lb.ft (63 Nm)

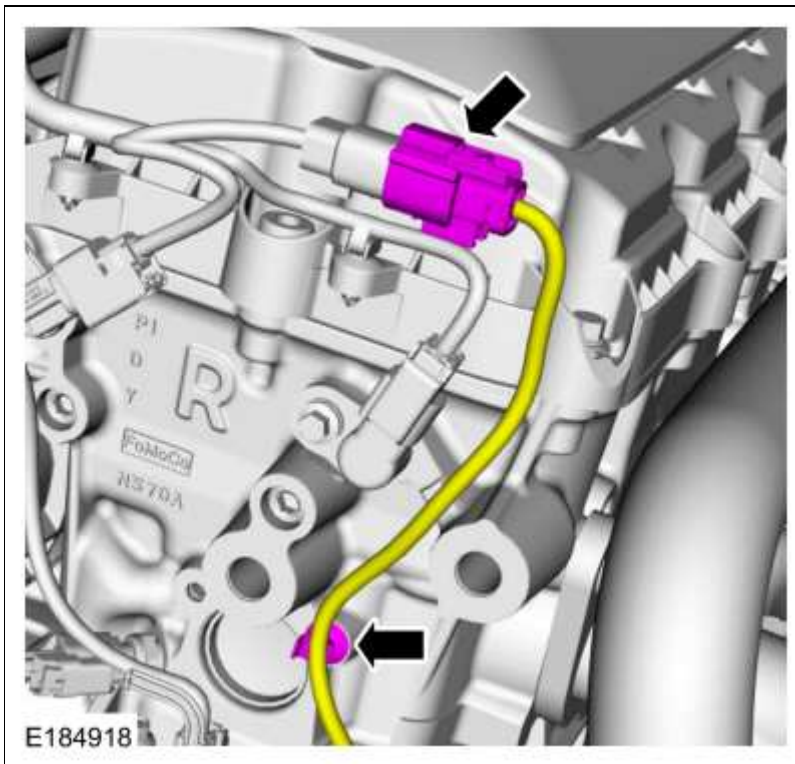


- 13.
- Install the CMP sensor and the bolt.
Torque: 89 lb.in (10 Nm)
 - Connect the CMP sensor electrical connector and the wiring harness retainers.



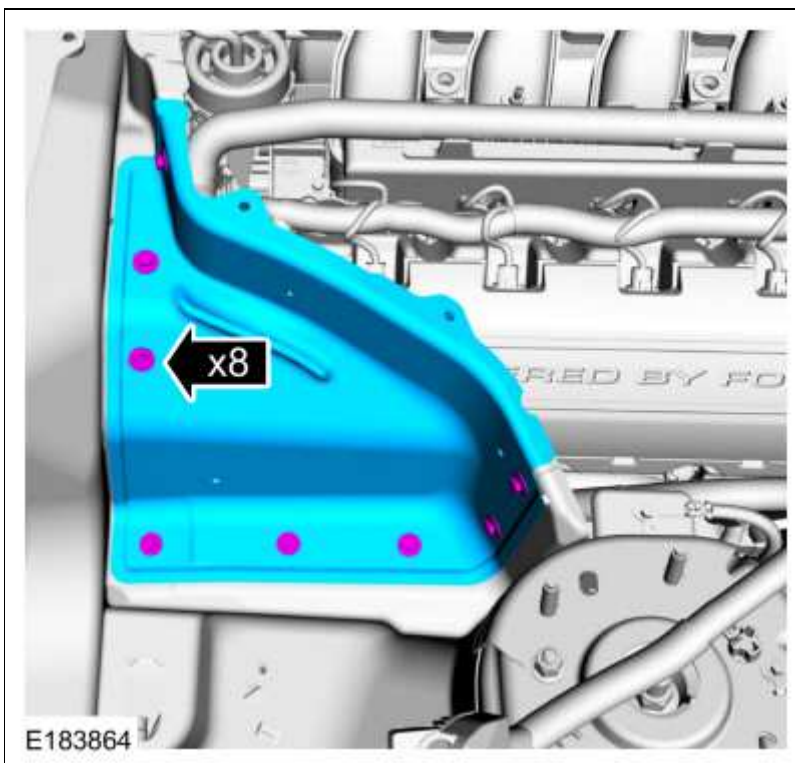
6-Speed Manual Transmission - MT82

14. Connect the HO2S electrical connector and wiring harness retainer.

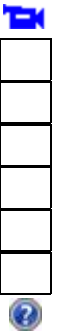
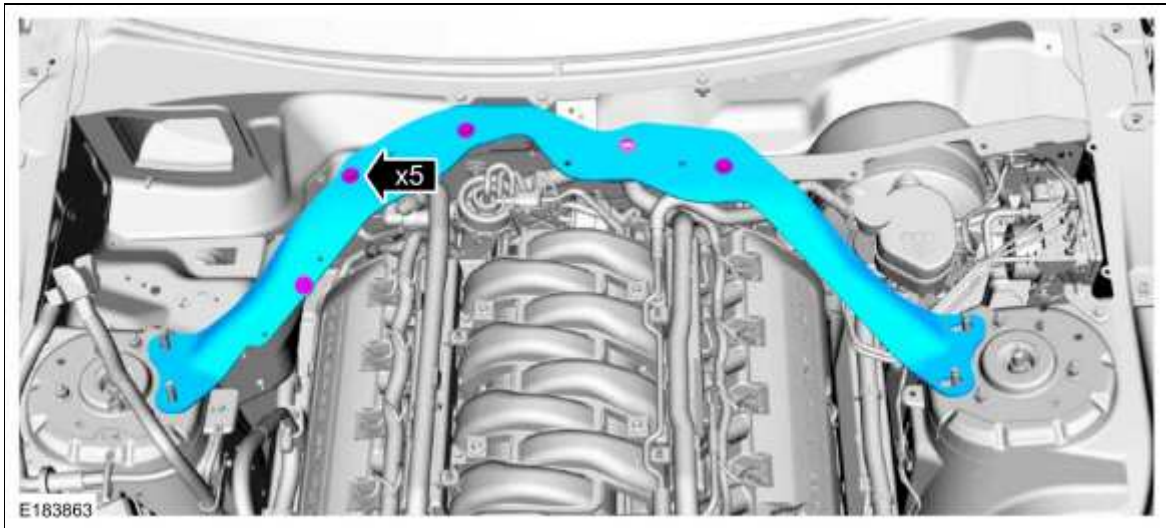


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

15. Install the battery heat shield and fasteners.
Torque: 80 lb.in (9 Nm)



16. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)

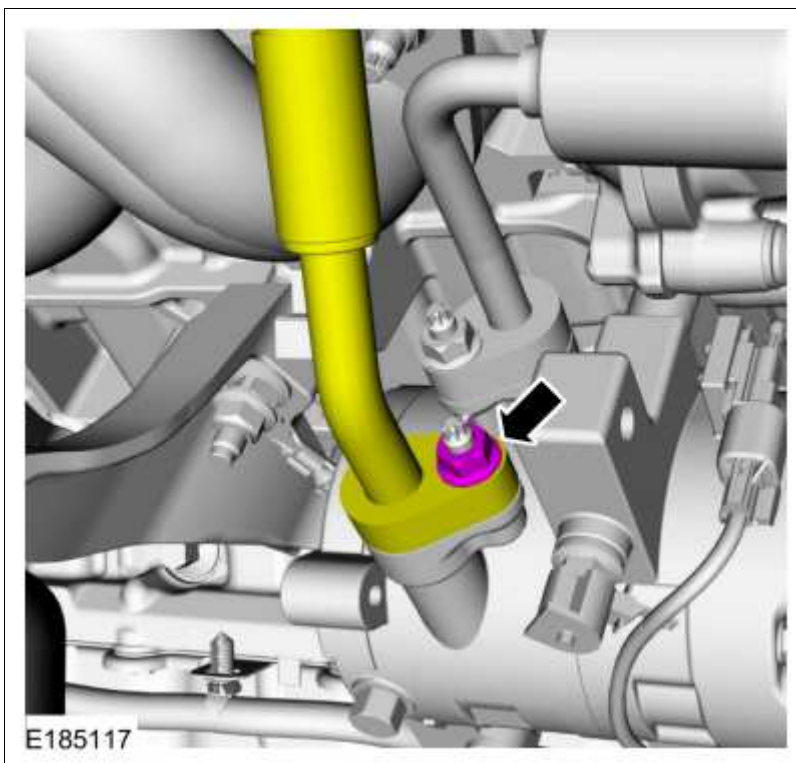


17. Install the following items:

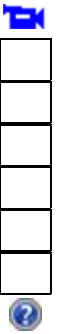
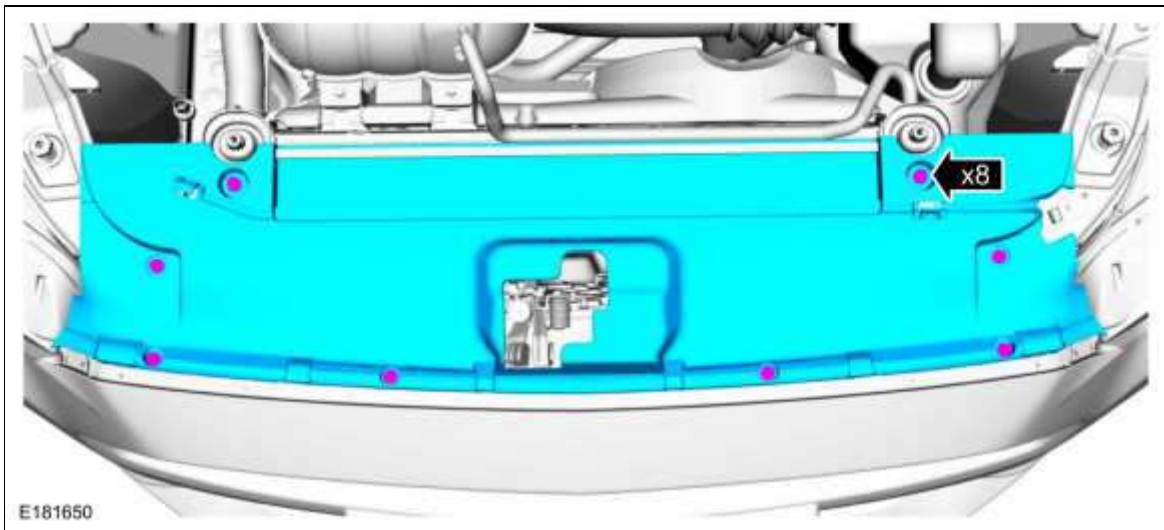
1. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

18. **NOTE:** Install a new O-ring seal and gasket.

Connect the A/C compressor fitting and install the nut.
Torque: 133 lb.in (15 Nm)

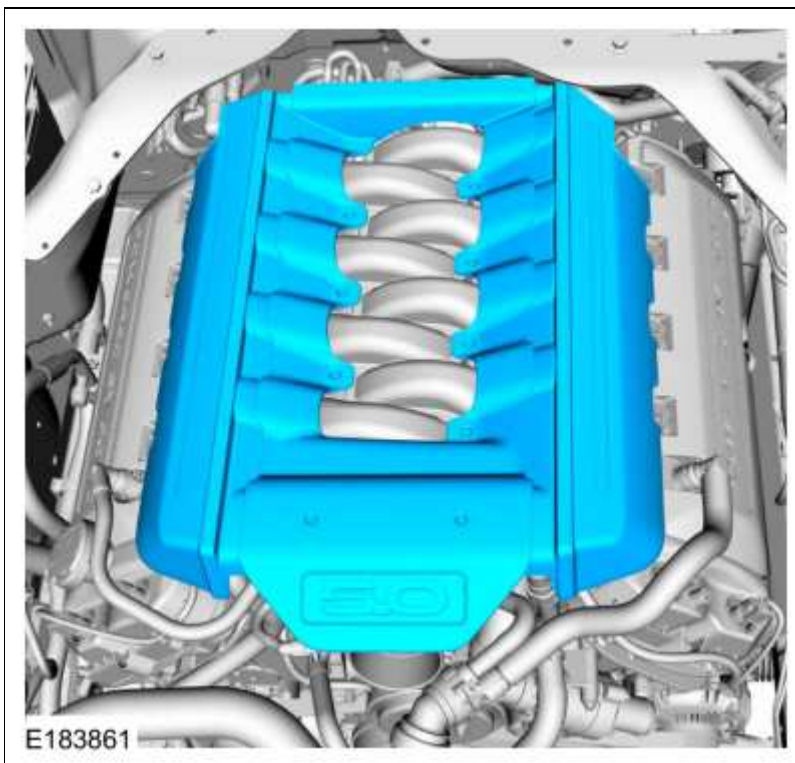


19. Install the radiator top shield and the retainers.

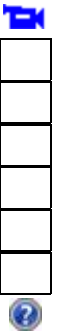
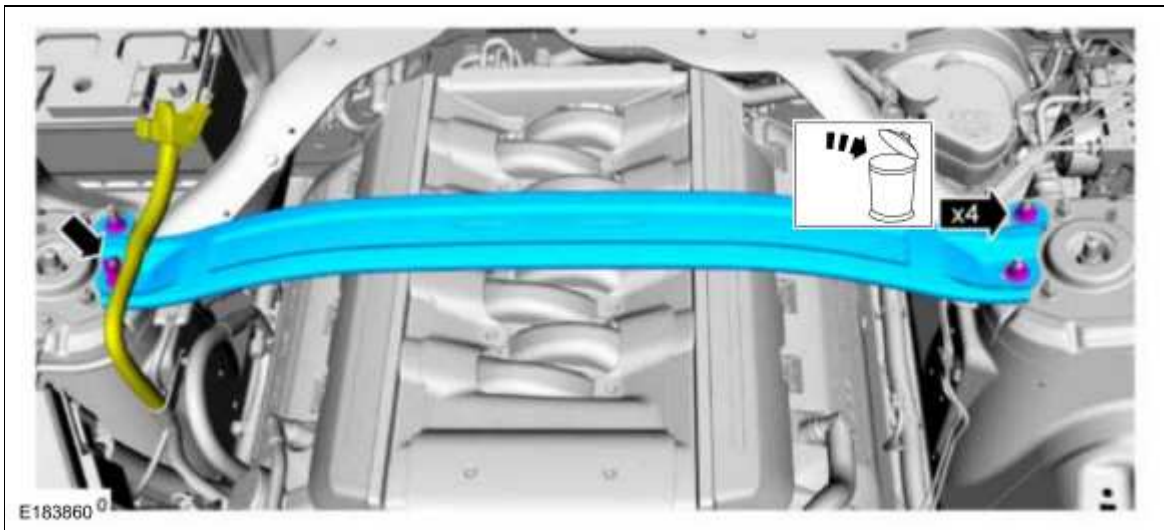


20. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.



- 21.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



22. Connect the battery ground and positive cables.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

23. Recharge the A/C system.

Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

Flexplate

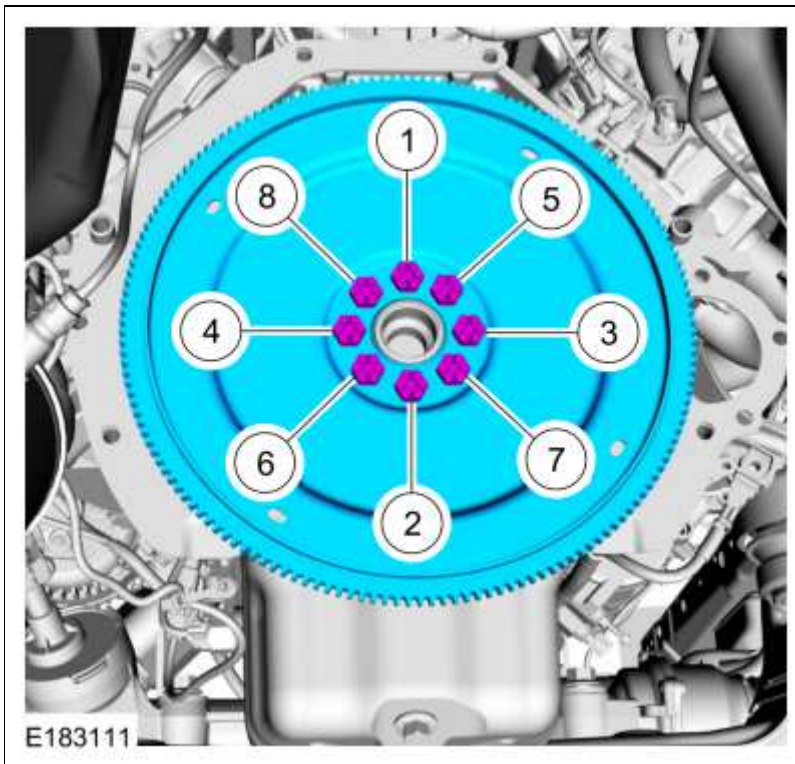
Removal

1. Remove the transmission.
Refer to: [Transmission - 5.0L 32V Ti-VCT](#) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
2. **NOTE:** *The flexplate bolts are torque-to-yield design and are not reusable.*
 - Remove and discard the bolts.
 - Remove and discard the bolts.
 - Remove the flexplate.



Installation

1. Install the flexplate and the bolts.
Torque:
Stage 1: 177 lb.in (20 Nm)
Stage 2: 60°



2. Install the transmission.

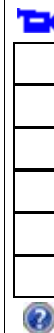
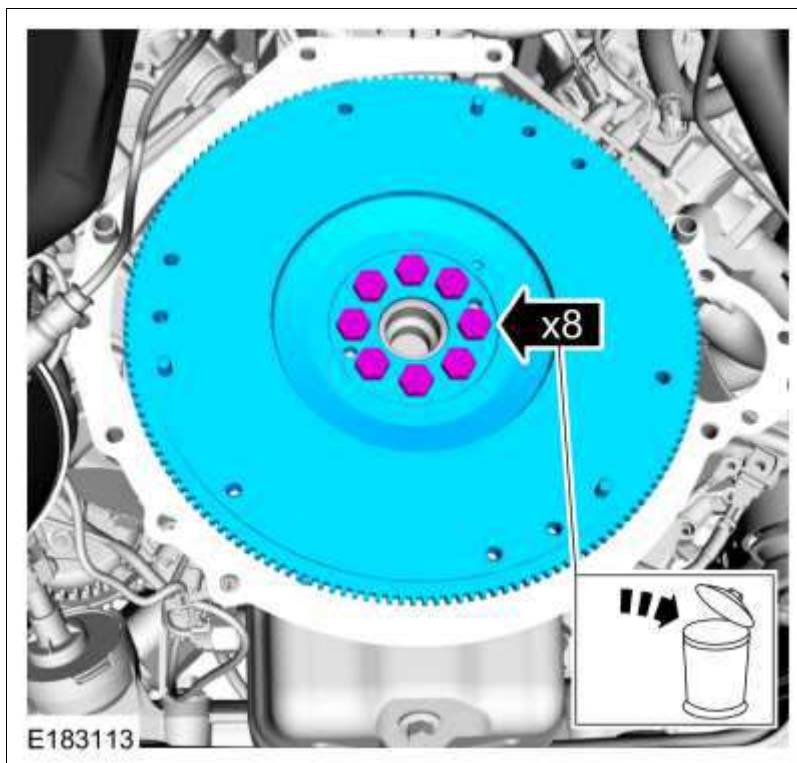
Refer to: [Transmission - 5.0L 32V Ti-VCT](#) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).

3. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.

Flywheel

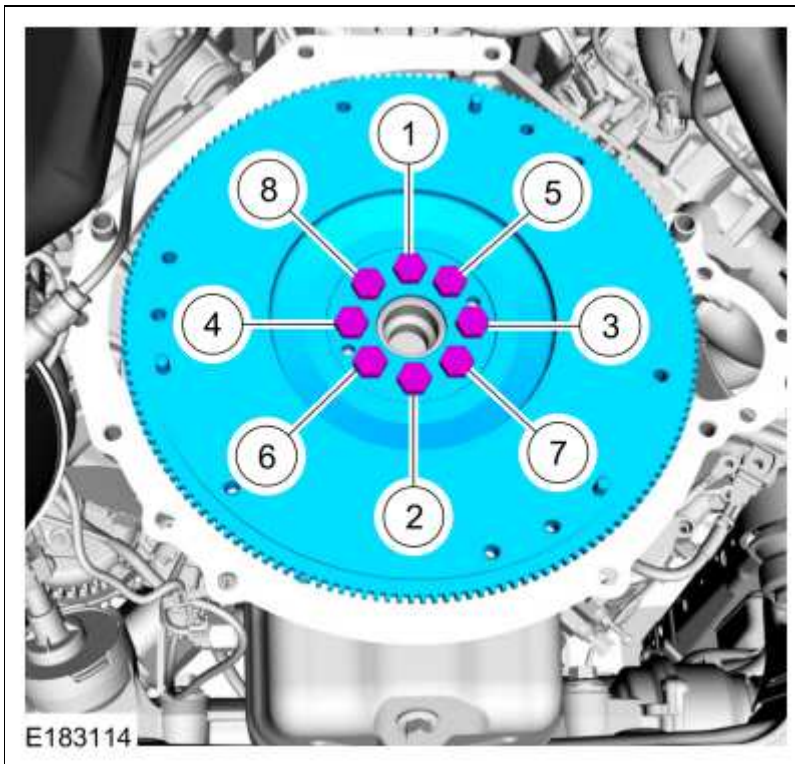
Removal

1. Remove the clutch disc.
Refer to: [Clutch Disc and Pressure Plate - 5.0L 32V Ti-VCT](#) (308-01 Clutch, Removal and Installation).
2. **NOTE:** *The flywheel bolts are torque-to-yield design and are not reusable.*
 - Remove and discard the bolts.
 - Remove the flywheel.



Installation

1. Install the flywheel and the bolts.
Torque:
 - Stage 1: 89 lb.in (10 Nm)
 - Stage 2: 177 lb.in (20 Nm)
 - Stage 3: 60°



2. Install the clutch disc.
Refer to: [Clutch Disc and Pressure Plate - 5.0L 32V Ti-VCT](#) (308-01 Clutch, Removal and Installation).
3. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.



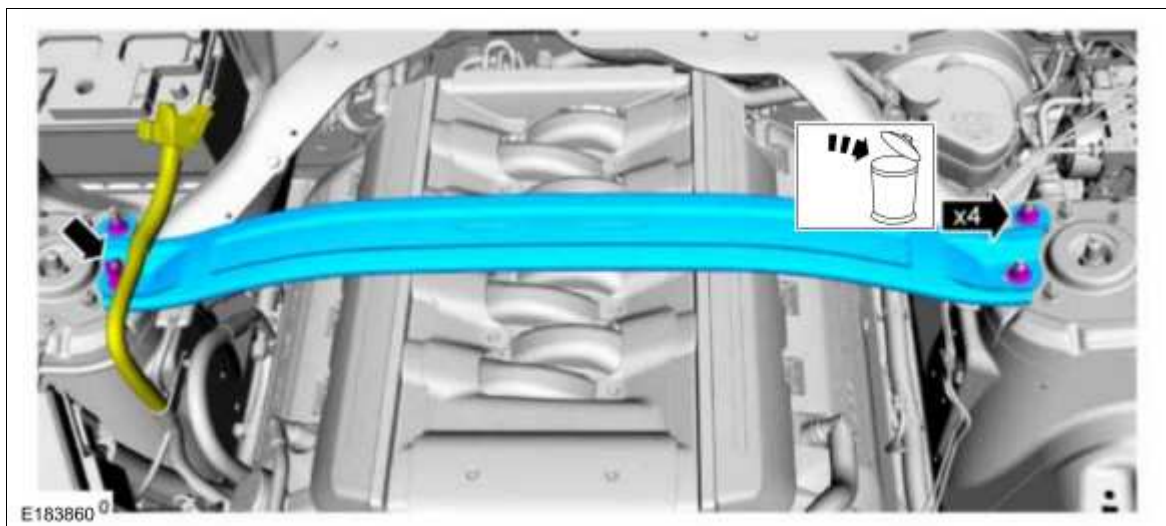
Intake Manifold

Base Part Number: [9424](#)

Removal

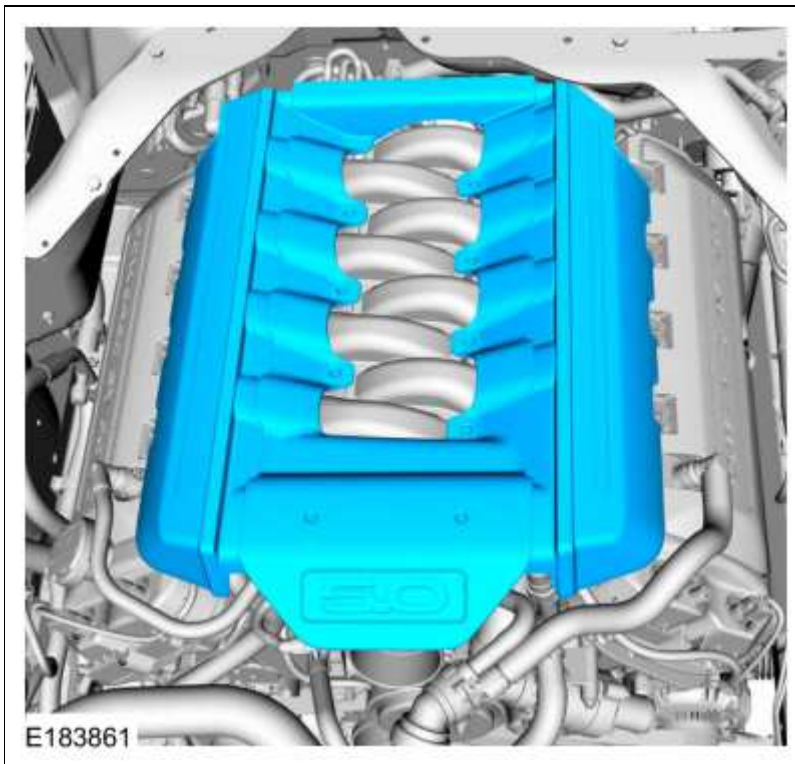
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
2. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.



4. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

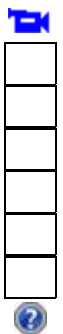
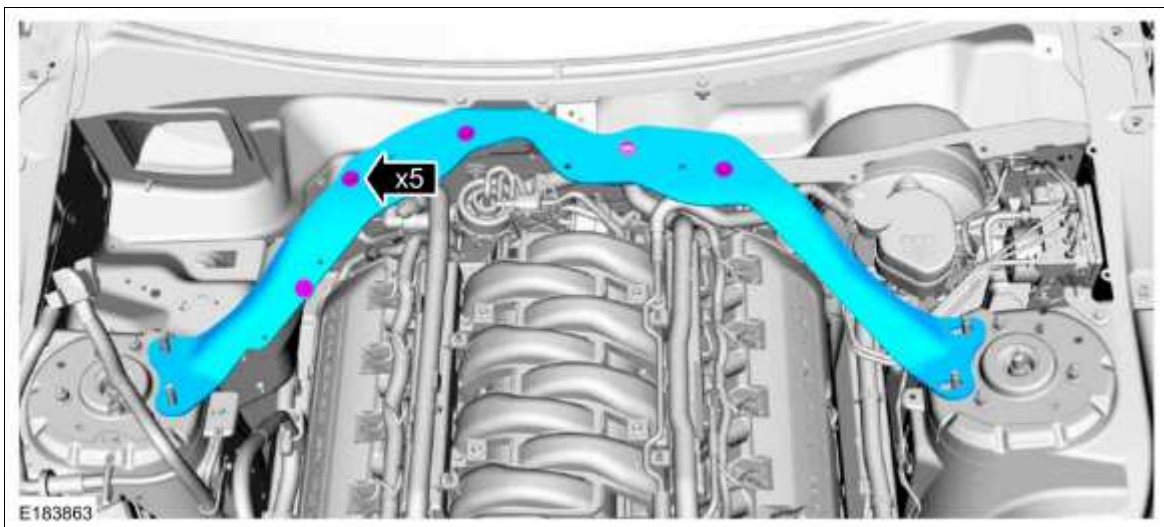
Remove the engine appearance cover.



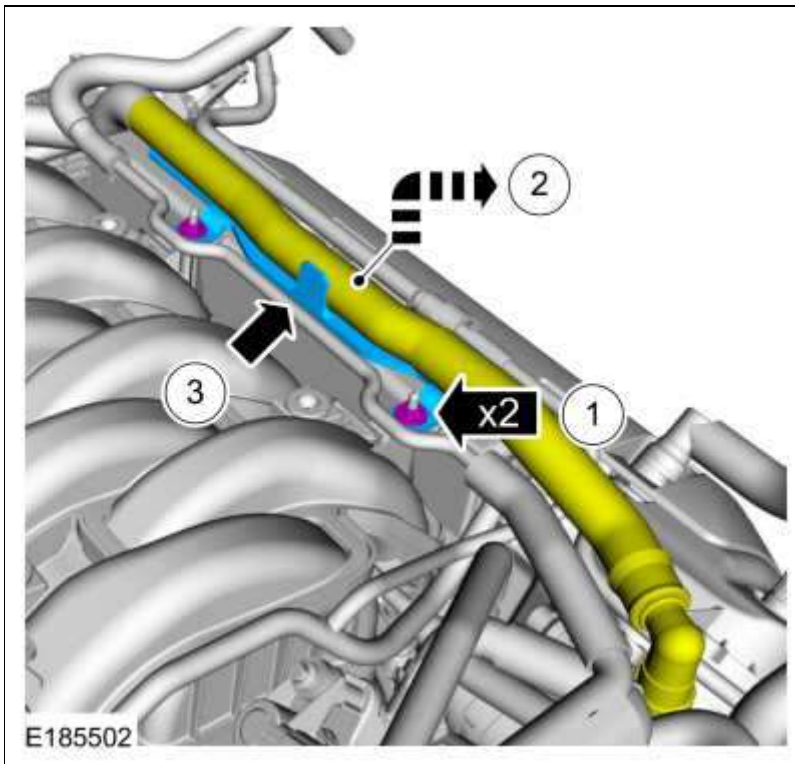
5. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

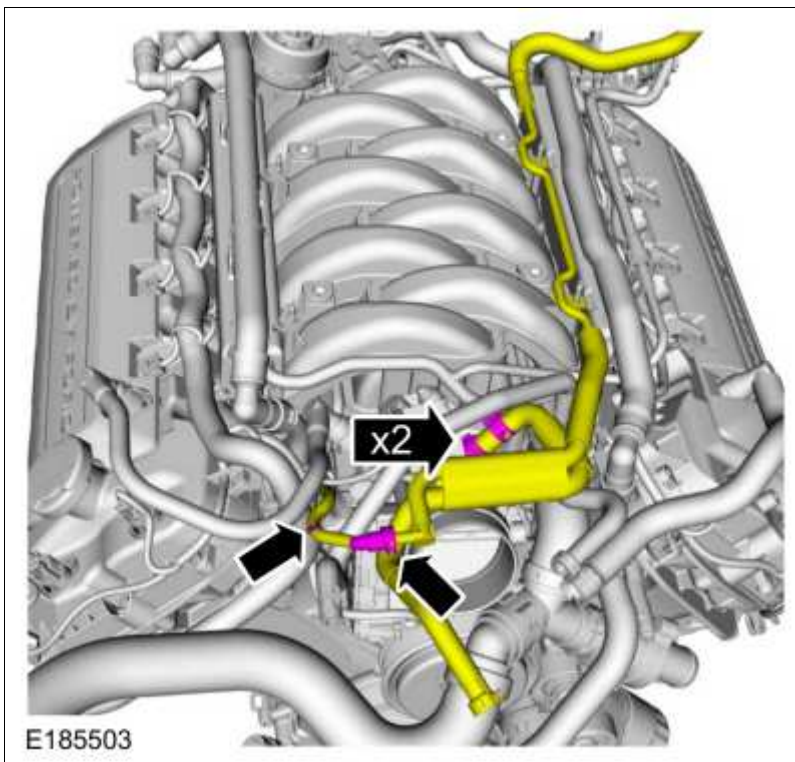
6. Remove the fasteners and the cowl extension.



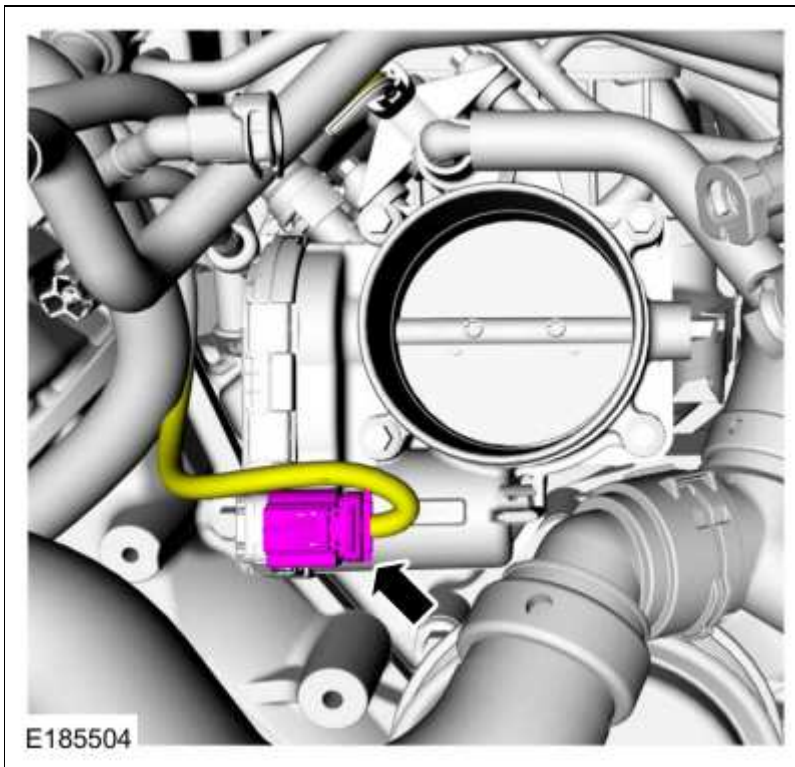
7.
 1. Remove the nuts.
 2. Position the heater hose aside.
 3. Remove the heater hose support.



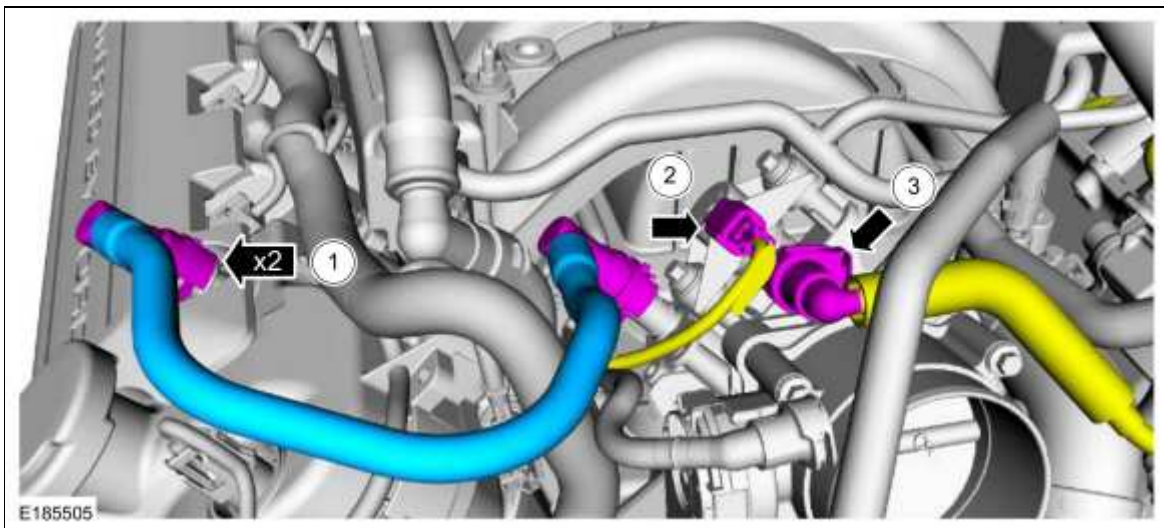
- 8.
- Detach the vacuum tube retainer.
 - Disconnect the vacuum tube.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 - Release the clamps and position the vacuum tube aside.



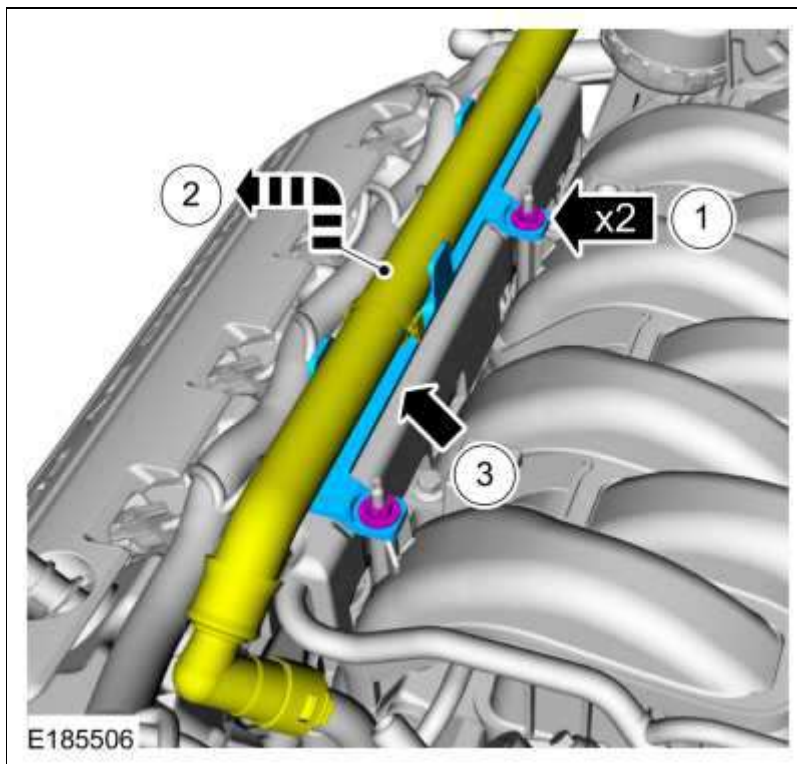
9. Disconnect the throttle body electrical connector.



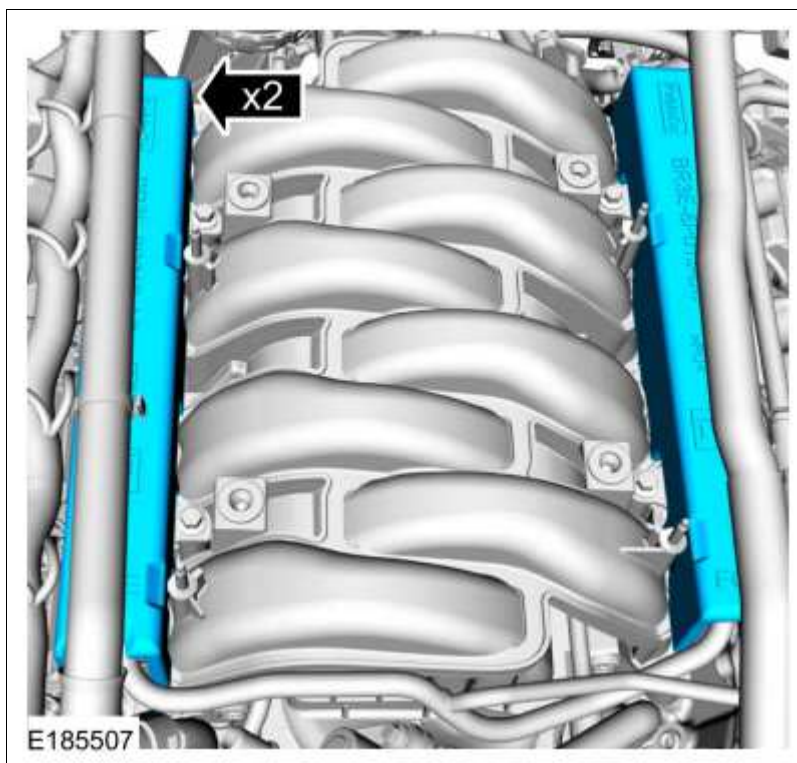
10.
 1. Disconnect the couplings and remove the crankcase vent tube.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 2. Disconnect the EVAP purge valve electrical connector.
 3. Disconnect the EVAP tube and position aside.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



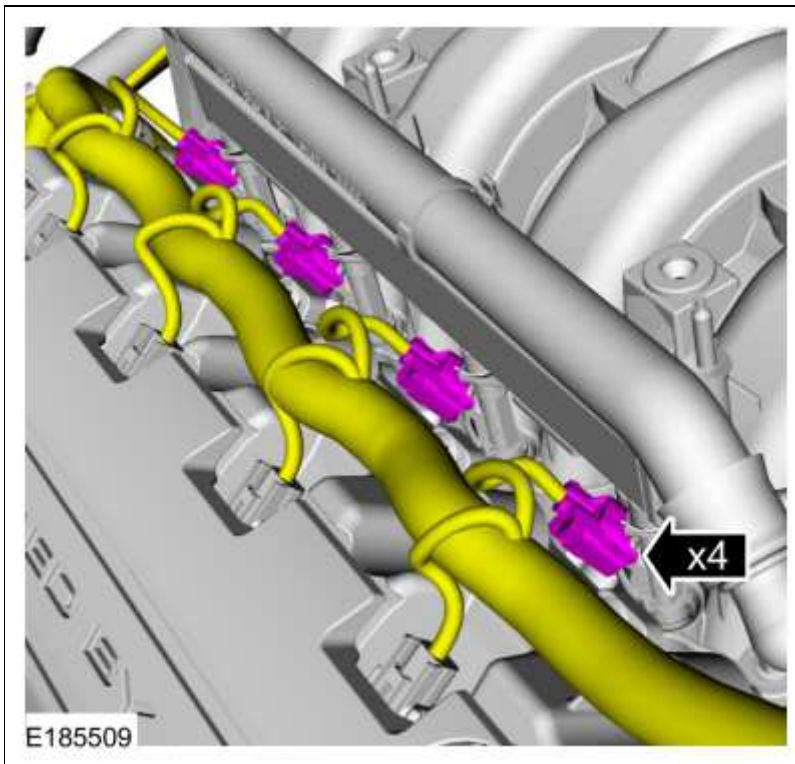
11.
 1. Remove the nuts.
 2. Position the heater hose aside.
 3. Remove the heater hose support.



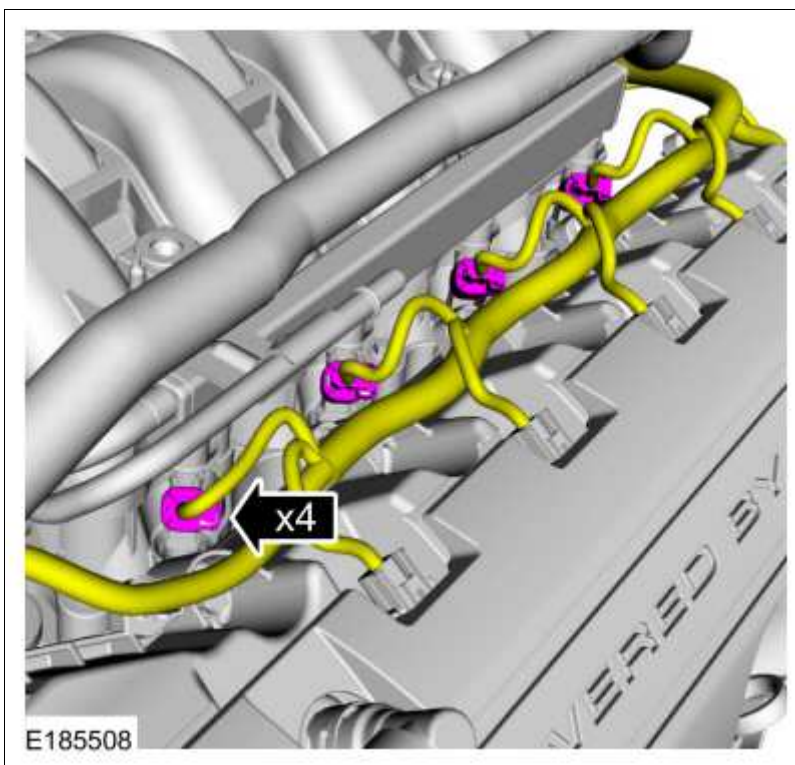
12. Remove the fuel rail insulators.



13. Disconnect the RH fuel injector electrical connectors.

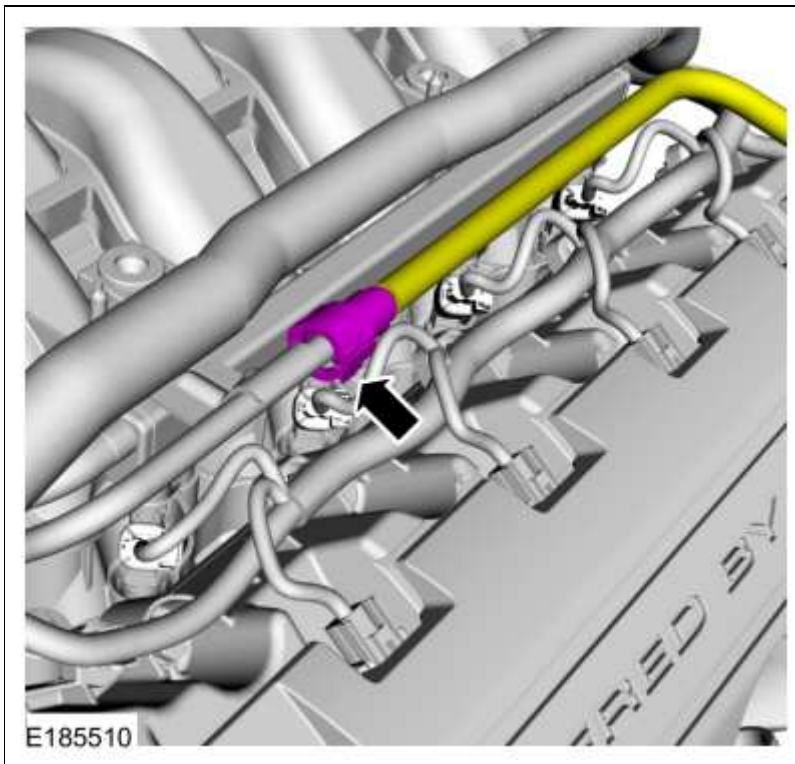


14. Disconnect the LH fuel injector electrical connectors.



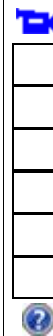
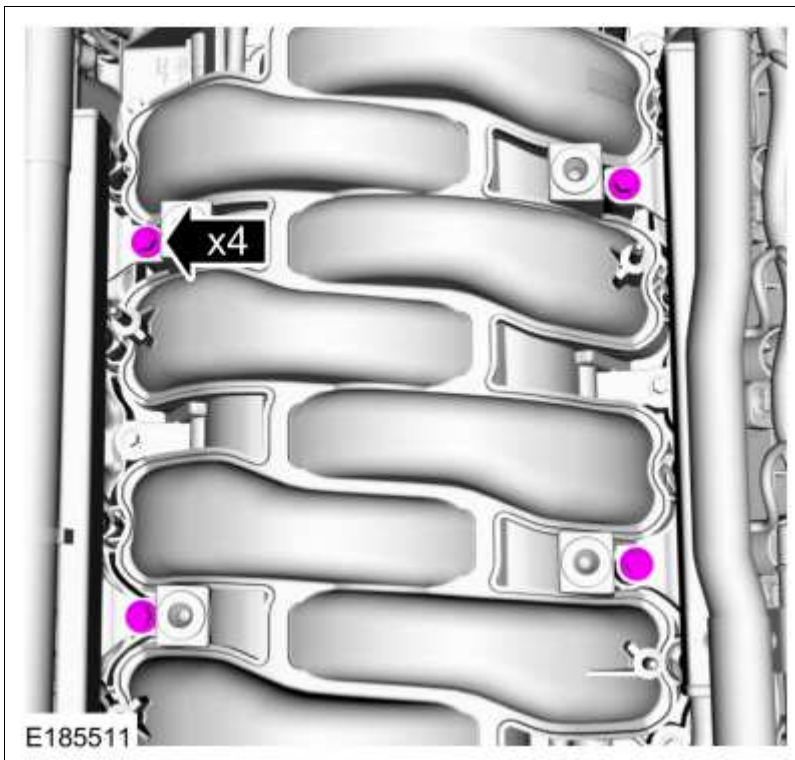
15. Disconnect the fuel supply tube.

Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).

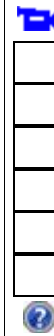
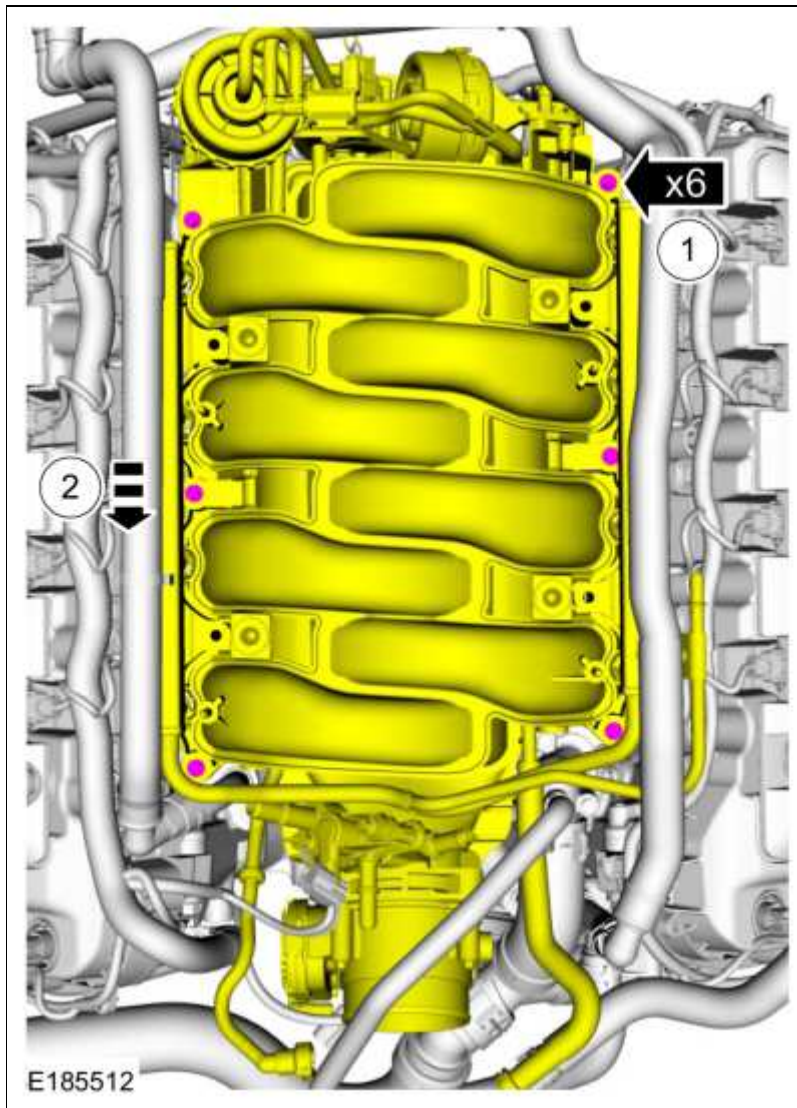


16. **NOTE:** It is not necessary to remove the fuel rail from the intake manifold assembly.

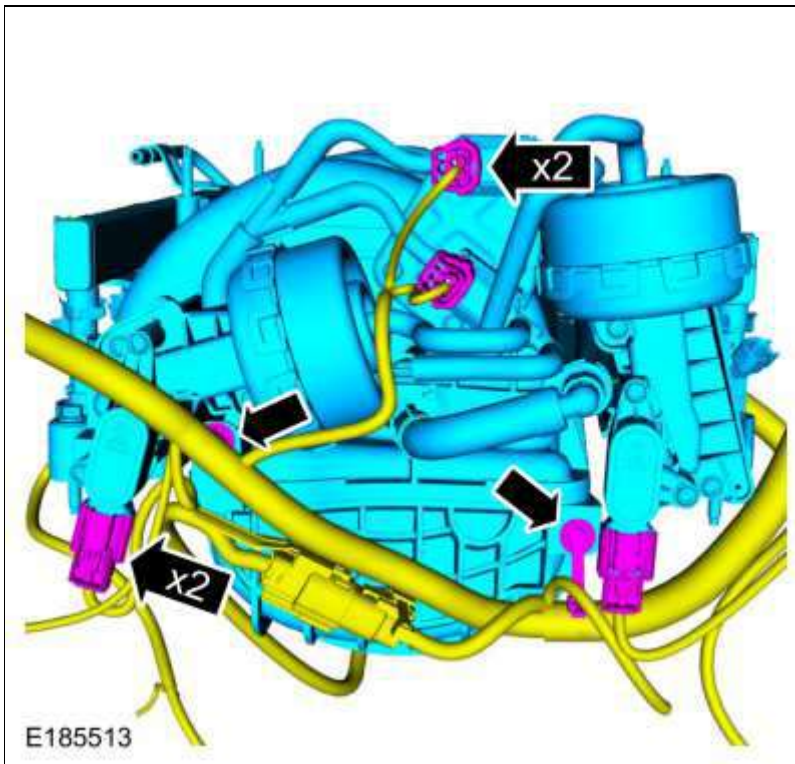
Remove the fuel rail bolts.



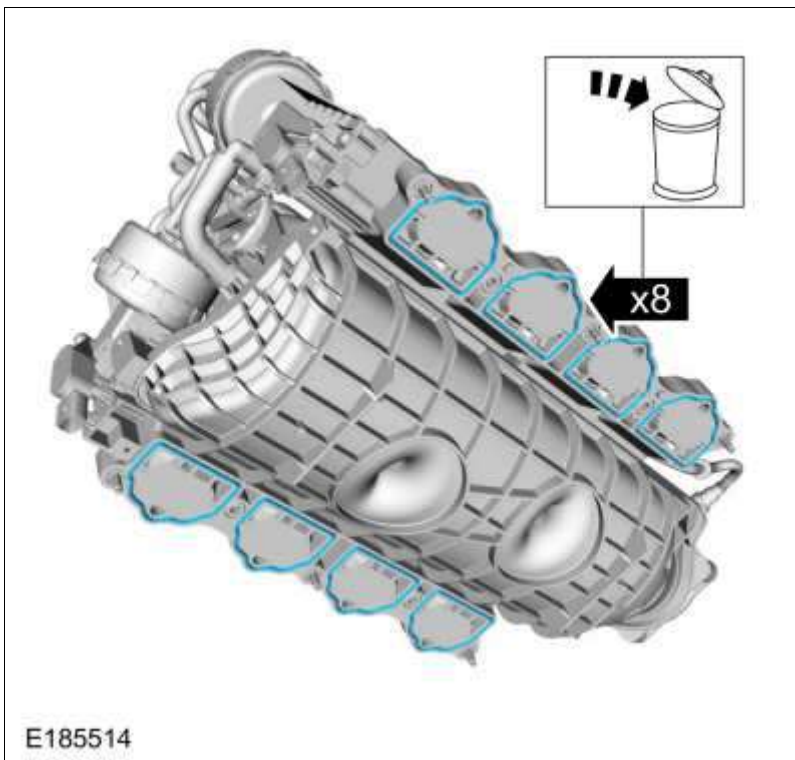
17.
 1. Loosen the intake manifold bolts.
 2. Position the manifold up and towards the front of the engine to access the rear of the manifold.



- 18.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.
 - Remove the intake manifold.



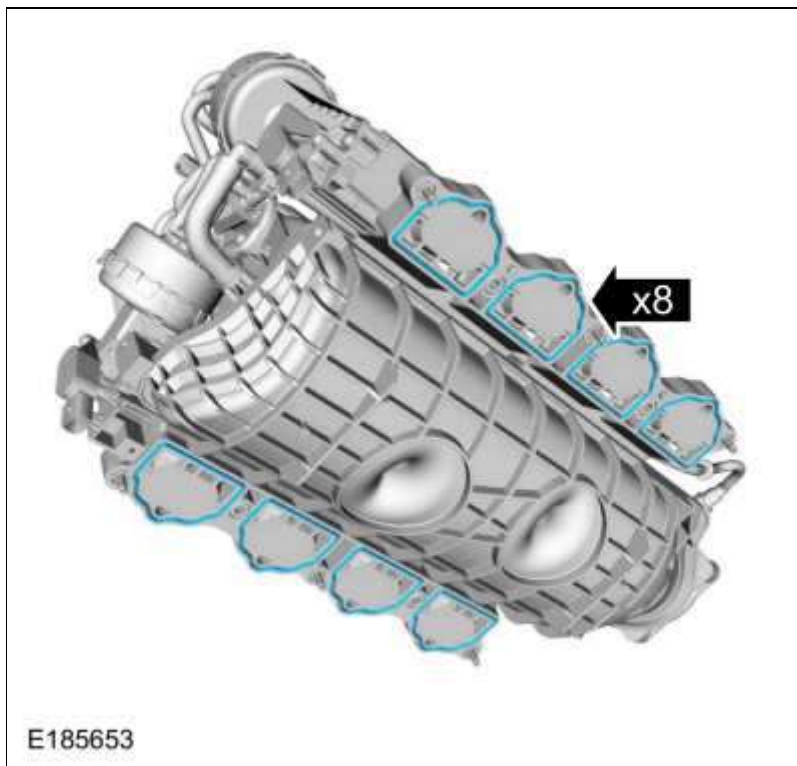
- 19.
- Remove and discard the gaskets.
 - Clean and inspect all sealing surfaces.



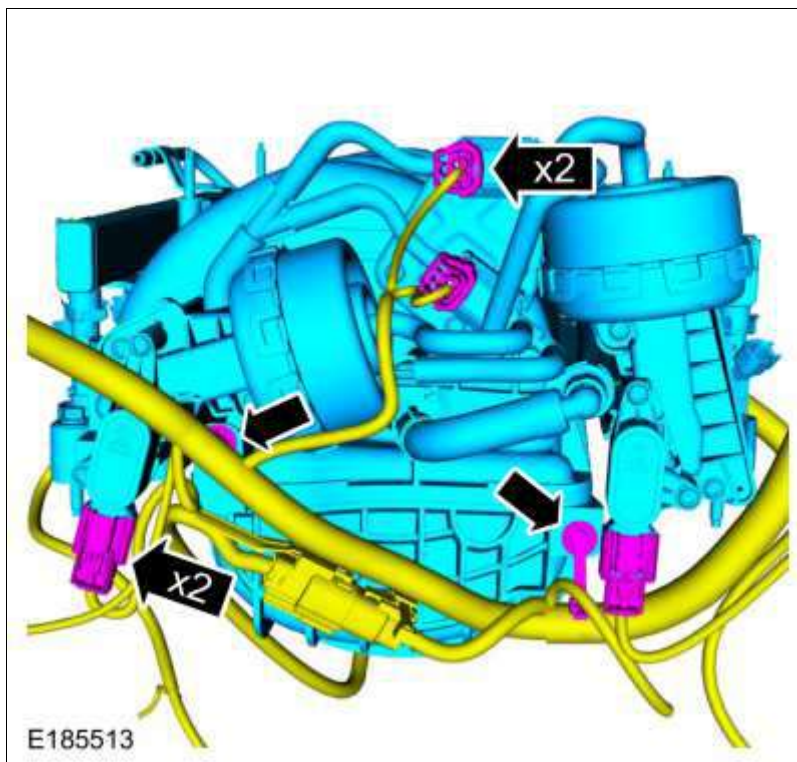
Installation

NOTICE: 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.

1. Install new gaskets.

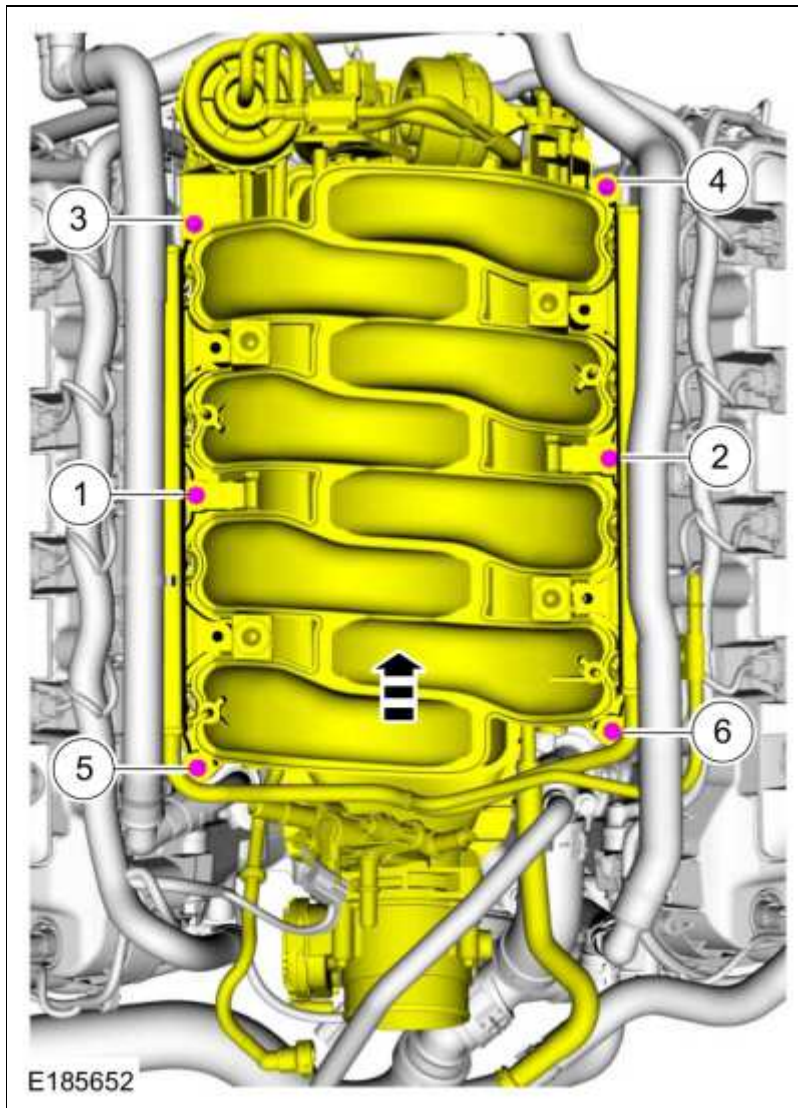


2. Position the intake manifold onto the engine.
 - Attach the wiring harness retainers.
 - Connect the wiring harness electrical connectors.



3.
 1. Position the manifold to the installed position.
 2. Tighten the intake manifold bolts.

Torque:
 Stage 1: 106 lb.in (12 Nm)
 Stage 2: 35°

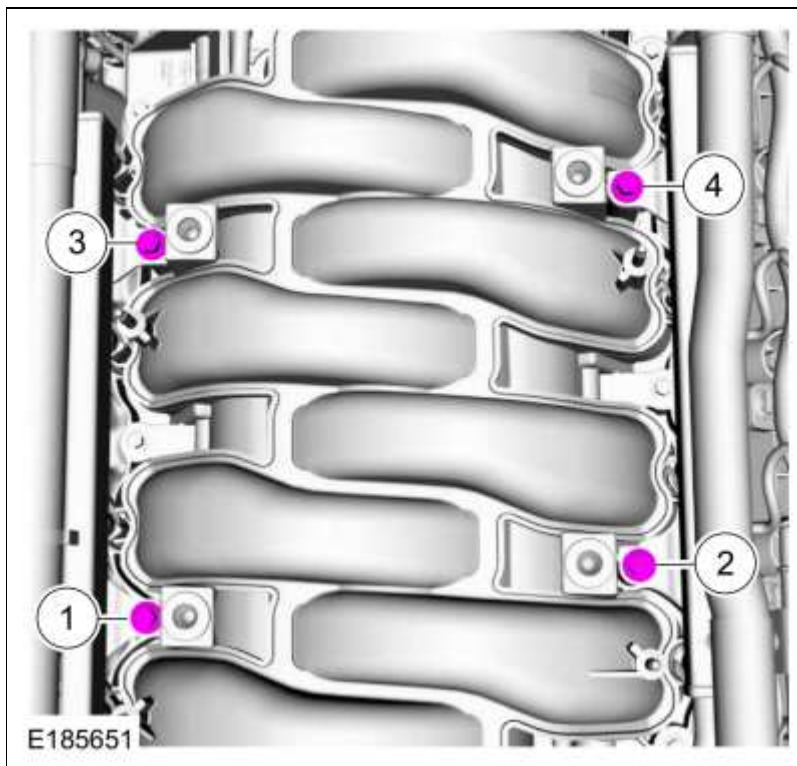


4. Install the fuel rail bolts.

Torque:

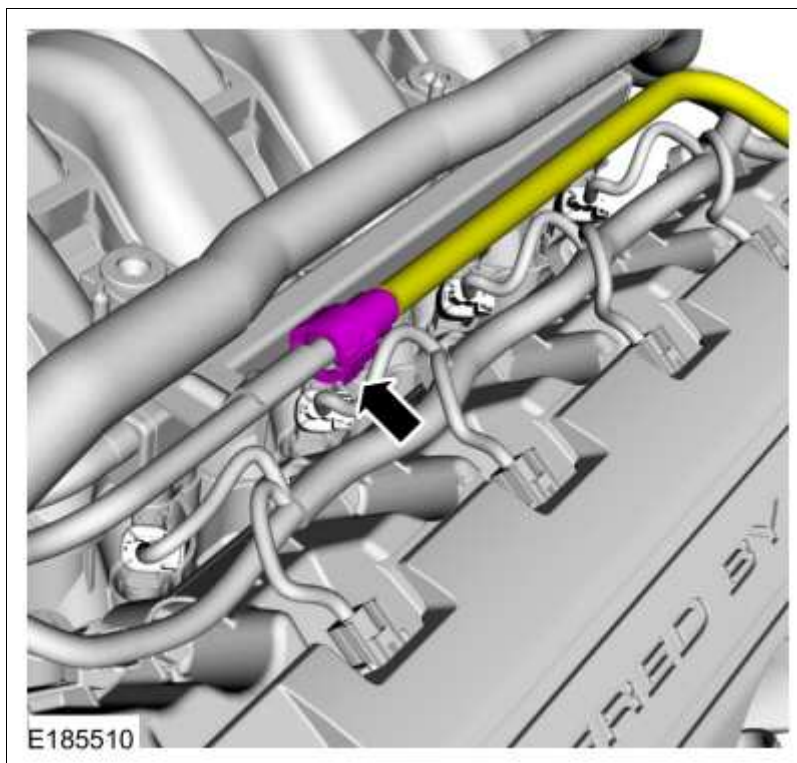
Stage 1: 89 lb.in (10 Nm)

Stage 2: 90°

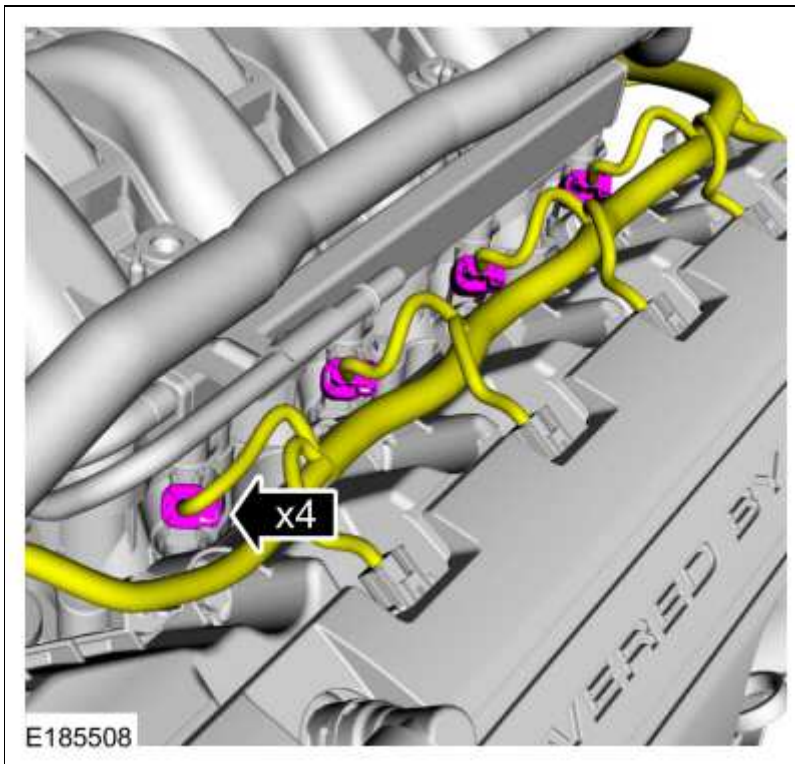


5. Connect the fuel supply tube.

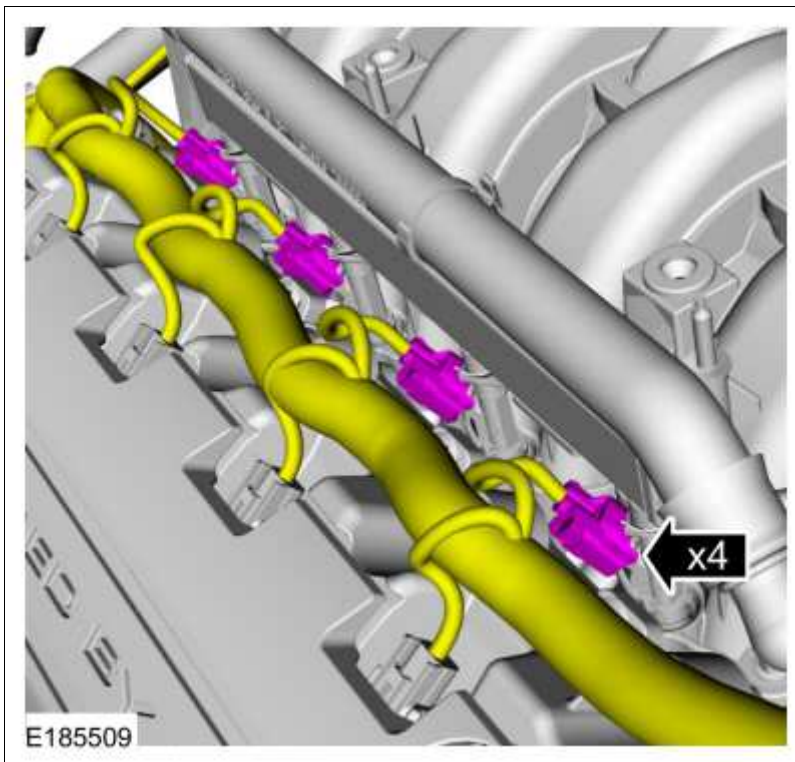
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



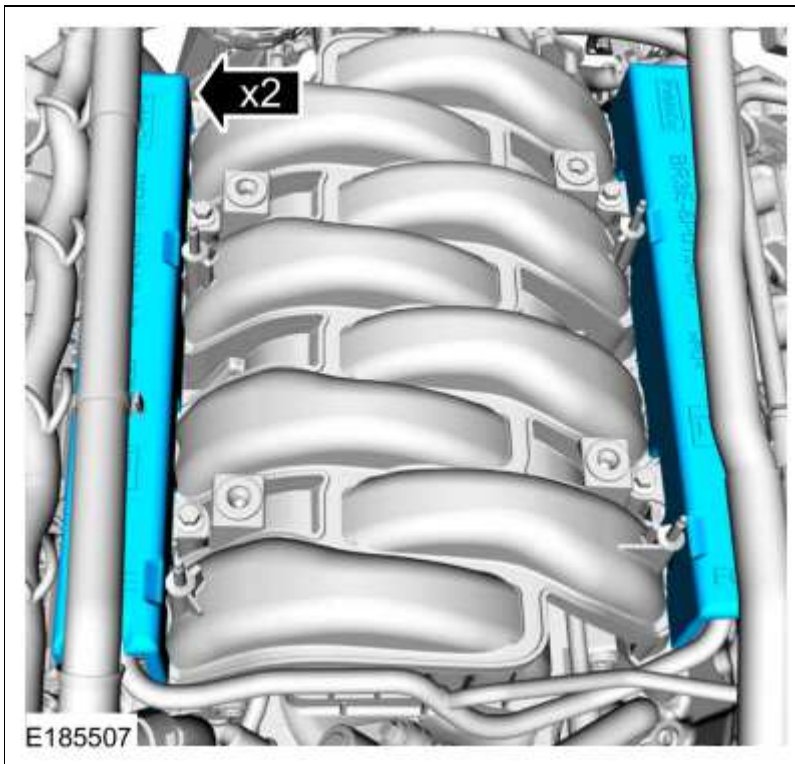
6. Connect the LH fuel injector electrical connectors.



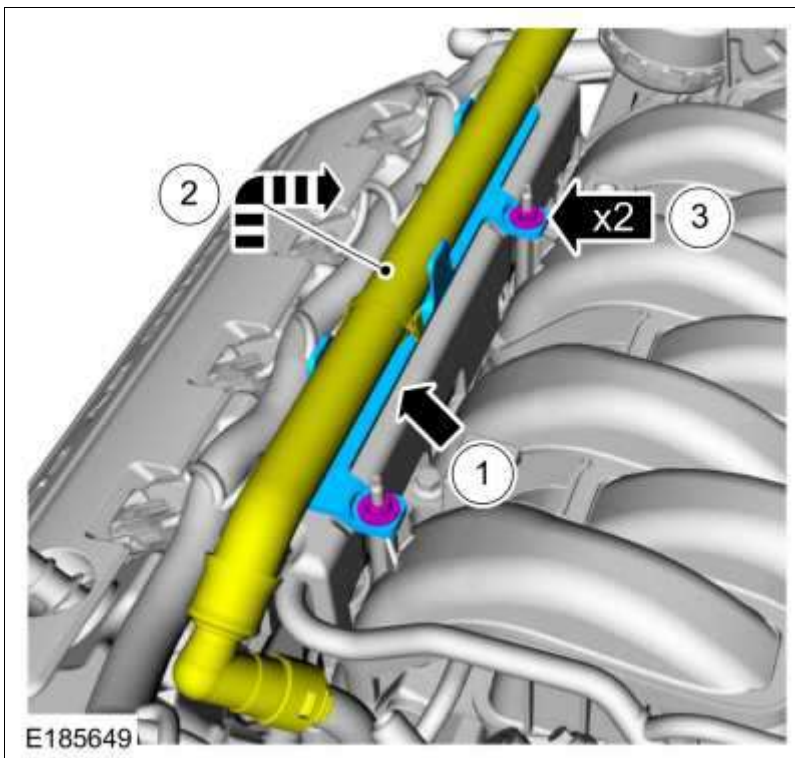
7. Connect the RH fuel injector electrical connectors.



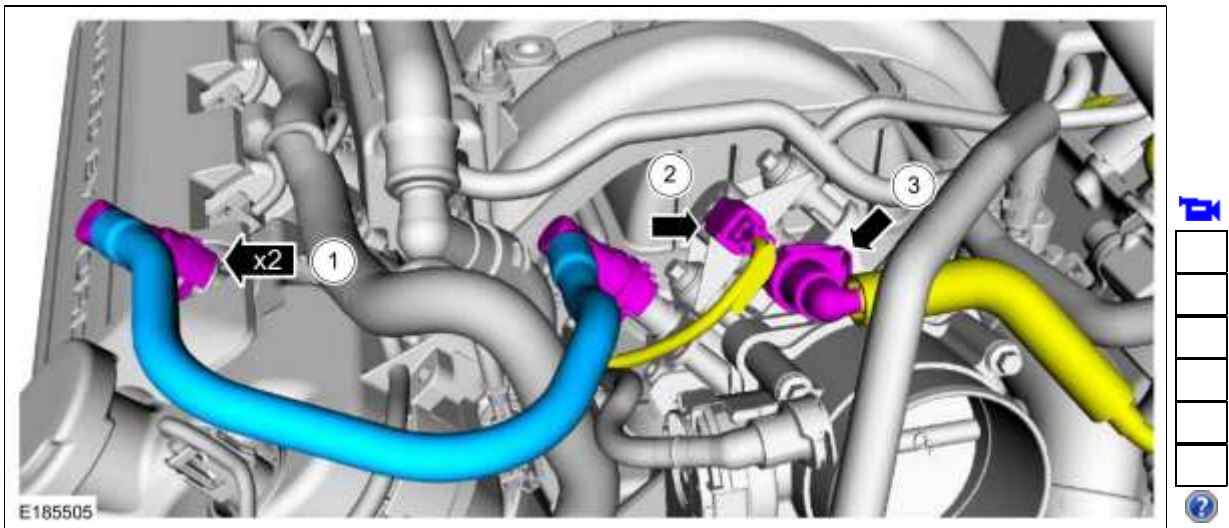
8. Install the fuel rail insulators.



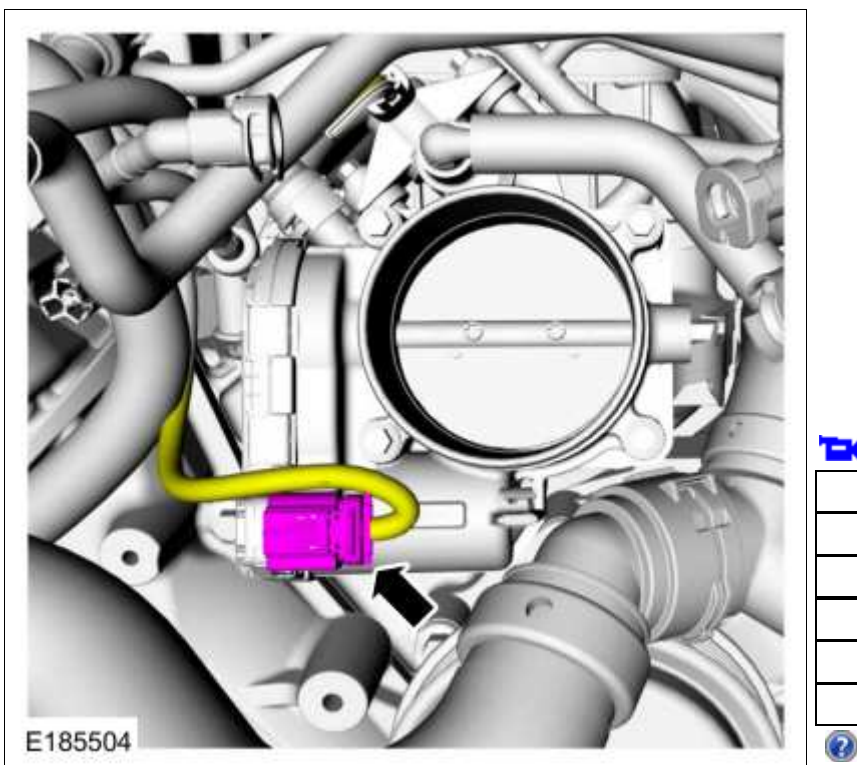
- 9.
1. Install the heater hose support.
 2. Position the heater hose.
 3. Install the nuts.
- Torque: 62 lb.in (7 Nm)*



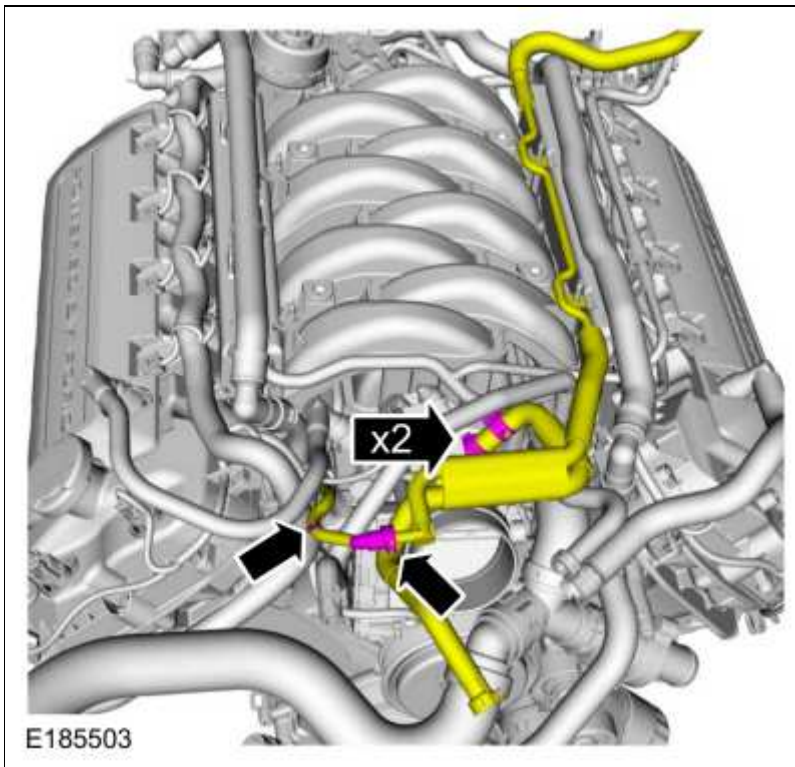
- 10.
1. Install the crankcase vent tube and connect the couplings.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 2. Connect the EVAP purge valve electrical connector.
 3. Connect the EVAP tube.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



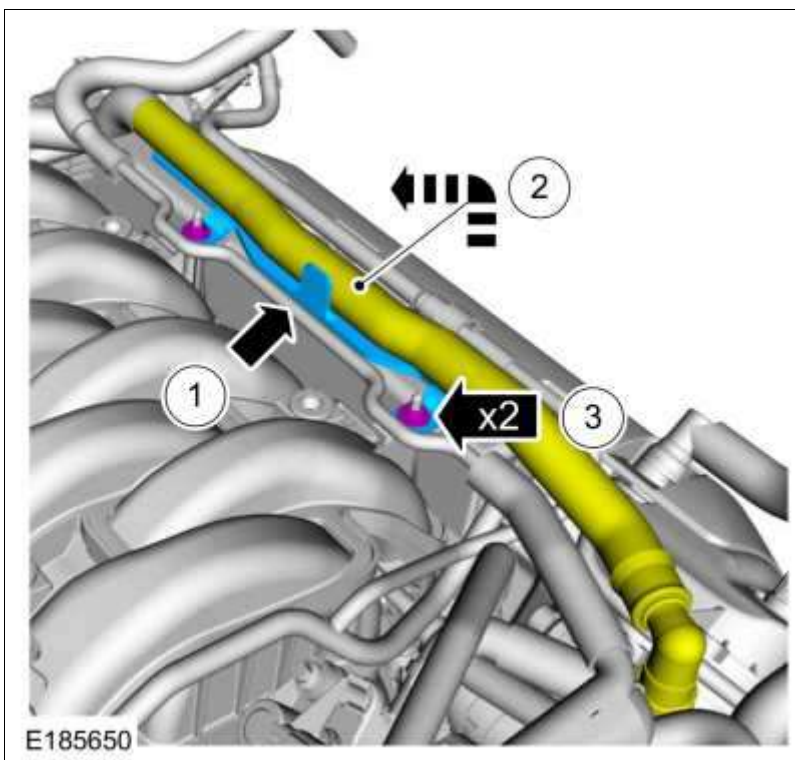
11. Connect the throttle body electrical connector.



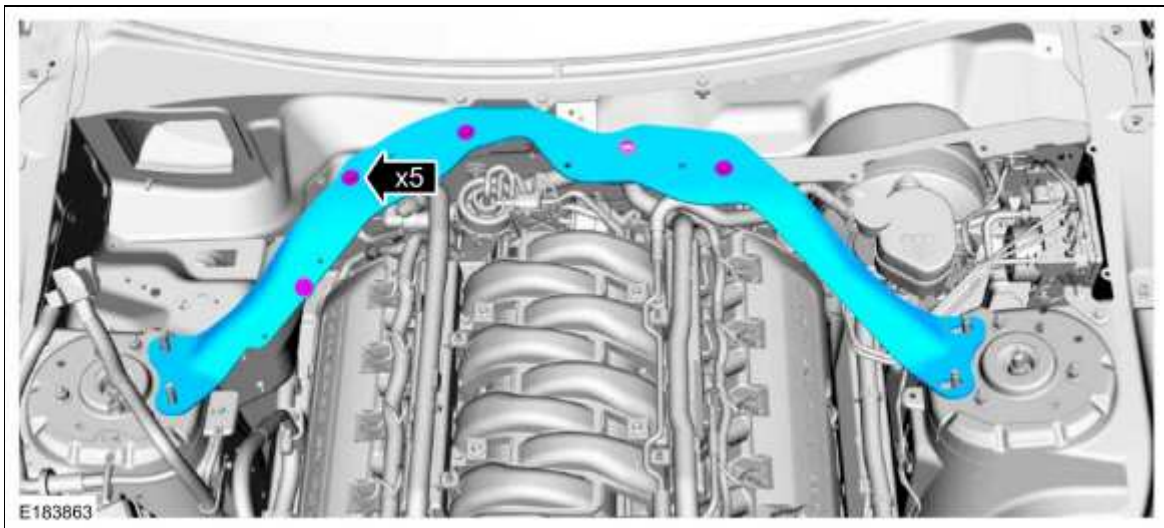
- 12.
- Install the vacuum tube and clamps.
 - Connect the vacuum tube.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 - Attach the vacuum tube retainer.



13. 1. Install the heater hose support.
 2. Position the heater hose.
 3. Install the nuts.
Torque: 62 lb.in (7 Nm)



14. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)

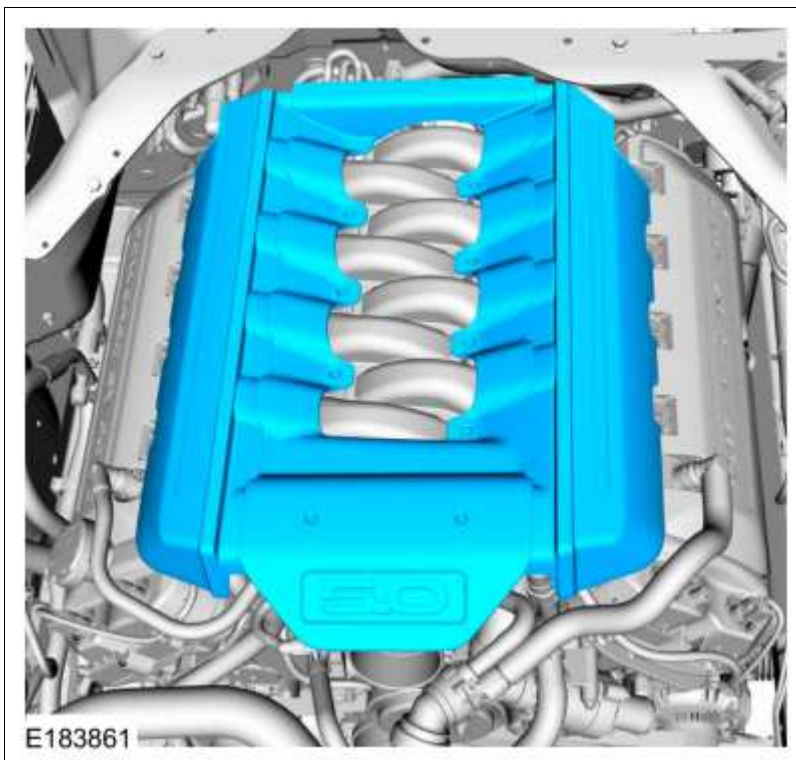


15. Install the following items:

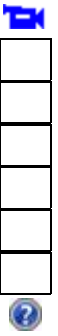
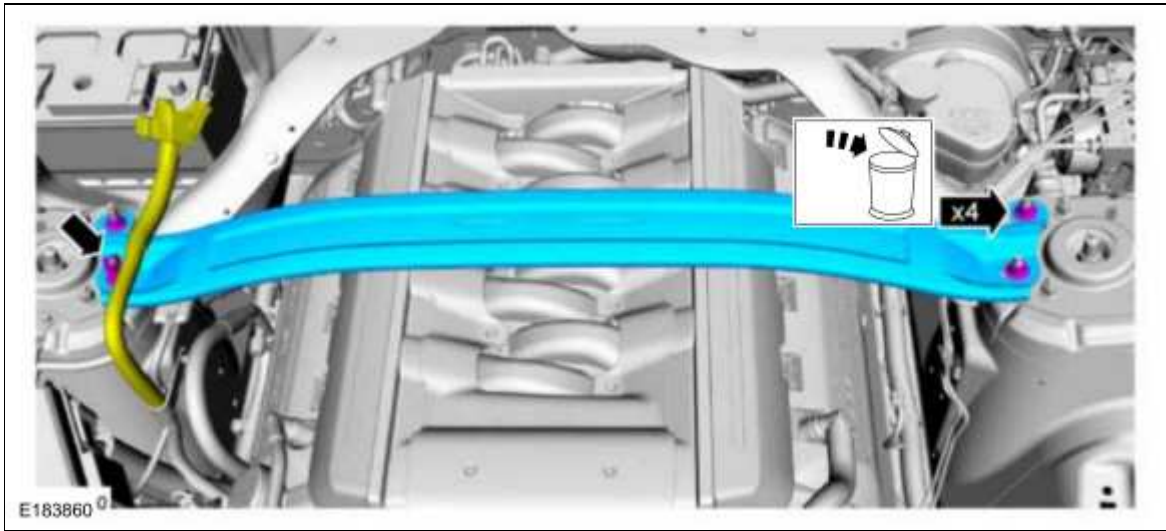
1. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

16. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.



- 17.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



18. Connect the battery ground and positive cables.

Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

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Oil Cooler

Special Tool(s) / General Equipment

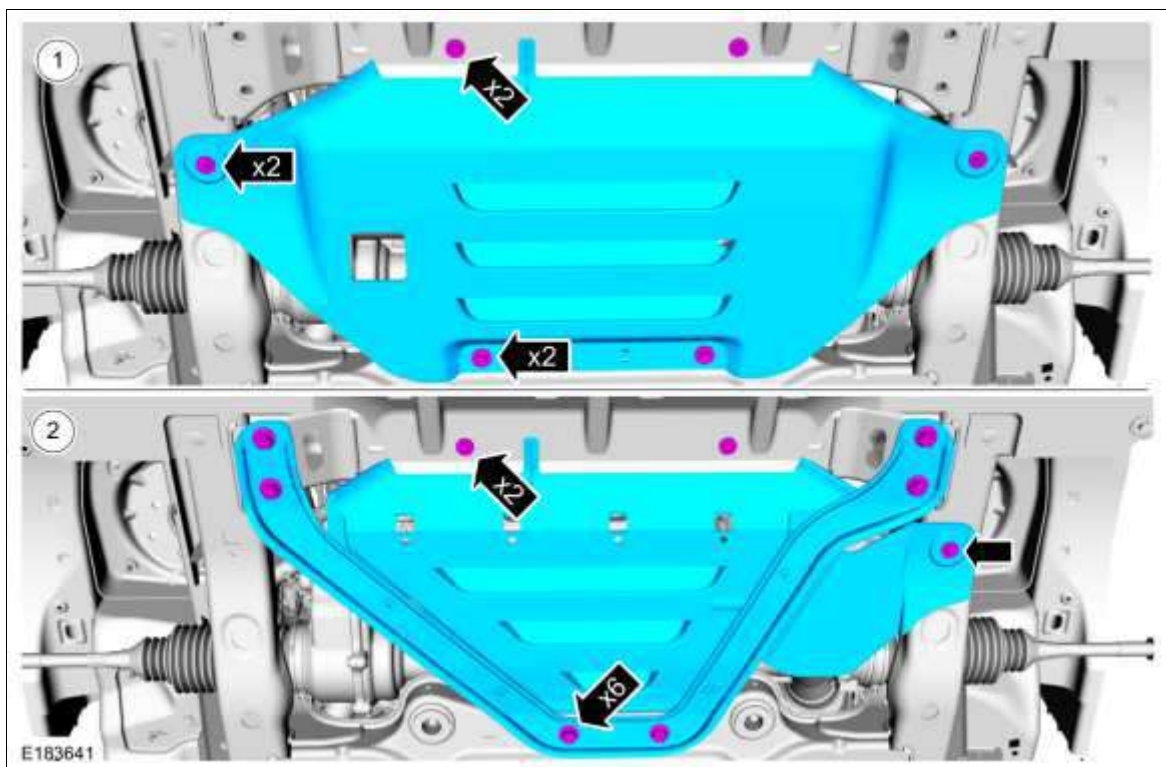
Locking Pliers

Materials

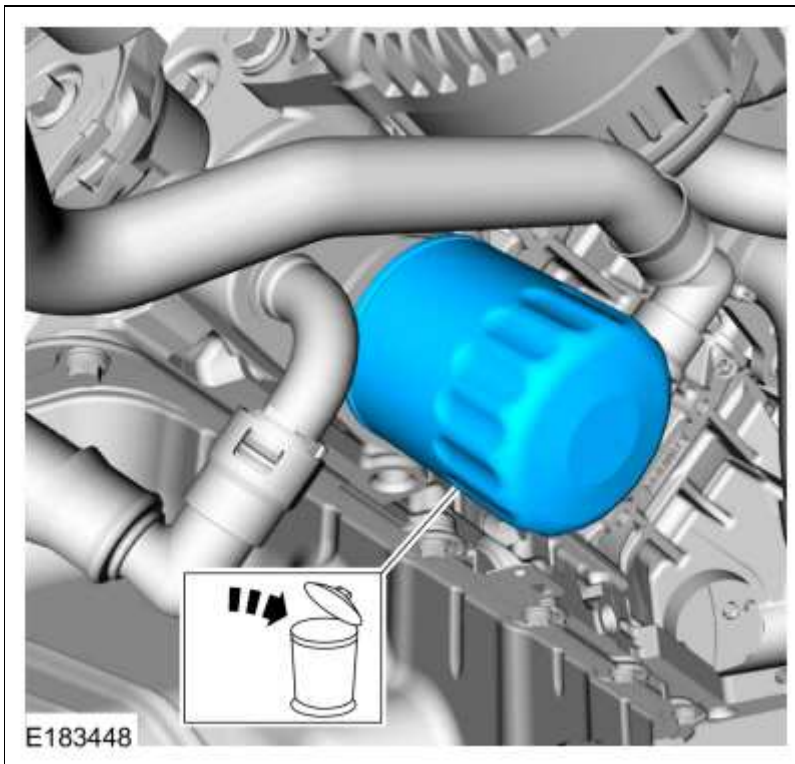
Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) VC-3-B (U.S.)	WSS-M97B44-D

Removal

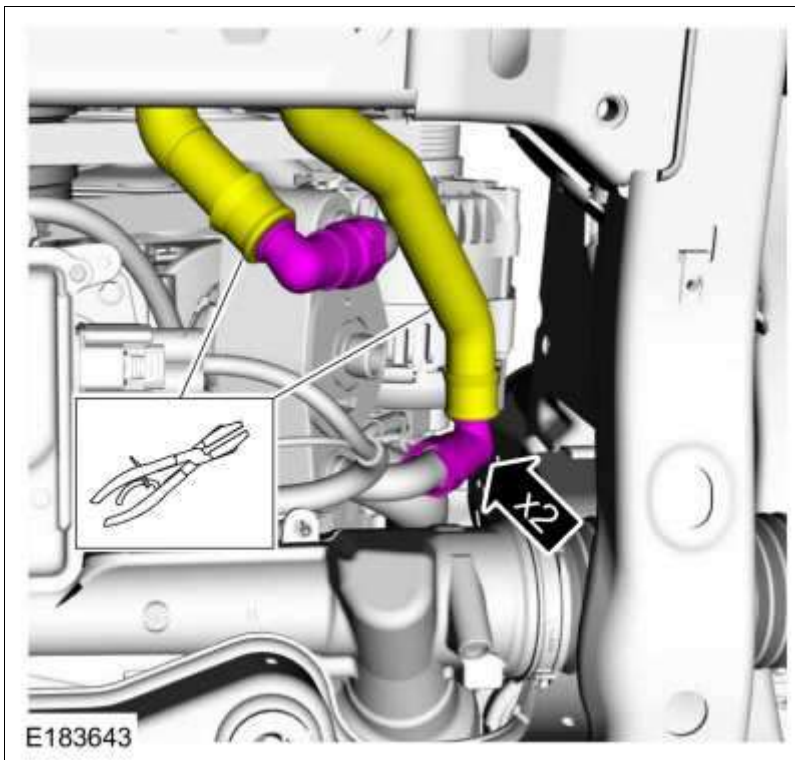
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.
 1. Loosen the 2 front bolts, remove the remaining bolts and the underbody shield.
 2. Loosen the 2 front bolts, remove the remaining bolts and the subframe bracket and underbody shield assembly.



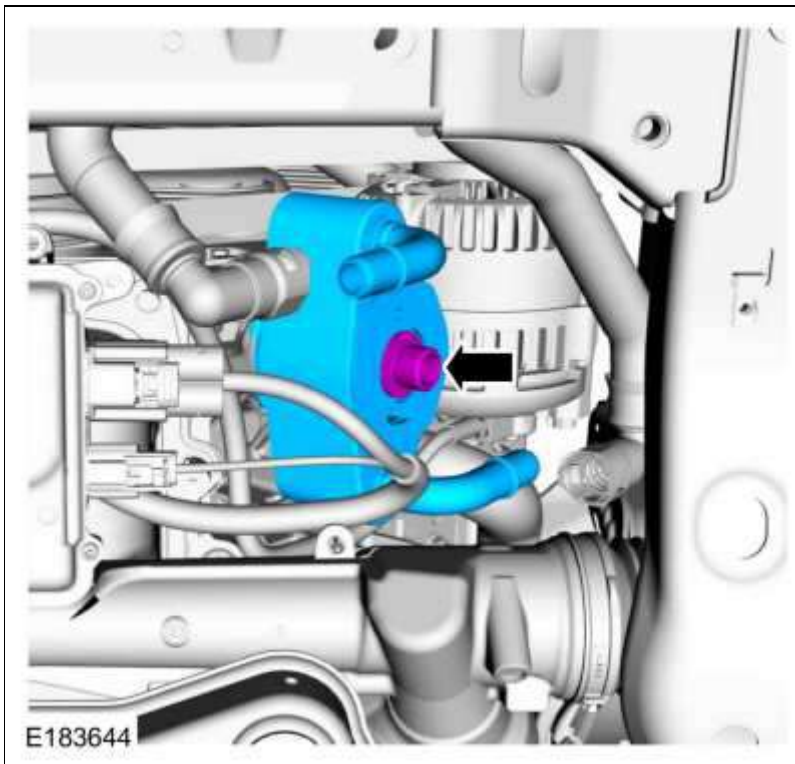
3. Remove and discard the engine oil filter.



4.
 - Using hose locking pliers, clamp the oil cooler coolant hoses. Use the General Equipment: Locking Pliers
 - Disconnect the coolant hoses.

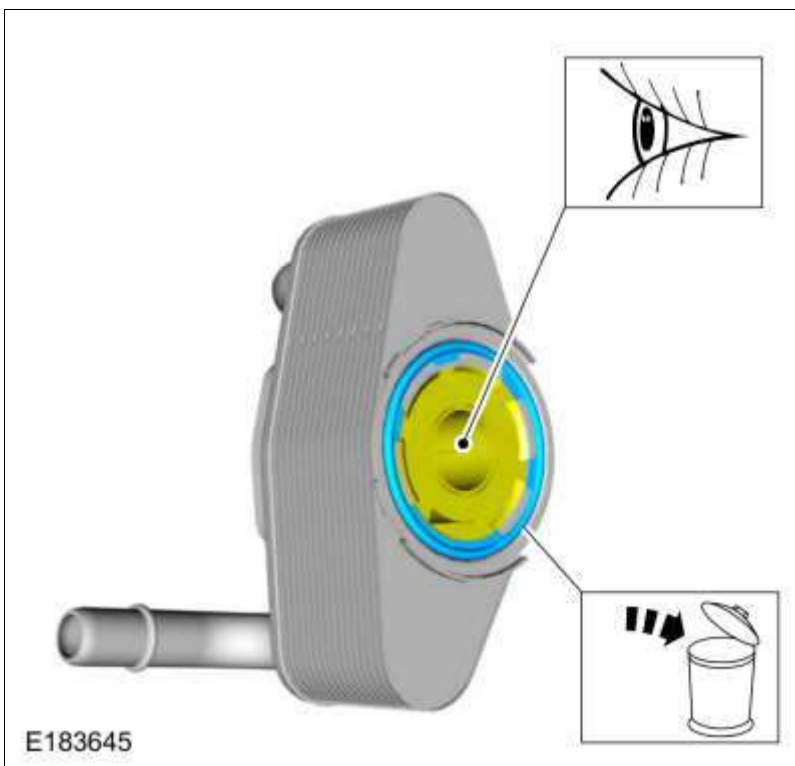


5. Remove the retainer and the oil cooler.



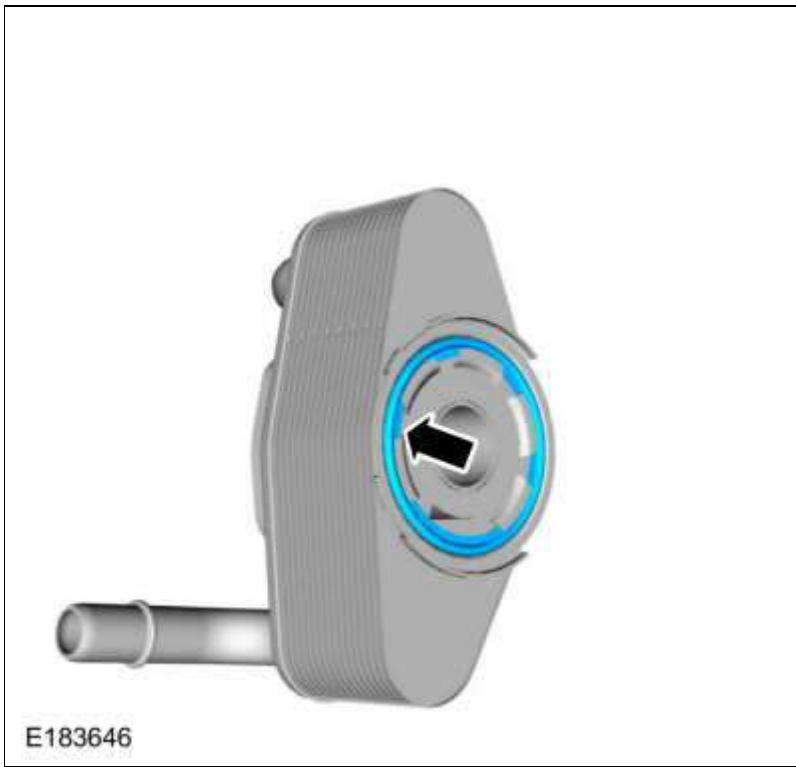
6. **NOTICE:** If metal or aluminum material is present in the oil cooler, mechanical concerns exist. Failure to correct these concerns may cause engine failure. To diagnose mechanical concerns, refer to Section 303-00.

- Remove and discard the gasket.
- Inspect the oil cooler.

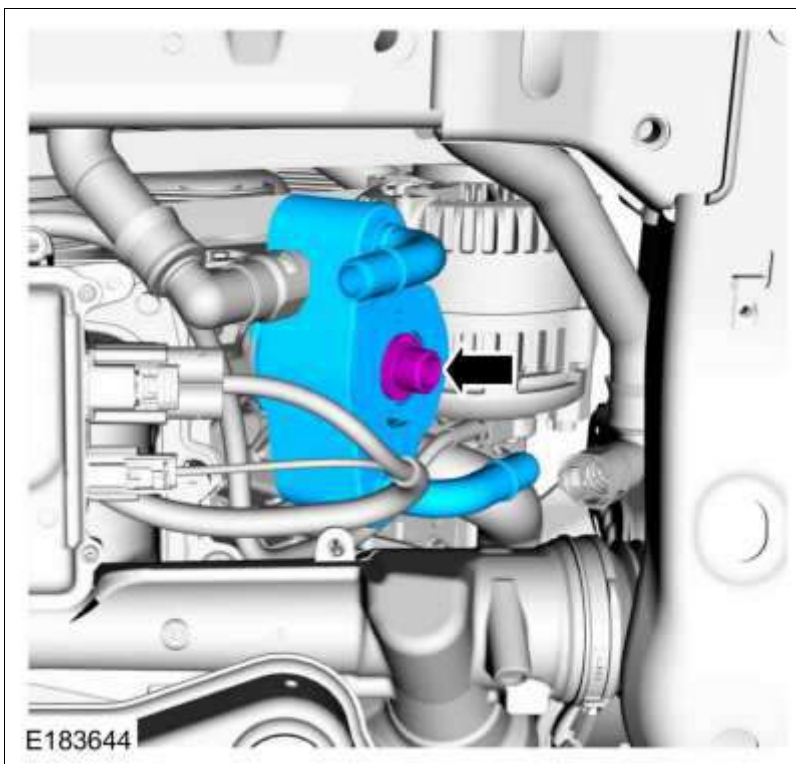


Installation

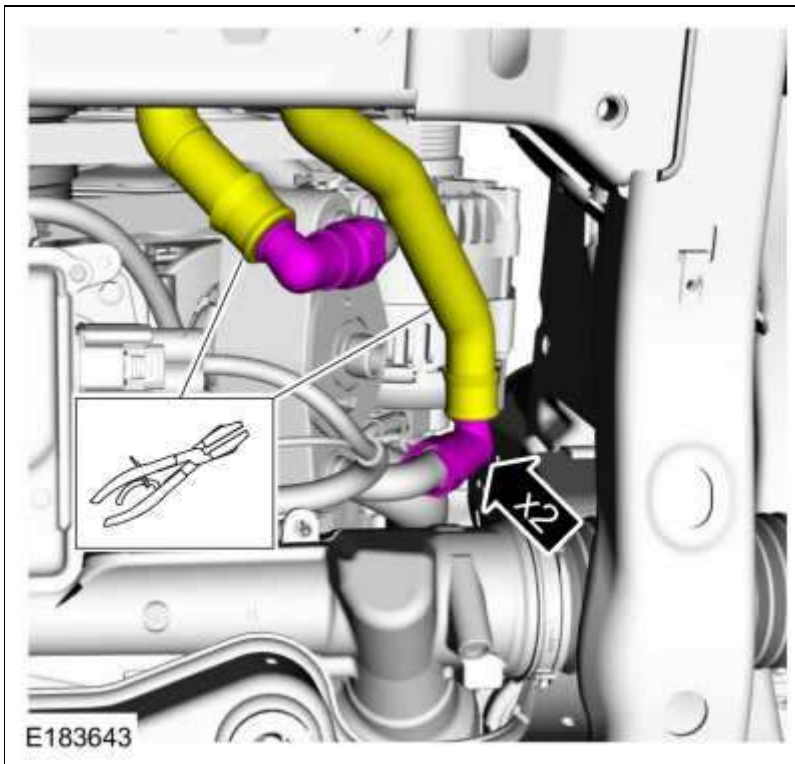
1. Install a new gasket.



2. Install the oil cooler and the retainer.
Torque: 43 lb.ft (58 Nm)



3.
 - Connect the coolant hoses.
 - Remove the hose locking pliers.
 Use the General Equipment: Locking Pliers



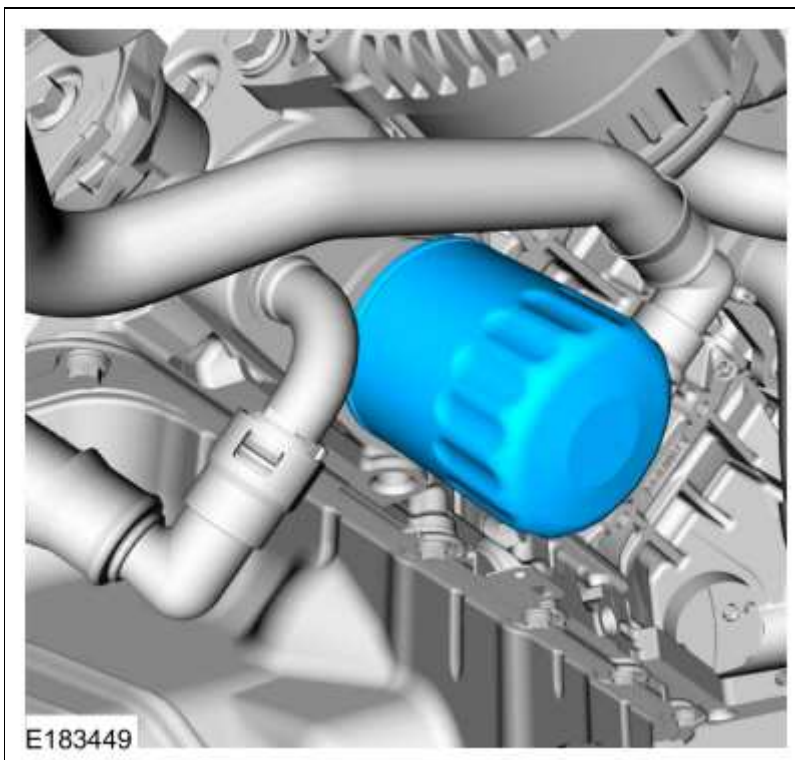
4. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

Torque:

Stage 1: 44 lb.in (5 Nm)

Stage 2: 180°



5. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

1. Install the underbody shield and the bolts.

Torque:

A: 97 lb.in (11 Nm)

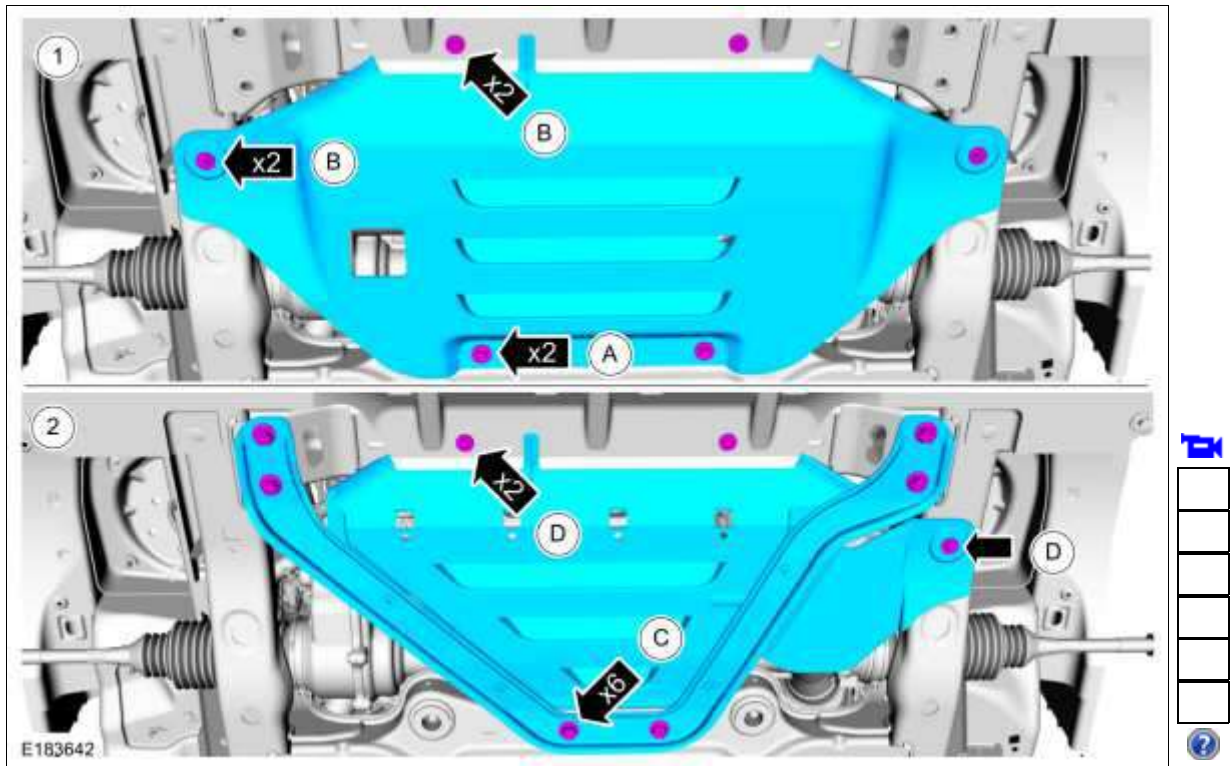
B: 18 lb.in (2 Nm)

2. Install the subframe bracket and underbody shield assembly and the bolts.

Torque:

C: 46 lb.ft (63 Nm)

D: 18 lb.in (2 Nm)



6. Inspect and adjust the coolant level in the degas bottle

Material: Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) / VC-3-B (U.S.) (WSS-M97B44-D)

7. Inspect and adjust the engine oil level.

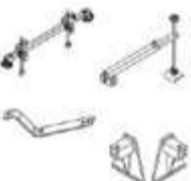
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



Oil Pan

Base Part Number: [6675](#)

Special Tool(s) / General Equipment

	303-050 (T70P-6000) Lifting Bracket, Engine
	303-F072 Support Bar, Engine
Plastic Scraper	
Oil Drain Equipment	
Vehicle/Axle Stands	

Materials

Name	Specification
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Engine Oil - 5W20	WSS-M2C948-B
Motorcraft® Metal Surface Prep ZC-31-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

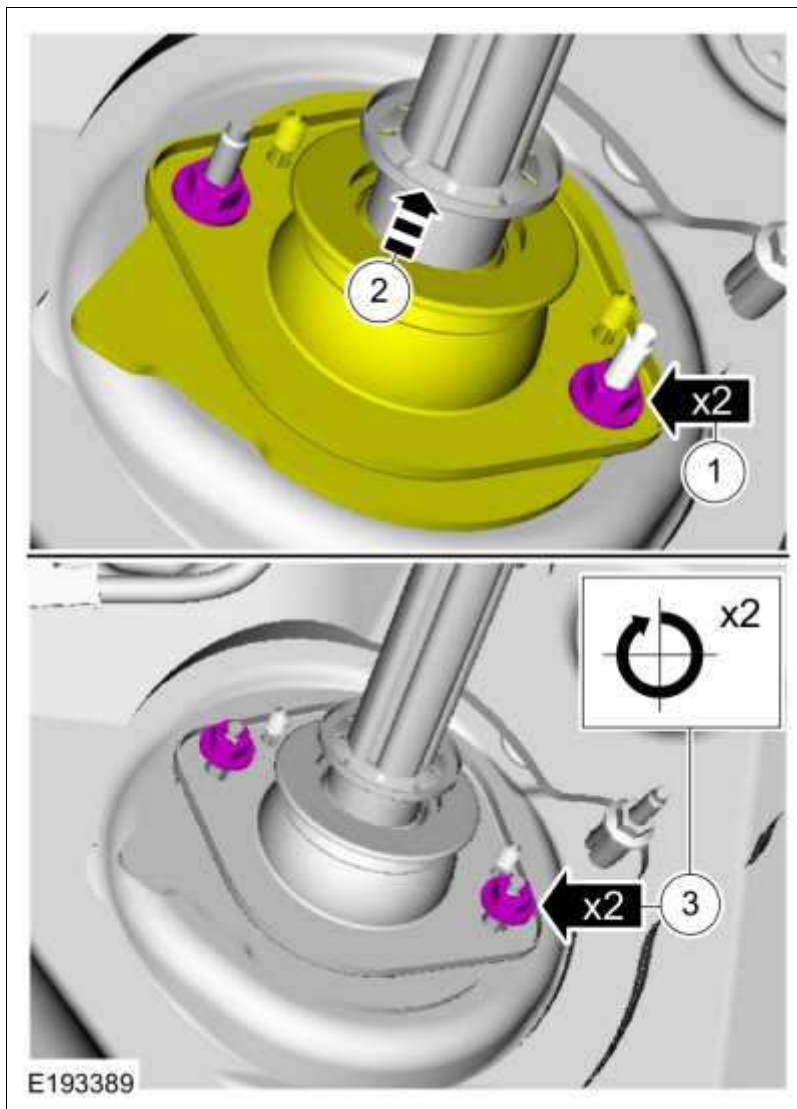
Removal

6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

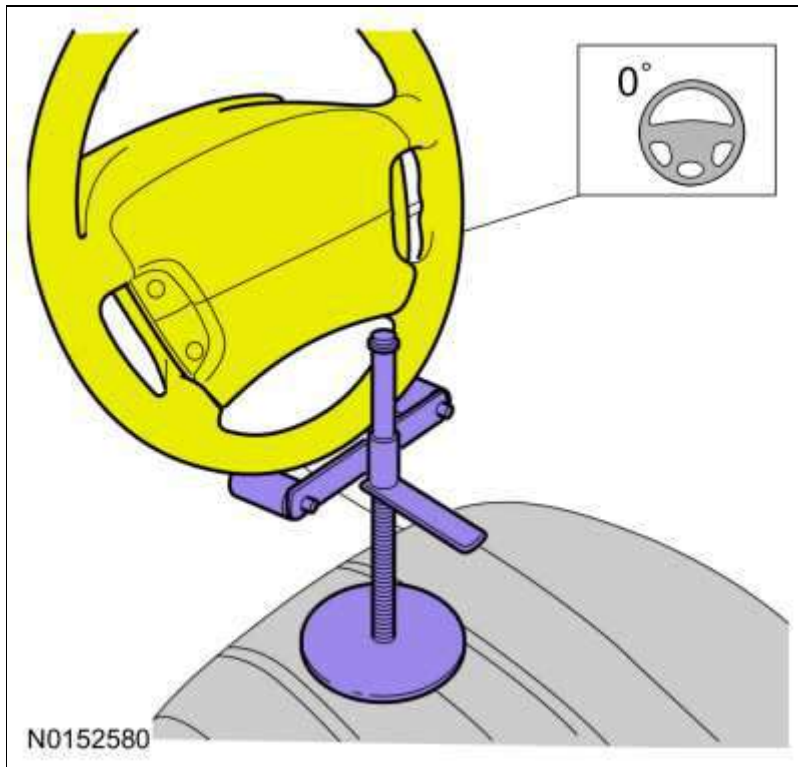
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3. **NOTICE:** Make sure to minimize damage to sealer foam and avoid pulling apart dash seal brackets from retainer pins. Excessive damage may allow engine noise, fumes, air or water to enter the passenger compartment.
 1. Remove the steering column dash seal nuts.

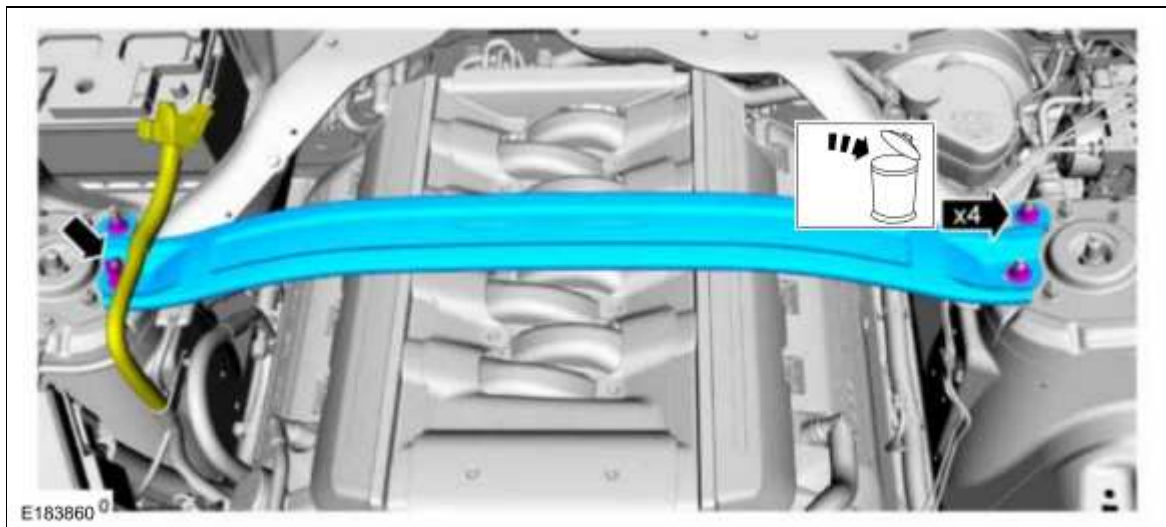
2. Loosen the dash seal.
3. Hand start the dash seal nuts.



4. Using a holding device, hold the steering wheel in the straight-ahead position.
Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

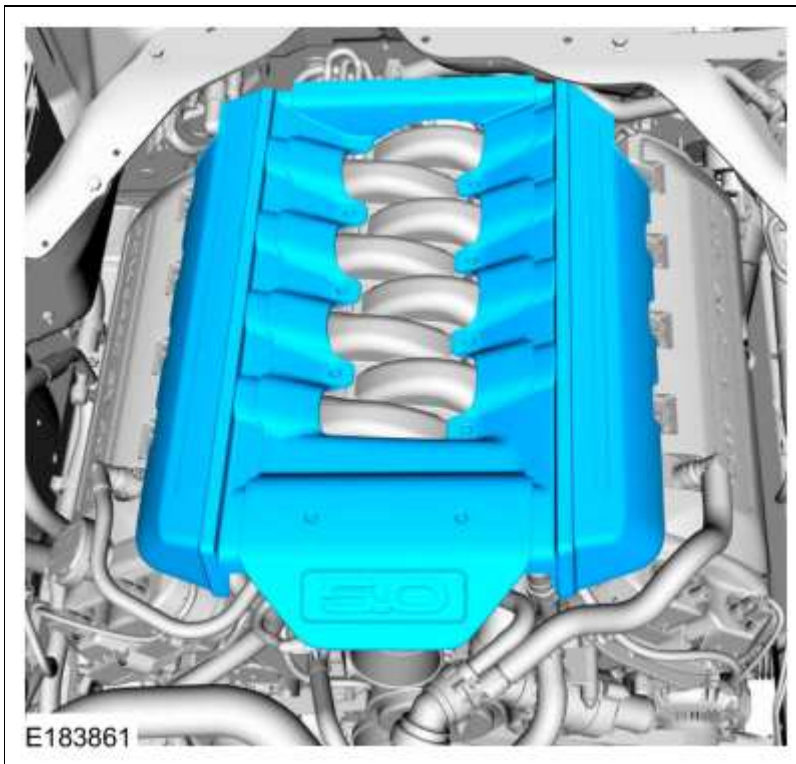


- 5.
- If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.

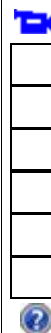
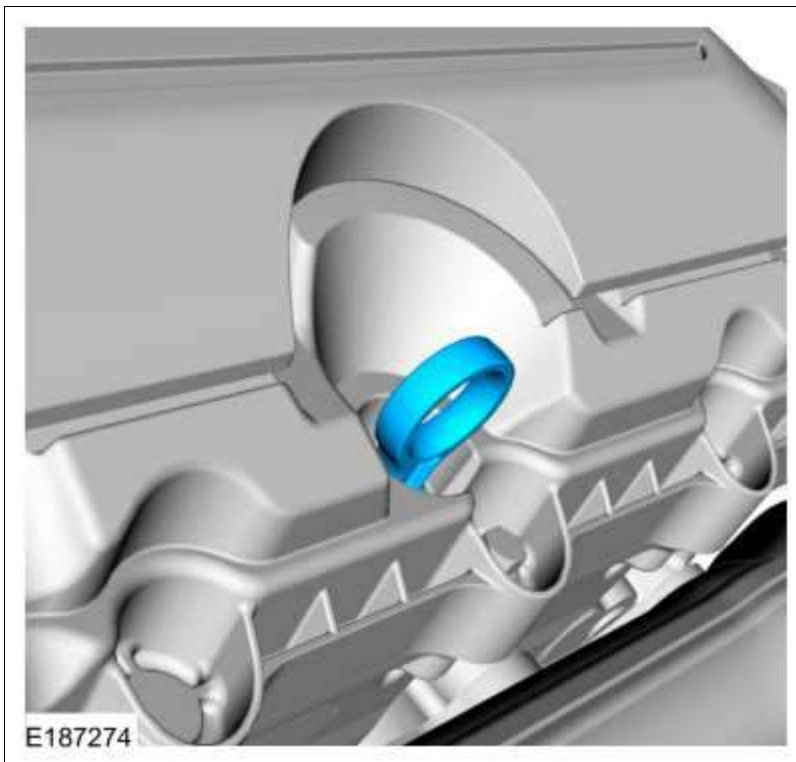


6. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

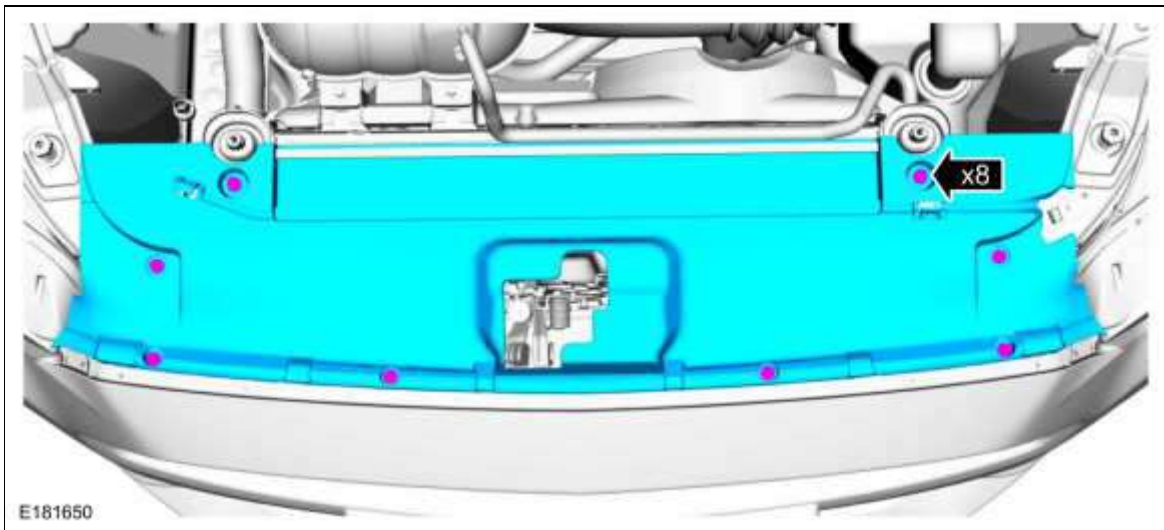
Remove the engine appearance cover.



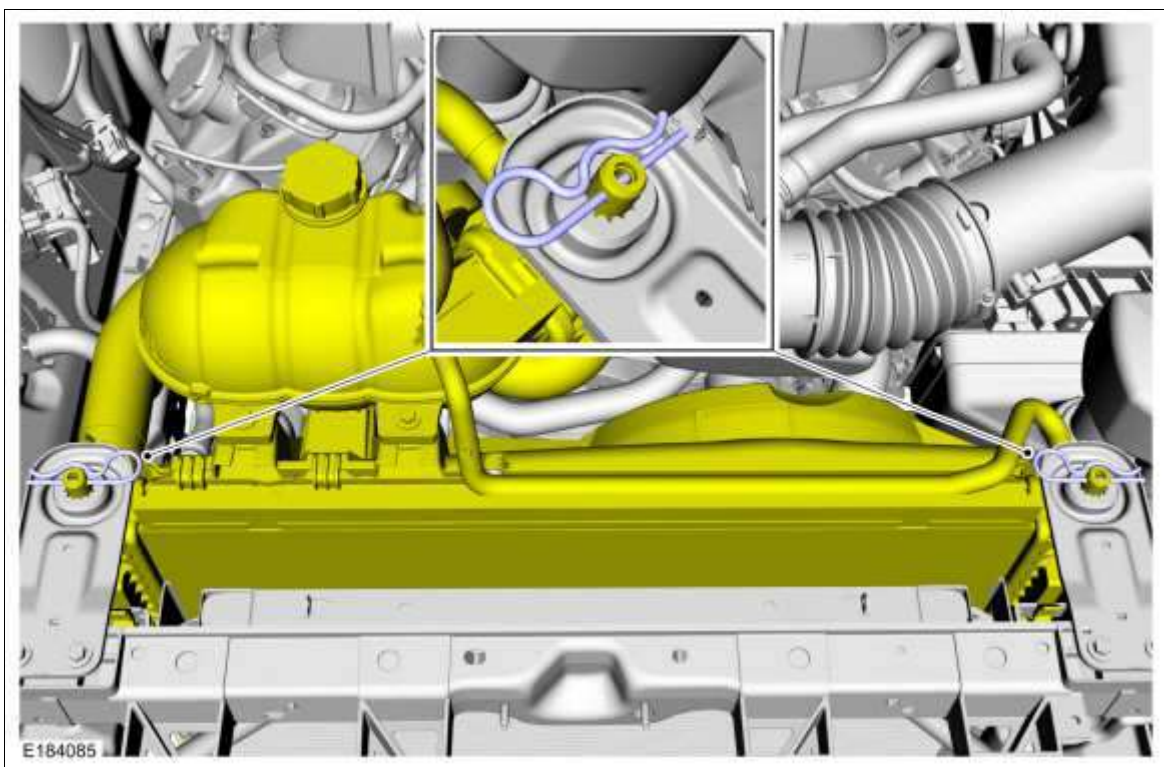
7. Remove the oil level indicator.



8. Remove the retainers and the radiator top shield.



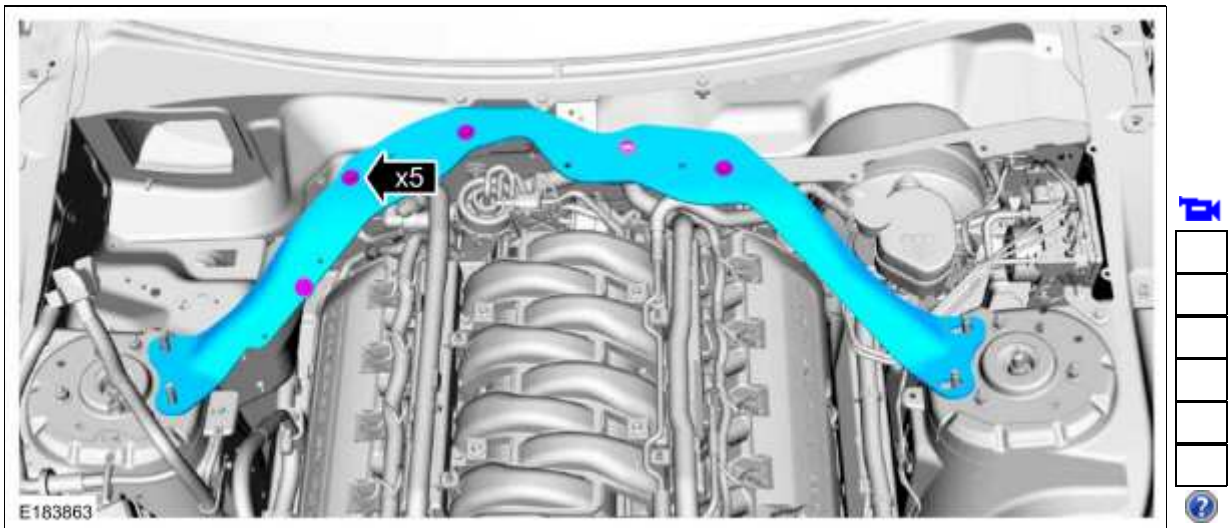
9. Install clips to support the cooling module.



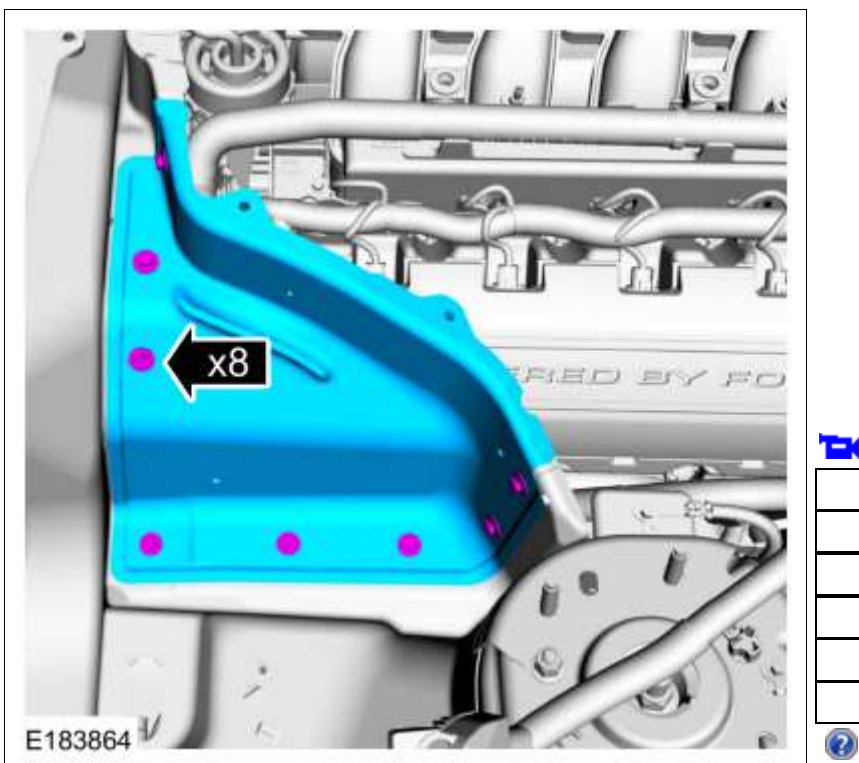
10. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

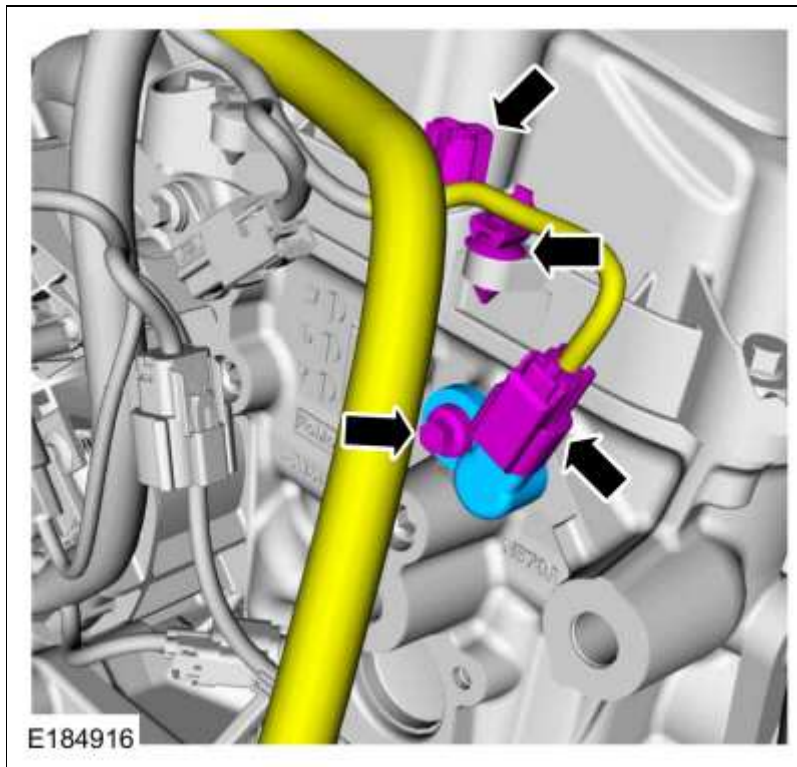
11. Remove the fasteners and the cowl extension.



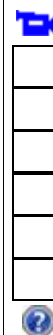
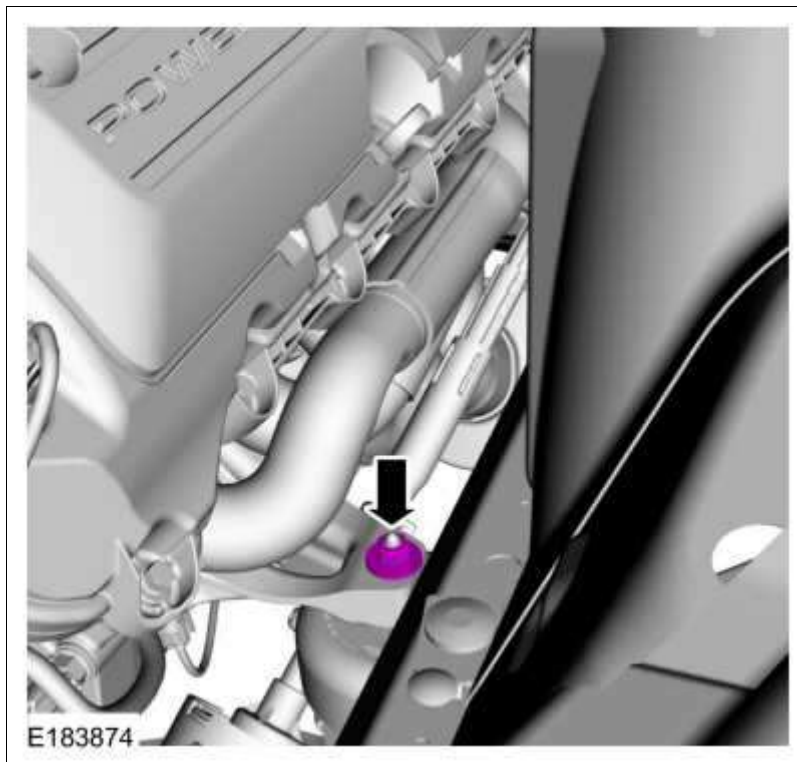
12. Remove the fasteners and the battery heat shield.



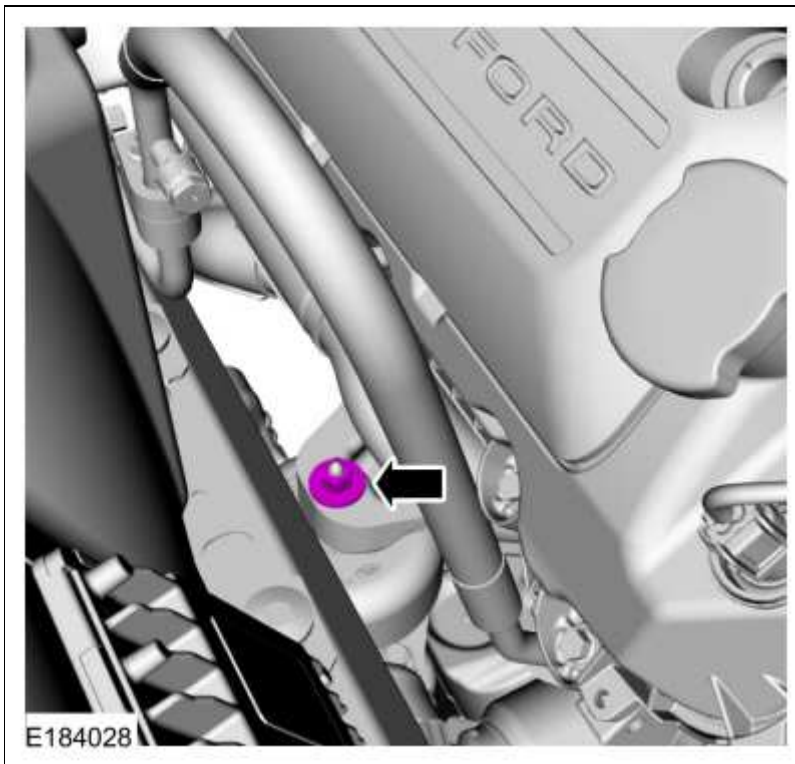
- 13.
- Disconnect the CMP sensor electrical connector, the wiring harness retainers and position the harness aside.
 - Remove the bolt and the CMP sensor.



14. Remove the LH engine mount nut.



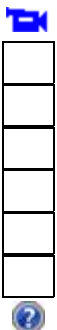
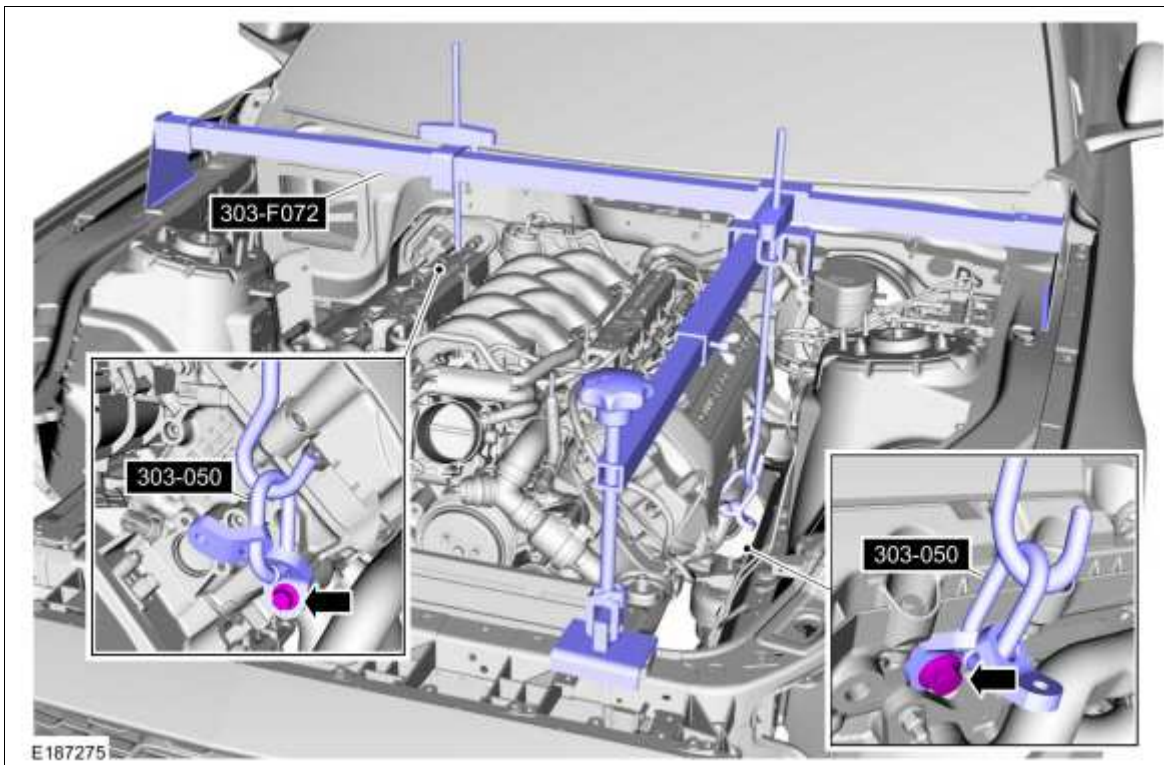
15. Remove the RH engine mount nut.



16. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

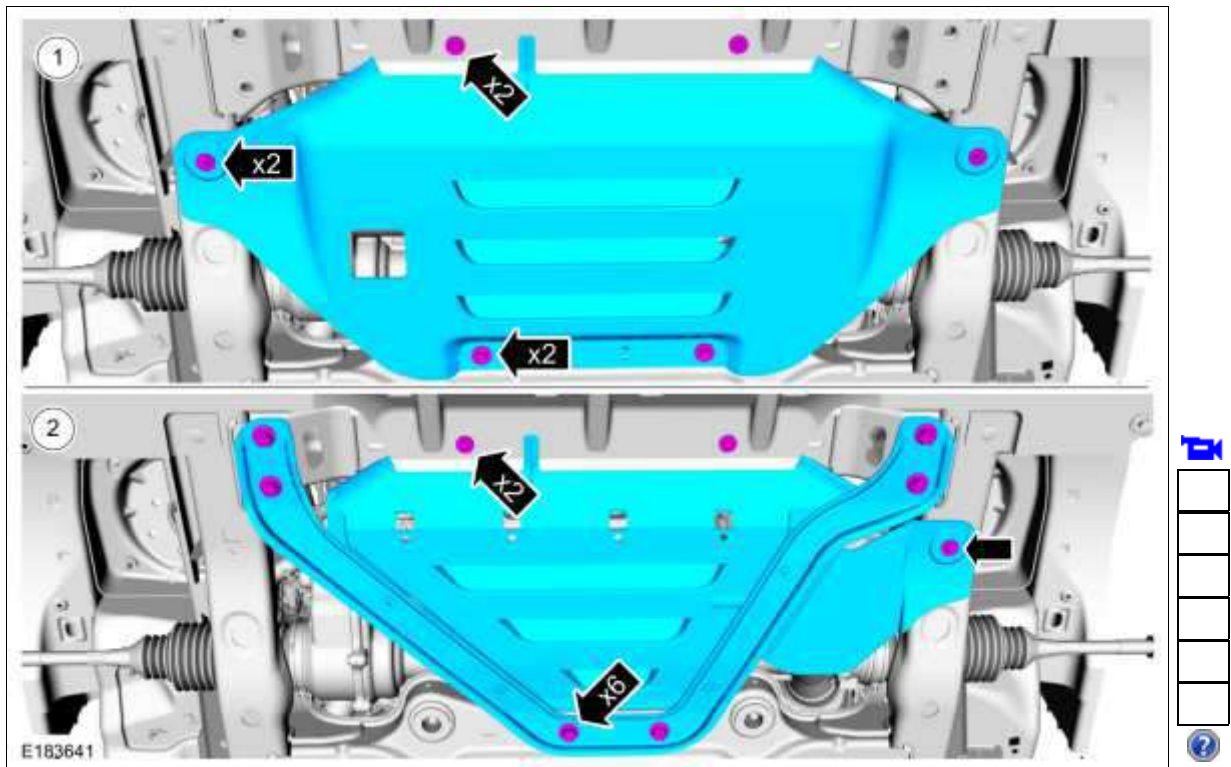
Install the special tools and raise the engine 50 mm (2 inch).

Use Special Service Tool: [303-F072 Support Bar, Engine](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine](#).

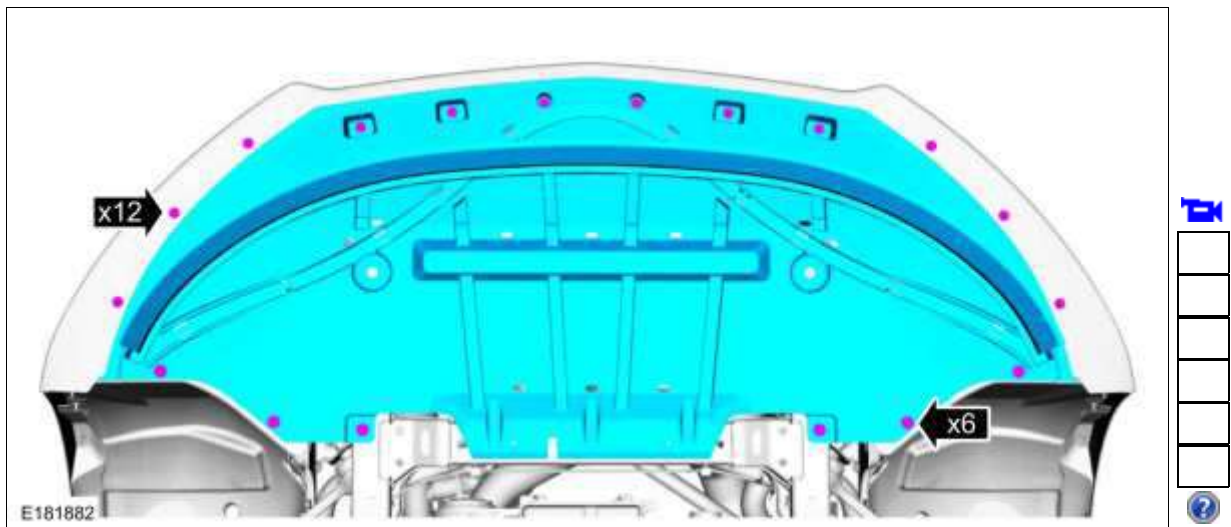


17. Remove the front wheels and tires.
Refer to: [Wheel and Tire](#) (204-04A Wheels and Tires, Removal and Installation).
18. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.
1. Remove the bolts and the underbody shield.

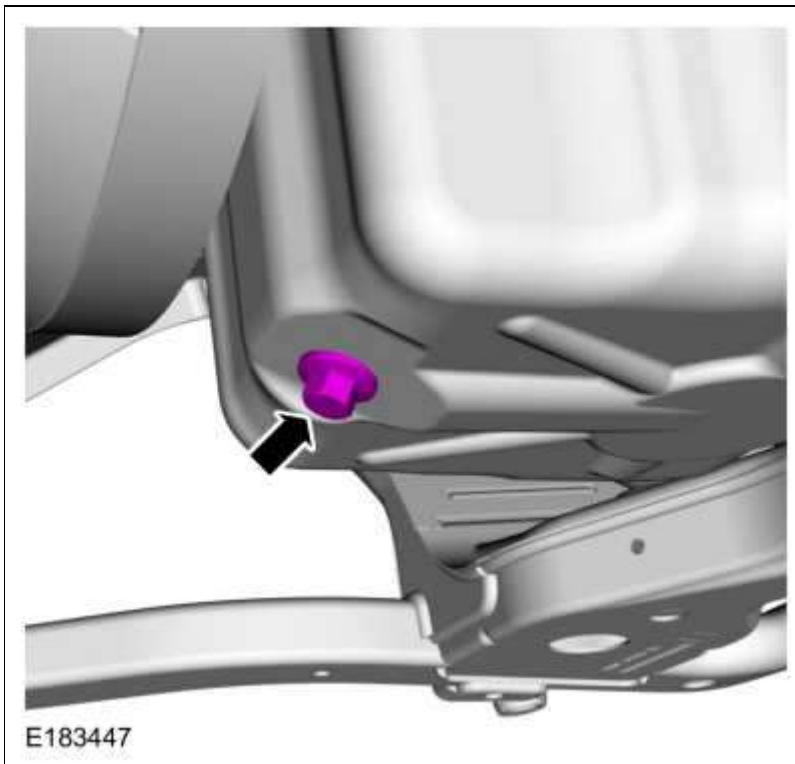
2. Remove the bolts and the subframe bracket and underbody shield assembly.



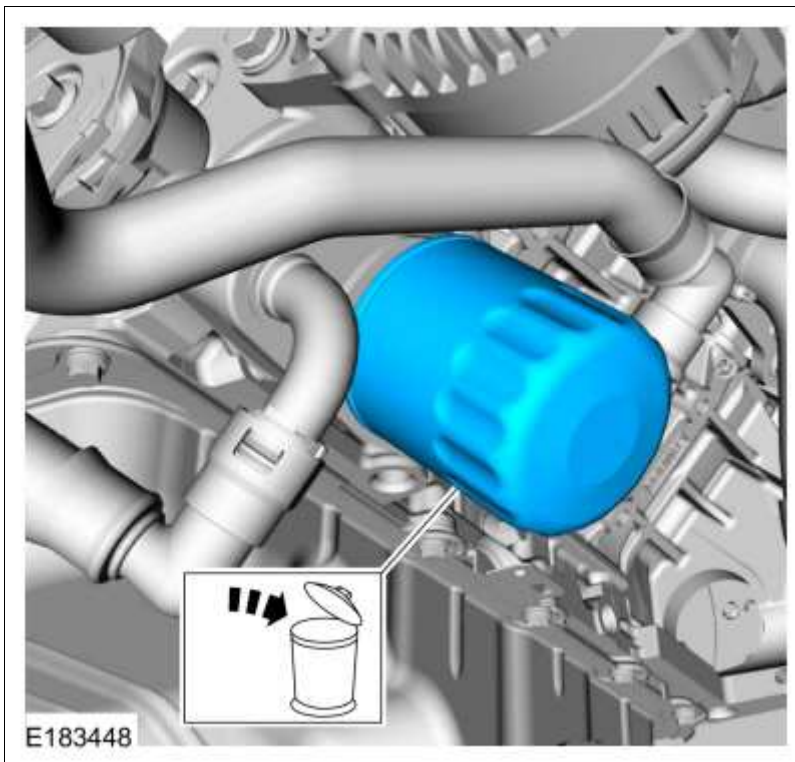
19. Remove the pin-type retainers, bolts and the underbody shield.



- 20.
- Remove the oil pan drain plug and drain the engine oil.
Use the General Equipment: Oil Drain Equipment
 - Install the oil pan drain plug.
Torque: 19 lb.ft (26 Nm)



21. Remove and discard the engine oil filter.



22. **⚠ WARNING:** Do not reuse steering column shaft bolts. This may result in fastener failure and steering column shaft detachment or loss of steering control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

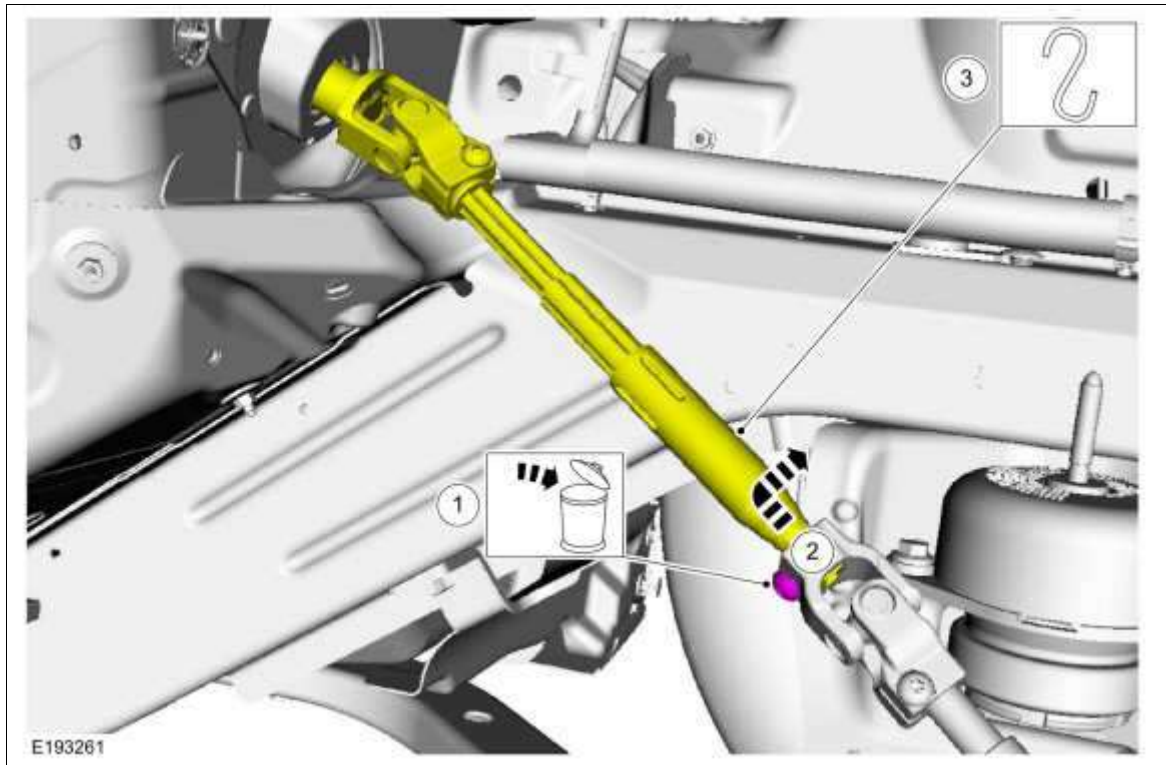
⚠ WARNING: DO NOT hammer, pry or force steering column and column shafts during installation or removal. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

⚠ WARNING: DO NOT attempt to remove or install the steering column lower u-joint at the

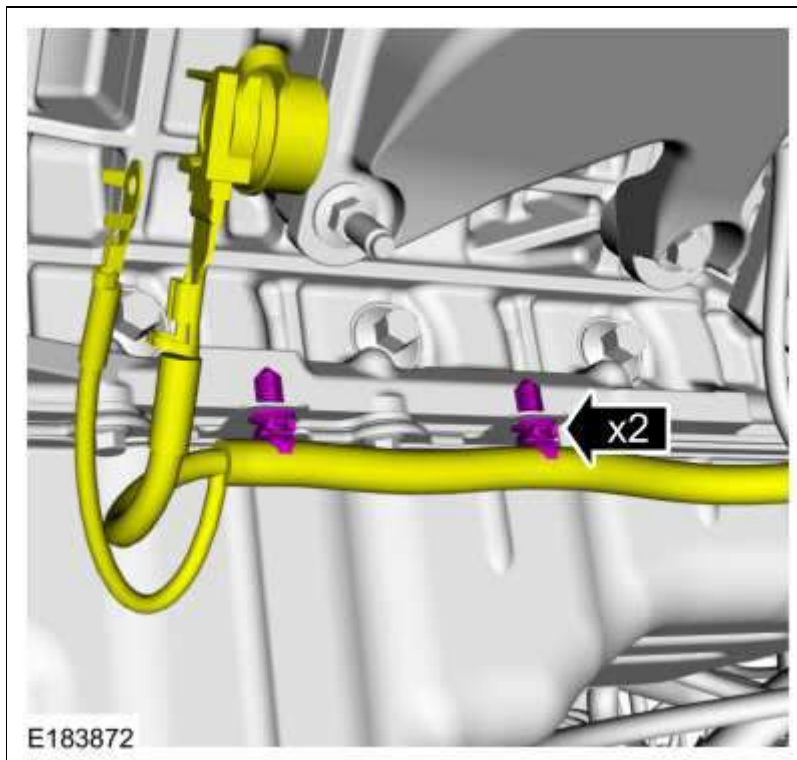
steering gear without first loosening the steering column dash seal and fasteners. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

Detach the steering column lower shaft from the lower coupling.

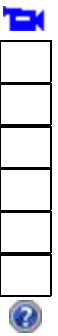
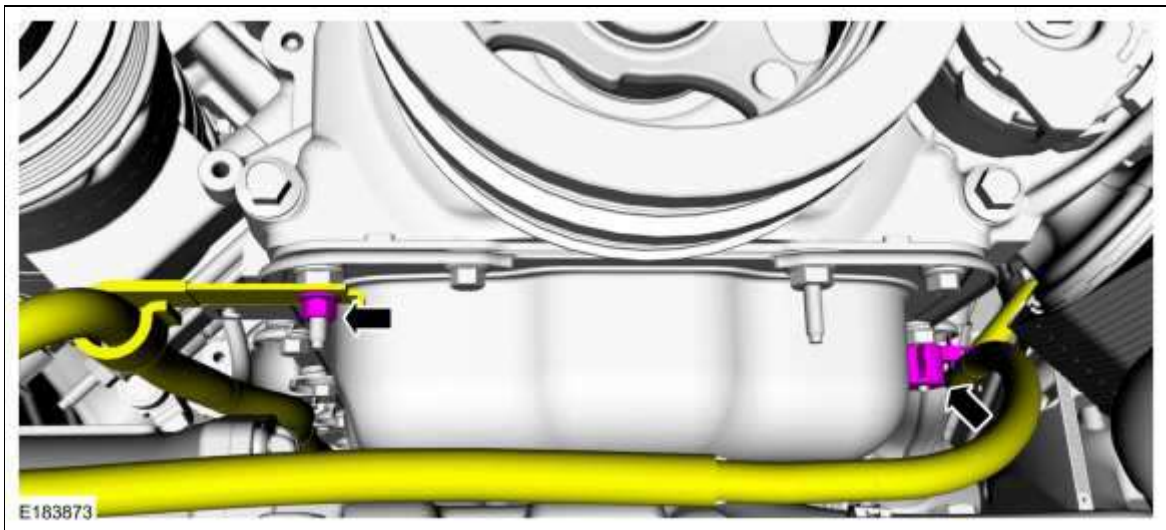
1. Remove and discard the steering column shaft bolt.
2. Pull apart the steering column shaft from the coupling.
3. Secure the lower shaft to the frame rail to avoid damage to the shaft.



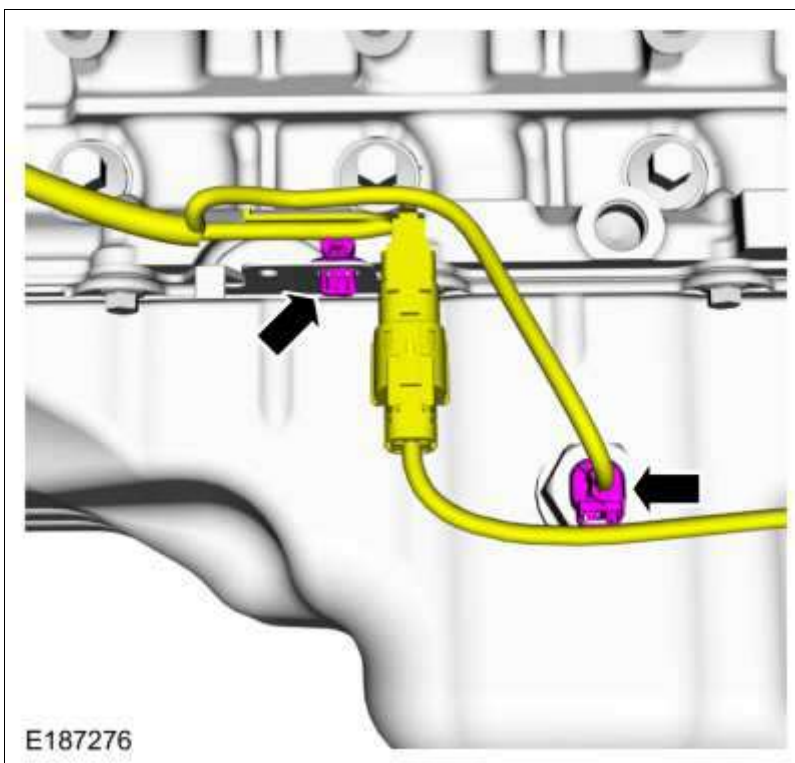
23. Detach the wiring harness retainers from the oil pan.



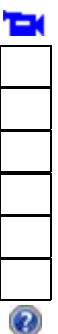
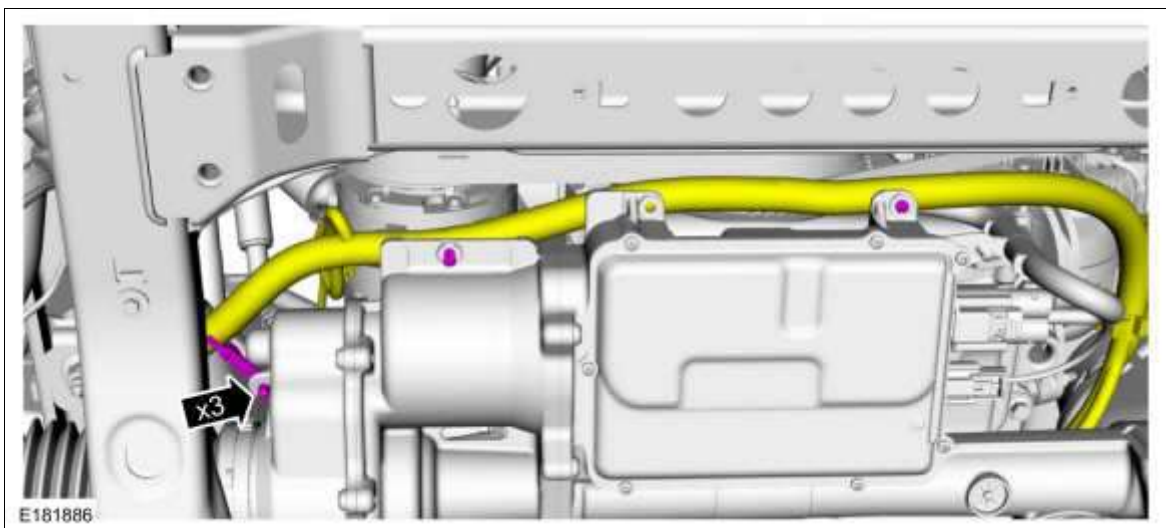
24.
 - Remove the nut and the wiring harness retainer.
 - Detach the wiring harness retainer from the oil pan stud bolt.



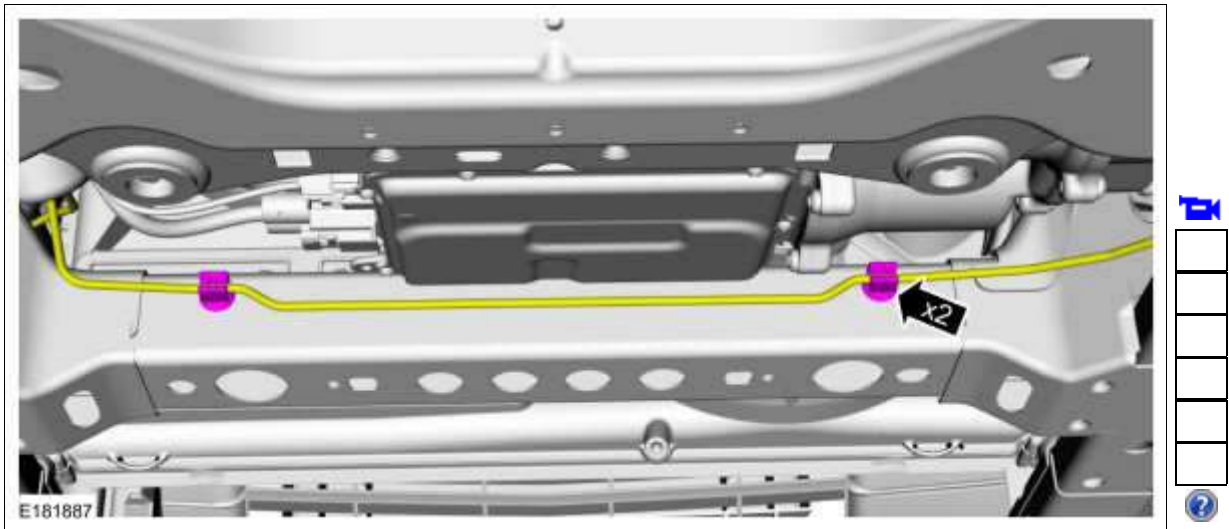
25. Disconnect the oil level sensor electrical connector and wiring harness retainer.



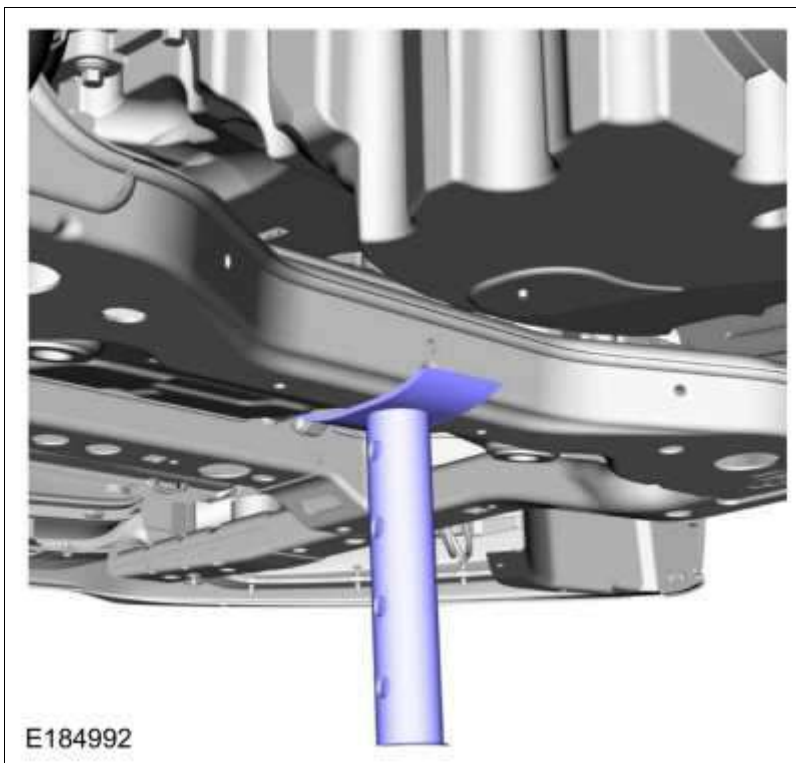
26. Detach the wiring harness pin-type retainers.



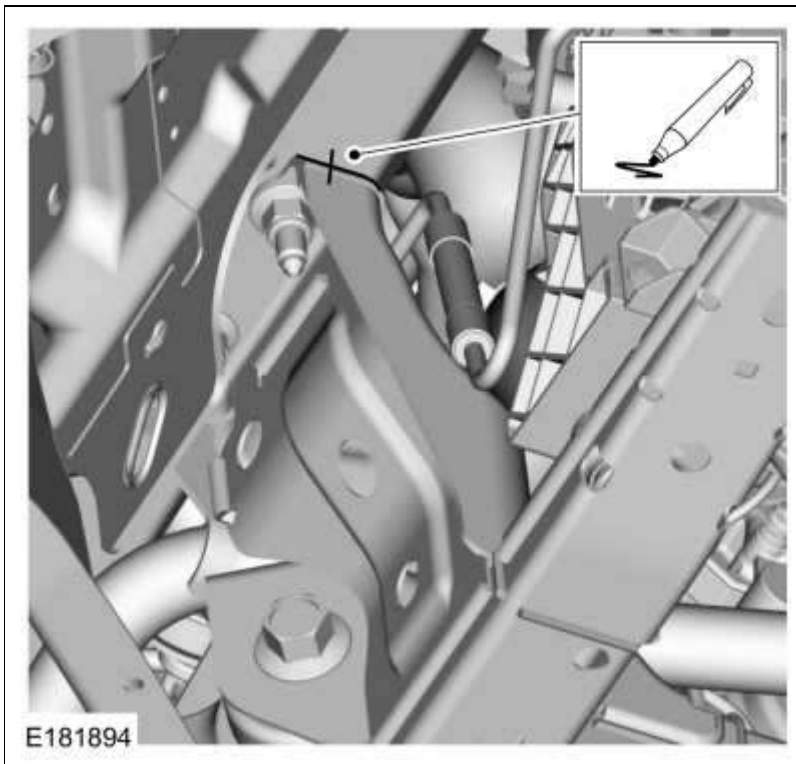
27. Detach the brake tube retainers from the subframe.



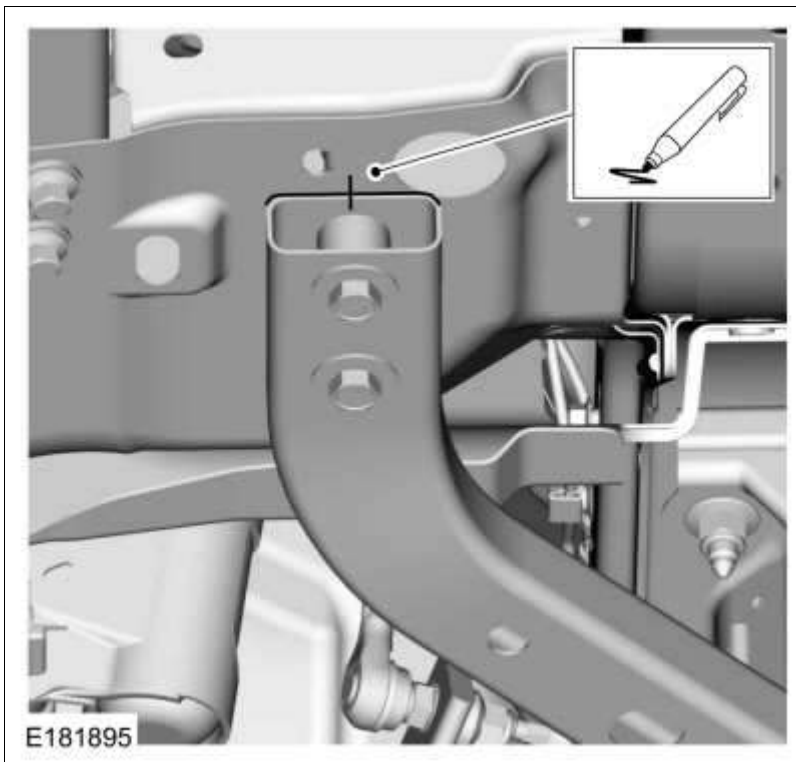
28. Using an adjustable stand, support the subframe.
Use the General Equipment: Vehicle/Axle Stands



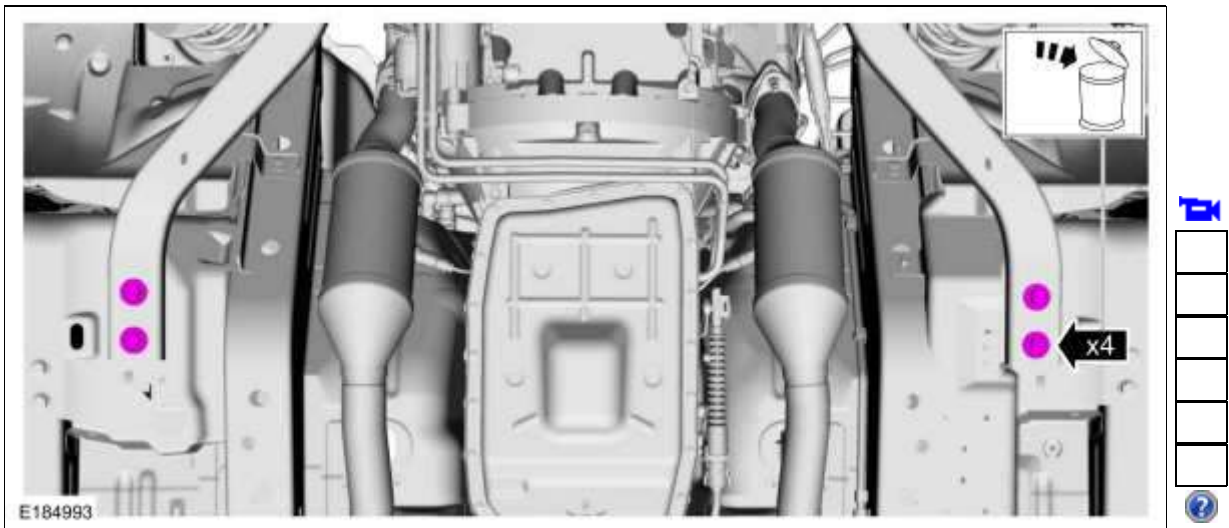
29. Mark the position of the front subframe for reference during installation.



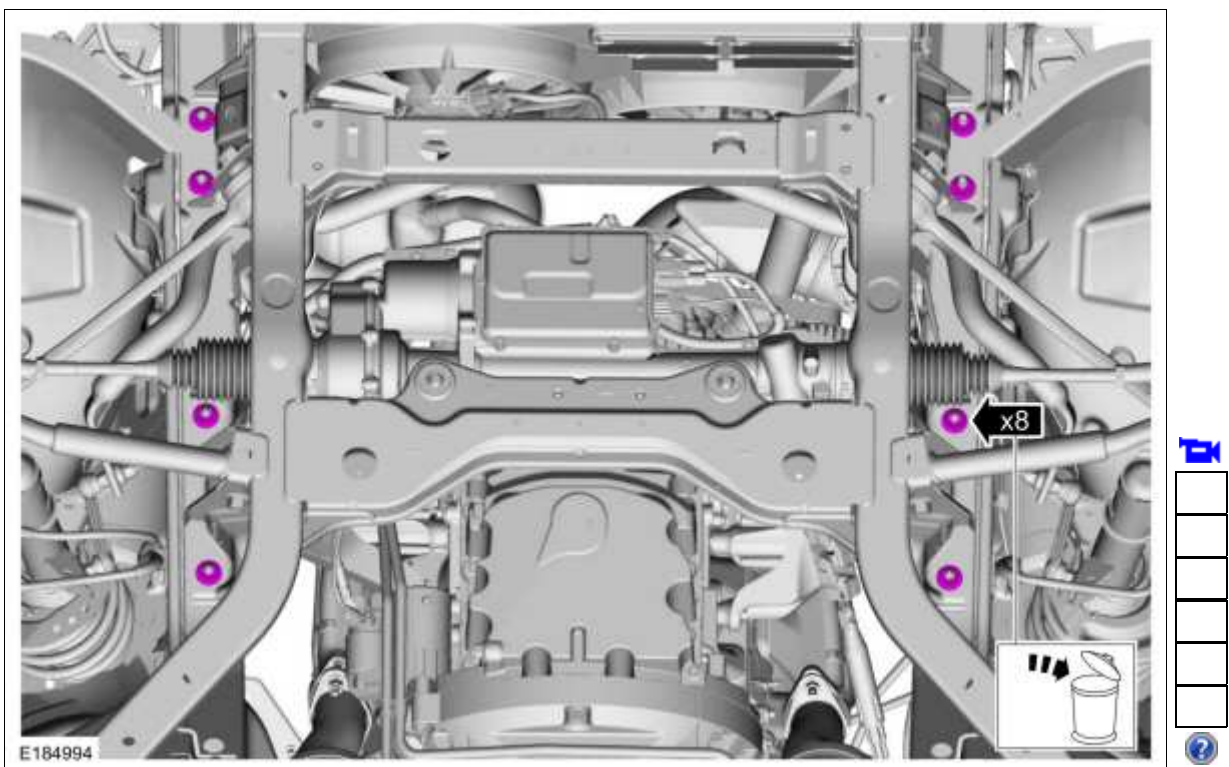
30. Mark the position of the rear subframe for reference during installation.



31. Remove and discard the rear subframe bolts.

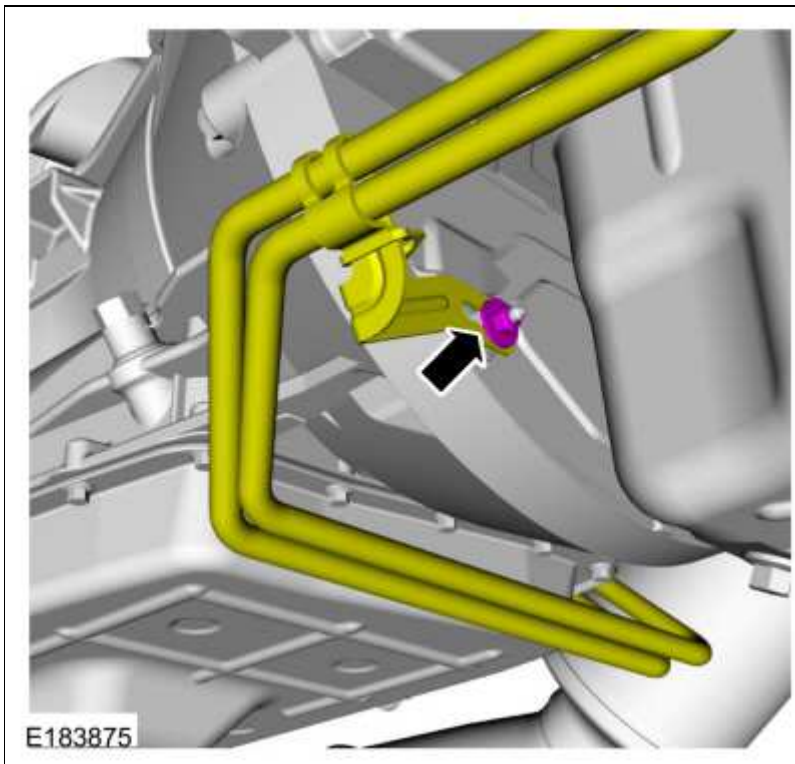


32. Remove and discard the front subframe nuts.

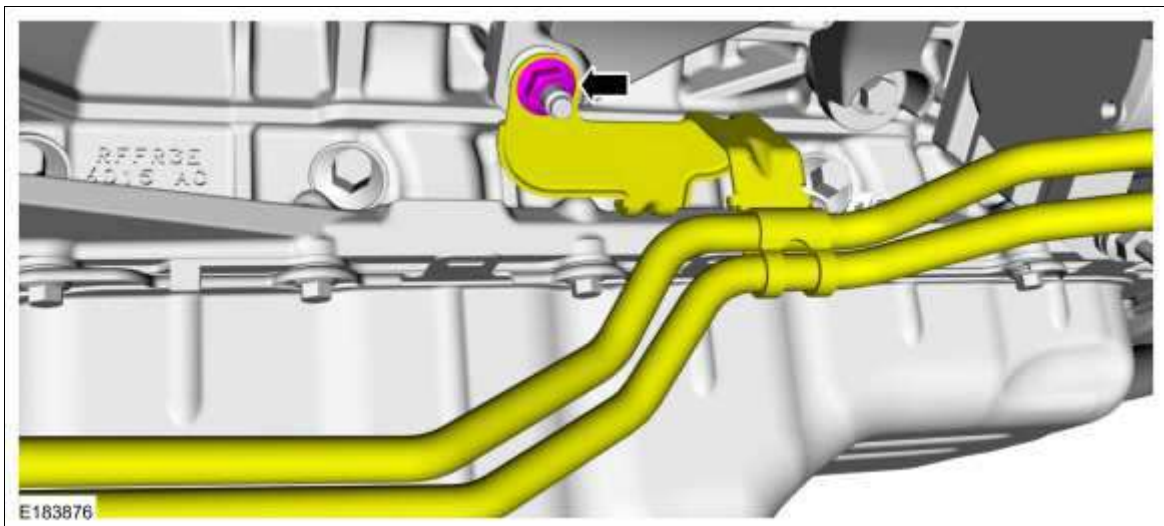


6-Speed Automatic Transmission - 6R80

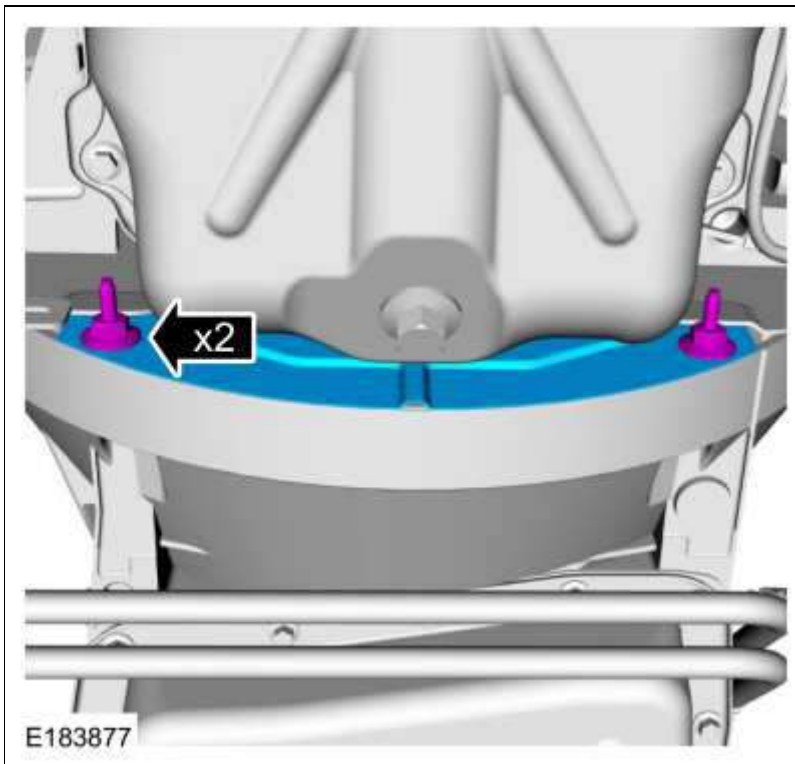
33. Remove the transmission cooling tube nut and bracket from the flexplate inspection cover stud bolt.



34. Remove the transmission cooling tube bracket nut and position the bracket and tubes aside.

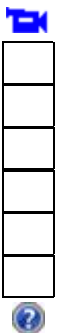
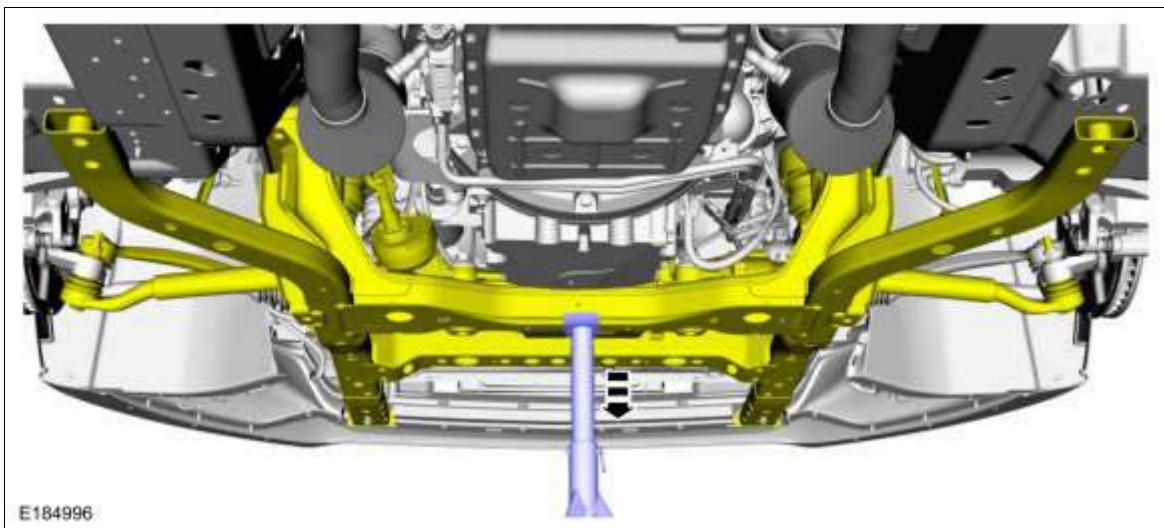


35. Remove the stud bolts and the flexplate inspection cover.

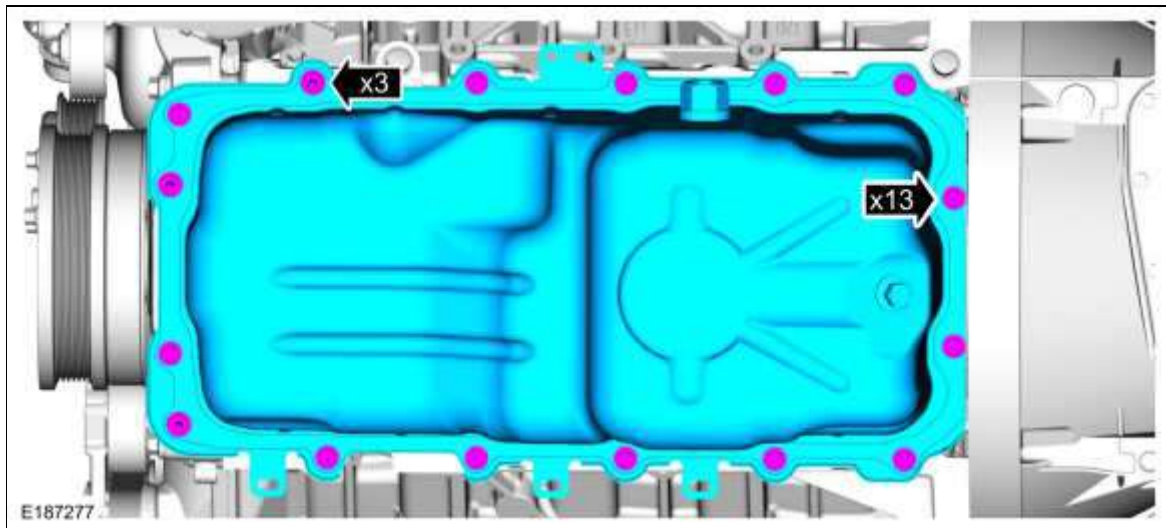


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

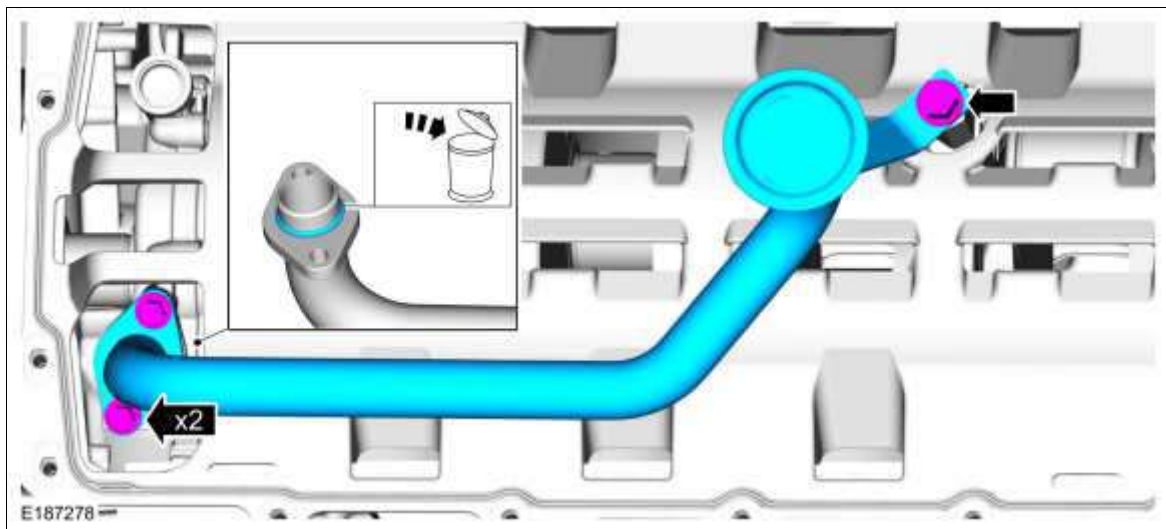
36. Using an adjustable stand, lower the subframe 102 mm (4.0 in).
Use the General Equipment: Vehicle/Axle Stands



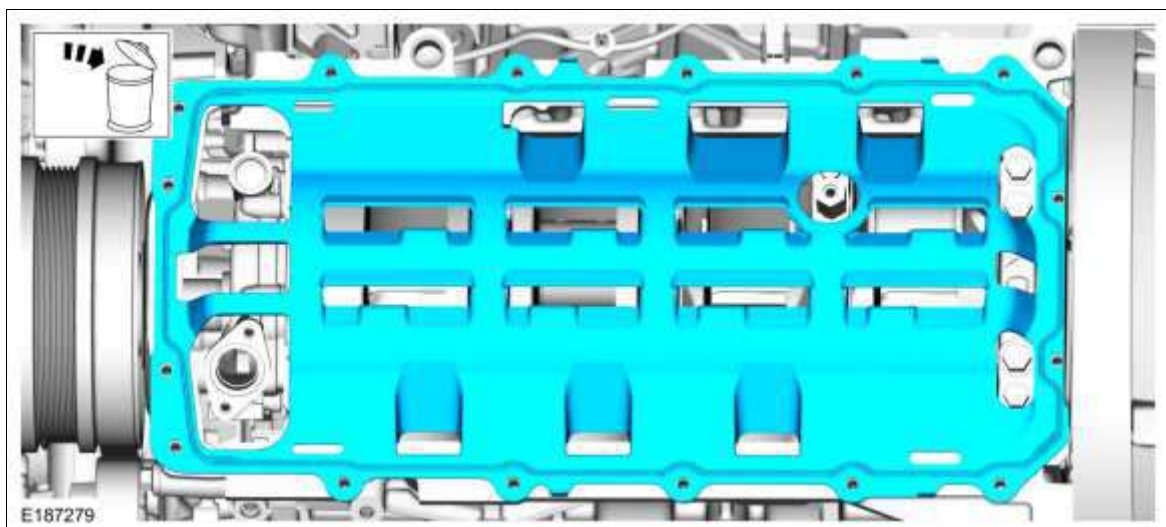
37. Remove the bolts, stud bolts and the oil pan.



38. Remove the bolts and the oil pump screen and pickup tube.
- Remove and discard the O-ring seal.

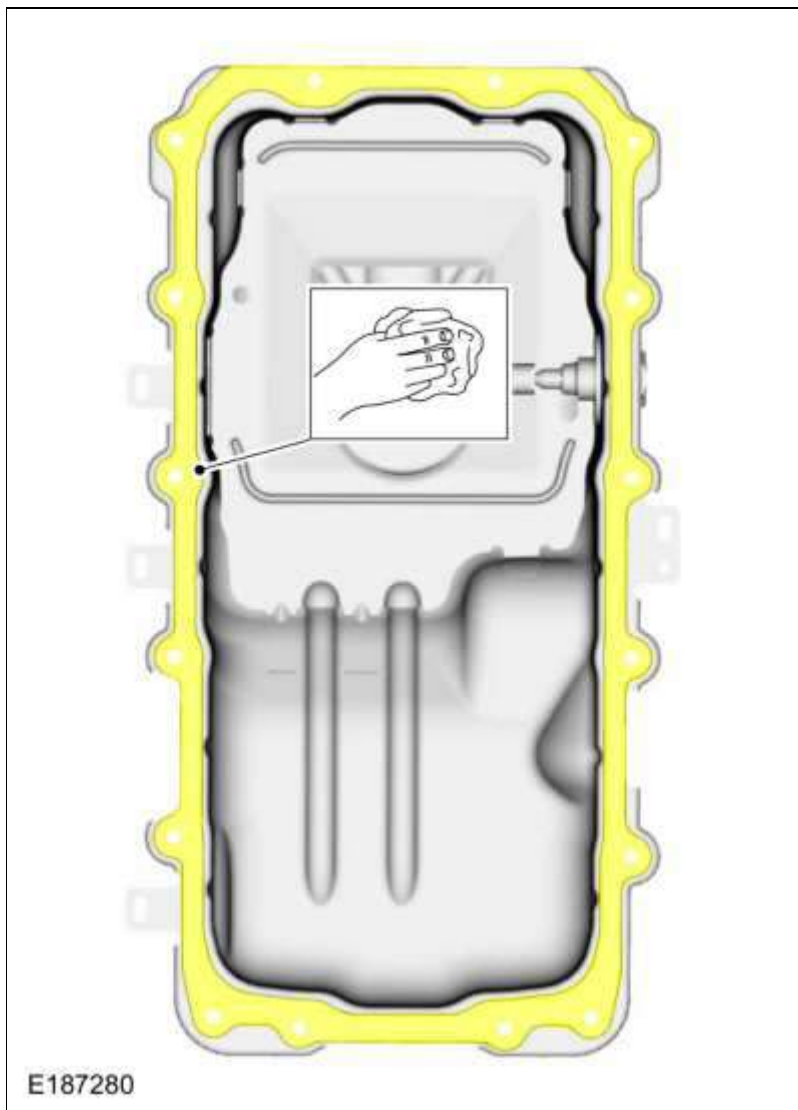


39. Remove and discard the oil pan baffle and gasket.



40. **NOTICE:** 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.

Make sure that the mating faces are clean and free of foreign material.



41. **NOTICE:** 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.

Make sure that the oil pan mating faces of the cylinder block, engine front cover and rear seal retaining plate are clean and free of foreign material.

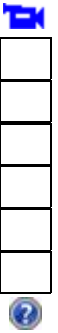
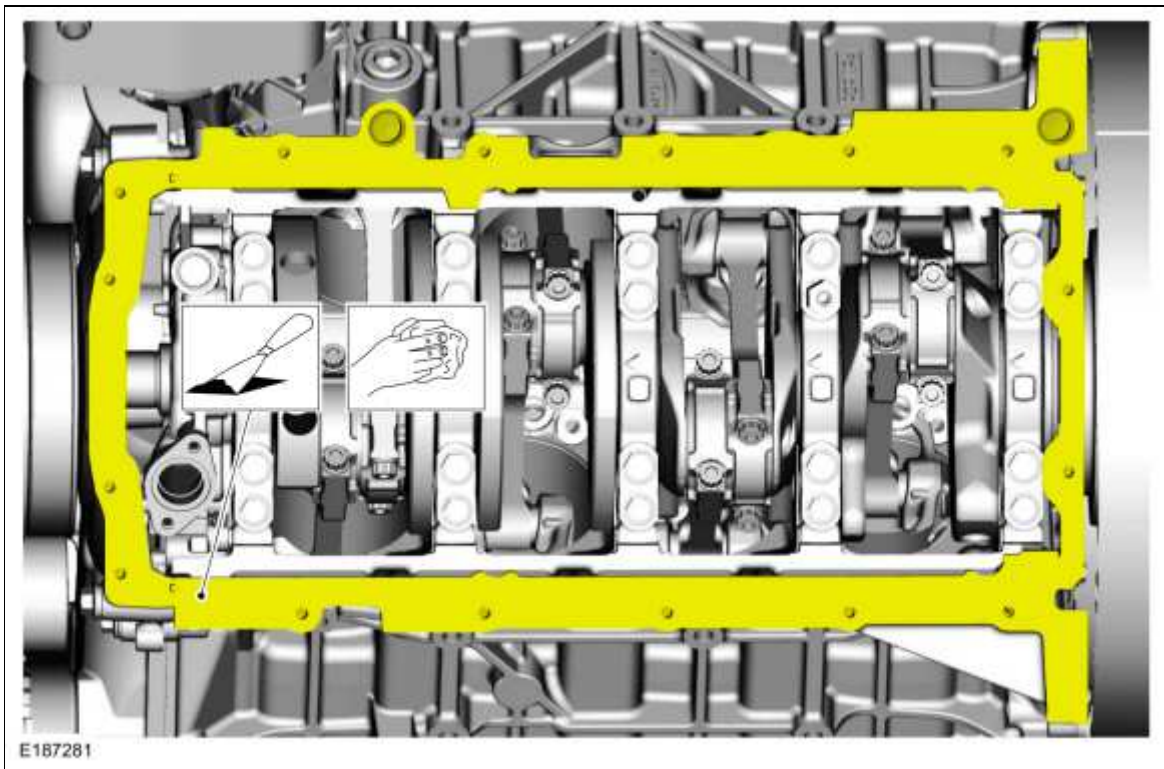
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

Material: Motorcraft® Metal Surface Prep / ZC-31-B



Installation

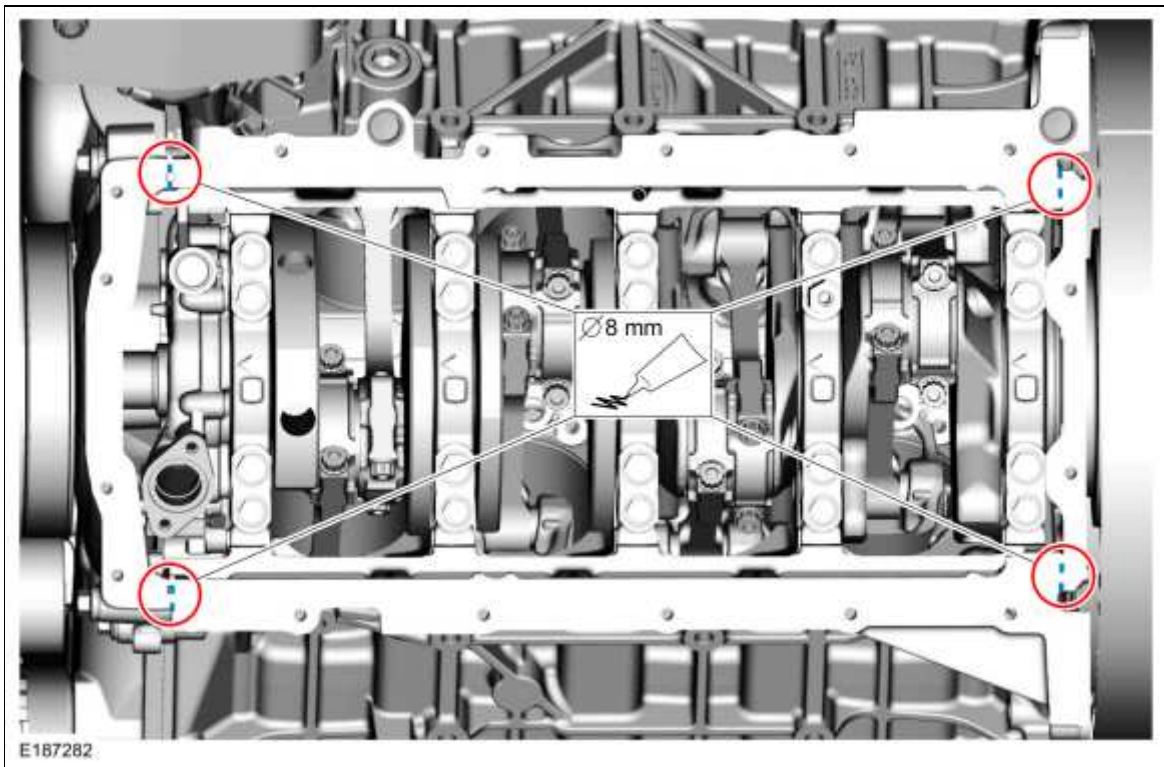
6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

1. **NOTE:** If the oil pan is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage. If this timing cannot be met, tighten fasteners 7, 8, 9 and 10 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer and final torque all of the fasteners within 1 hour of applying the sealer.

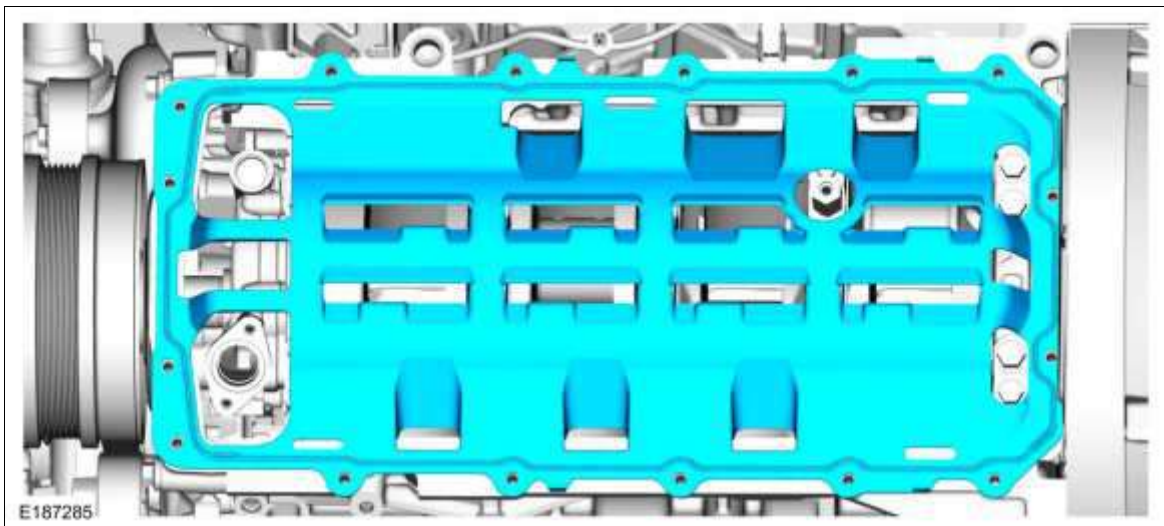
NOTE: If the engine front cover has been removed, it is only necessary to apply sealant to the crankshaft rear seal retainer plate-to-cylinder block sealing surfaces.

Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the crankshaft rear seal retainer plate-to-cylinder block sealing surfaces and the engine front cover-to-cylinder block sealing surfaces.

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



2. Install the new oil pan baffle and gasket.



3. Using a new O-ring seal, install the oil pump screen and pickup tube and the bolts.

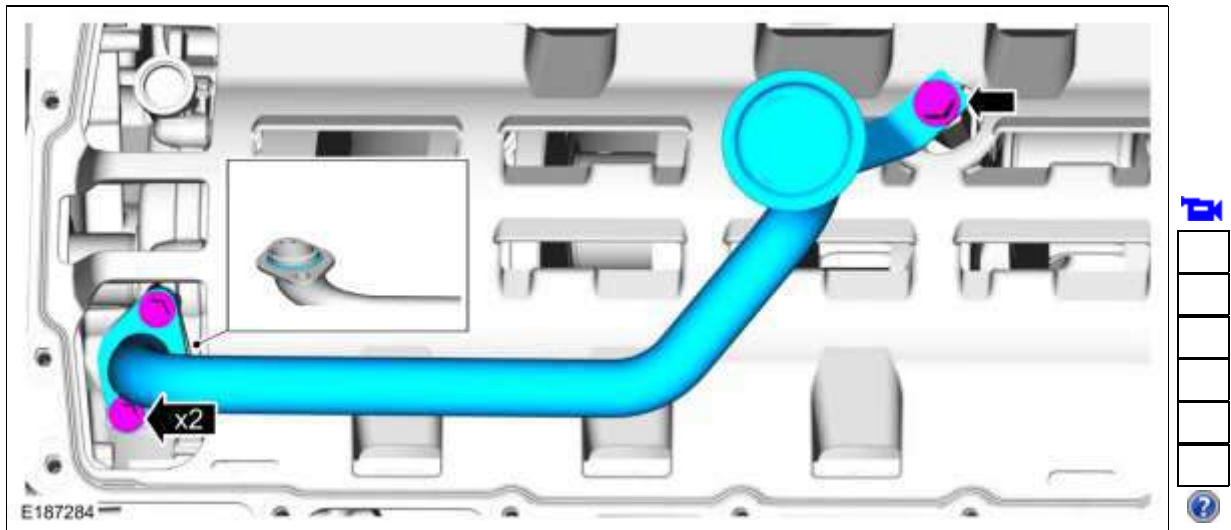
Torque:

Oil pump screen and pickup tube-to-oil pump bolts :

Stage 1: 89 lb.in (10 Nm)

Stage 2: 45°

Oil pump screen and pickup tube-to-spacer bolt : 18 lb.ft (25 Nm)



4. **NOTE:** Fastener locations 7, 13 and 16 are stud bolts.

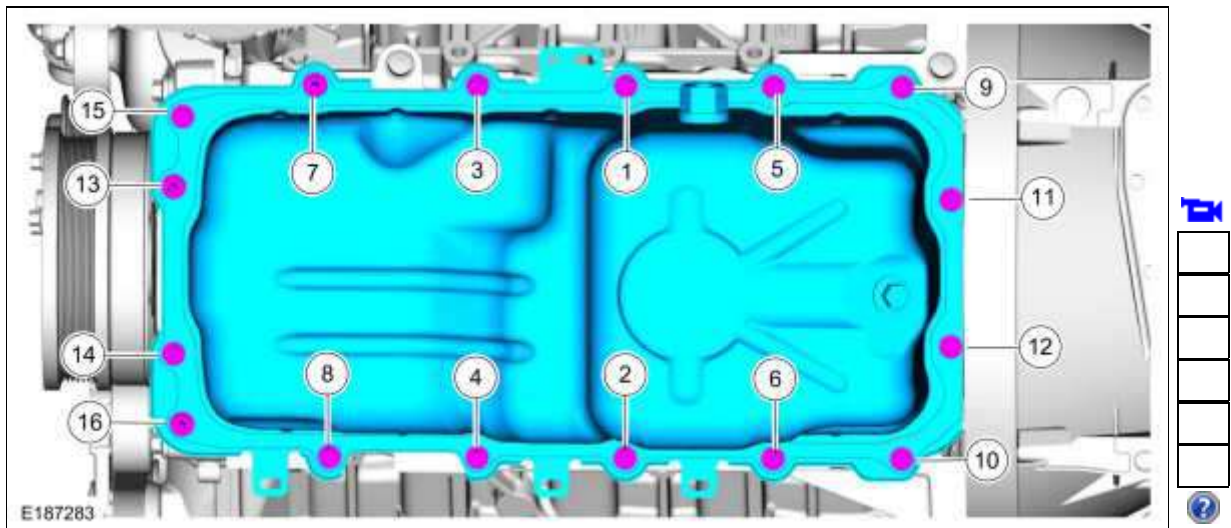
Install the oil pan and the bolts.

Torque:

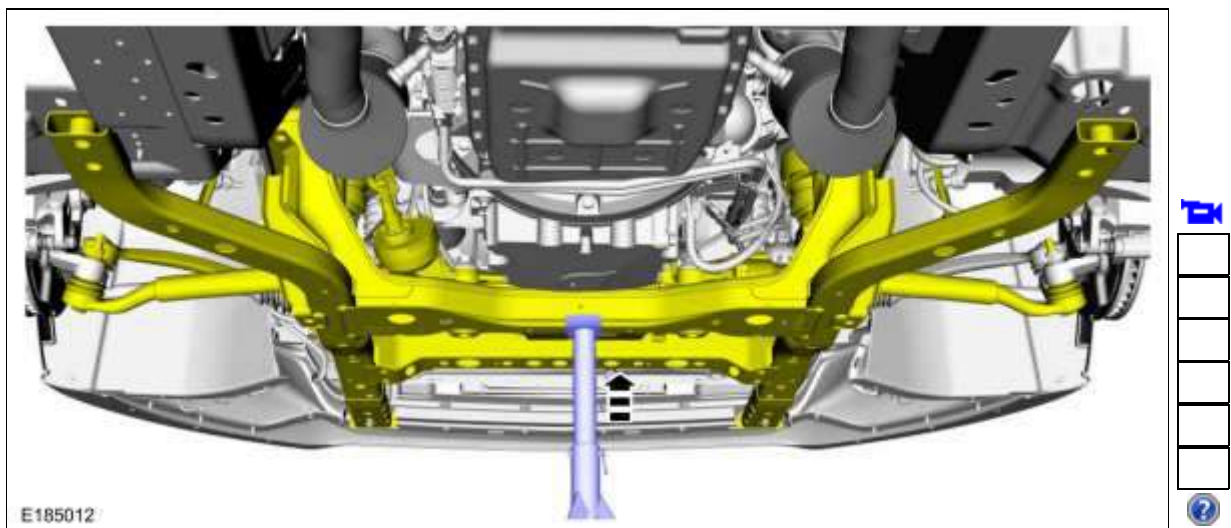
Stage 1: 18 lb.in (2 Nm)

Stage 2: 89 lb.in (10 Nm)

Stage 3: 45°



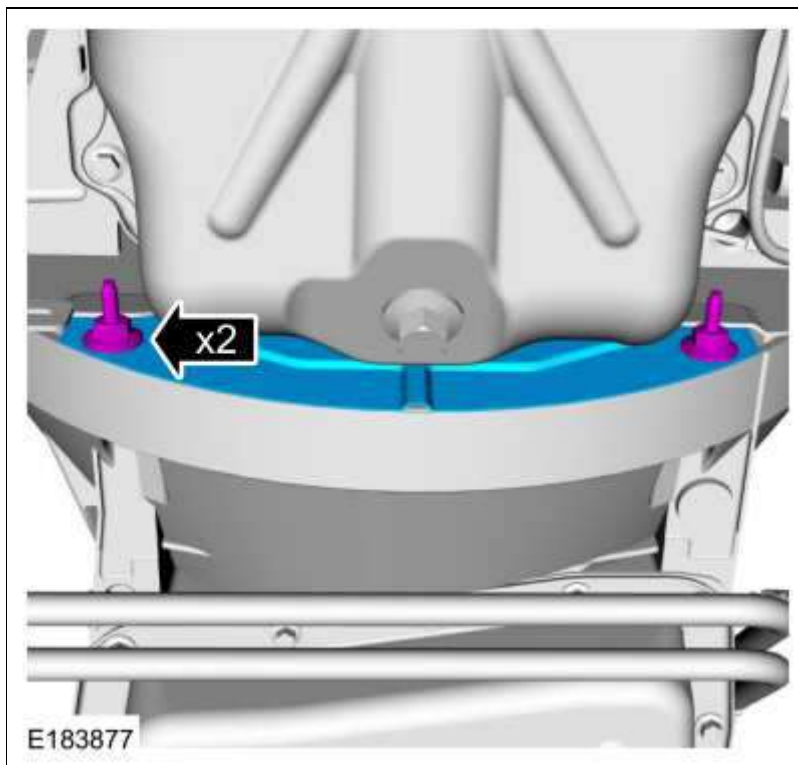
5. Using an adjustable stand, raise the subframe.
Use the General Equipment: Vehicle/Axle Stands



6-Speed Automatic Transmission - 6R80

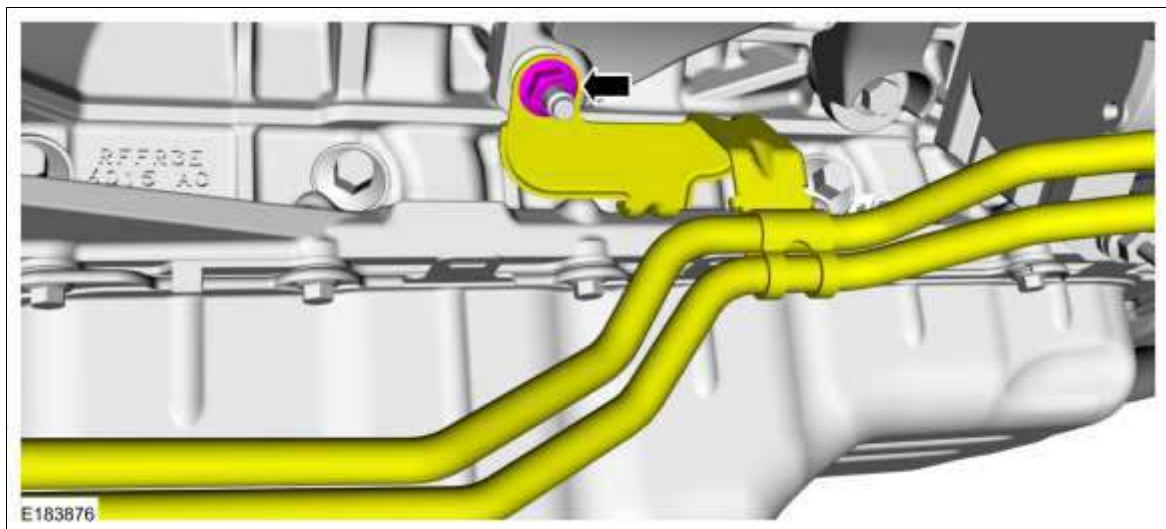
6. Install the flexplate inspection cover and the stud bolts.

Torque: 35 lb.ft (48 Nm)



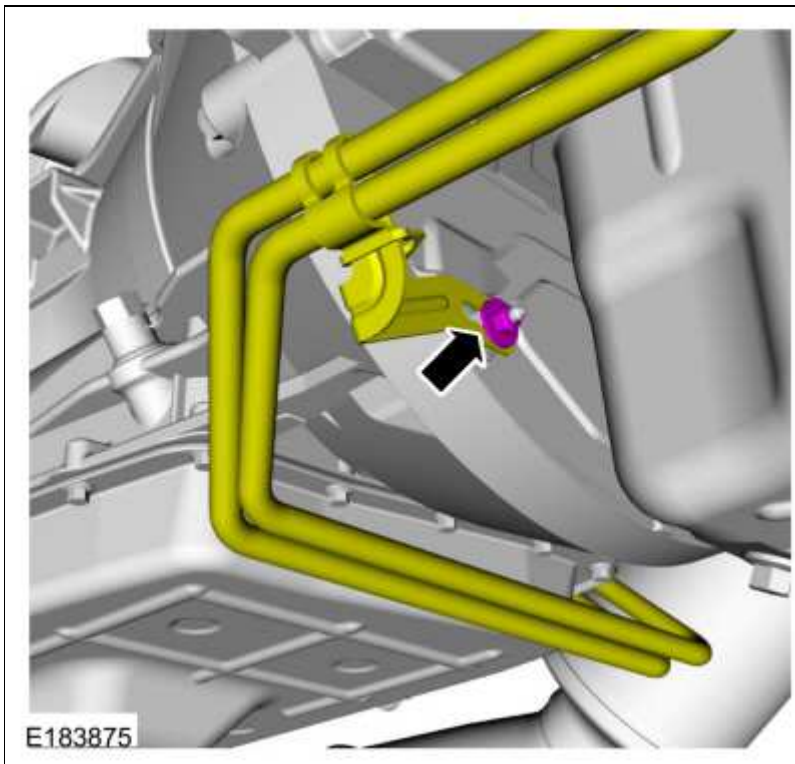
7. Install the transmission cooling tube bracket and nut.

Torque: 35 lb.ft (48 Nm)



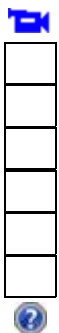
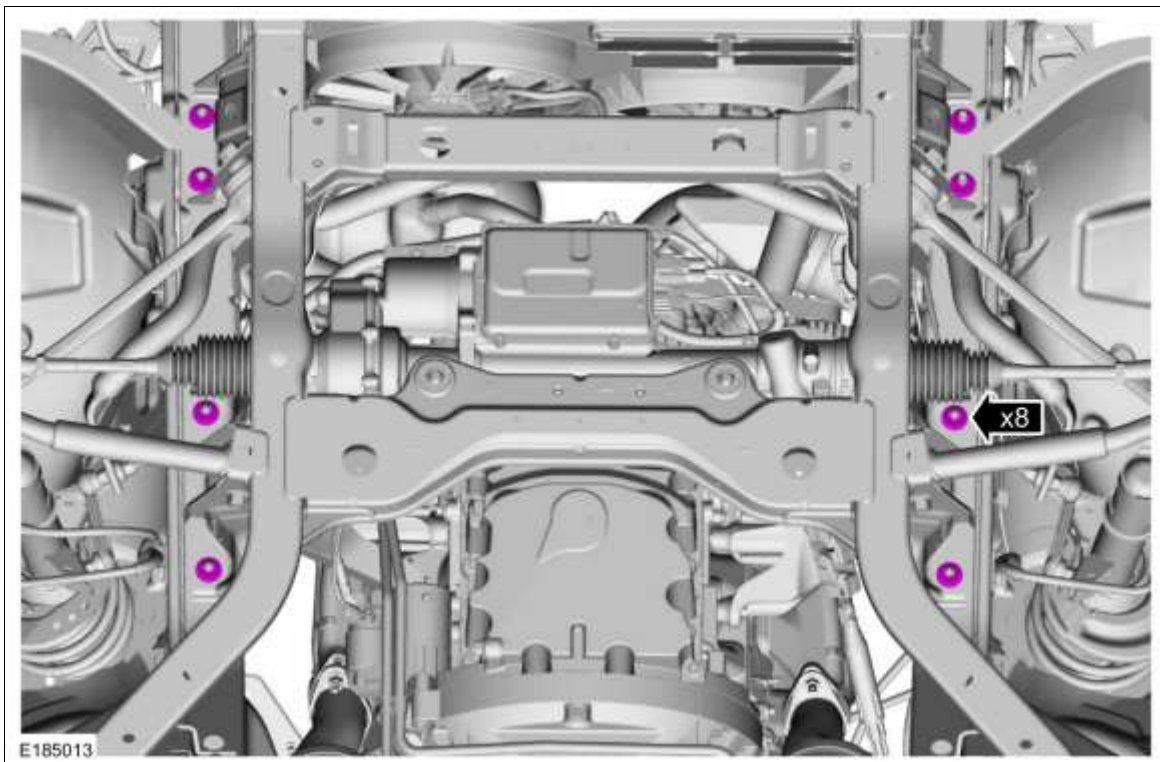
8. Install the transmission cooling tube bracket and nut.

Torque: 124 lb.in (14 Nm)

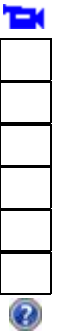
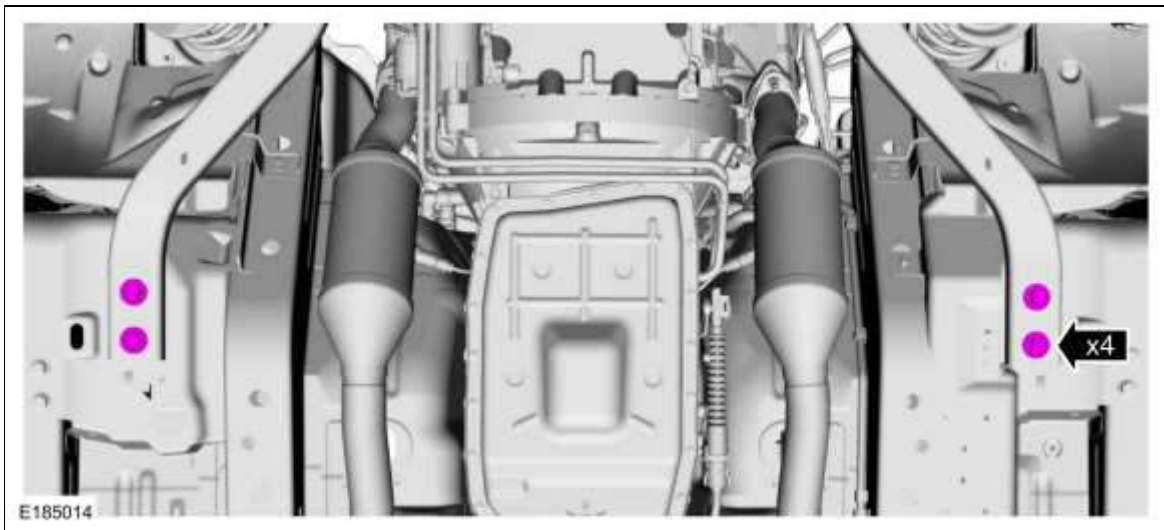


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

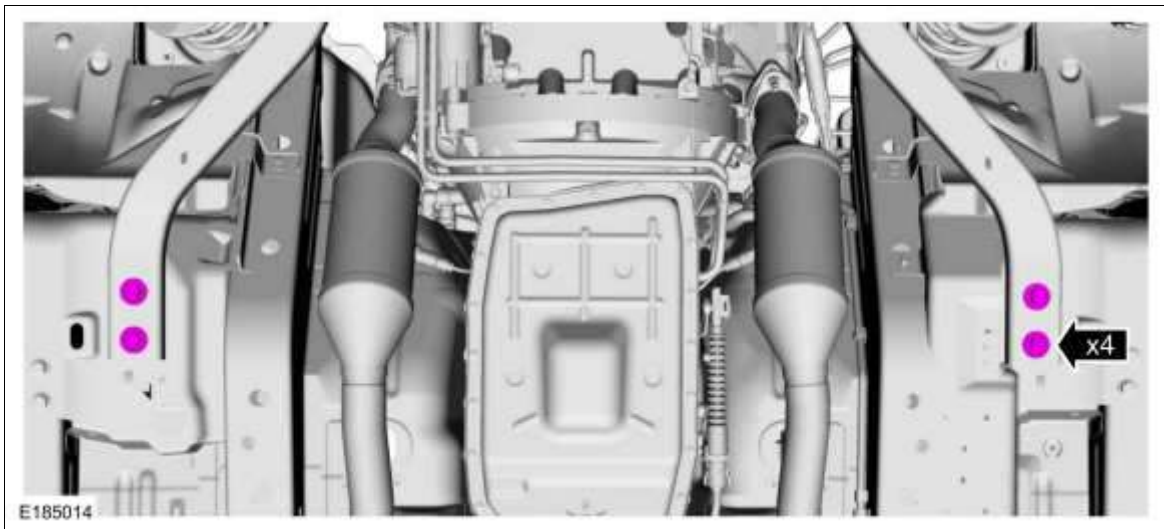
9. Install the new front subframe nuts loosely.



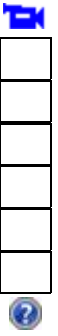
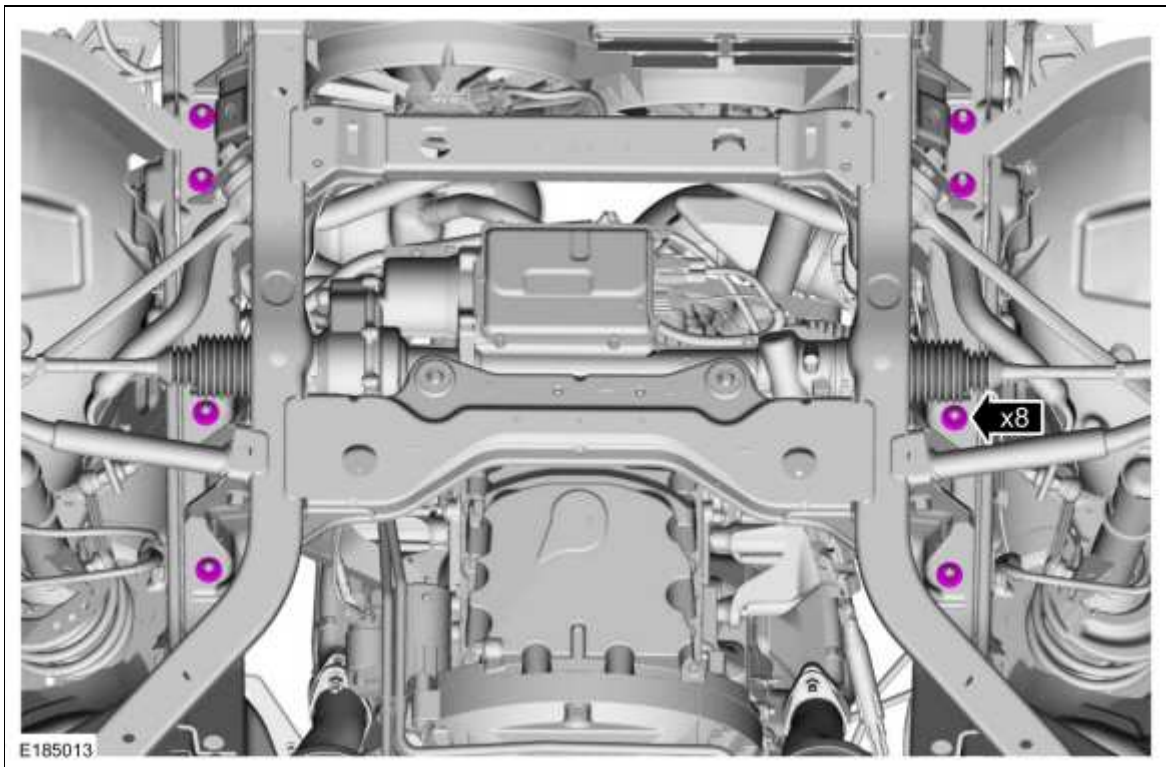
- 10.
- Use a suitable alignment tool with a 15 mm (0.59 in) OD shaft that is long enough to go through the subframe and body.
 - Align the subframe to the alignment marks made during removal.
 - Install the new rear subframe bolts loosely.



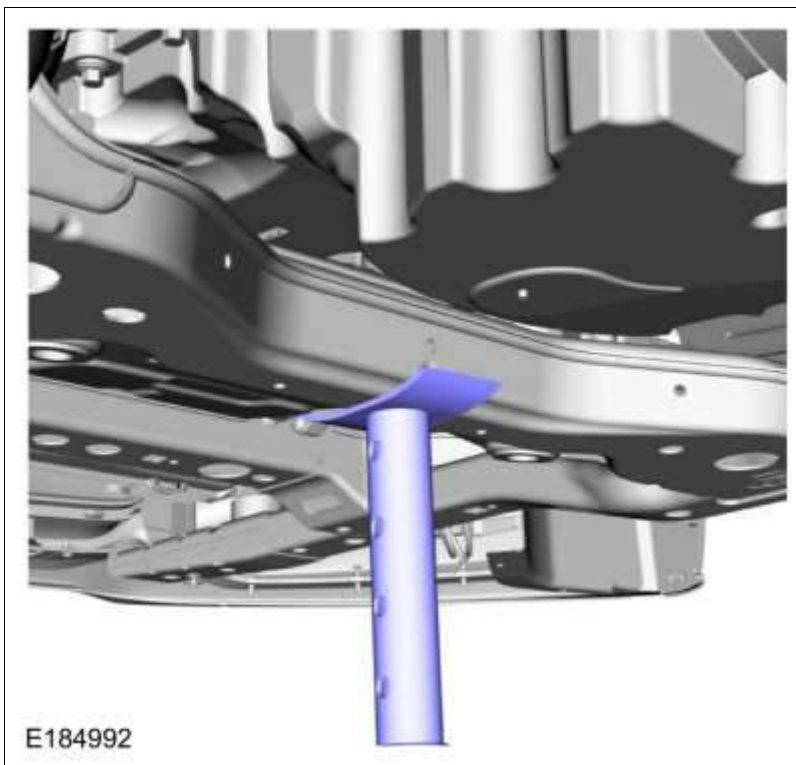
11. Tighten the rear subframe bolts in a cross pattern.
Torque: 85 lb.ft (115 Nm)



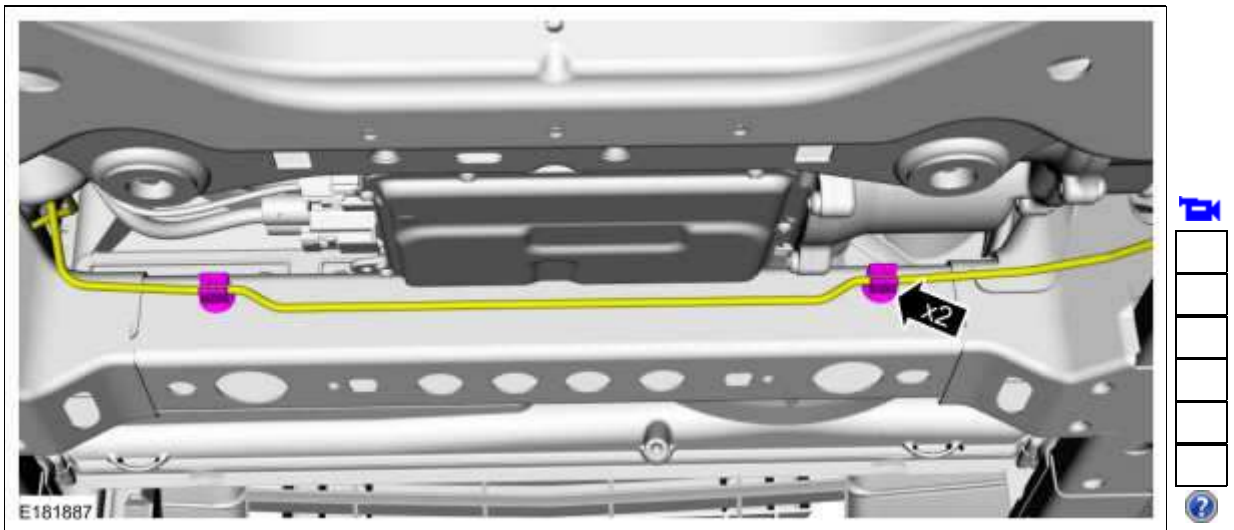
12. Tighten the front subframe nuts in a cross pattern.
Torque: 85 lb.ft (115 Nm)



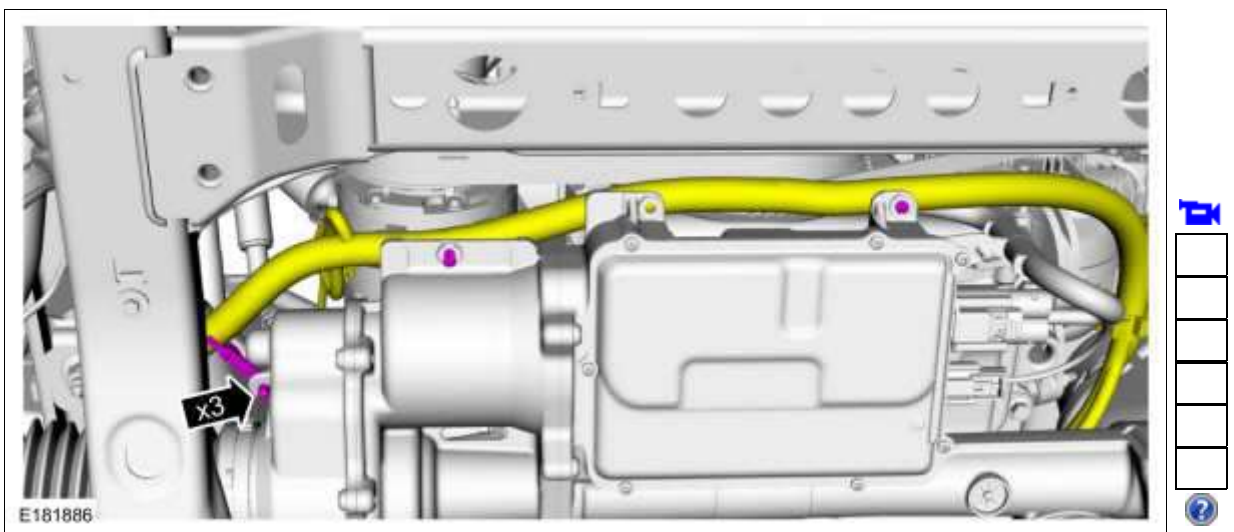
13. Remove the adjustable stand.
Use the General Equipment: Vehicle/Axle Stands



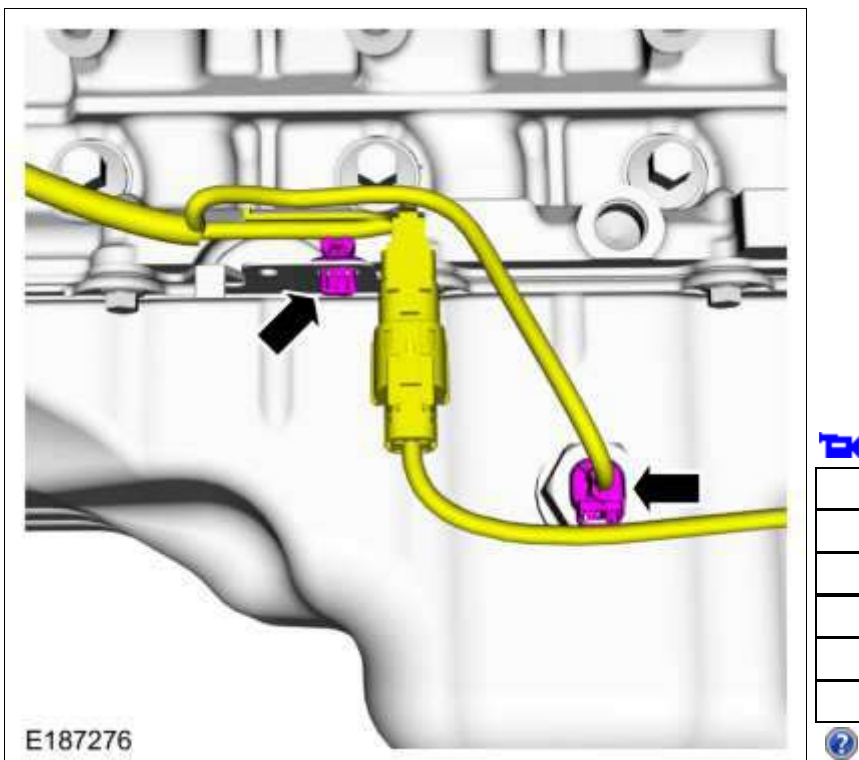
14. Attach the brake line retainers to the subframe.



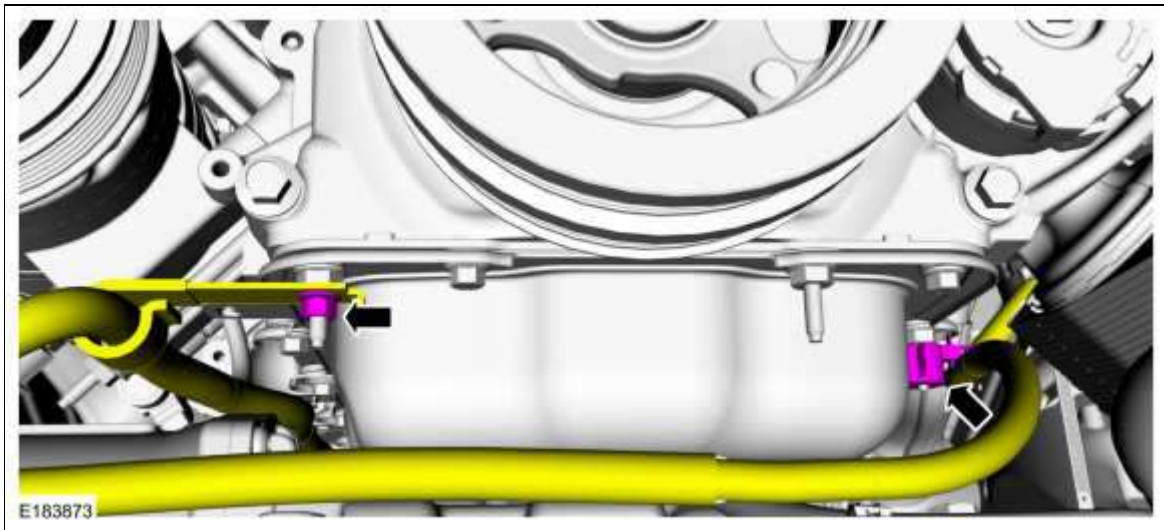
15. Attach the EPAS wiring harness pin-type retainers.



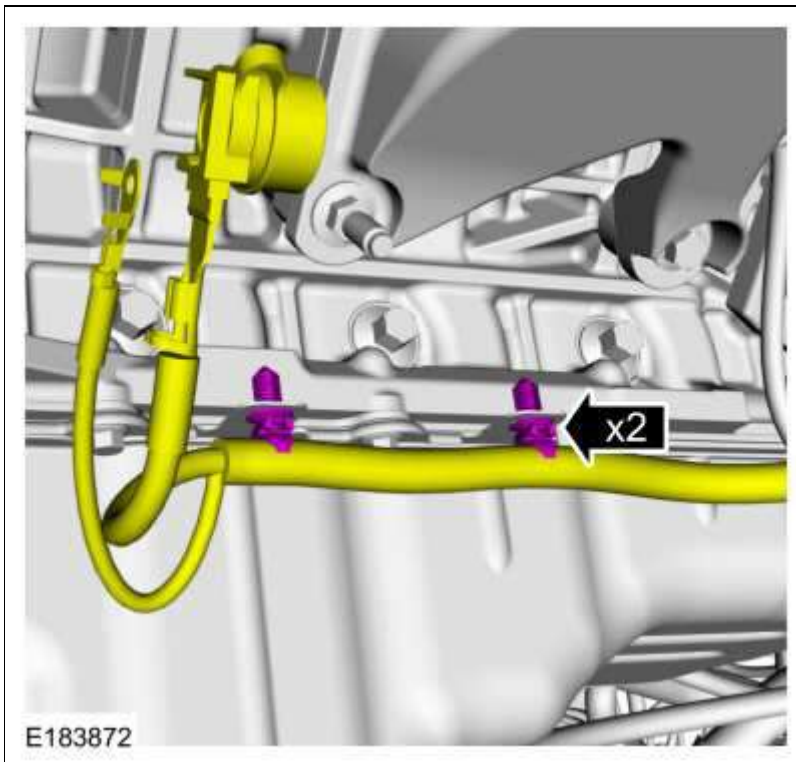
16. Connect the oil level sensor electrical connector and wiring harness retainer.



17.
 - Attach the wiring harness retainer to the oil pan stud bolt.
 - Install the wiring harness retainer and the nut.*Torque: 124 lb.in (14 Nm)*



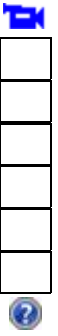
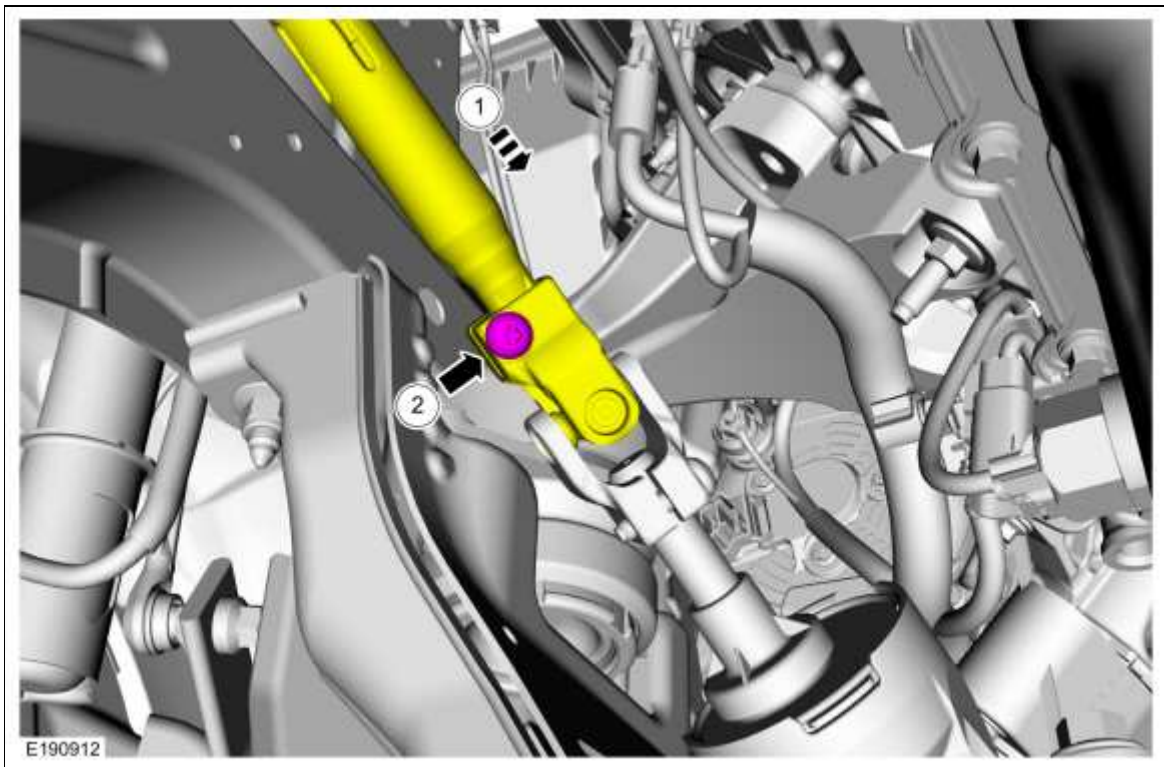
18. Attach the wiring harness retainers to the oil pan.



19. **⚠ WARNING: DO NOT hammer, pry or force steering column and column shafts during installation or removal. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.**

⚠ WARNING: DO NOT attempt to remove or install the steering column lower u-joint at the steering gear without first loosening the steering column dash seal and fasteners. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

1. Connect the steering column shaft to the steering gear universal joint.
 2. Install the new steering column shaft bolt.
- Torque: 22 lb.ft (30 Nm)*



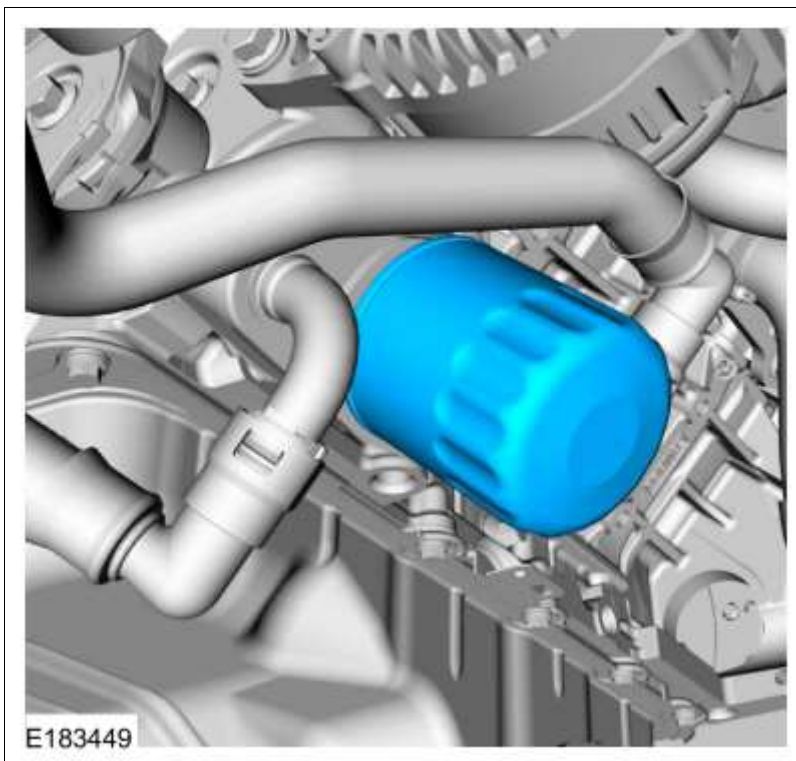
20. Inspect the steering column lower shaft.
Refer to: [Steering Column Collapsed Check](#) (211-04 Steering Column, General Procedures).
21. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

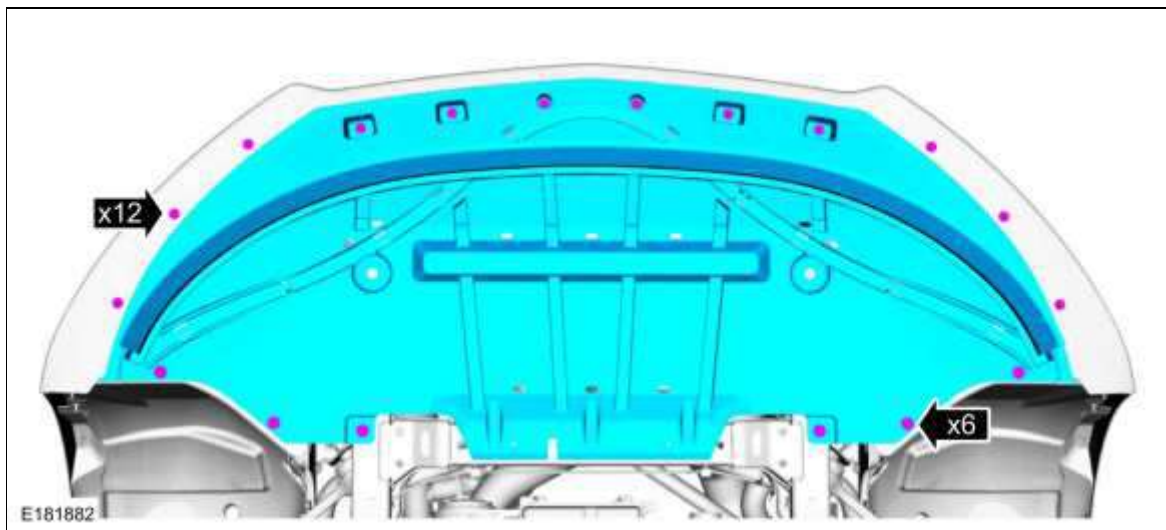
Torque:

Stage 1: 44 lb.in (5 Nm)

Stage 2: 180°



22. Install the underbody shield, bolts and the pin-type retainers.



23. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

1. Install the underbody shield and the bolts.

Torque:

A: 97 lb.in (11 Nm)

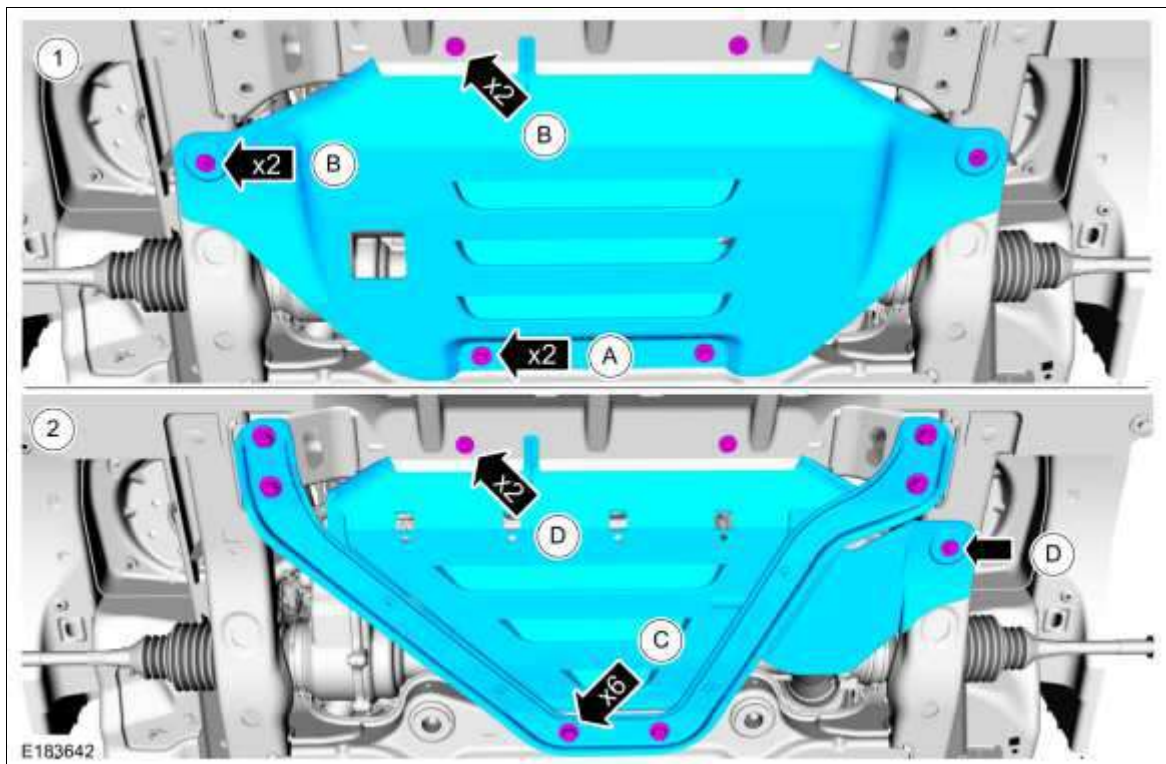
B: 18 lb.in (2 Nm)

2. Install the subframe bracket and underbody shield assembly and the bolts.

Torque:

C: 46 lb.ft (63 Nm)

D: 18 lb.in (2 Nm)

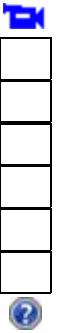
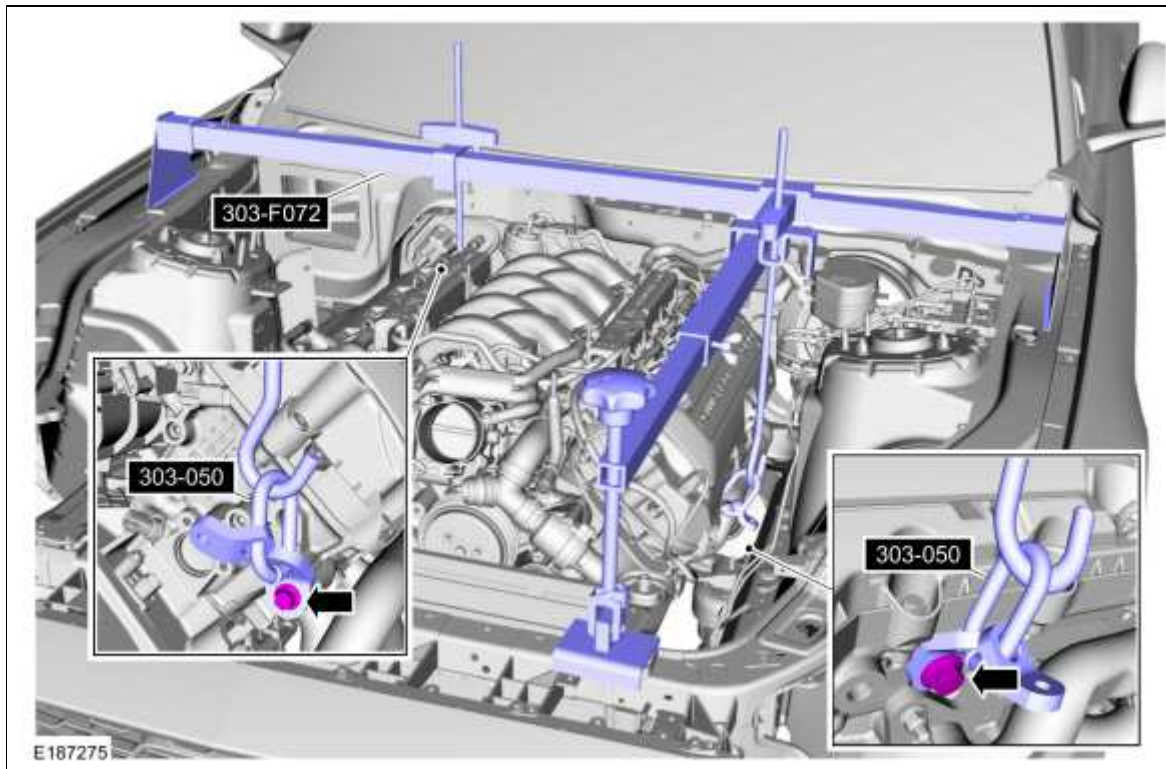


24. Install the front wheels and tires.

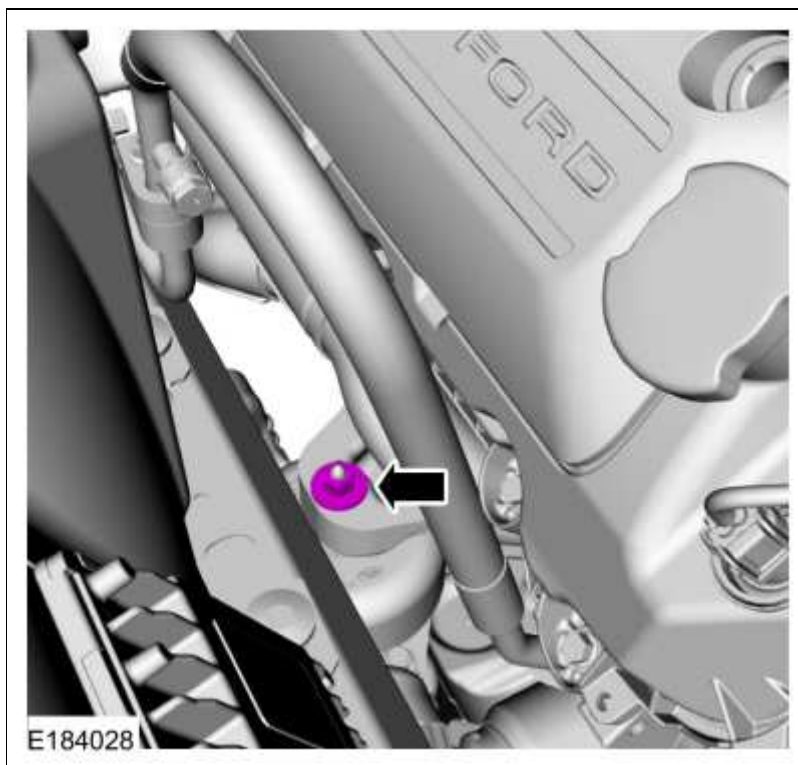
Refer to: [Wheel and Tire](#) (204-04A Wheels and Tires, Removal and Installation).

25. Lower the engine onto the engine mounts and remove the special tools

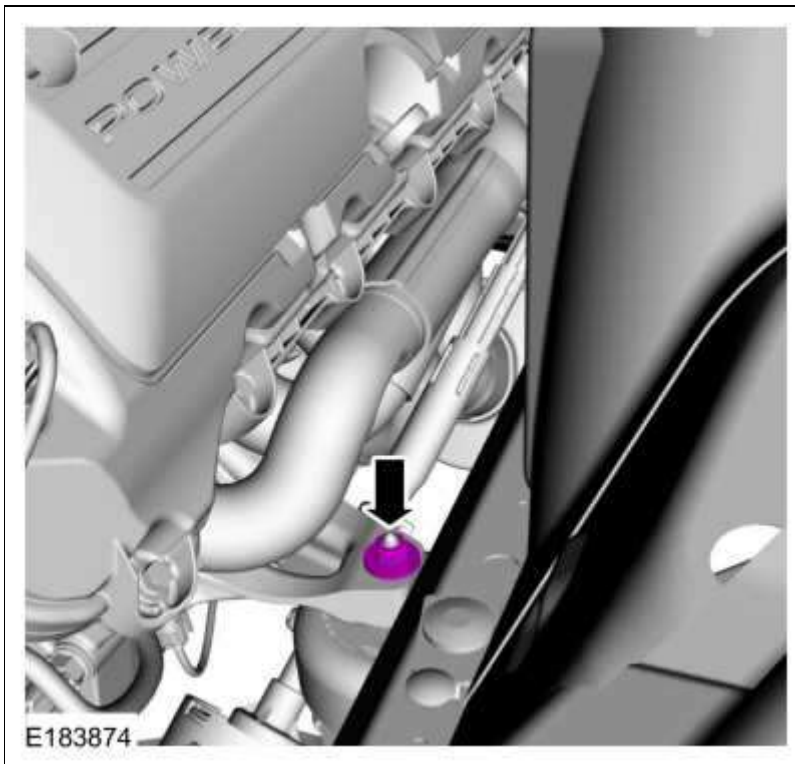
Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-050 \(T70P-6000\) Lifting Bracket, Engine.](#)



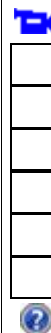
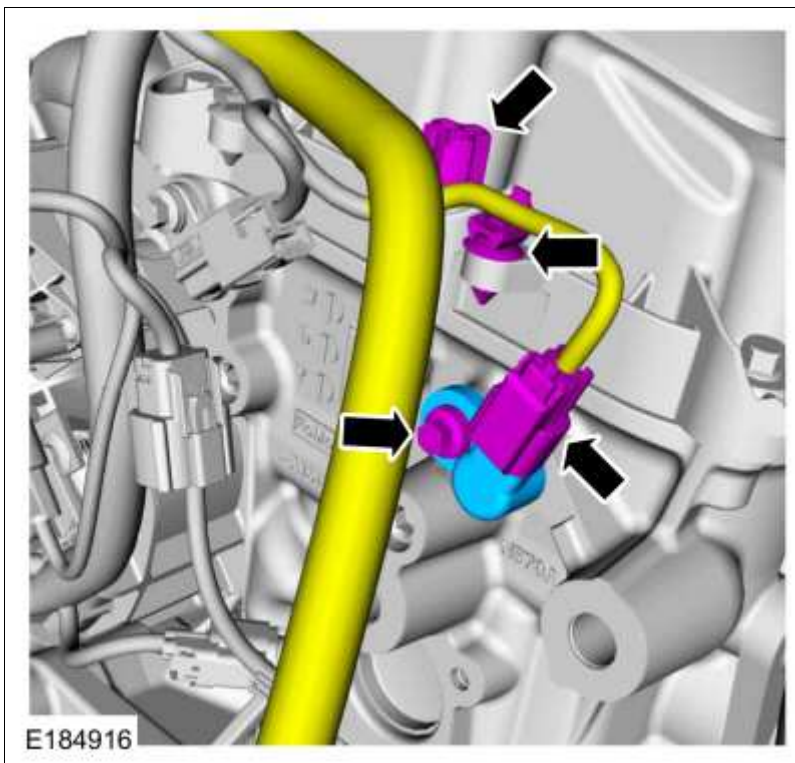
26. Install the RH engine mount nut.
Torque: 46 lb.ft (63 Nm)



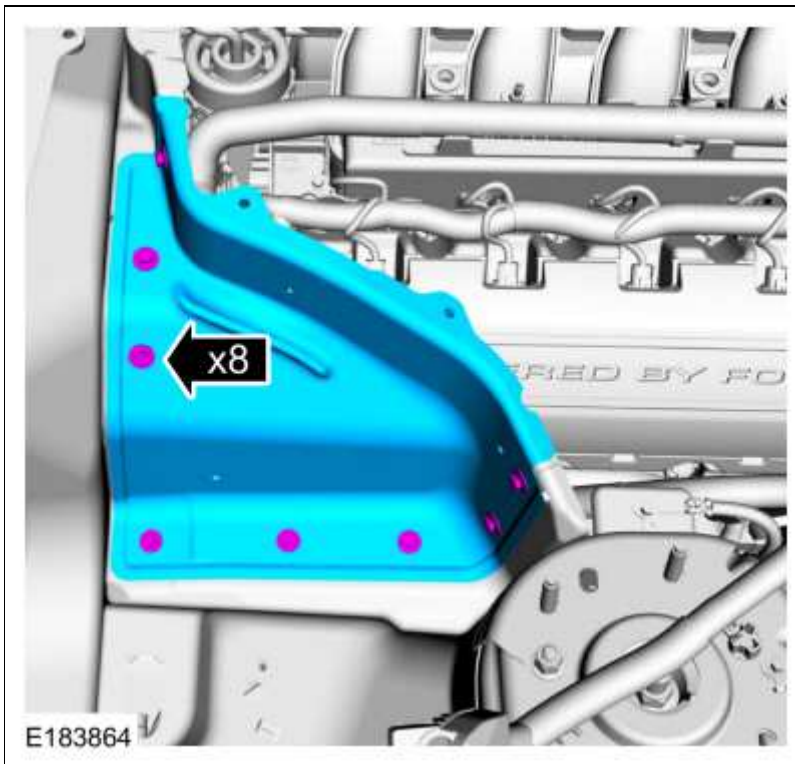
27. Install the LH engine mount nut.
Torque: 46 lb.ft (63 Nm)



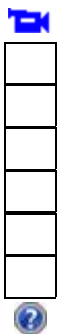
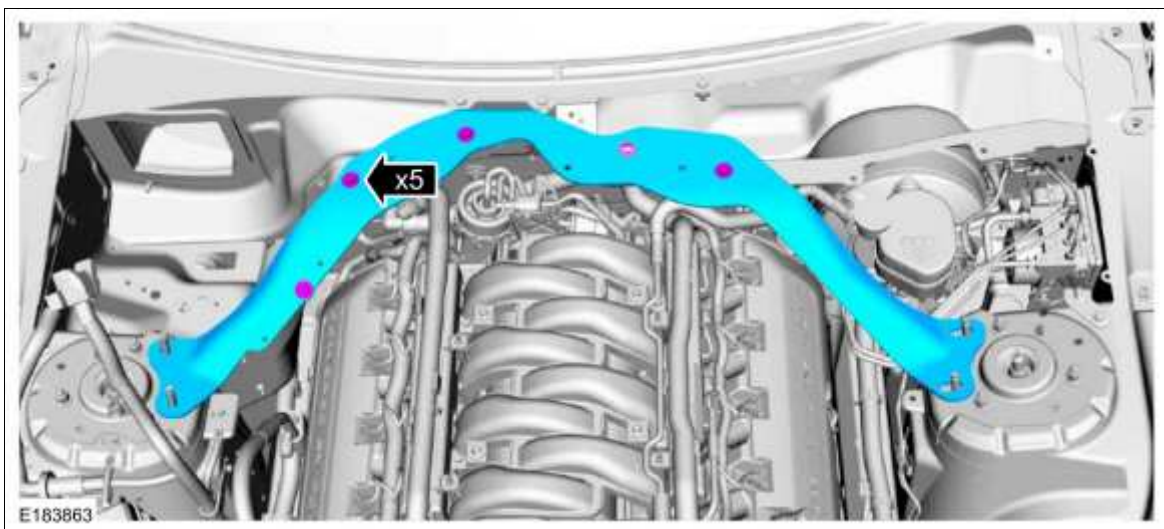
- 28.
- Install the CMP sensor and the bolt.
Torque: 89 lb.in (10 Nm)
 - Connect the CMP sensor electrical connector and the wiring harness retainers.



29. Install the battery heat shield and fasteners.
Torque: 80 lb.in (9 Nm)

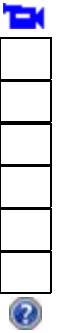
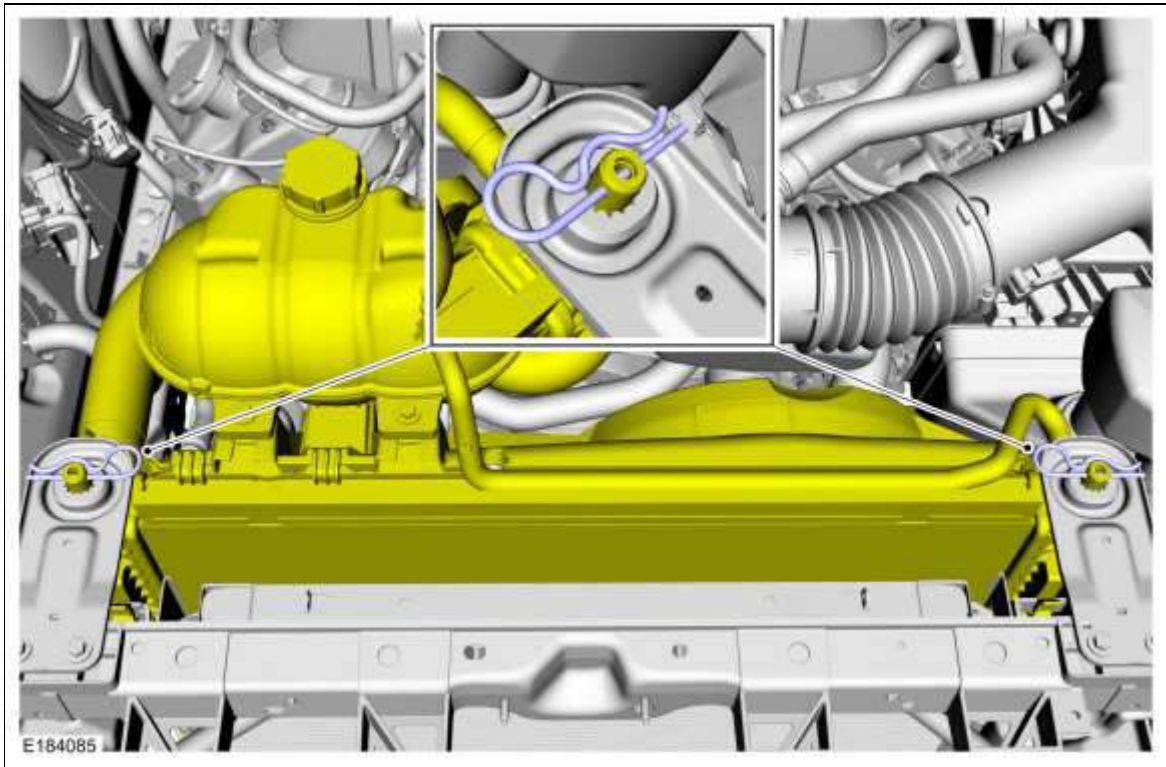


30. Install the cowl extension and the fasteners.
Torque: 26 lb.ft (35 Nm)

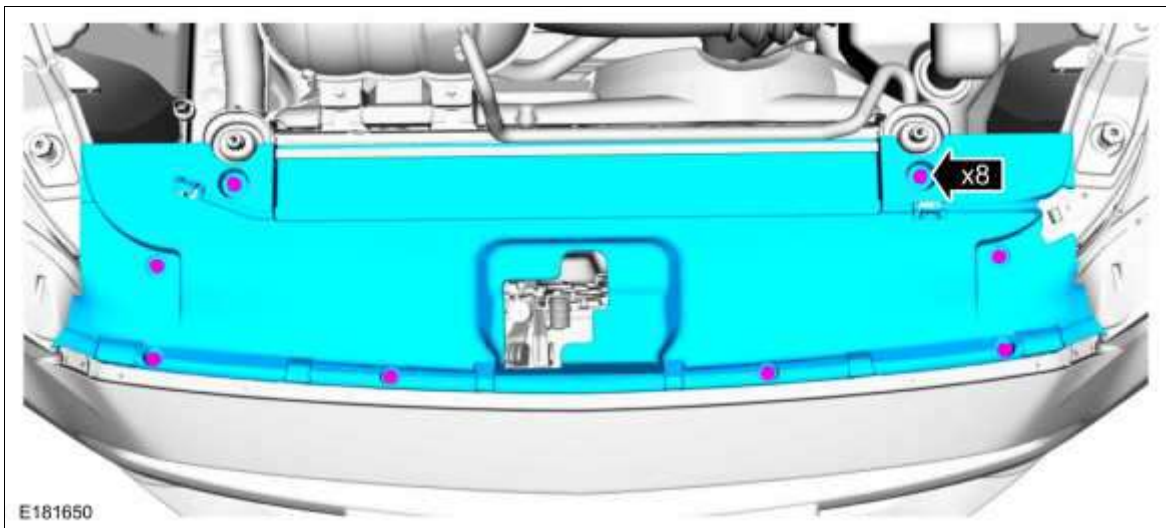


31. Install the following items:
1. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
 2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
 3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

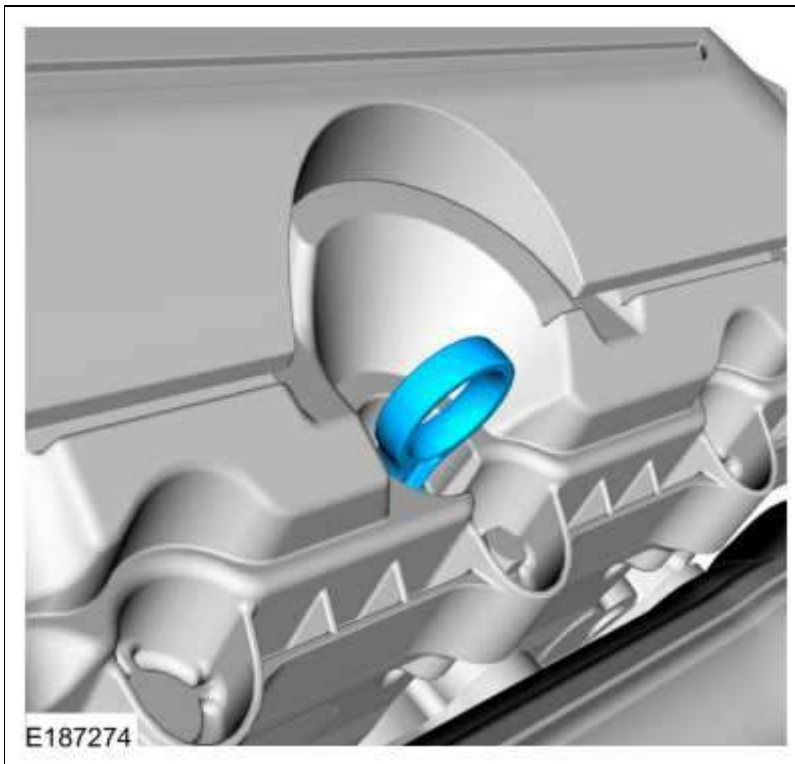
32. Remove the clips.



33. Install the radiator top shield and the retainers.

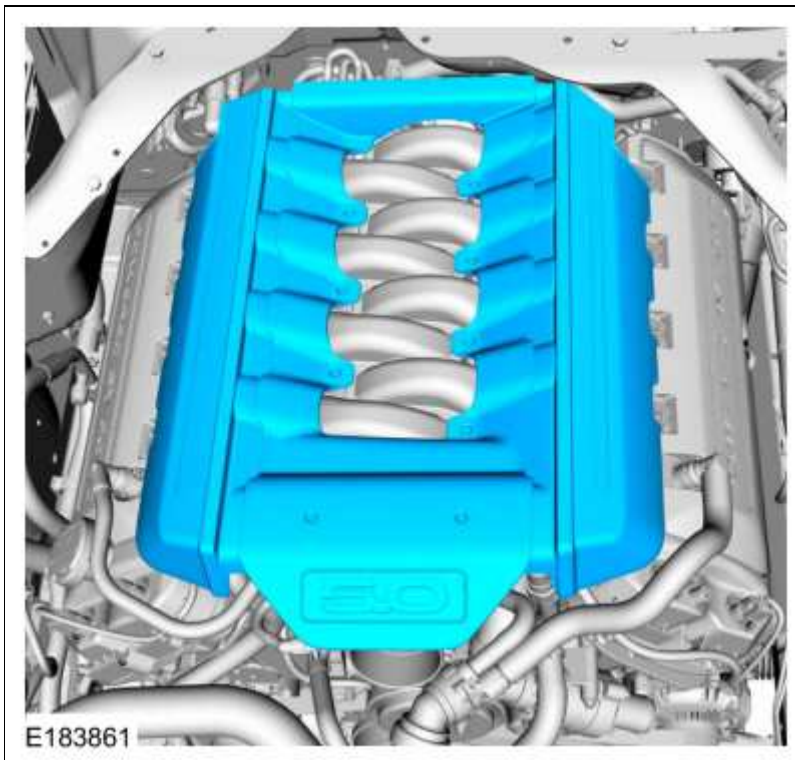


34. Install the oil level indicator.

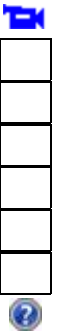
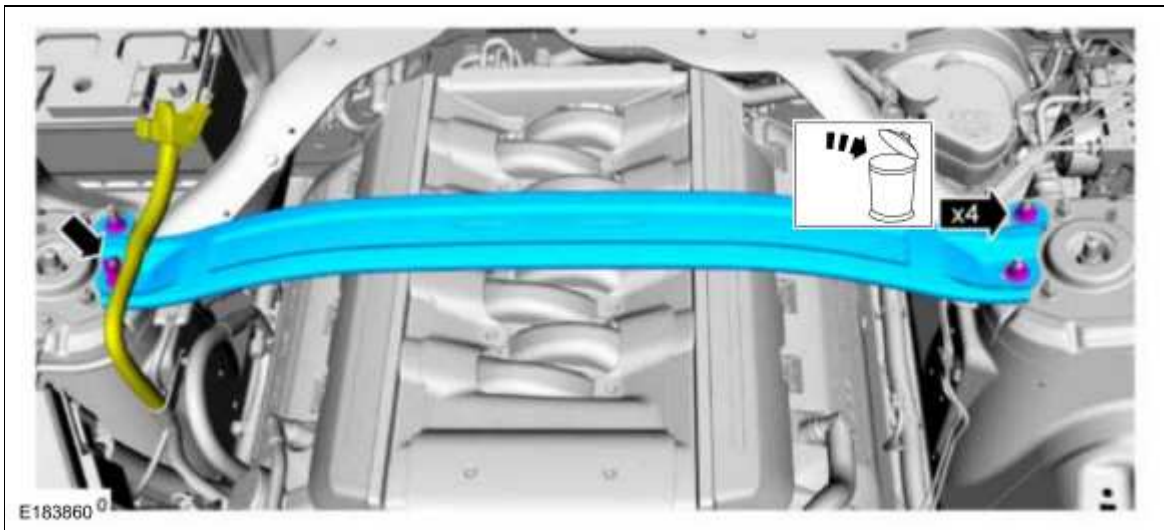


35. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

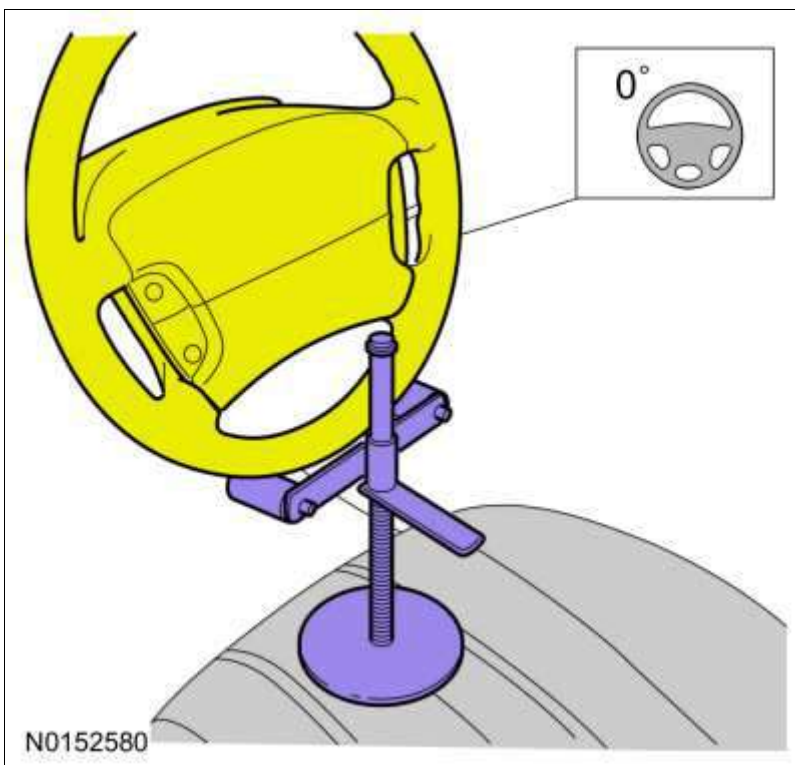
Install the engine appearance cover.



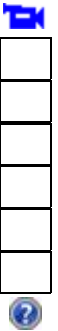
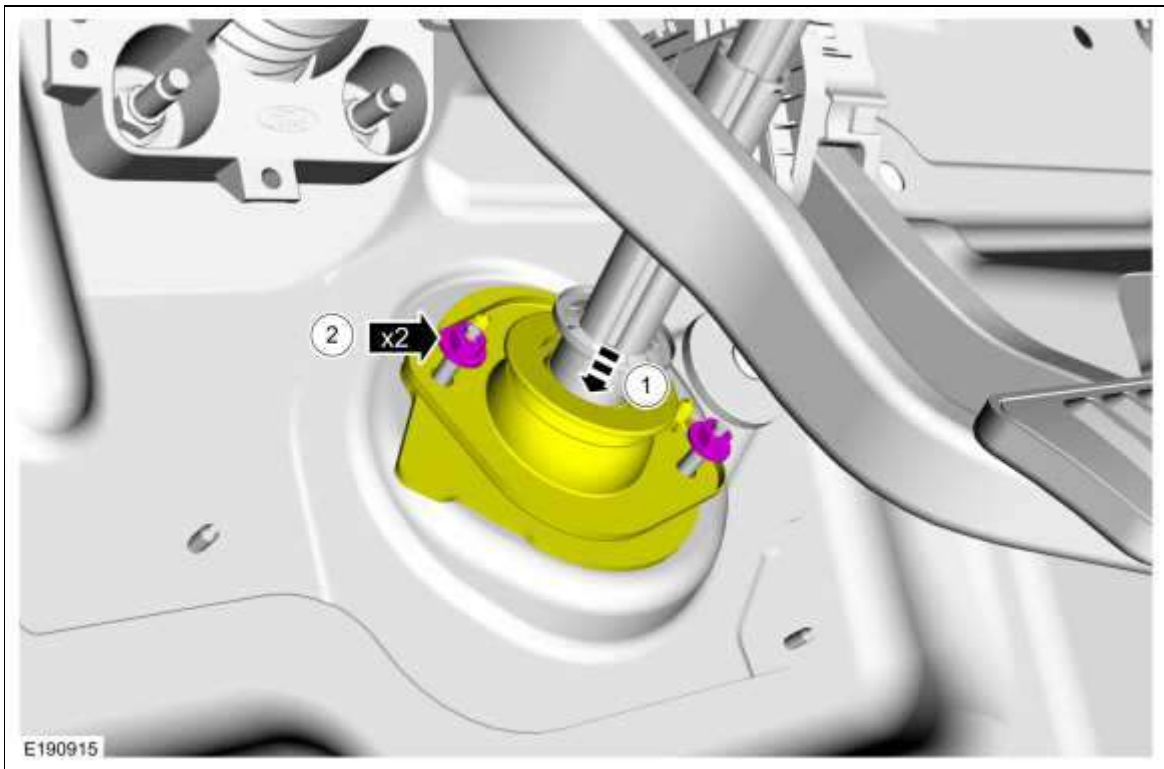
- 36.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



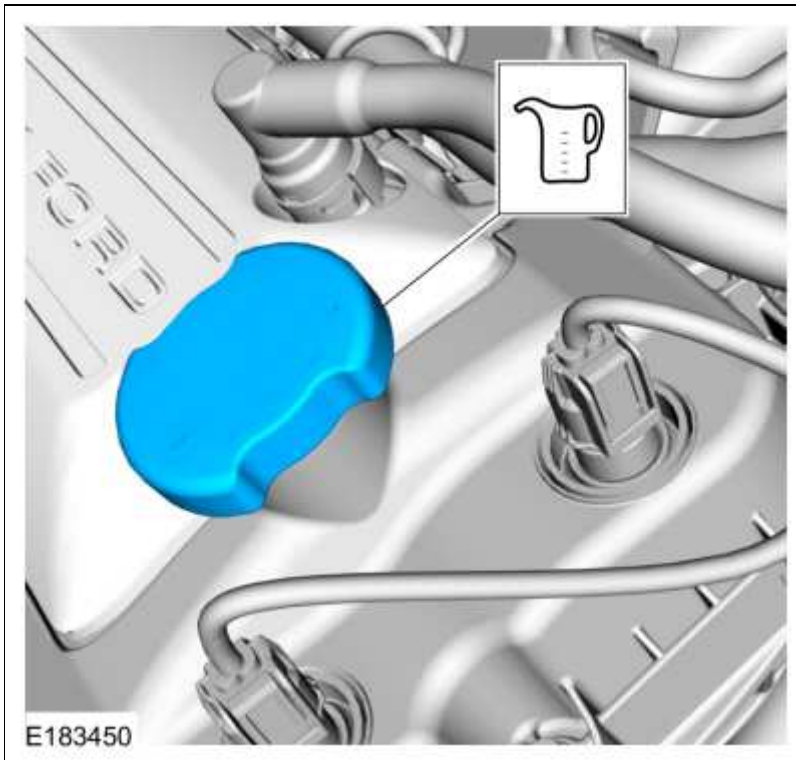
37. Remove the holding device.



- 38.
1. Position the steering column dash seal.
 2. Tighten the steering column dash seal nuts.
Torque: 80 lb.in (9 Nm)



39. Fill the engine with clean engine oil.
 Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).
 Material: Engine Oil - 5W20 (WSS-M2C948-B)



40. Connect the battery ground and positive cables.
 Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

Oil Pressure Switch

Materials

Name	Specification
Thread Sealant with PTFE TA-24-B	WSK-M2G350-A2

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

2.
 - Disconnect the EOP switch electrical connector.
 - **NOTE:** If the oil pressure switch is to be reused, apply thread sealant.

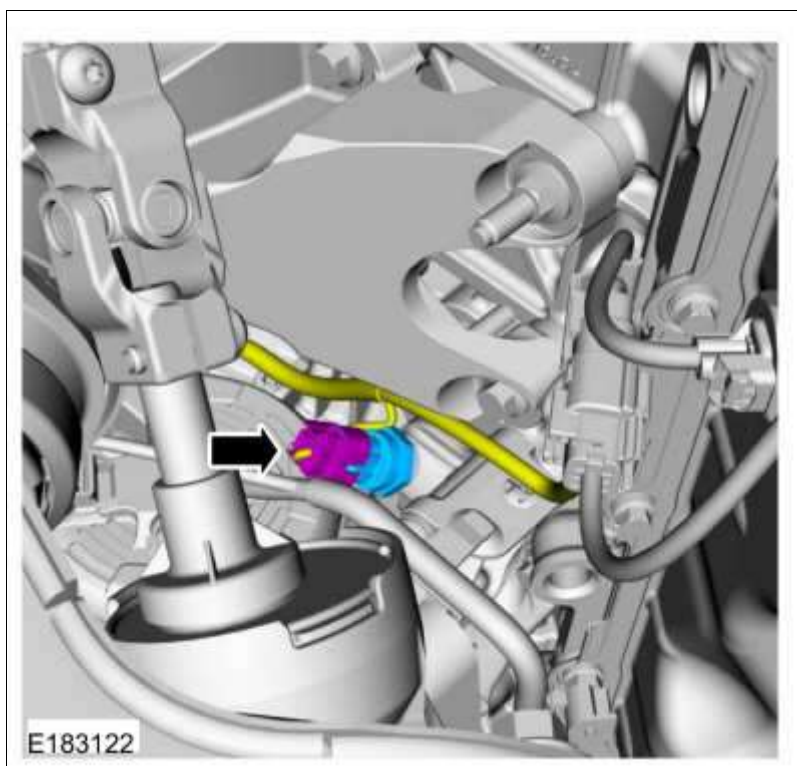
Remove the EOP switch.

Material: Thread Sealant with PTFE / TA-24-B (WSK-M2G350-A2)

Torque:

Stage 1: 124 lb.in (14 Nm)

Stage 2: 180°



Installation

1. To install, reverse the removal procedure.

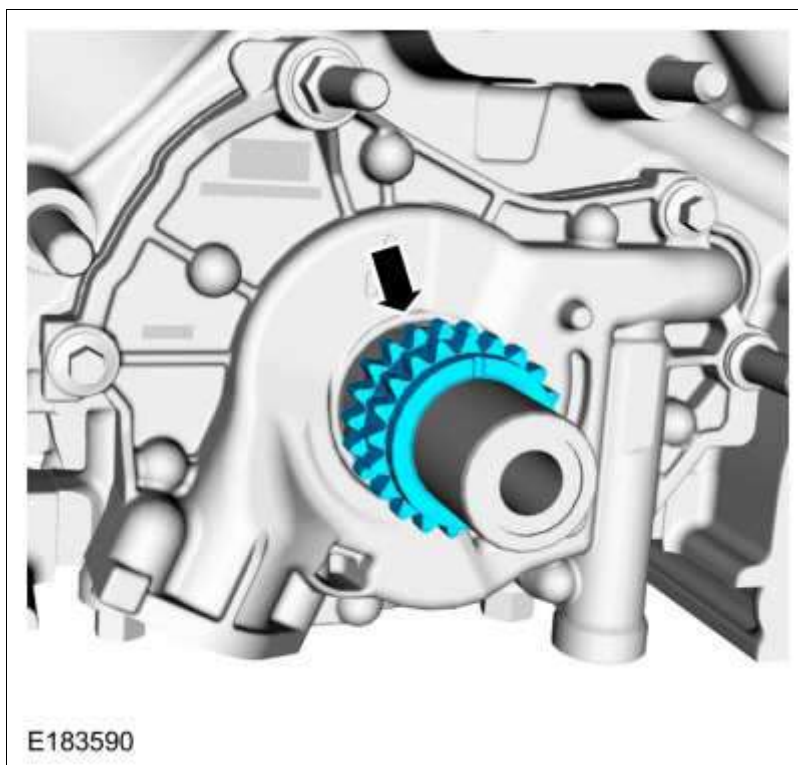


Oil Pump

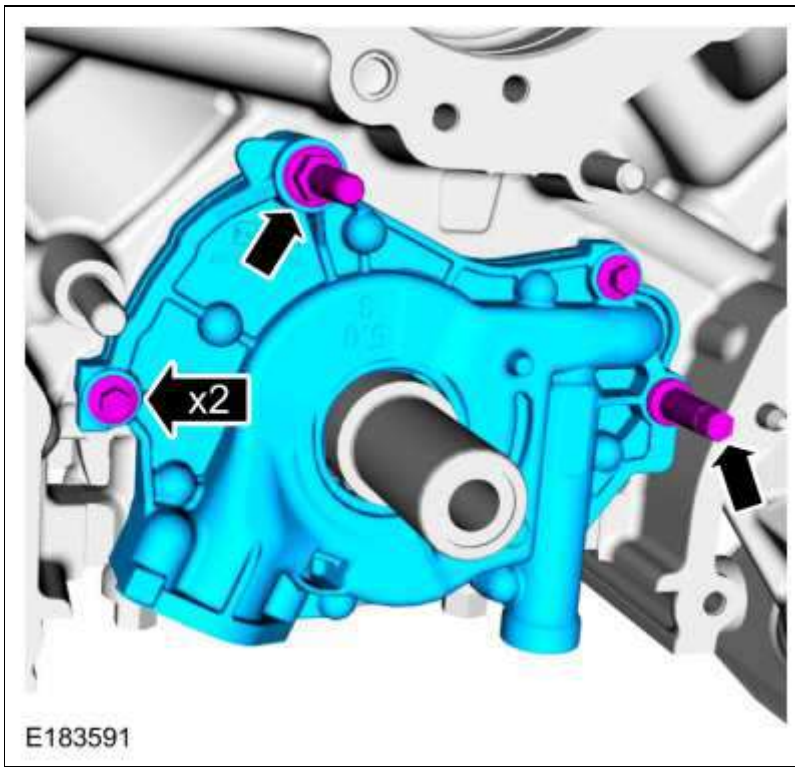
Base Part Number: [6621](#)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Remove the timing chains.
Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Remove the crankshaft sprocket.



4. Remove the oil pan.
Refer to: [Oil Pan](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
5. Remove the bolts, stud bolts and the oil pump.



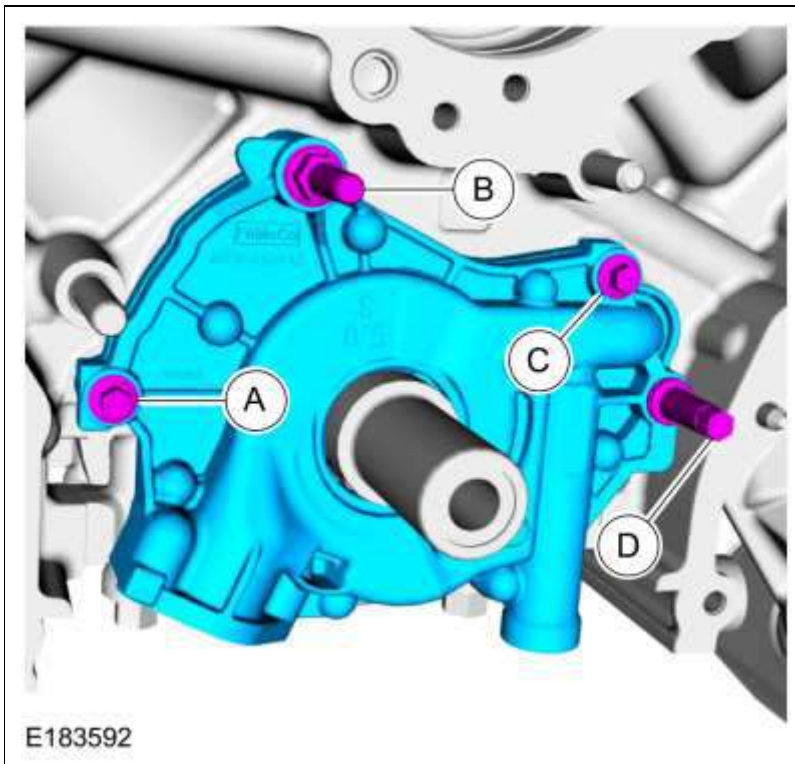
Installation

1. **NOTE:** Oil pump must be held against the cylinder block until all bolts are tightened.

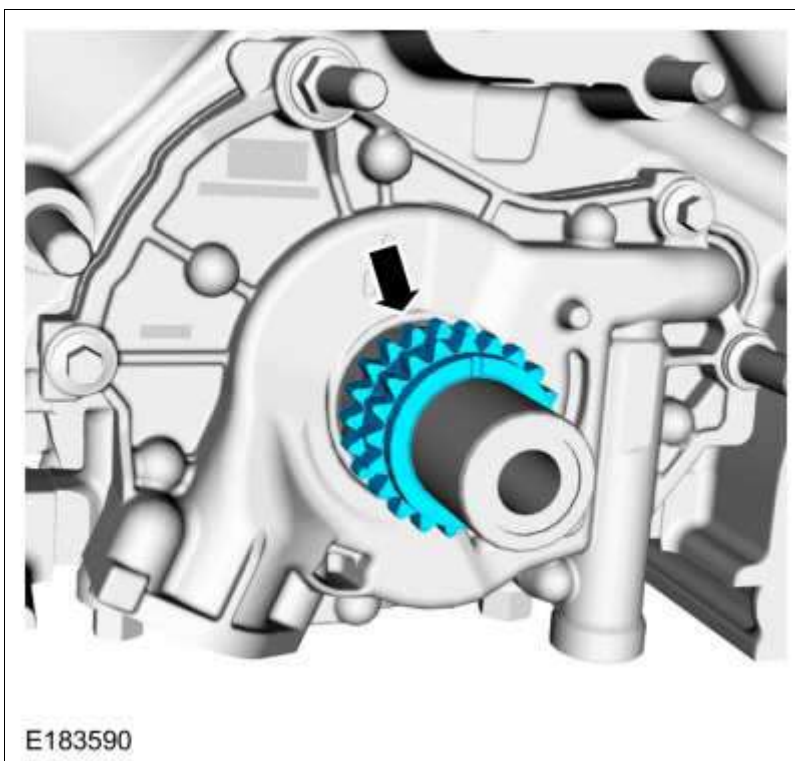
- Rotate the inner rotor of the oil pump assembly to align the flats on the crankshaft and slip the oil pump over the crankshaft until seated against the block.
- Rotate the oil pump until the bolt holes are aligned to the block and install the fasteners hand tight.

Torque:

- Stage 1: A: 89 lb.in (10 Nm)
- Stage 2: B: 18 lb.ft (25 Nm)
- Stage 3: C: 89 lb.in (10 Nm)
- Stage 4: D: 177 lb.in (20 Nm)
- Stage 5: A: 45°
- Stage 6: B: 75°
- Stage 7: C: 45°
- Stage 8: D: 60°



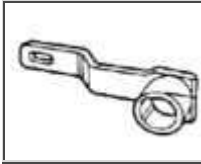
2. Install the oil pan.
Refer to: [Oil Pan](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Install the crankshaft sprocket.



4. Install the timing chains.
Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

Timing Chain

Special Tool(s) / General Equipment



[303-448](#) (T93P-6303-A)
Holding Tool, Crankshaft
TKIT-1993-FLM
TKIT-1993-LM

Removal

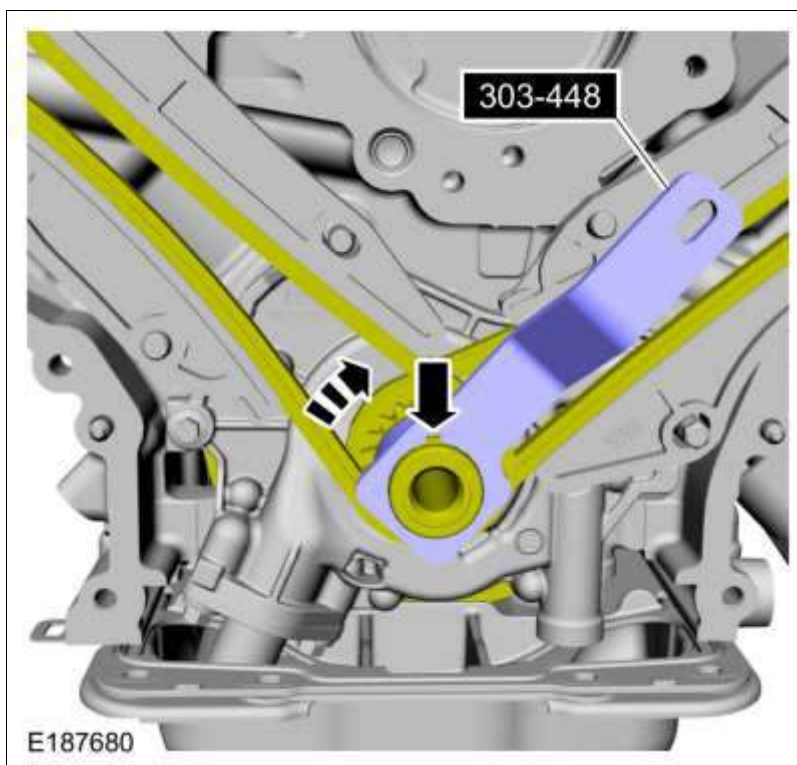
NOTICE: The timing chain procedure has changed from prior model year engines and must be followed exactly or damage to the engine will result.

NOTICE: 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.

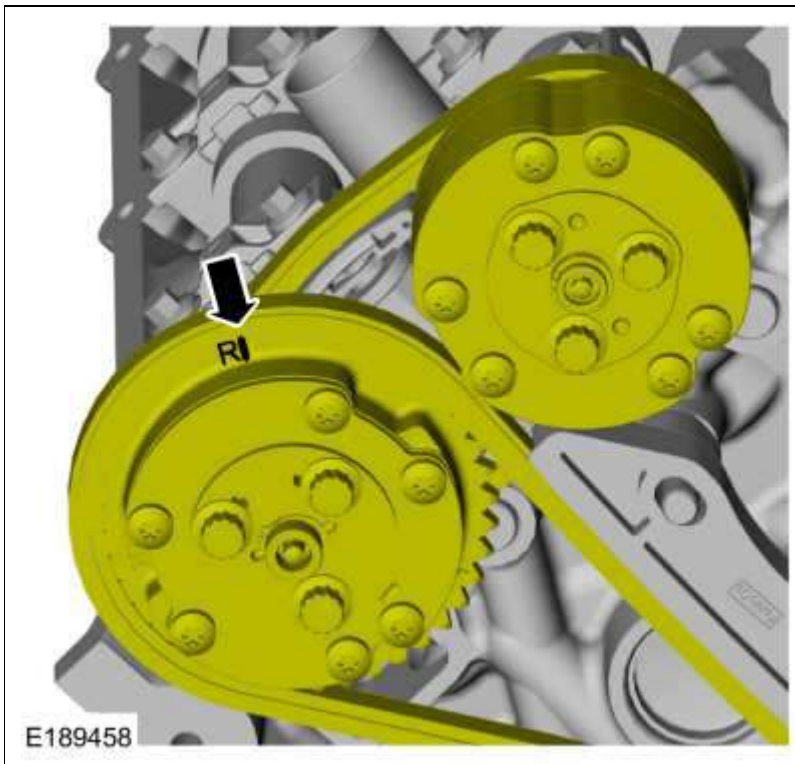
NOTE: In order to remove the LH timing chain, the RH timing chain must be removed first.

RH and LH timing chains

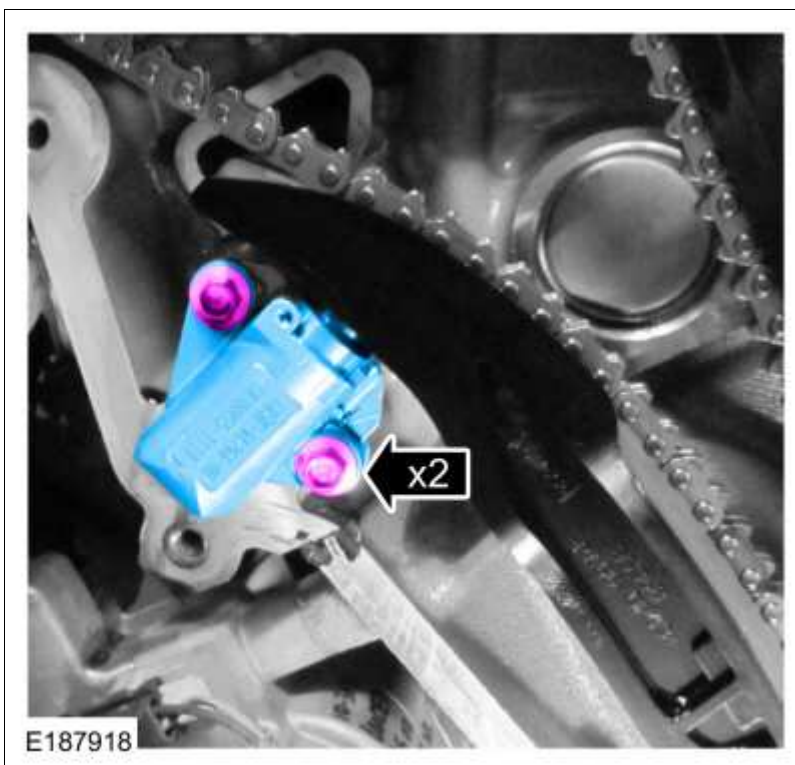
1. Remove the engine front cover.
Refer to: [Engine Front Cover](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 12 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



3. Verify the timing mark on the RH VCT unit is on top, if not, rotate the crankshaft clockwise one complete revolution so the keyway is at the 12 o'clock position.

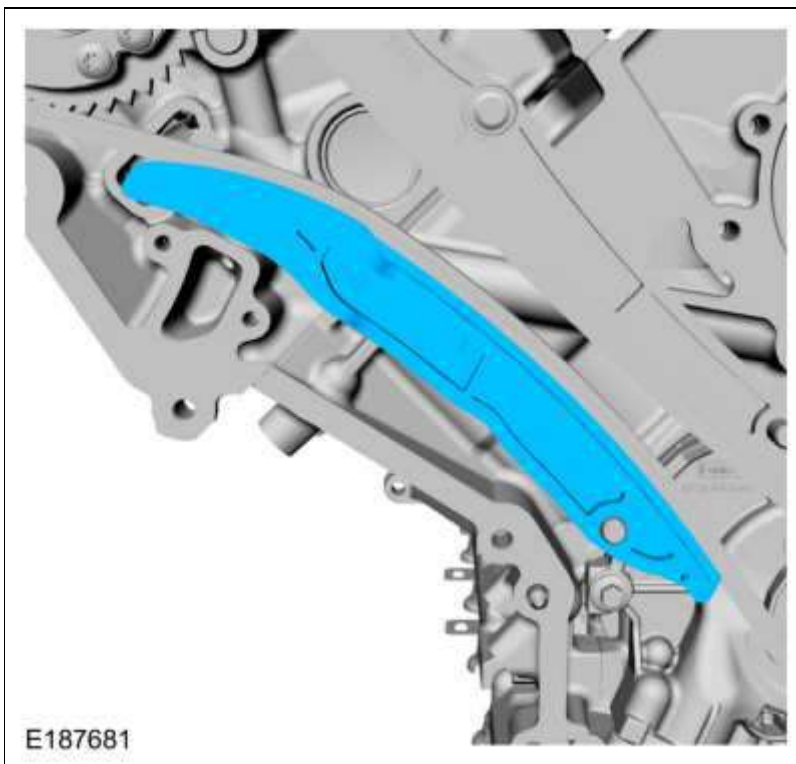


4. Remove the bolts and the RH primary timing chain tensioner.



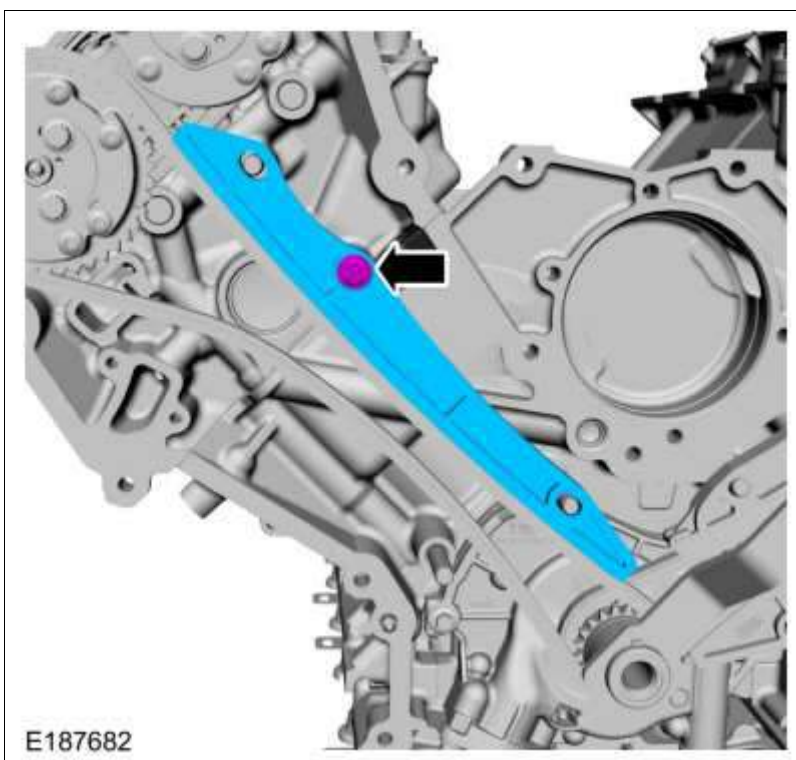
5. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain tensioner arm. Return the crankshaft keyway to the 12 o'clock position after removing the RH timing chain tensioner arm.

Remove the RH timing chain tensioner arm.

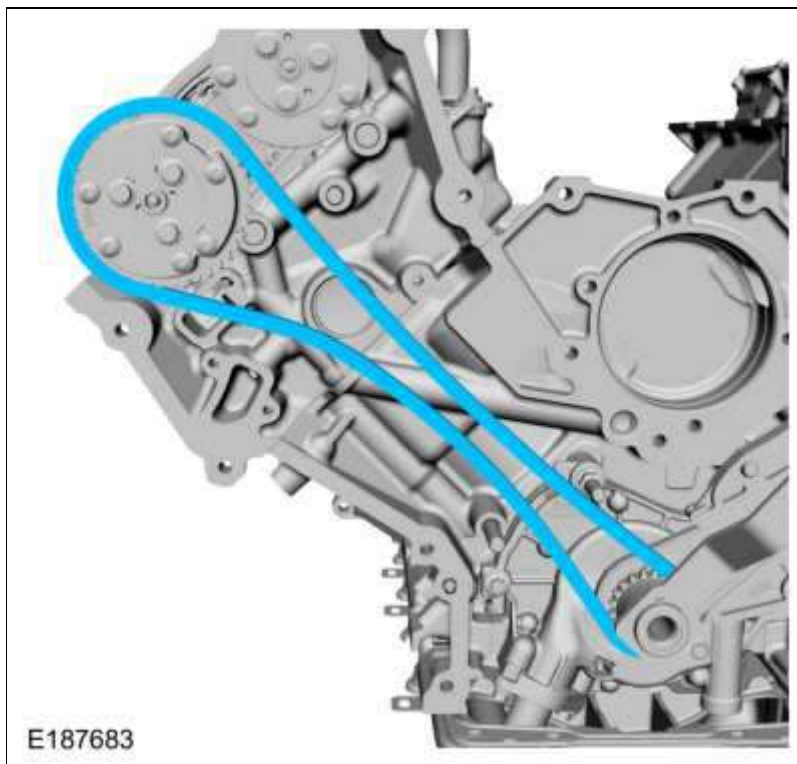


6. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain guide. Return the crankshaft keyway to the 12 o'clock position after removing the RH timing chain guide.

Remove the bolt and the RH timing chain guide.

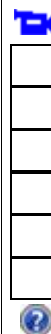
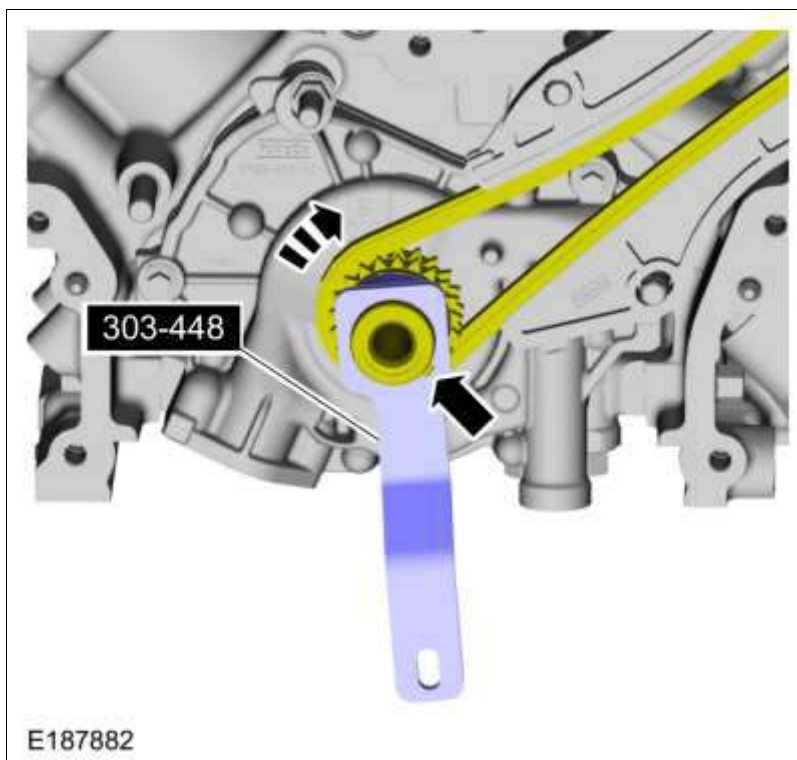


7. Remove the RH timing chain.

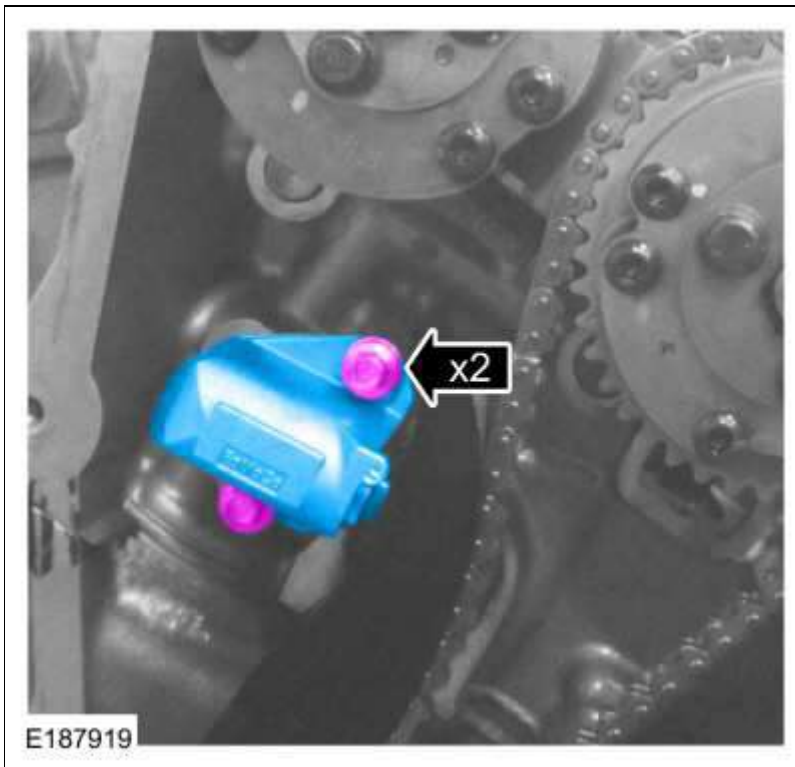


LH timing chain

8. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 5 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft.](#)

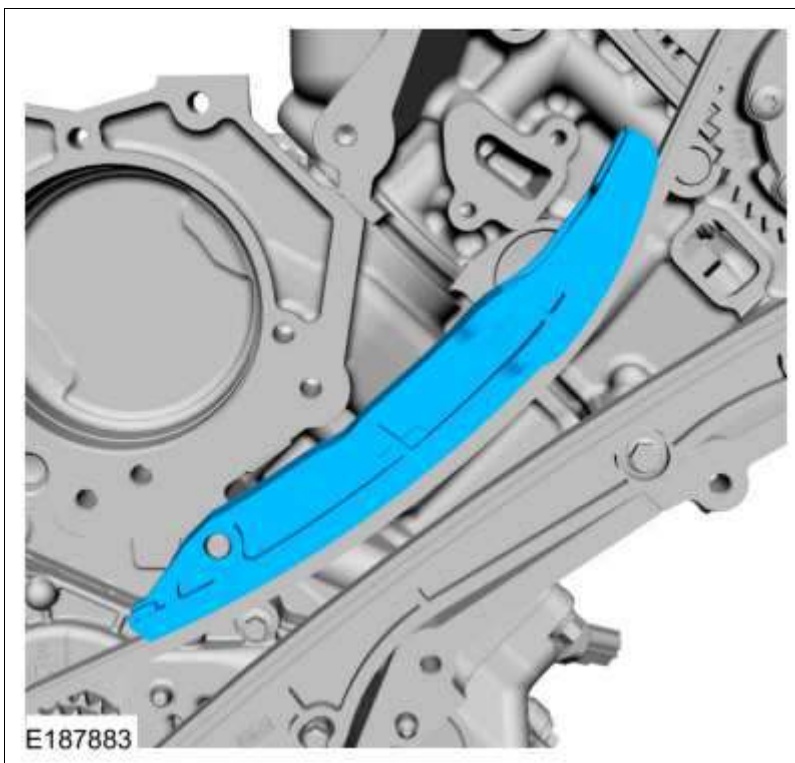


9. Remove the bolts and the LH primary timing chain tensioner.



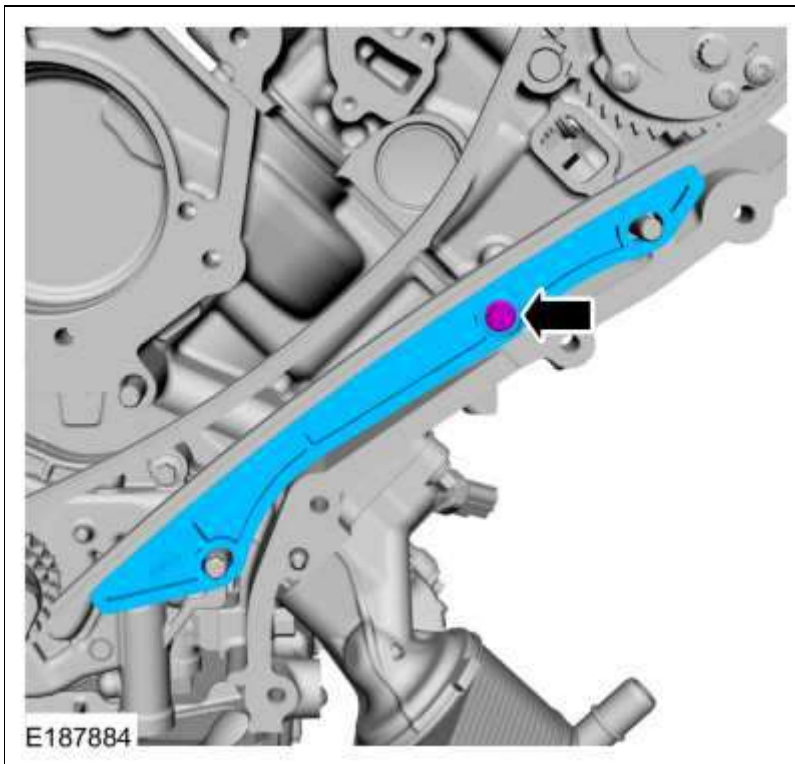
10. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain tensioner arm. Return the crankshaft keyway to the 5 o'clock position after removing the LH timing chain tensioner arm.

Remove the LH timing chain tensioner arm.

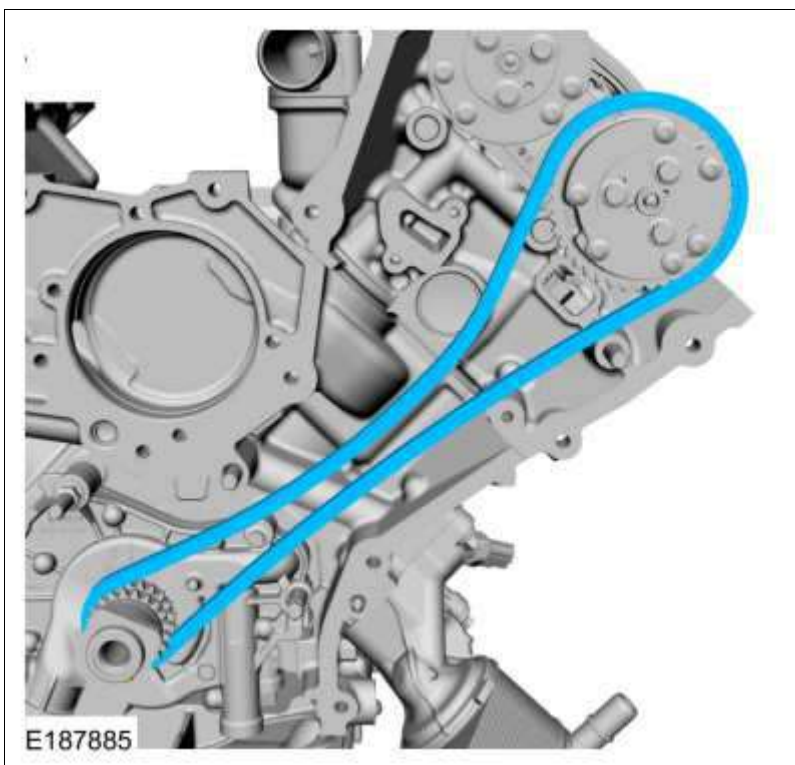


11. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain guide. Return the crankshaft keyway to the 5 o'clock position after removing the LH timing chain guide.

Remove the bolt and the LH timing chain guide.



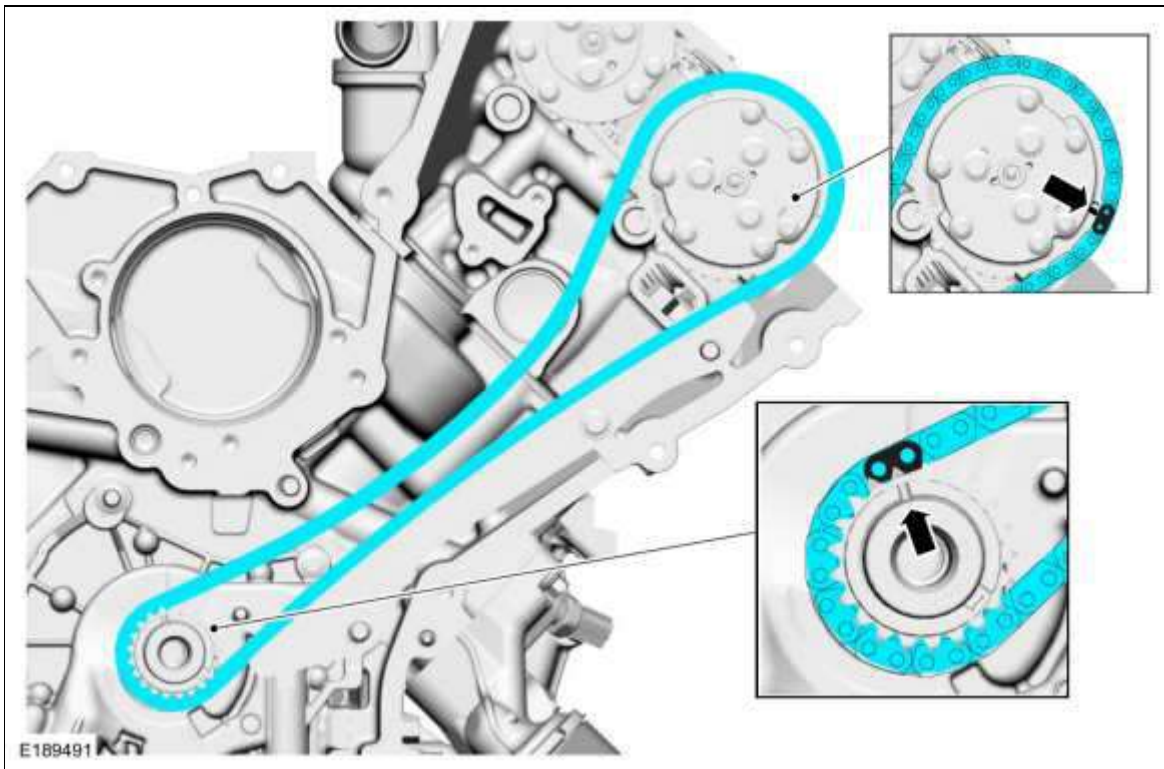
12. Remove the LH timing chain.



Installation

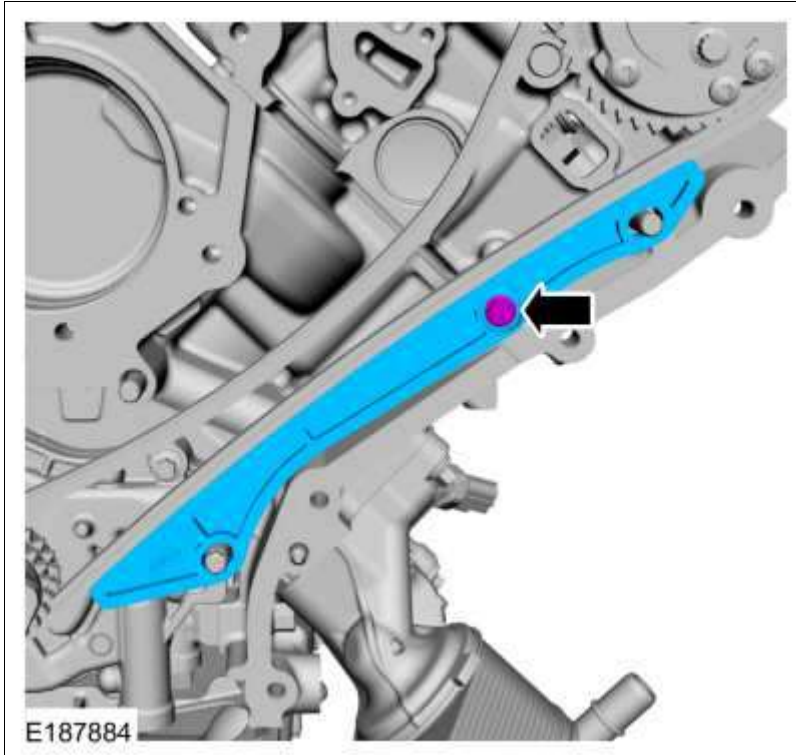
LH timing chain

1. Install the LH timing chain.
 - Align the colored link on the timing chain with the timing mark on the LH VCT assembly.
 - Align the remaining colored link on the timing chain with the timing mark on the crankshaft sprocket.



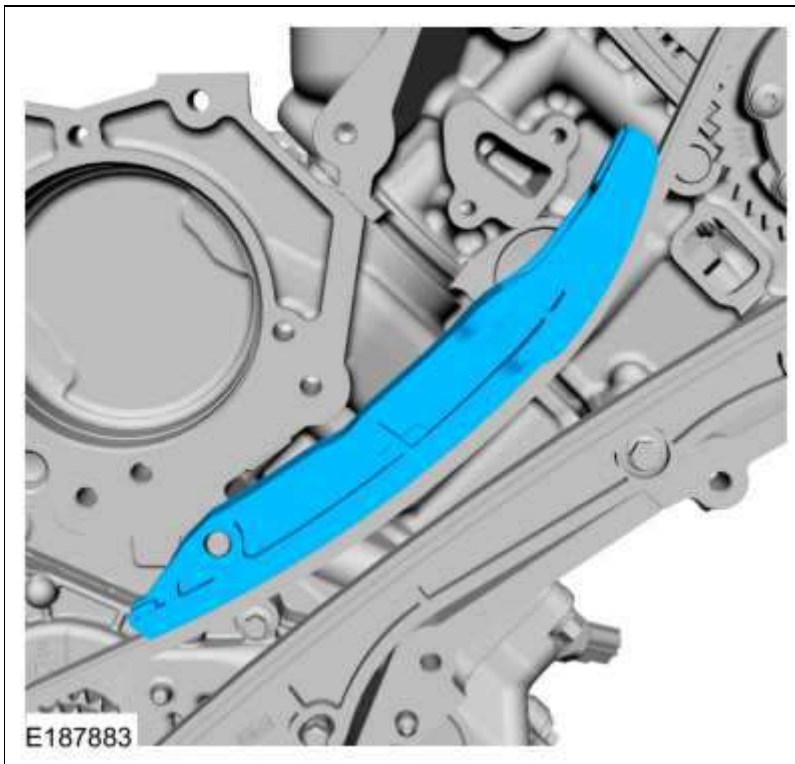
2. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the LH timing chain guide. Return the crankshaft keyway to the 5 o'clock position after installing the LH timing chain guide.

Install the LH timing chain guide and bolt.
Torque: 89 lb.in (10 Nm)

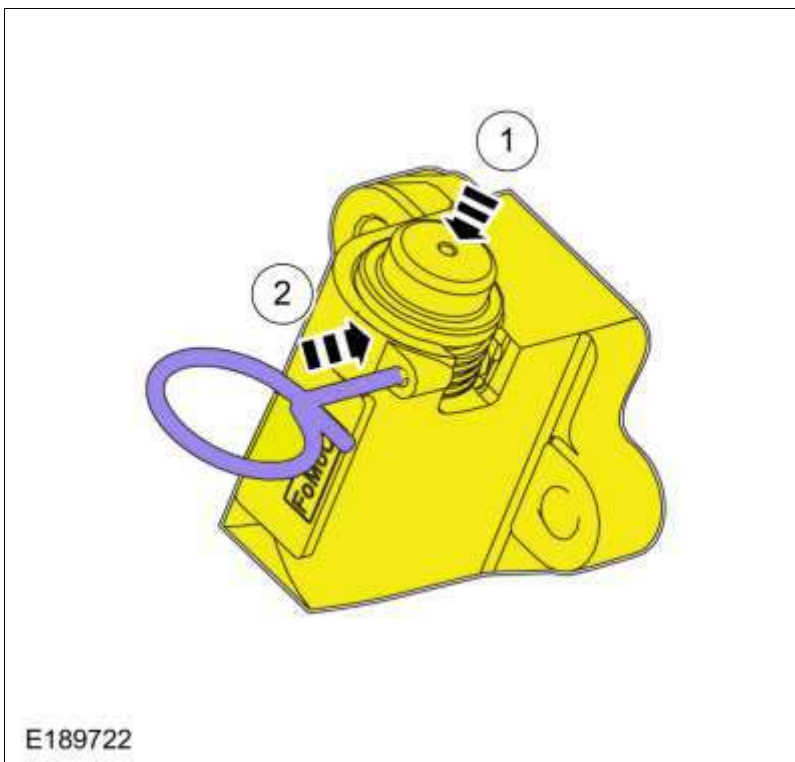


3. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the LH timing chain arm. Return the crankshaft keyway to the 5 o'clock position after installing the LH timing chain arm.

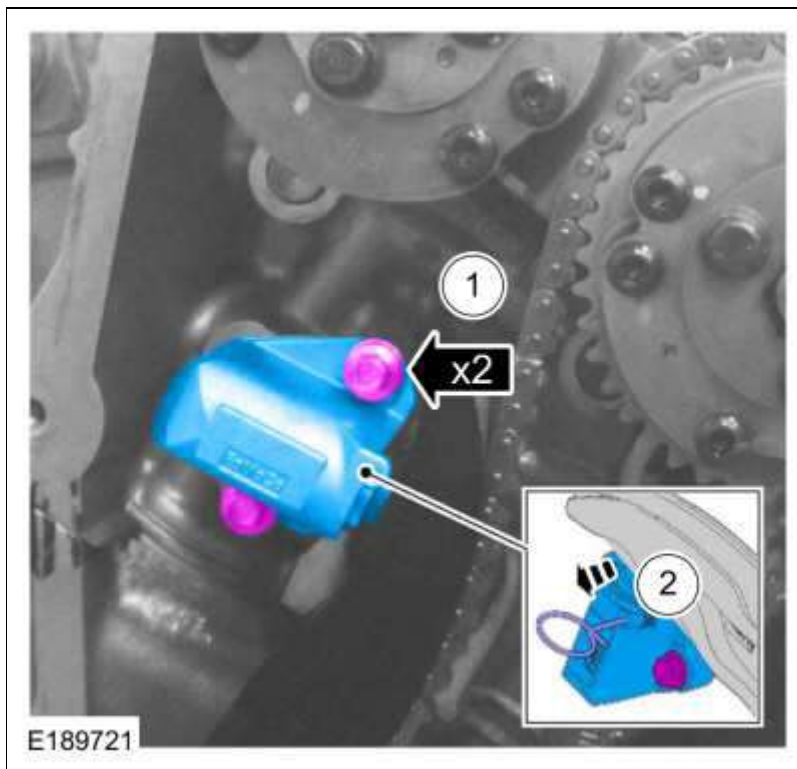
Install the LH timing chain tensioner arm.



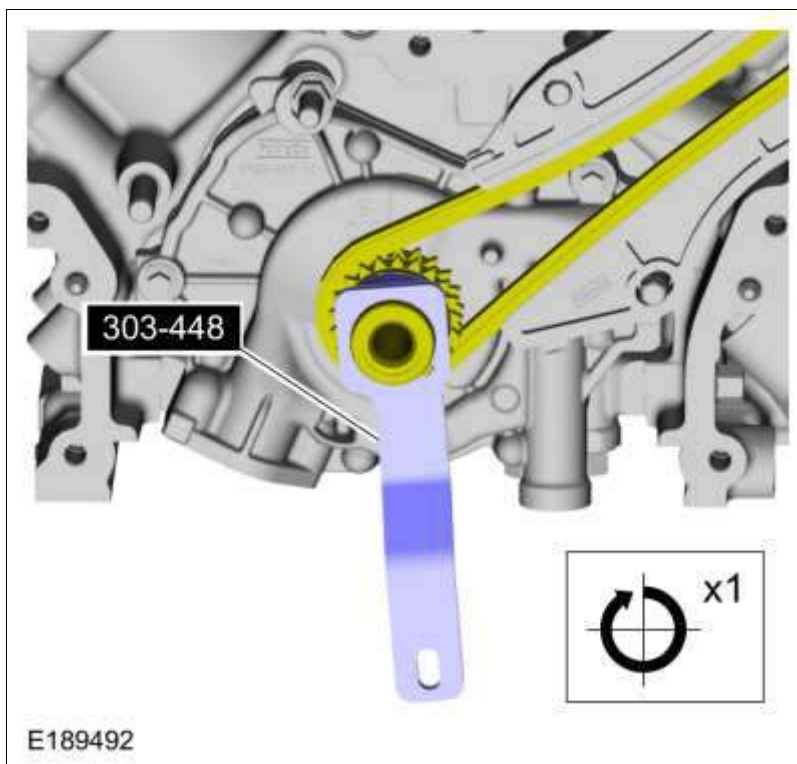
4.
 1. Compress the primary timing chain tensioner plunger, using an edge of a vise.
 2. Install a suitable pin into the hole of the tensioner housing to hold the plunger in place during installation.



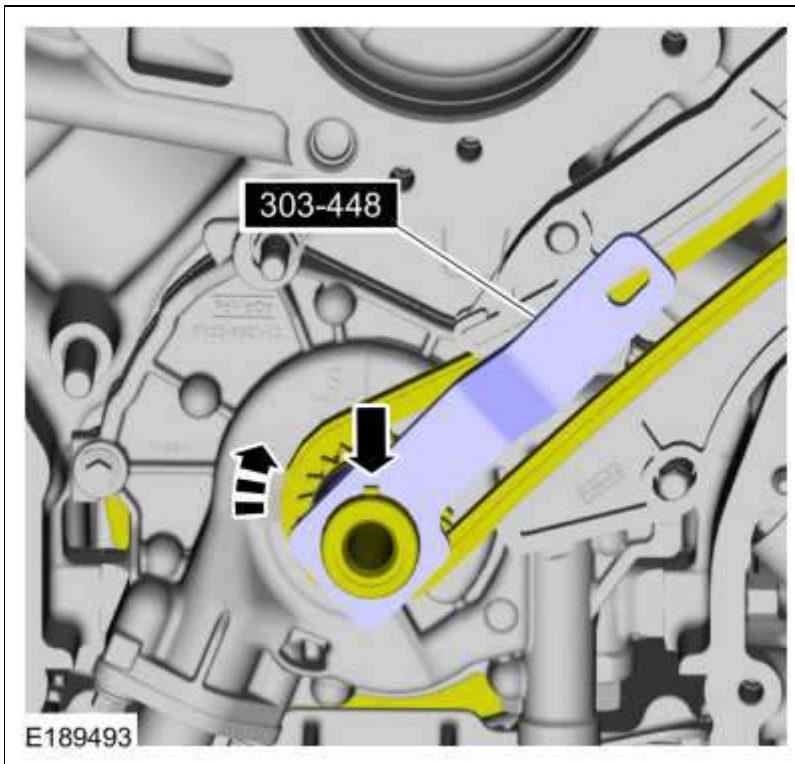
5.
 1. Install the LH primary timing chain tensioner and bolts.
Torque: 89 lb.in (10 Nm)
 2. Remove the holding pin from the tensioner.



6. Using the special tool, rotate the crankshaft clockwise one complete revolution.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



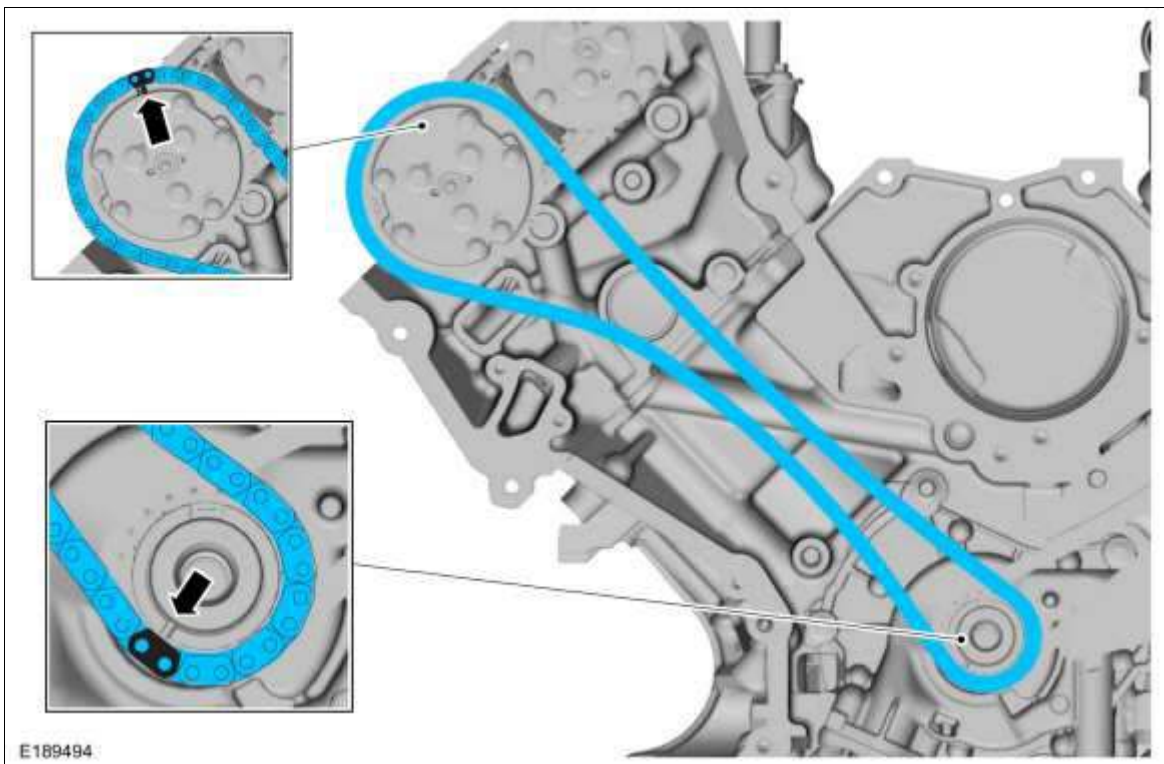
7. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 12 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



RH and LH timing chains

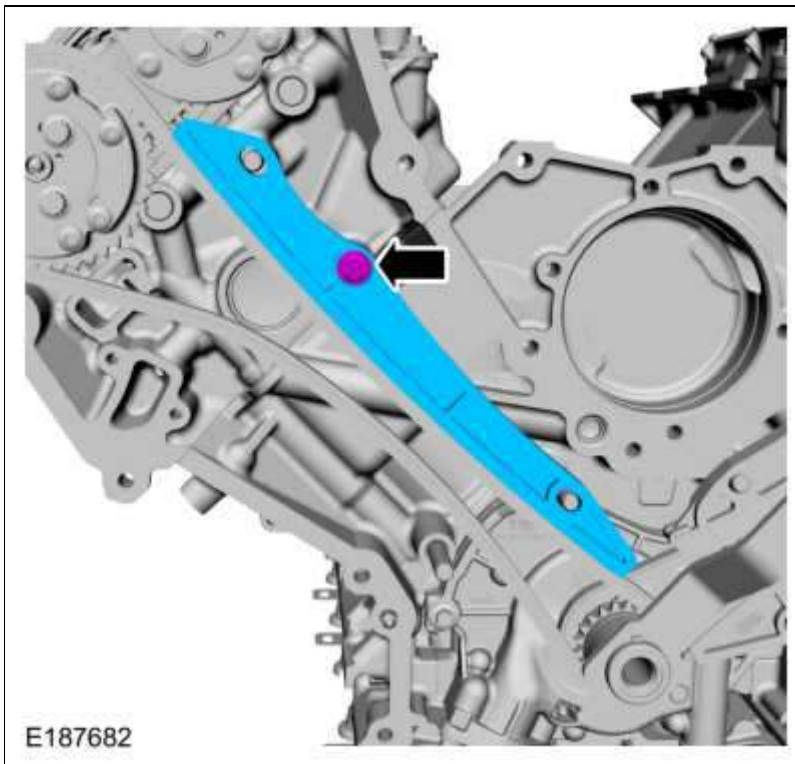
8. Install the RH timing chain.

- Align the colored link on the timing chain with the timing mark on the RH VCT assembly.
- Align the remaining colored link on the timing chain with the timing mark on the crankshaft sprocket.



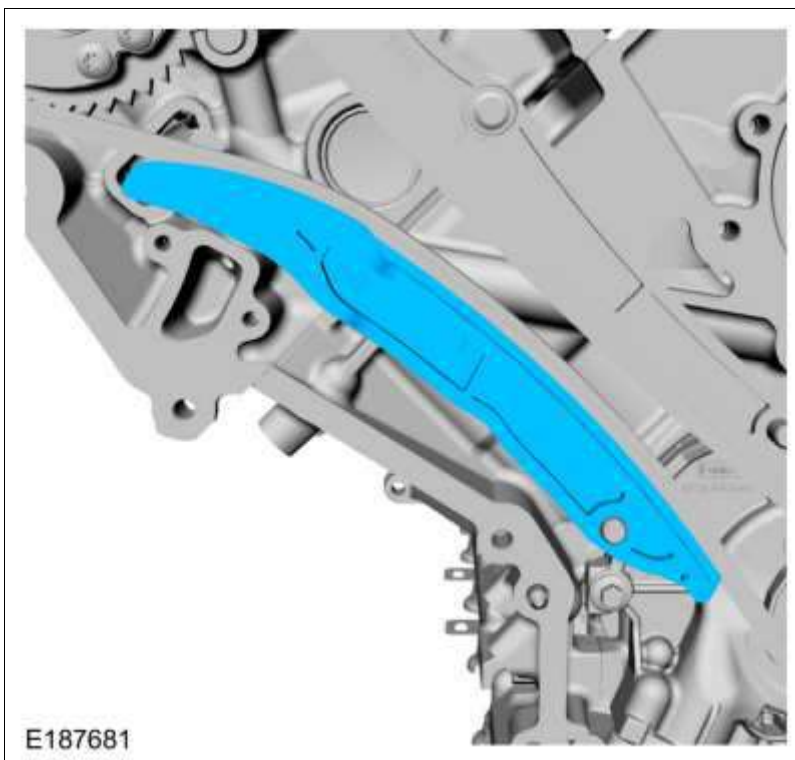
9. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the RH timing chain guide. Return the crankshaft keyway to the 12 o'clock position after installing the RH timing chain guide.

Install the RH timing chain guide and bolt.
Torque: 89 lb.in (10 Nm)

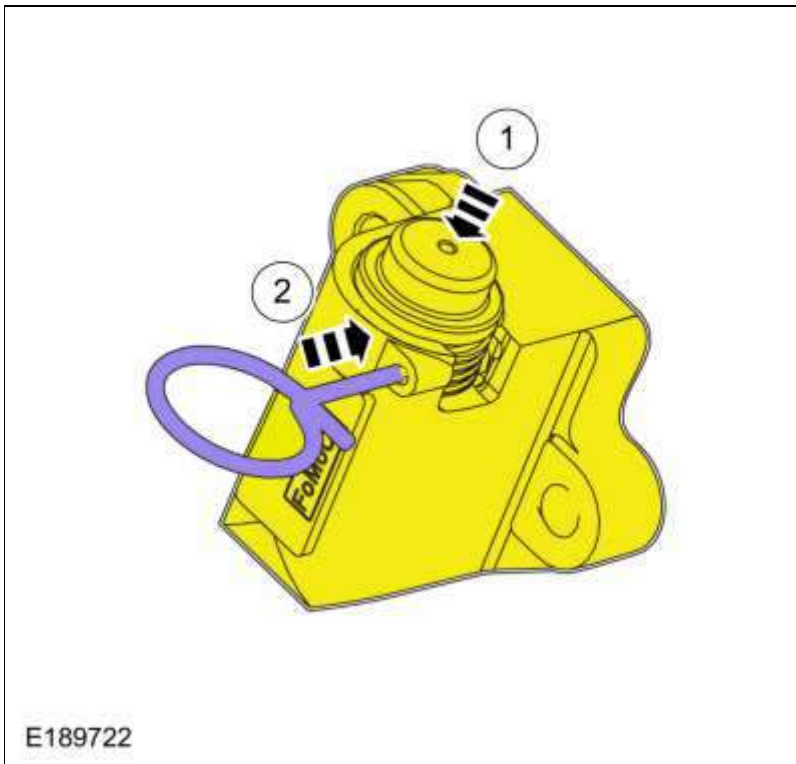


10. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the RH timing chain arm. Return the crankshaft keyway to the 12 o'clock position after installing the RH timing chain arm.

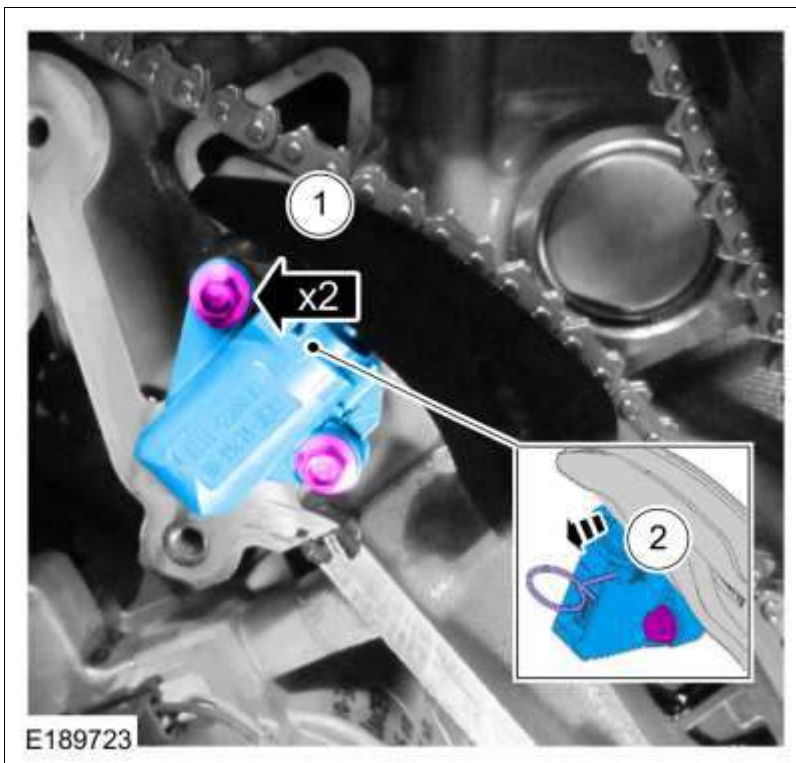
Install the RH timing chain tensioner arm.



11. 1. Compress the primary timing chain tensioner plunger, using an edge of a vise.
2. Install a suitable pin into the hole of the tensioner housing to hold the plunger in place during installation.



12.
 1. Install the RH primary timing chain tensioner and bolts.
Torque: 89 lb.in (10 Nm)
 2. Remove the holding pin from the tensioner.



13. Install the engine front cover.
Refer to: [Engine Front Cover](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).



Valve Cover LH

Special Tool(s) / General Equipment

	205-142 (T80T-4000-J) Installer, Differential Bearing Cone
	205-153 (T80T-4000-W) Handle
	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
Plastic Scraper	

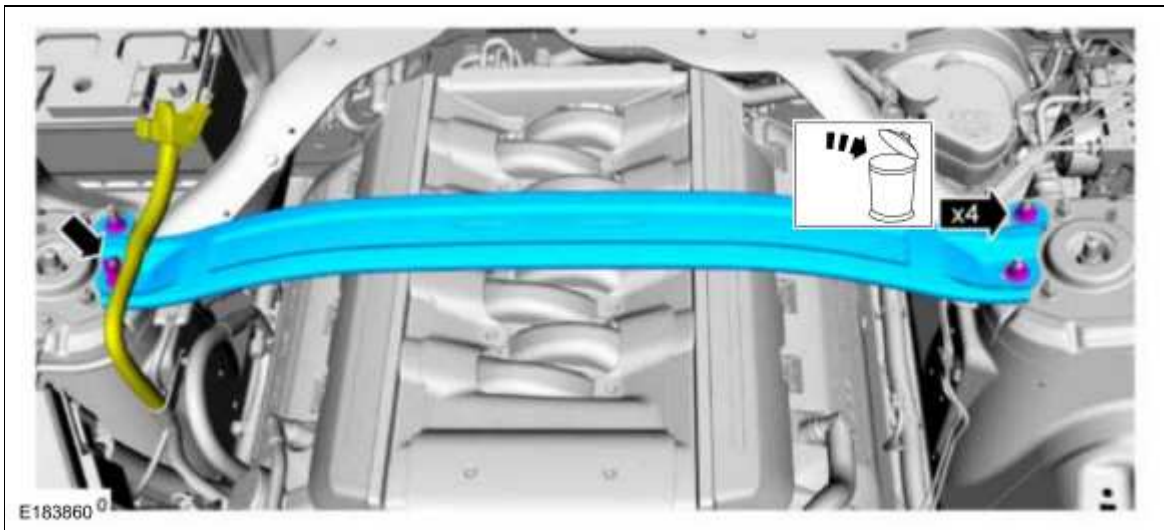
Materials

Name	Specification
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Motorcraft® Metal Surface Prep ZC-31-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

Removal

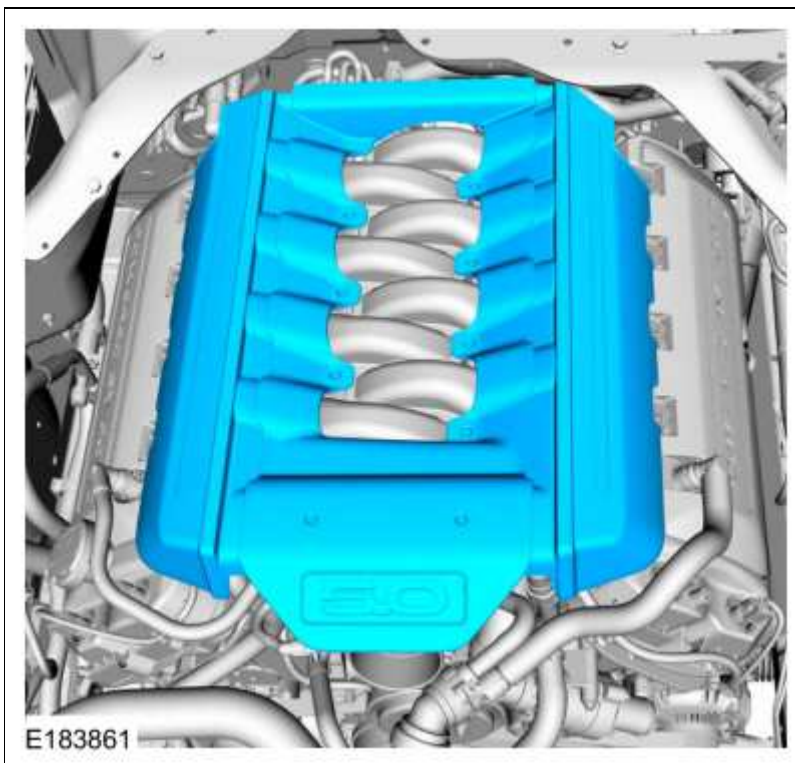
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
2. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
3.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.



4. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

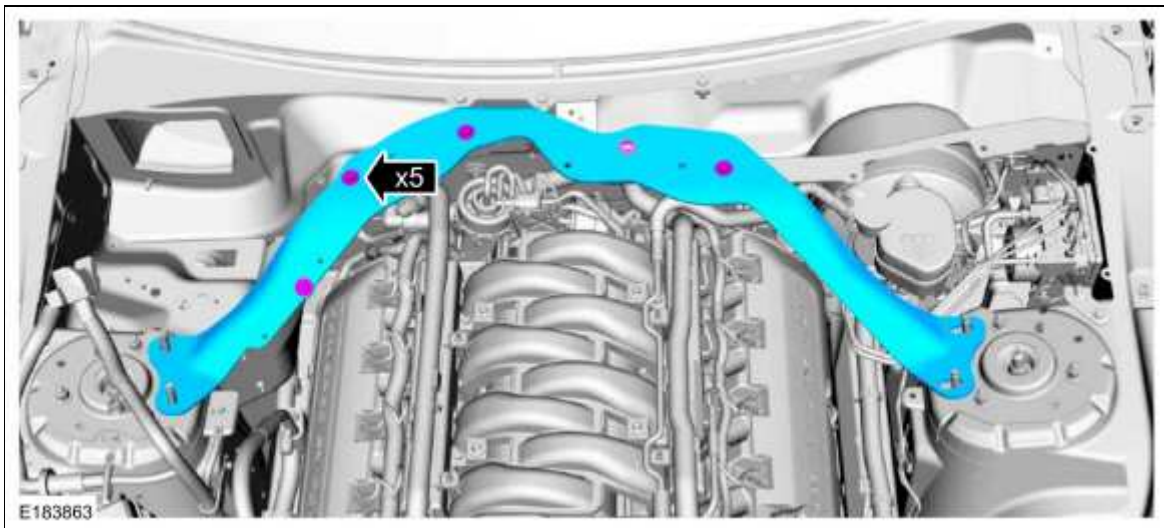
Remove the engine appearance cover.



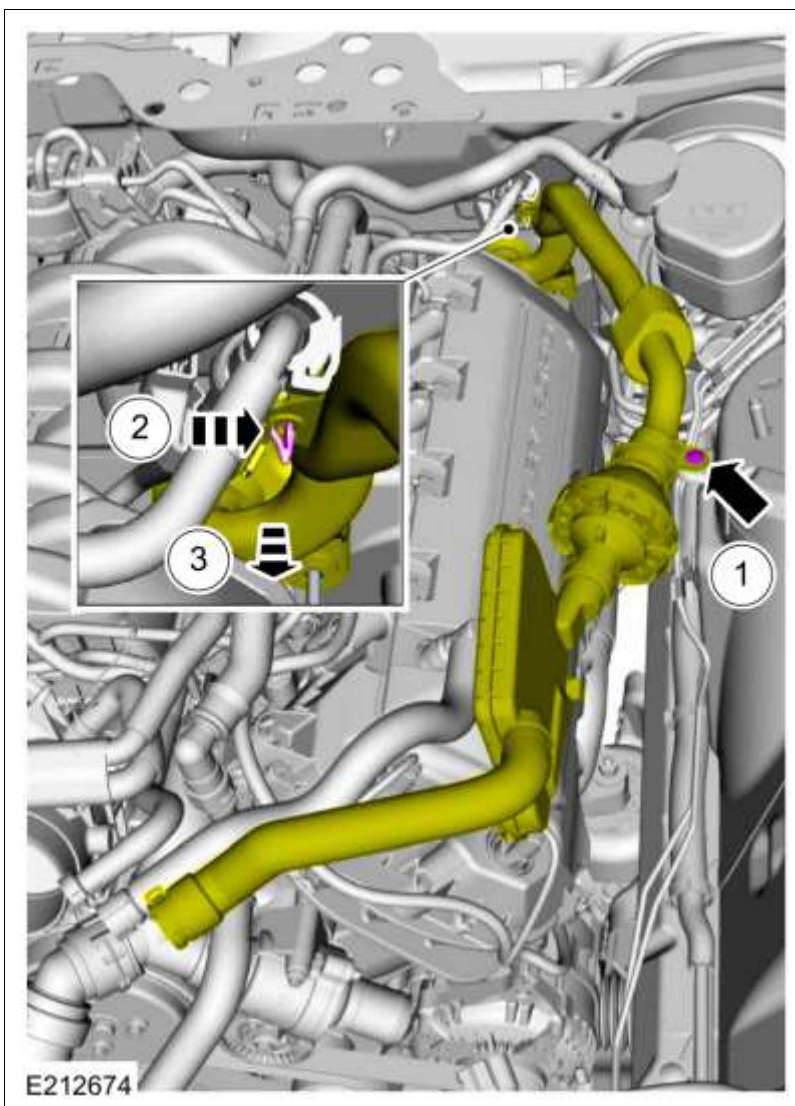
5. Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

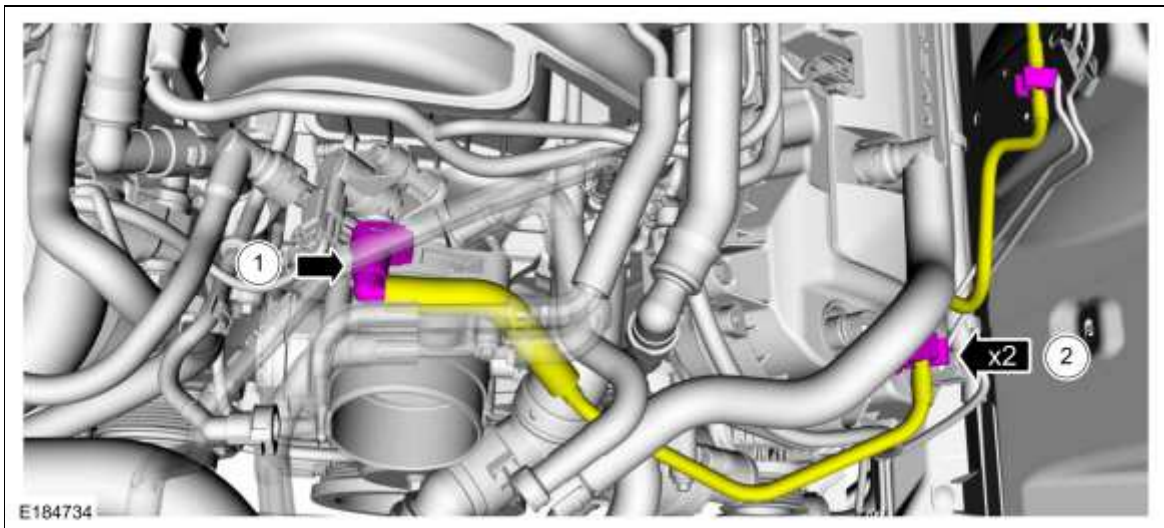
6. Remove the fasteners and the cowl extension.



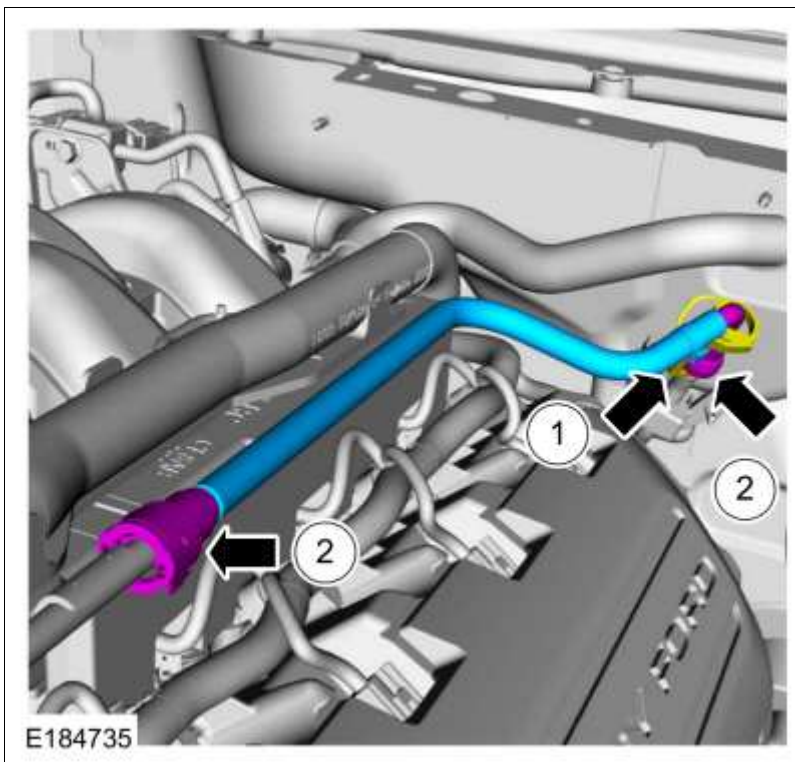
7.
 1. Remove the pin-type retainer.
 2. Depress the retainer.
 3. Position the sound enhancement pipe aside.



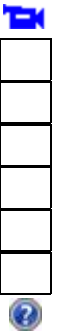
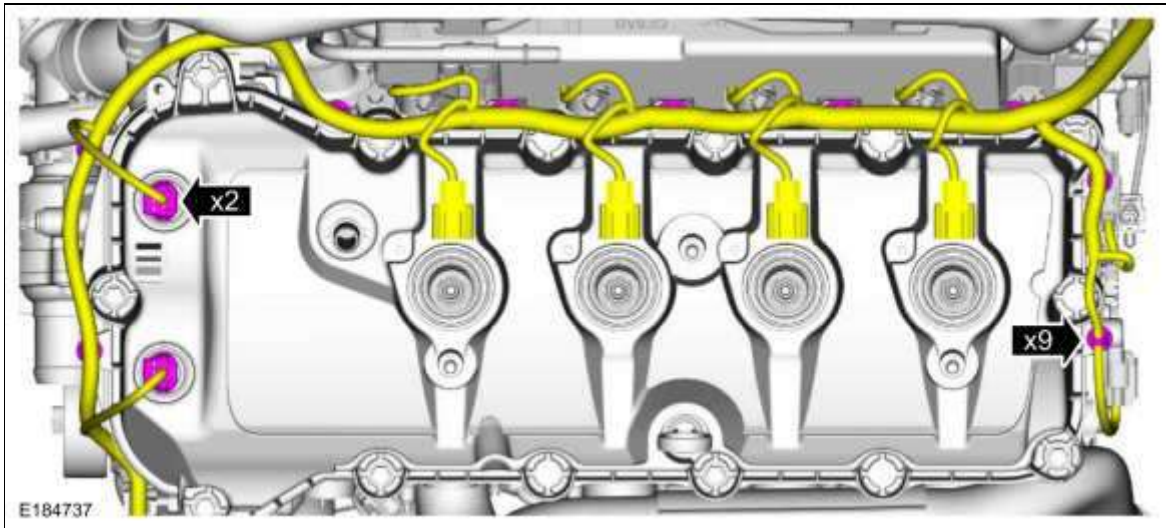
8.
 1. Disconnect the EVAP tube quick release coupling.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 2. Detach the EVAP tube from the retainers.



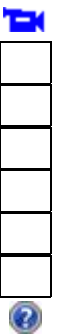
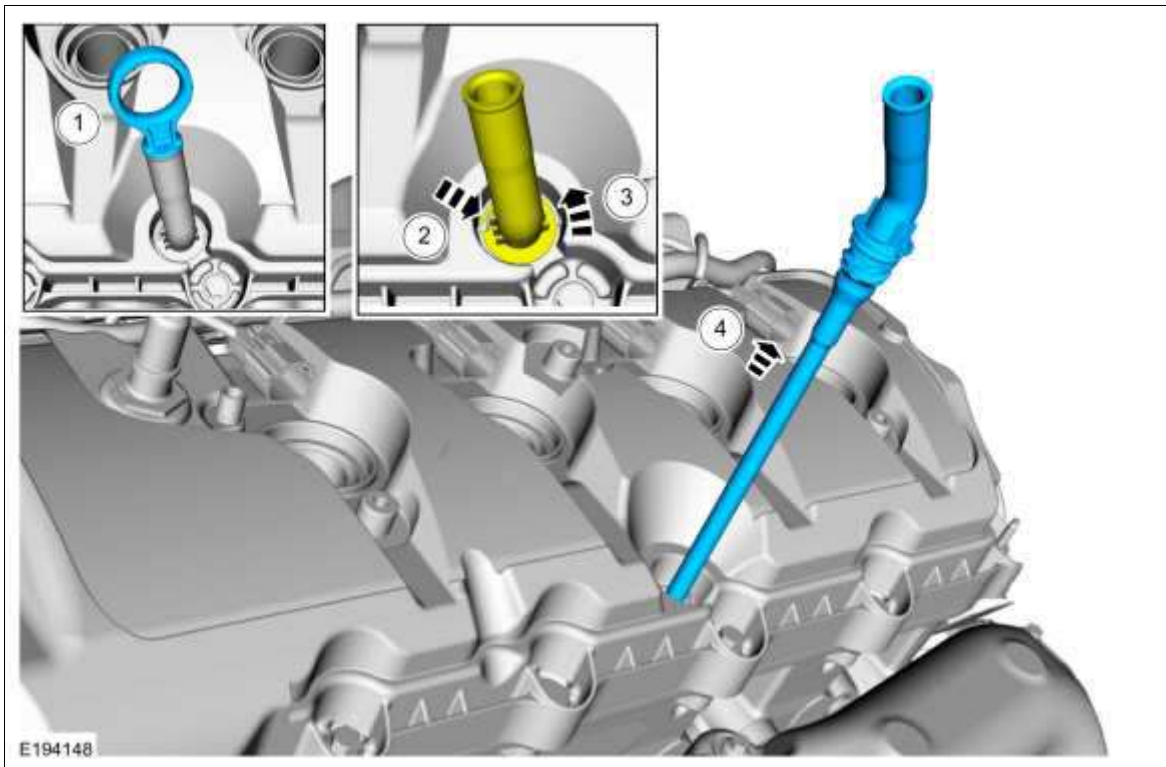
9.
 1. Position the safety clip aside.
 2. Disconnect the quick release couplings and remove the fuel tube.
 Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



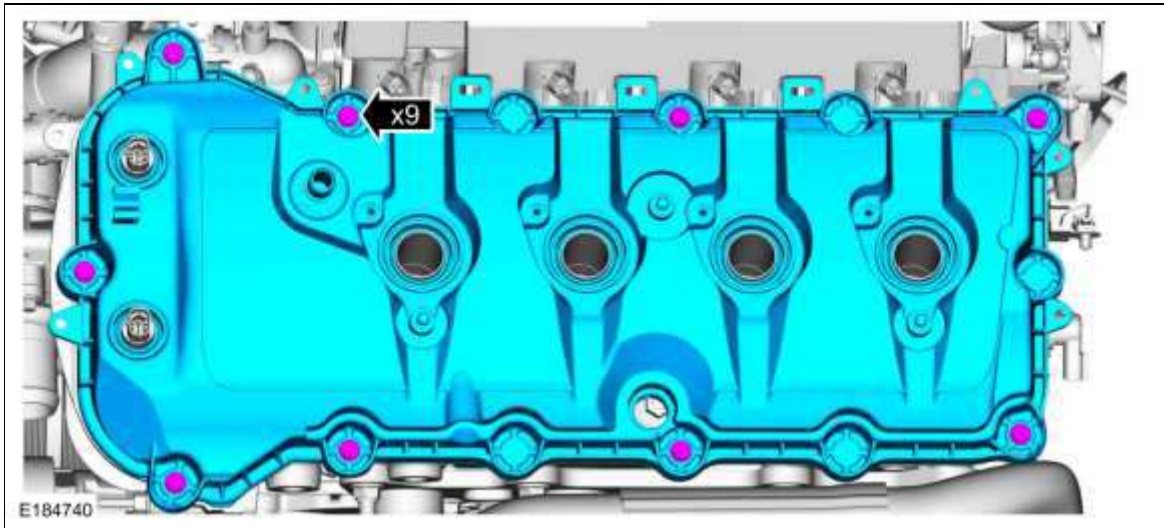
10. Remove the LH ignition coils.
 Refer to: [Ignition Coil-On-Plug](#) (303-07C Engine Ignition - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
11.
 - Disconnect the VCT variable force solenoid electrical connectors.
 - Detach the wiring harness retainers.



12.
 1. Remove the oil level indicator.
 2. Depress the tab.
 3. Rotate the oil level indicator tube counterclockwise.
 4. Pull the oil level indicator tube from the engine.

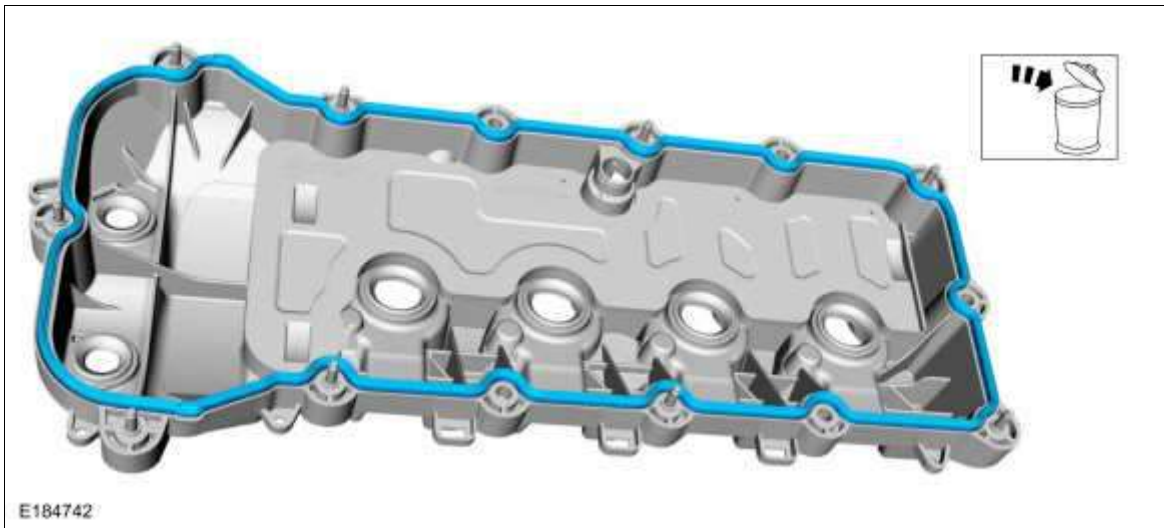


13. Loosen the bolts and remove the valve cover.



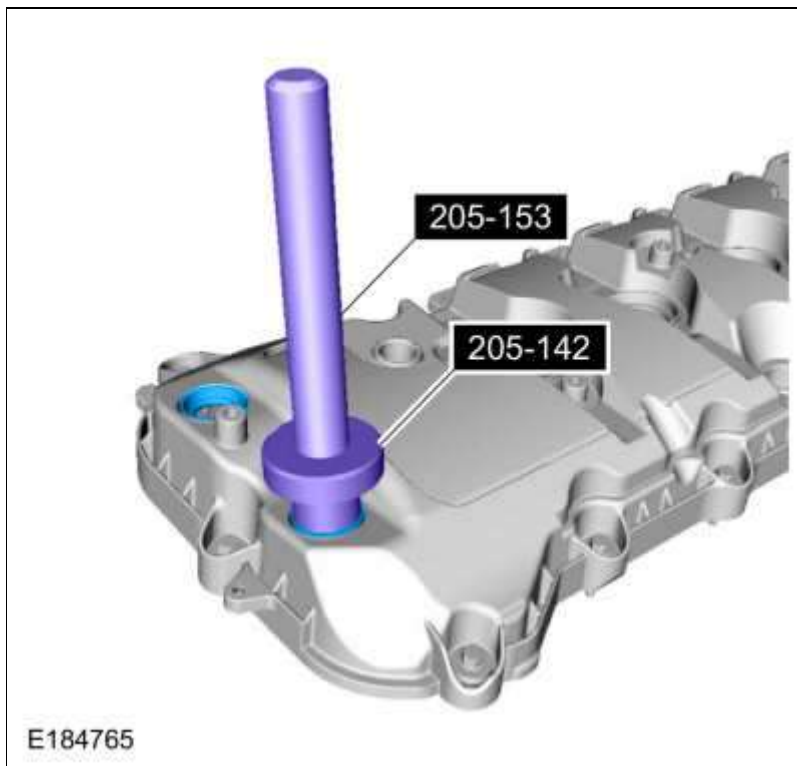
14. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.

Remove and discard the gasket.

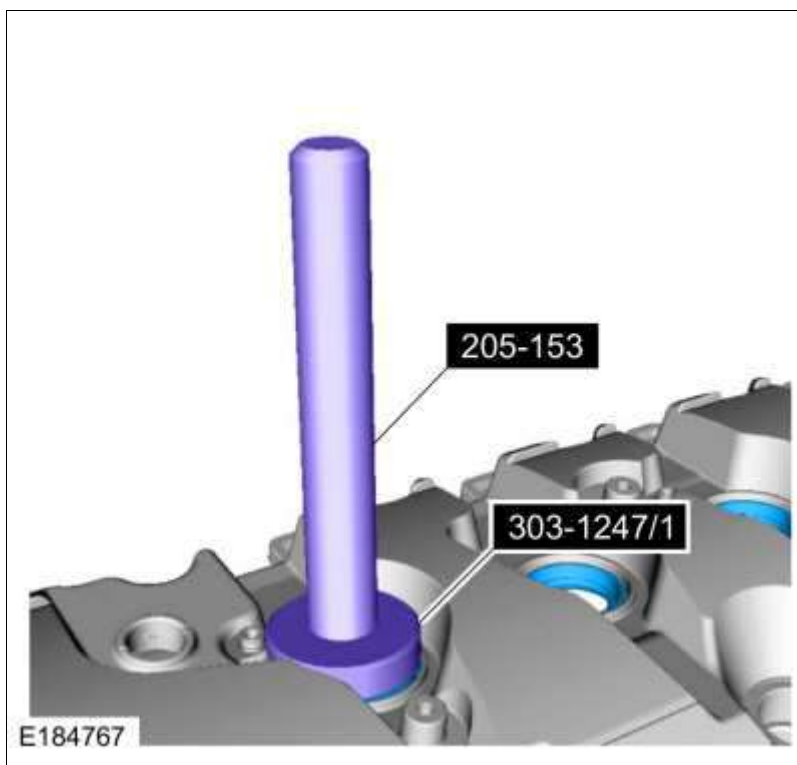


15. Inspect the VCT variable force solenoid seals. Remove and discard any damaged seals using the special tools.

Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone.](#)



16. Inspect the spark plug seals. Remove and discard any damaged seals using the special tools. Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer.](#)



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

Clean the valve cover mating surface of the cylinder head and engine front cover.

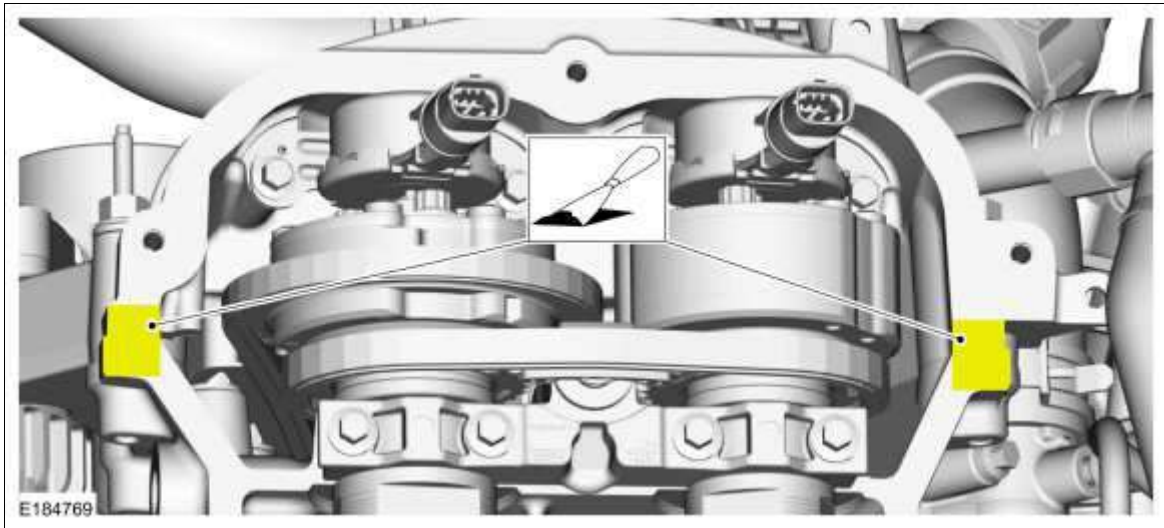
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Motorcraft® Metal Surface Prep / ZC-31-B

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

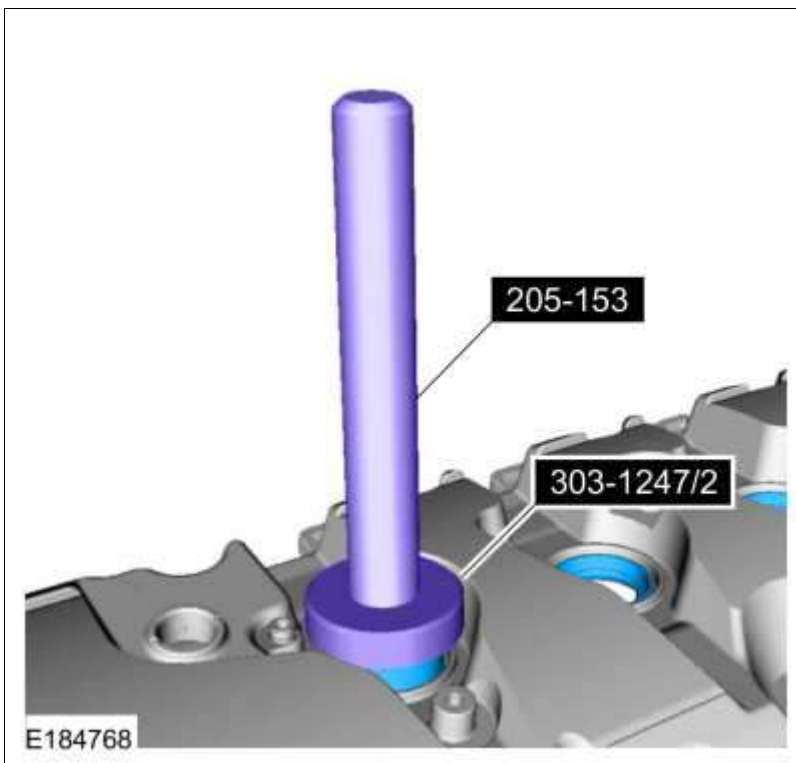


Installation

1. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new spark plug tube seals.

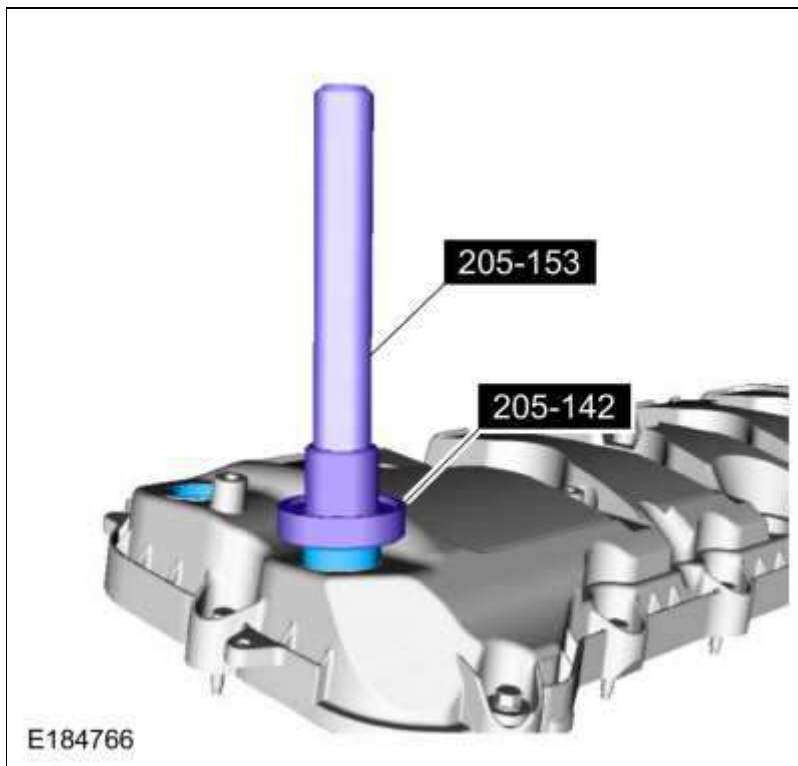
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer](#).



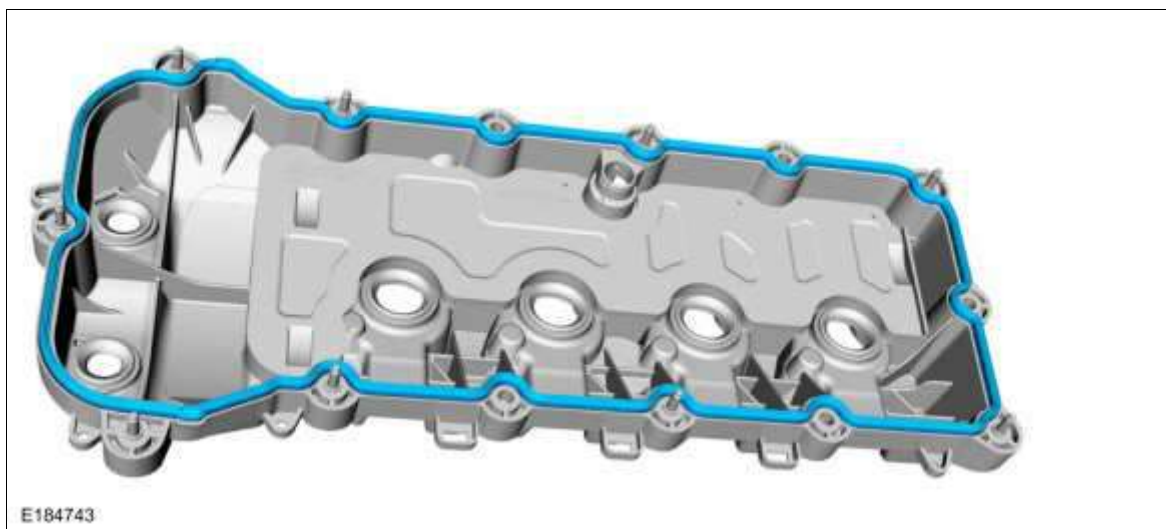
2. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new VCT variable force solenoid seals.

Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone](#).



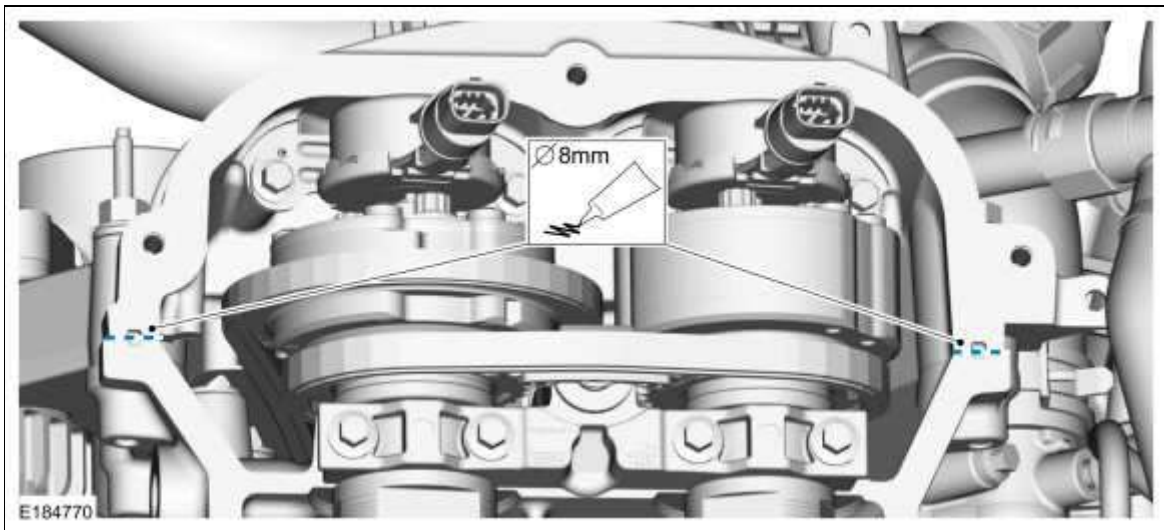
3. Install a new gasket.



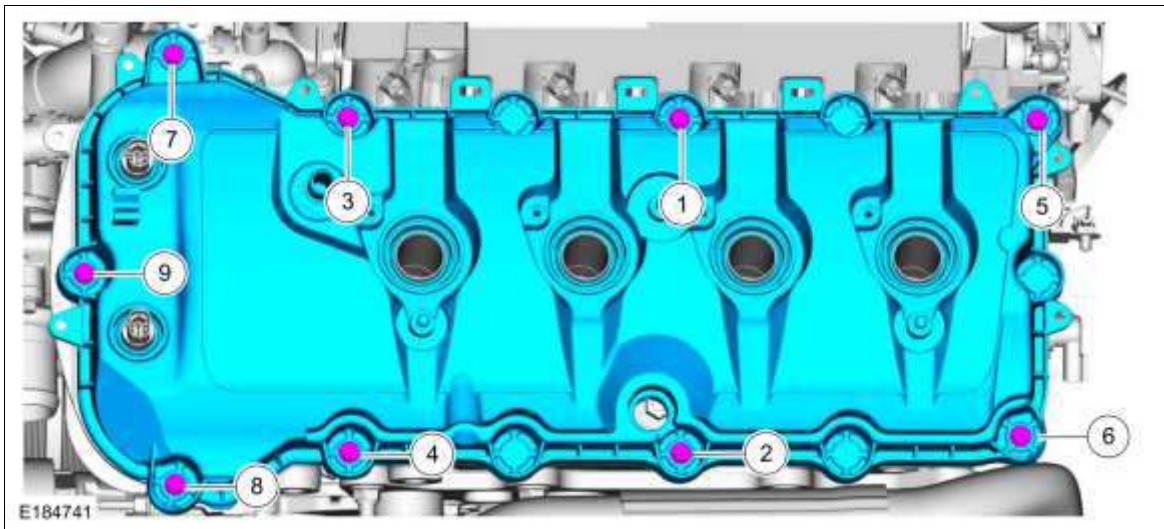
4. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the engine front cover-to-cylinder head joints.

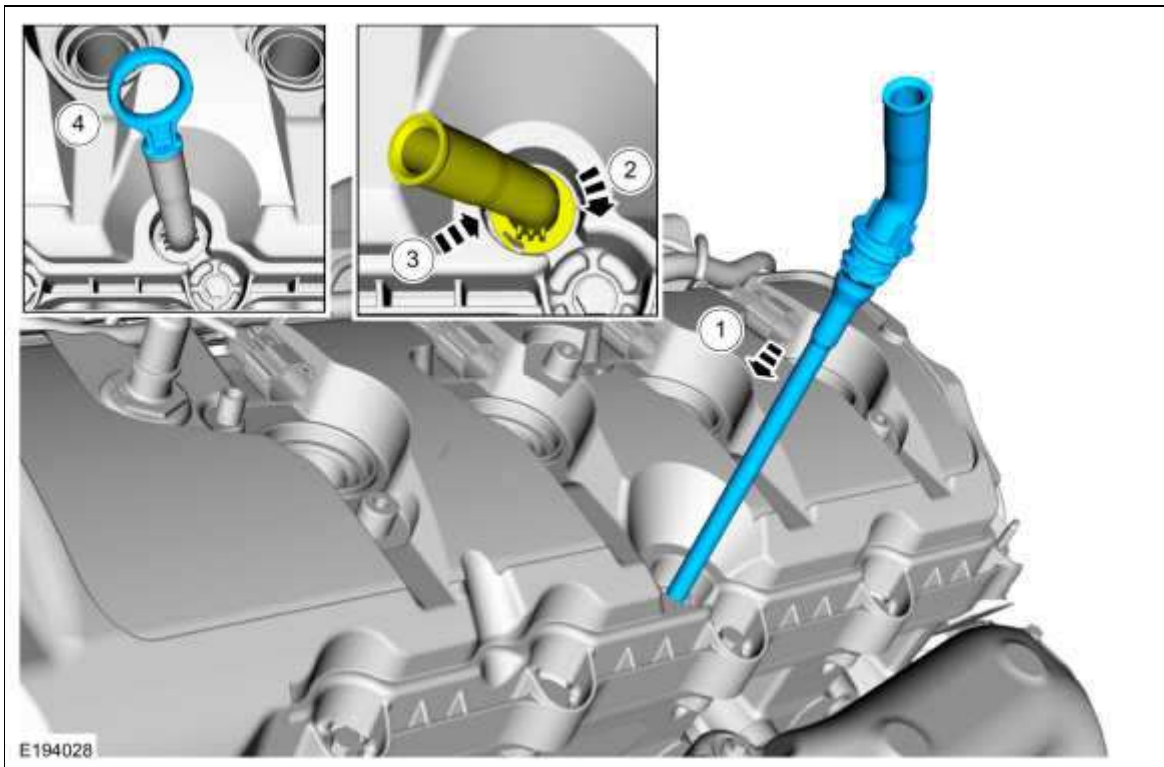
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



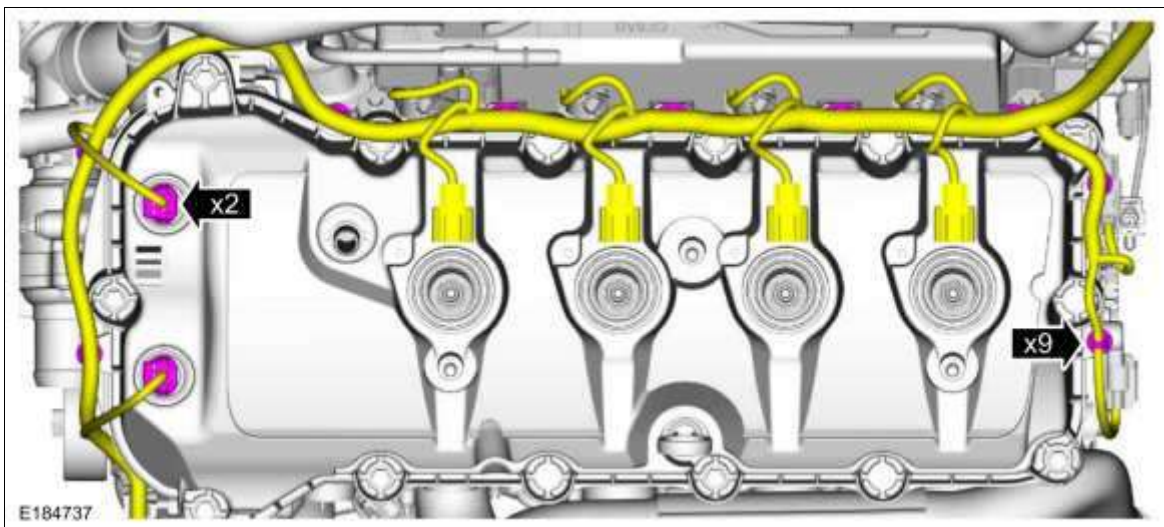
5. Install the valve cover and tighten the bolts.
Torque: 89 lb.in (10 Nm)



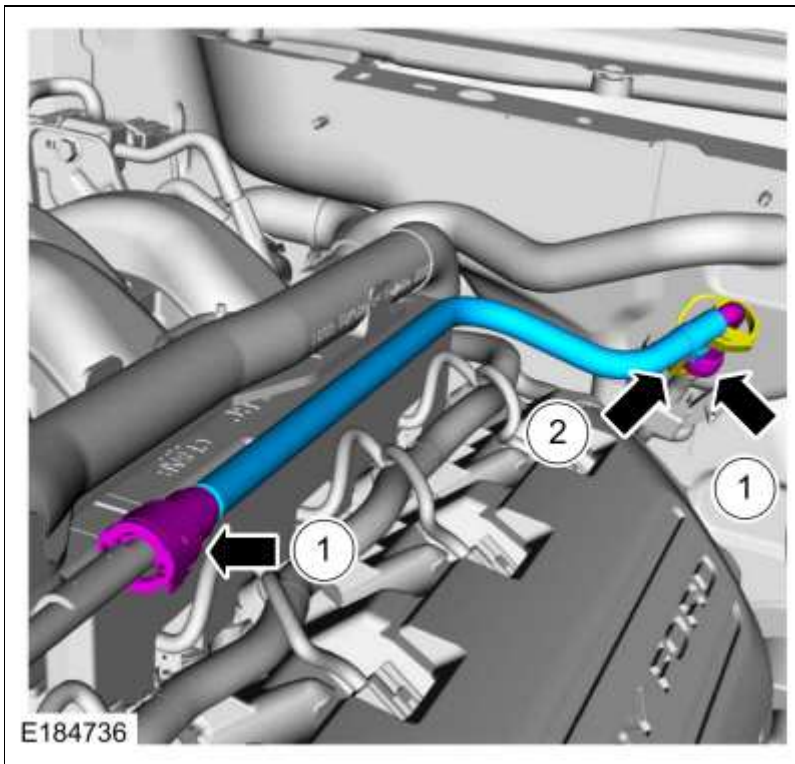
6.
 1. Push the oil level indicator tube into the engine.
 2. Rotate the oil level indicator tube clockwise.
 3. Verify the tab is locked in place.
 4. Install the oil level indicator.



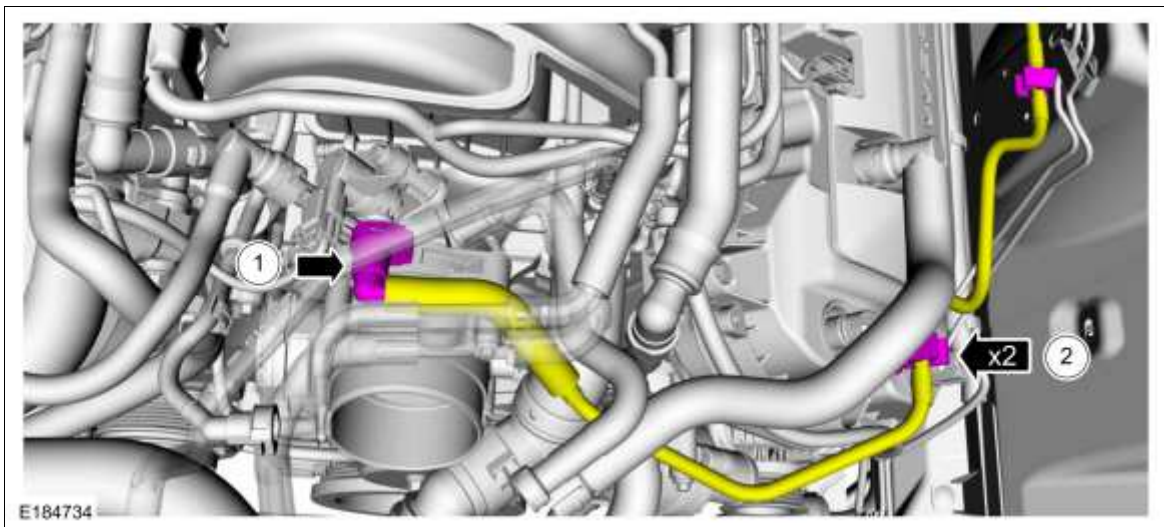
7.
 - Attach the wiring harness retainers.
 - Connect the VCT variable force solenoid electrical connectors.



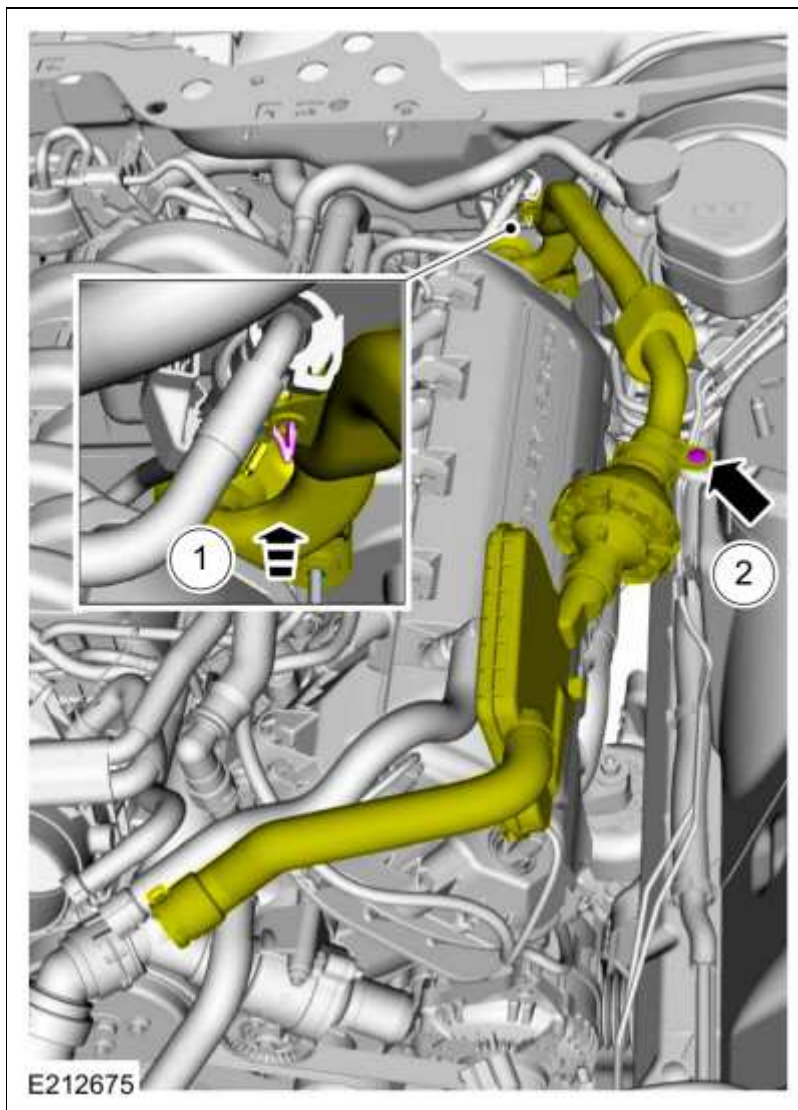
8. Install the LH ignition coils.
Refer to: [Ignition Coil-On-Plug](#) (303-07C Engine Ignition - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
9.
 1. Position the fuel tube and connect the quick release couplings.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 2. Install the safety clip.



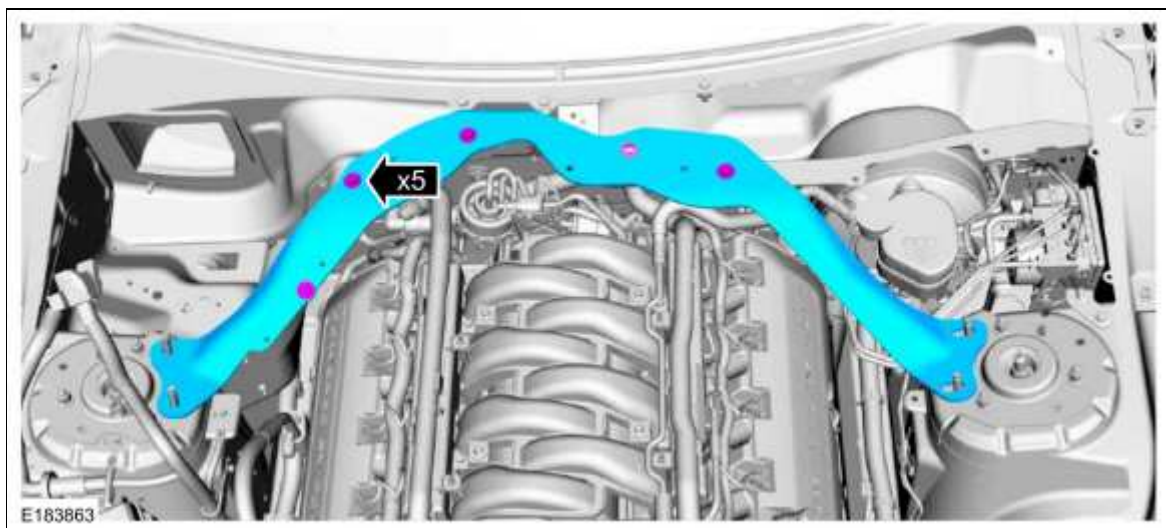
10.
 1. Connect the EVAP tube coupling.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 2. Attach the EVAP tube to the retainers.



11.
 1. Position the sound enhancement pipe onto the retainer.
 2. Install the pin-type retainer.



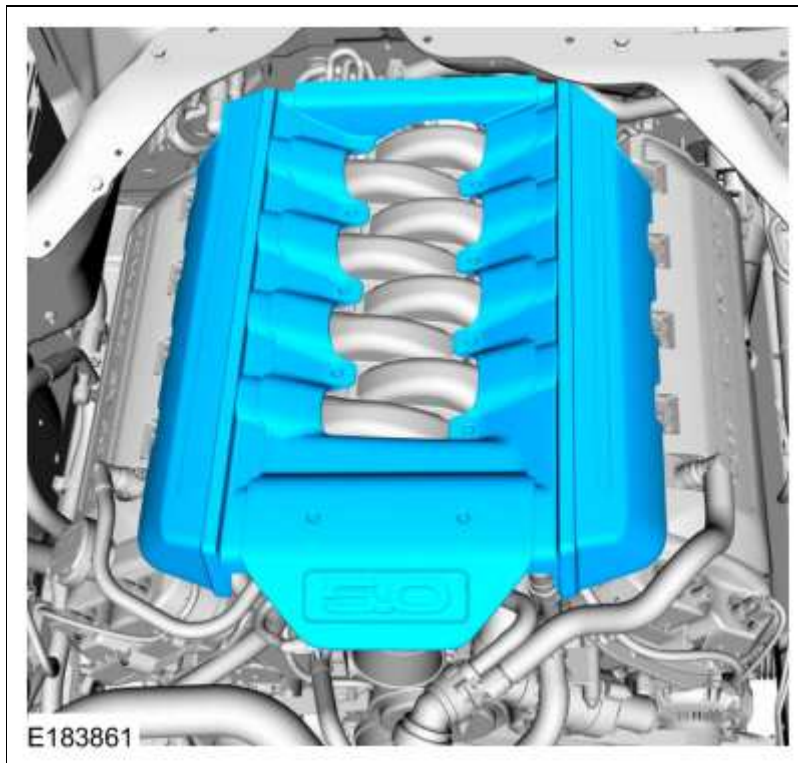
12. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)



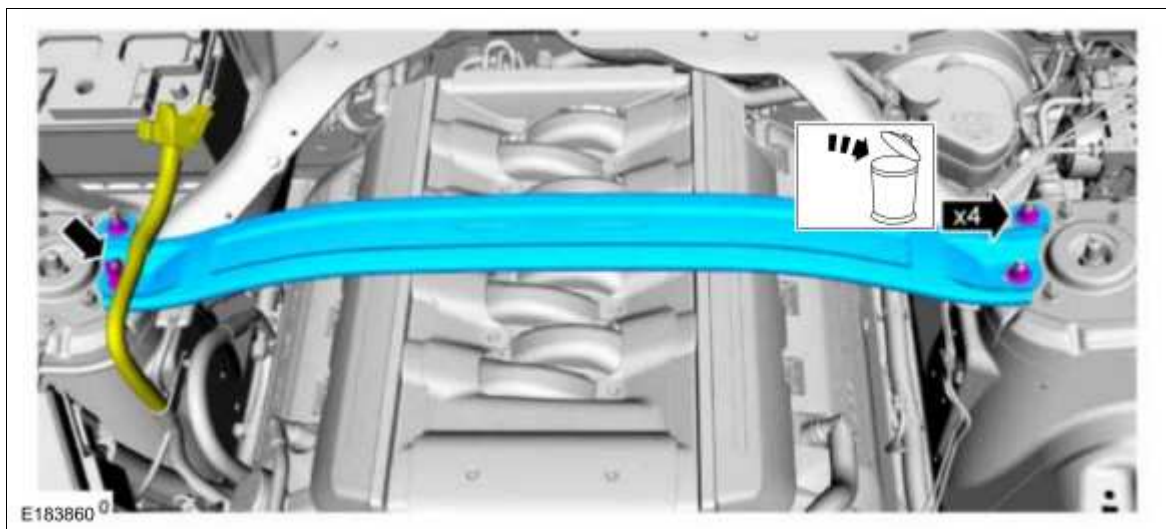
13. Install the following items:
1. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
 2. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 3. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

14. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

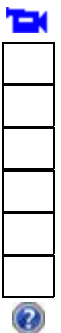
Install the engine appearance cover.



15.
 - If equipped, install the strut tower cross brace and nuts.
 - Attach the wiring harness retainer.



x4



16. Connect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).

**Valve Cover RH****Special Tool(s) / General Equipment**

	205-142 (T80T-4000-J) Installer, Differential Bearing Cone
	205-153 (T80T-4000-W) Handle
	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
Plastic Scraper	

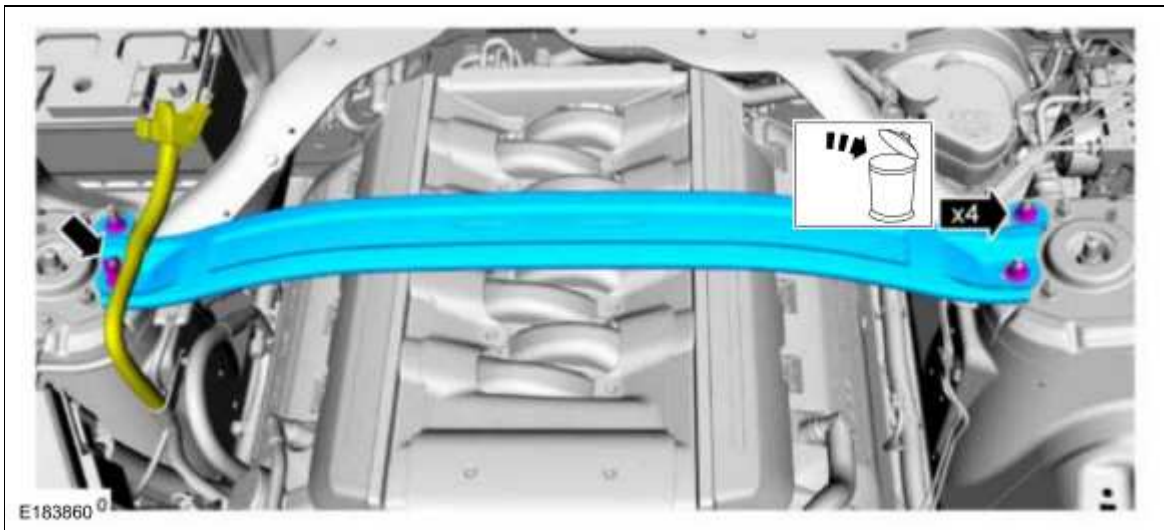
Materials

Name	Specification
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Motorcraft® Metal Surface Prep ZC-31-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

Removal

NOTICE: 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.

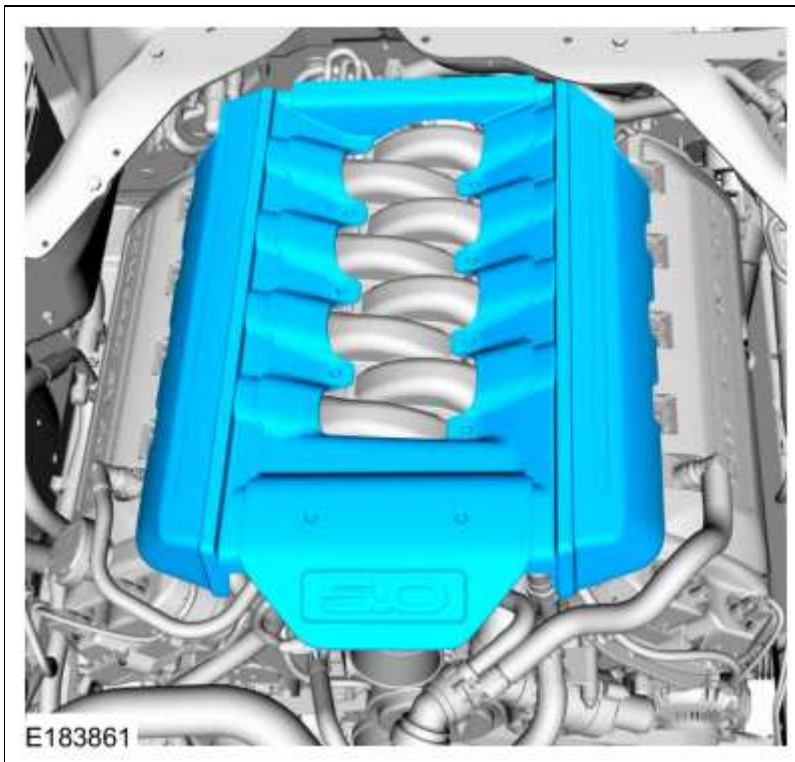
1. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
2.
 - If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.



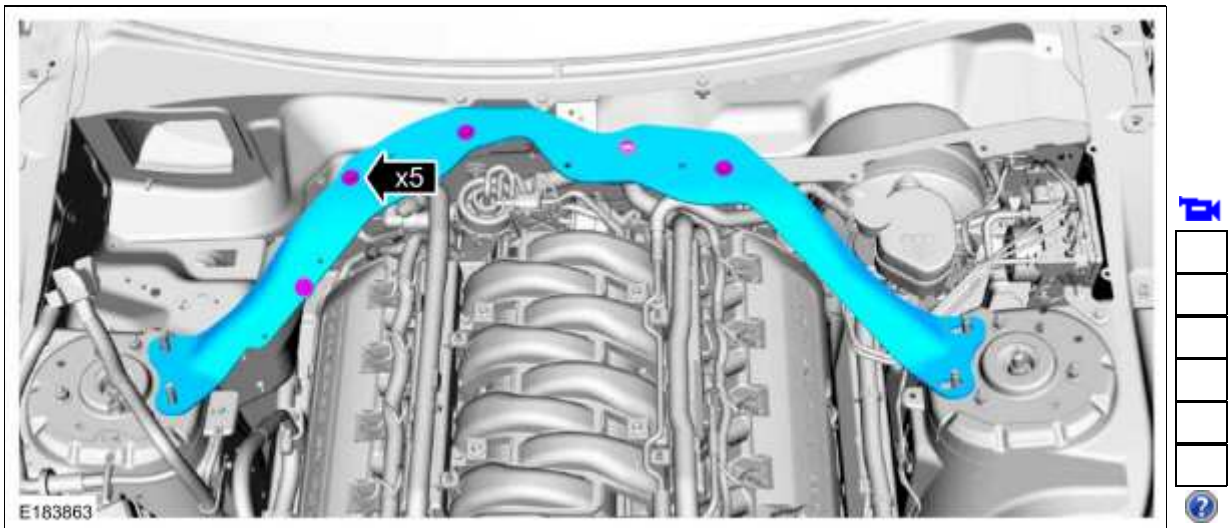
3. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Remove the engine appearance cover.

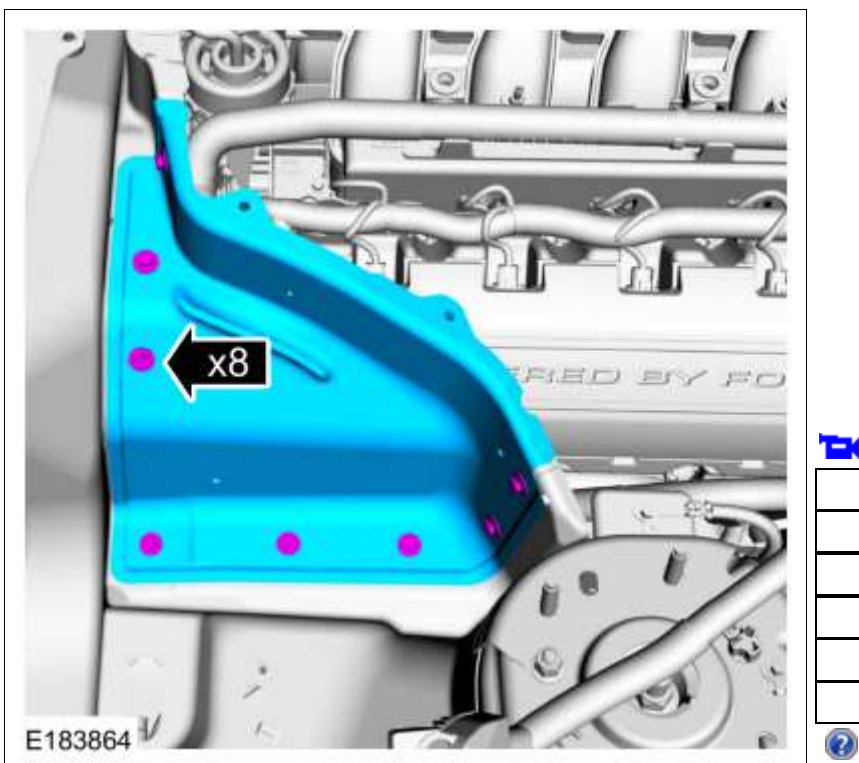
Remove the nuts and the strut tower cross brace.



4. Remove the following items:
1. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
 2. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Remove the fasteners and the cowl extension.



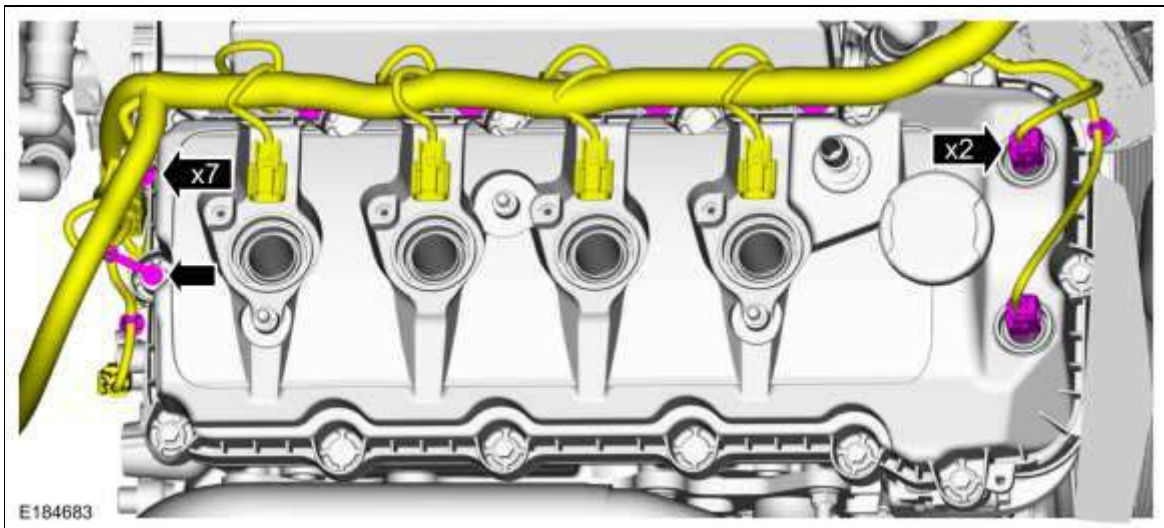
6. Remove the fasteners and the battery heat shield.



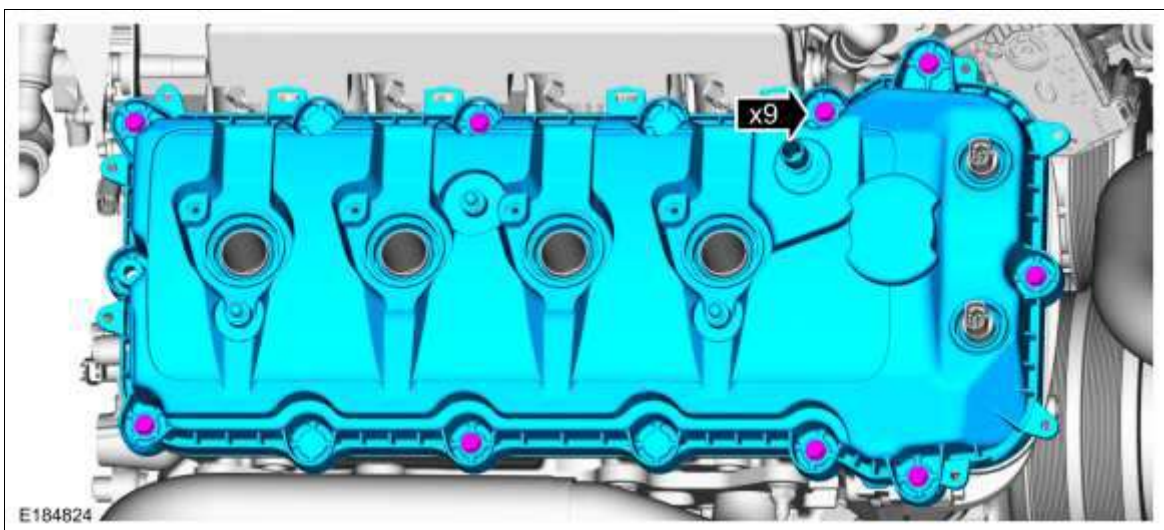
7. Remove the RH ignition coils.

Refer to: [Ignition Coil-On-Plug](#) (303-07C Engine Ignition - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

- 8.
- Disconnect the VCT variable force solenoid electrical connectors.
 - Detach the wiring harness retainers.

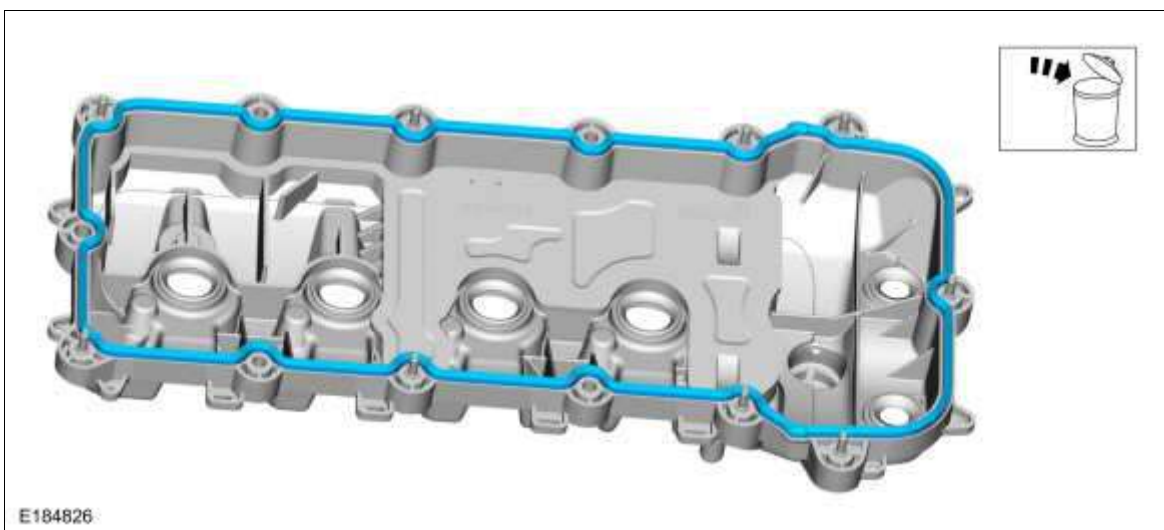


9. Loosen the bolts and remove the valve cover.

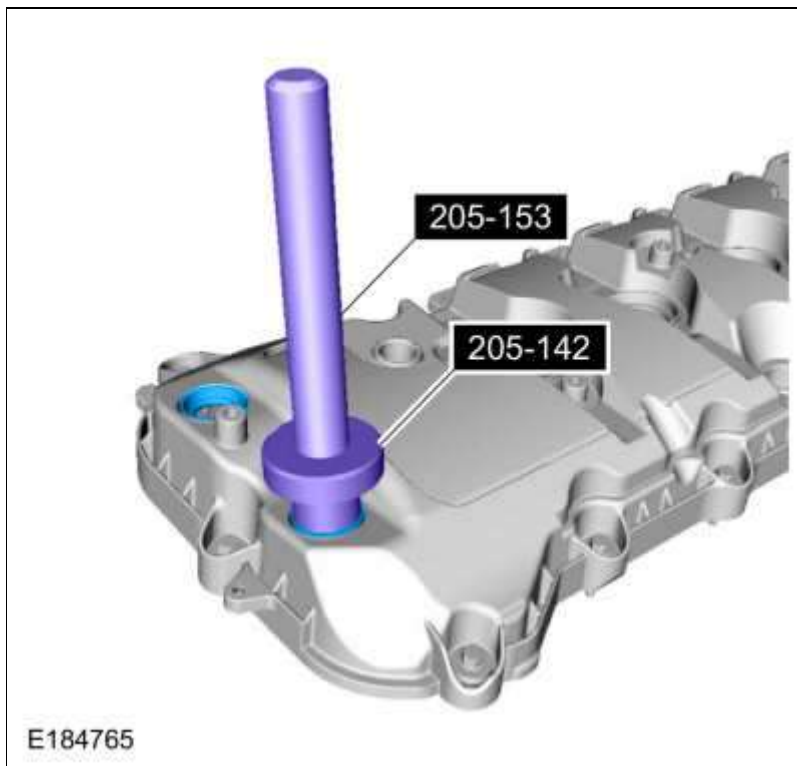


10. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.

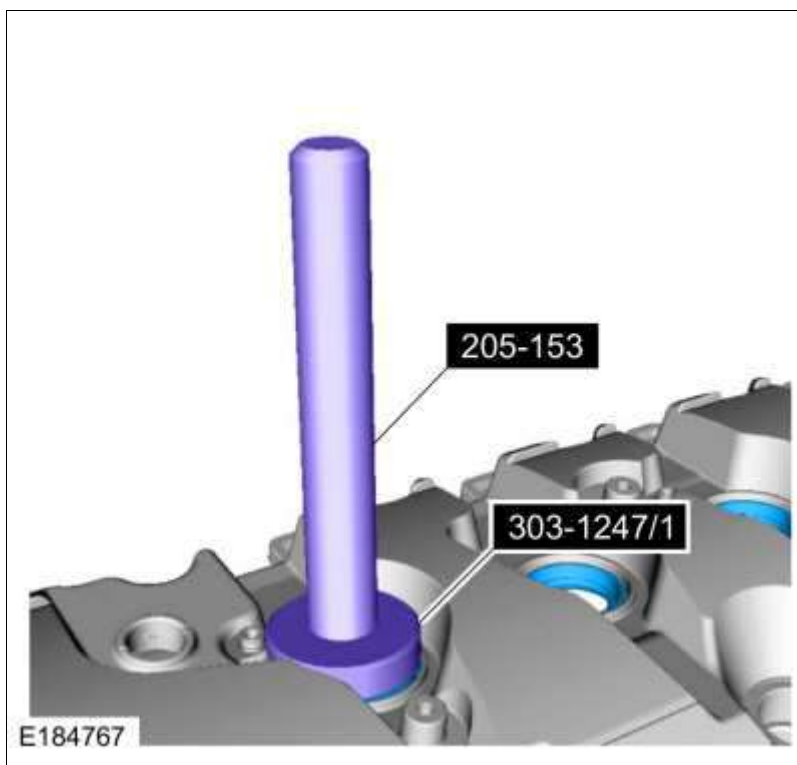
Remove and discard the gasket.



11. Inspect the VCT variable force solenoid seals. Remove any damaged seals using the special tools. Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#), [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone](#).



12. Inspect the spark plug seals. Remove any damaged seals using the special tools.
 Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer](#).



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

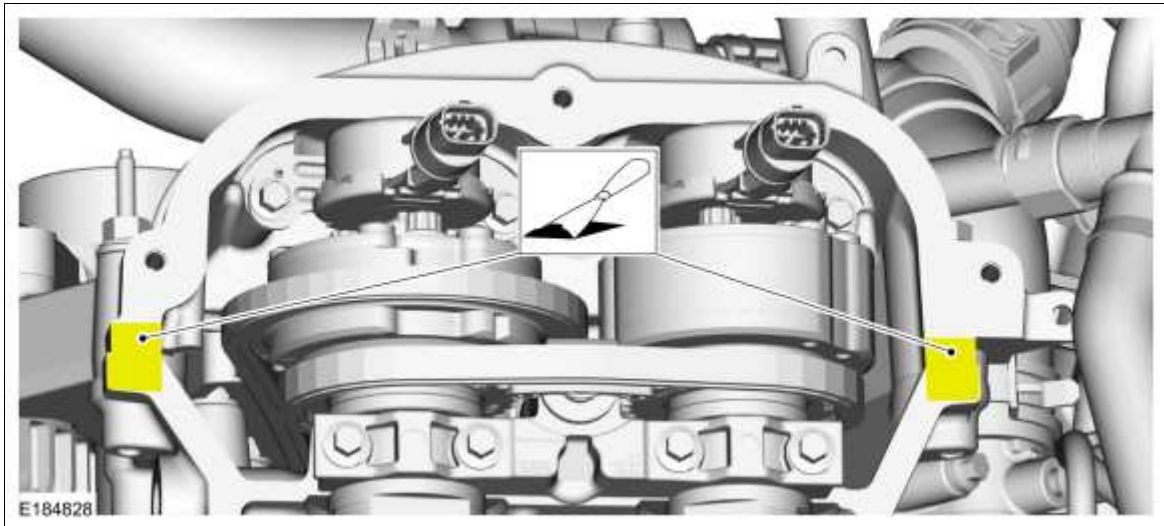
Clean the valve cover mating surface of the cylinder head and engine front cover.
 Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Motorcraft® Metal Surface Prep / ZC-31-B

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

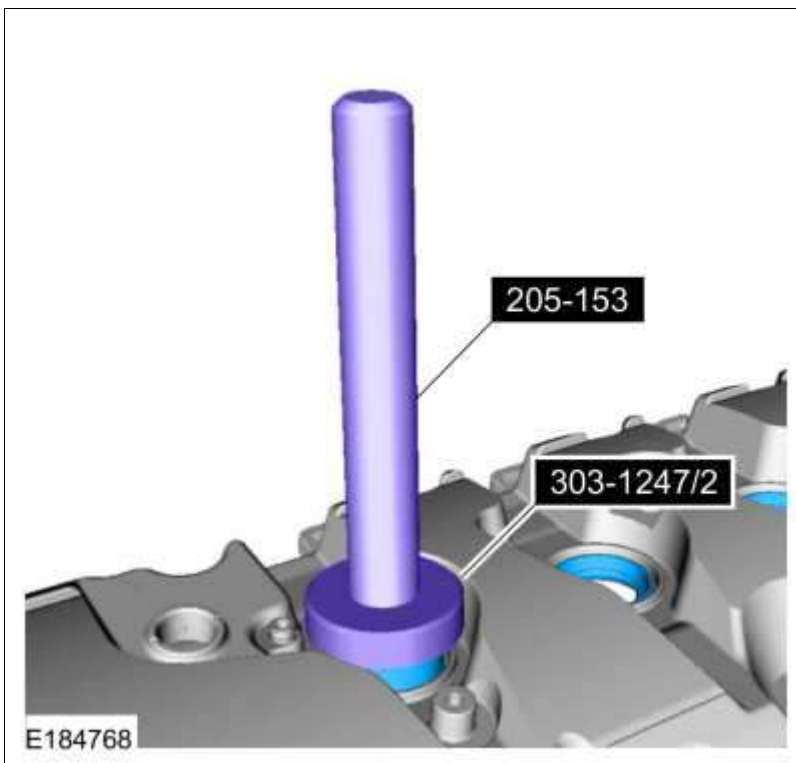


Installation

1. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new spark plug tube seals.

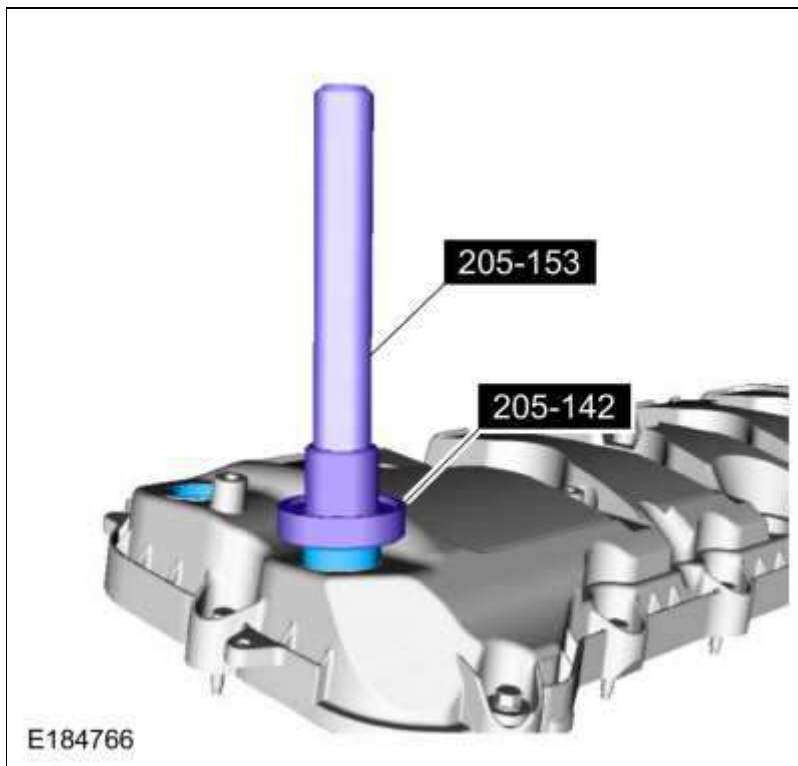
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer](#).



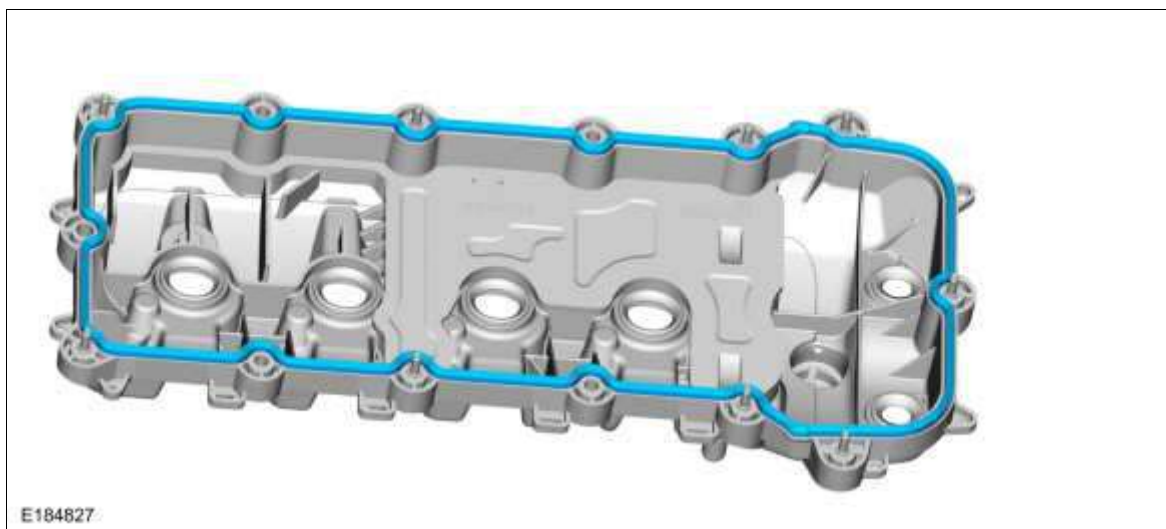
2. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new VCT variable force solenoid seals.

Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone](#).



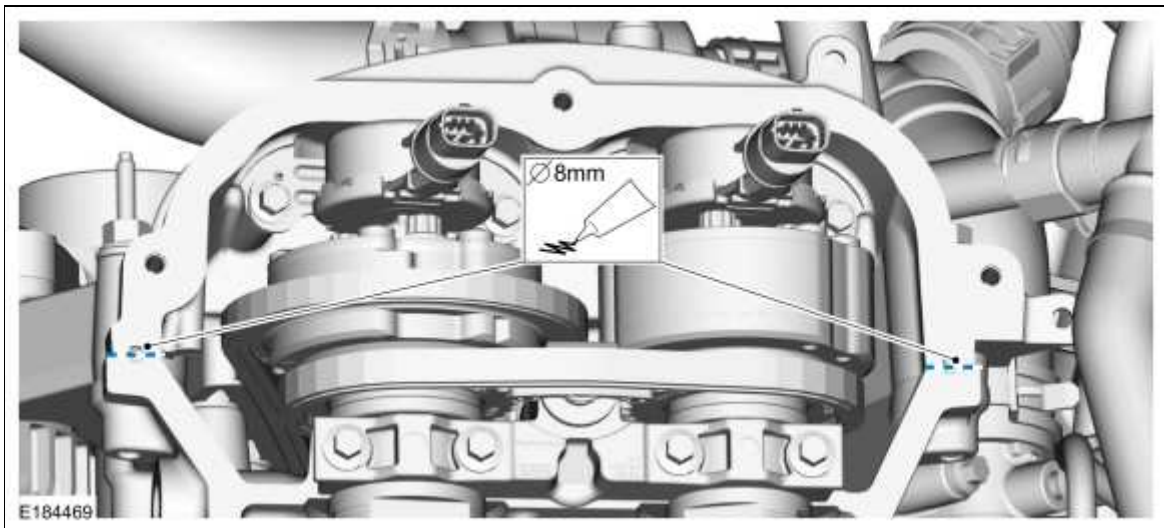
3. Install a new gasket.



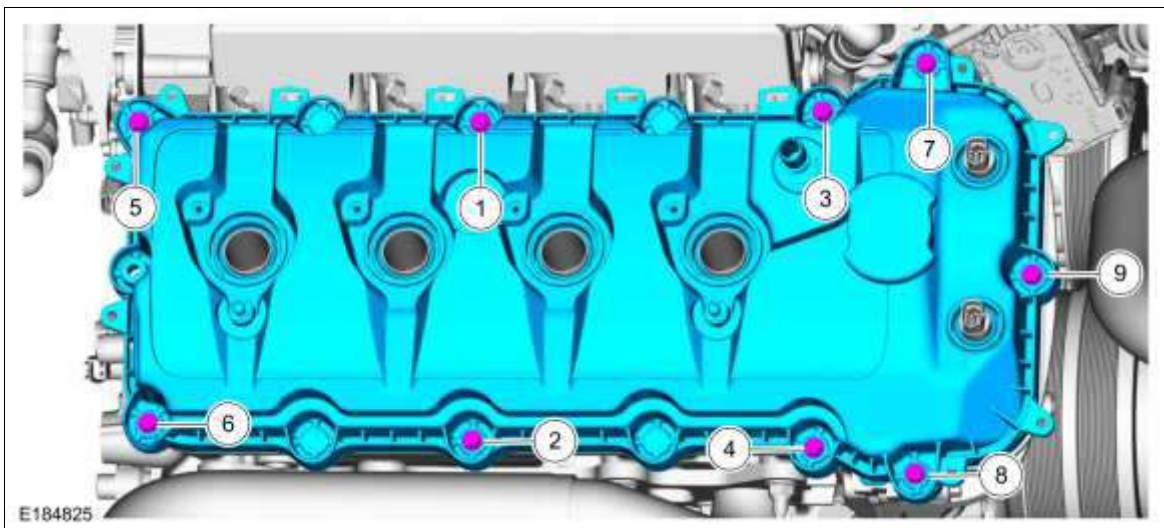
4. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the engine front cover-to-cylinder head joints.

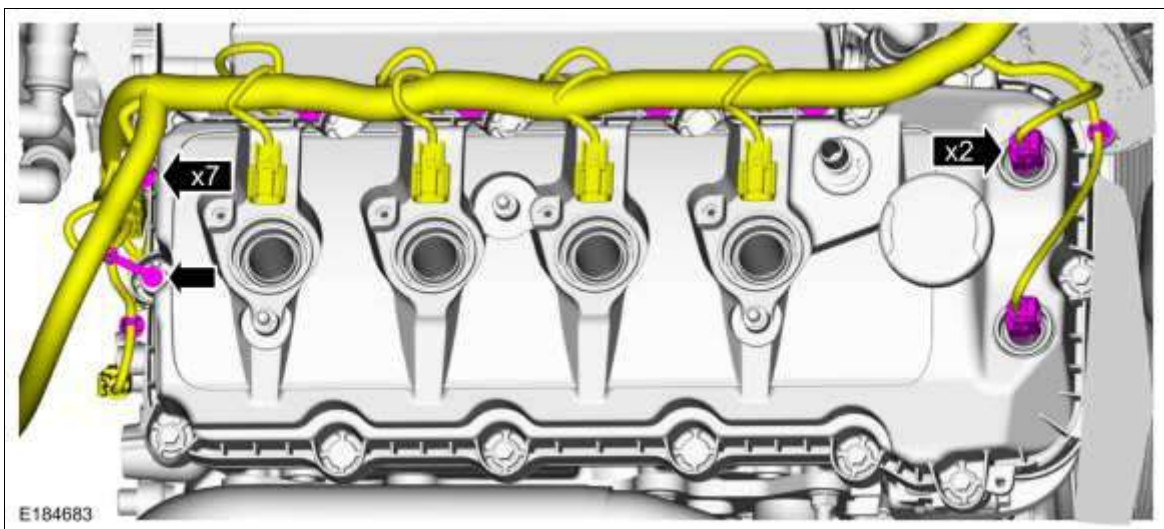
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



5. Install the valve cover and tighten the bolts.
Torque: 89 lb.in (10 Nm)

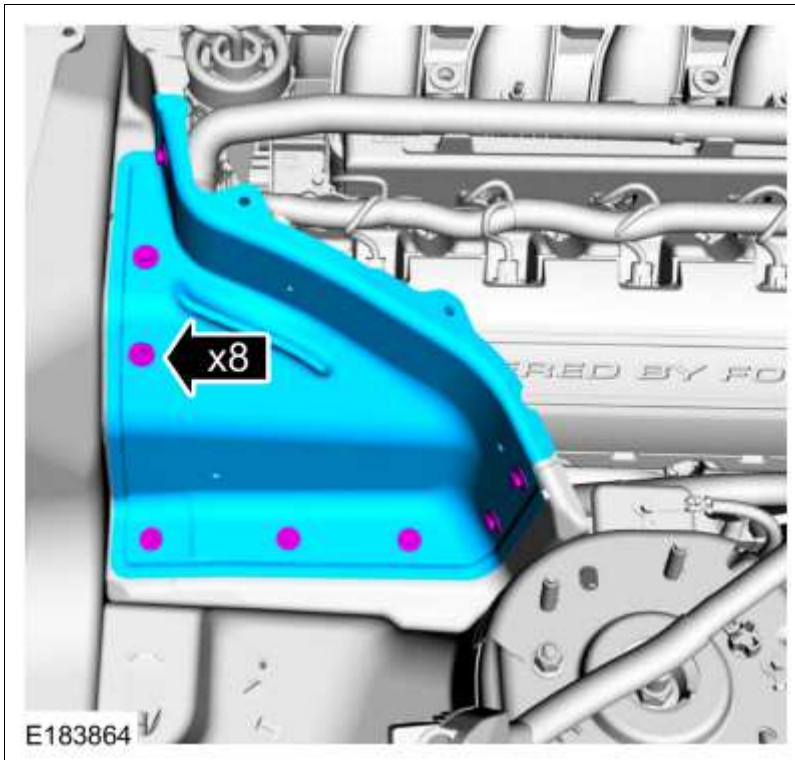


6. • Attach the wiring harness retainers.
• Connect the VCT variable force solenoid electrical connectors.

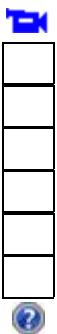
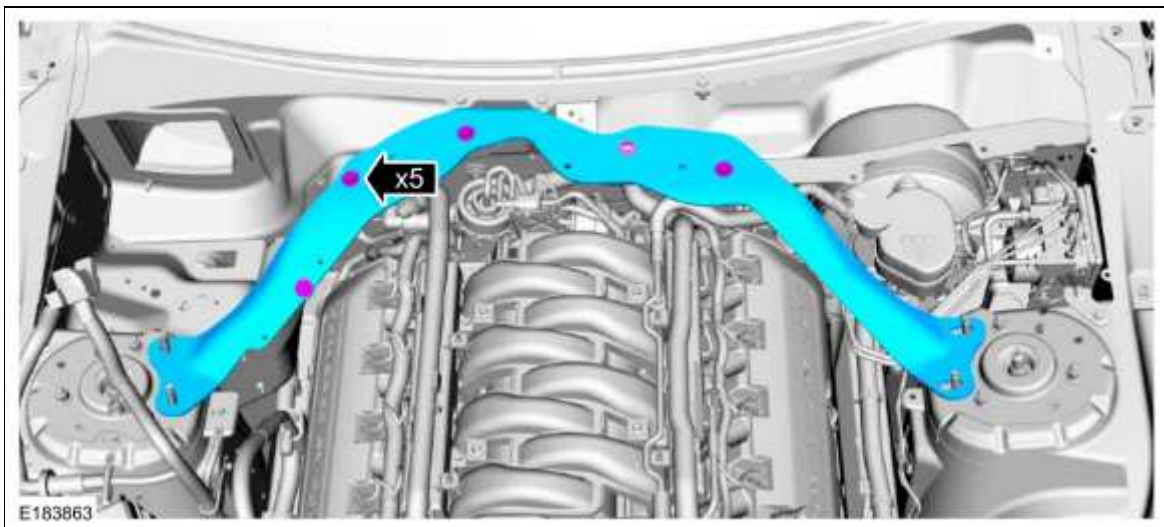


7. Install the RH ignition coils.
Refer to: [Ignition Coil-On-Plug](#) (303-07C Engine Ignition - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

8. Install the battery heat shield and fasteners.
Torque: 80 lb.in (9 Nm)



9. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)

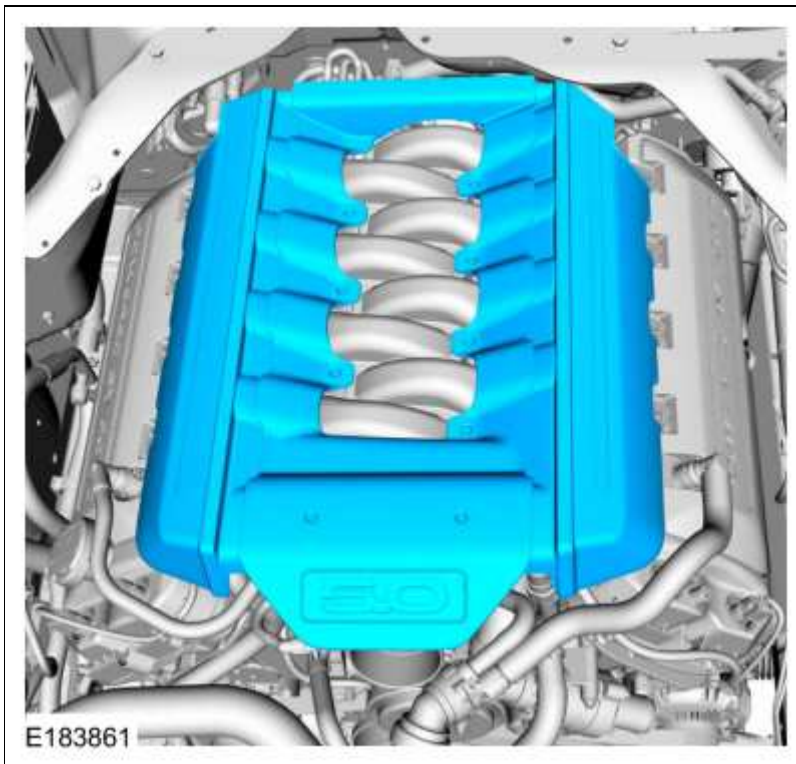


10. Install the following items:

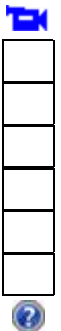
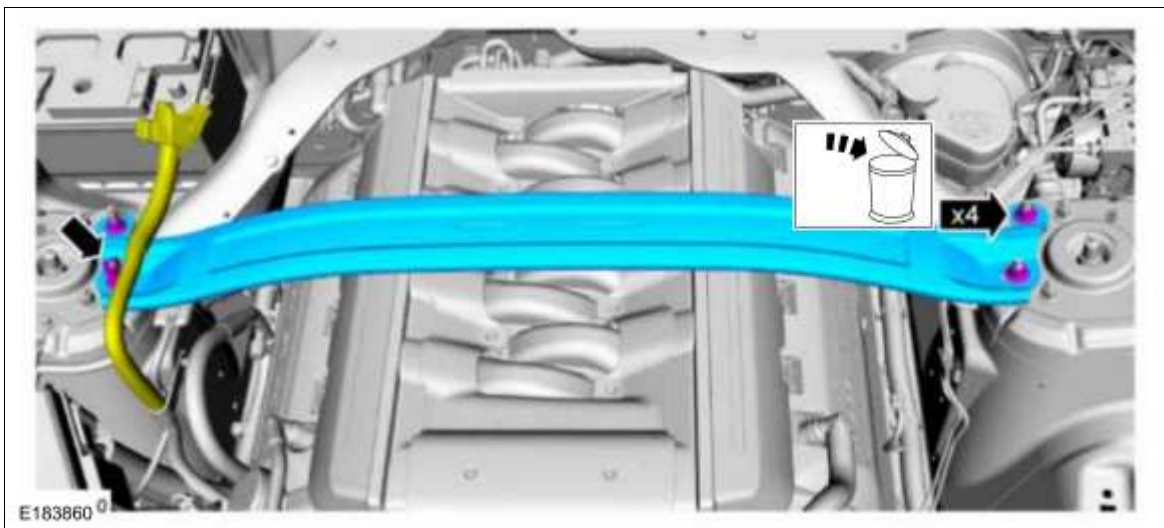
1. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

11. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.



- 12.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.



13. Connect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).



Variable Camshaft Timing (VCT) Unit

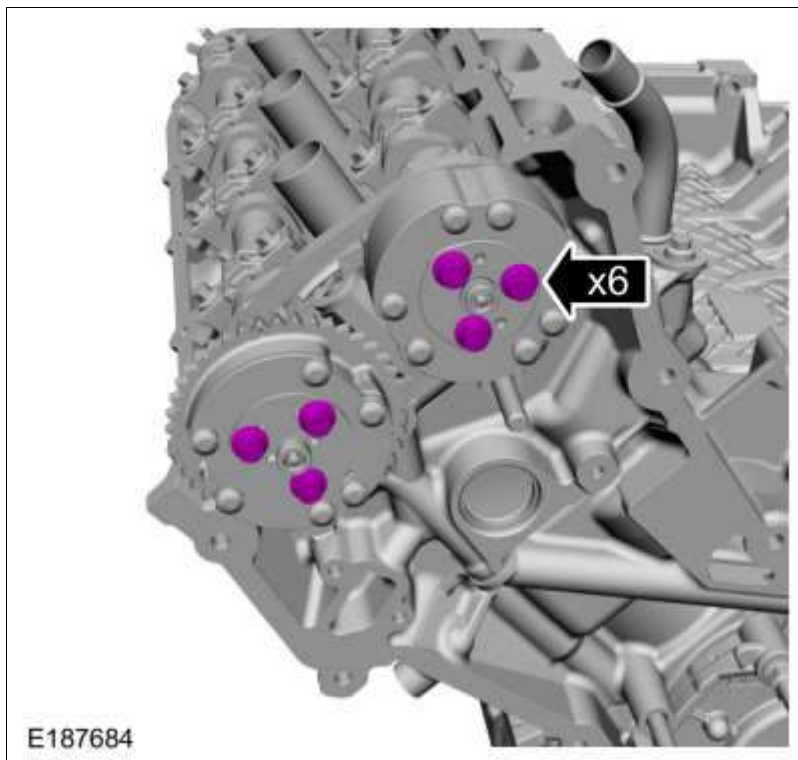
Removal

NOTICE: 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.

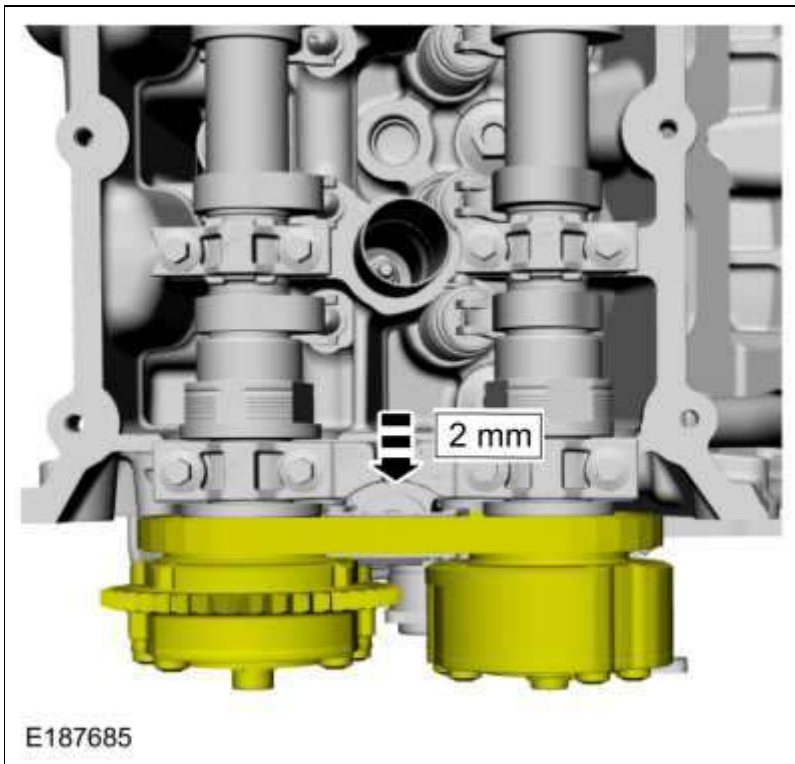
NOTE: If the RH VCT units are being serviced at the same time as the LH VCT units, remove the RH VCT units first.

Right hand units

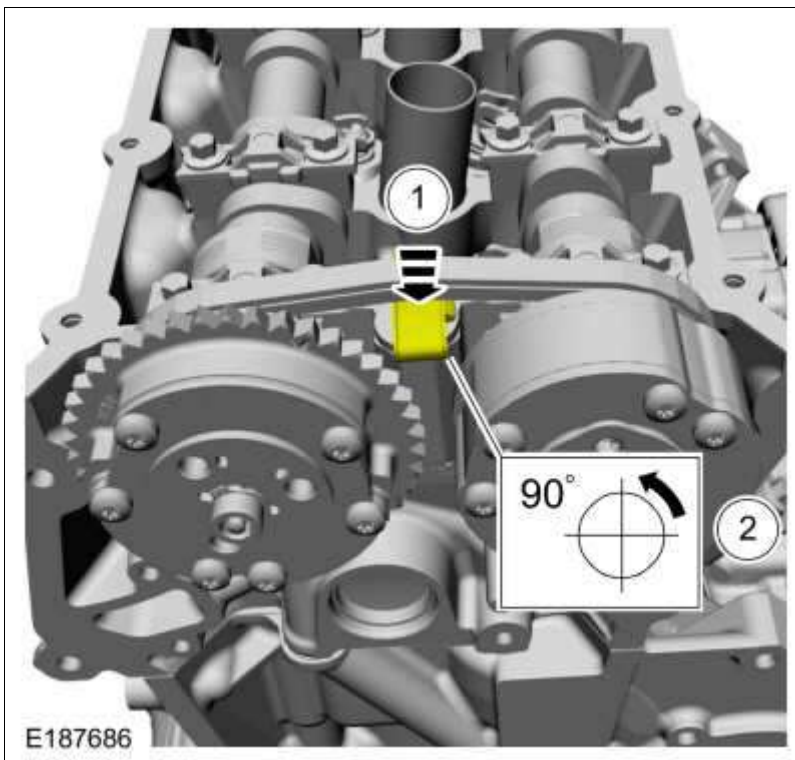
1. Remove the RH timing chain.
Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Remove the intake and exhaust VCT assembly bolts.



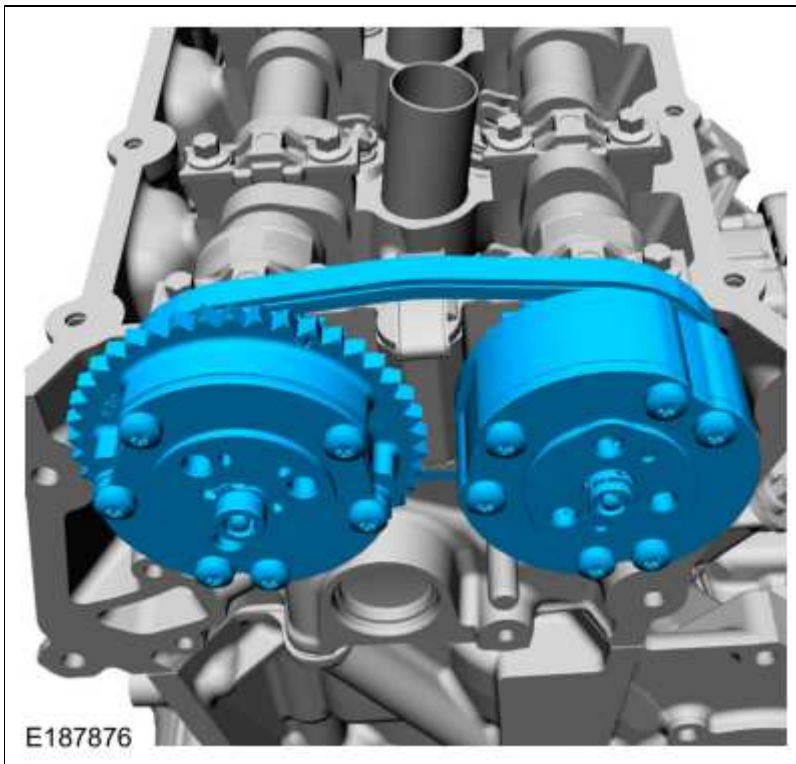
3. Slide the VCT assemblies and secondary timing chain forward 2 mm (0.078 in).



4.
 1. Depress the secondary timing chain tensioner.
 2. Turn the tensioner counterclockwise 90 degrees.



5. Remove the VCT assemblies and the secondary timing chain.

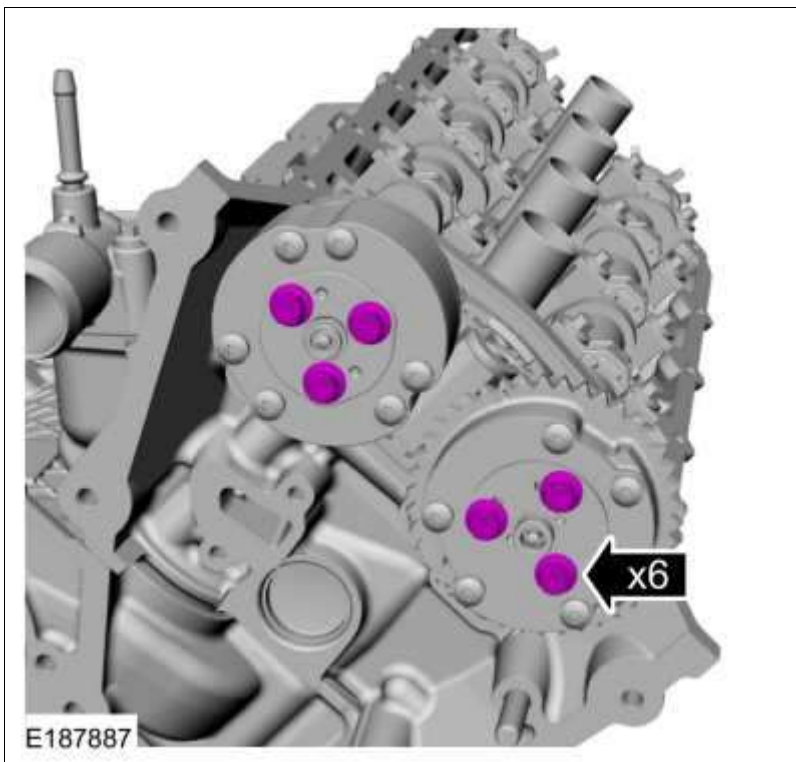


Left hand units

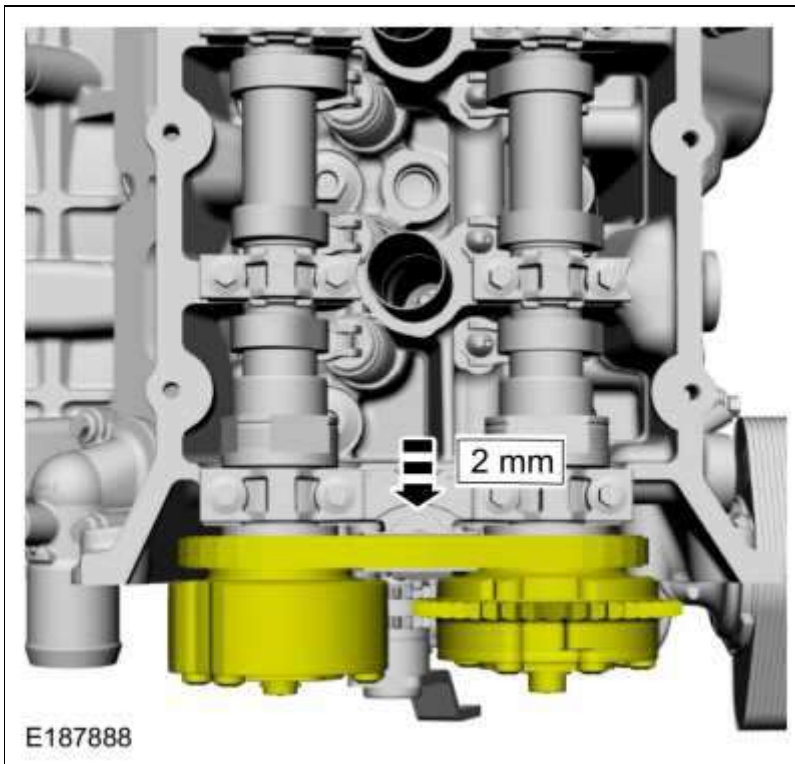
6. Remove the LH timing chain.

Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

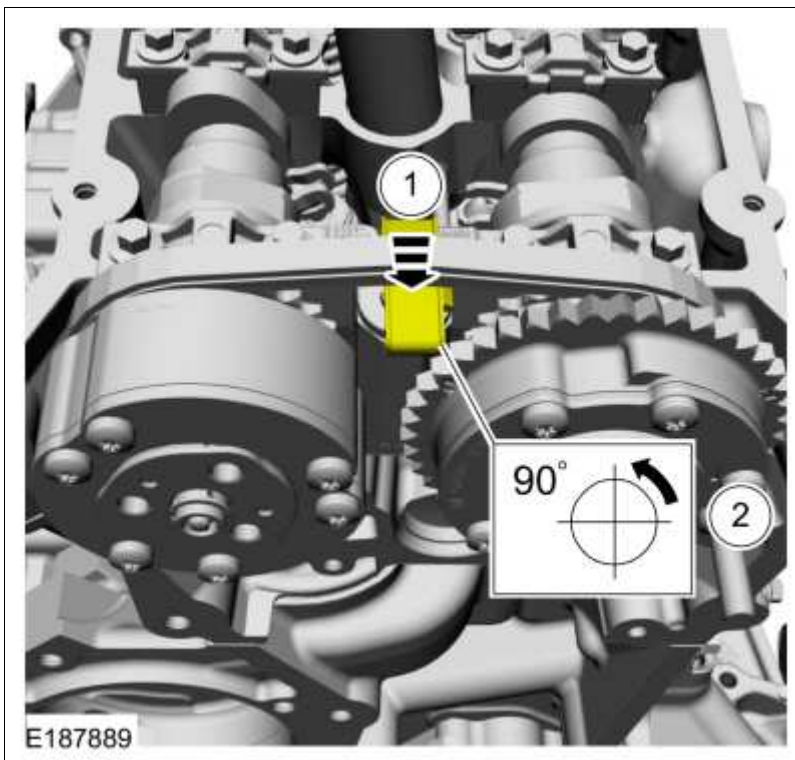
7. Remove the intake and exhaust VCT assembly bolts.



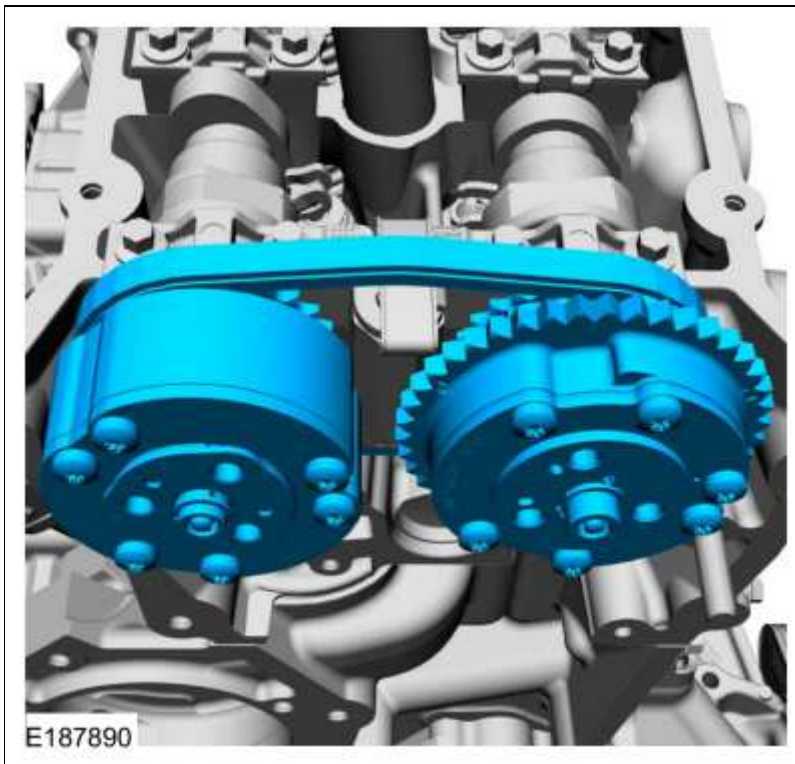
8. Slide the Variable Camshaft Timing VCT assemblies and secondary timing chain forward 2 mm (0.078 in).



9.
 1. Depress the secondary timing chain tensioner.
 2. Turn the tensioner counterclockwise 90 degrees.



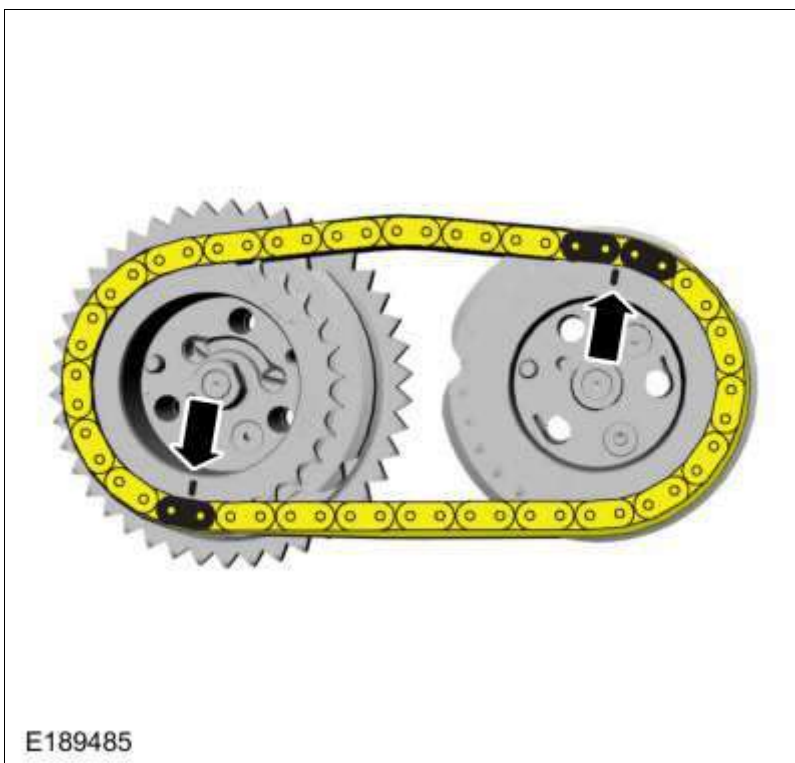
10. Remove the VCT assemblies and the secondary timing chain.



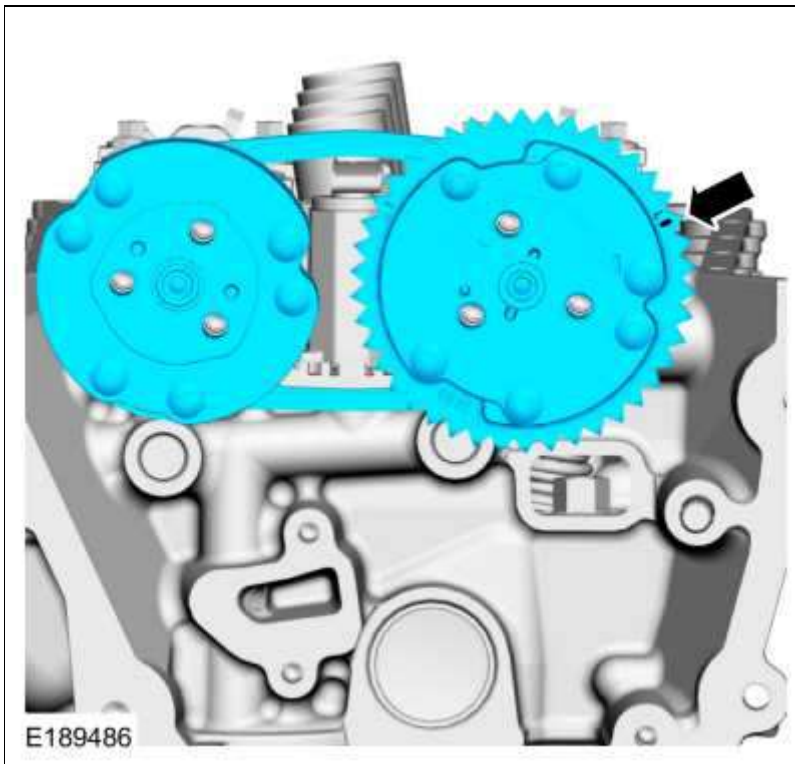
Installation

Left hand units

1. Position the secondary timing chain onto the VCT assemblies. Align the colored links on the secondary timing chain with the timing marks on the VCT assemblies as shown in the illustration.
 - The timing mark on the intake VCT assembly should align between the 2 consecutive colored links.
 - The timing mark on the exhaust VCT assembly should align with the single colored link.



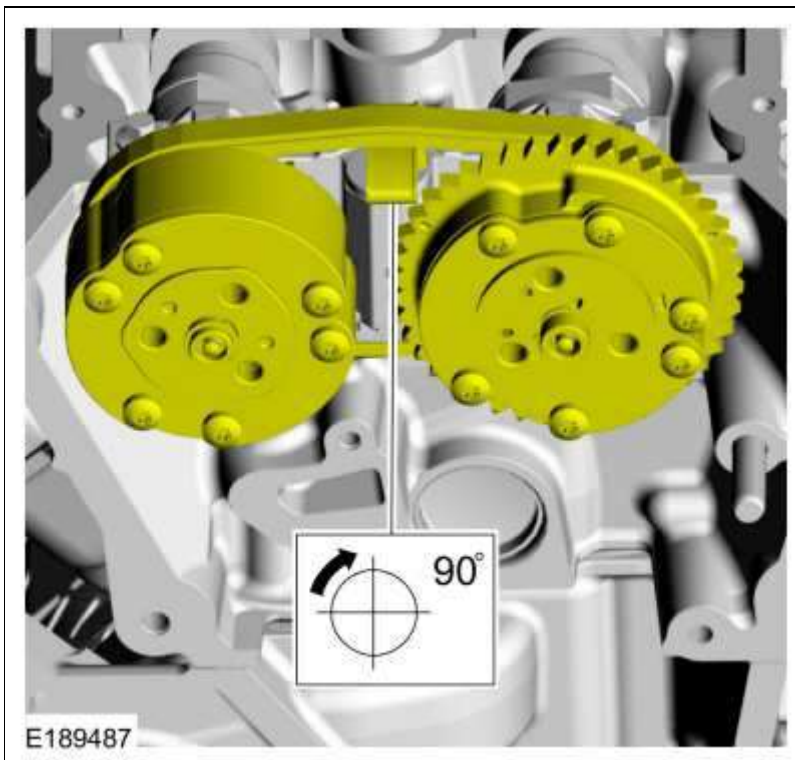
2. Install the VCT assemblies and the secondary timing chain onto the camshafts. The timing mark on the exhaust VCT assembly should be approximately in the 2 o'clock position.



3. **NOTE:** It may be necessary to rotate the exhaust camshaft slightly (using a wrench on the flats of the camshaft) to seat the VCT assemblies onto the camshafts.

Rotate the secondary timing chain tensioner 90 degrees so the ramped area is facing forward and fully seat the VCT assemblies onto the camshafts.

- If the secondary timing chain is not centered over the tensioner, reposition the VCT assemblies until they are fully seated on the camshafts.



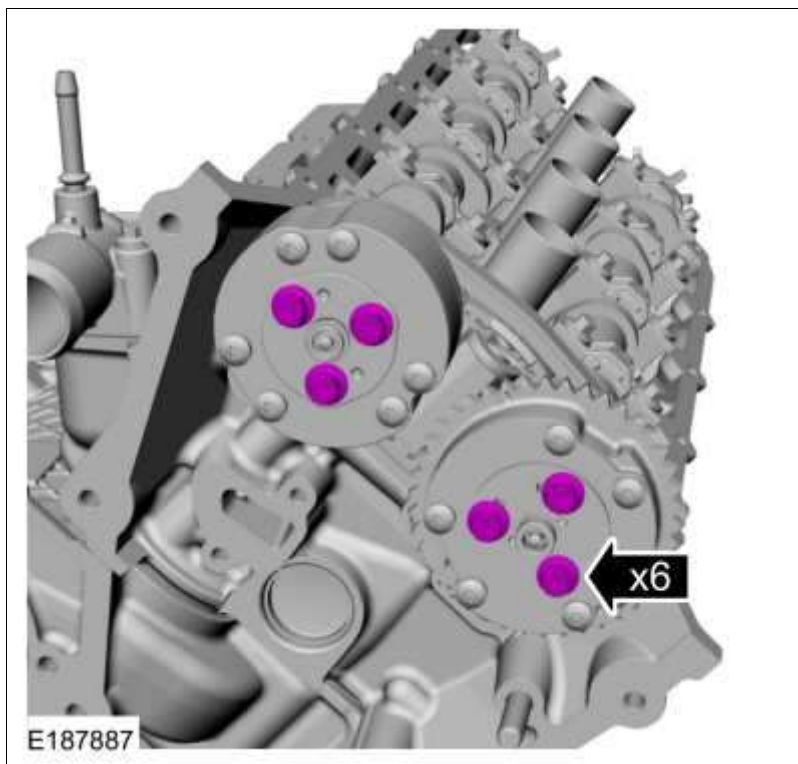
4. **NOTE:** Use a wrench on the flats of the camshaft to hold the camshafts while tightening the VCT assembly bolts.

Install the intake and the exhaust VCT assembly bolts.

Torque:

Stage 1: 133 lb.in (15 Nm)

Stage 2: 90°



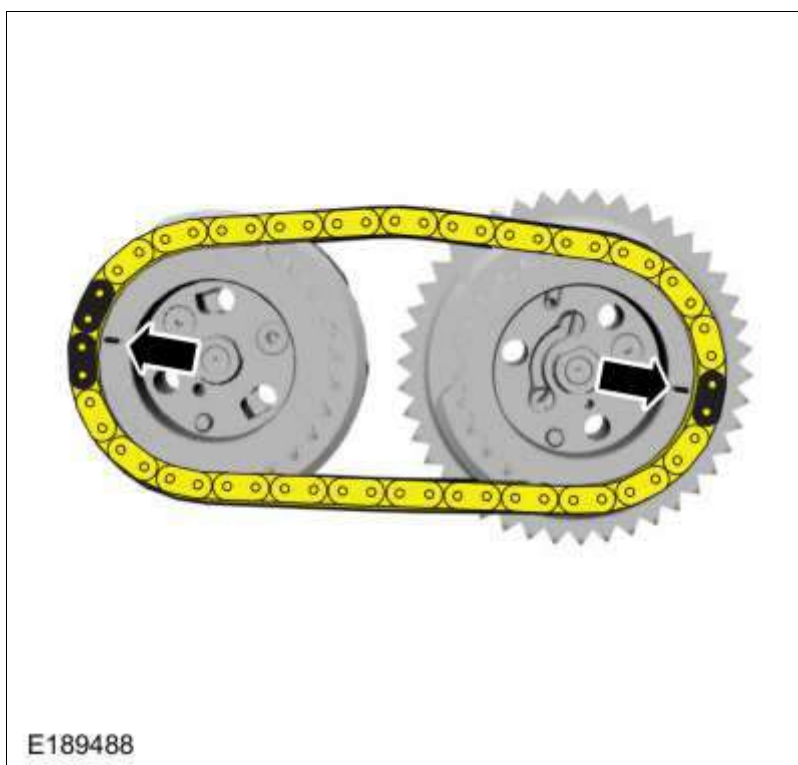
5. Install the LH timing chain.

Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

Right hand units

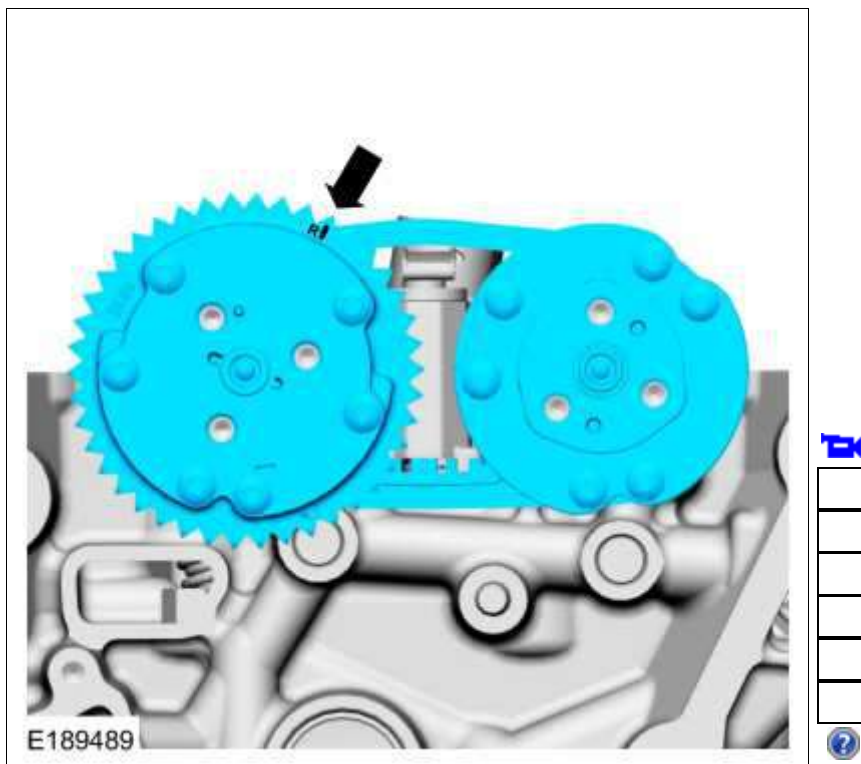
6. Position the secondary timing chain onto the VCT assemblies. Align the colored links on the secondary timing chain with the timing marks on the VCT assemblies as shown in the illustration.

- The timing mark on the intake VCT assembly should align between the 2 consecutive colored links.
- The timing mark on the exhaust VCT assembly should align with the single colored link.



7. Install the VCT assemblies and the secondary timing chain onto the camshafts. The timing mark on the

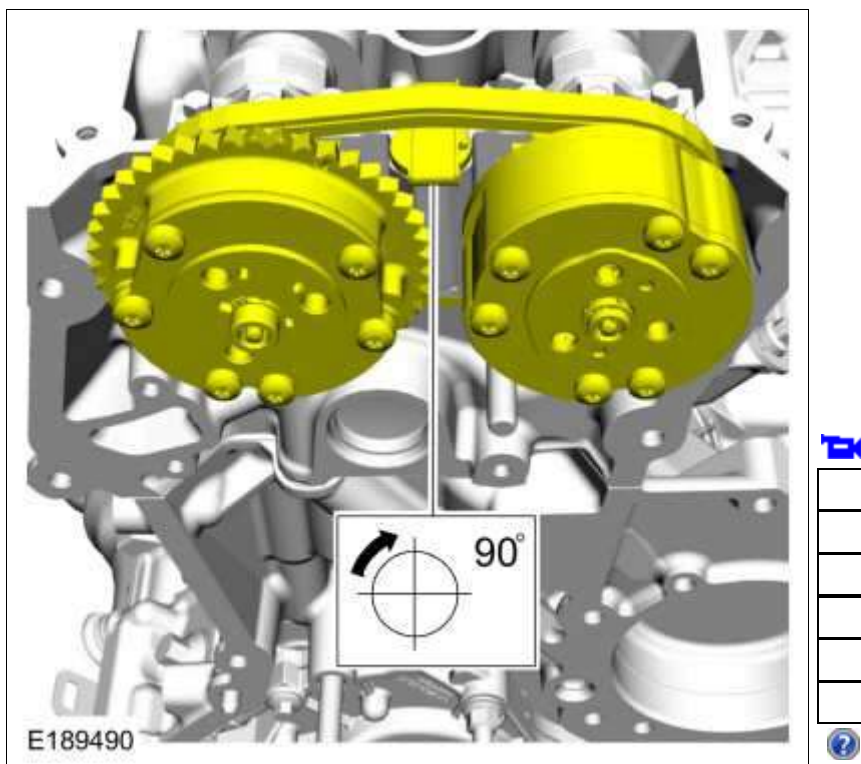
exhaust VCT assembly should be approximately in the 1 o'clock position.



8. **NOTE:** It may be necessary to rotate the exhaust camshaft slightly (using a wrench on the flats of the camshaft) to seat the VCT assemblies onto the camshafts.

Rotate the secondary timing chain tensioner 90 degrees so the ramped area is facing forward and fully seat the VCT assemblies onto the camshafts.

- If the secondary timing chain is not centered over the tensioner, reposition the VCT assemblies until they are fully seated on the camshafts.



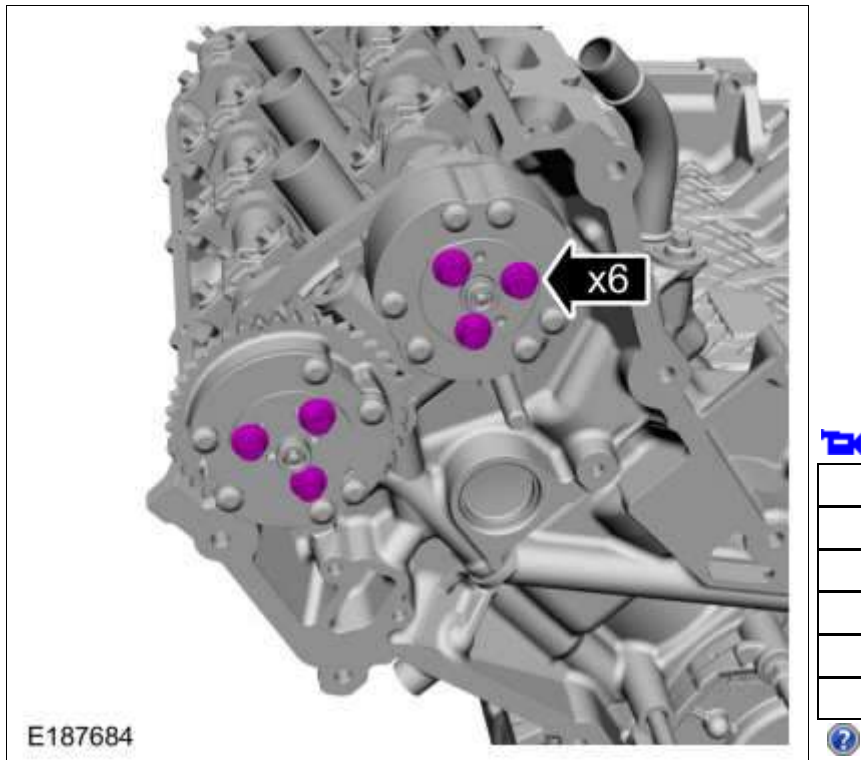
9. **NOTE:** Use a wrench on the flats of the camshaft to hold the camshafts while tightening the VCT assembly bolts.

Install the intake and the exhaust VCT assembly bolts.

Torque:

Stage 1: 133 lb.in (15 Nm)

Stage 2: 90°



10. Install the RH timing chain.

Refer to: [Timing Chain](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).



Engine

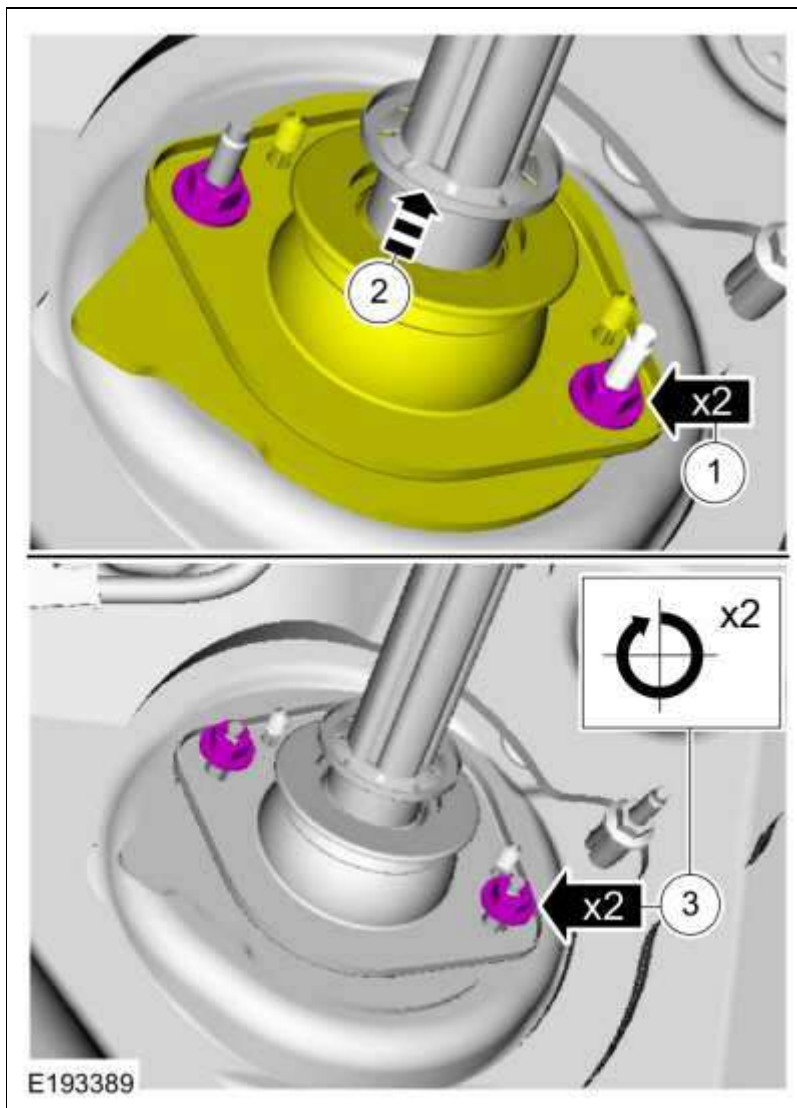
Base Part Number: [6L084](#)

Special Tool(s) / General Equipment

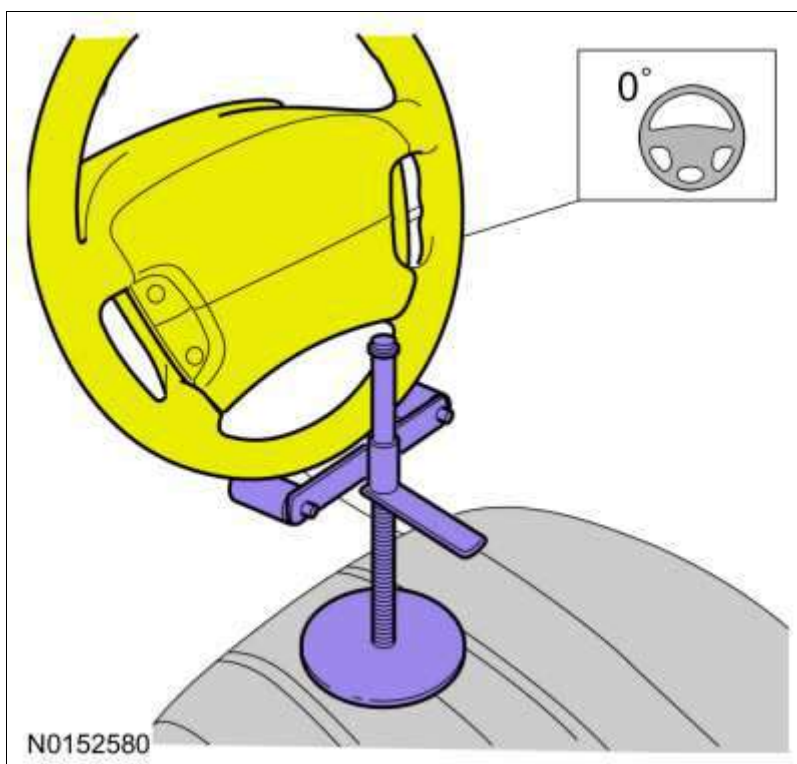
	303-F047 Lifting Bracket, Engine
	303-F072 Support Bar, Engine
Magnetic Socket	
Floor Crane	
Oil Drain Equipment	
Trolley Jack	
Wooden Block	

6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

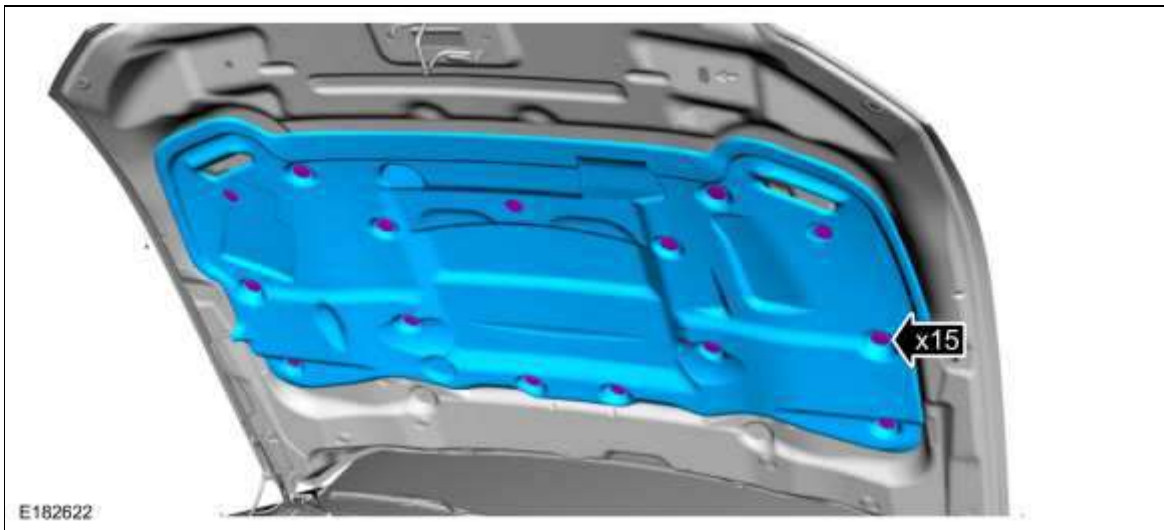
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Release the fuel system pressure.
Refer to: [Fuel System Pressure Release](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
3. Disconnect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
4. Drain the engine cooling system.
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
5. **NOTICE: Make sure to minimize damage to sealer foam and avoid pulling apart dash seal brackets from retainer pins. Excessive damage may allow engine noise, fumes, air or water to enter the passenger compartment.**
 1. Remove the steering column dash seal nuts.
 2. Loosen the dash seal.
 3. Hand start the dash seal nuts.



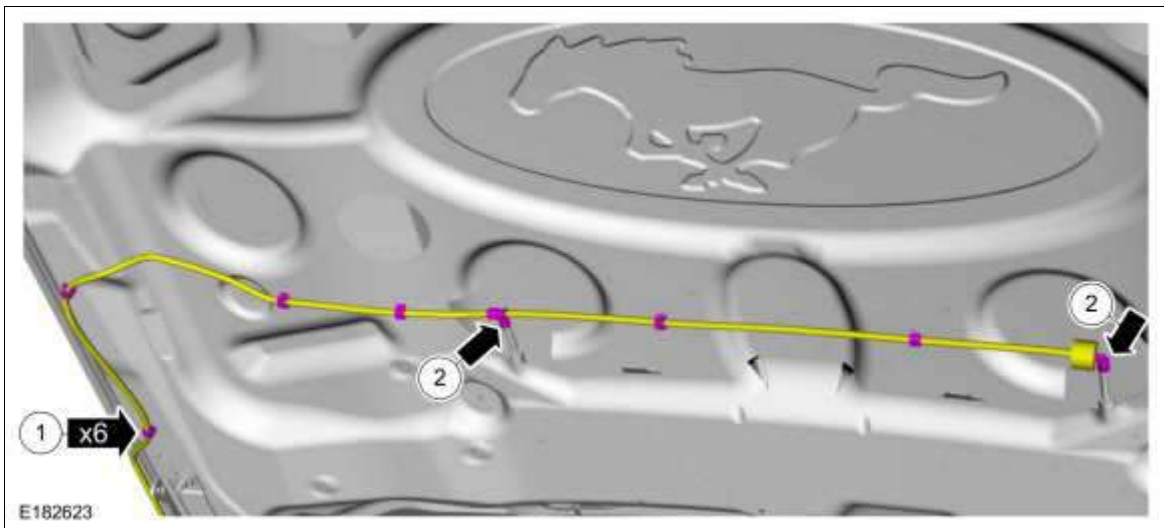
6. Using a holding device, hold the steering wheel in the straight-ahead position.



7. Remove the pin-type retainers and the hood insulation.

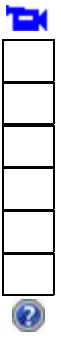
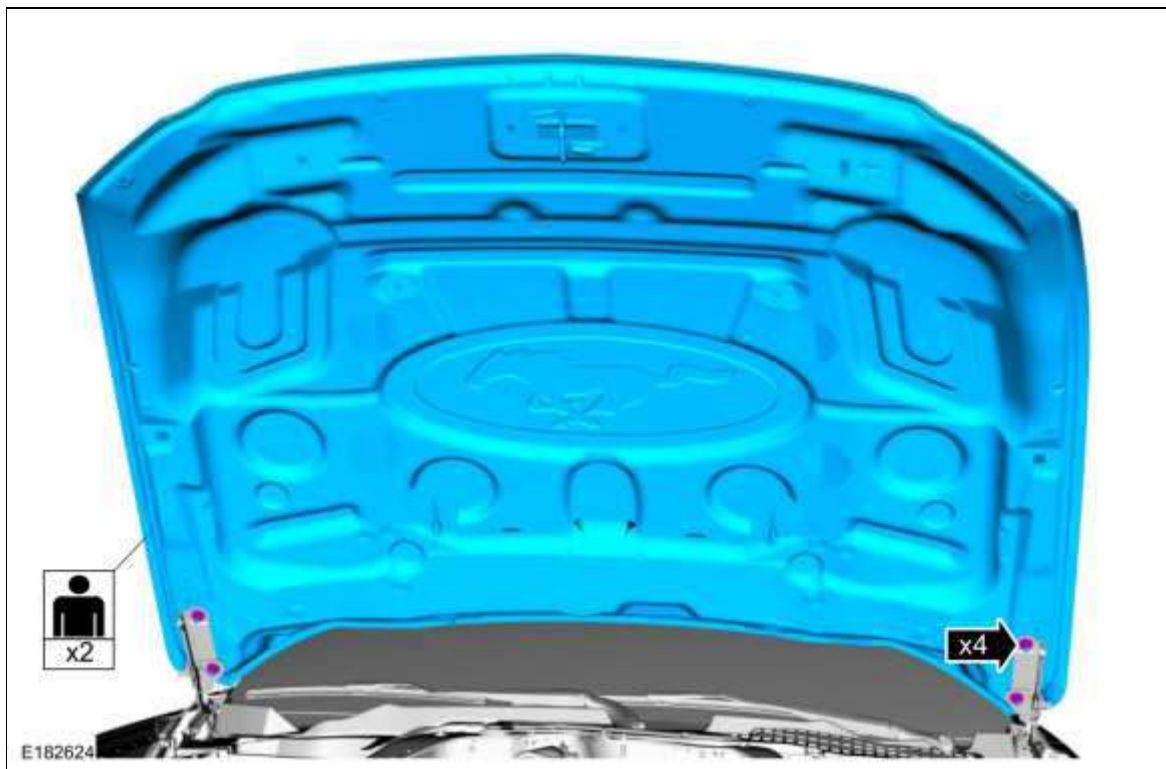


8.
 1. Detach the windshield washer hose retainers.
 2. Disconnect the windshield washer hose C-Lock Couplers.

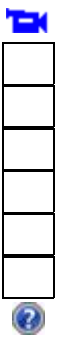
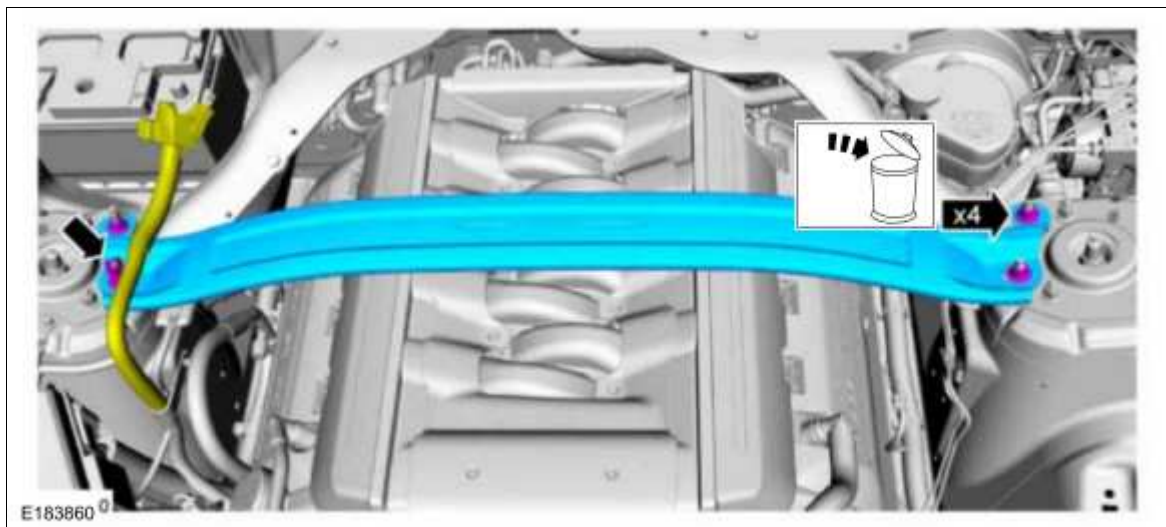


9. **NOTE:** Index-mark the hood hinge location to aid in hood installation.

Remove the nuts and the hood.

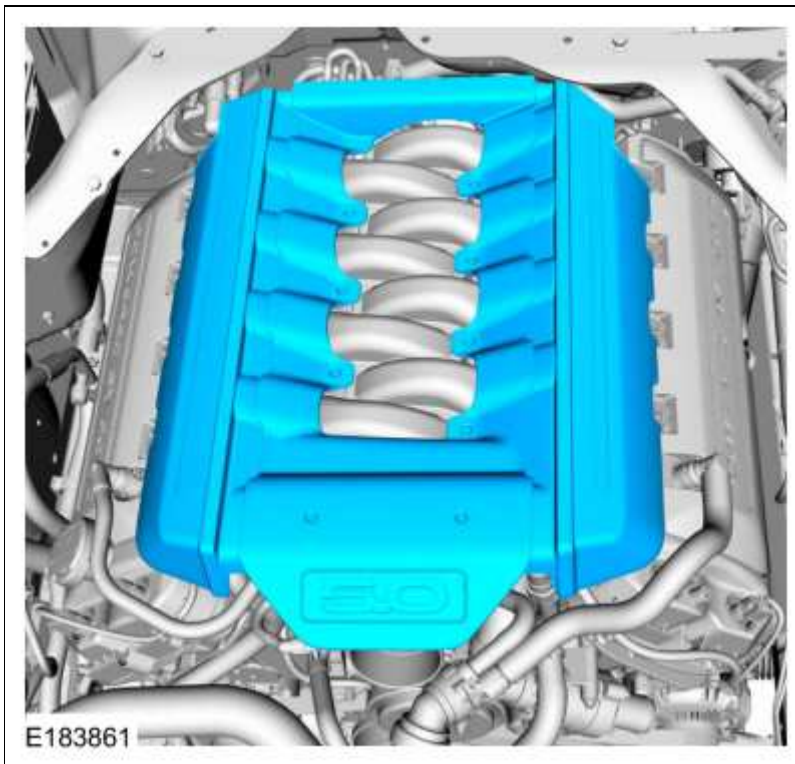


- 10.
- If equipped with a strut tower cross brace, detach the wiring harness retainer.
 - Remove the nuts and the strut tower cross brace.

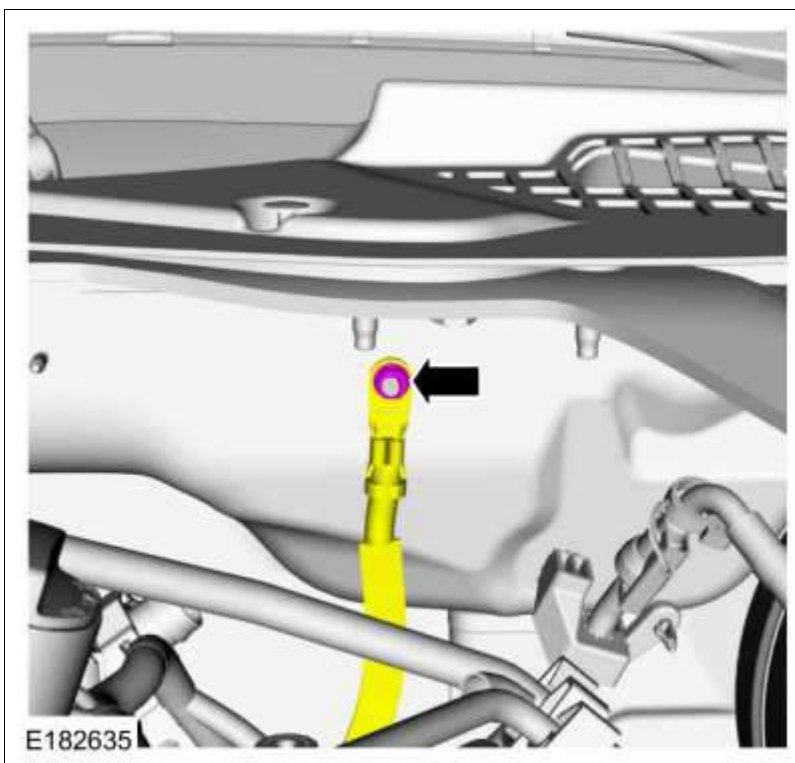


11. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Remove the engine appearance cover.



12. Remove the nut and the engine ground wire from the cowl.

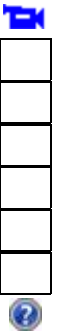
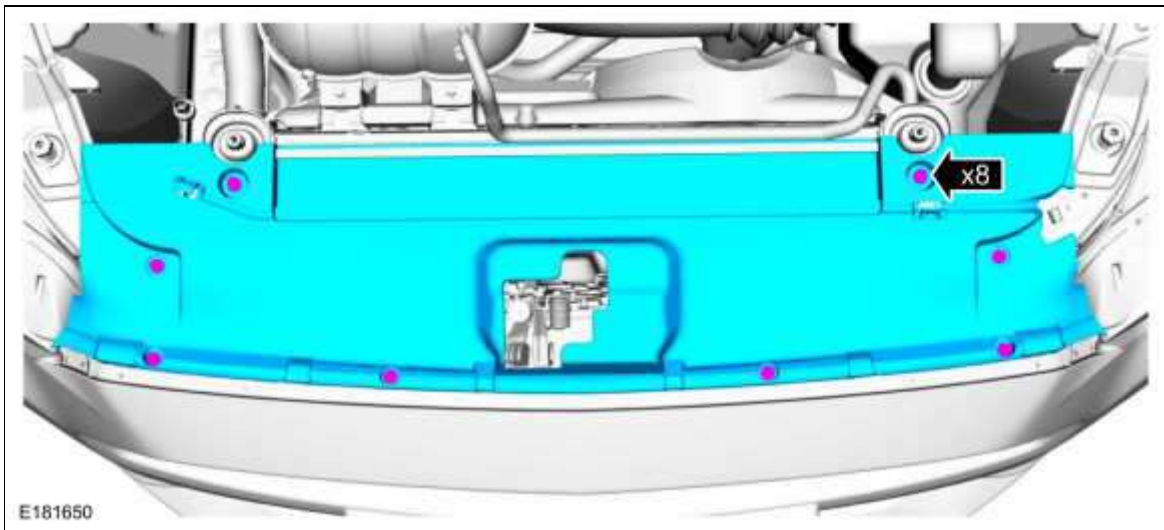


13. **NOTE:** It is not necessary to separate the air cleaner outlet pipe and the air cleaner, the 2 components can be removed as an assembly.

Remove the following items:

1. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

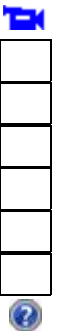
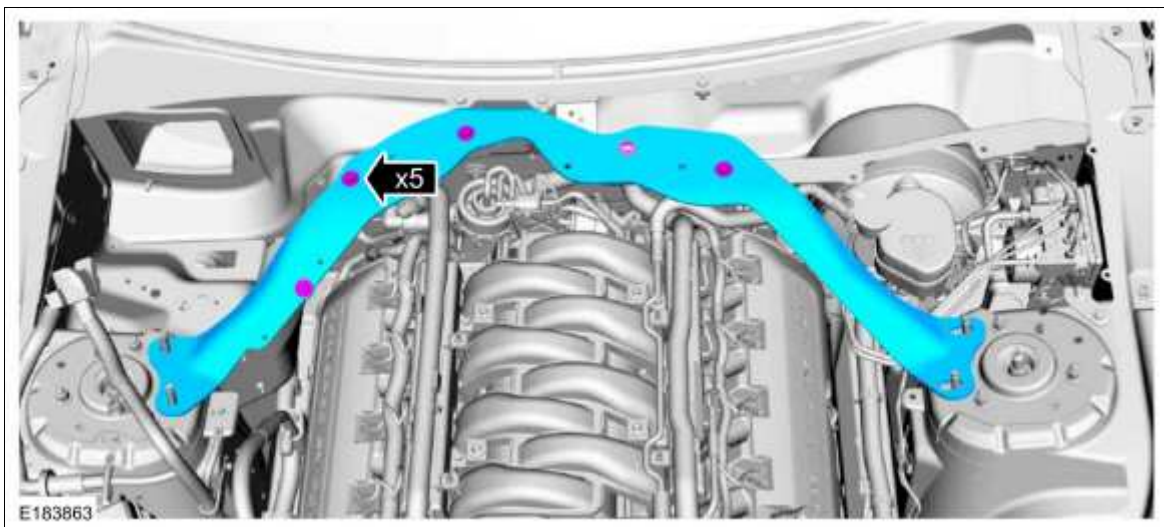
14. Remove the retainers and the radiator top shield.



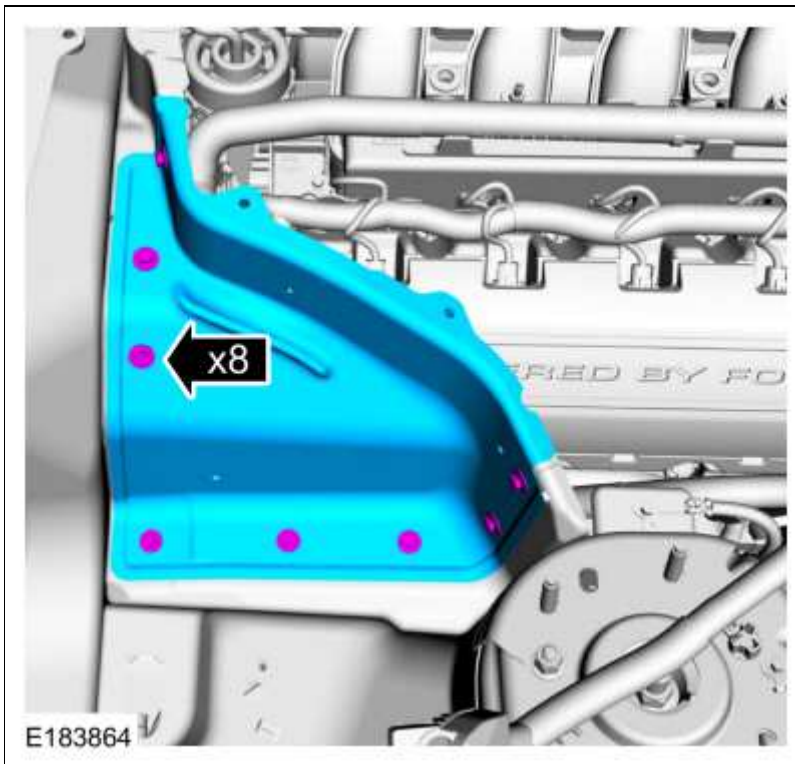
15. Remove the following items:

1. Refer to: [Degas Bottle](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Cooling Fan Motor and Shroud](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
3. Refer to: [Air Conditioning \(A/C\) Compressor Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
4. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
5. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).

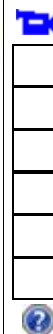
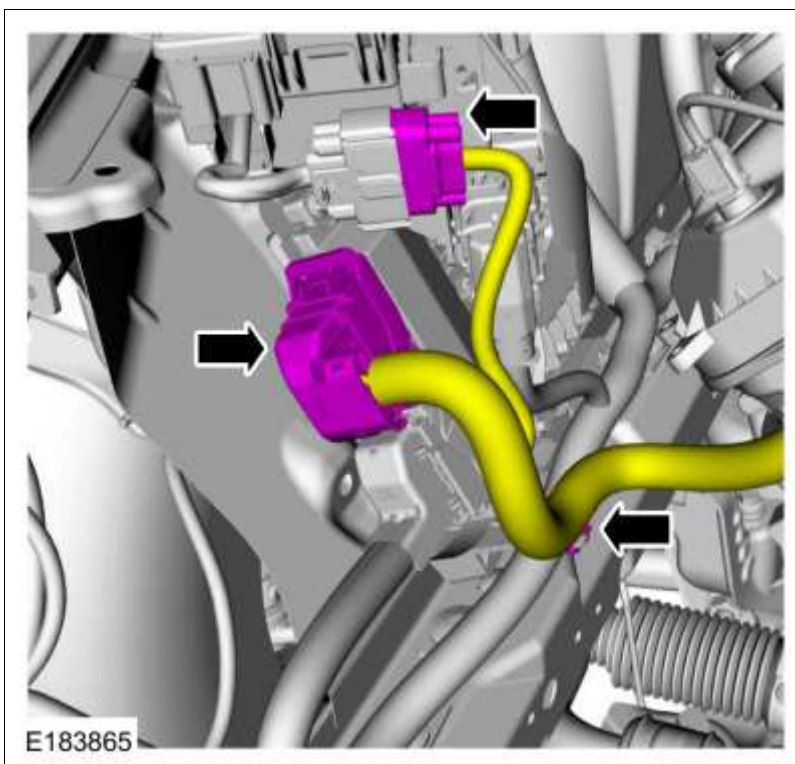
16. Remove the fasteners and the cowl extension.



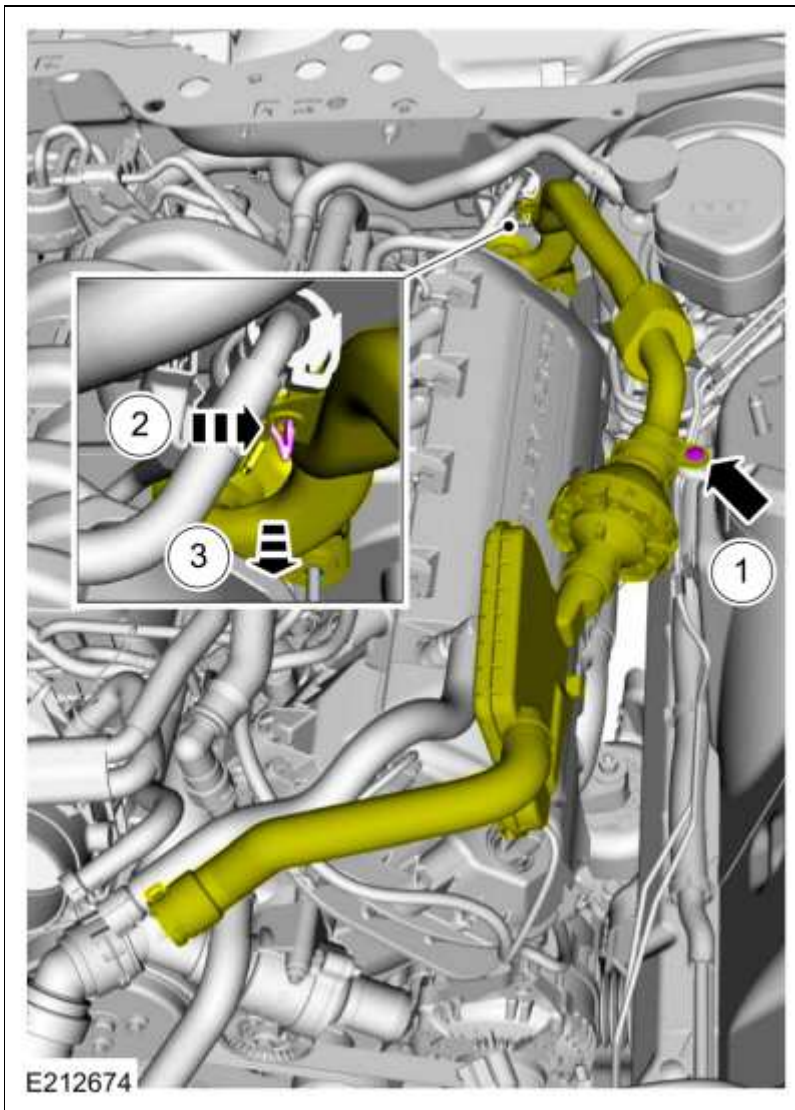
17. Remove the fasteners and the battery heat shield.



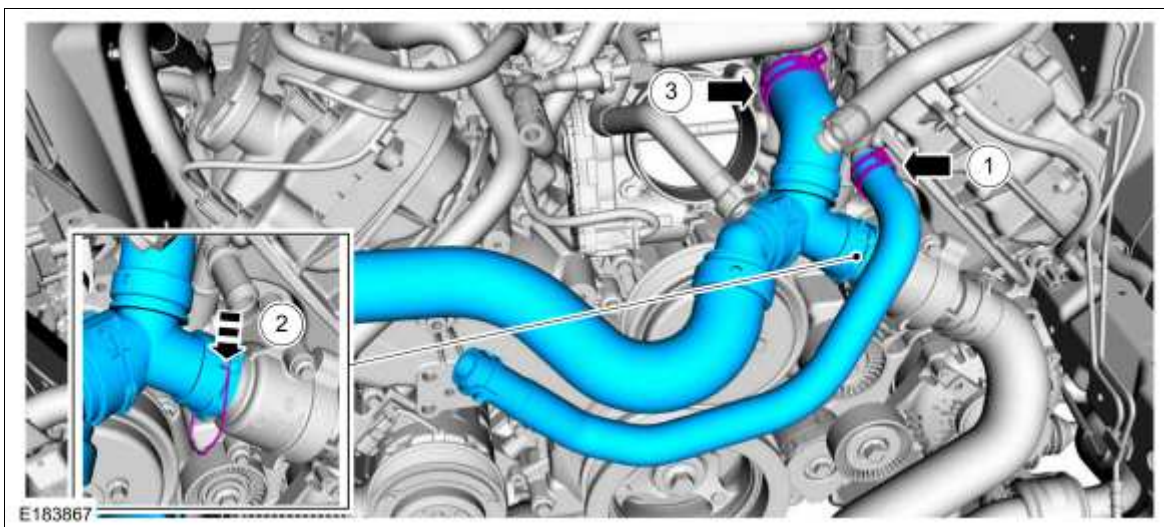
18. Disconnect the top PCM electrical connector, the 16 pin electrical connector and detach the wiring harness retainers from the PCM bracket.



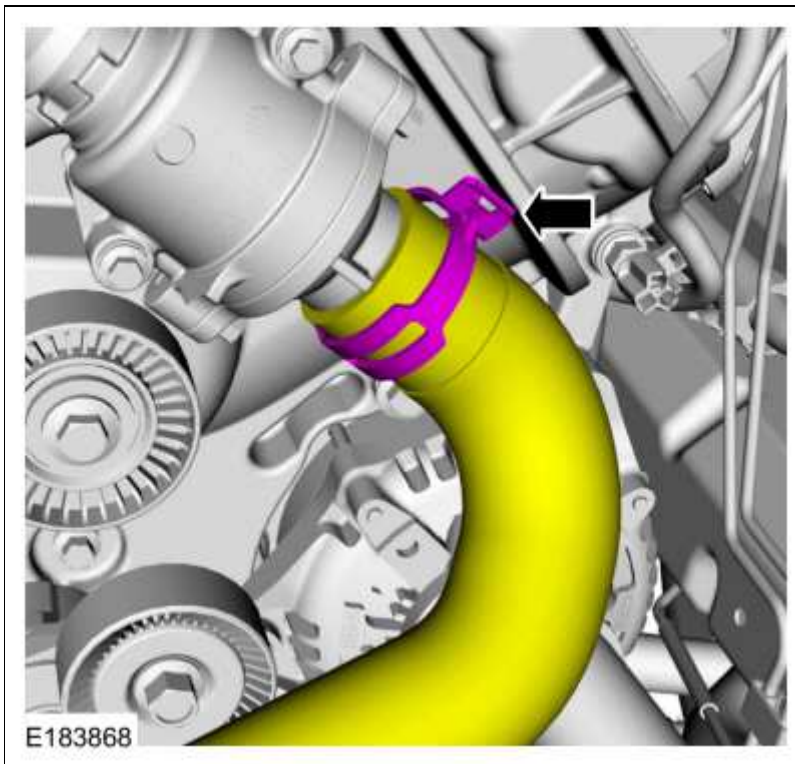
- 19.
1. Remove the pin-type retainer.
 2. Depress the retainer.
 3. Position the sound enhancement pipe aside.



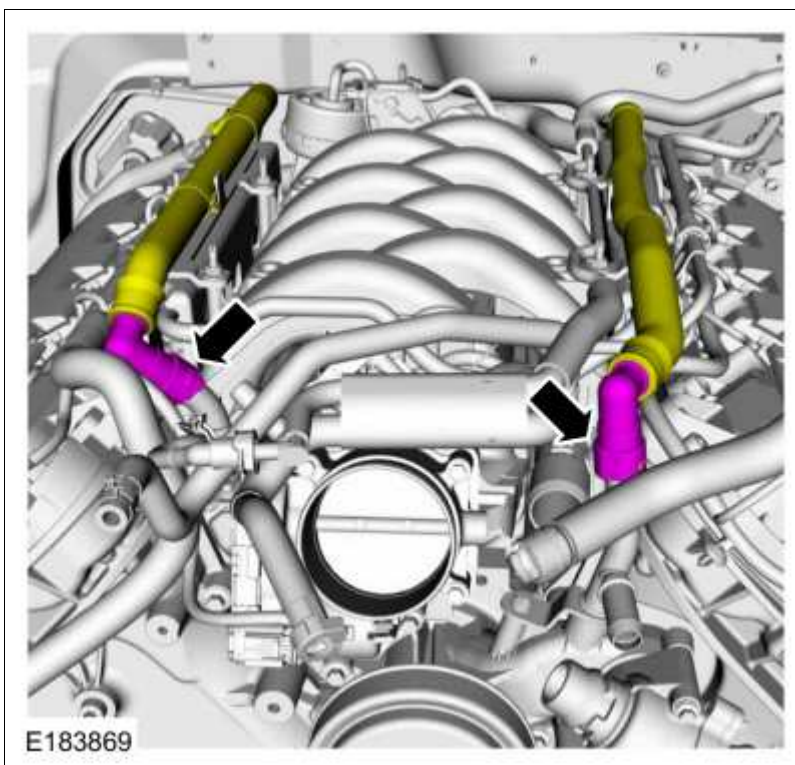
- 20.
1. Release the clamp and remove the degas bottle hose.
 2. Slide the spring clip until it hits the stop on the hose fitting.
 3. Release the clamp and remove the coolant bypass T assembly from the engine.



21. Disconnect the lower radiator hose from the thermostat housing assembly.



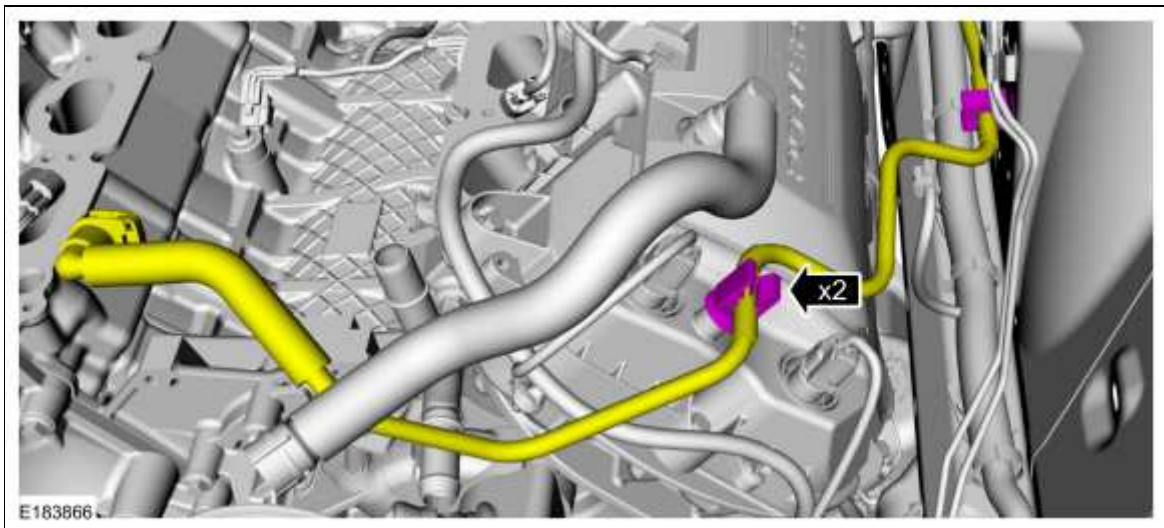
22. Disconnect the heater hose quick connect couplings.



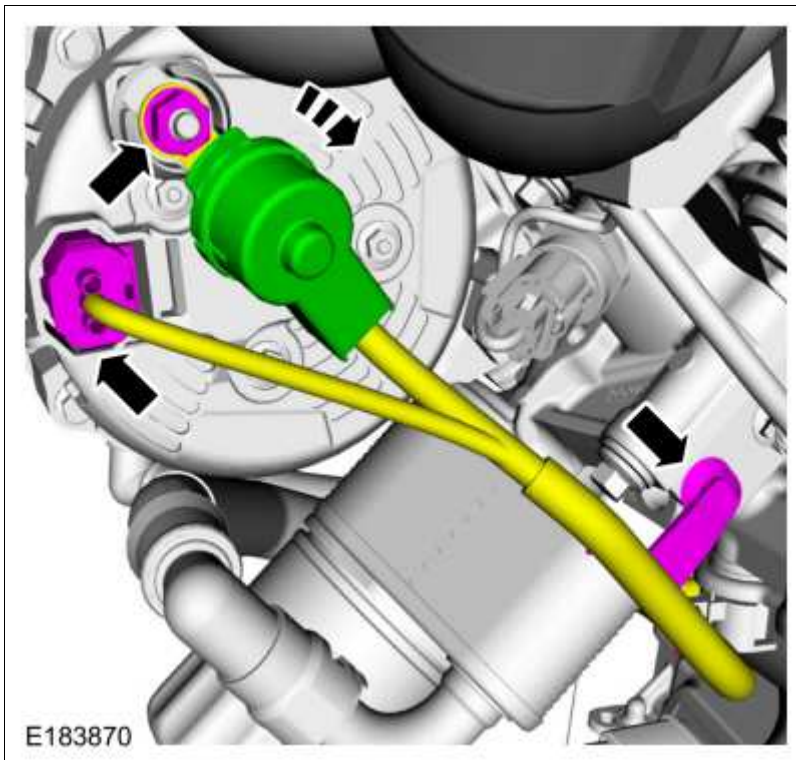
23. Remove the intake manifold.

Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

24. Detach the EVAP tube from the LH valve cover and the LH inner fender.



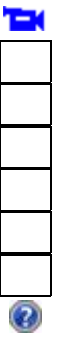
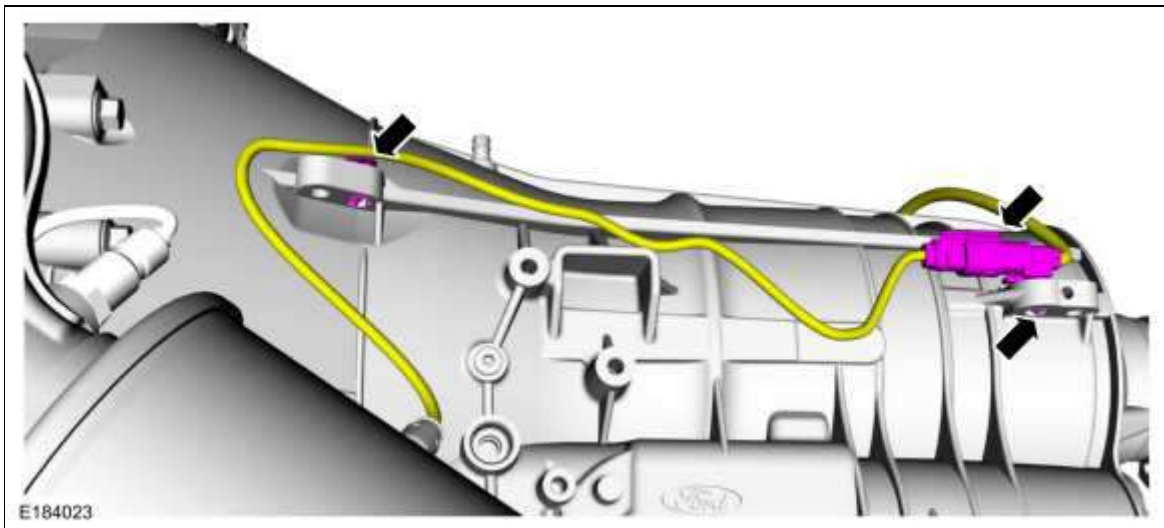
- 25.
- Position the cover aside.
 - Remove the nut and disconnect the B+ cable.
 - Disconnect the wiring harness electrical connector.
 - Detach the harness retainer.



26. Remove the following items:
1. Refer to: [Catalytic Converter RH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 2. Refer to: [Starter Motor](#) (303-06C Starting System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

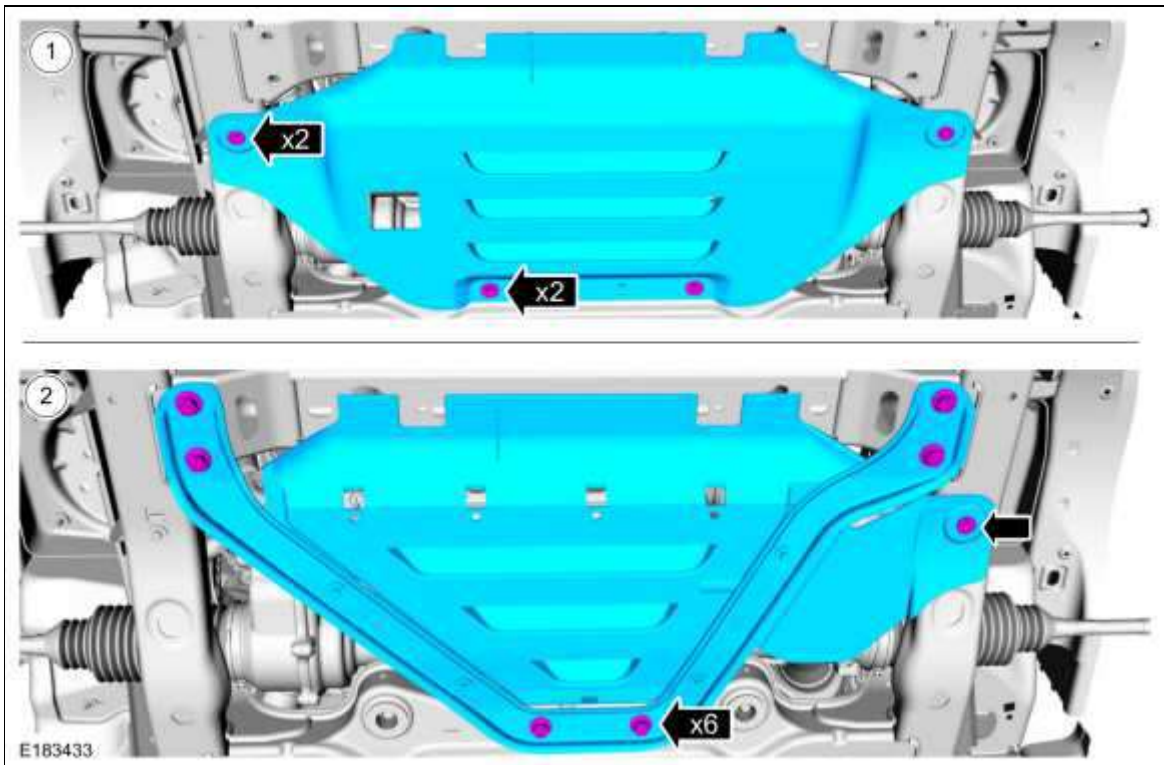
27. **NOTE:** Automatic transmission shown, manual transmission similar.

Disconnect the LH catalyst monitor sensor electrical connector and detach the harness retainers.

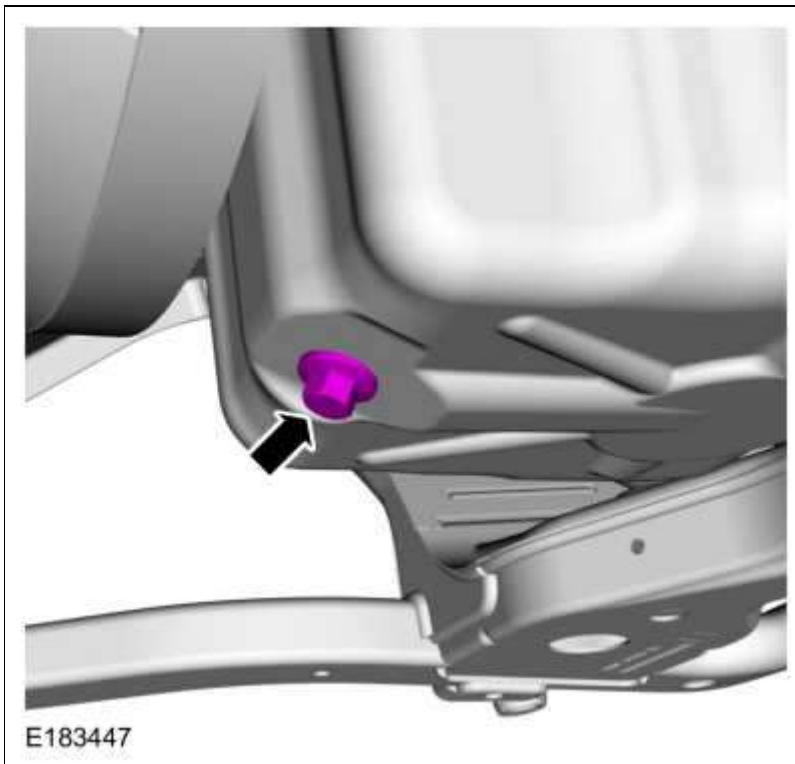


28. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

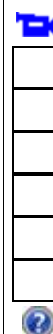
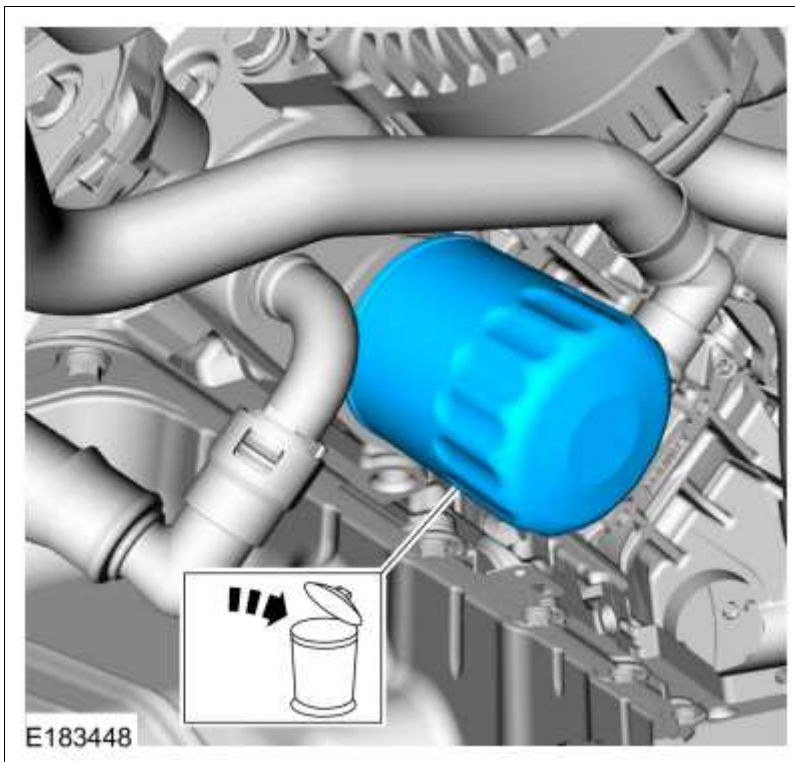
1. Remove the bolts and the underbody shield.
2. Remove the bolts and the subframe bracket and underbody shield assembly.



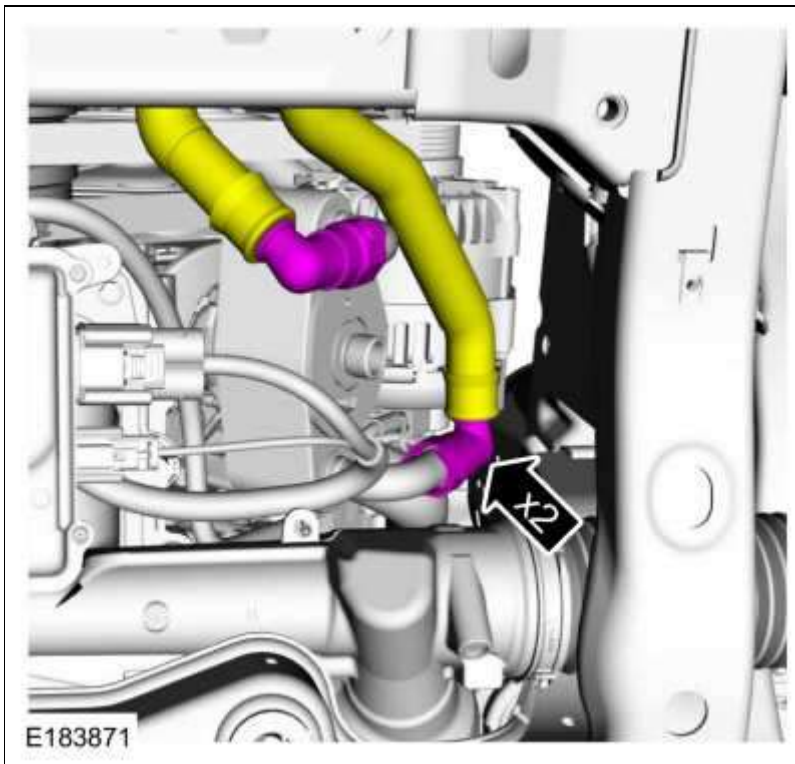
- 29.
- Remove the oil pan drain plug and drain the engine oil.
Use the General Equipment: Oil Drain Equipment
 - Install the oil pan drain plug.
Torque: 19 lb.ft (26 Nm)



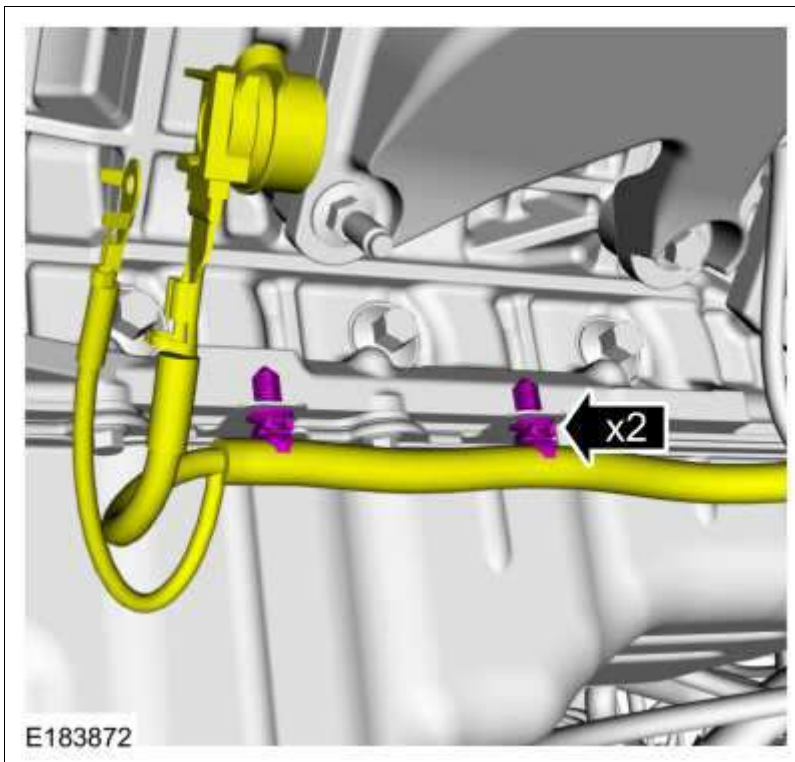
30. Remove and discard the engine oil filter.



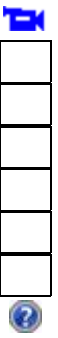
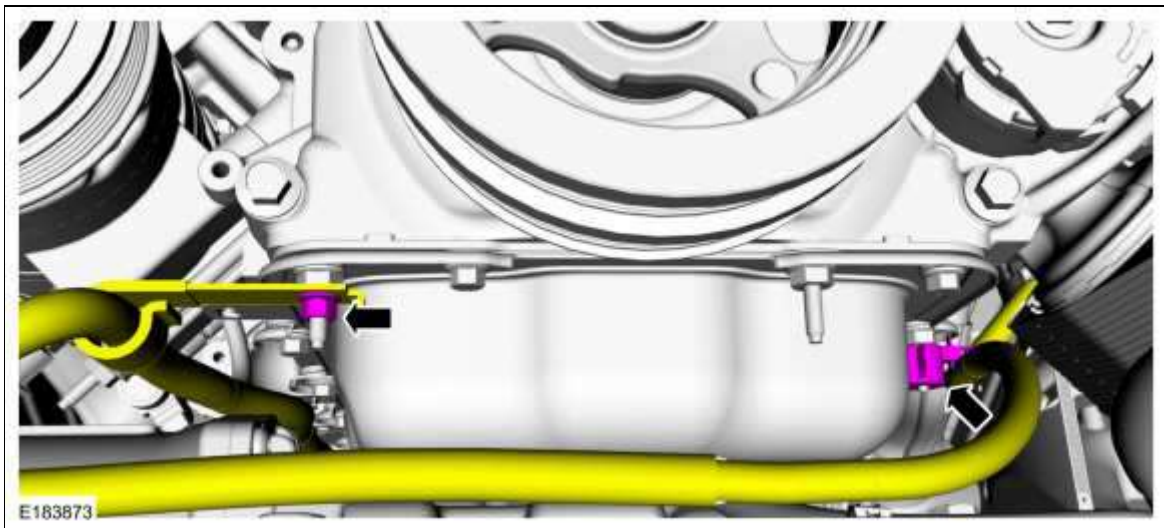
31. Disconnect the oil cooler hoses.



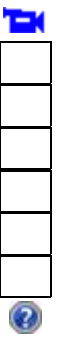
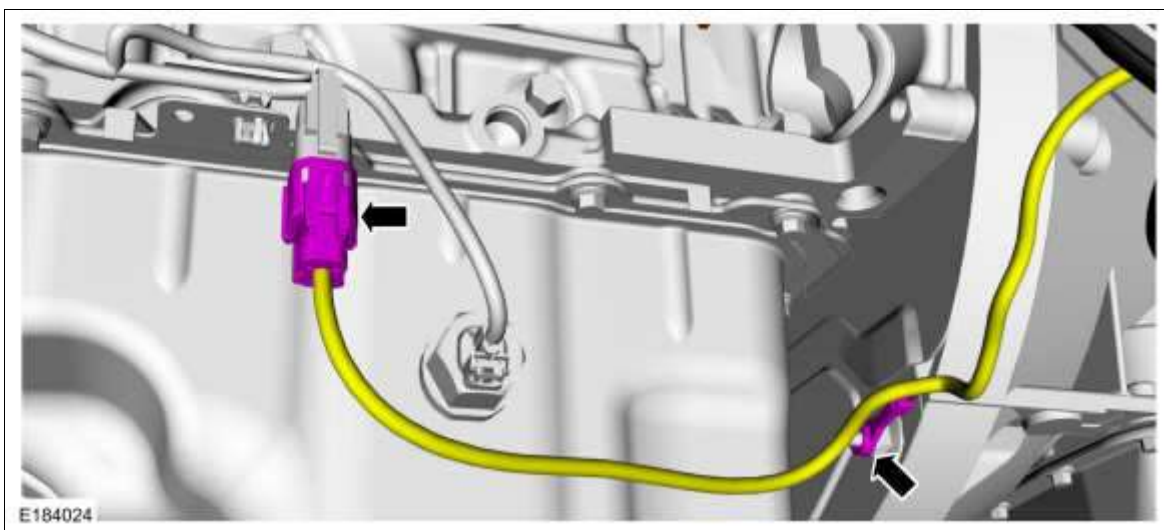
32. Detach the wiring harness retainers from the oil pan.



- 33.
- Remove the nut and the wiring harness retainer.
 - Detach the wiring harness retainer from the oil pan stud bolt.



34. Disconnect the LH HO2S electrical connector and wiring harness retainer.



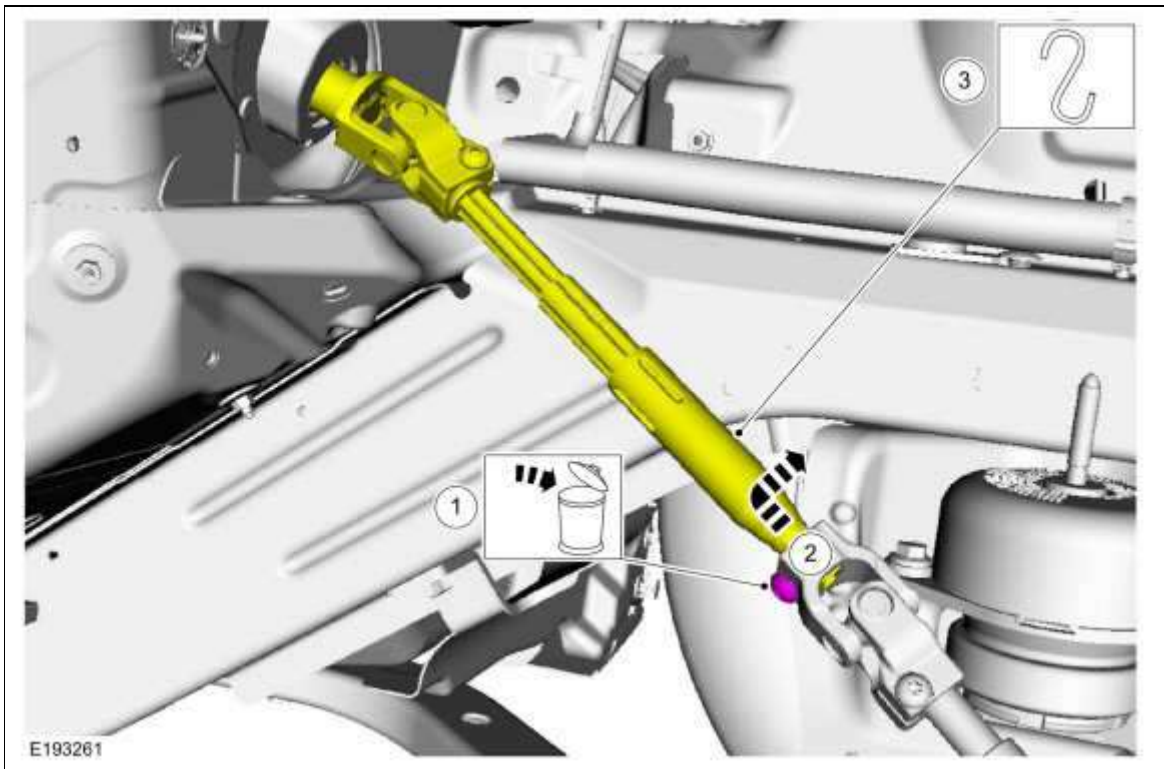
35. **⚠ WARNING:** Do not reuse steering column shaft bolts. This may result in fastener failure and steering column shaft detachment or loss of steering control. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

⚠ WARNING: DO NOT hammer, pry or force steering column and column shafts during installation or removal. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

⚠ WARNING: DO NOT attempt to remove or install the steering column lower u-joint at the steering gear without first loosening the steering column dash seal and fasteners. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

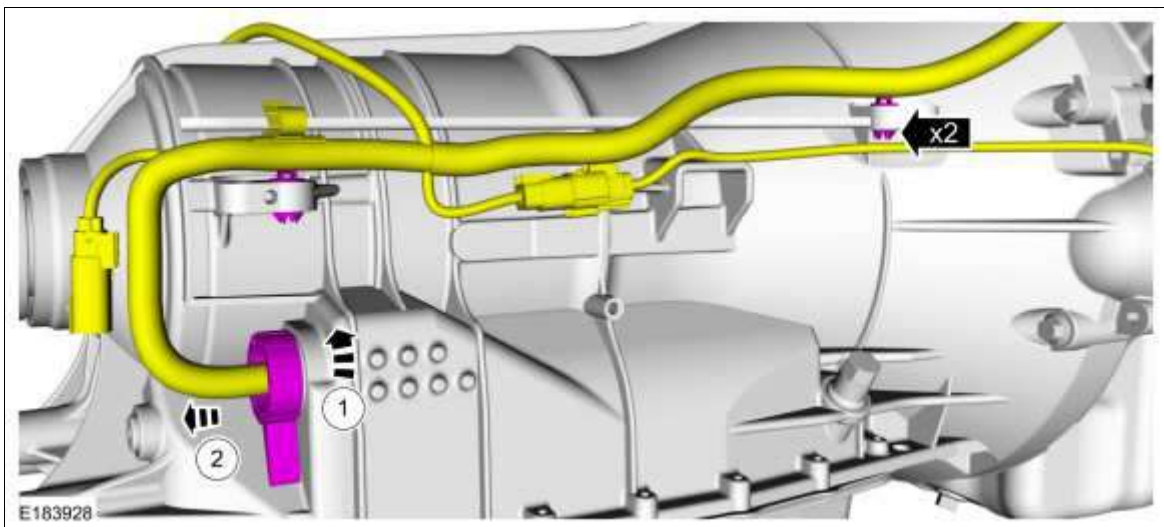
Detach the steering column lower shaft from the lower coupling.

1. Remove and discard the steering column shaft bolt.
2. Pull apart the steering column shaft from the coupling.
3. Secure the lower shaft to the frame rail to avoid damage to the shaft.

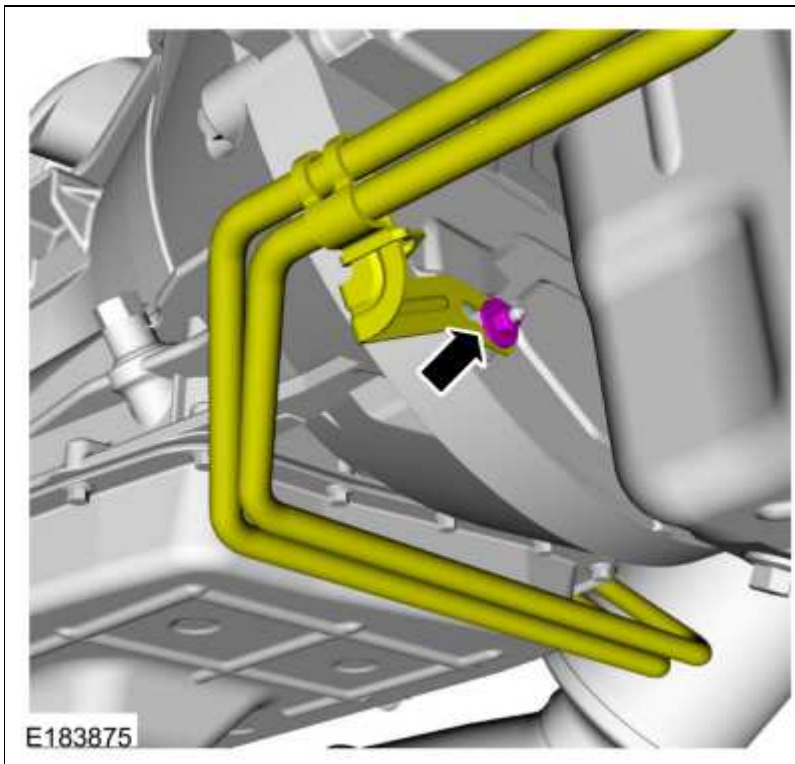


6-Speed Automatic Transmission - 6R80

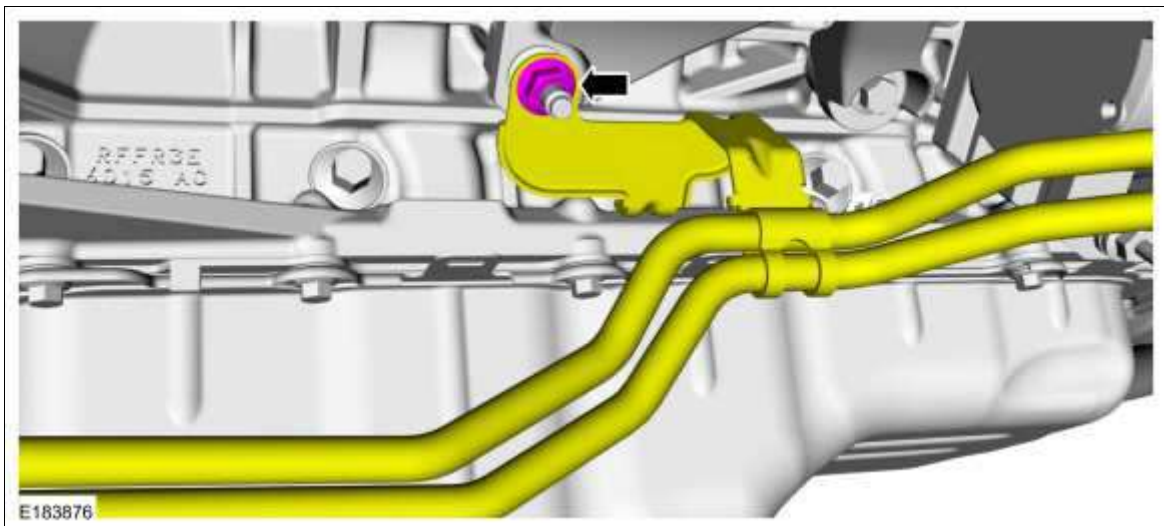
- 36.
- Rotate the transmission electrical connector.
 - Pull the transmission electrical connector out to disconnect.
 - Detach the retainers and position the wiring harness aside.



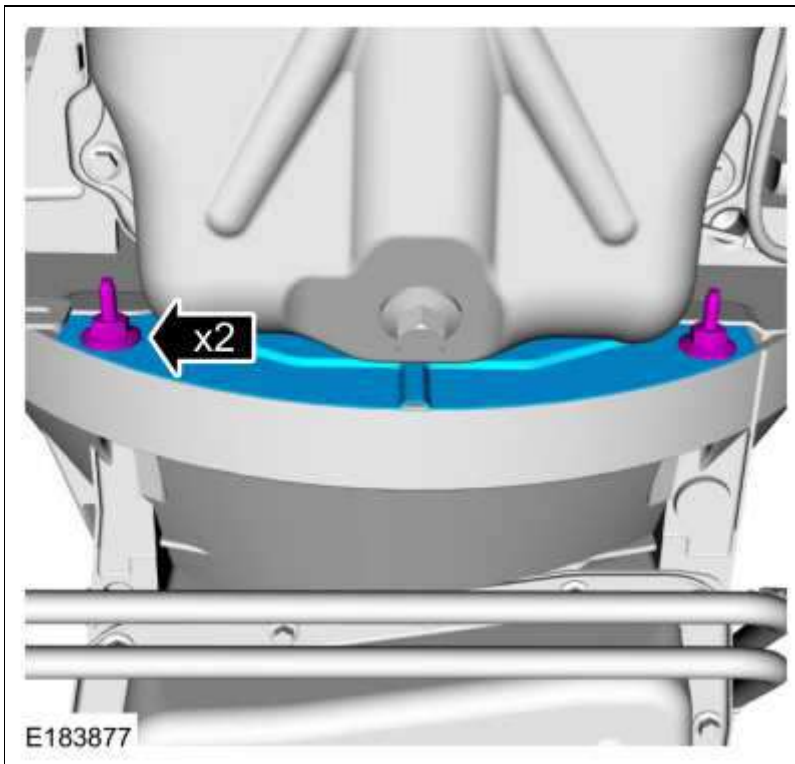
37. Remove the transmission cooling tube nut and bracket from the flexplate inspection cover stud bolt.



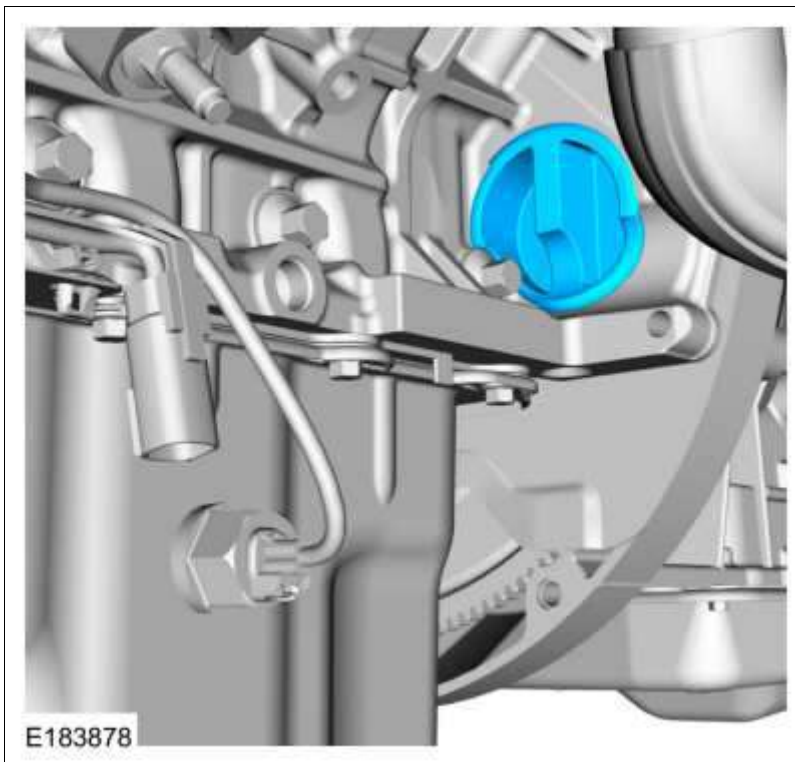
38. Remove the transmission cooling tube bracket nut and position the bracket and tubes aside.



39. Remove the stud bolts and the flexplate inspection cover.

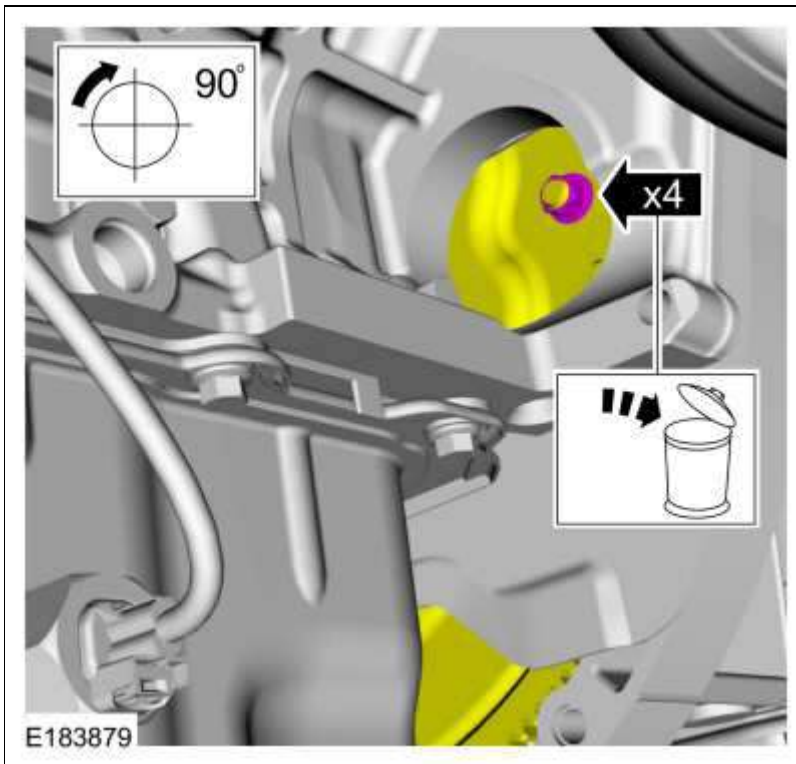


40. Remove the rubber access plug.



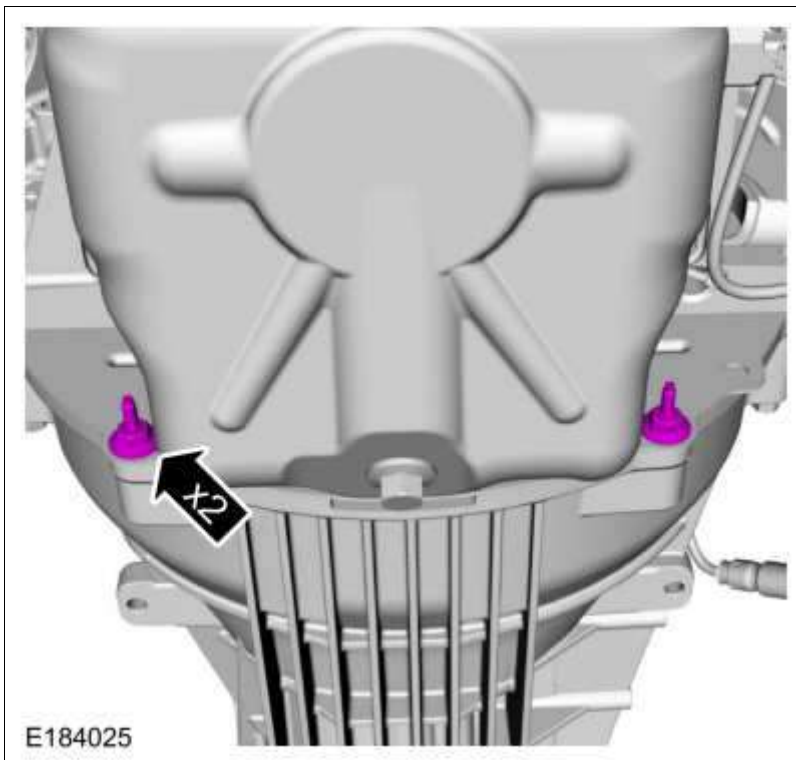
41. **NOTE:** Only rotate the crankshaft in a clockwise direction.

Remove and discard the torque converter nuts.
Use the General Equipment: Magnetic Socket



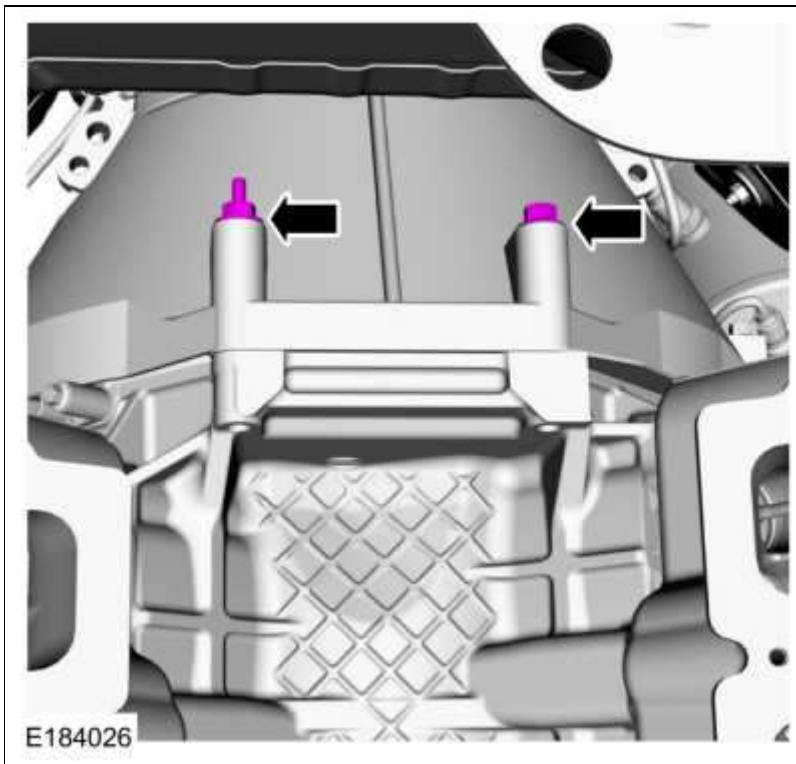
6-Speed Manual Transmission - MT82

42. Remove the engine rear cover plate stud bolts.

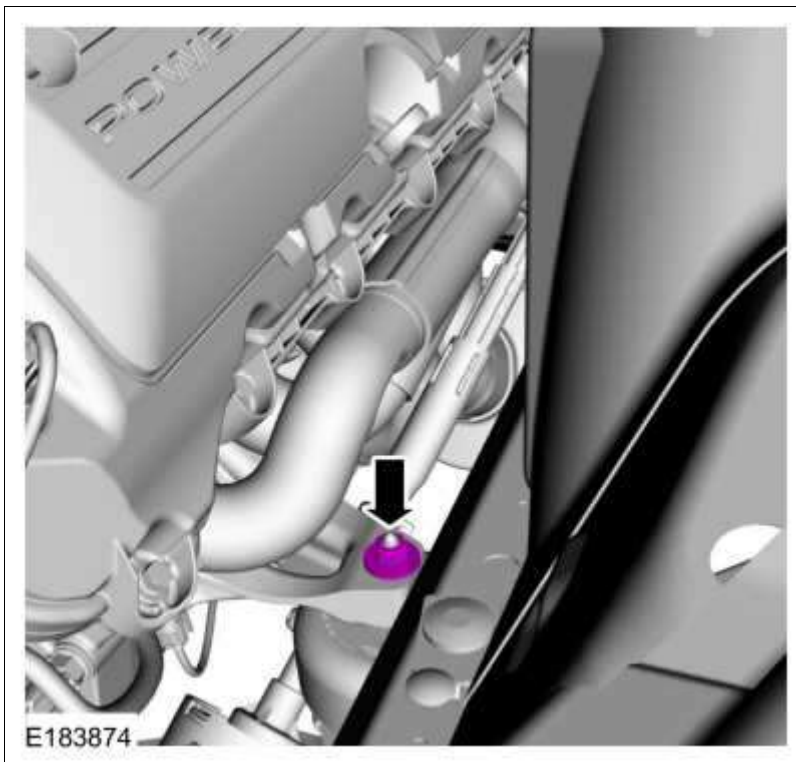


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

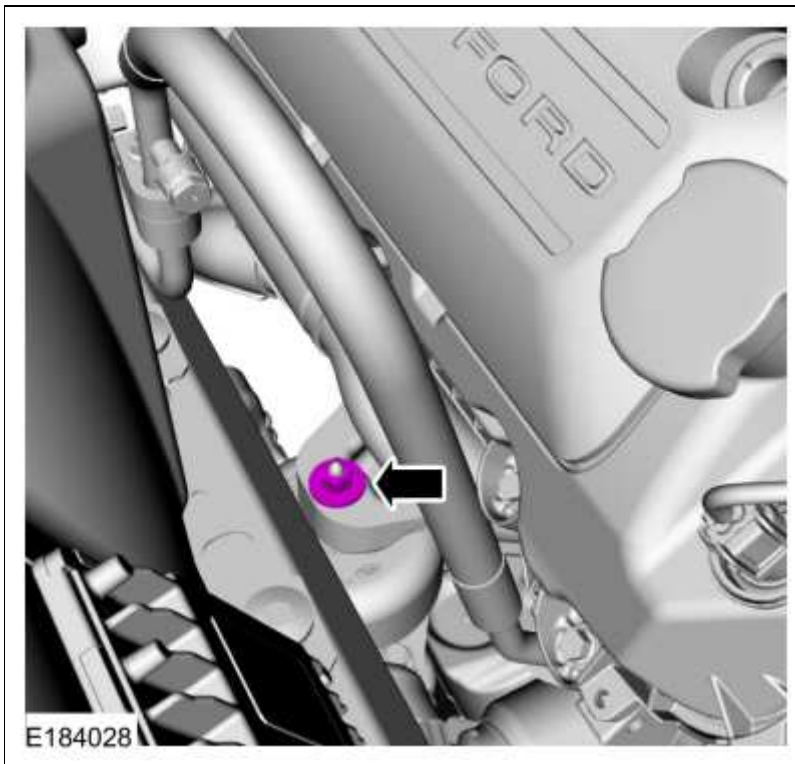
43. Remove the top transmission-to-engine bolt and stud bolt.



44. Remove the LH engine mount nut.



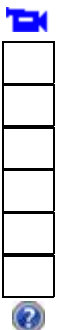
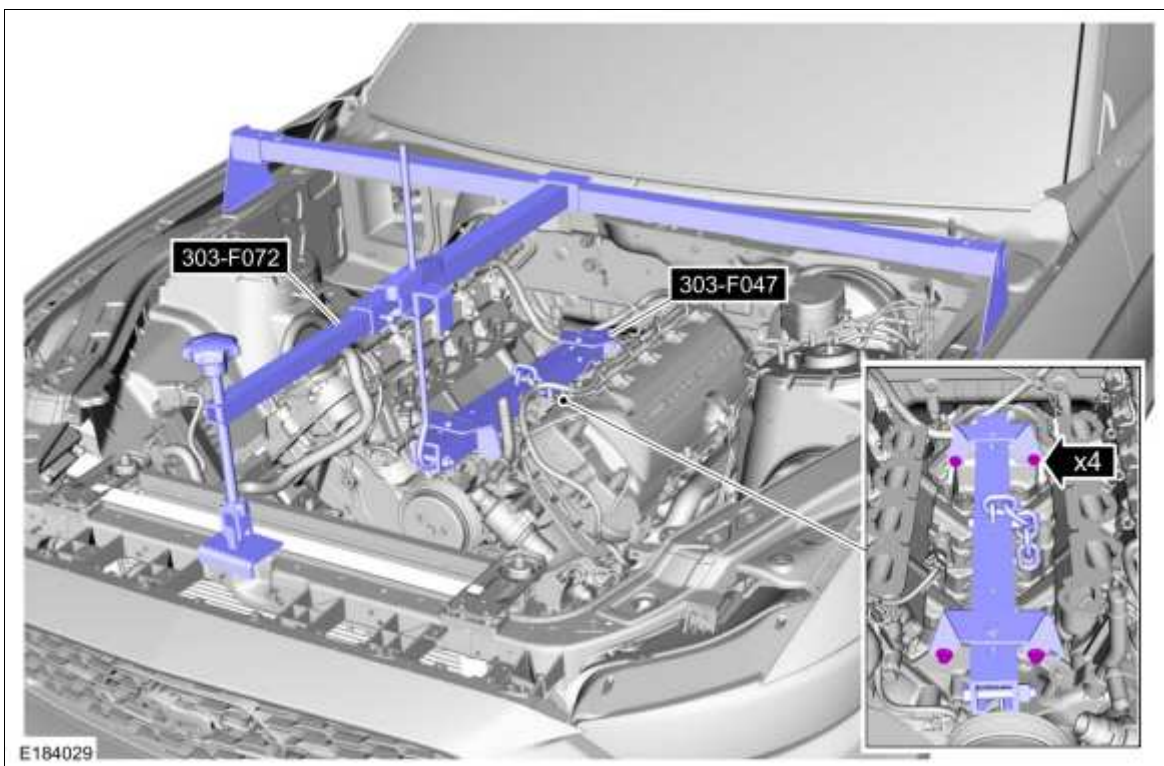
45. Remove the RH engine mount nut.



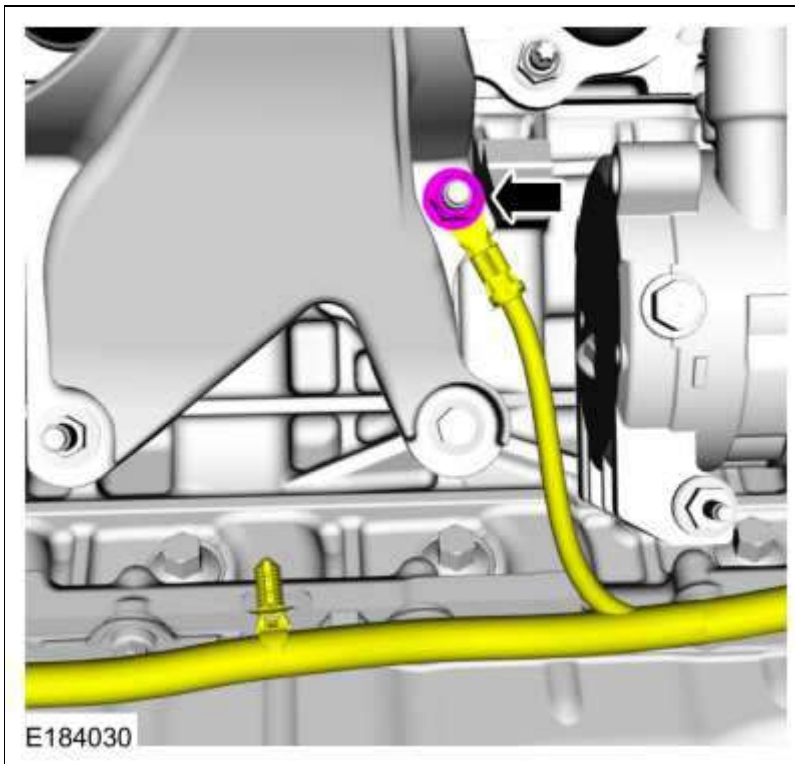
46. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

Install the special tools and raise the engine 25 mm (1 inch).

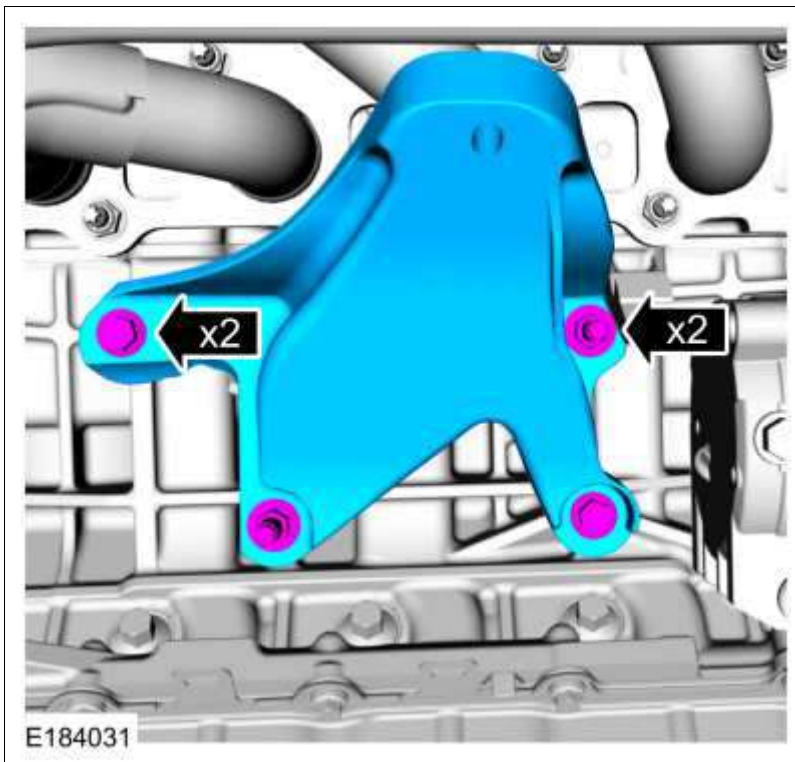
Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-F047 Lifting Bracket, Engine.](#)



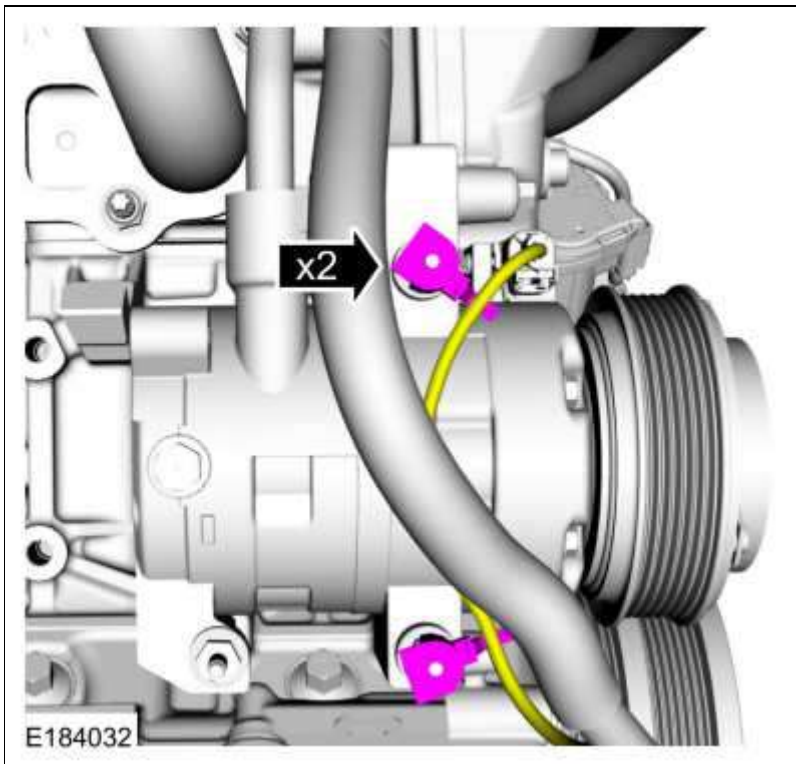
47. Remove the nut and ground strap from the RH engine mount bracket stud bolt.



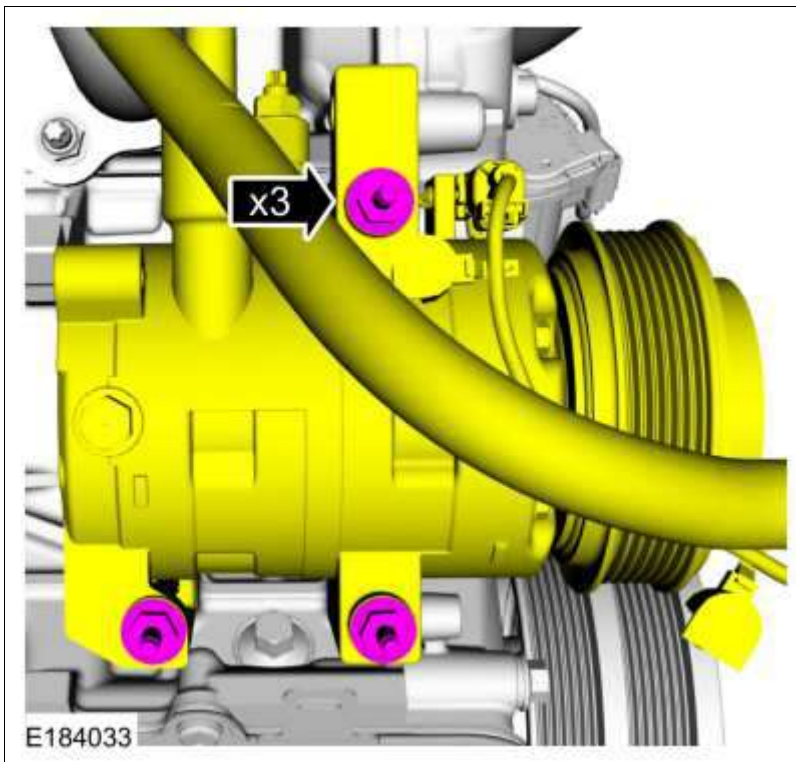
48. Remove the bolts, the stud bolts and the RH engine mount bracket.



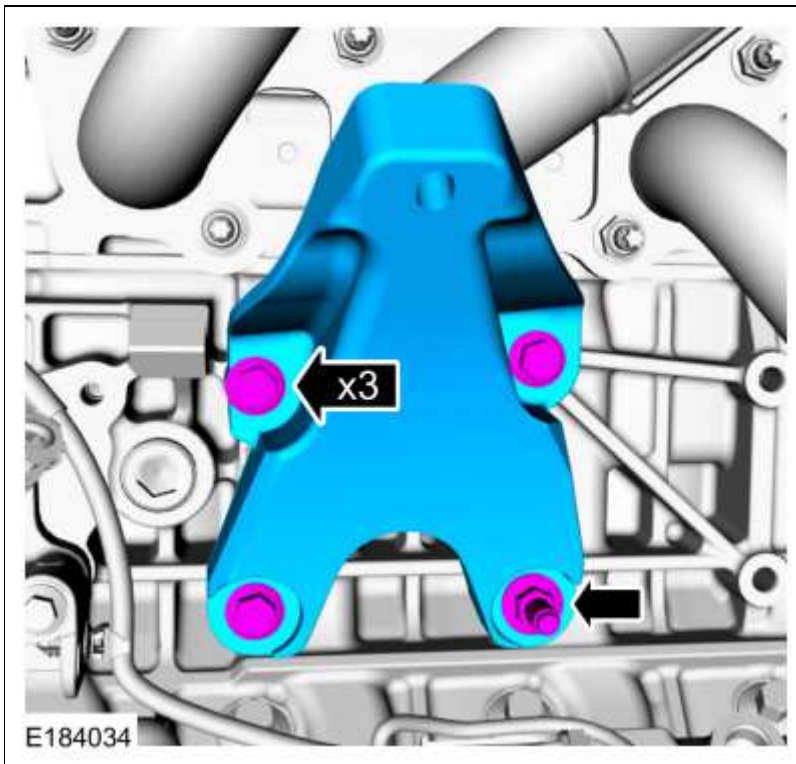
49. Detach the wiring harness retainers from the A/C compressor stud bolts.



50. Remove the stud bolts and position the A/C compressor aside.



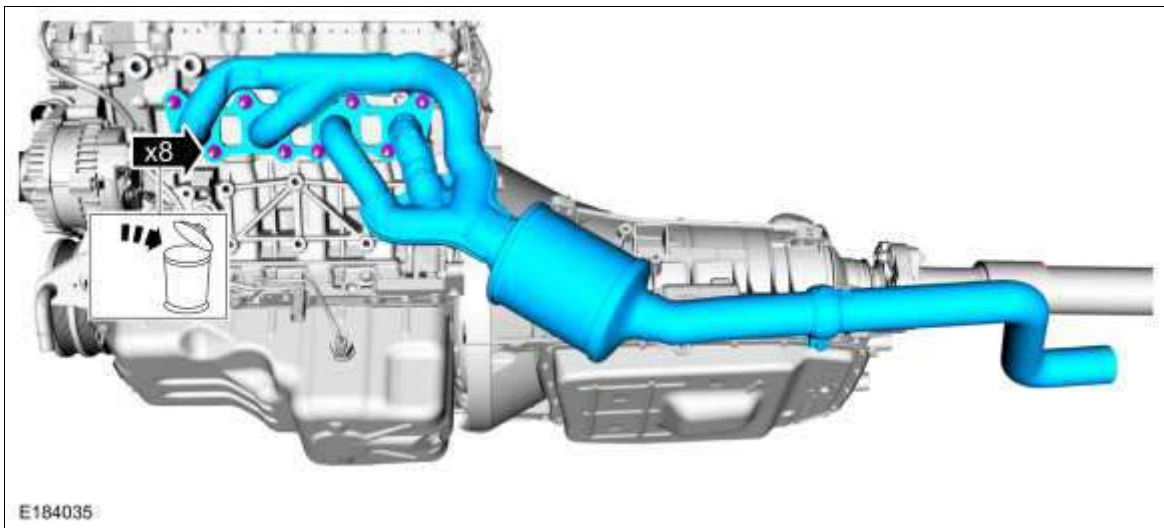
51. Remove the bolts, the stud bolt and the LH engine mount bracket.



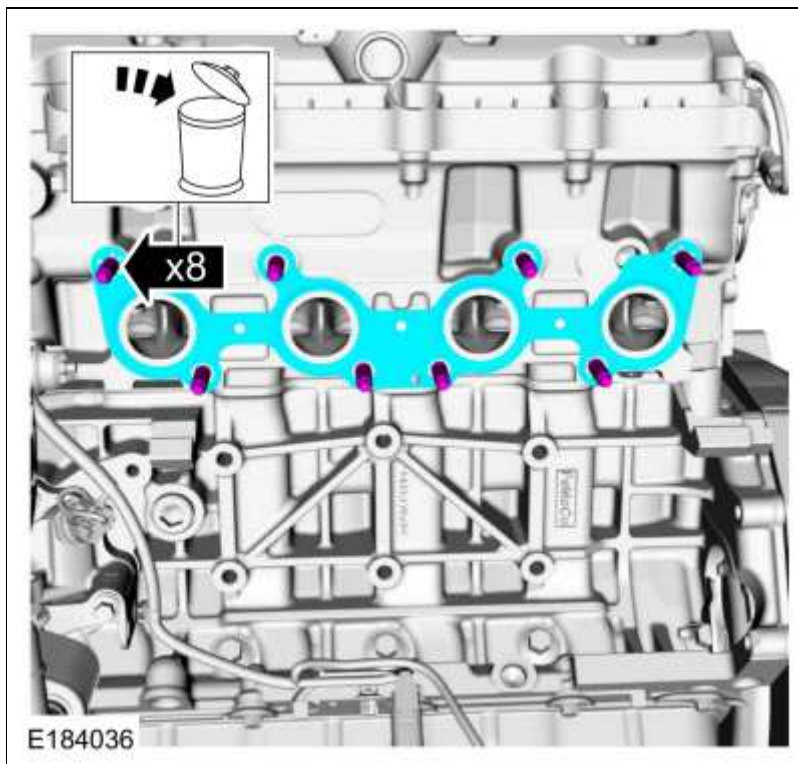
52.

Remove and discard the nuts.

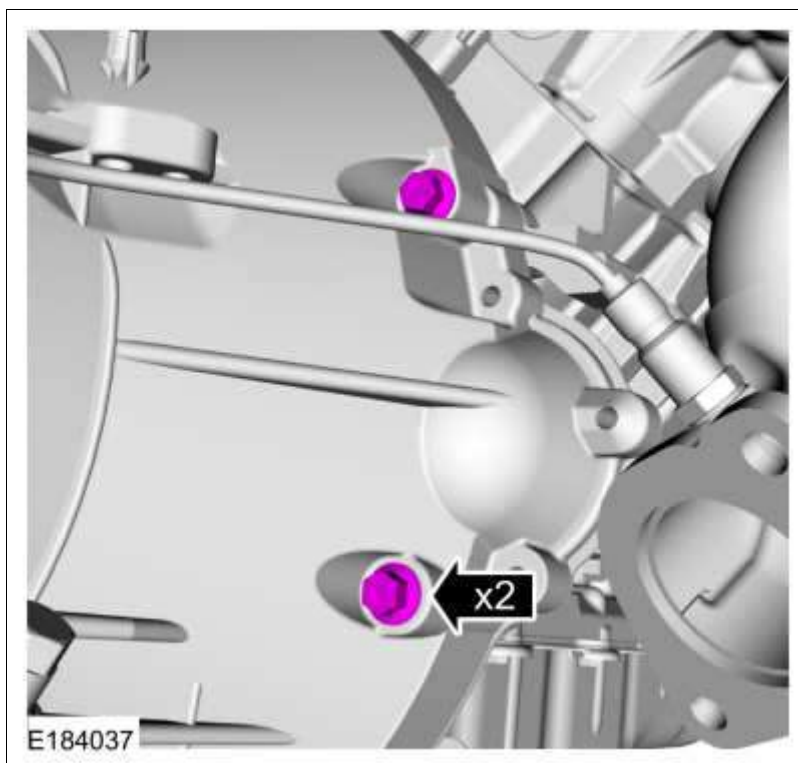
- Remove the LH catalytic converter.



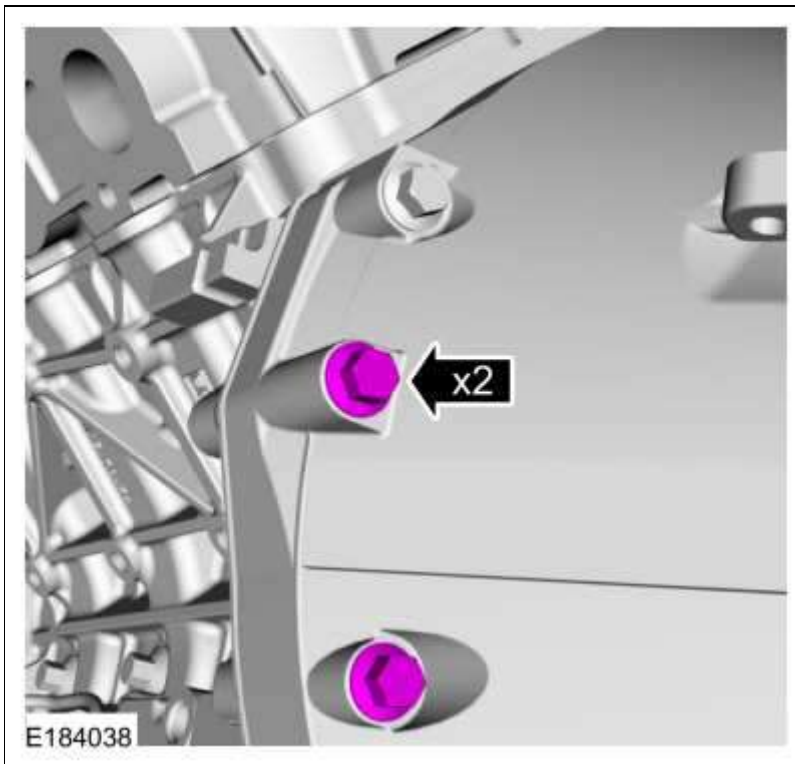
53. Remove and discard the gasket and studs.



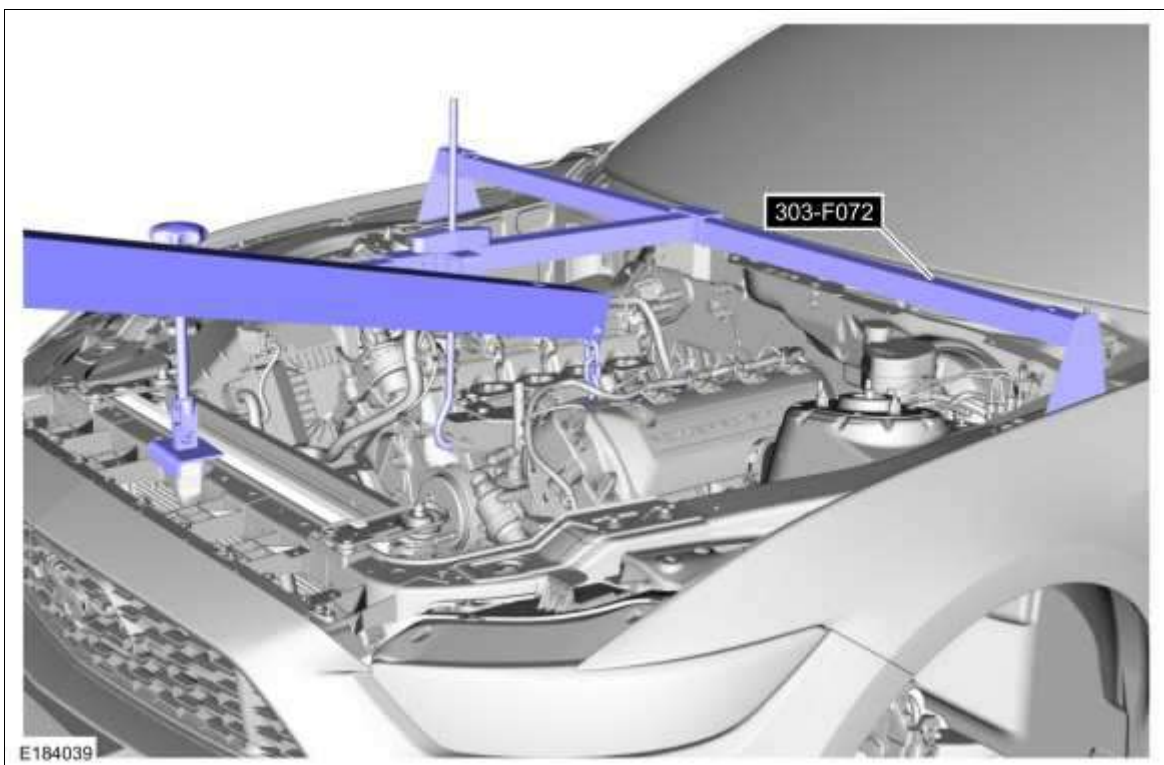
54. Remove RH transmission-to-engine bolts.



55. Remove LH transmission-to-engine bolts.

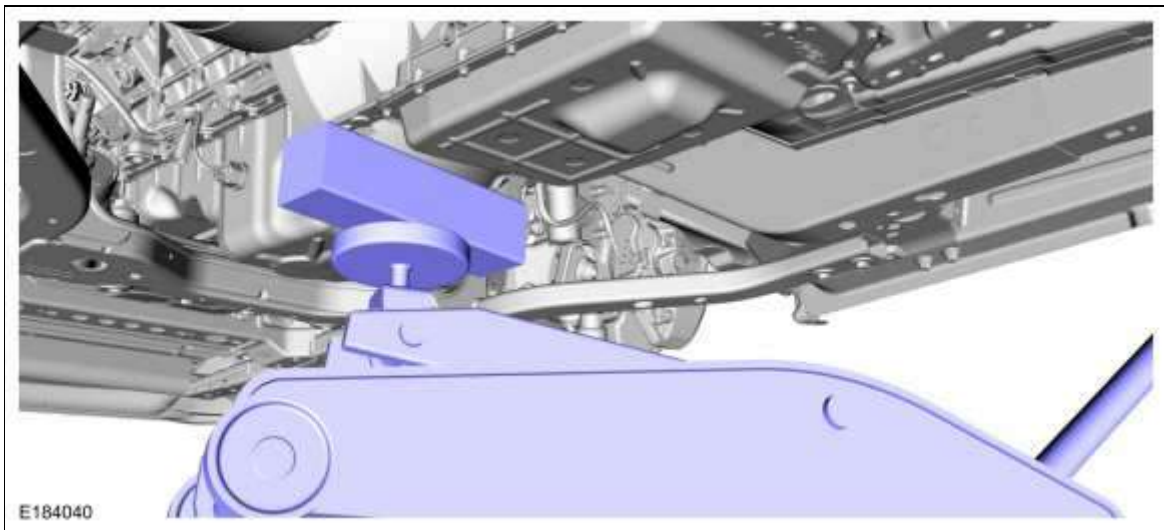


56. 1. Attach the Floor Crane to the Engine Lifting Bracket
Use the General Equipment: Floor Crane
2. Once the engine is supported by the Floor Crane, remove the special tools.
Use Special Service Tool: [303-F072 Support Bar, Engine](#).

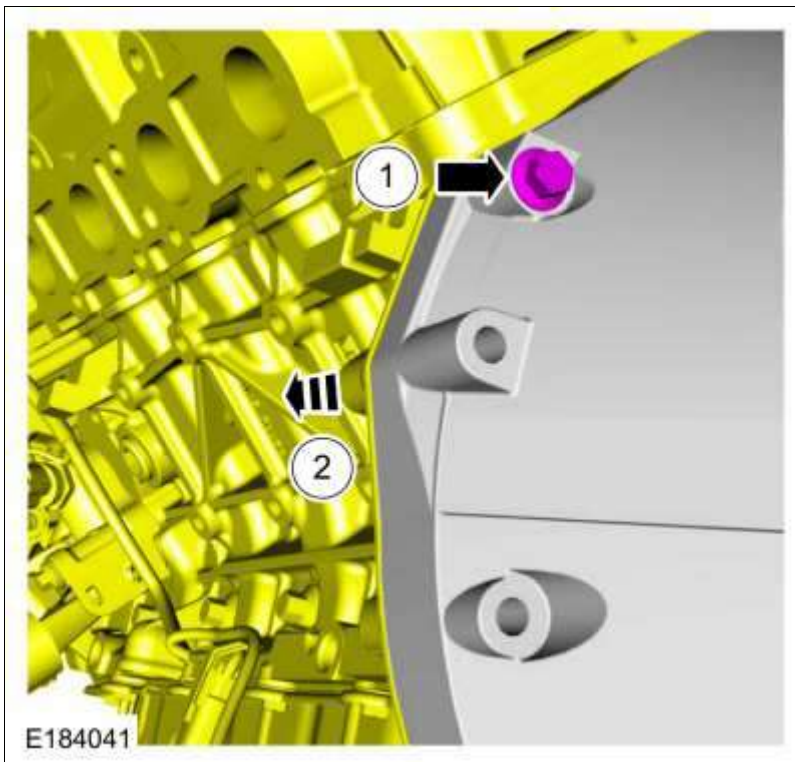


57. **NOTICE:** Do not support the transmission by the fluid pan, failure to follow this instruction may result in serious damage to the transmission.

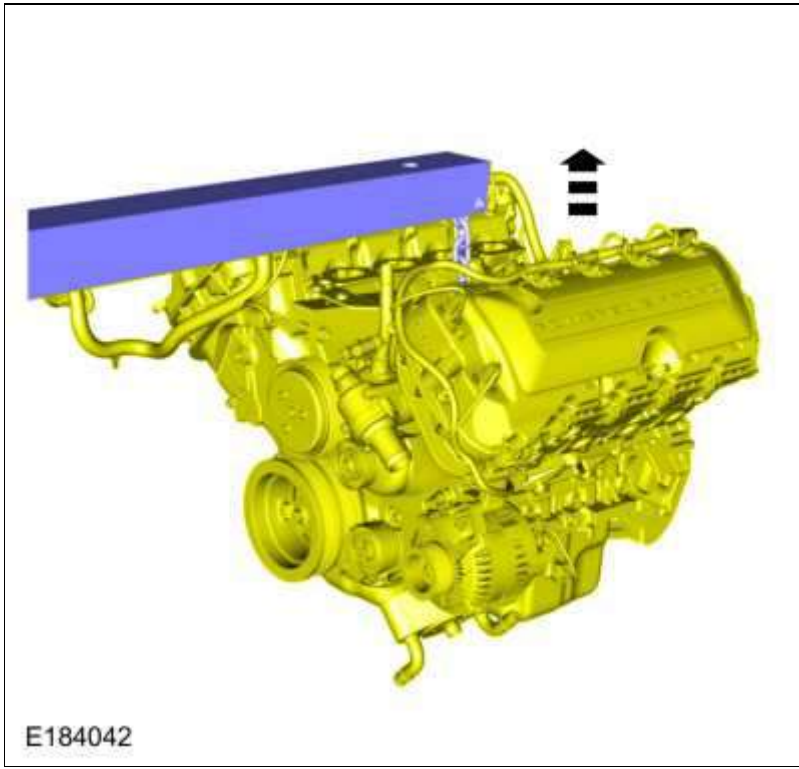
Install a jack and wooden block under the transmission bell housing to support the transmission.
Use the General Equipment: Wooden Block
Use the General Equipment: Trolley Jack



58. 1. Remove the remaining transmission-to-engine bolt.
2. Separate the engine from the transmission.

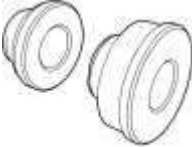


59. Using the Floor Crane lift the engine from the vehicle.
Use the General Equipment: Floor Crane



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**Engine**Base Part Number: [6L084](#)**Special Tool(s) / General Equipment**

 E129694	100-001 (T50T-100-A) Slide Hammer
	205-142 (T80T-4000-J) Installer, Differential Bearing Cone
 E133913	205-153 (T80T-4000-W) Handle
 E175042	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
 E134603	303-409 (T92C-6700-CH) Remover, Crankshaft Seal TKIT-1992-FH/FMH/FLMH TKIT-1993-LMH/MH
	303-448 (T93P-6303-A) Holding Tool, Crankshaft TKIT-1993-FLM TKIT-1993-LM
	303-519 (T95P-6701-EH) Remover, Crankshaft Rear Oil Seal TKIT-1995-FH/FLMH TKIT-1995-LMH/MH
	303-F047 Lifting Bracket, Engine
Floor Crane	
Three Leg Puller	
Mounting Stand	

Materials

Name	Specification
Motorcraft® Silicone Gasket Remover ZC-30-A	-
Motorcraft® Metal Surface Prep ZC-31-B	-
Metal Brake Parts Cleaner (U.S.) PM-4-A, PM-4-B (U.S.)	-

NOTICE: 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.

NOTICE: Remove the cylinder heads before removing the crankshaft. Failure to do so can result in engine damage.

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

NOTE: Refer to the exploded view under the Engine Component View in the Description and Operation.

6-Speed Automatic Transmission - 6R80

- NOTE:** The flexplate bolts are torque-to-yield design and are not reusable

Remove and discard the flexplate bolts.

- Remove the flexplate.



6-Speed Manual Transmission - MT82

- WARNING:** Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may be a cancer and lung disease hazard. Exposure to potentially hazardous components

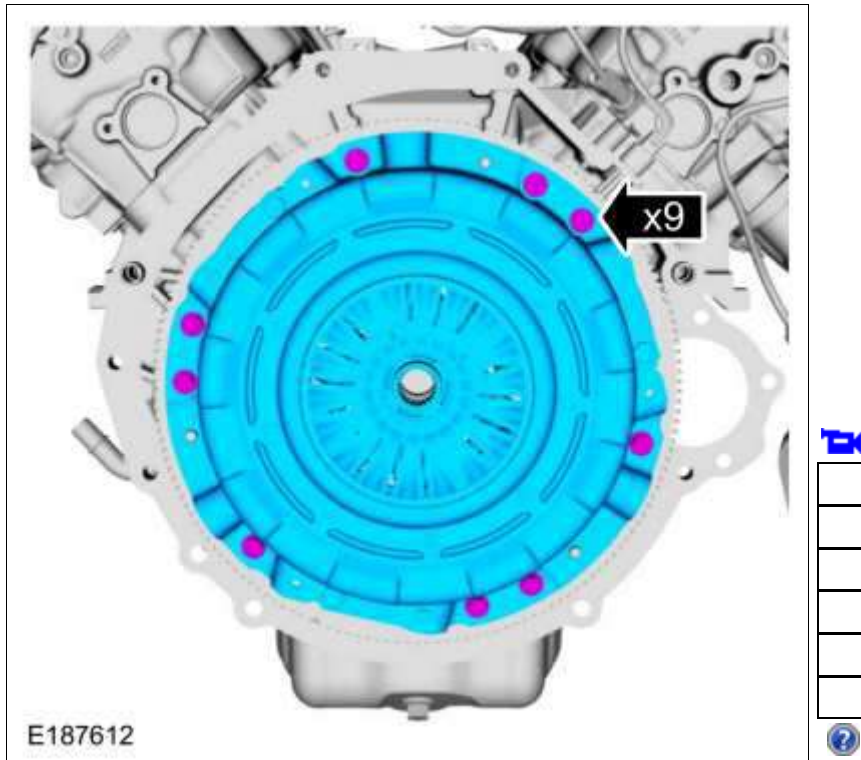
may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

NOTICE: Loosen the bolts evenly to prevent clutch pressure plate damage.

NOTE: If the parts are to be reused, index-mark the pressure plate to the flywheel.

Remove and discard the pressure plate bolts.

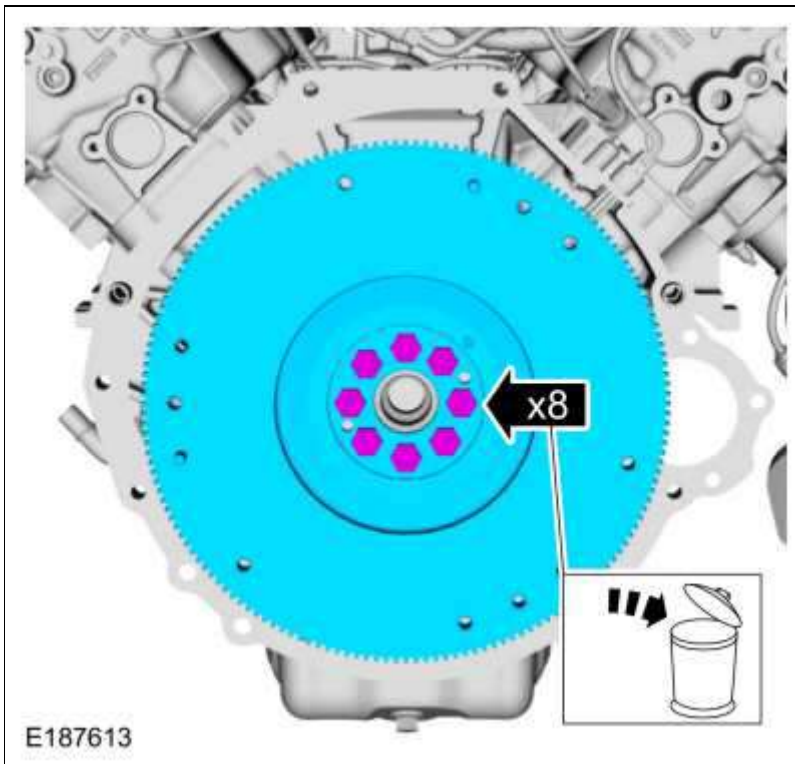
- Remove the pressure plate and the clutch disc.



3. **NOTE:** The flywheel bolts are torque-to-yield design and are not reusable

Remove and discard the flywheel bolts.

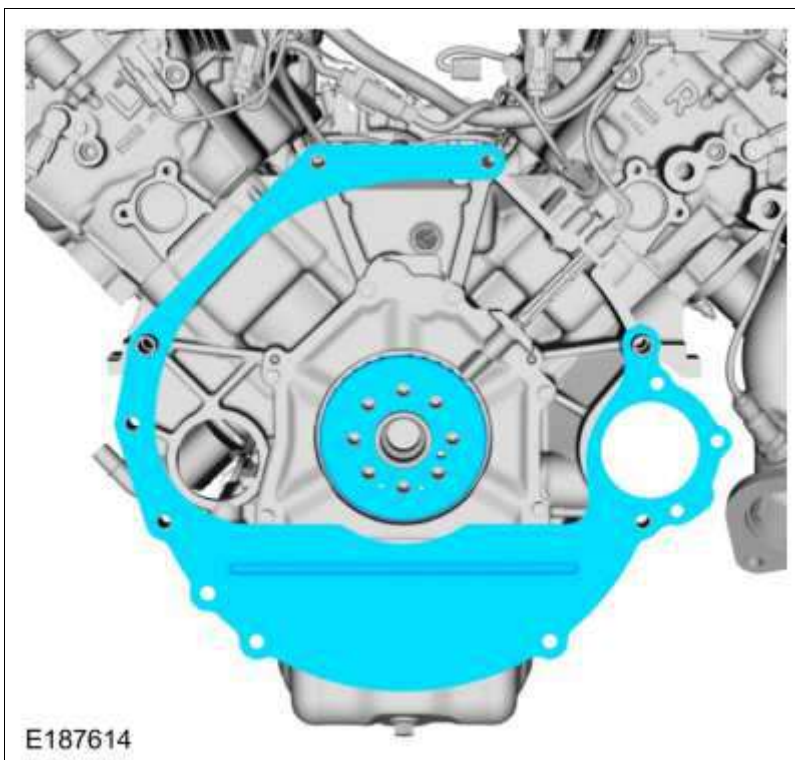
- Remove the flywheel.



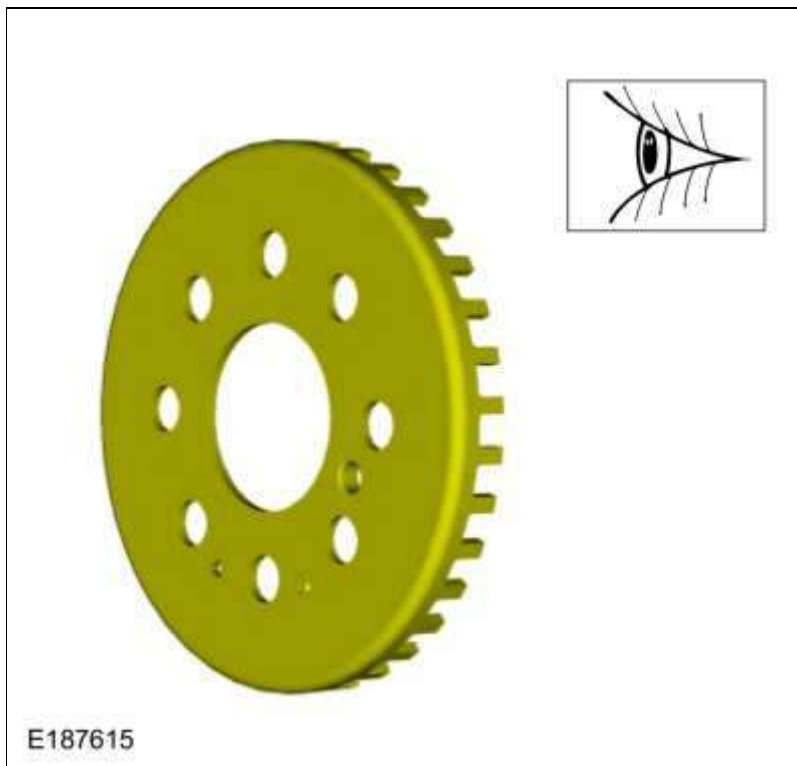
6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

4. **NOTE:** Engine equipped with manual transmission shown, automatic transmission engine similar.

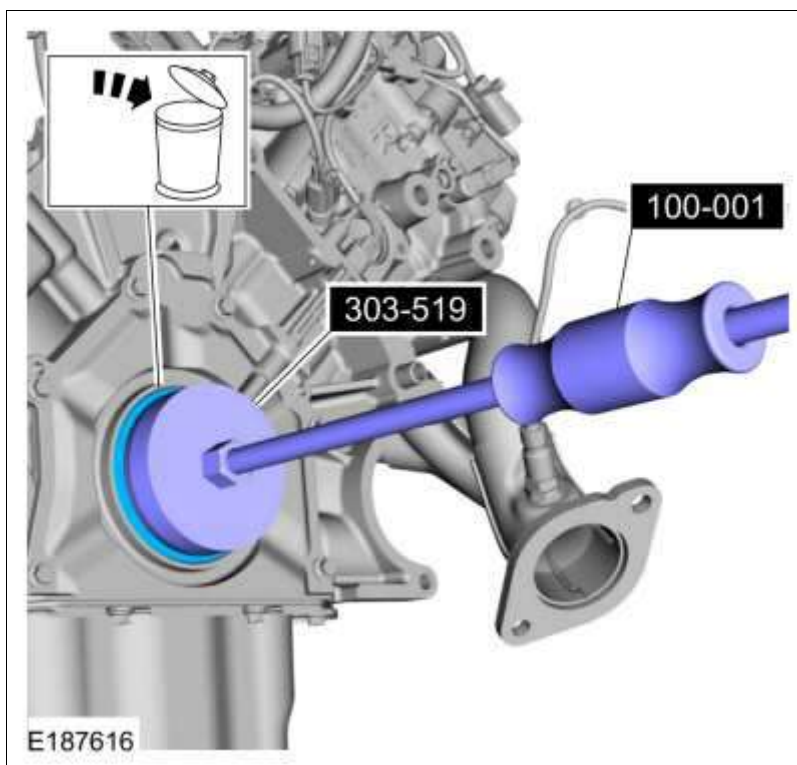
Remove the crankshaft sensor ring and the engine-to-transmission spacer plate.



5. Inspect the crankshaft sensor ring for damage. If the crankshaft sensor ring has been dropped or has any visual damage, it must be replaced.



6. Using the special tools, remove and discard the crankshaft rear seal.
 Use Special Service Tool: [100-001 \(T50T-100-A\) Slide Hammer](#) , [303-519 \(T95P-6701-EH\) Remover, Crankshaft Rear Oil Seal](#).

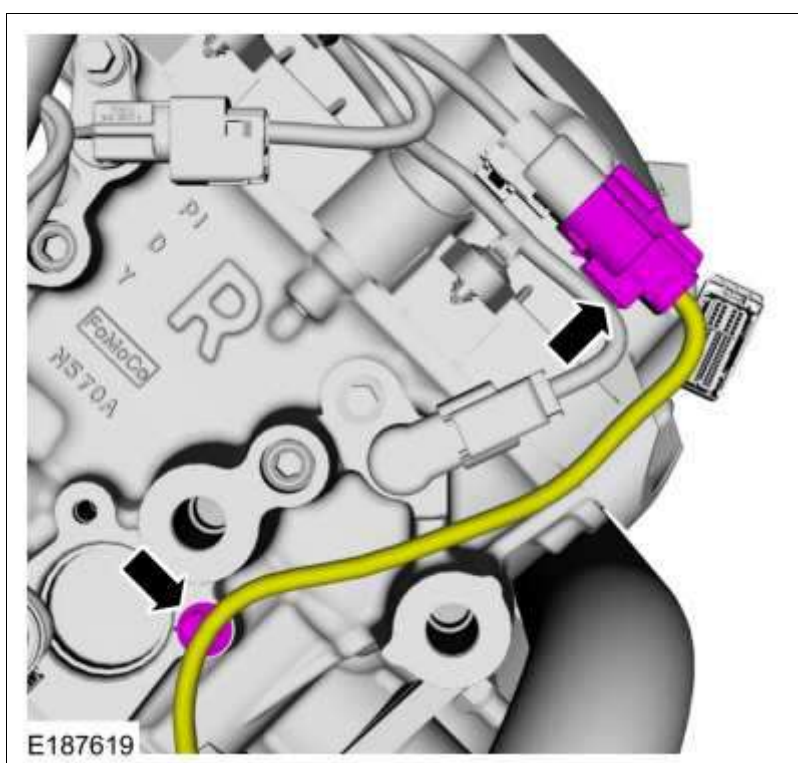


7. Using a floor crane, install the engine on a mounting stand and remove the special tool.
 Remove Special Service Tool: [303-F047 Lifting Bracket, Engine](#).
 Use the General Equipment: Floor Crane
 Use the General Equipment: Mounting Stand

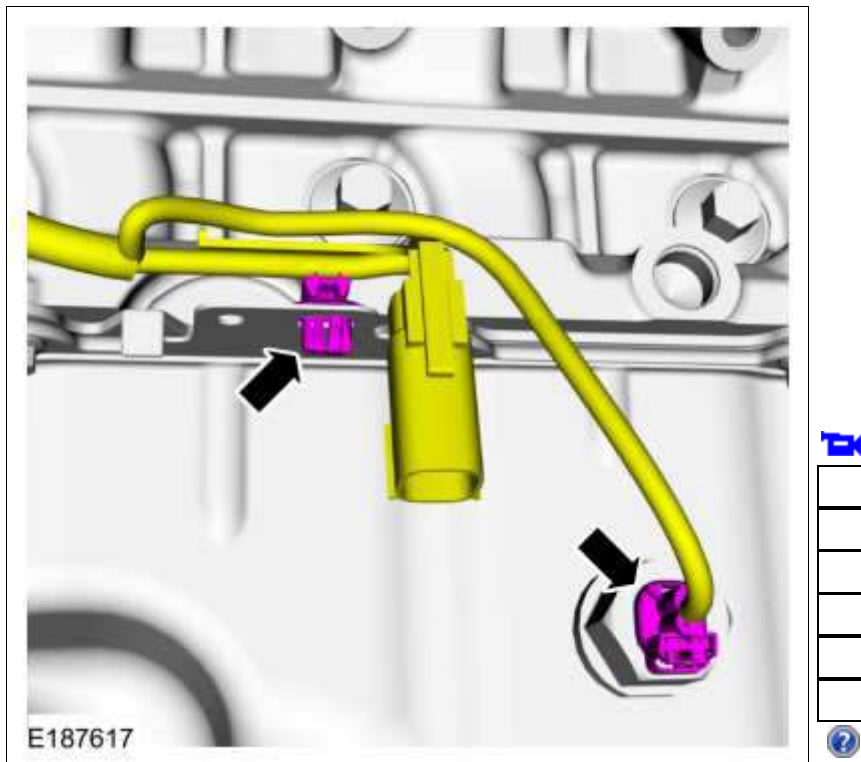


8. **NOTE:** Manual transmission engine shown, automatic transmission engine similar.

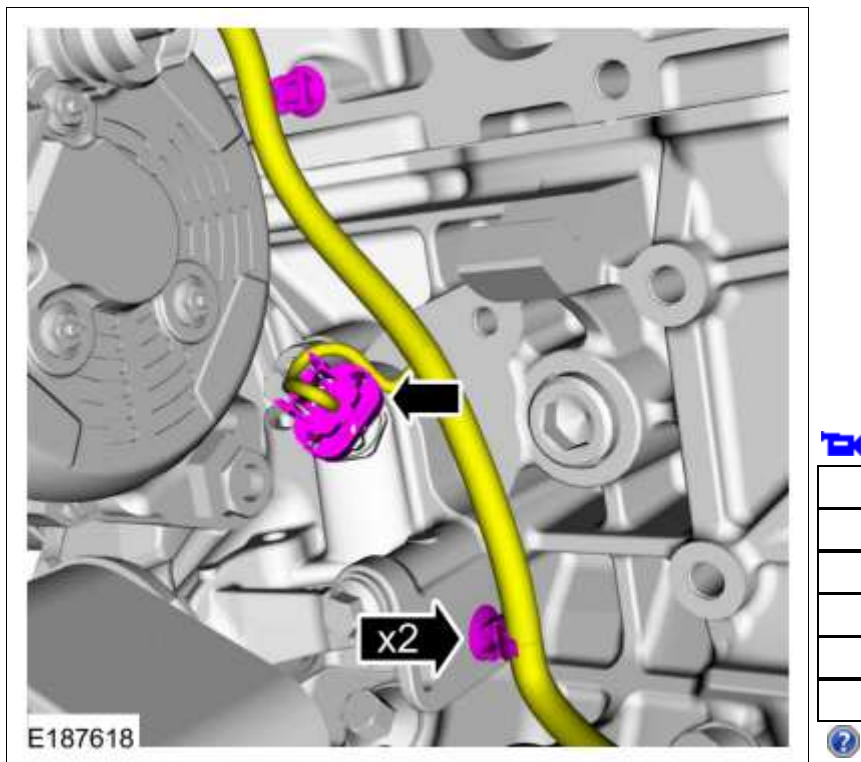
Disconnect the RH HO2S electrical connector and wiring harness retainer.



9. Disconnect the engine oil level sensor electrical connector and the wiring harness retainer.

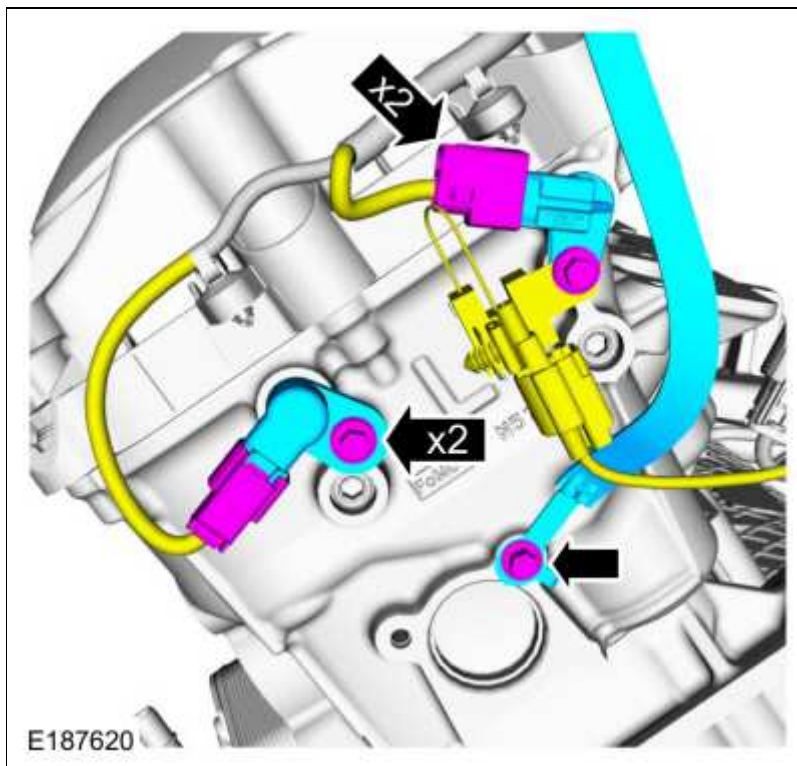


10. Disconnect the EOP) switch electrical connector and the wiring harness retainers.

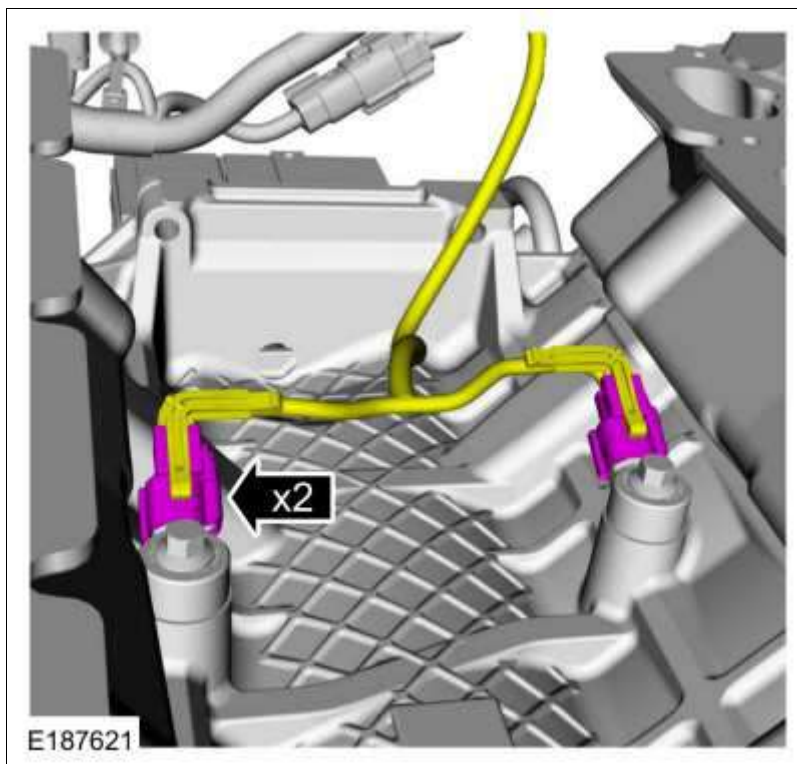


11. Disconnect the LH camshaft position sensor electrical connectors.

- Remove the bolt and the ground wire.
- Remove the bolts and the LH camshaft position sensors.

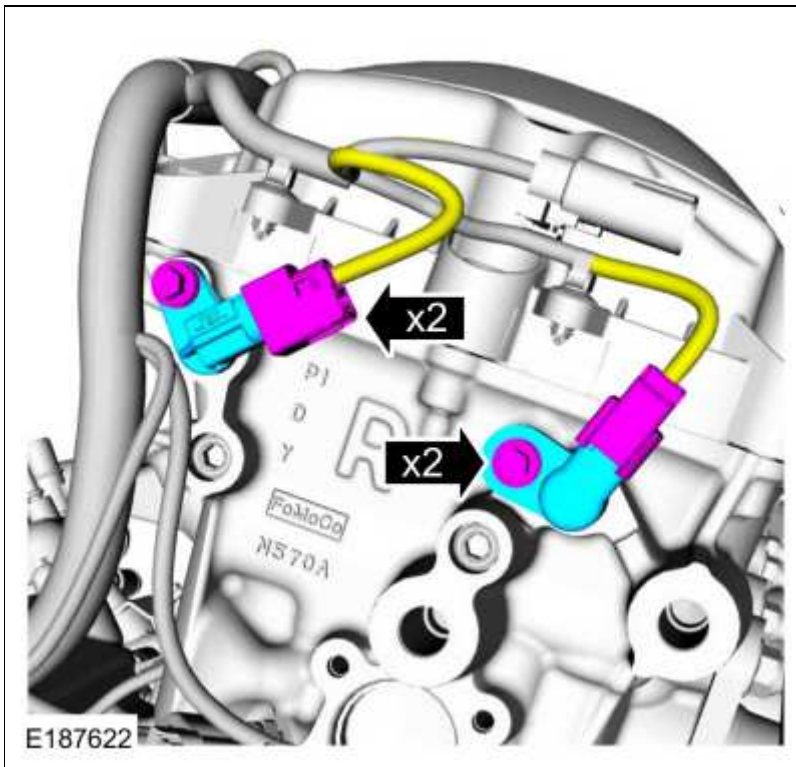


12. Disconnect the KS electrical connectors.

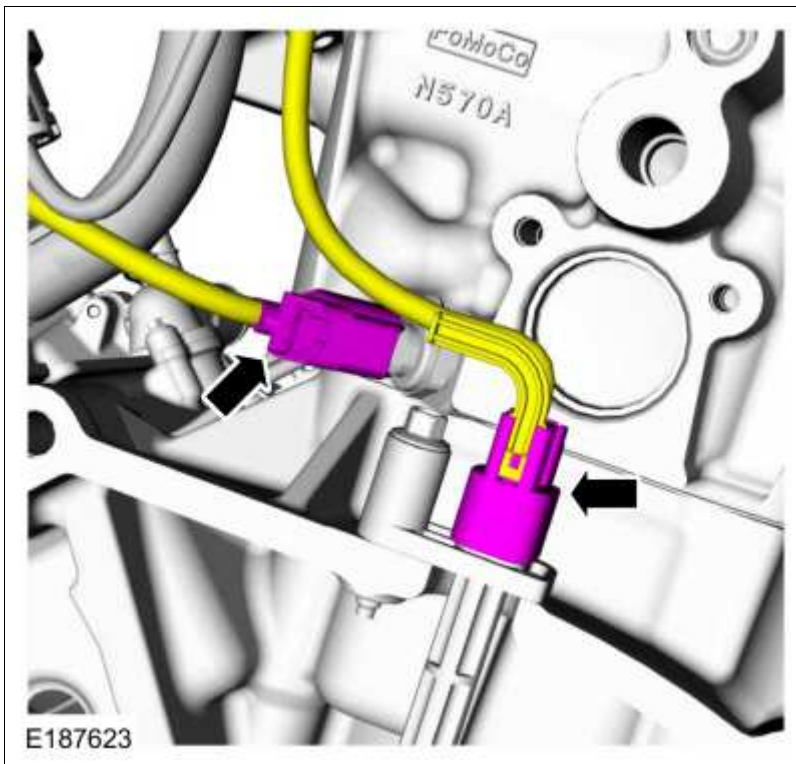


13. Disconnect the RH camshaft position sensor electrical connectors.

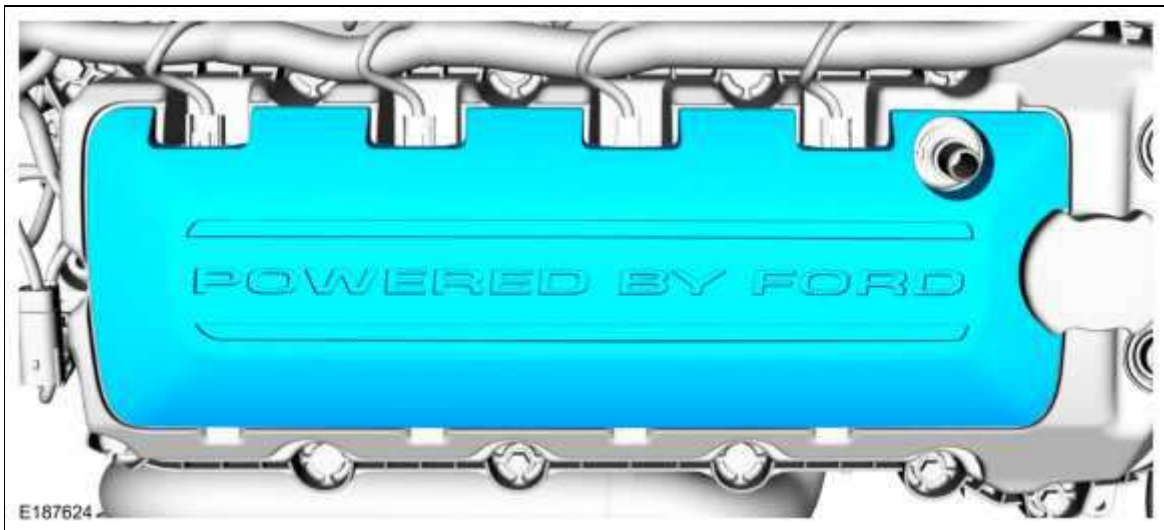
- Remove the bolts and the RH camshaft position sensors.



14. Disconnect the CHT sensor and the CKP sensor electrical connectors.

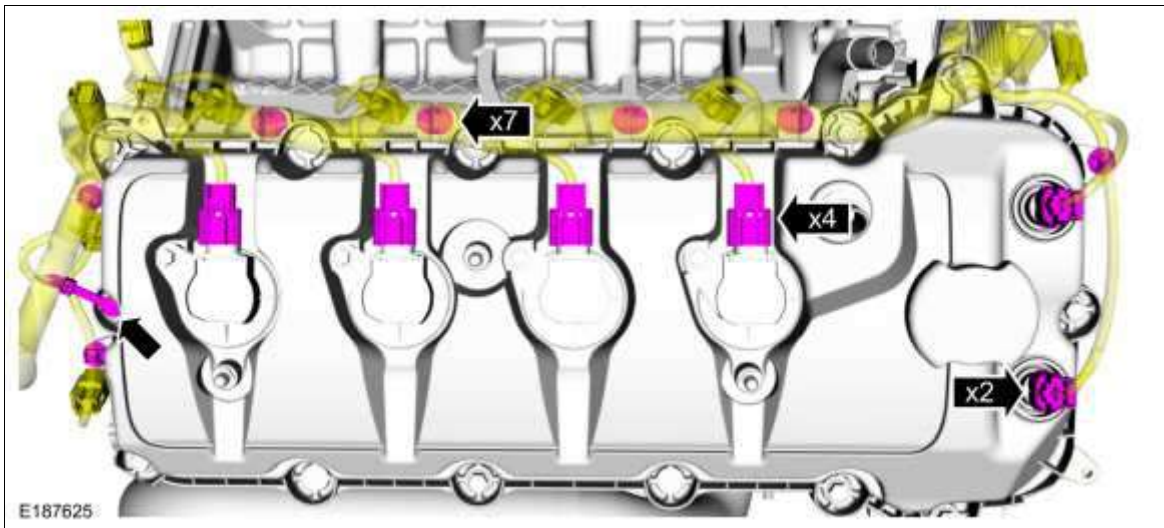


15. Remove the RH spark plug cover.

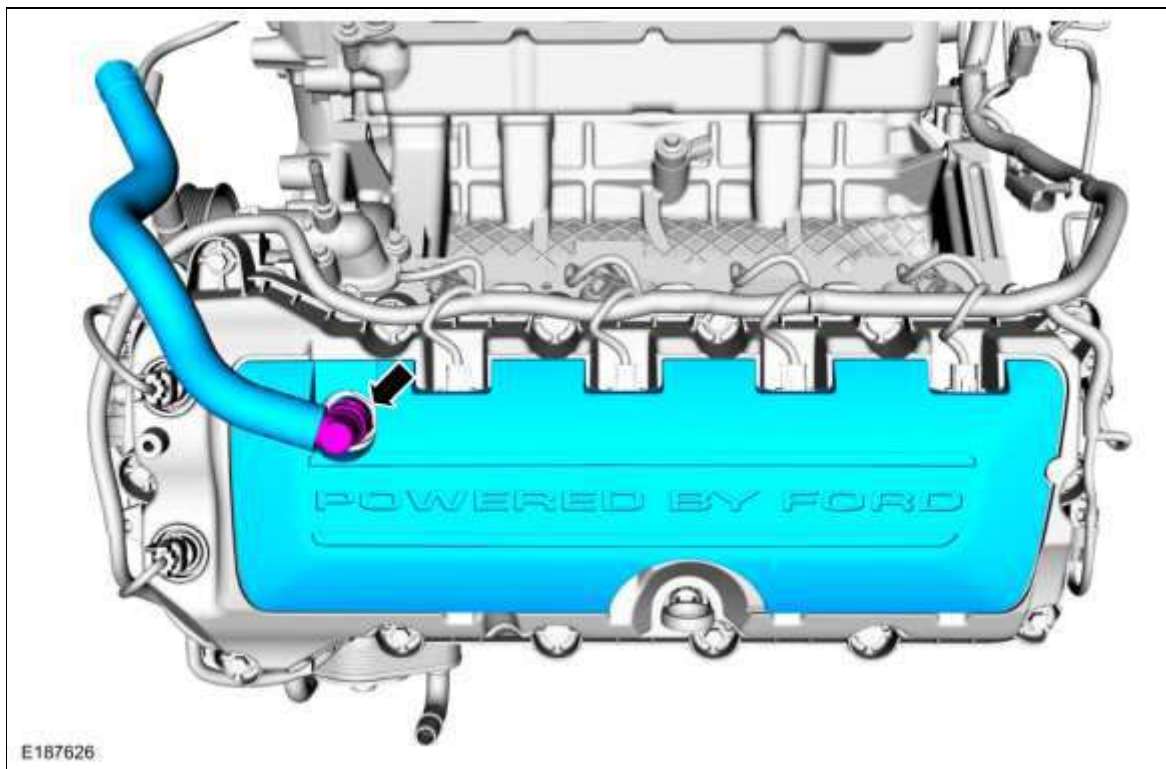


16. **NOTE:** Engine equipped with automatic transmission shown, manual transmission engine similar.

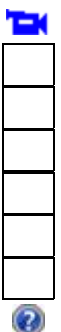
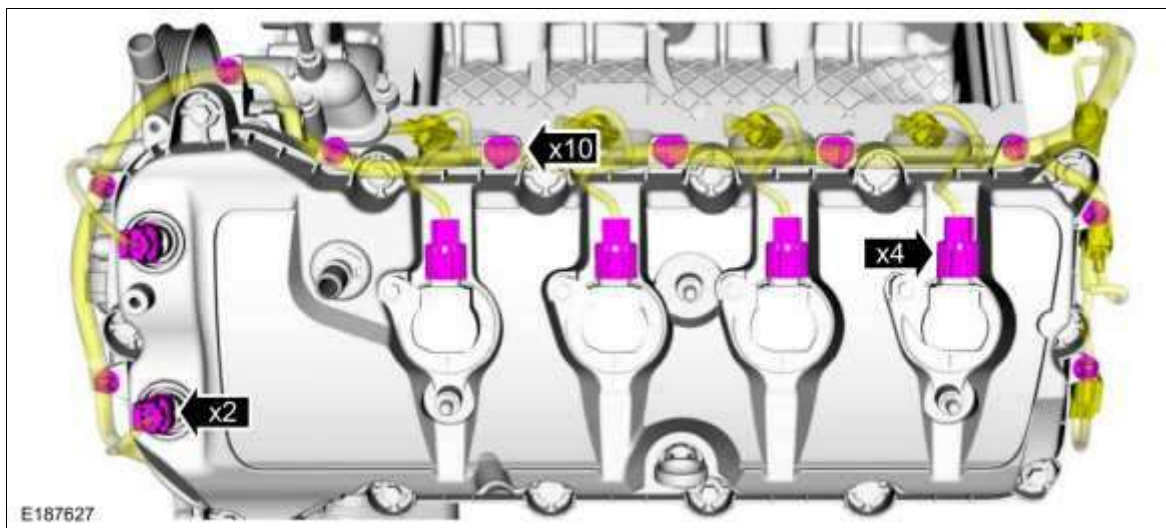
Disconnect the wiring harness electrical connectors and retainers.



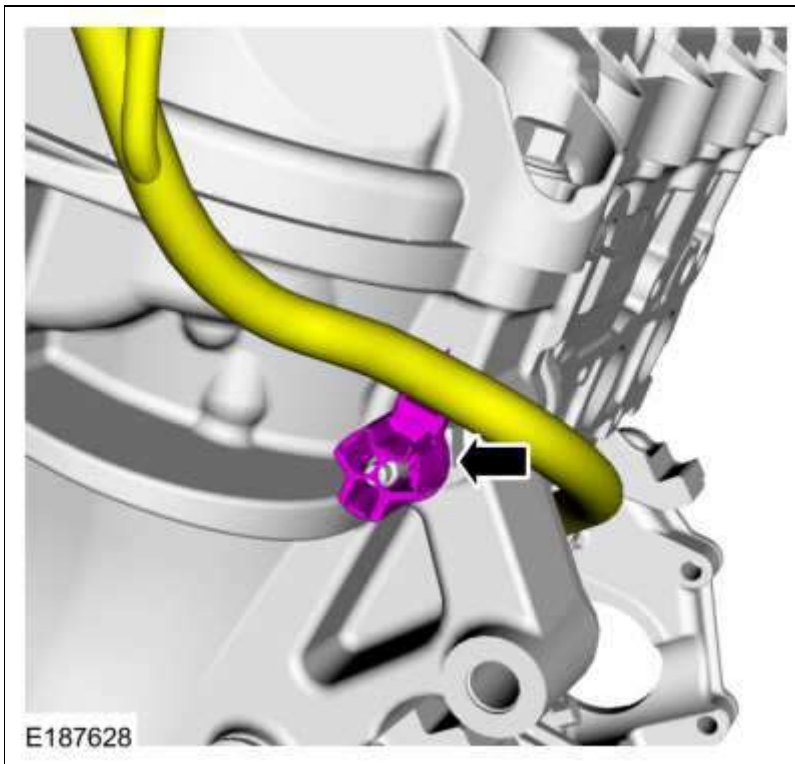
17.
 - Remove the crankcase ventilation tube.
Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
 - Remove the LH spark plug cover.



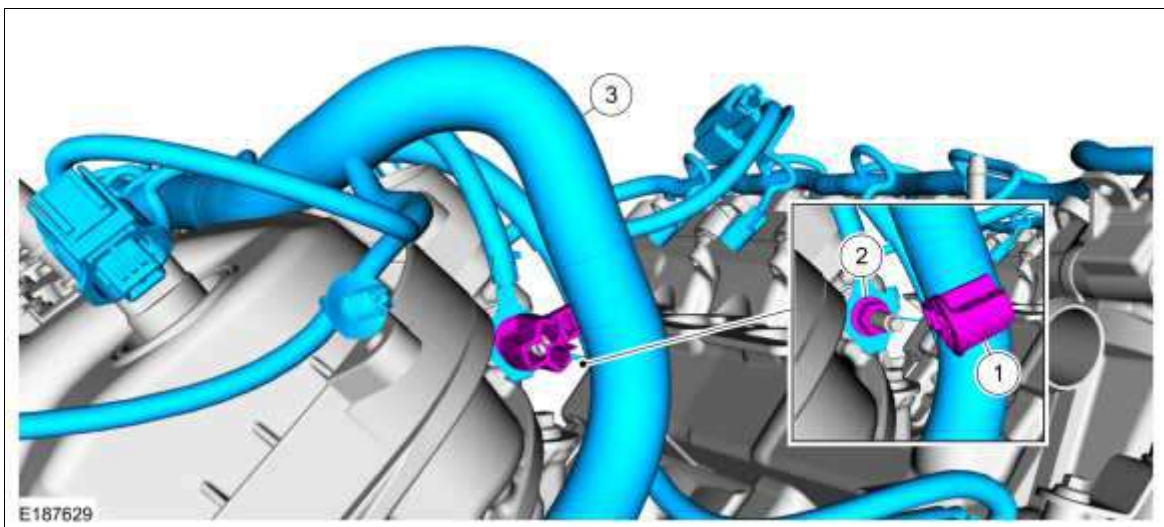
18. Disconnect the wiring harness electrical connectors and retainers.



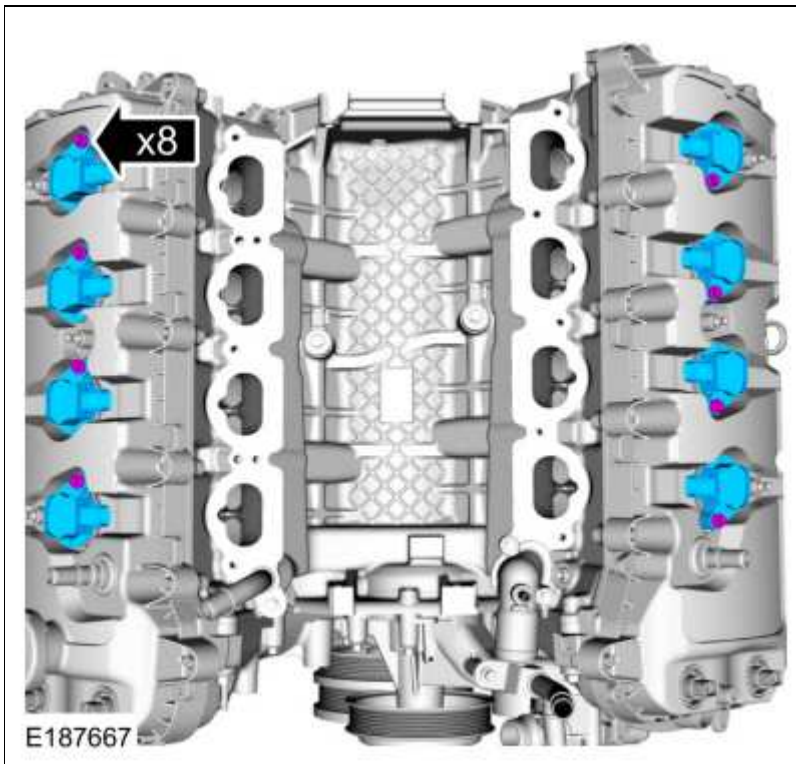
19. Detach the wiring harness retainer from the engine front cover stud bolt.



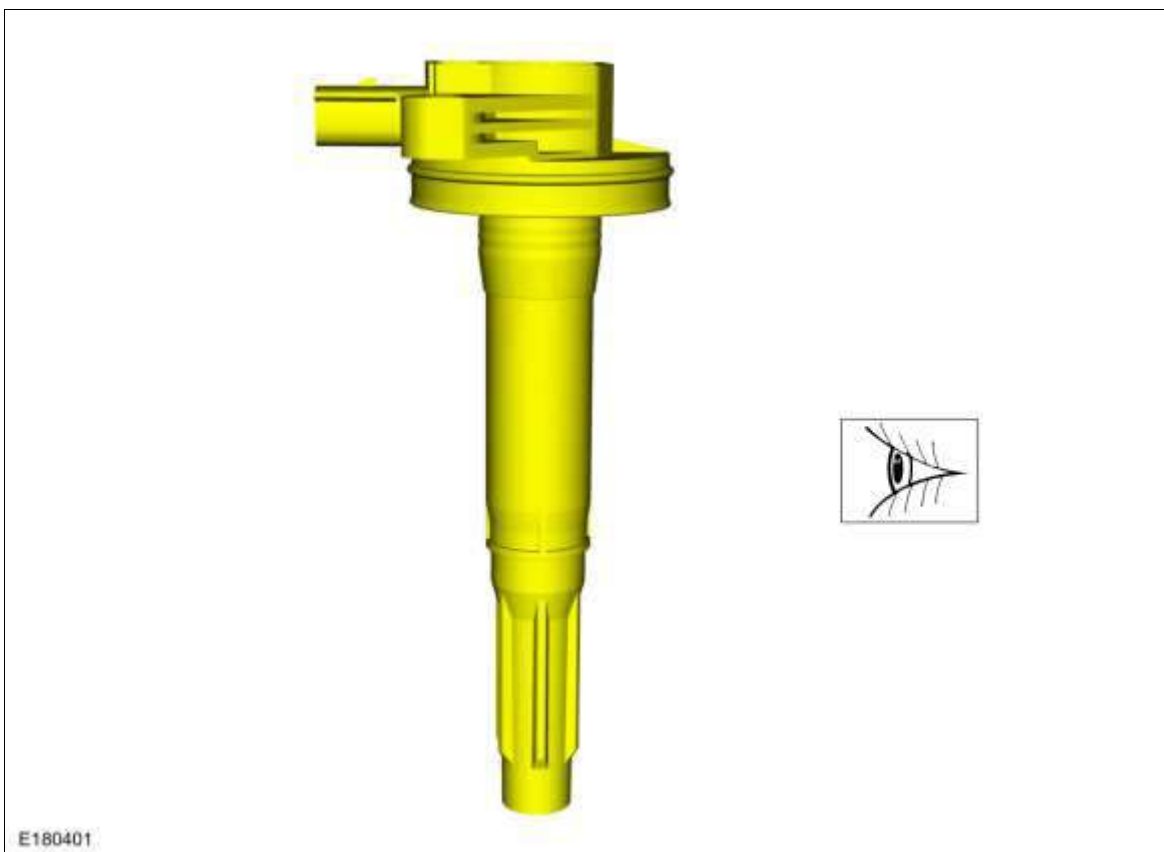
- 20.
1. Detach the wiring harness retainer from the engine front cover stud bolt.
 2. Remove the nut and the ground wire.
 3. Remove the wiring harness from the engine.



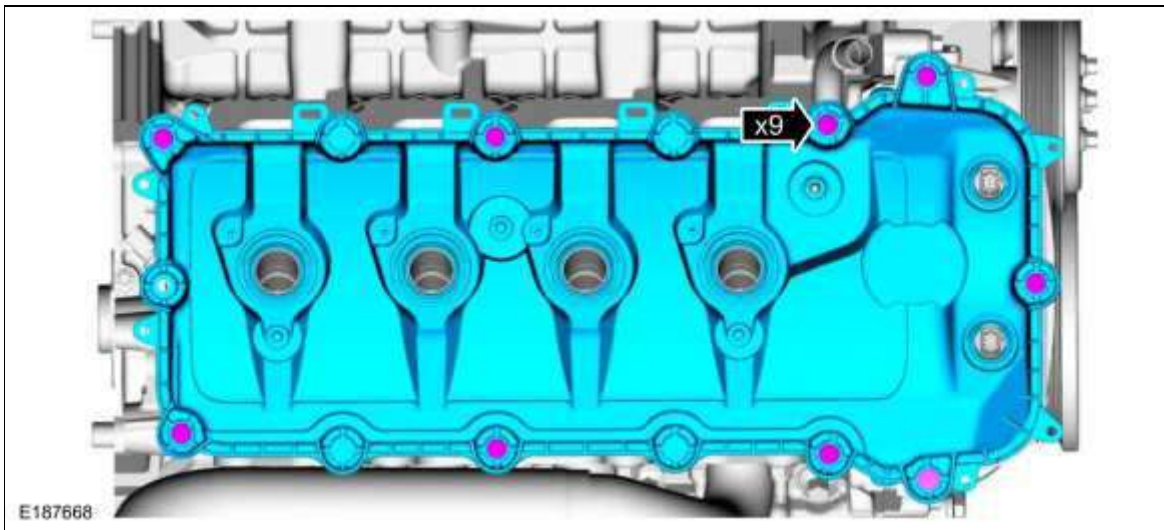
21. **NOTE:** When removing the ignition coils, a slight twisting motion will break the seal and ease removal.
- Remove the bolts and the ignition coils.



22. Inspect the ignition coil-on-plug assembly for cracks, rips, or tears. Replace any damaged coil-on-plug assemblies.

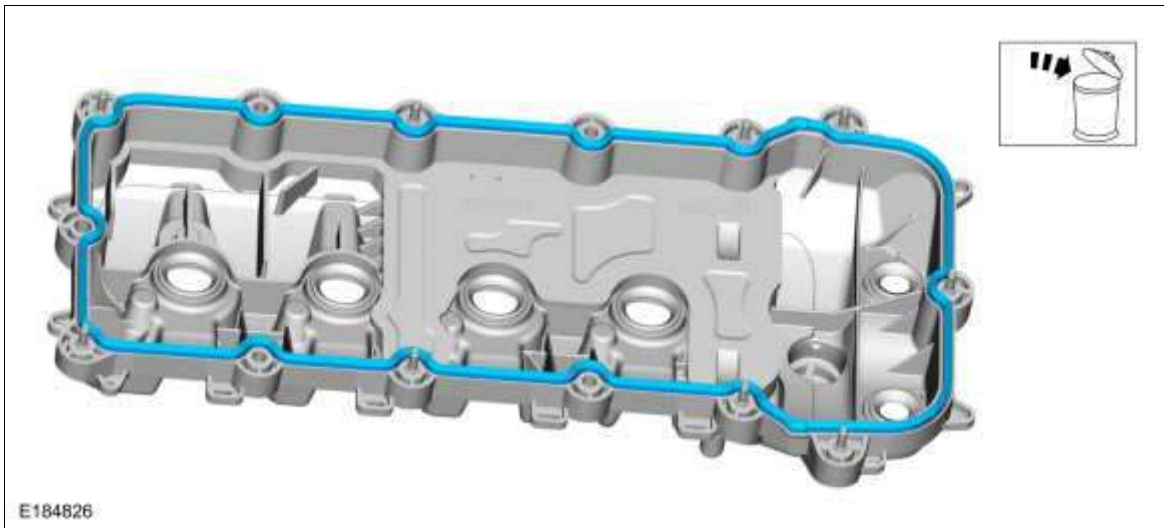


23. Loosen the bolts and remove the RH valve cover.

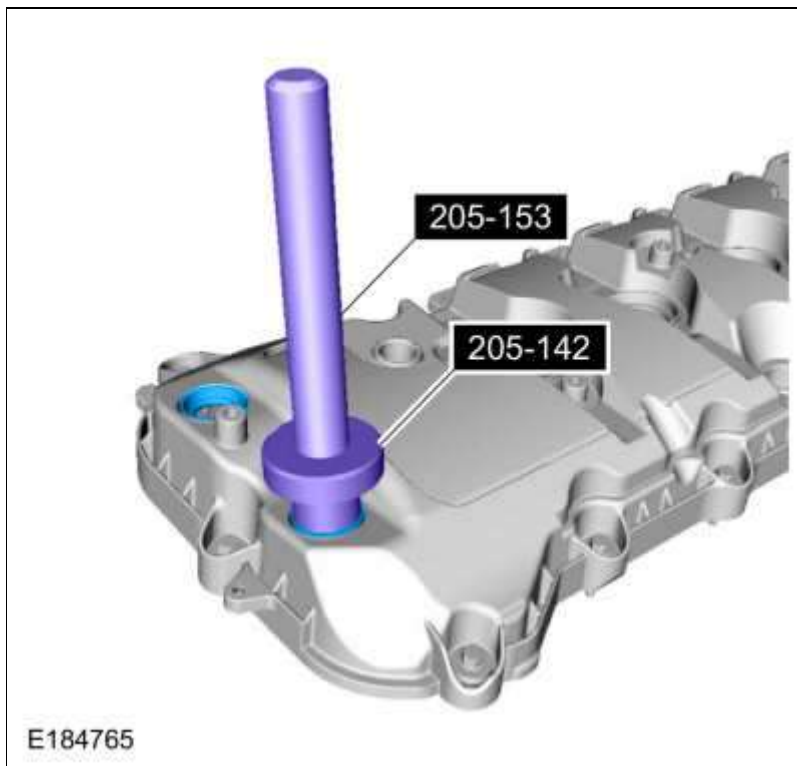


24. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.

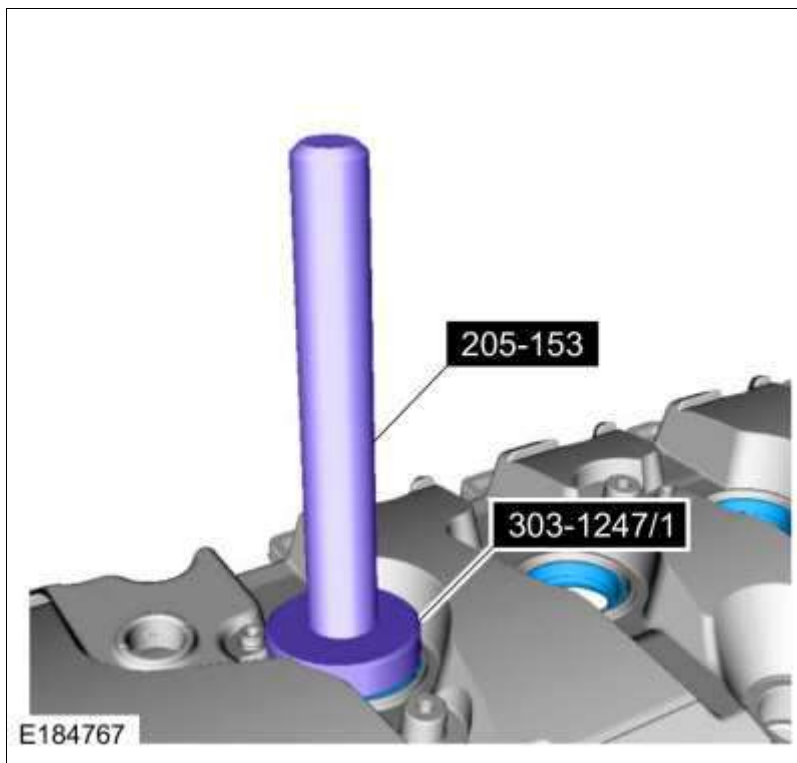
Remove and discard the gasket.



25. Inspect the VCT variable force solenoid seals. Remove any damaged seals using the special tools. Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone.](#)



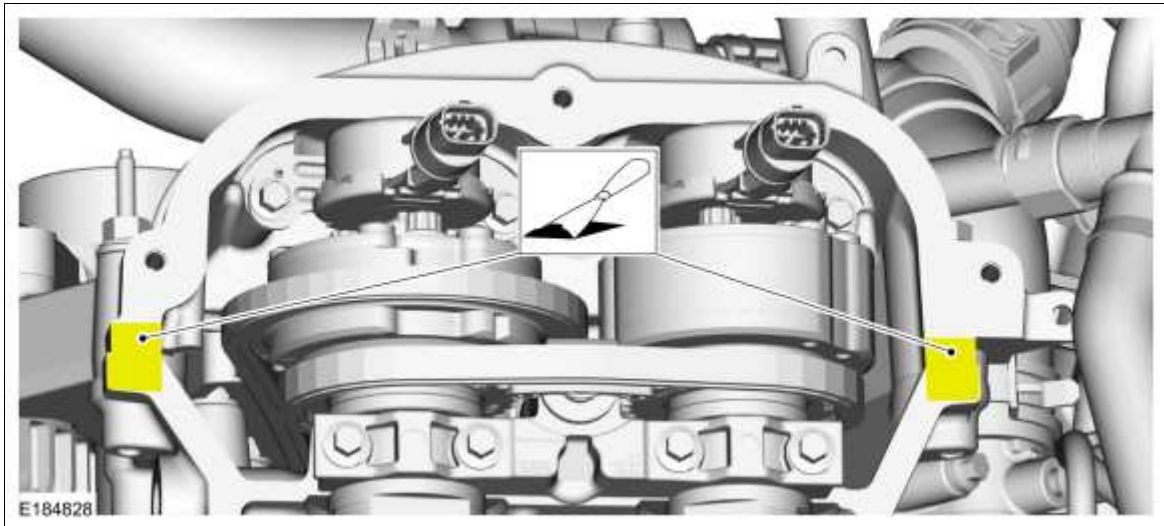
26. Inspect the spark plug seals. Remove any damaged seals using the special tools.
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer.](#)



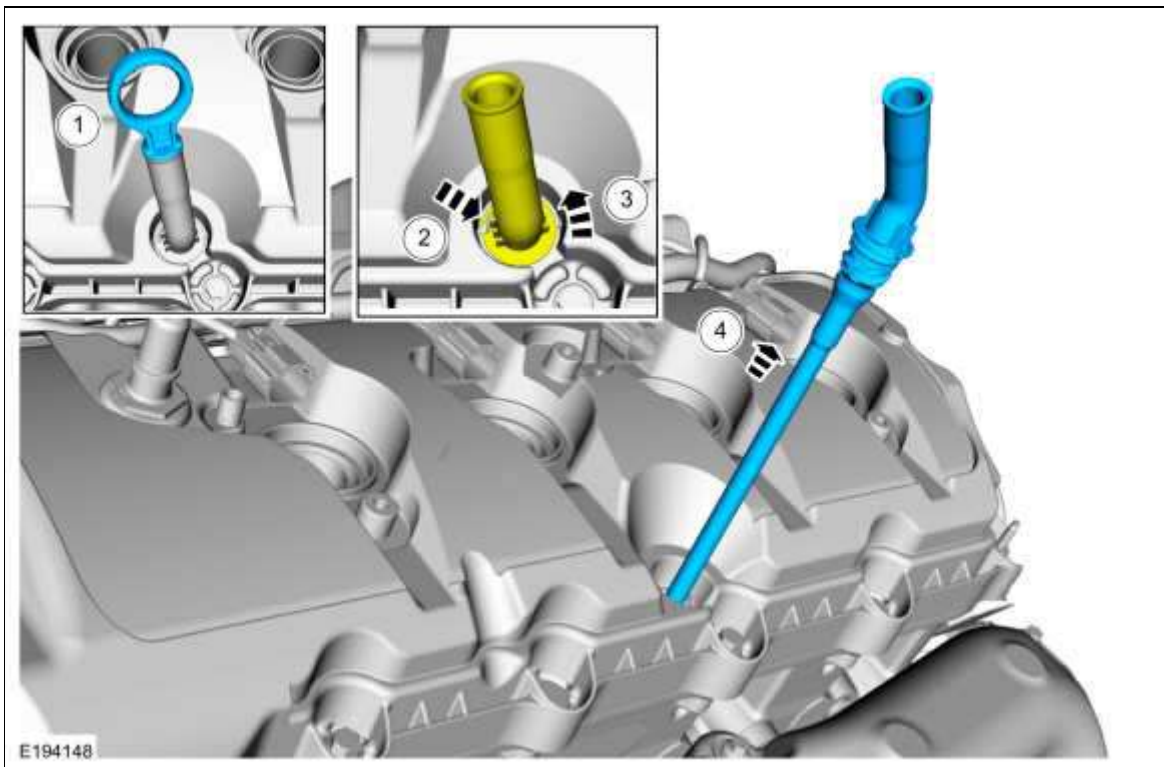
27. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

Clean the valve cover mating surface of the RH cylinder head and engine front cover.
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper
Material: Motorcraft® Silicone Gasket Remover / ZC-30-A
Material: Motorcraft® Metal Surface Prep / ZC-31-B

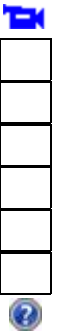
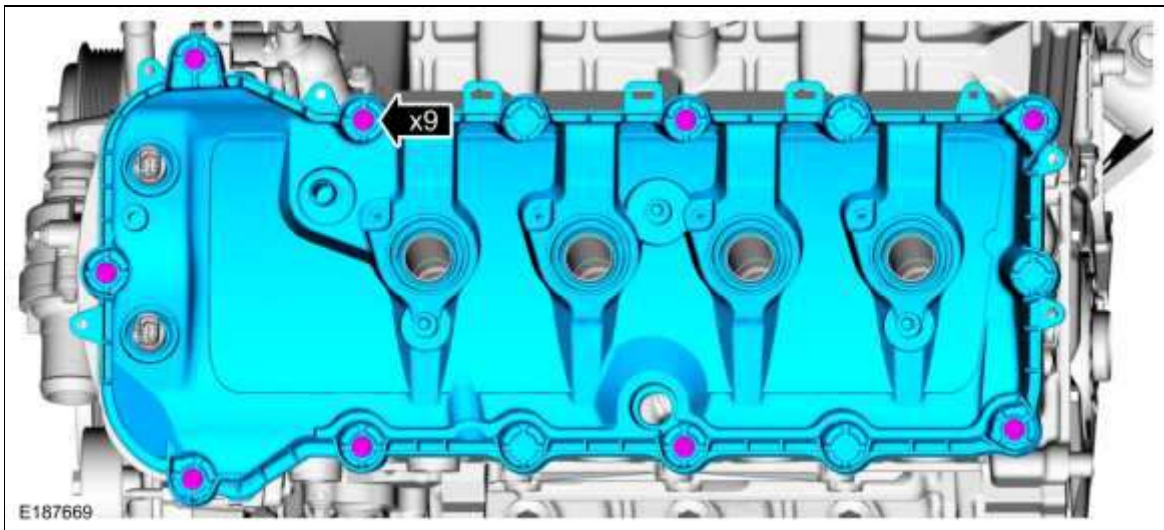
Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)



- 28.
1. Remove the oil level indicator.
 2. Depress the tab.
 3. Rotate the oil level indicator tube counterclockwise.
 4. Pull the oil level indicator tube from the engine.

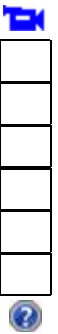
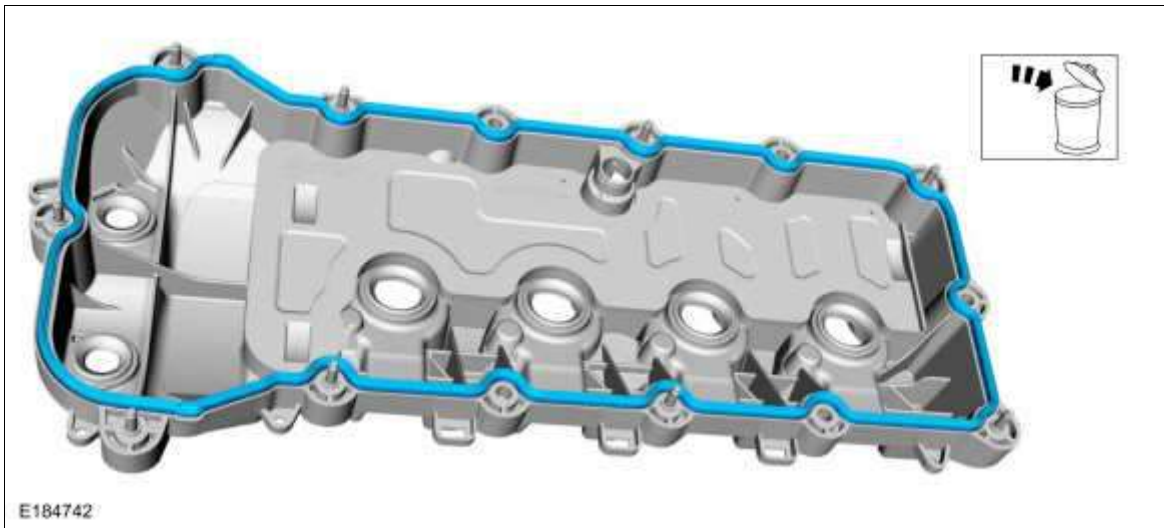


29. Loosen the bolts and remove the LH valve cover.

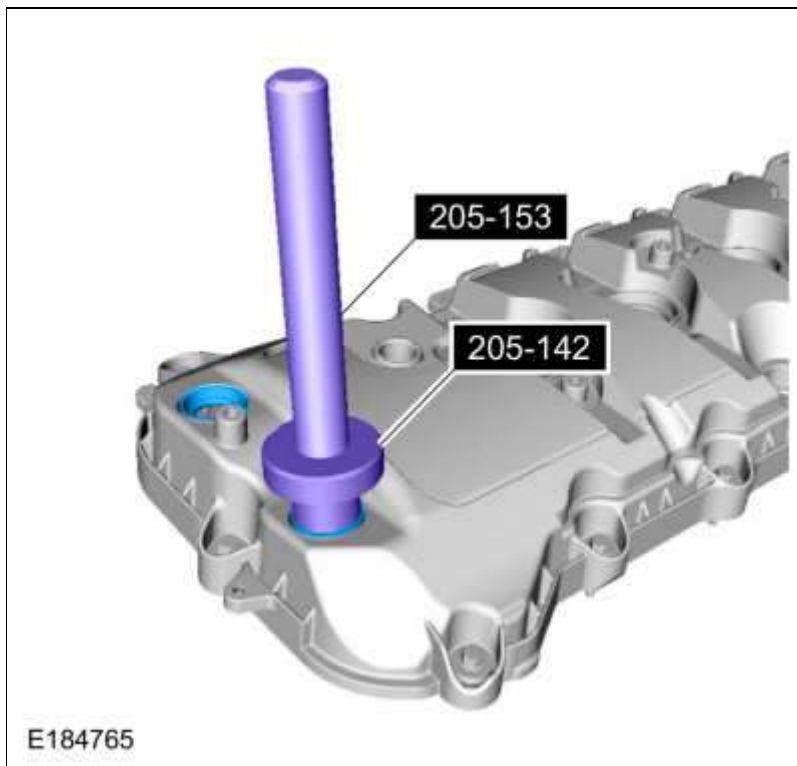


30. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.

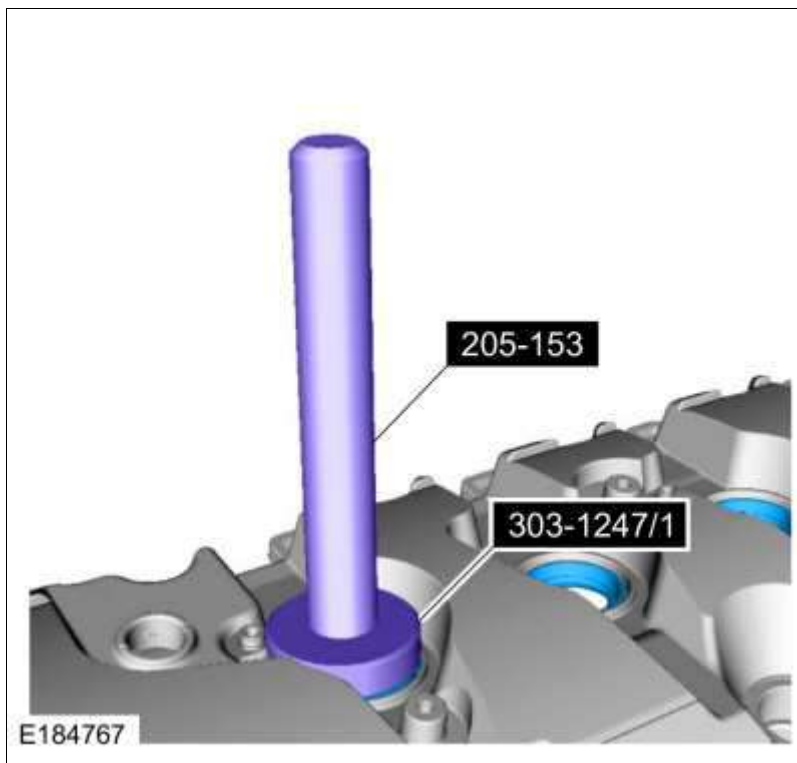
Remove and discard the gasket.



31. Inspect the VCT variable force solenoid seals. Remove any damaged seals using the special tools. Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone.](#)



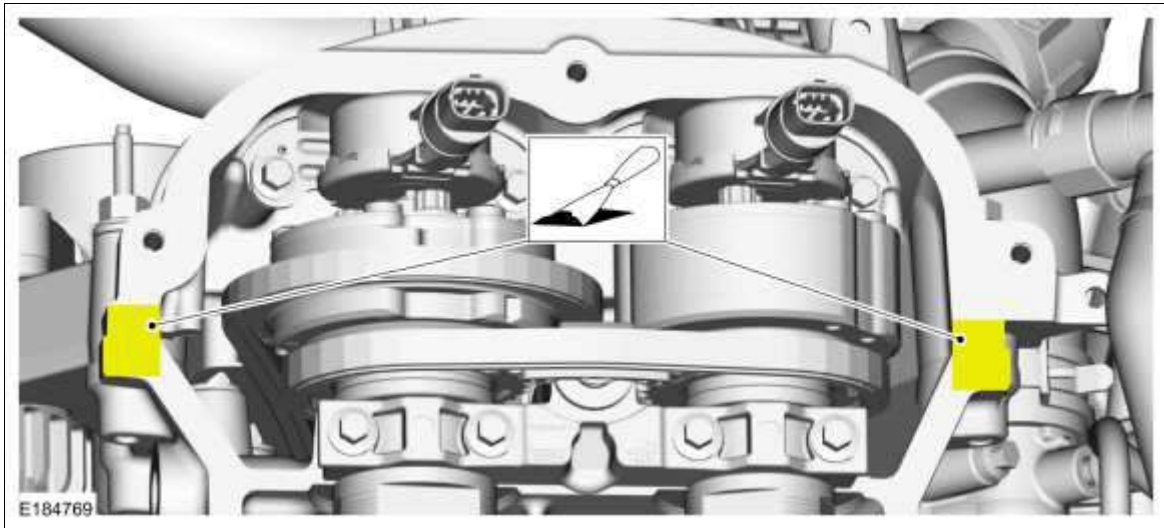
32. Inspect the spark plug seals. Remove any damaged seals using the special tools.
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer](#).



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

Clean the valve cover mating surface of the LH cylinder head and engine front cover.
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper
Material: Motorcraft® Silicone Gasket Remover / ZC-30-A
Material: Motorcraft® Metal Surface Prep / ZC-31-B

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

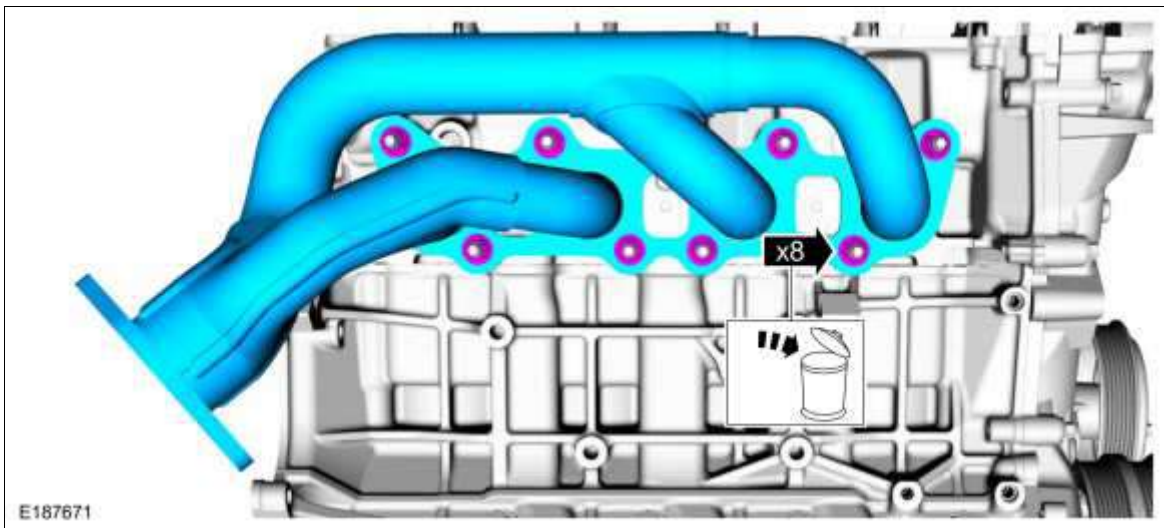


34.

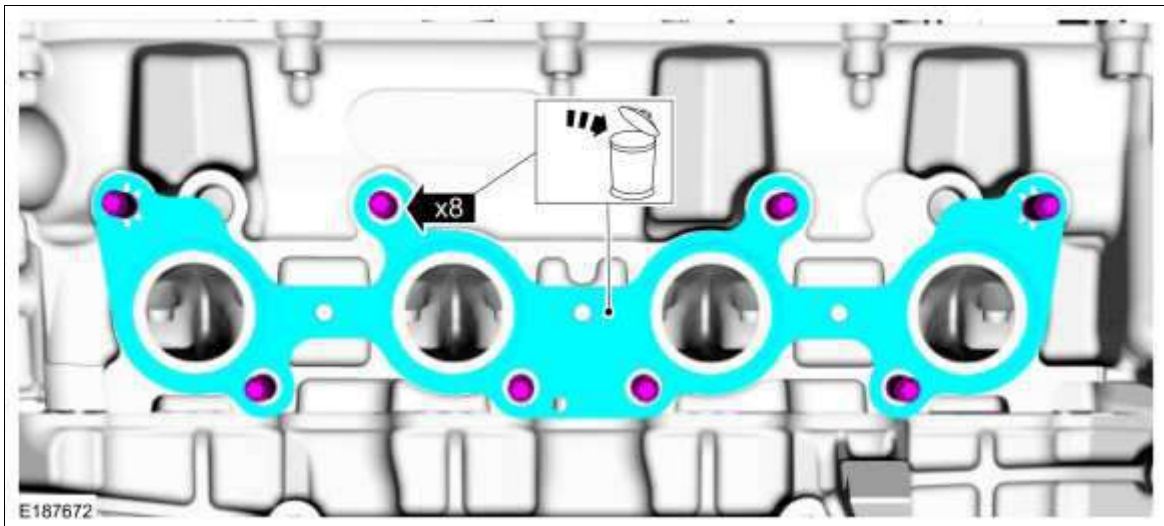
Remove and discard the nuts.

- Remove the exhaust manifold.
- Clean and inspect the exhaust manifold.

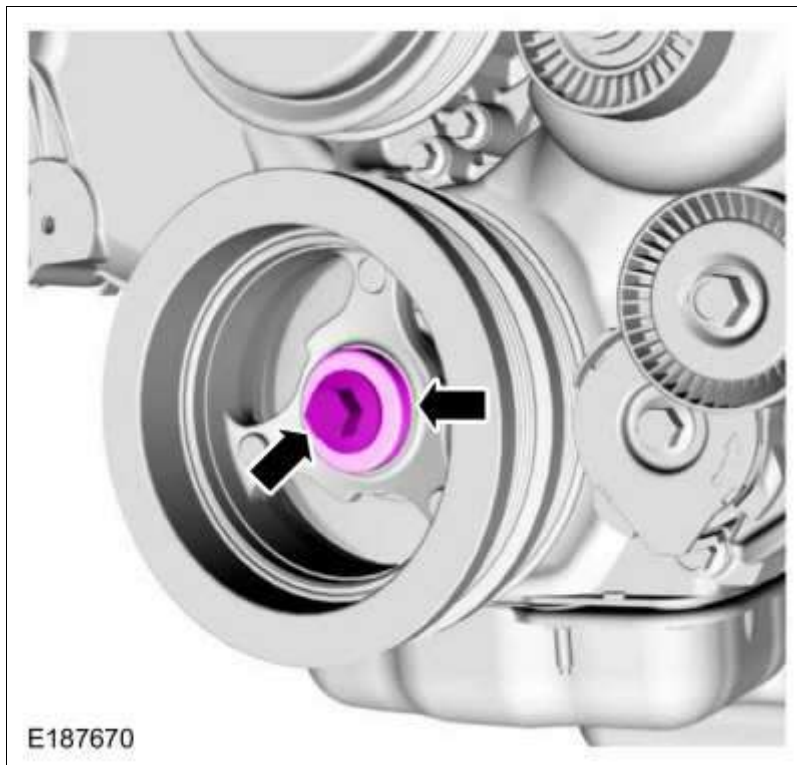
Refer to: [Exhaust Manifold Cleaning and Inspection](#) (303-00 Engine System - General Information, General Procedures).



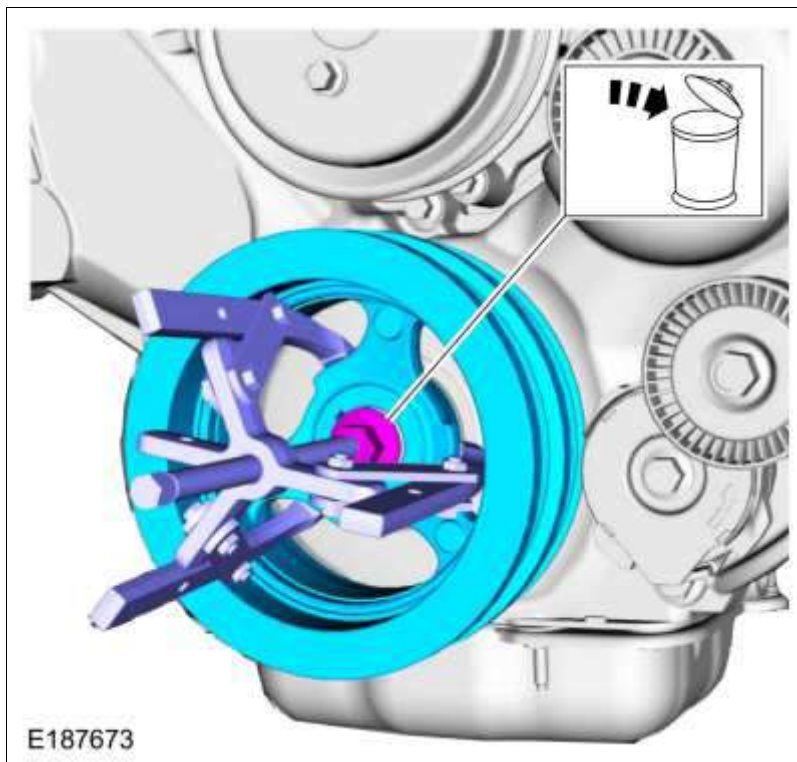
35. Remove and discard the gasket and studs.



36. Remove the crankshaft pulley bolt and washer.



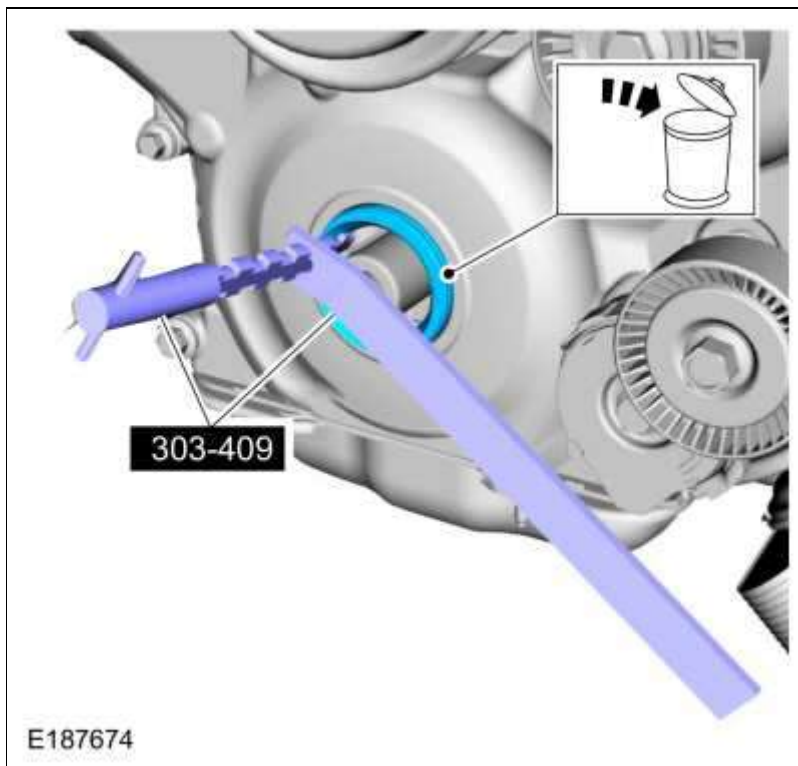
- 37.
- Using the 3 Leg Puller and the crankshaft pulley bolt, remove the crankshaft pulley. Use the General Equipment: Three Leg Puller
 - Discard the crankshaft pulley bolt.



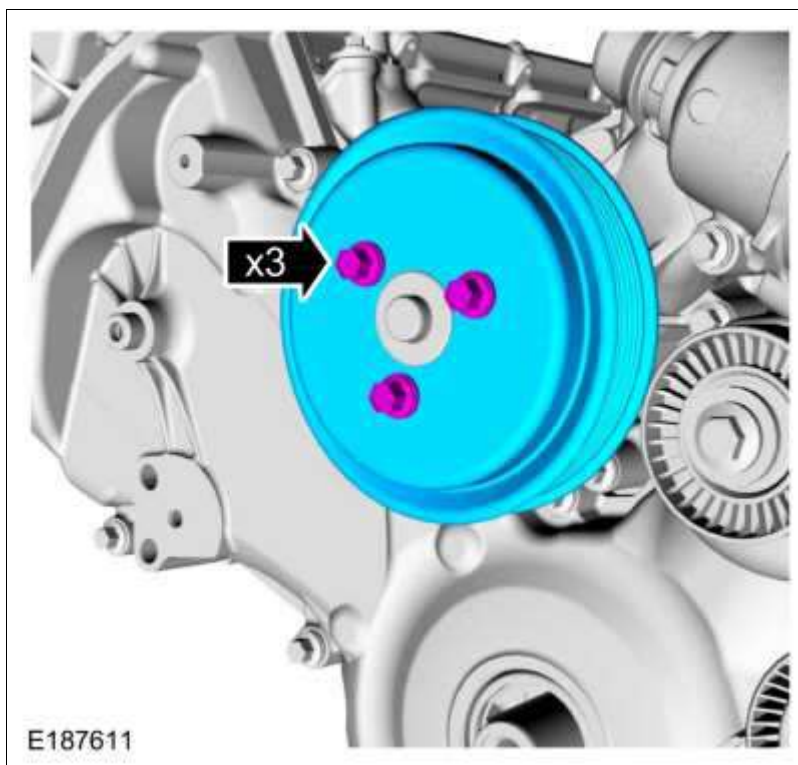
38. **NOTICE:** Use care not to damage the engine front cover or the crankshaft when removing the seal.

Using the special tool, remove and discard the crankshaft front oil seal.

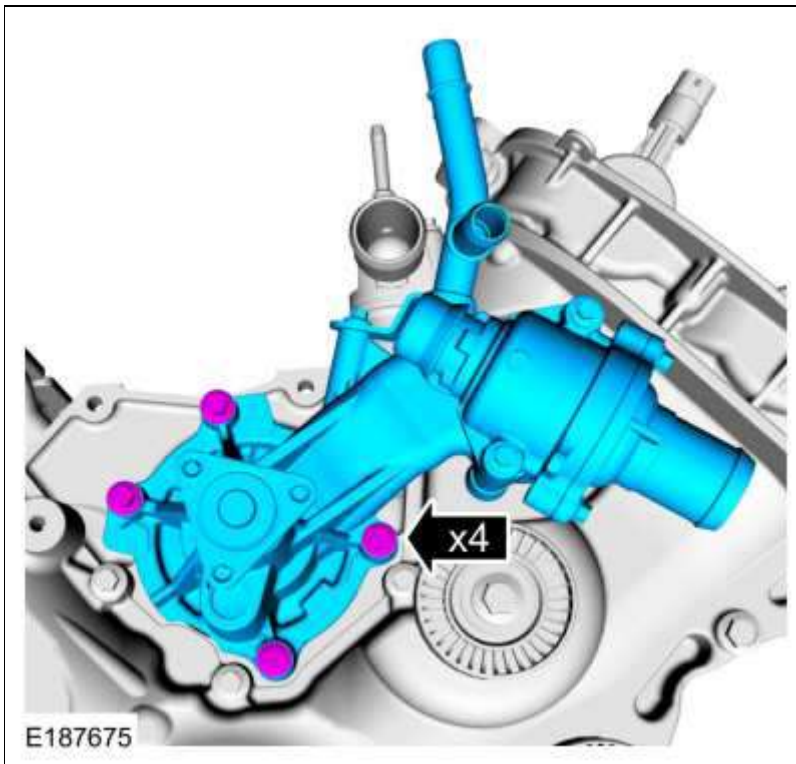
Use Special Service Tool: [303-409 \(T92C-6700-CH\) Remover, Crankshaft Seal](#).



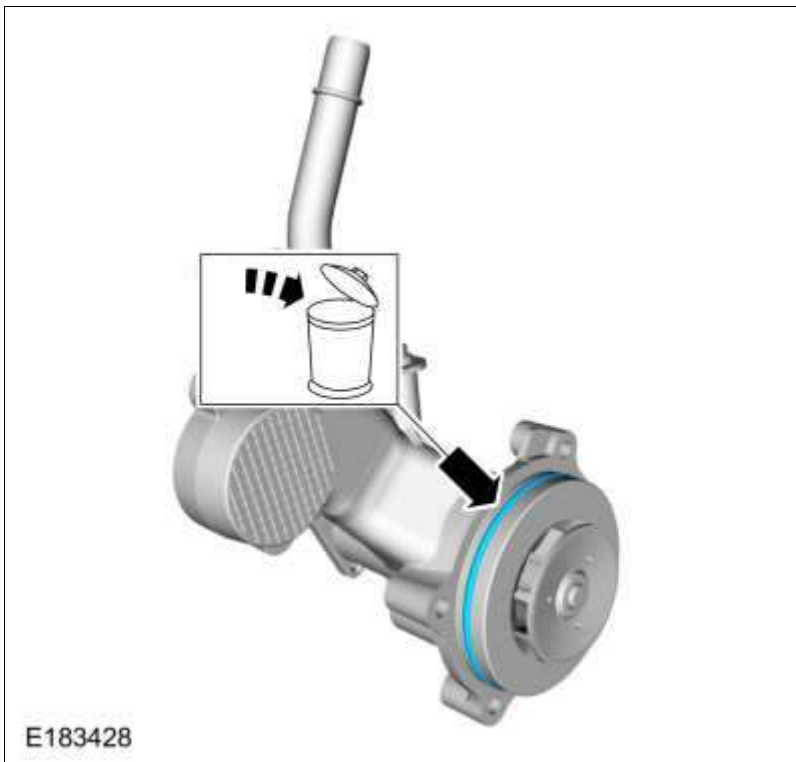
39. Remove the bolts and the coolant pump pulley.



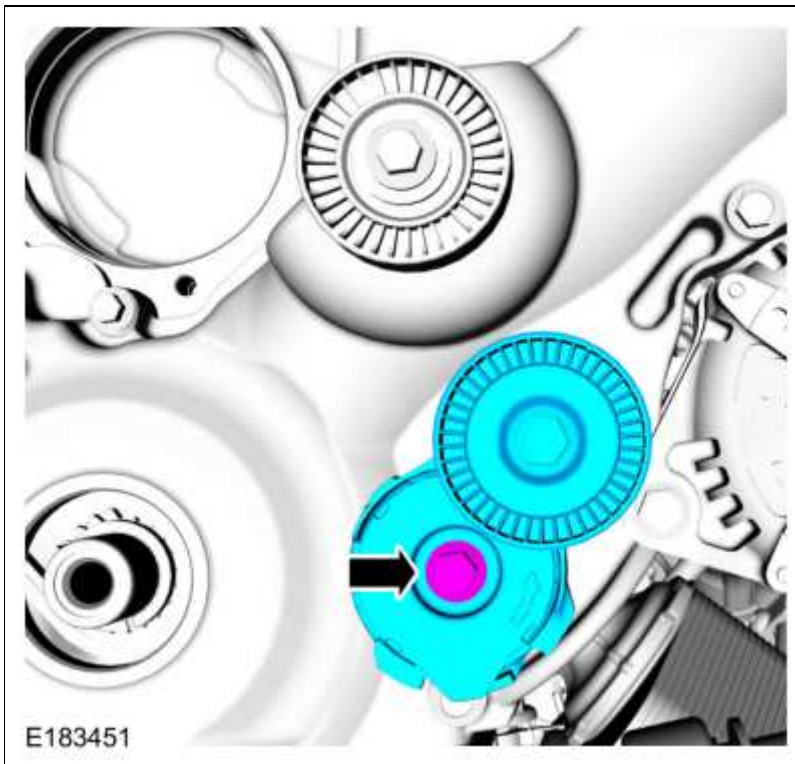
40. Remove the bolts and the coolant pump.



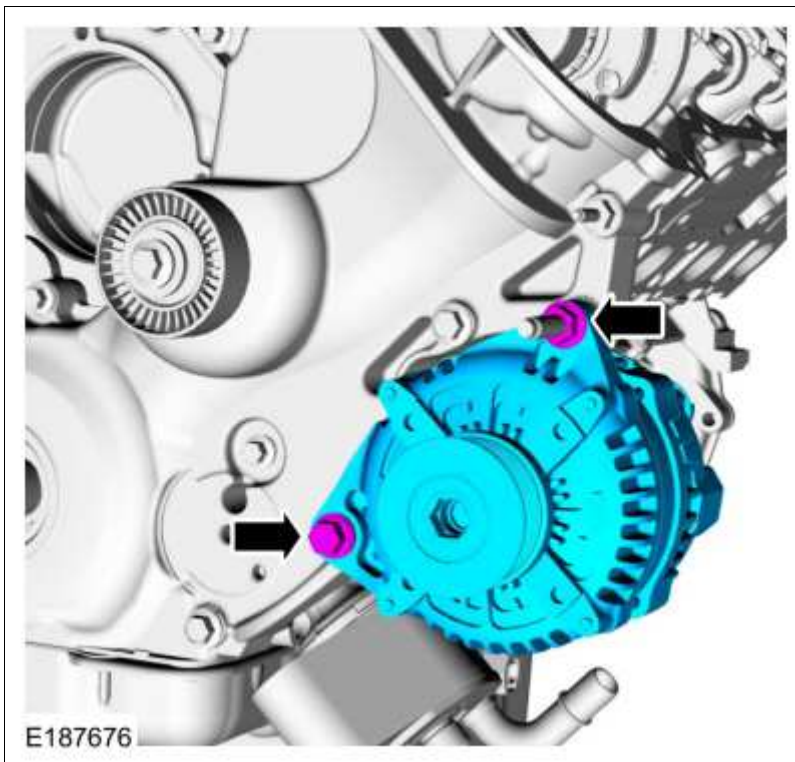
41. Remove and discard the coolant pump O-ring seal.



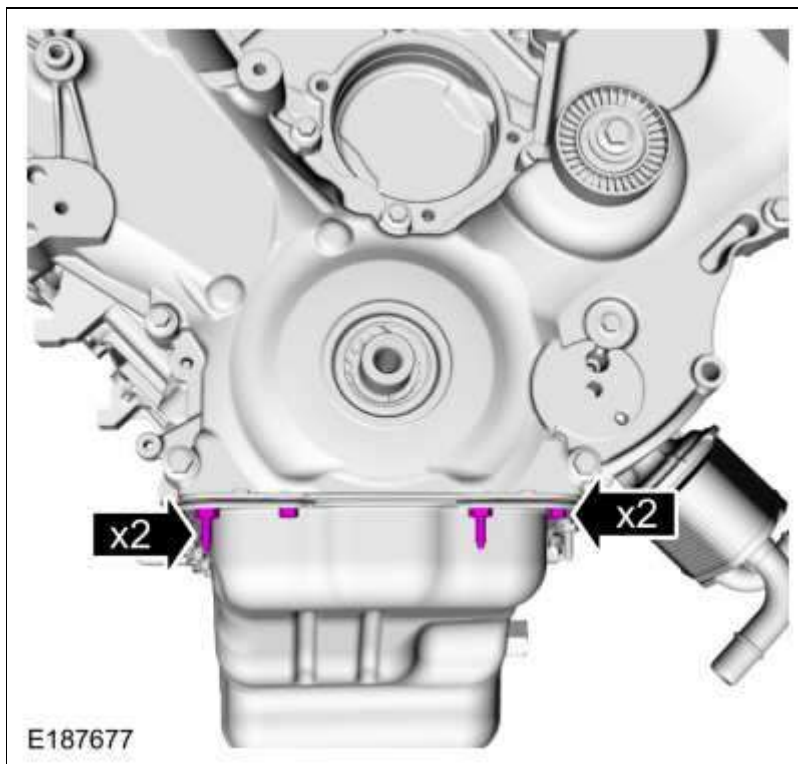
42. Remove the bolt and the accessory drive belt tensioner.



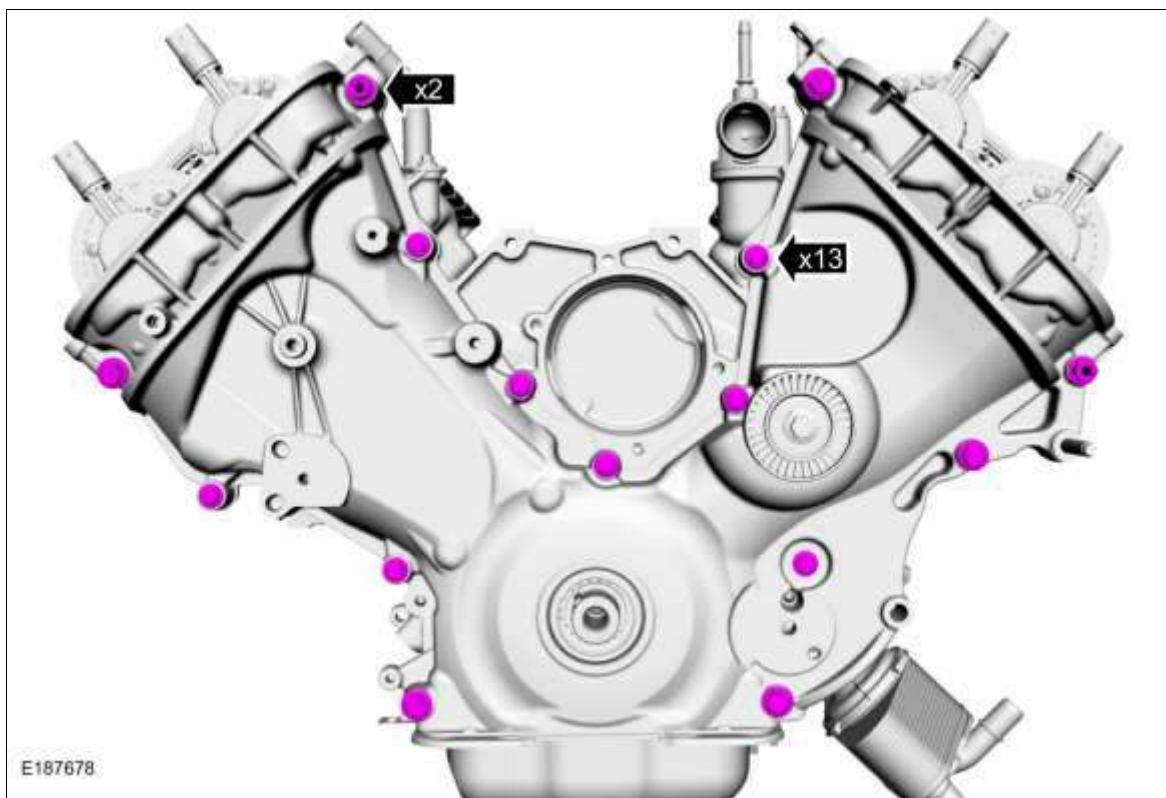
43. Remove the nut, the bolt and the generator.



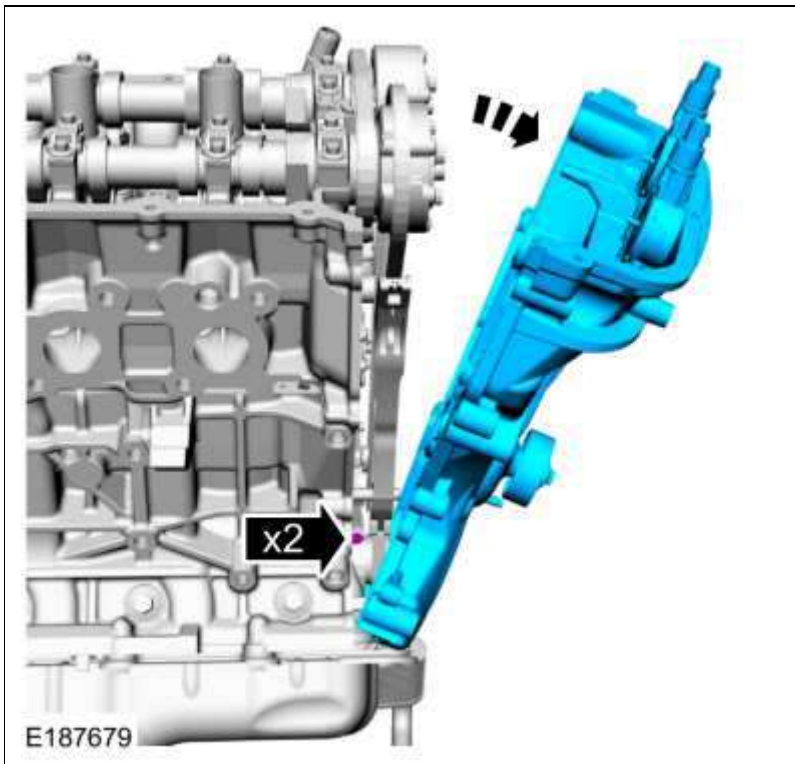
44. Remove the bolts and stud bolts.



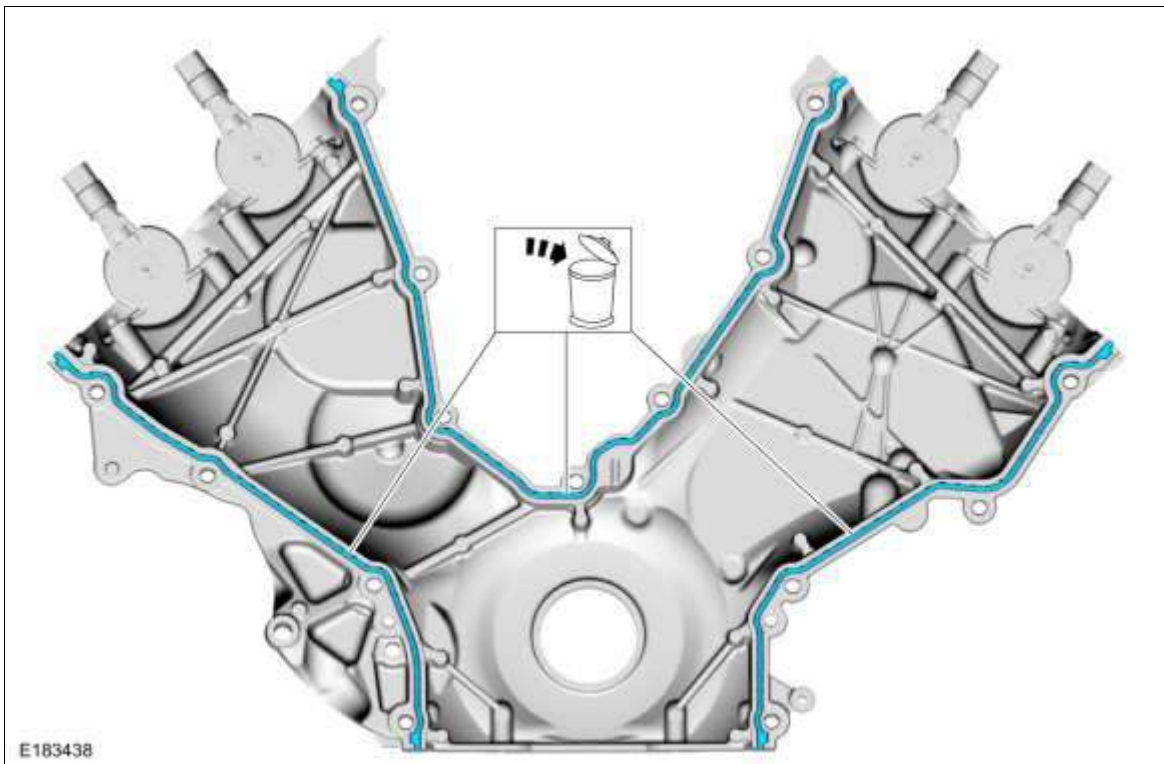
45. Remove the bolts and stud bolts.



46. Remove the engine front cover from the front cover to cylinder block dowels.



47. Remove and discard the gaskets.



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

Clean and inspect the mating surface.

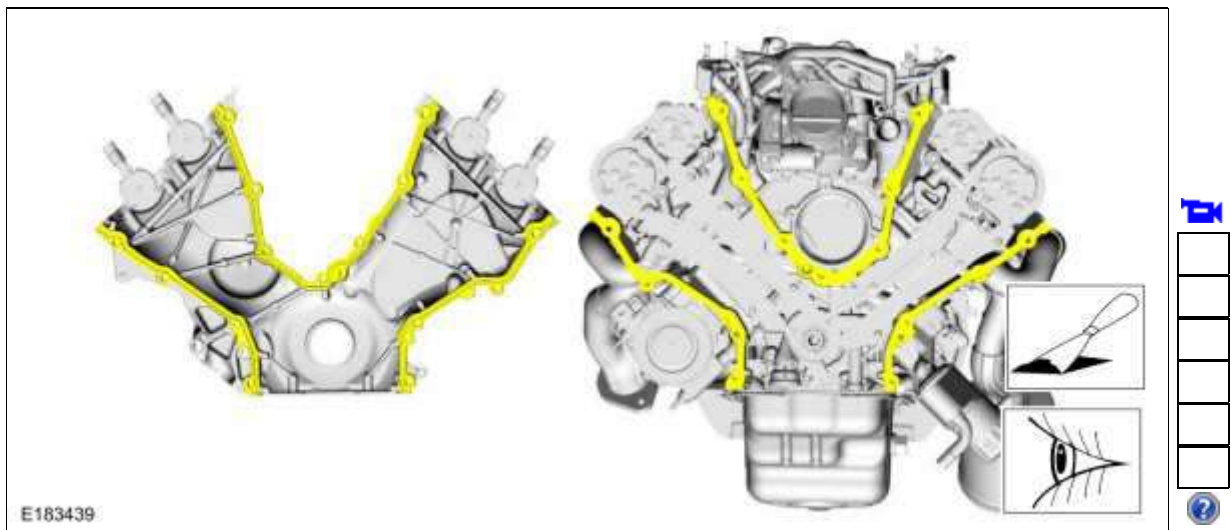
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

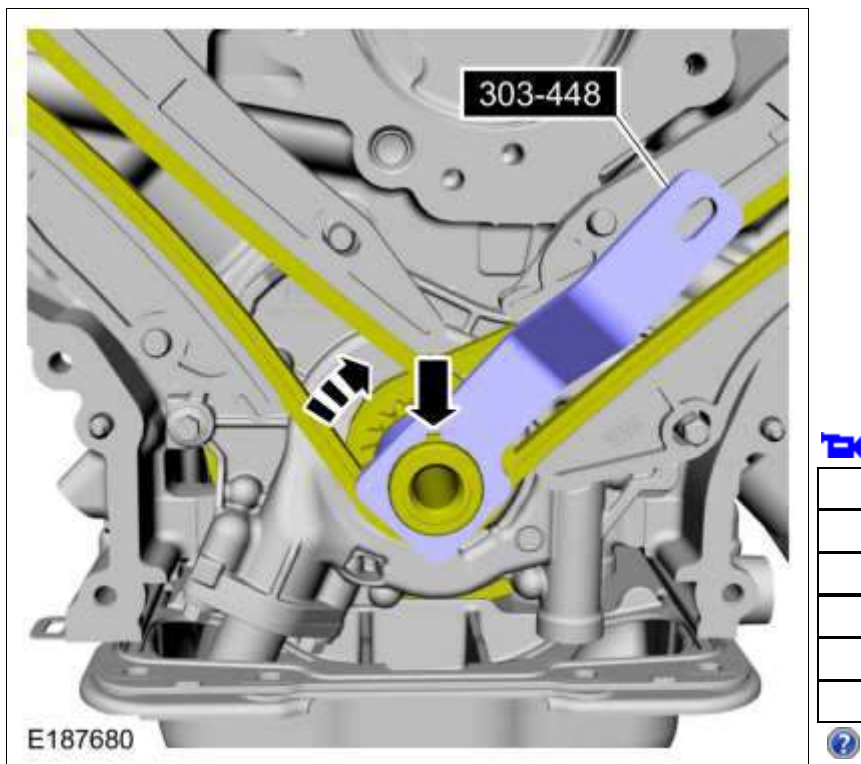
Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

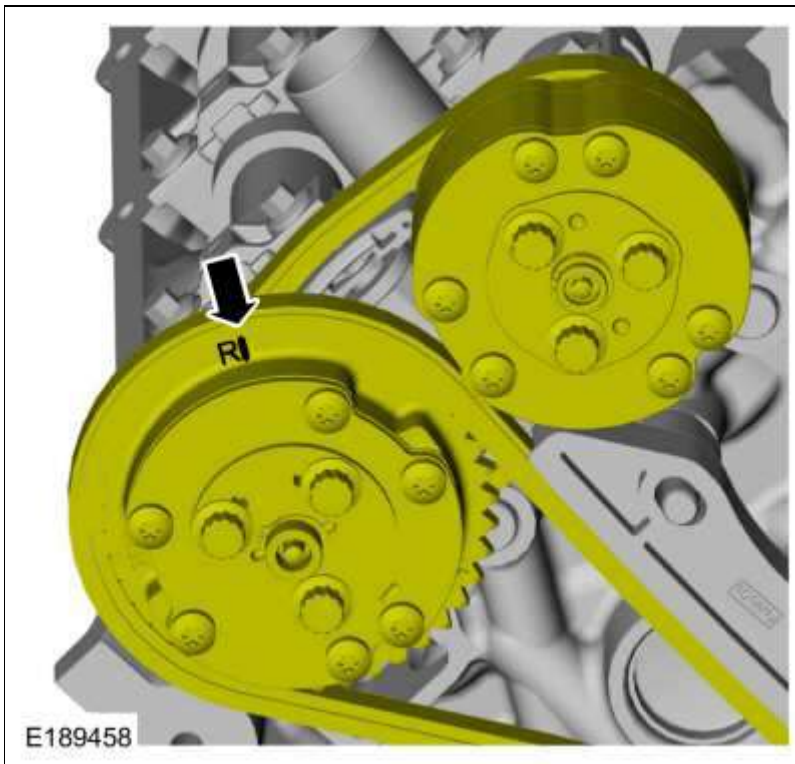
Material: Motorcraft® Metal Surface Prep / ZC-31-B



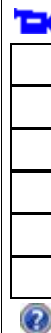
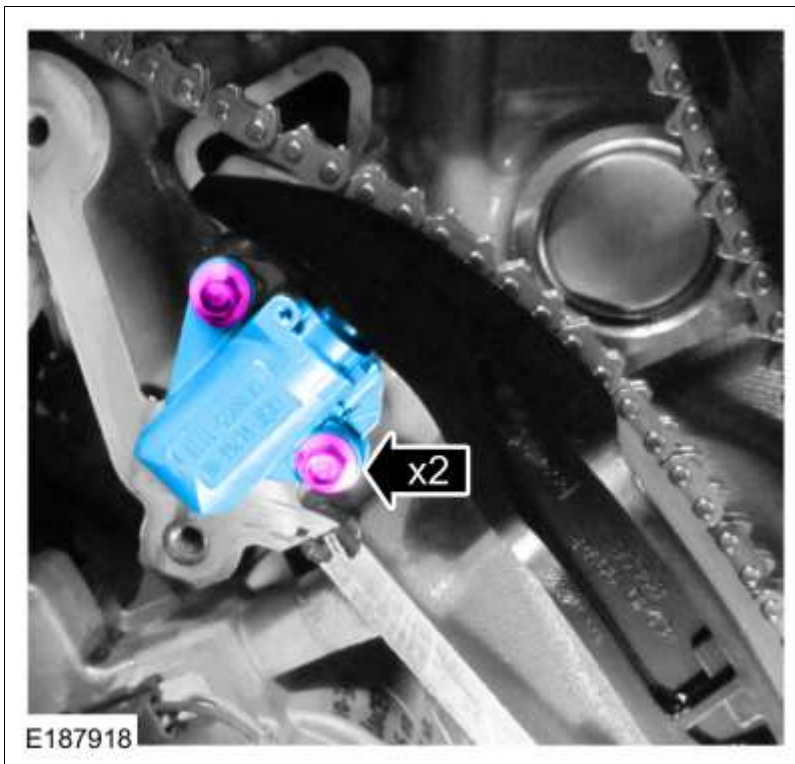
49. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 12 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



50. Verify the timing mark on the RH VCT unit is on top, if not, rotate the crankshaft clockwise one complete revolution so the keyway is at the 12 o'clock position.

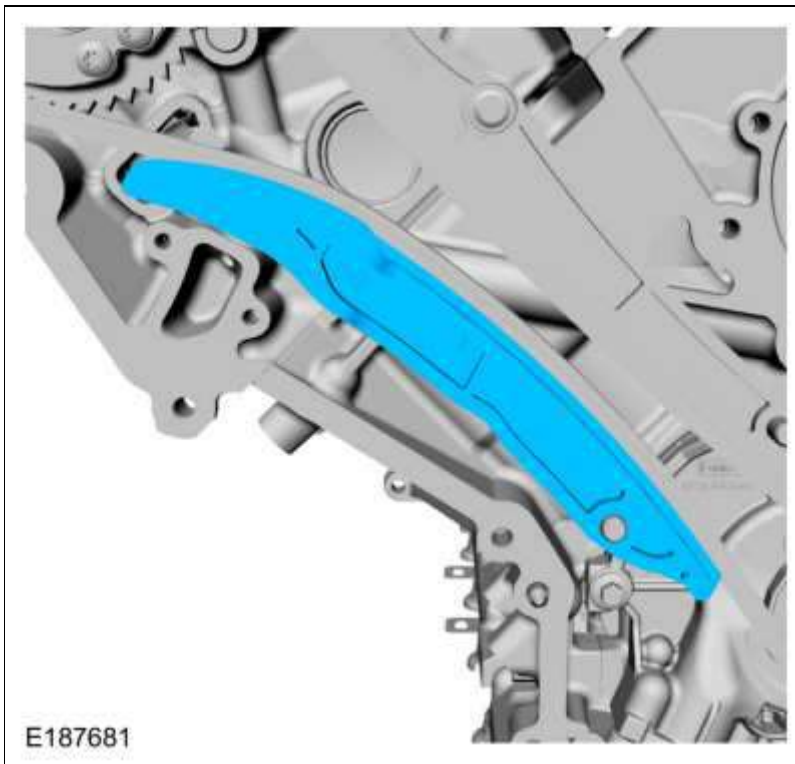


51. Remove the bolts and the RH primary timing chain tensioner.



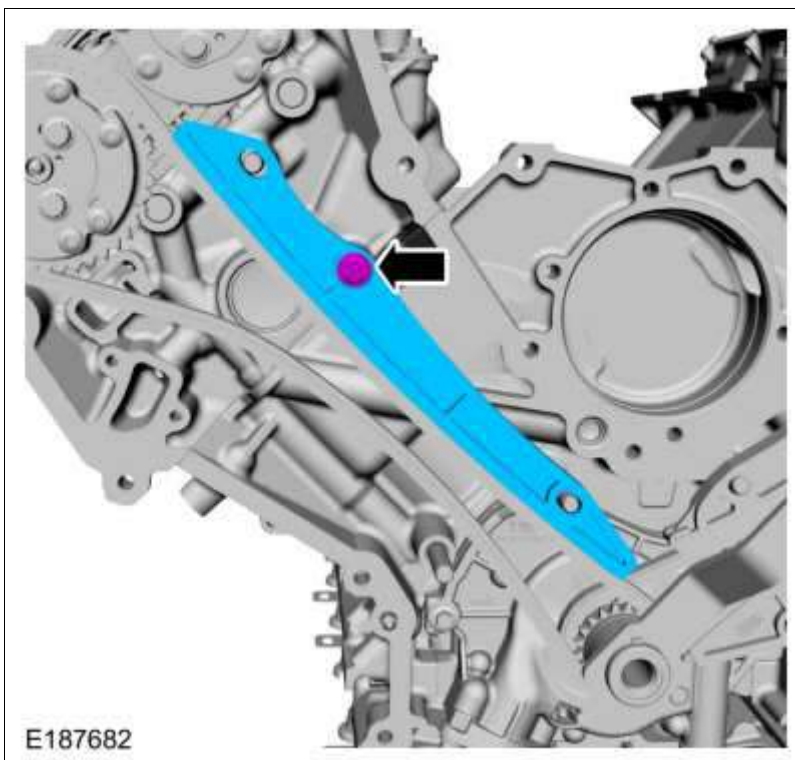
52. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain tensioner arm. Return the crankshaft keyway to the 12 o'clock position after removing the RH timing chain tensioner arm.

Remove the RH timing chain tensioner arm.

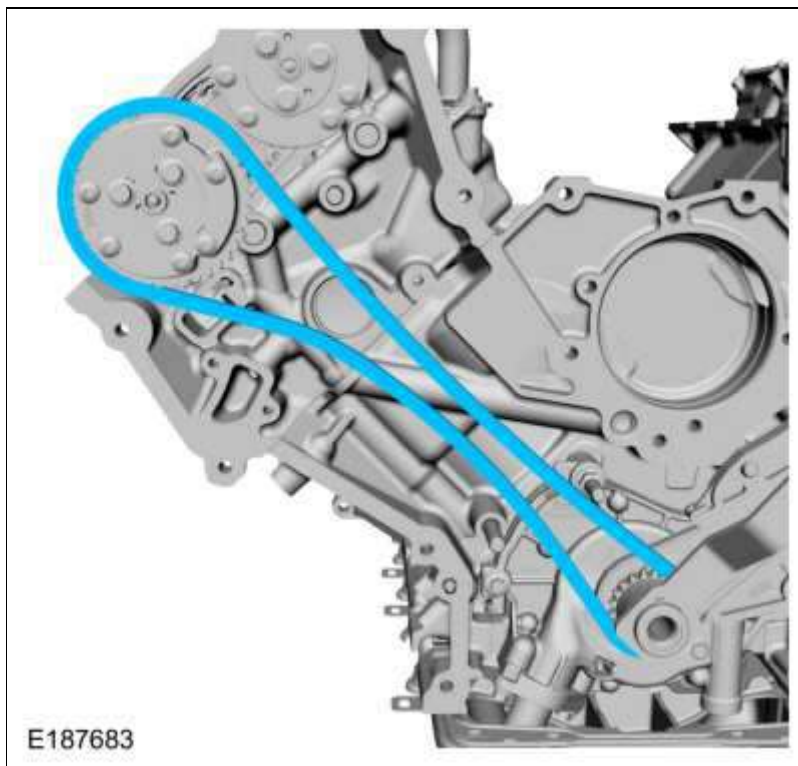


53. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain guide. Return the crankshaft keyway to the 12 o'clock position after removing the RH timing chain guide.

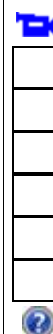
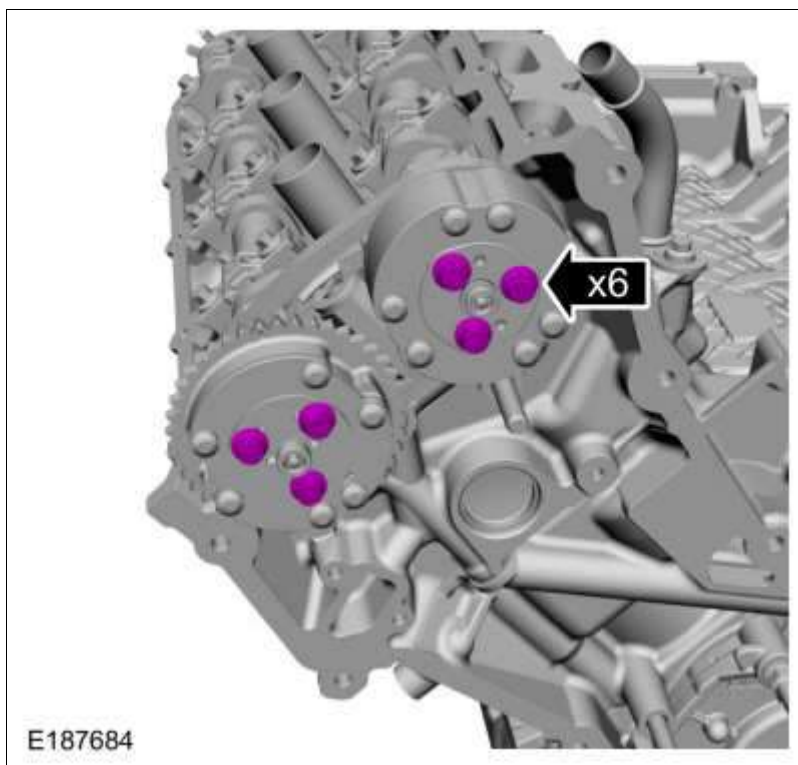
Remove the bolt and the RH timing chain guide.



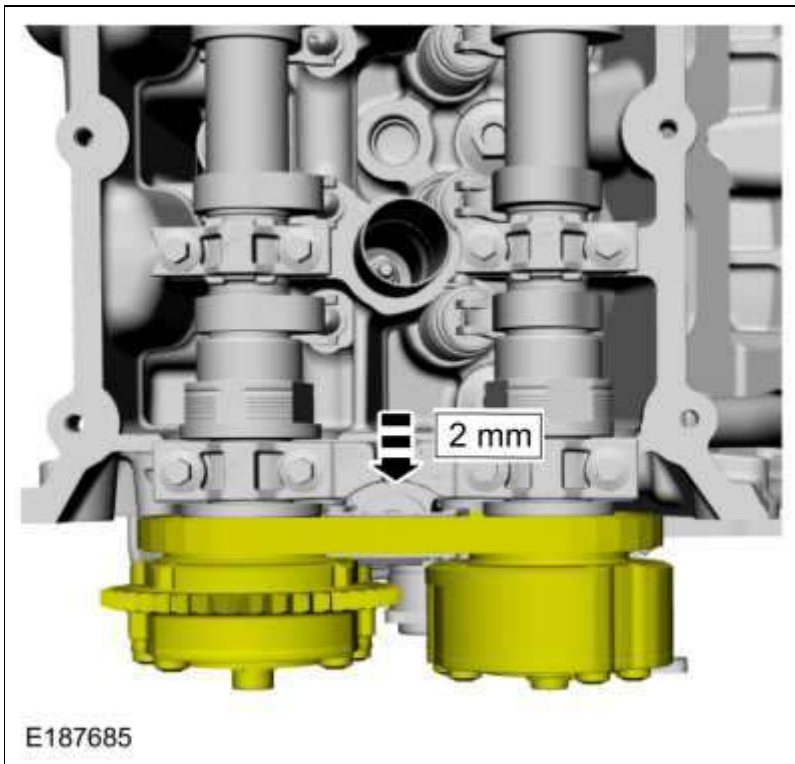
54. Remove the RH timing chain.



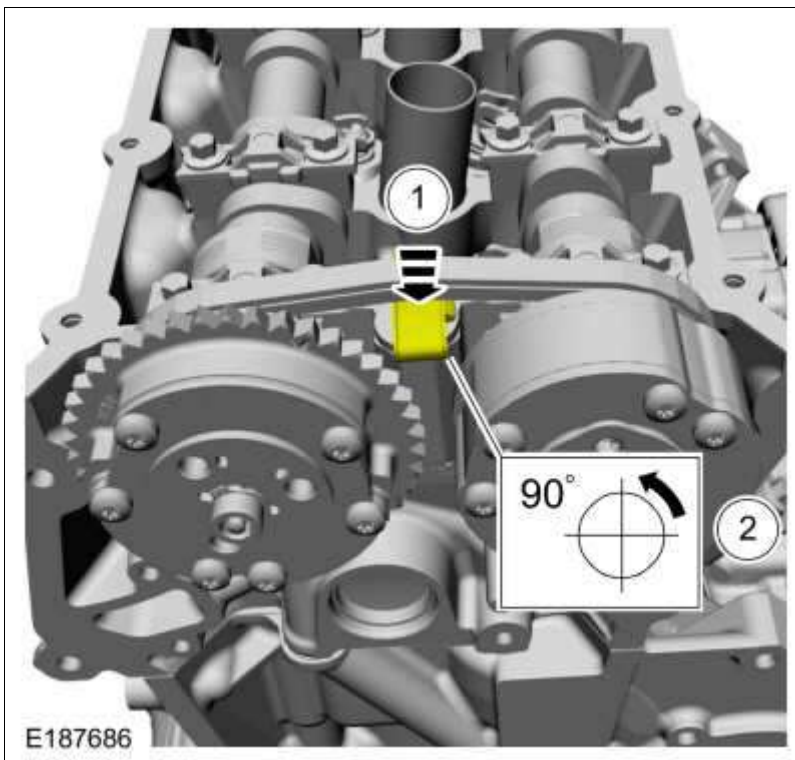
55. Remove the intake and exhaust VCT assembly bolts.



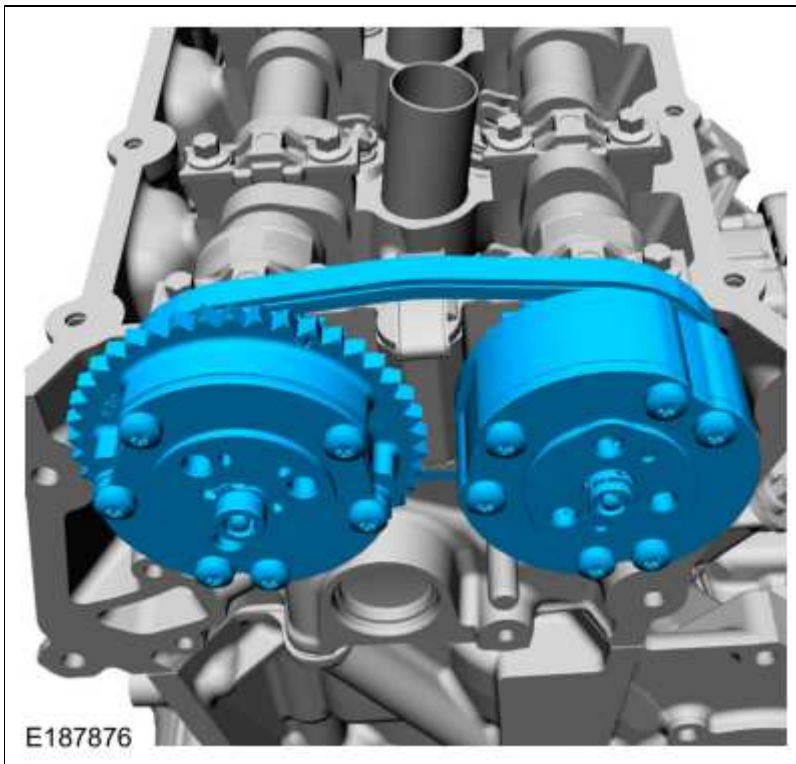
56. Slide the VCT assemblies and secondary timing chain forward 2 mm (0.078 in).



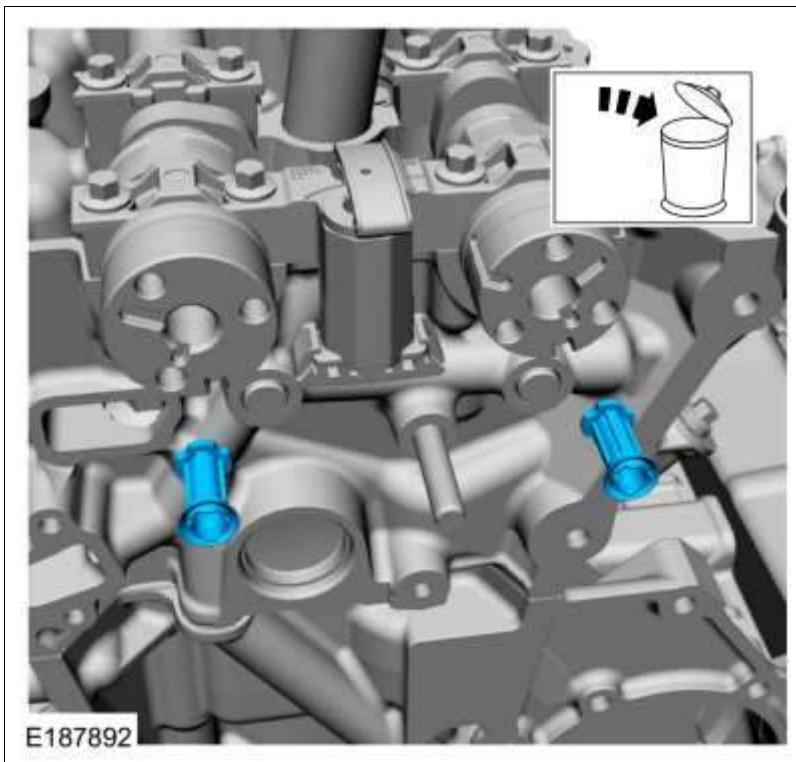
57. 1. Depress the secondary timing chain tensioner.
2. Turn the tensioner counterclockwise 90 degrees.



58. Remove the VCT assemblies and the secondary timing chain.

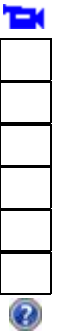
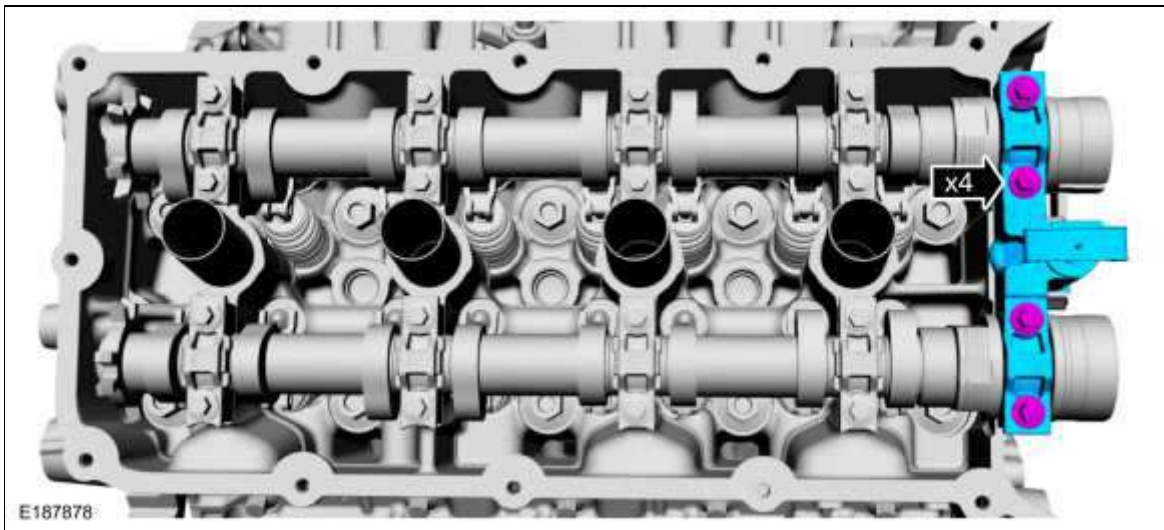


59. Remove and discard the VCT system oil filters.

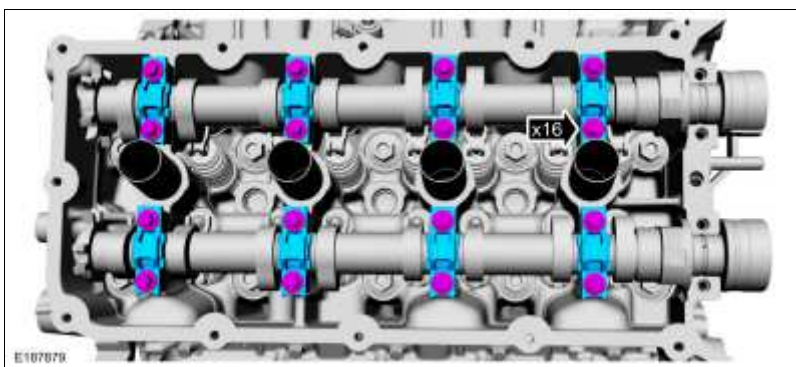


60. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

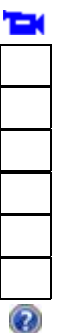
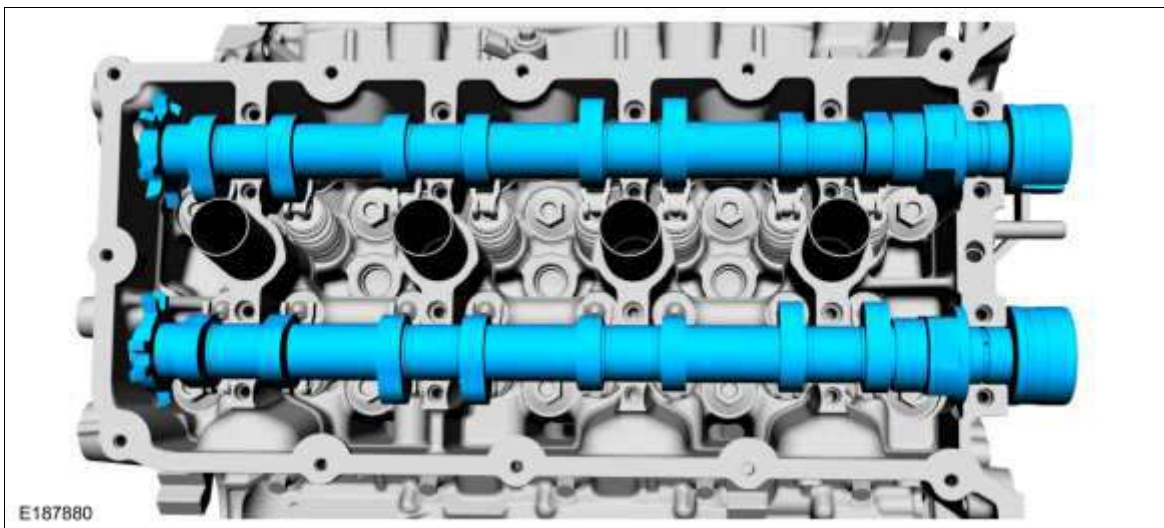
Remove the bolts and the front camshaft bearing mega cap.



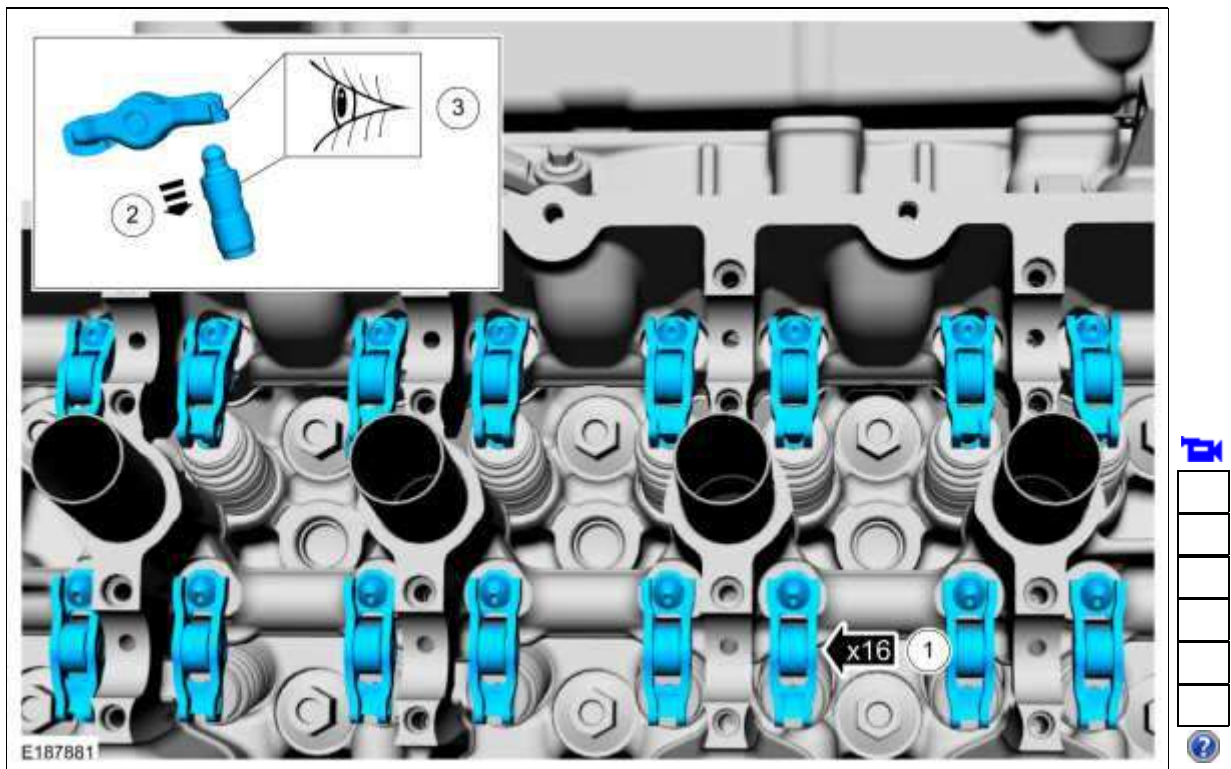
61. Remove the bolts and the camshaft bearing caps.



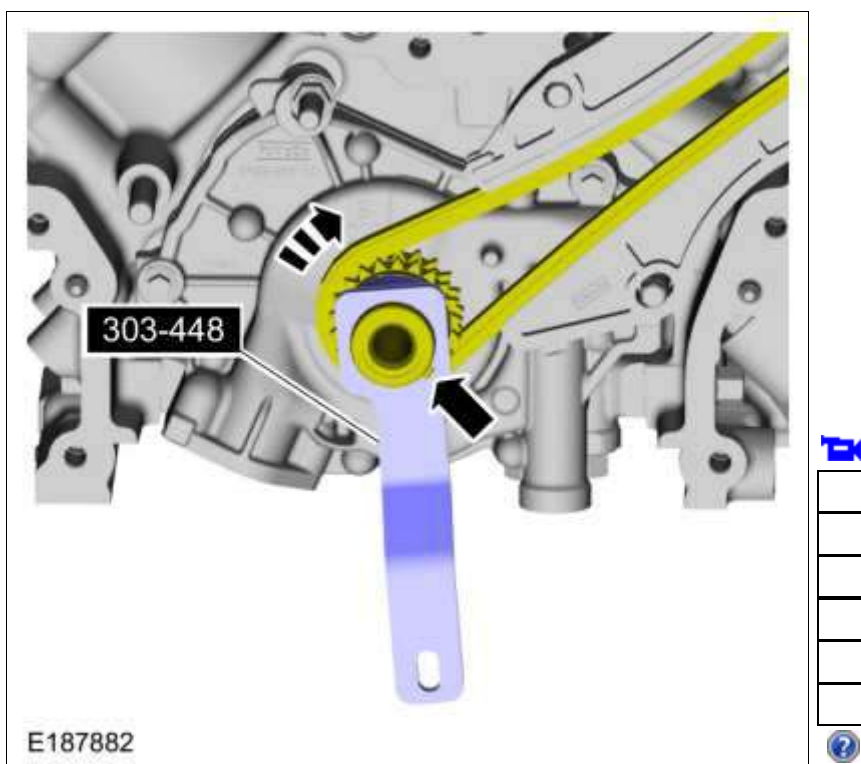
62. Remove the intake and exhaust camshafts.



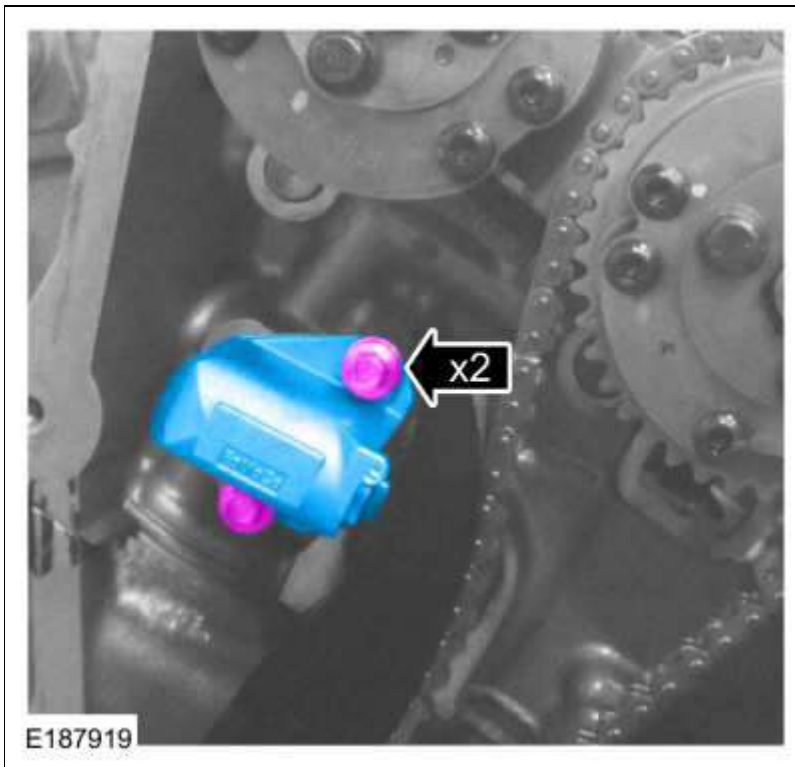
- 63.
- Remove the camshaft roller follower and hydraulic lash adjuster assemblies.
 - Separate the hydraulic lash adjusters from the spring clips on the camshaft roller followers.
 - Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage. Replace damaged components as necessary.



64. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 5 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).

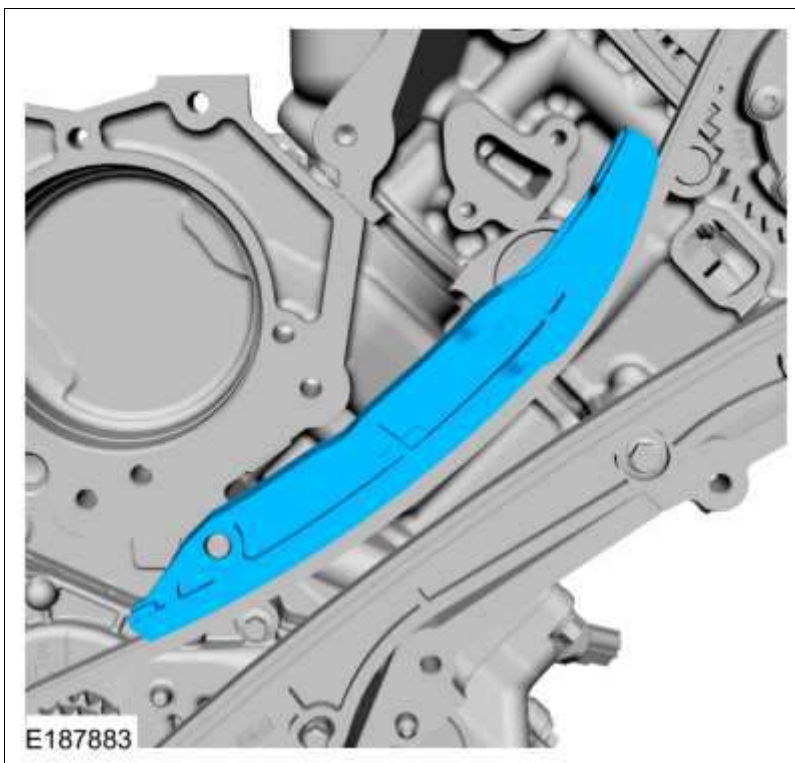


65. Remove the bolts and the LH primary timing chain tensioner.



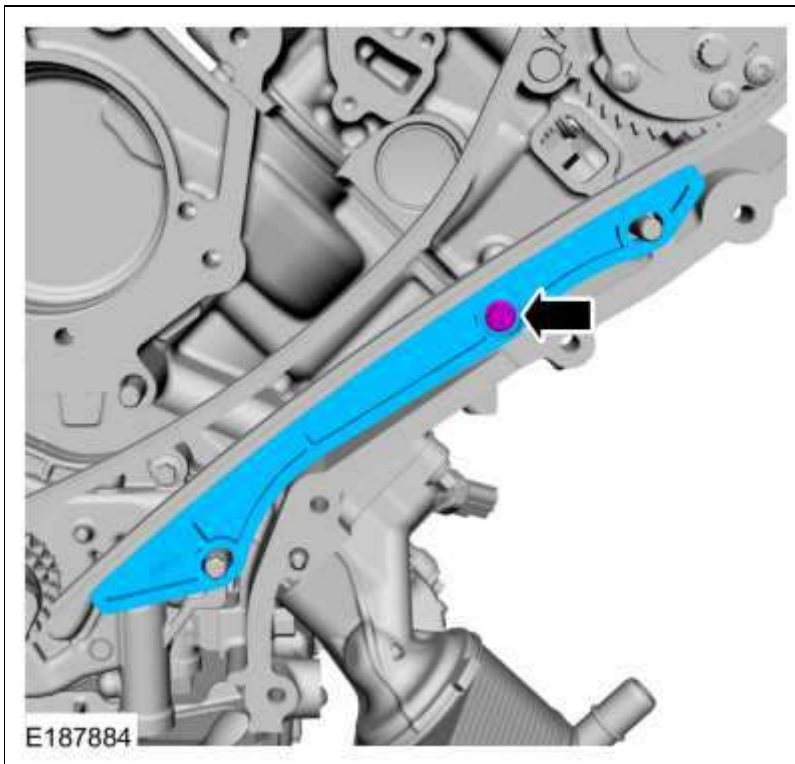
66. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain tensioner arm. Return the crankshaft keyway to the 5 o'clock position after removing the LH timing chain tensioner arm.

Remove the LH timing chain tensioner arm.

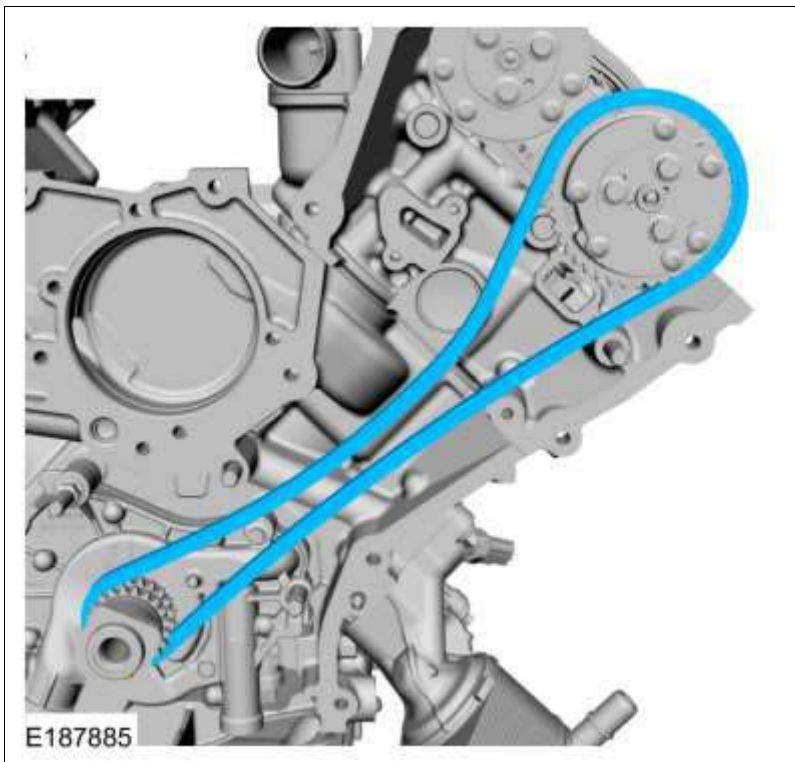


67. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain guide. Return the crankshaft keyway to the 5 o'clock position after removing the LH timing chain guide.

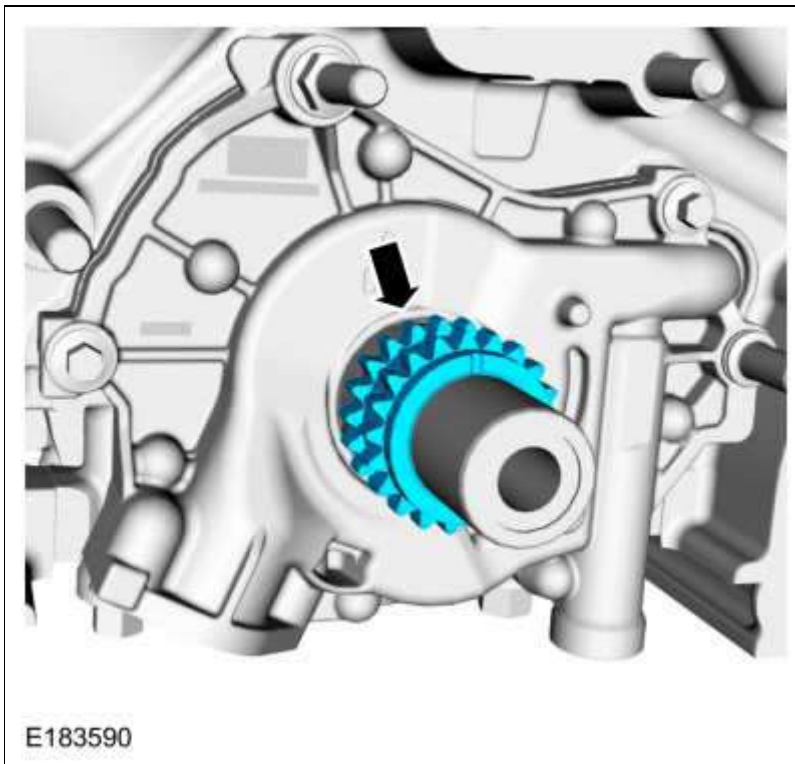
Remove the bolt and the LH timing chain guide.



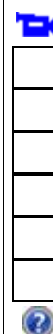
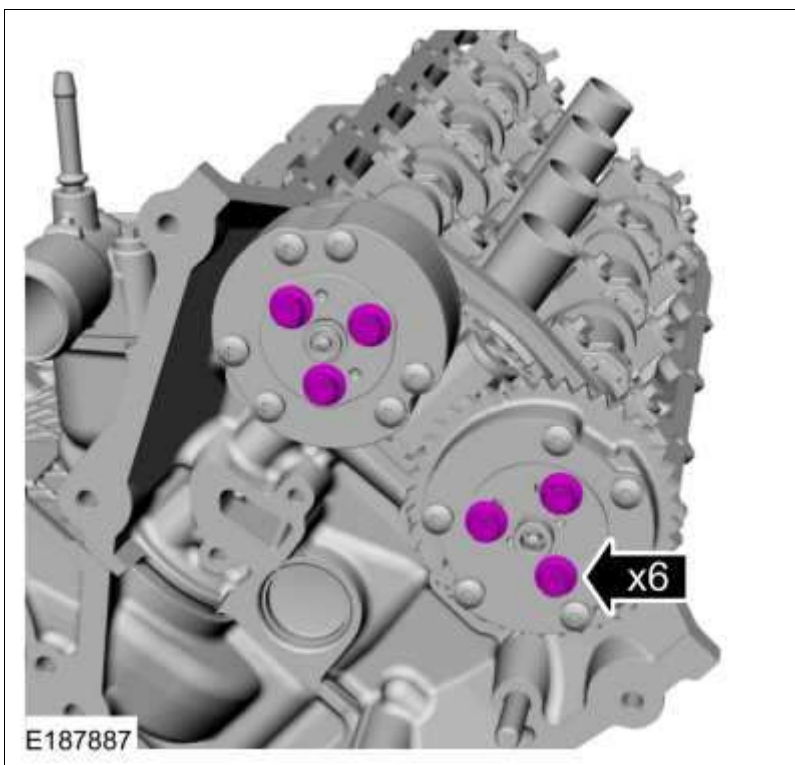
68. Remove the LH timing chain.



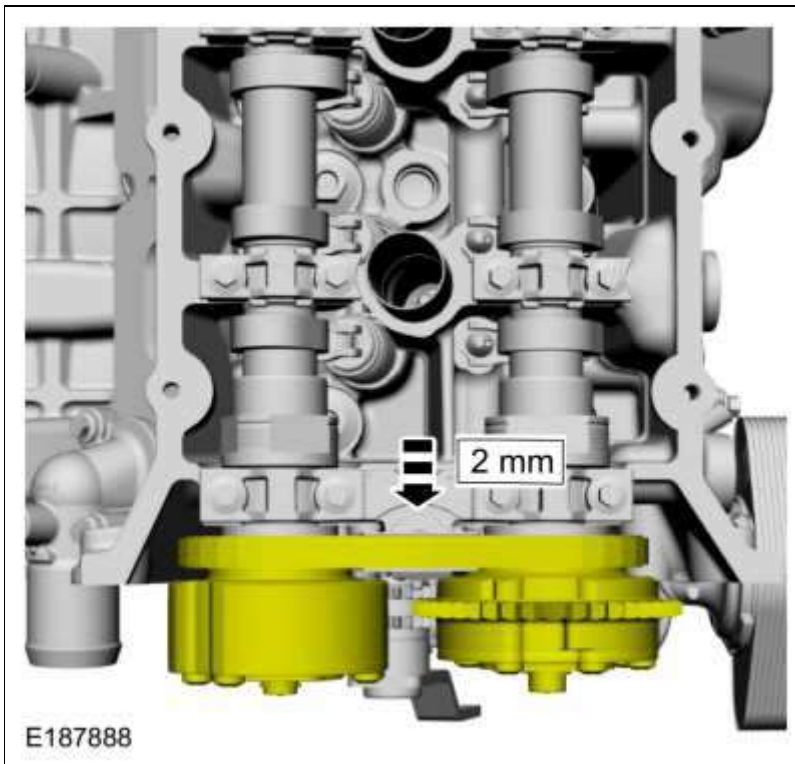
69. Remove the crankshaft sprocket.



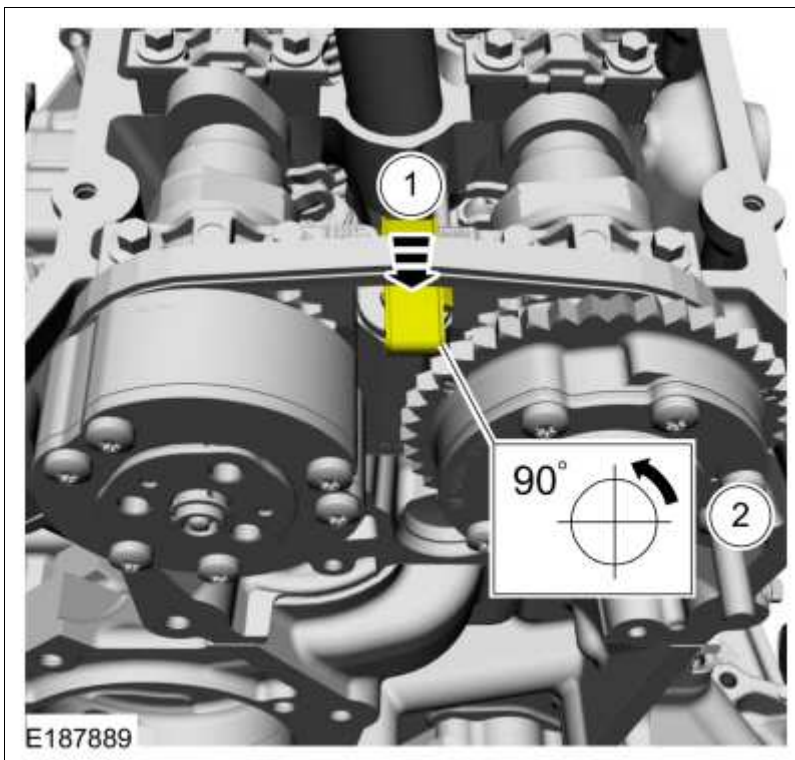
70. Remove the intake and exhaust VCT assembly bolts.



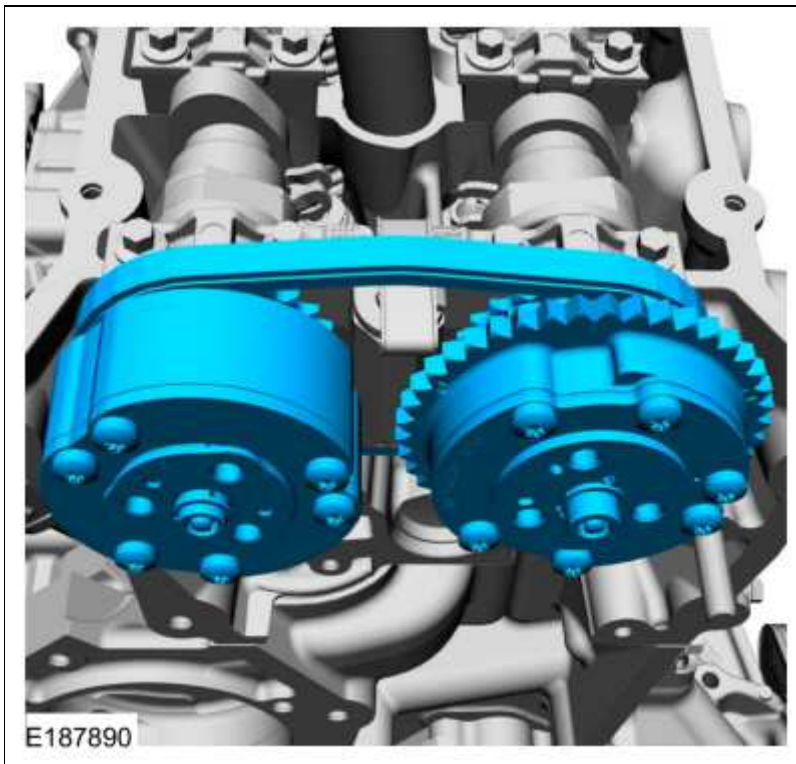
71. Slide the Variable Camshaft Timing VCT assemblies and secondary timing chain forward 2 mm (0.078 in).



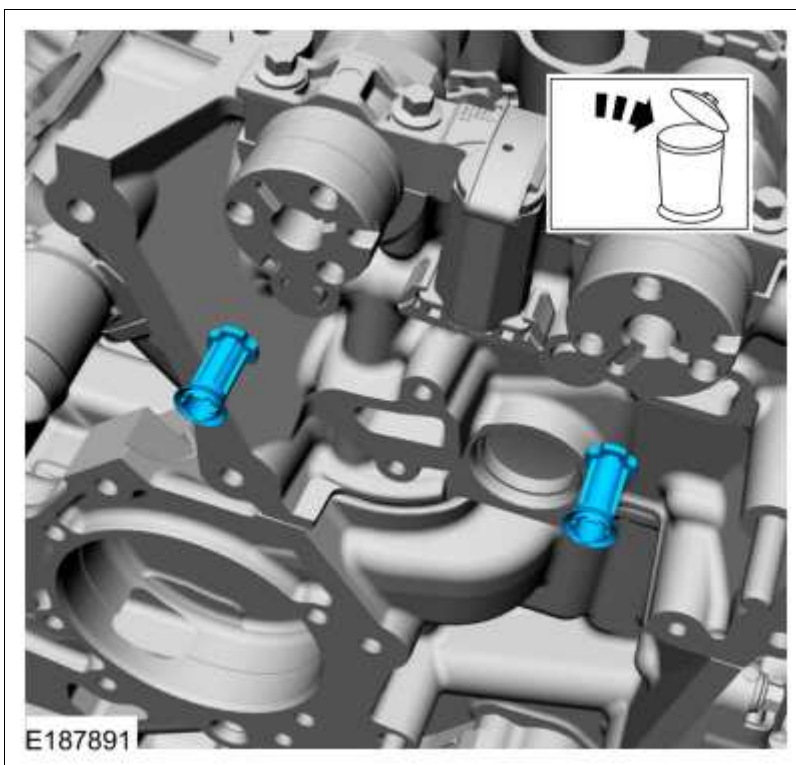
72. 1. Depress the secondary timing chain tensioner.
2. Turn the tensioner counterclockwise 90 degrees.



73. Remove the VCT assemblies and the secondary timing chain.

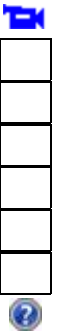
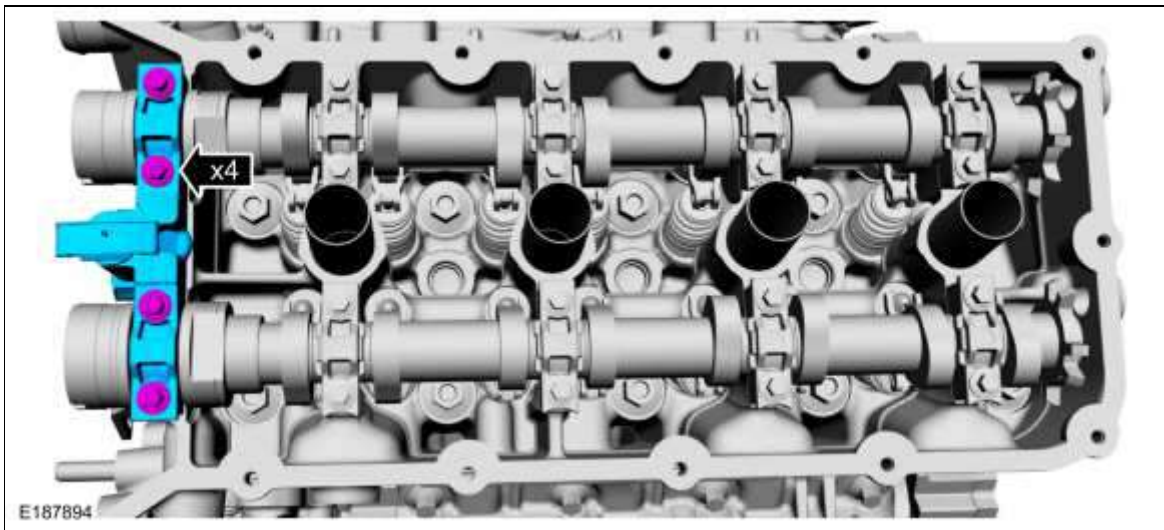


74. Remove and discard the VCT system oil filters.

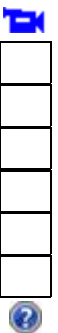
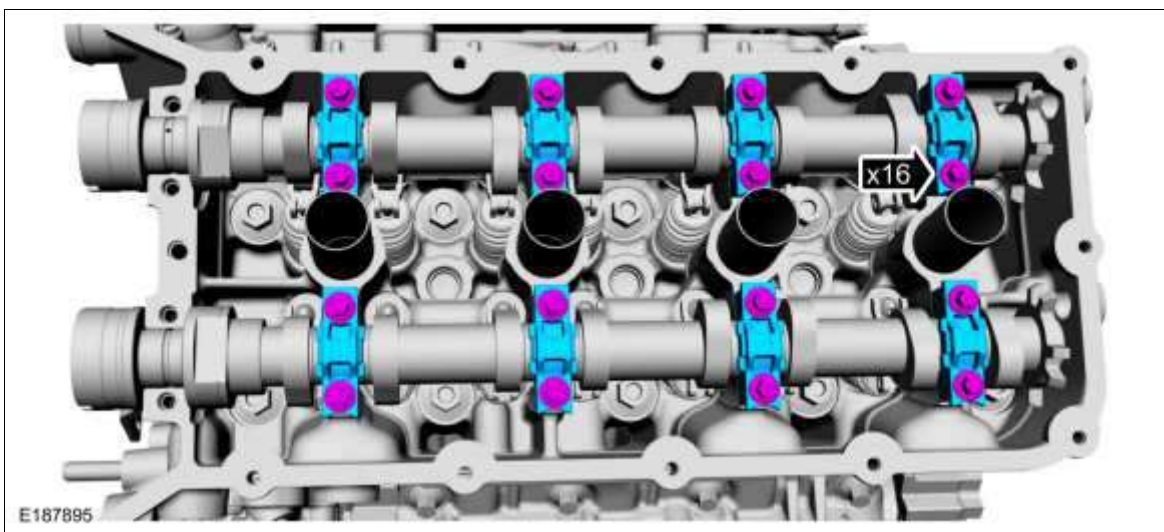


75. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

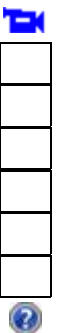
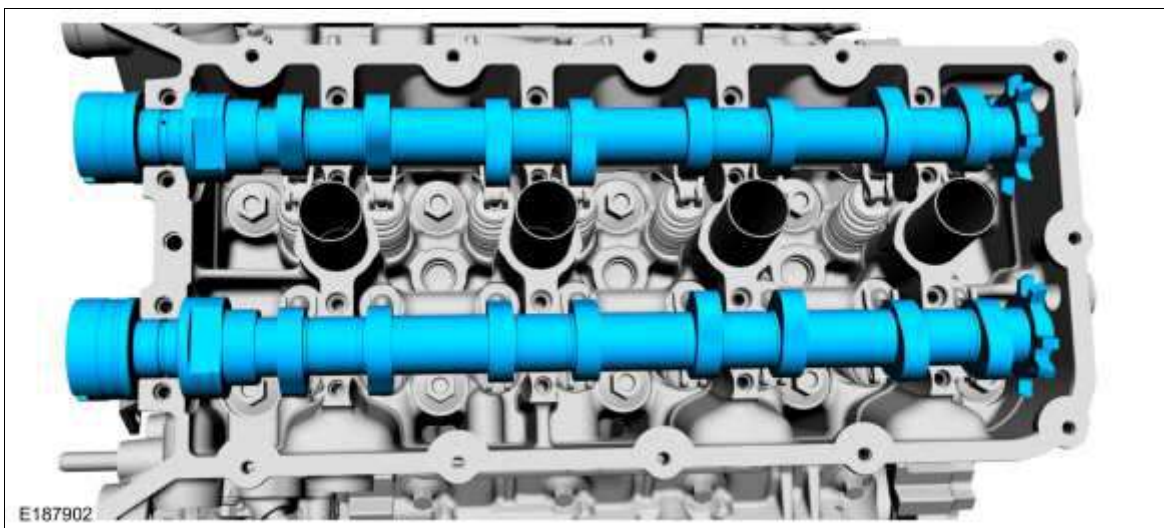
Remove the bolts and the front camshaft bearing mega cap.



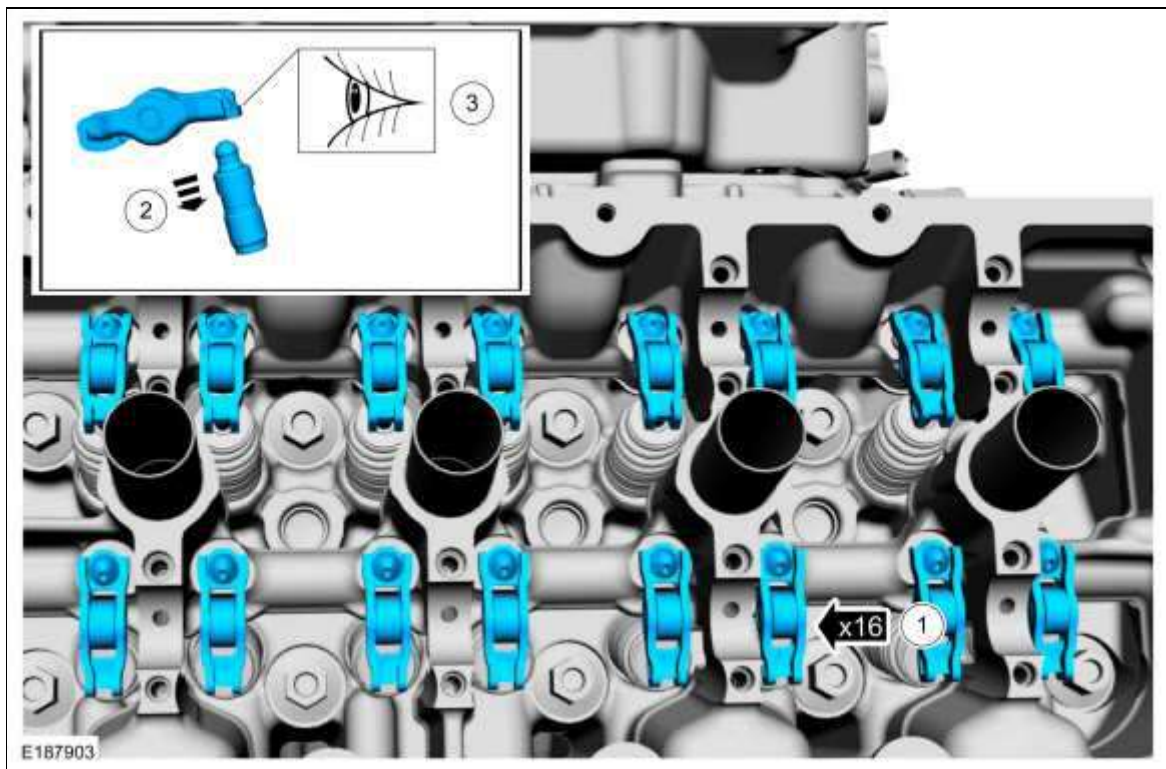
76. Remove the bolts and the camshaft bearing caps.



77. Remove the intake and exhaust camshafts.



- 78.
- Remove the camshaft roller follower and hydraulic lash adjuster assemblies.
 - Separate the hydraulic lash adjusters from the spring clips on the camshaft roller followers.
 - Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage. Replace damaged components as necessary.



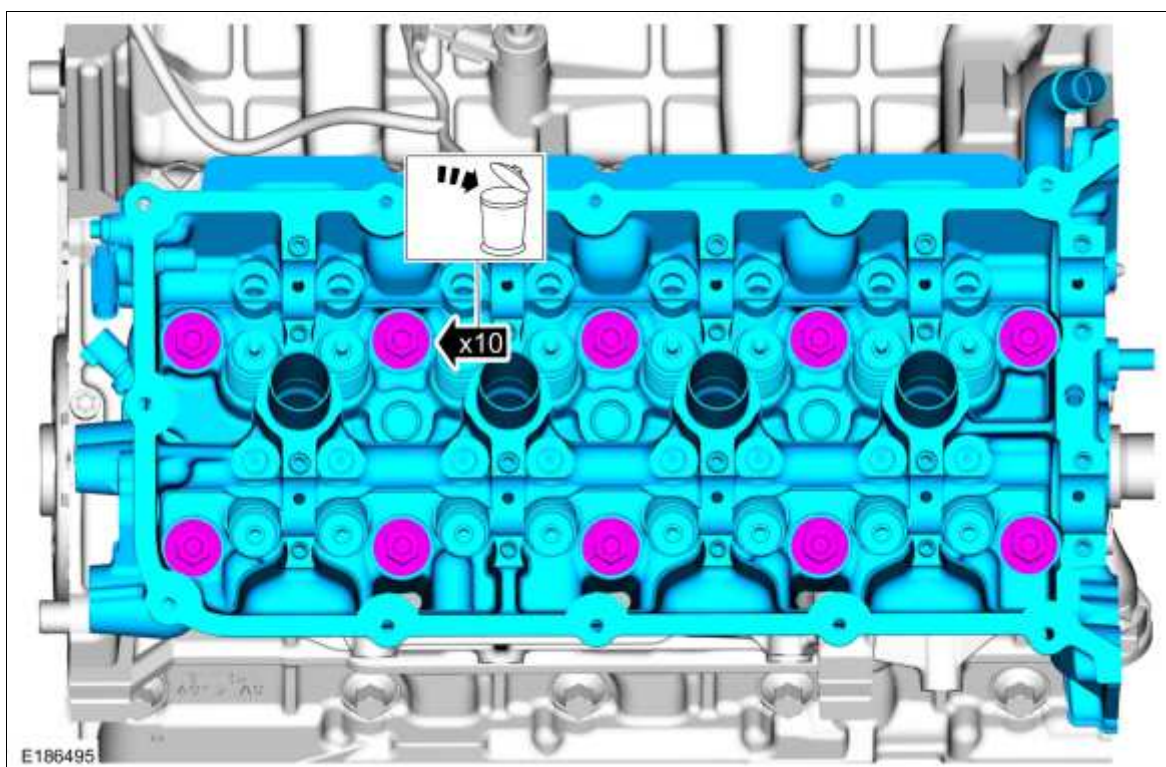
79. **NOTICE:** The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.

NOTICE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

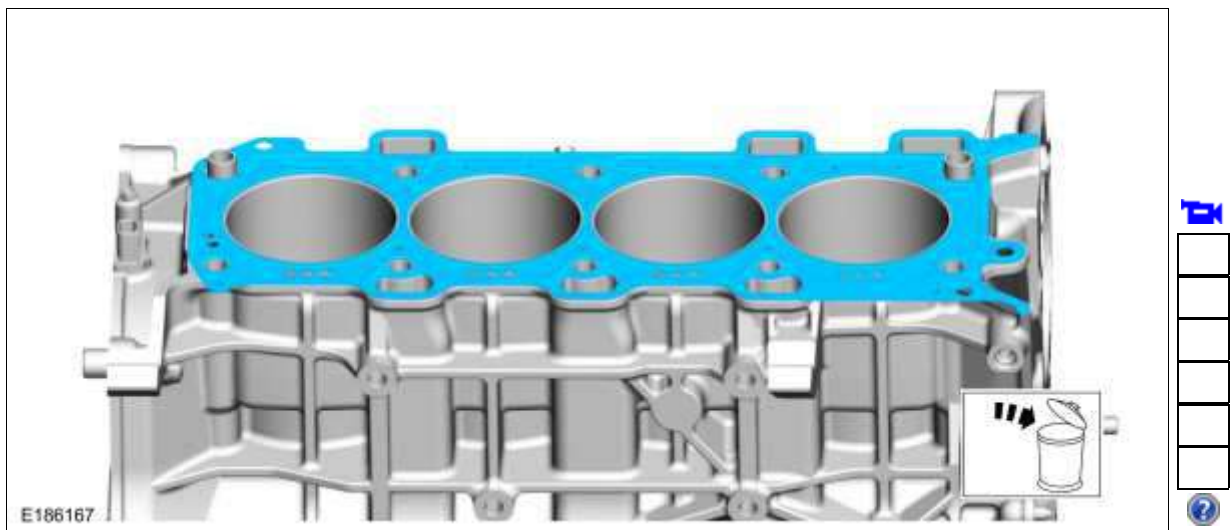
NOTICE: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

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

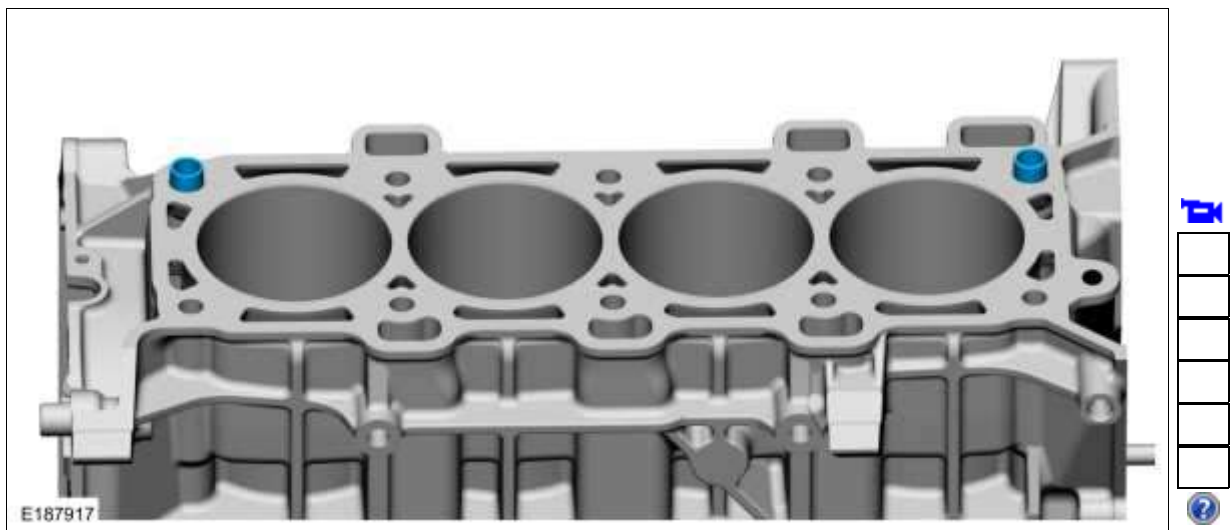
- Remove and discard the bolts.
- Remove the cylinder head.



80. Remove and discard the cylinder head gasket.



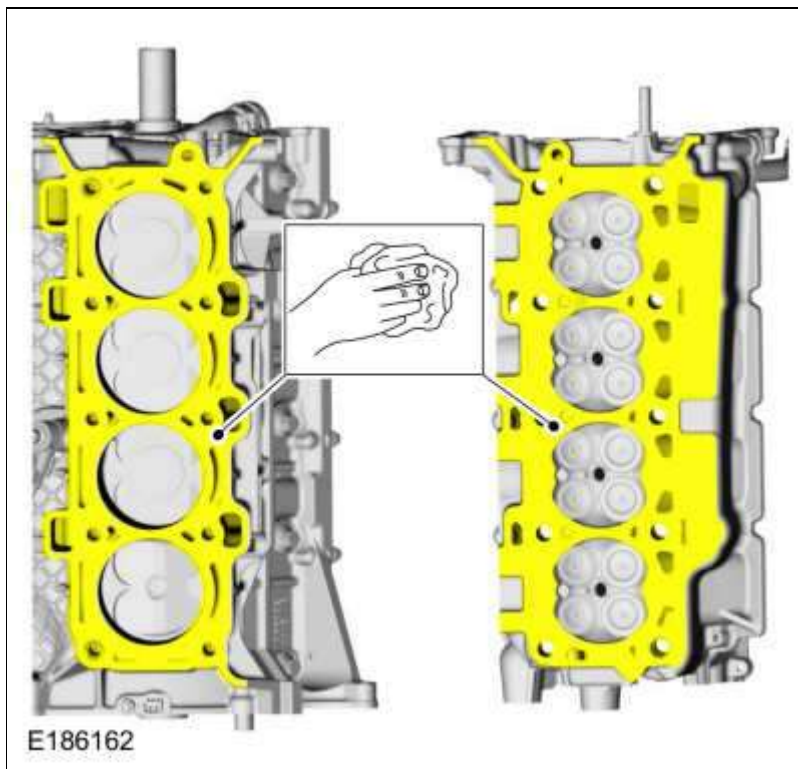
81. Remove the dowels.



82. **NOTICE:** 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.

NOTE: Clean the cylinder head bolt holes in the cylinder block using compressed air. Make sure all coolant, oil or other foreign material is removed.

- Clean and inspect the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block.
- Refer to: [Cylinder Head Distortion](#) (303-00 Engine System - General Information, General Procedures).
- Refer to: [Cylinder Block Distortion](#) (303-00 Engine System - General Information, General Procedures).



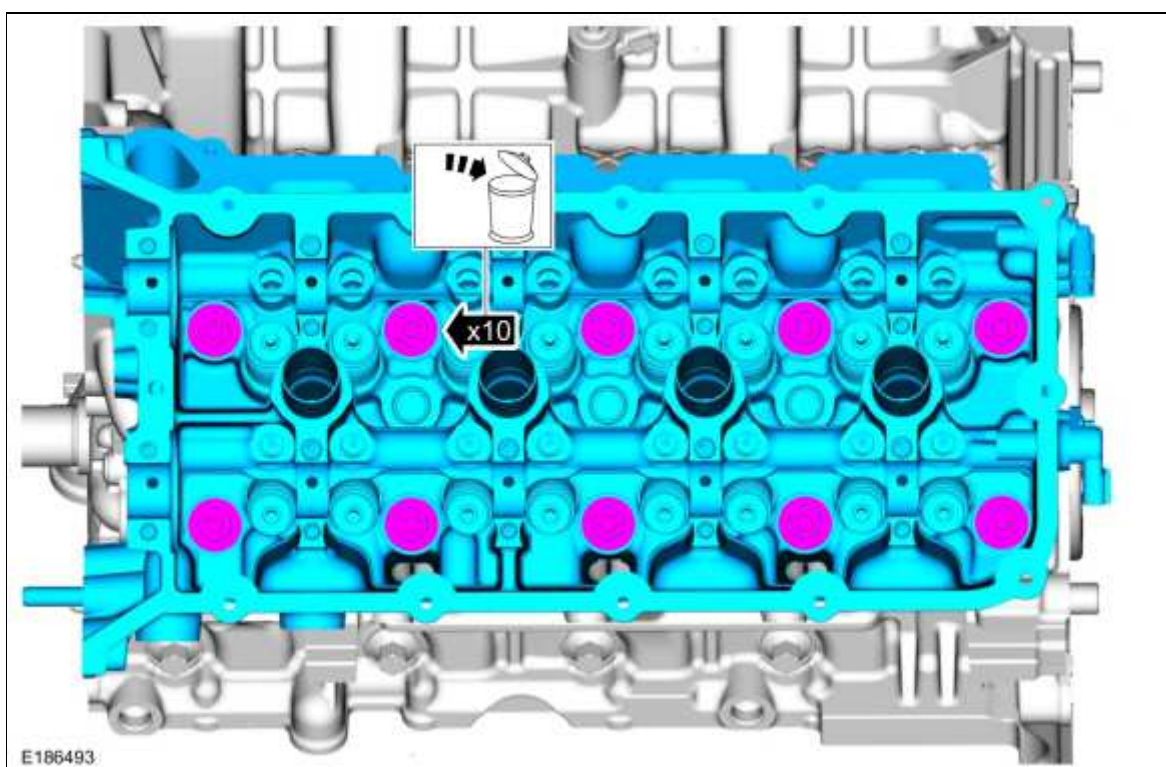
83. **NOTICE:** The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.

NOTICE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

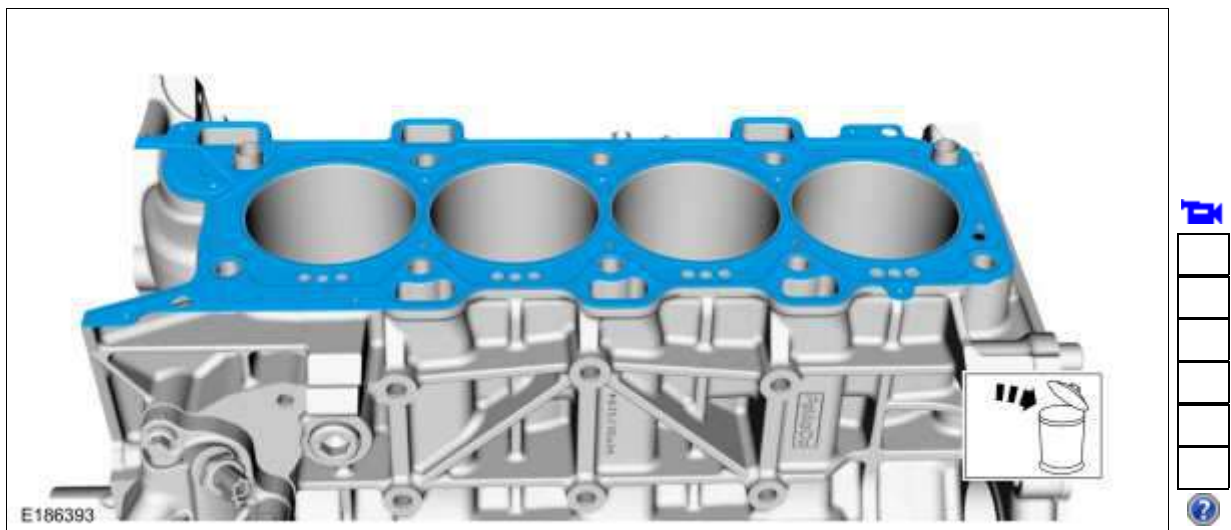
NOTICE: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

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

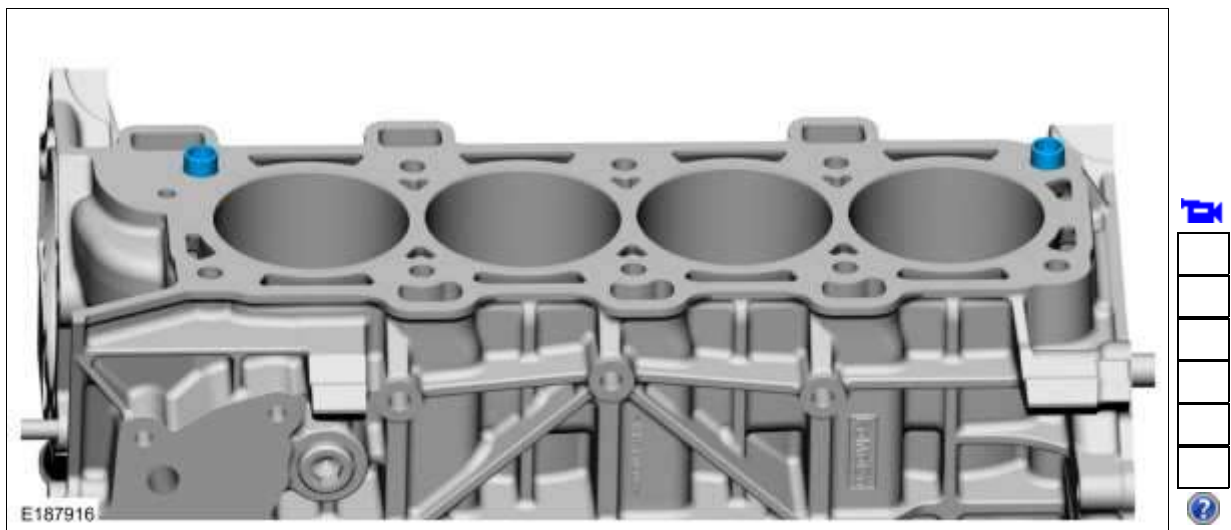
- Remove and discard the bolts.
- Remove the cylinder head.



84. Discard the cylinder head gasket.



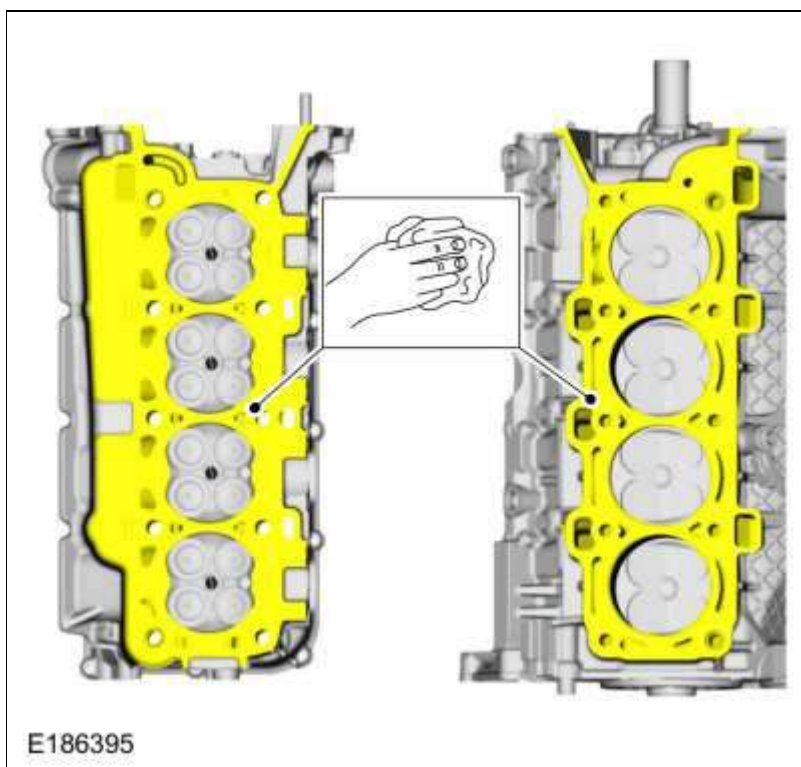
85. Remove the dowels.



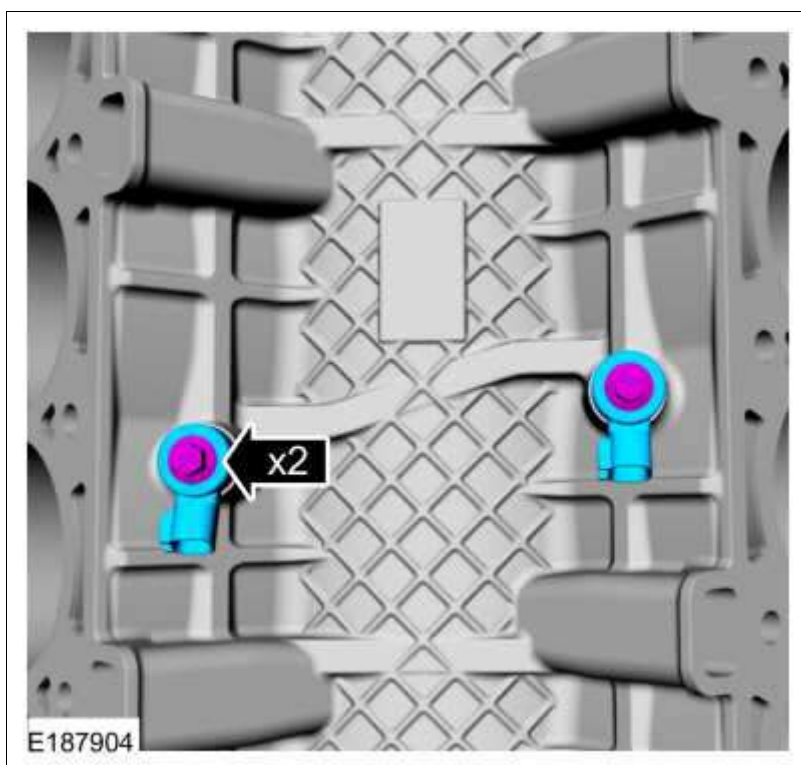
86. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

NOTE: Clean the cylinder head bolt holes in the cylinder block using compressed air. Make sure all coolant, oil or other foreign material is removed.

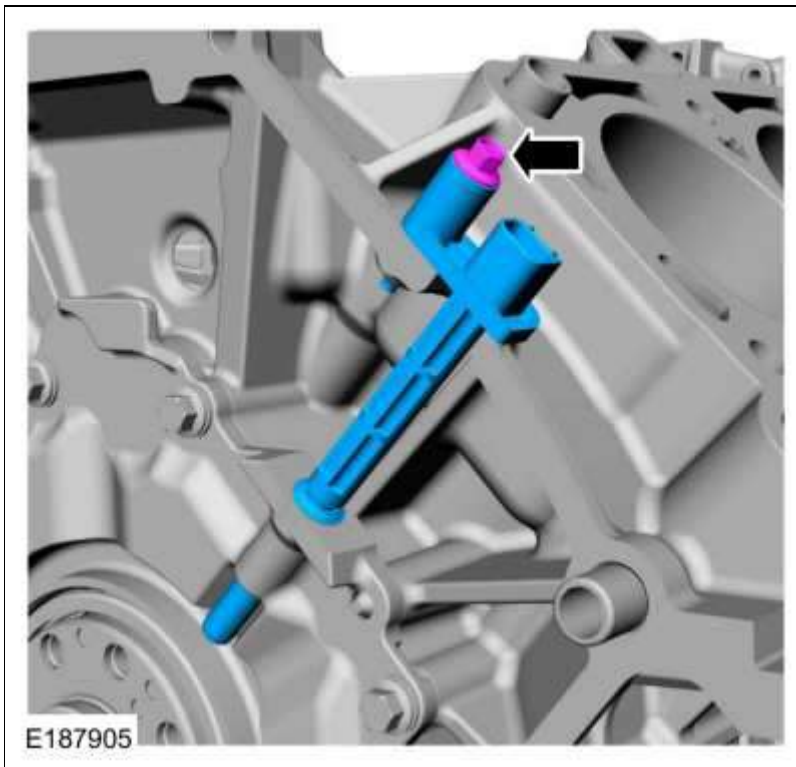
- Clean and inspect the cylinder head-to-cylinder block mating surfaces of both the cylinder head and the cylinder block.
- Refer to: [Cylinder Head Distortion](#) (303-00 Engine System - General Information, General Procedures).
- Refer to: [Cylinder Block Distortion](#) (303-00 Engine System - General Information, General Procedures).



87. Remove the bolts and the KSs.



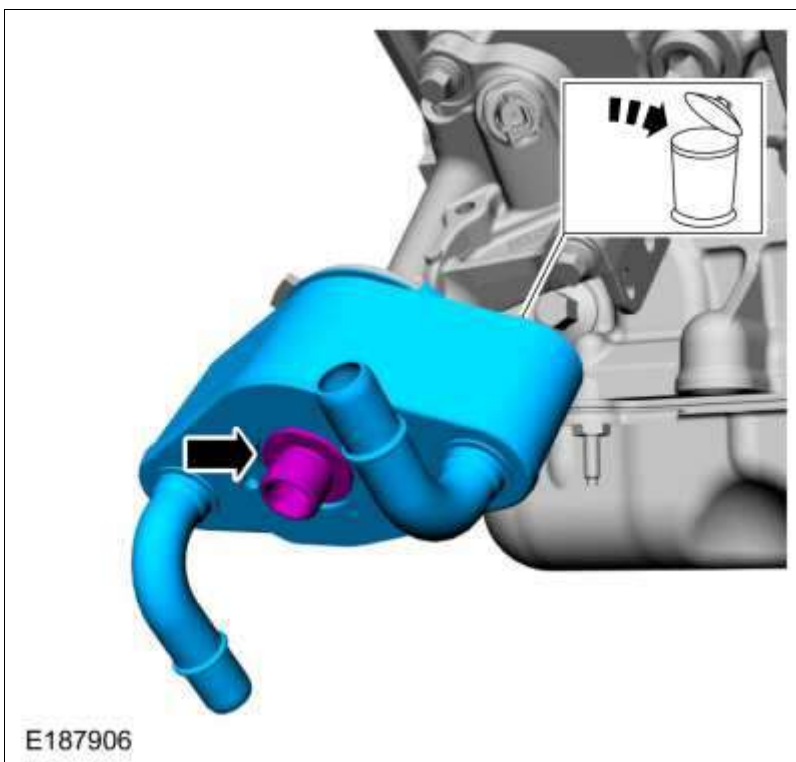
88. Remove the bolt and the CKP sensor.



89. **NOTICE:** A new oil cooler must be installed or severe damage to the engine can occur.

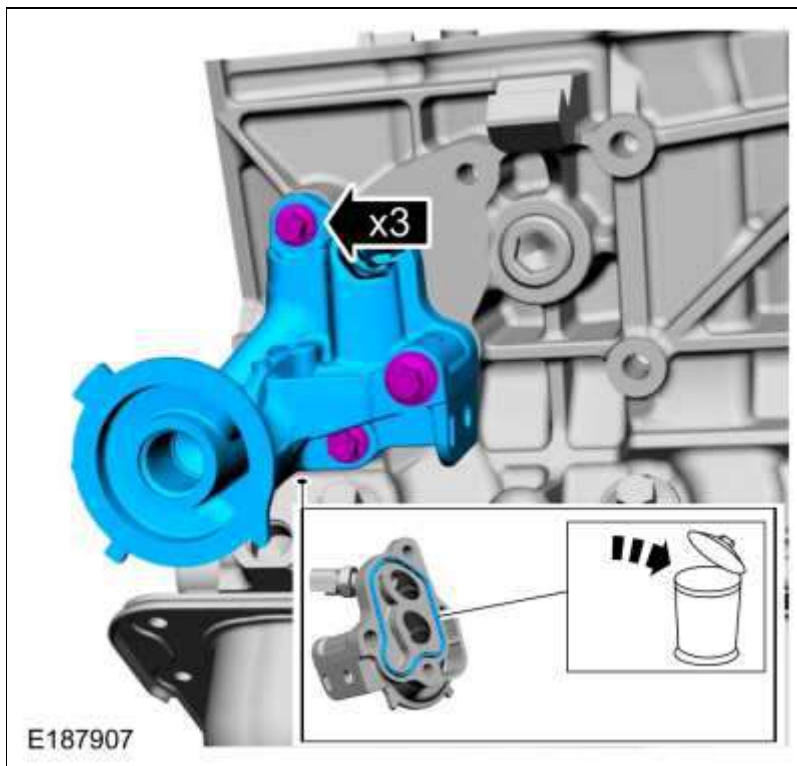
Remove the threaded fitting and the oil cooler.

- Discard the oil cooler.

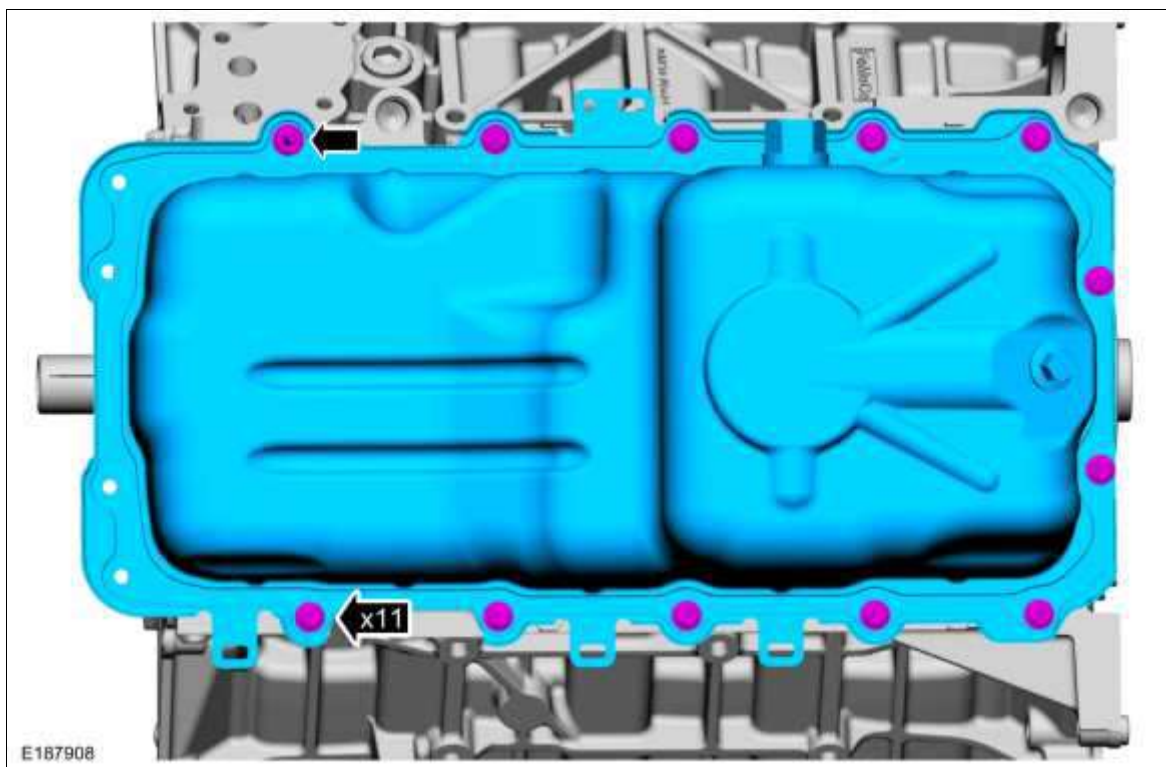


90. Remove the bolts and the oil filter adapter.

- Discard the gasket.

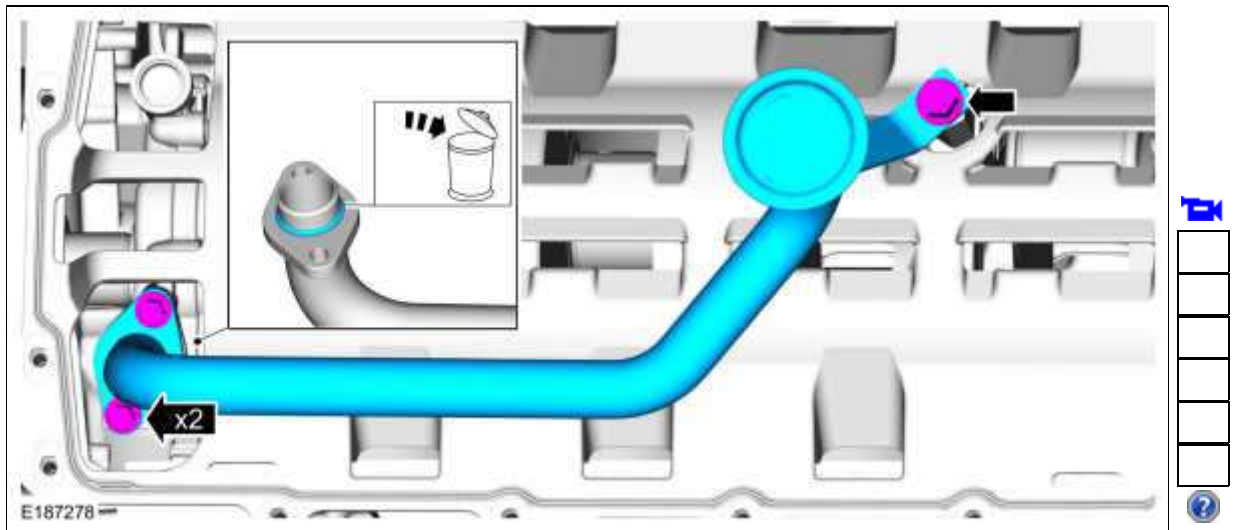


91. Remove the bolts and the oil pan.

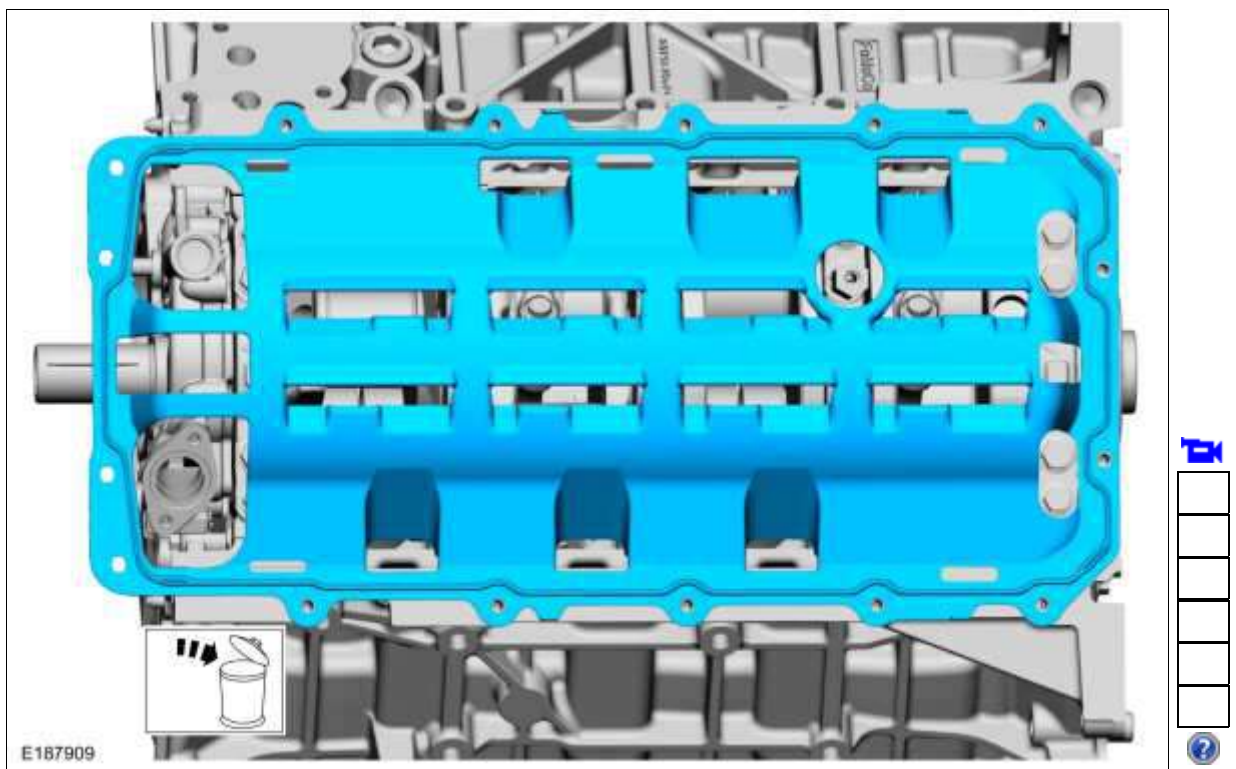


92. Remove the bolts and the oil pump screen and pickup tube.

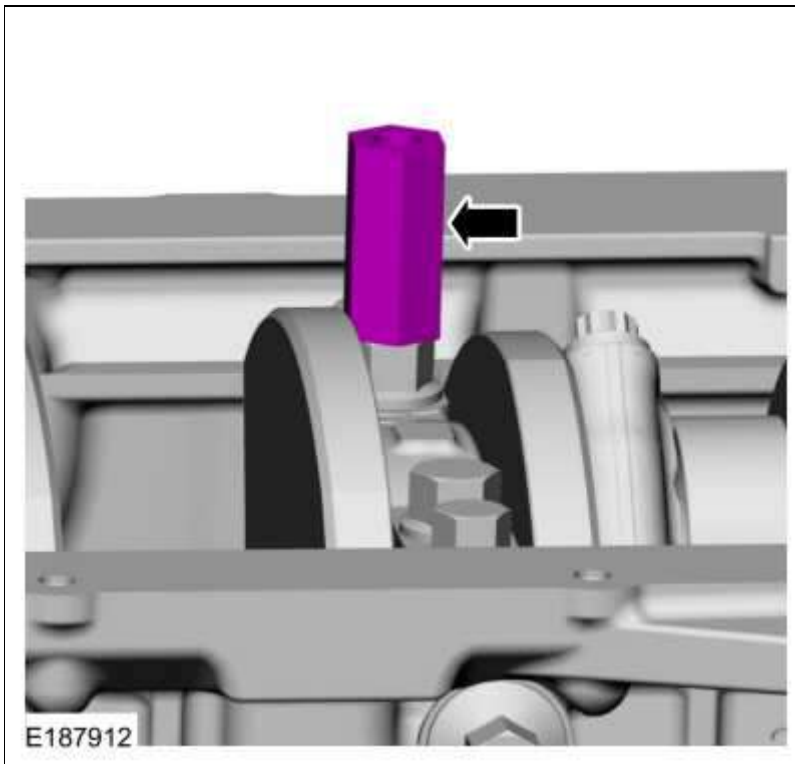
- Discard the O-ring seal.



93. Remove and discard the oil pan baffle and gasket.



94. Remove the oil pump screen and pickup tube spacer.



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

Clean the mating surface of the cylinder block.

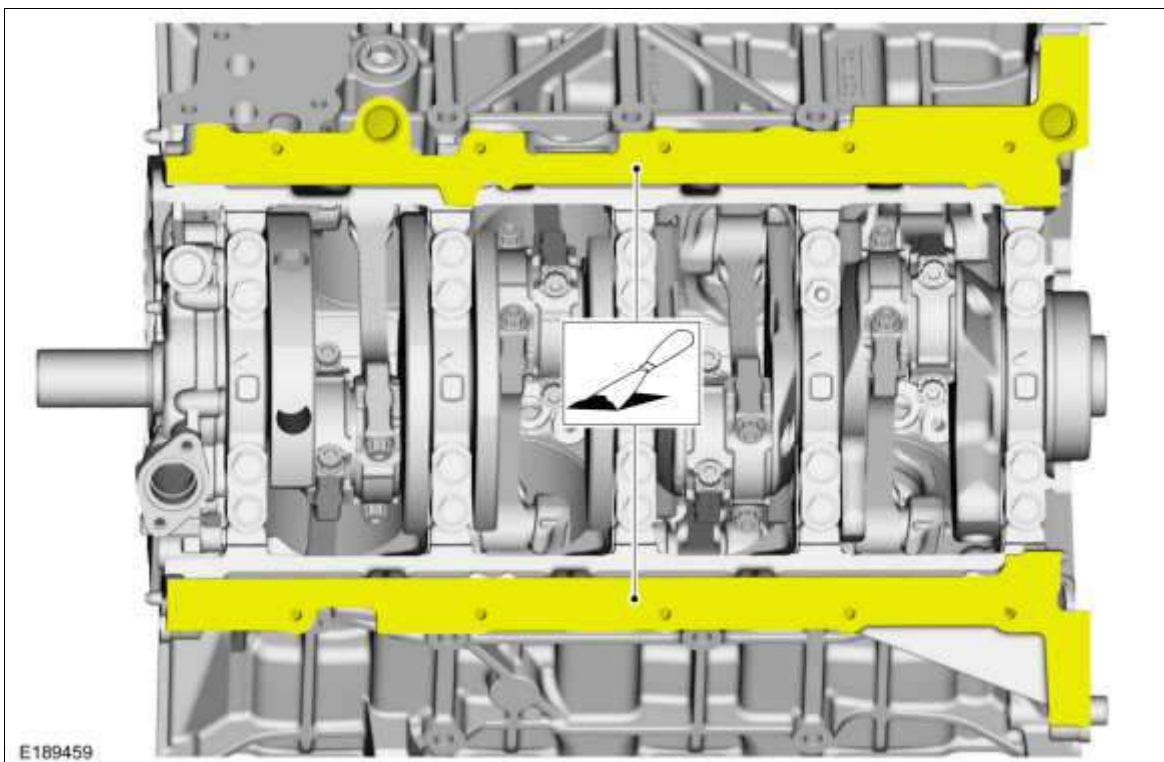
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

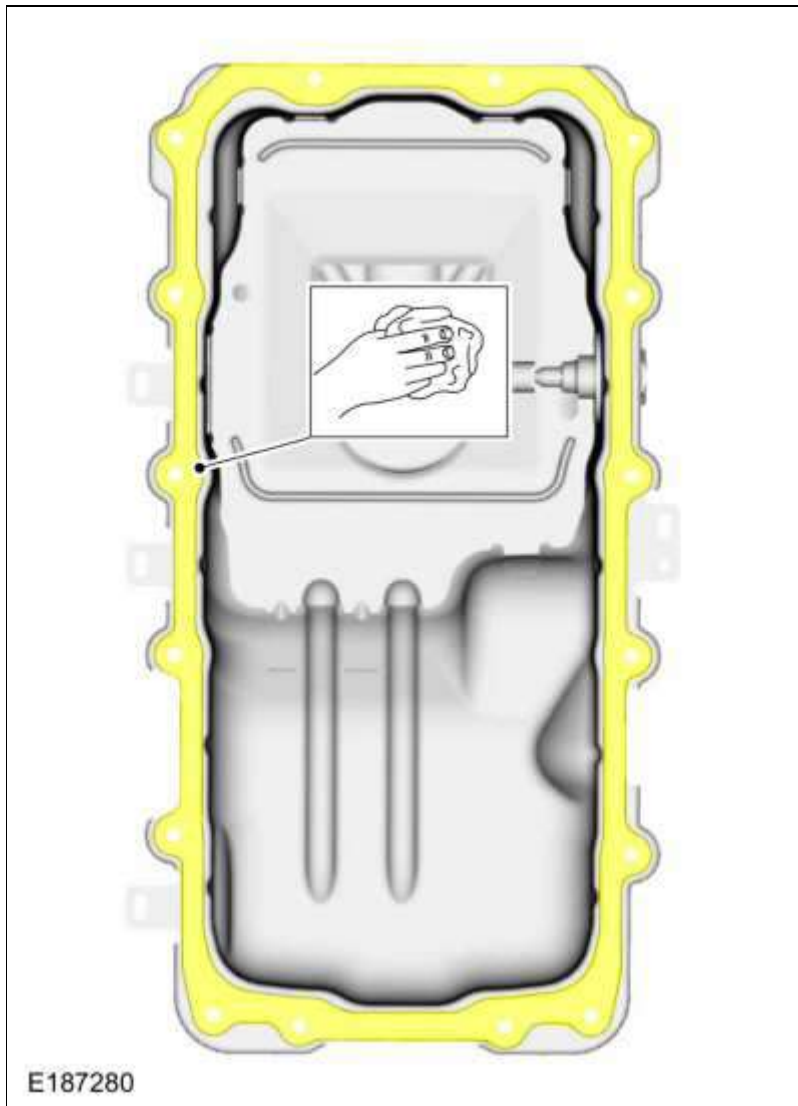
Material: Motorcraft® Metal Surface Prep / ZC-31-B

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

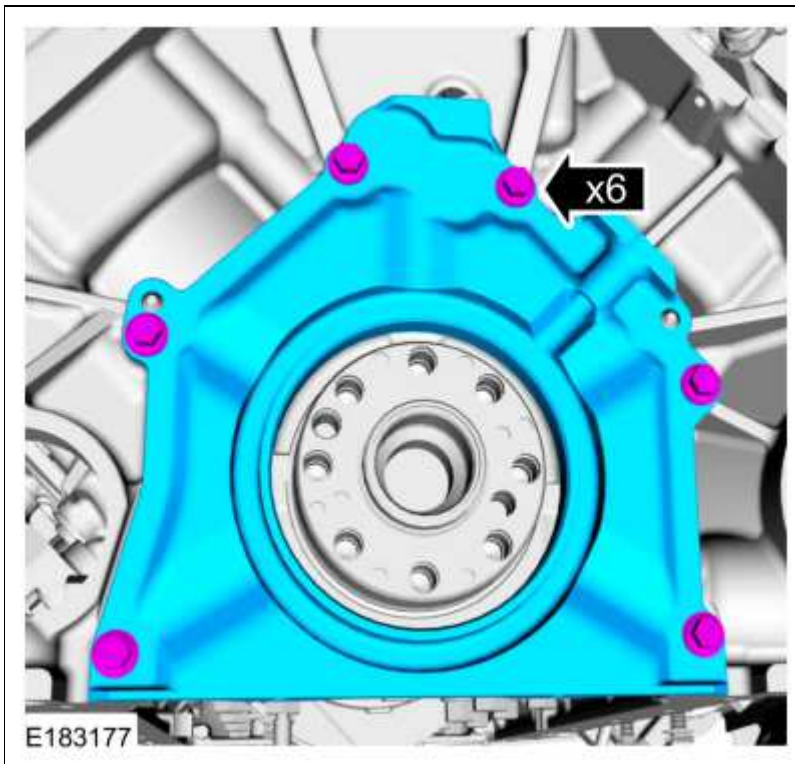


96. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

Make sure that the mating faces are clean and free of foreign material.



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



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

Clean and inspect the mating surface.

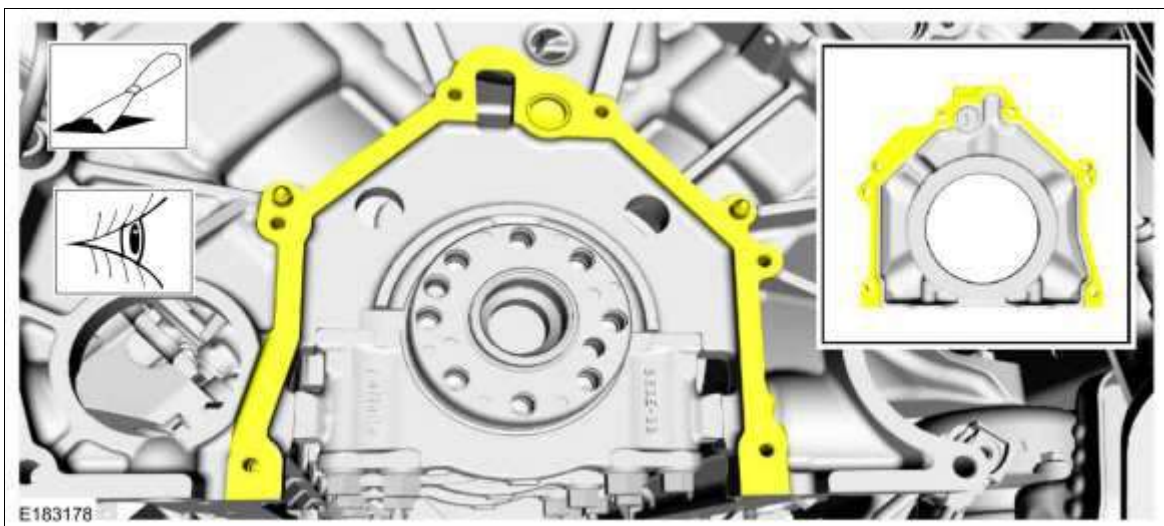
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

Use the General Equipment: Plastic Scraper

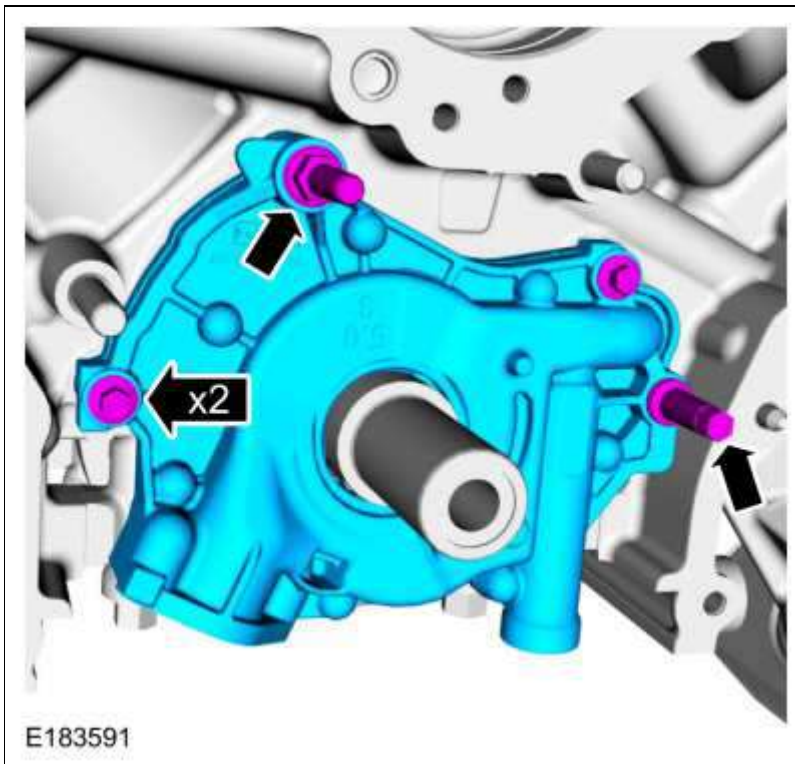
Material: Motorcraft® Silicone Gasket Remover / ZC-30-A

Material: Metal Brake Parts Cleaner (U.S.) / PM-4-A, PM-4-B (U.S.)

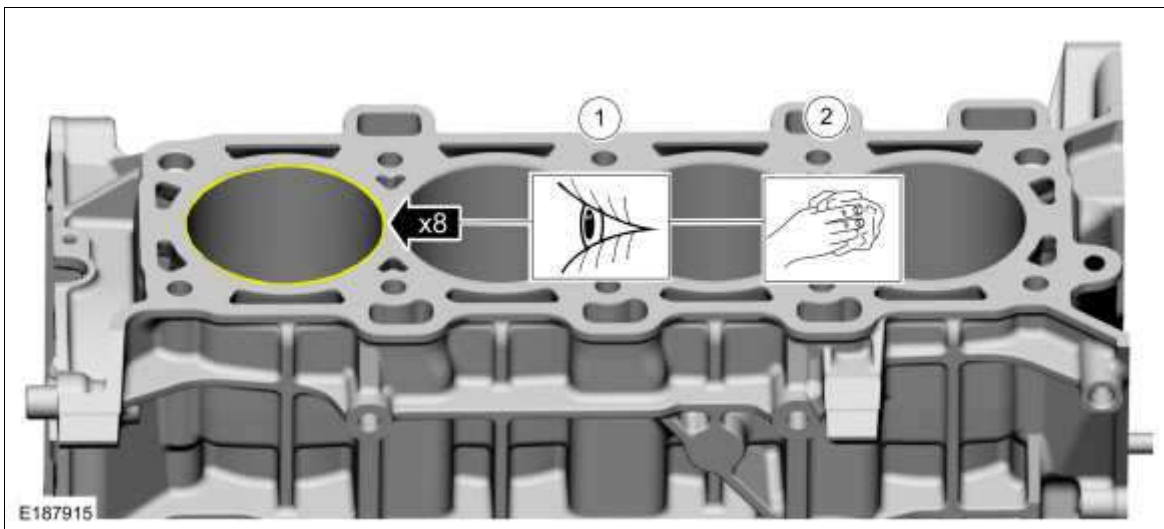
Material: Motorcraft® Metal Surface Prep / ZC-31-B



99. Remove the bolts, the stud bolts and the oil pump.

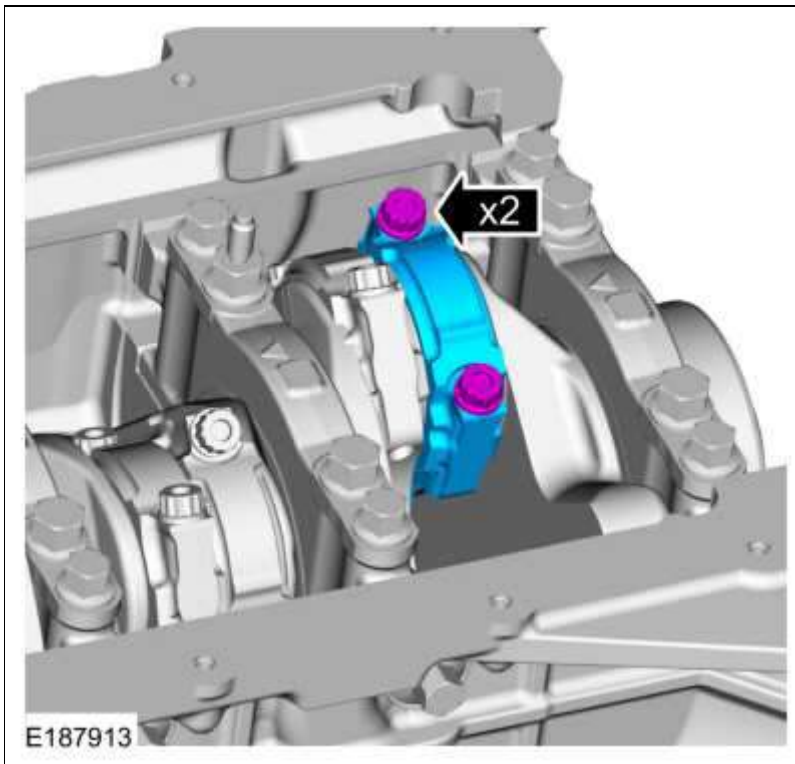


- 100.
- Before removing the pistons, inspect the top of the cylinder bores.
 - If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad.



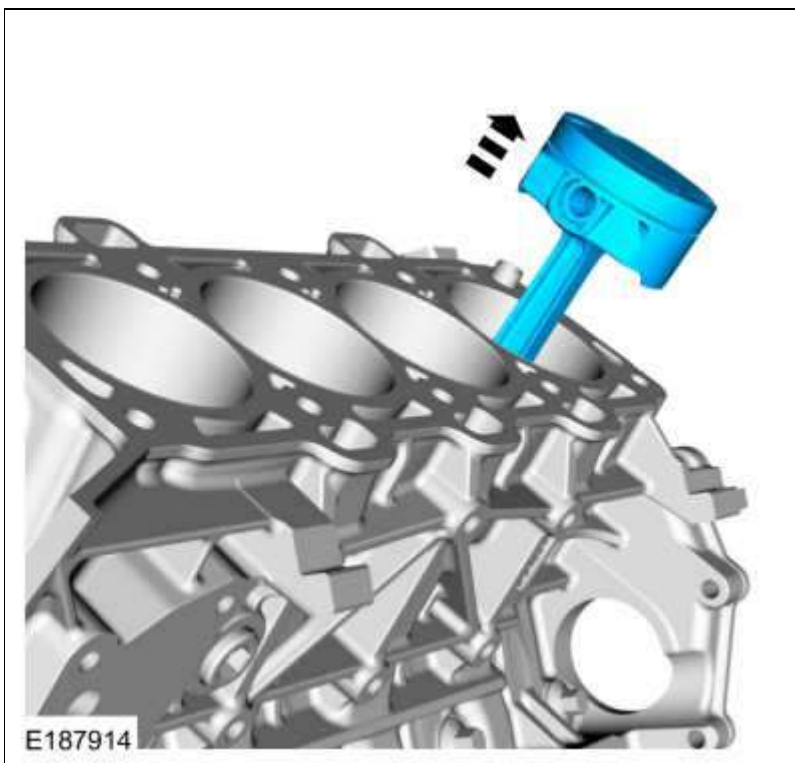
101. **NOTICE:** Verify that the connecting rod and rod cap have orientation numbers cast into them. If not, number the connecting rod and rod cap for correct orientation. Failure to do so can result in engine damage.

Remove the bolts and the connecting rod cap.

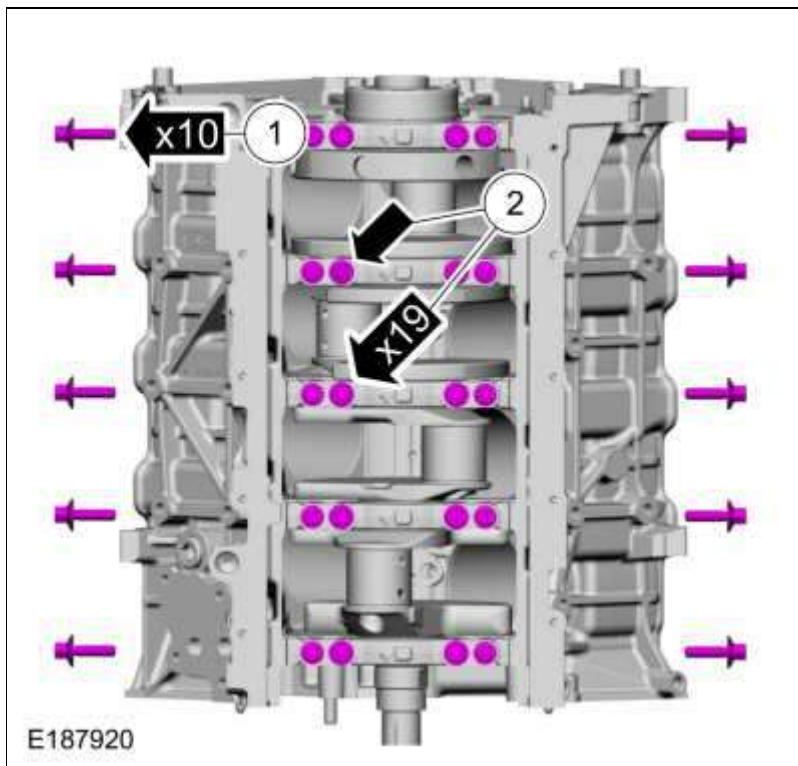


102. **NOTICE:** Do not scratch the cylinder walls or crankshaft journals with the connecting rod or engine damage may occur.

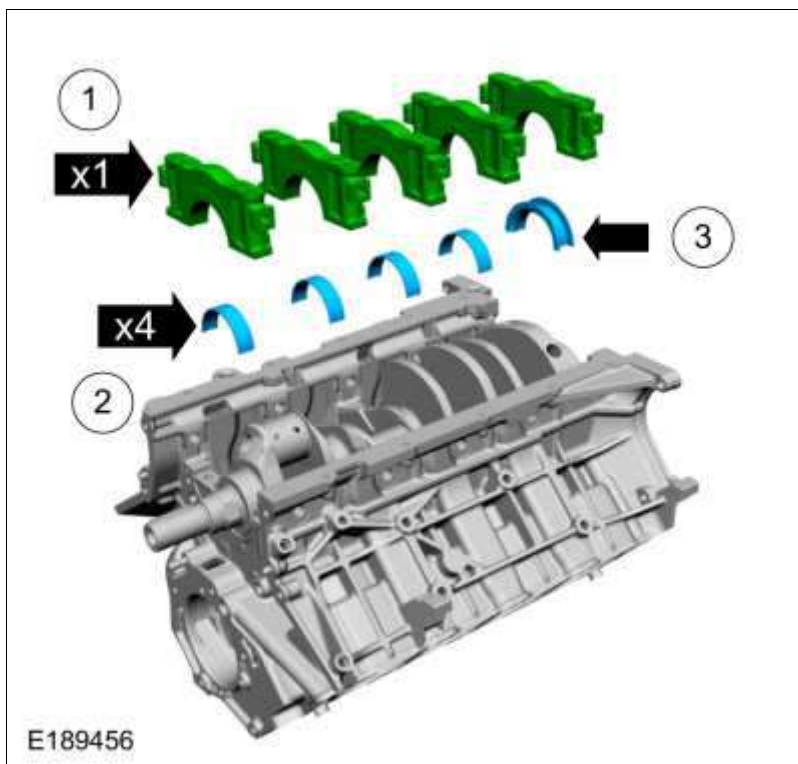
Remove the piston through the top of the cylinder block.



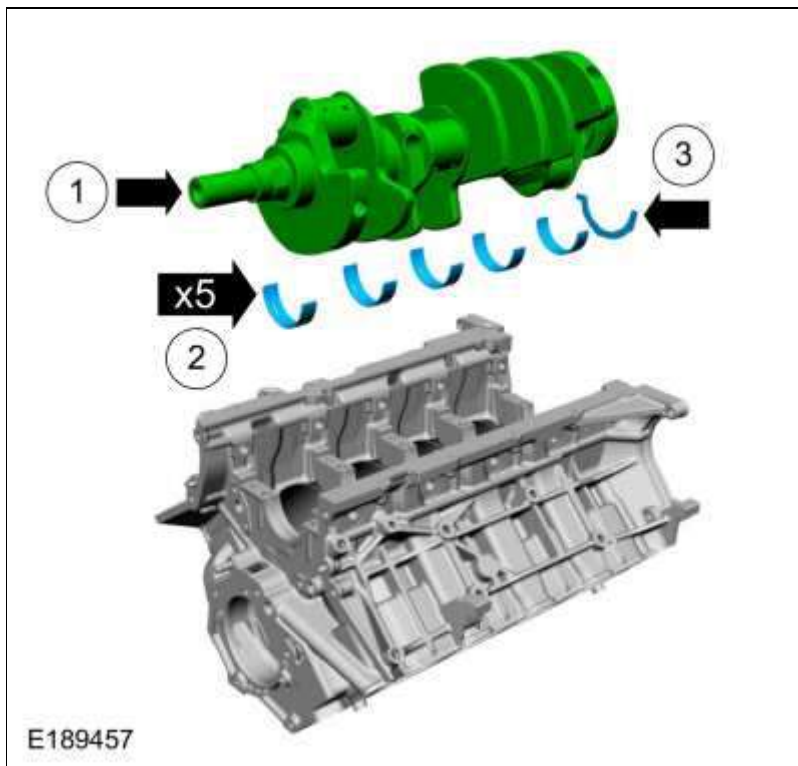
103. Repeat the previous 2 steps for each of the remaining pistons.
104. Disassemble the 8 pistons.
Refer to: [Piston](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Disassembly and Assembly of Subassemblies).
105. 1. Remove and discard the cross-mounted main cap bolts.
 2. Remove and discard the main bearing cap bolts and stud bolt.



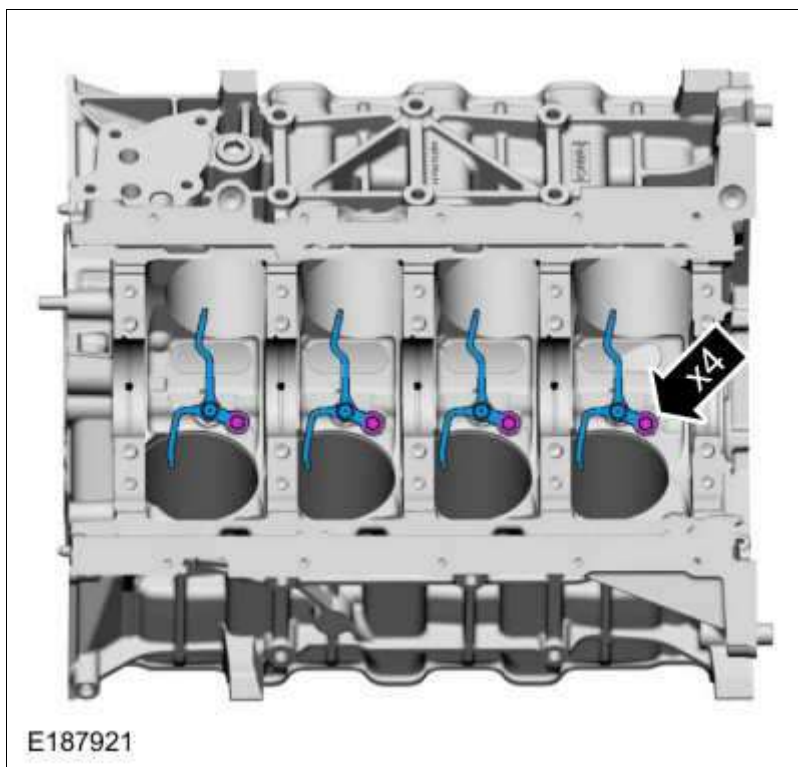
106. Remove the main bearing caps (1), the lower crankshaft main bearings (2) and the lower thrust bearing (3).



107. Remove the crankshaft (1), the upper crankshaft main bearings (2) and the upper thrust washer (3) from the cylinder block.



108. Remove the bolts and the piston cooling jets from the cylinder block.

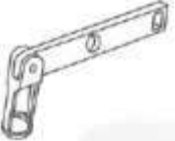
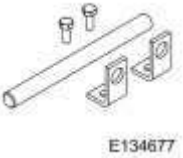




Cylinder Head

Base Part Number: [6051](#)

Special Tool(s) / General Equipment

 E223048	303-1249 Valve Spring Compressor TKIT-2006UF-FLM TKIT-2006UF-ROW
 E134677	303-1418 Compressor, Valve Spring TKIT-2008ET-FLM TKIT-2008ET-ROW
 E134677	303-300 (T87C-6565-A) Set, Valve Spring Compressor T88C-1000-ST TKIT-1988-FESTIVA TKIT-1988-TRACER TKIT-2009TC-F
 E134678	303-350 (T89P-6565-A) Compressor, Valve Spring TKIT-1989-F TKIT-1989-FLM TKIT-1989-FM TKIT-1990-LMH

Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) VC-3-B (U.S.)	WSS-M97B44-D

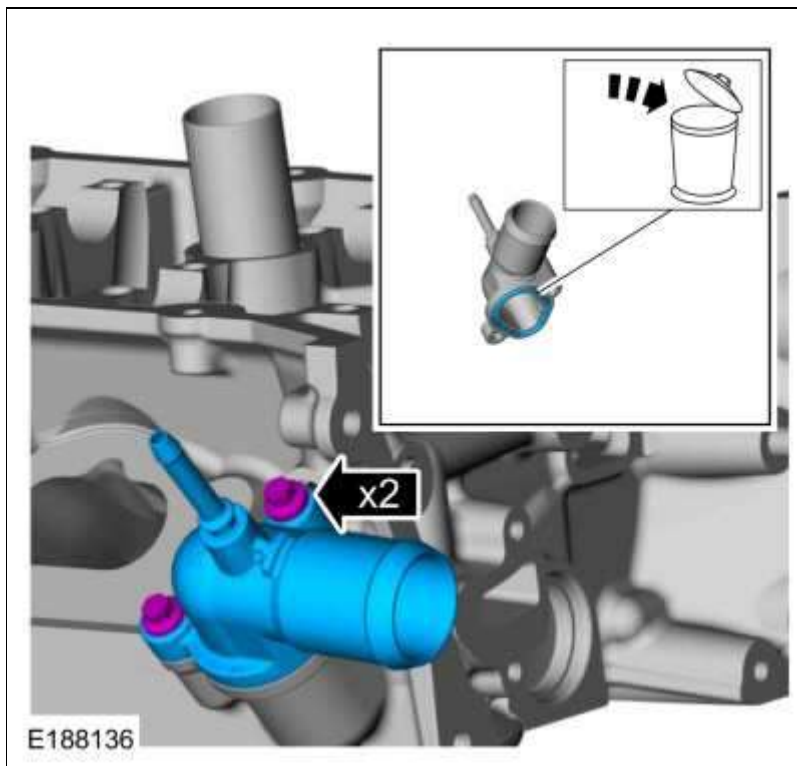
DISASSEMBLY

NOTICE: 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.

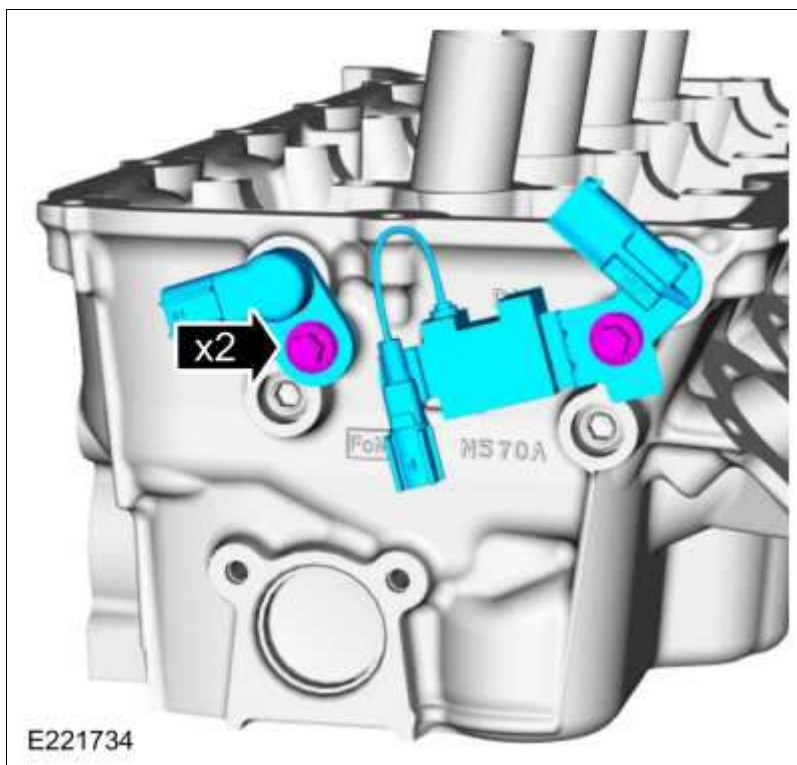
NOTE: If the components are to be reinstalled, they must be installed in their original locations. Mark the components for installation into their original locations.

LH cylinder heads

1. Remove the bolts and the coolant outlet.
 - Discard the gasket.

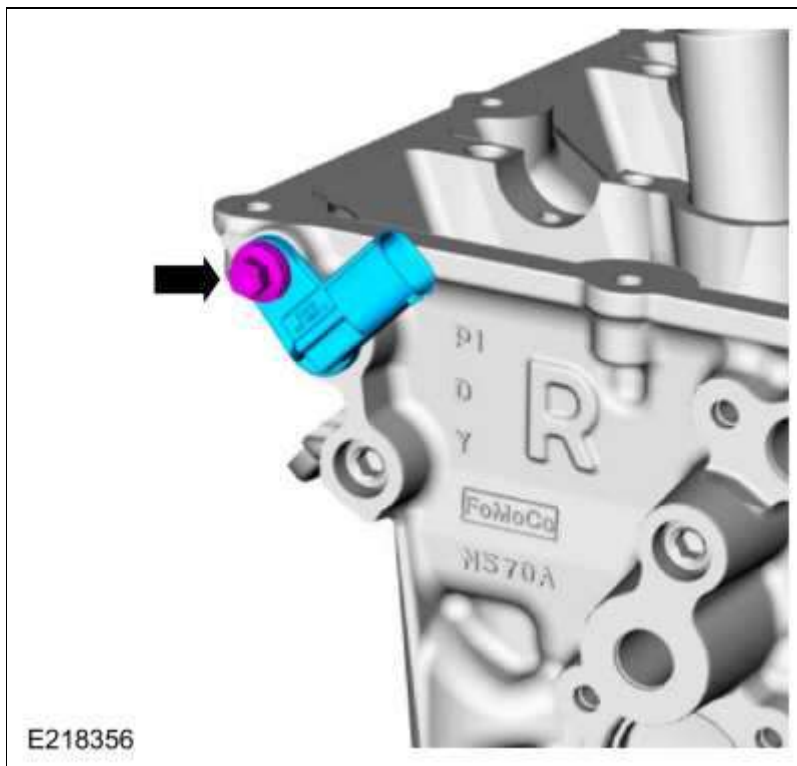


2. Remove the bolts, the CMP sensors and the radio interference capacitor.

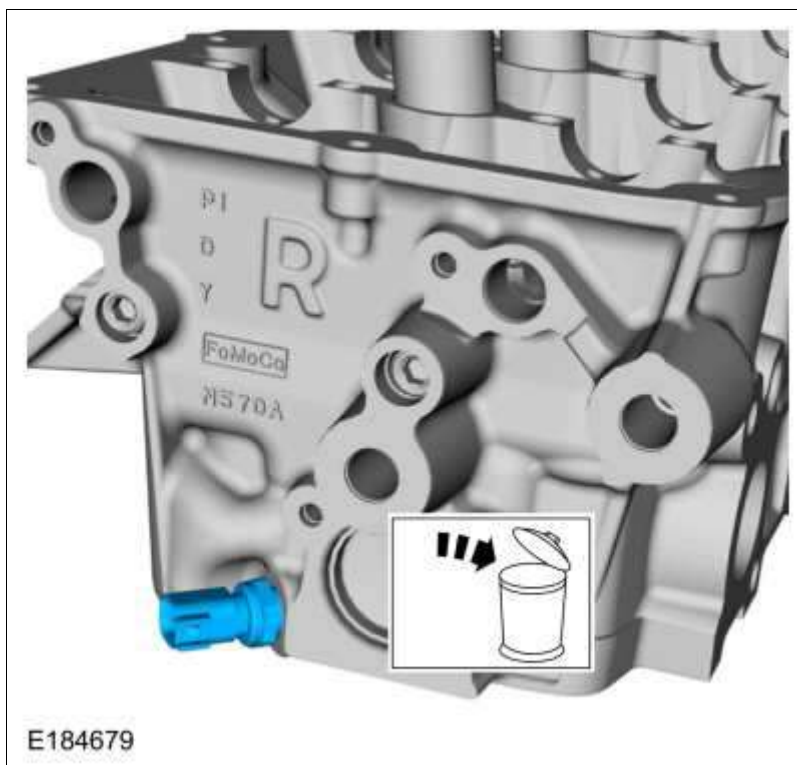


RH cylinder heads

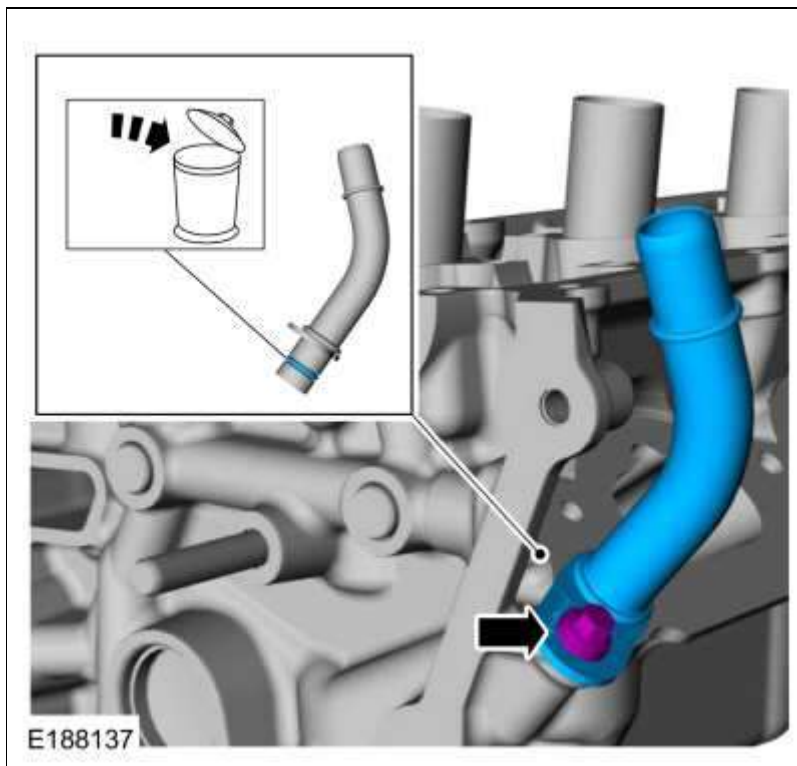
3. Remove the bolt and the CMP sensor.



4. Remove and discard the CHT sensor.

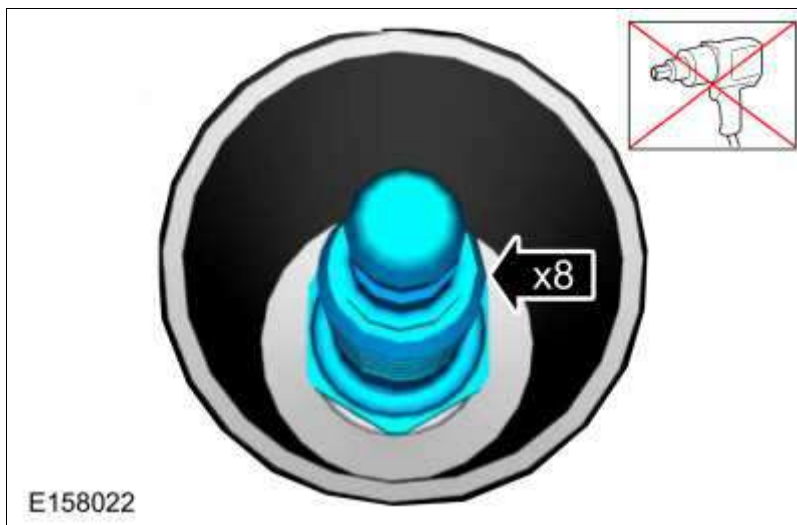


5. Remove the bolt and the coolant outlet.
 - Discard the O-ring seal.

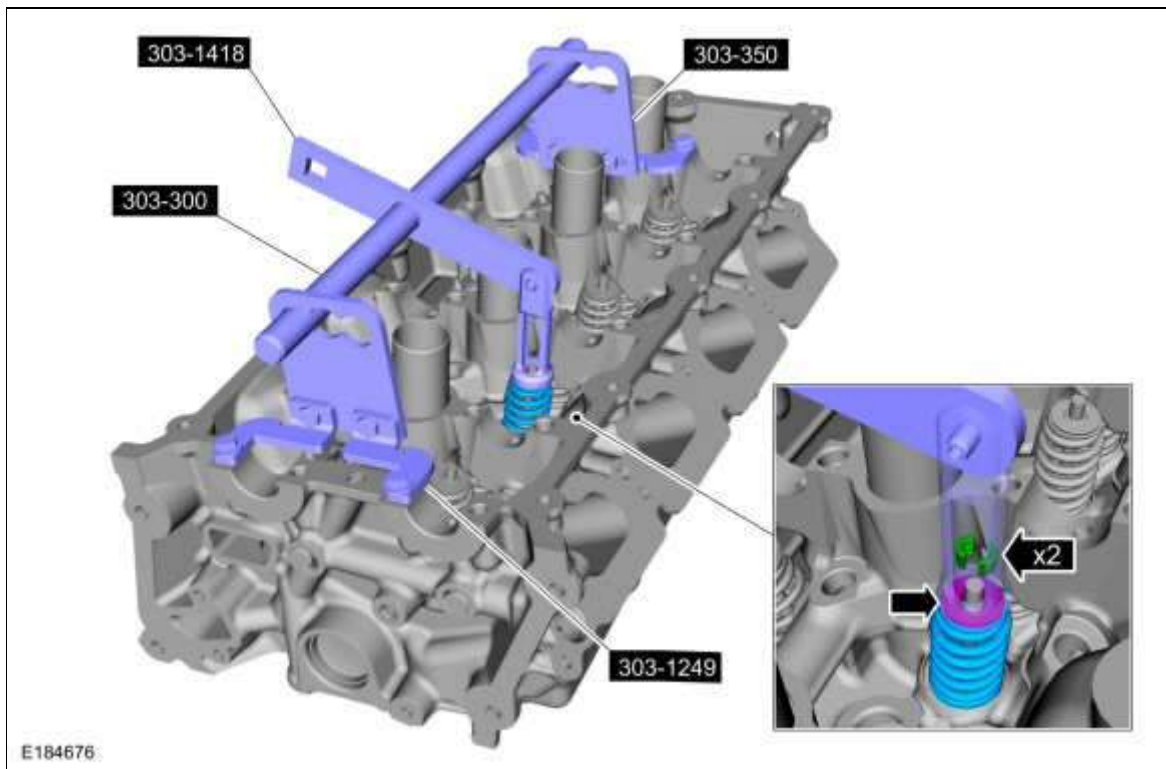


All cylinder heads

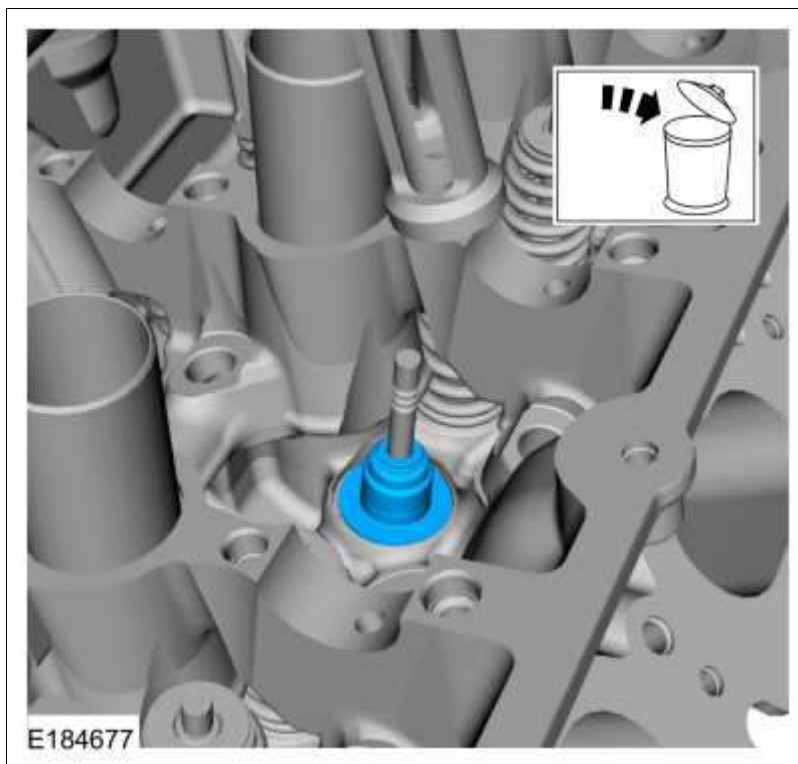
6. Remove the spark plugs.



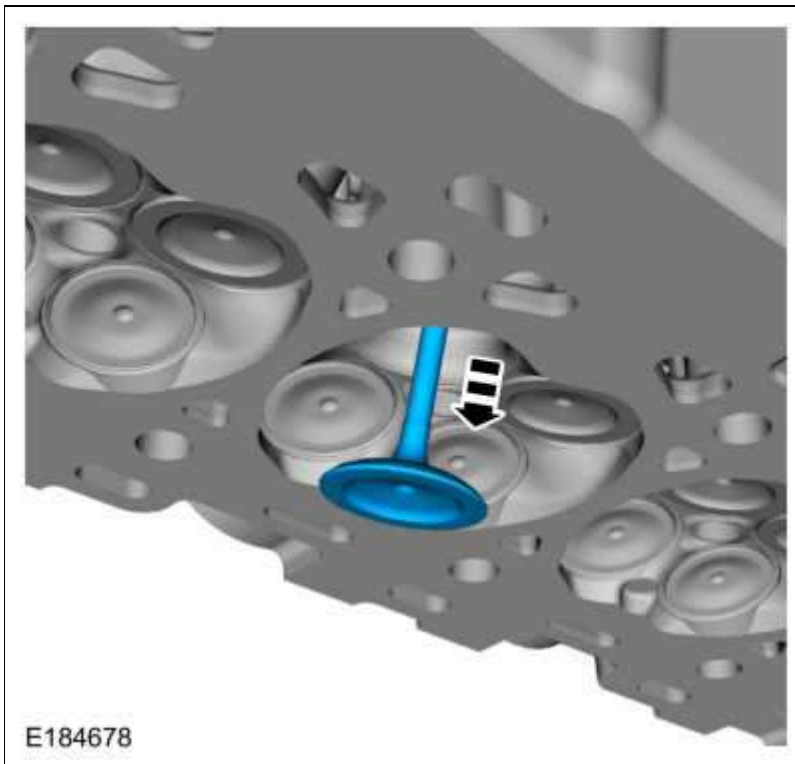
7. Using the special tools, remove the keys, retainer and spring.
Use Special Service Tool: [303-300 \(T87C-6565-A\) Set, Valve Spring Compressor.](#) , [303-350 \(T89P-6565-A\) Compressor, Valve Spring.](#) , [303-1249 Valve Spring Compressor.](#) , [303-1418 Compressor, Valve Spring.](#)



8. Remove and discard the valve stem seal.



9. Remove the valve from the cylinder head.



10. Repeat the previous steps for each of the remaining valves.

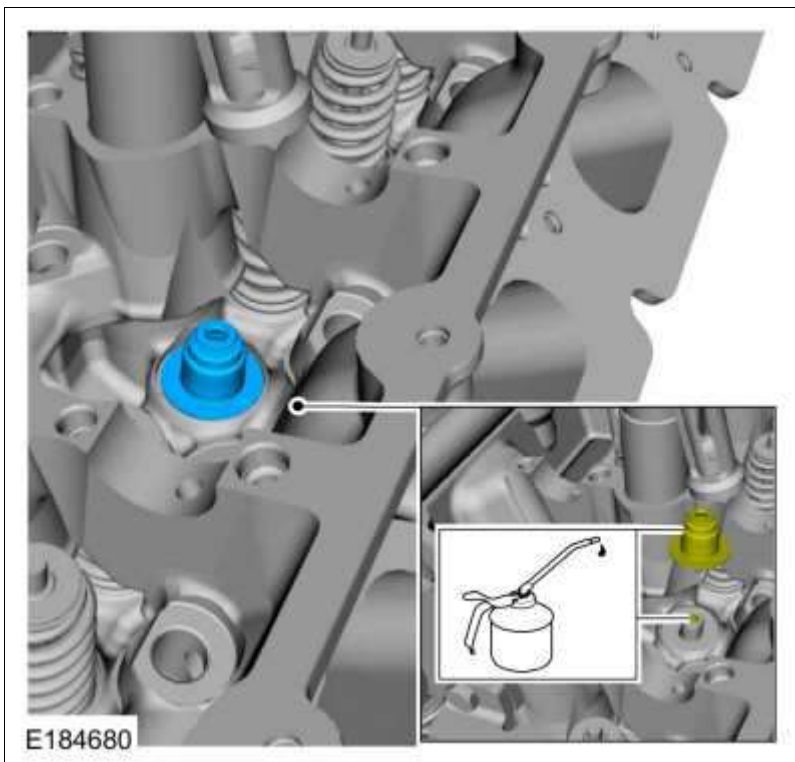
ASSEMBLY

All cylinder heads

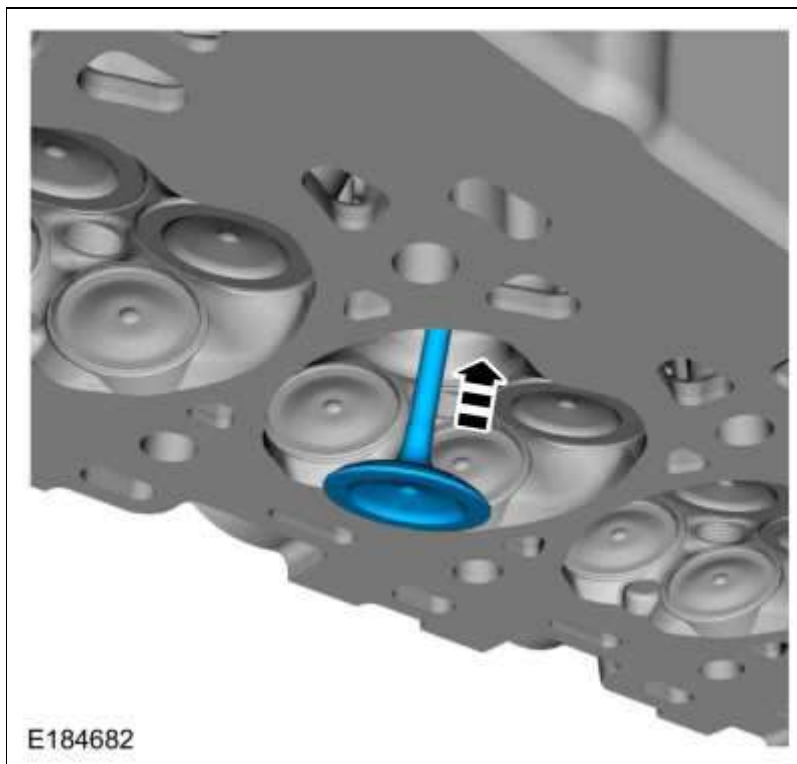
1. **NOTE:** Lubricate the new valve stem seal and valve guide bore with clean engine oil.

Install the new valve stem seal.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)

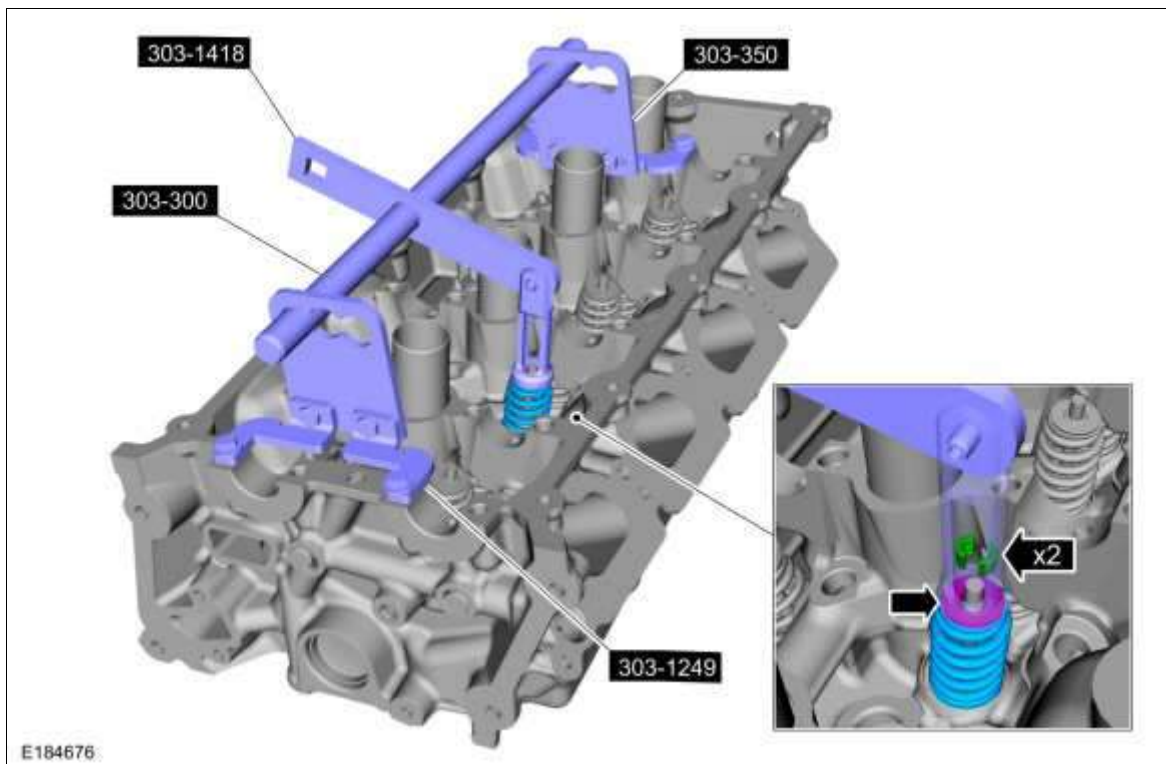


2. Install the valve into the cylinder head.



3. Using the special tools, install the spring, retainer and keys.

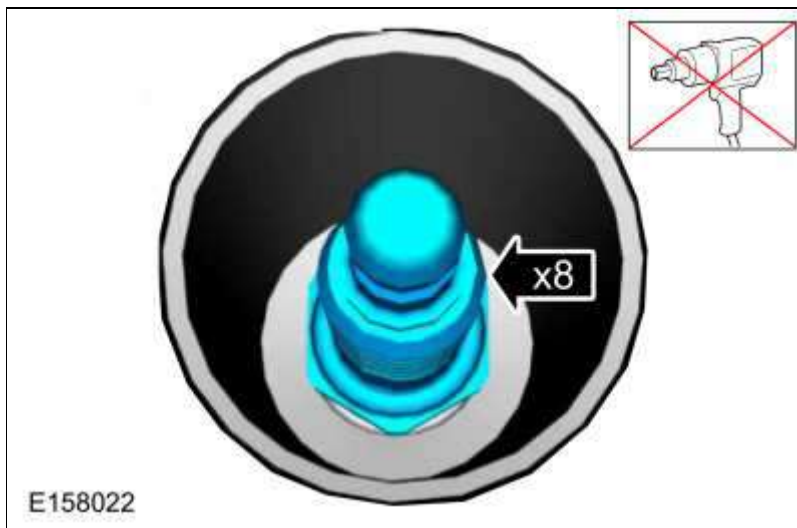
Use Special Service Tool: [303-300 \(T87C-6565-A\) Set, Valve Spring Compressor.](#) , [303-350 \(T89P-6565-A\) Compressor, Valve Spring.](#) , [303-1249 Valve Spring Compressor.](#) , [303-1418 Compressor, Valve Spring.](#)



4. Repeat the previous steps for each of the remaining valves.

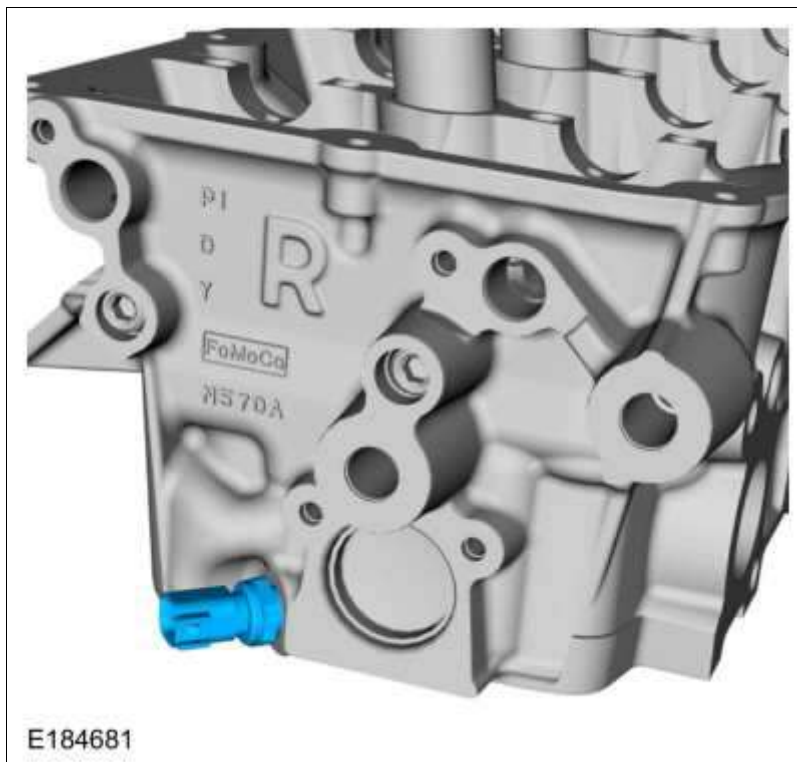
5. Install the spark plugs.

Torque: 133 lb.in (15 Nm)

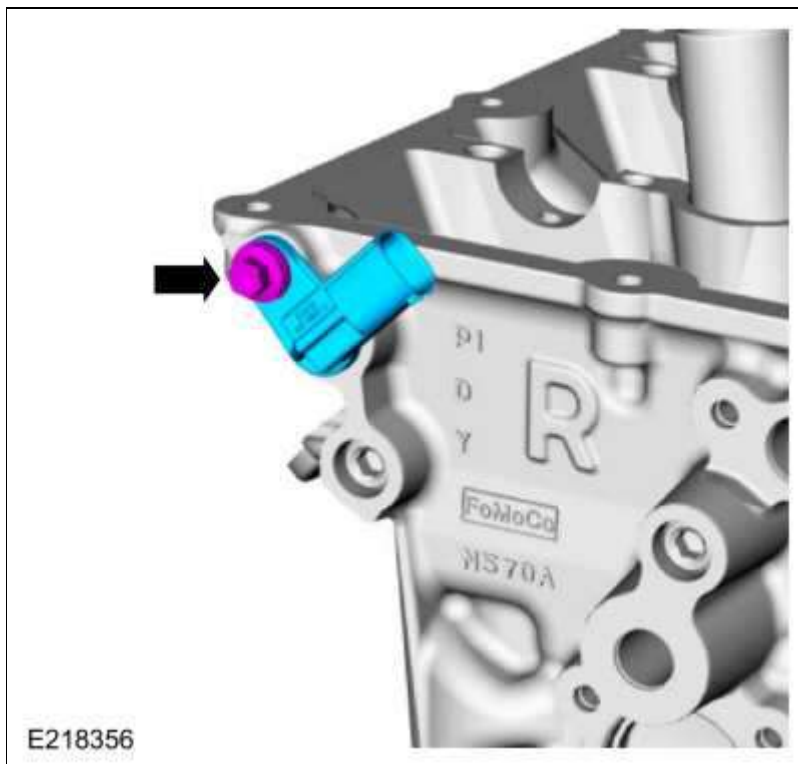


RH cylinder heads

6. Install a new CHT sensor.
Torque: 97 lb.in (11 Nm)



7. Install the CMP sensor and bolt.
Torque: 89 lb.in (10 Nm)

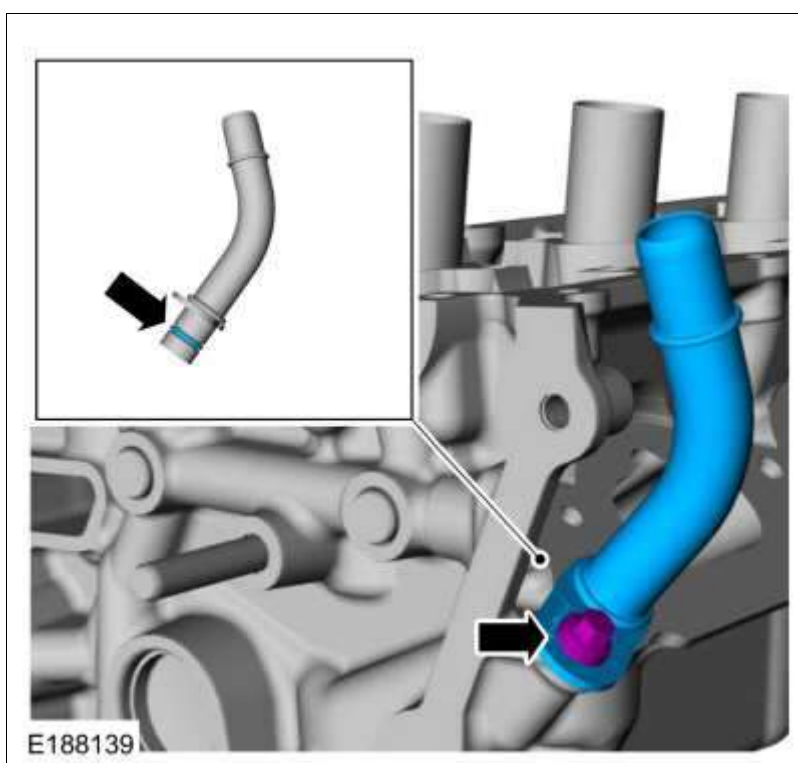


8. **NOTE:** Lubricate the O-ring seal with clean engine coolant prior to installing.

Using a new O-ring seal, install the coolant outlet pipe.

Material: Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) / VC-3-B (U.S.) (WSS-M97B44-D)

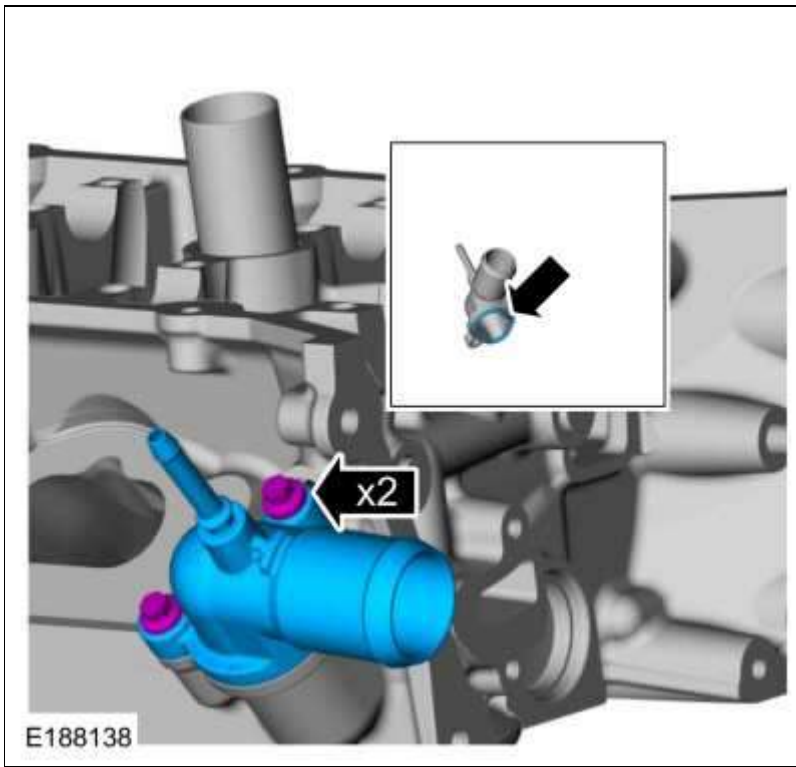
Torque: 89 lb.in (10 Nm)



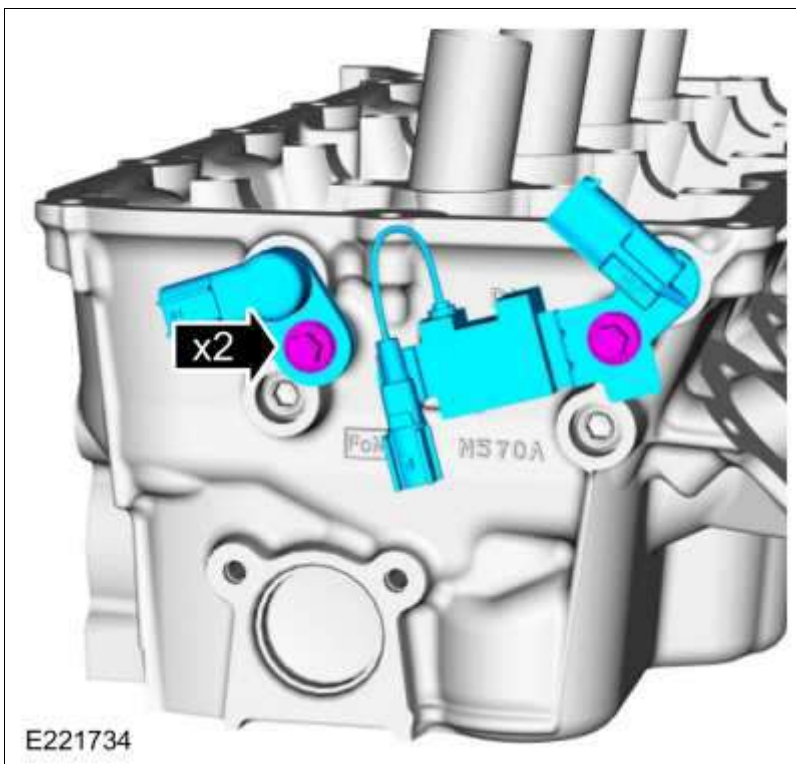
LH cylinder heads

9. Using a new gasket, install the coolant outlet and the bolts.

Torque: 89 lb.in (10 Nm)



10. Install the CMP sensors, the radio interference capacitor and the bolts.
Torque: 89 lb.in (10 Nm)





Piston

Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

DISASSEMBLY

1. Remove and discard the piston rings.



2. Remove and discard the piston pin retainers.
 - Remove the piston pin.

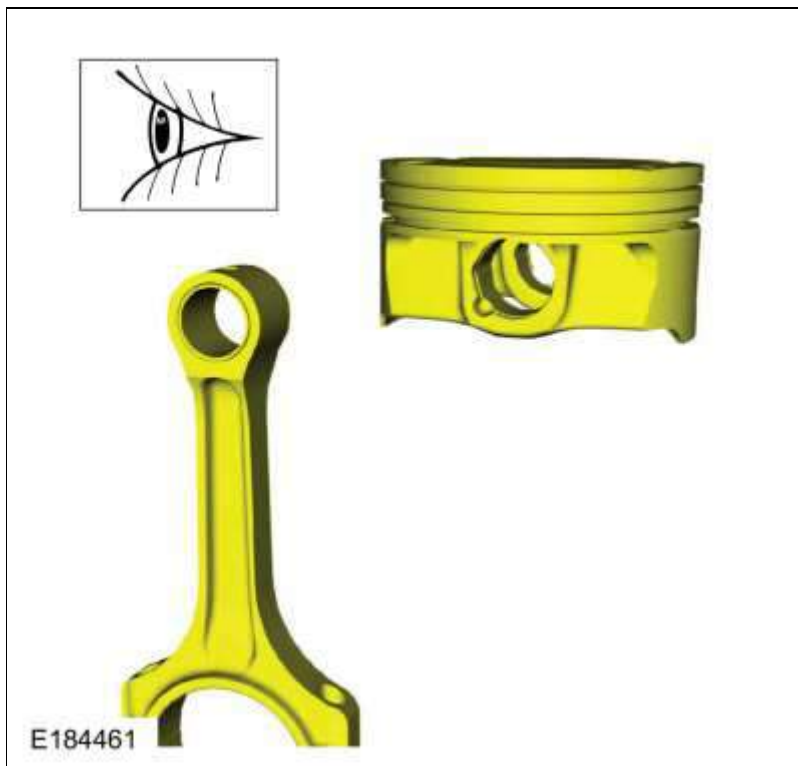


3. **NOTE:** If the piston and connecting rod are to be reinstalled, they must be assembled in the same orientation. Mark the piston orientation to the connecting rod for reassembly.

Separate the piston from the connecting rod.

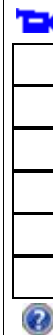
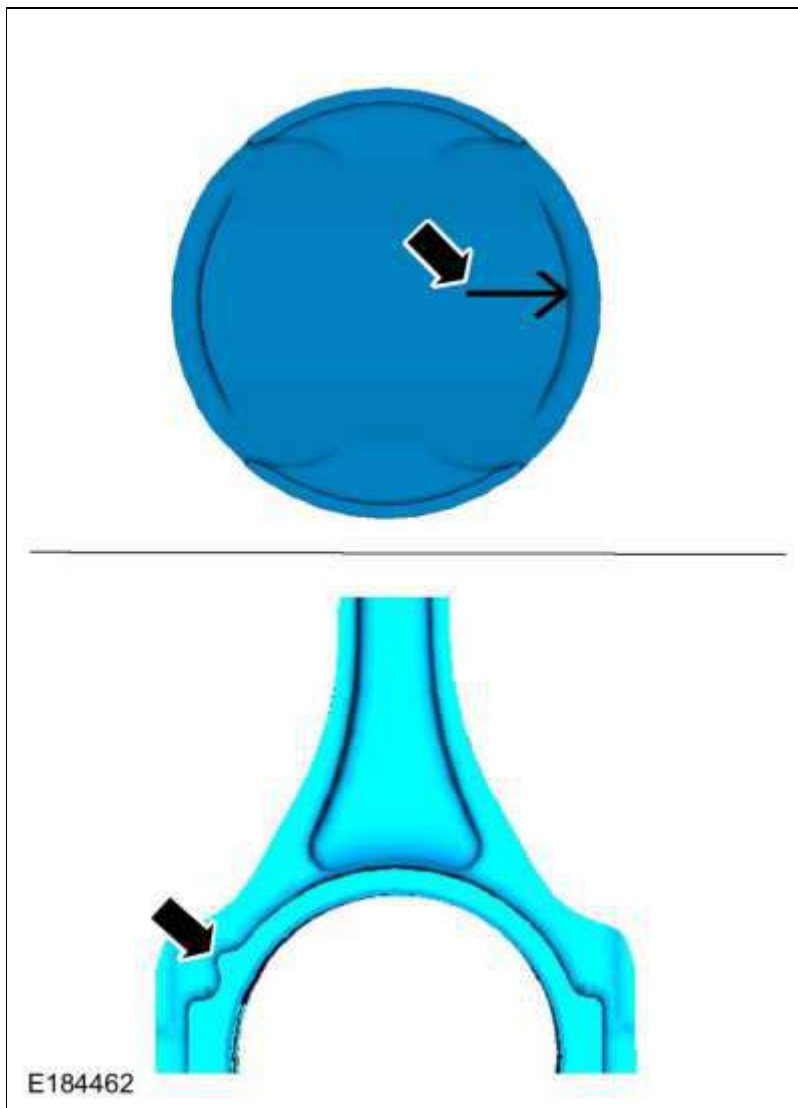


4. Clean and inspect the piston and connecting rod.
Refer to: [Piston Inspection](#) (303-00 Engine System - General Information, General Procedures).

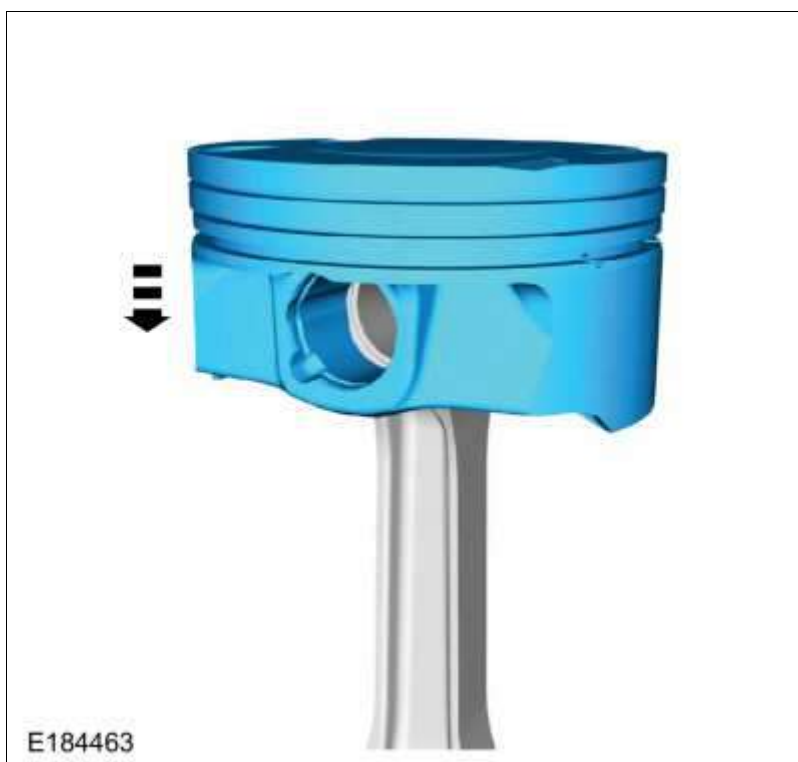


ASSEMBLY

1. If the piston and/or connecting rod are being installed new, the connecting rod orientation marks and the arrow on the top of the dome of the piston should be facing toward the front of the engine block.



2. Position the piston on the connecting rod.



3. Lubricate and install the piston pin.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



4. **NOTE:** The piston pin retainer gap orientation must be toward the top of the piston.

Install the piston pin retainers.



5. Lubricate and install the oil control rings.

1. Upper oil control ring.
2. Oil control expander ring.
3. Lower oil control ring.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



6. Install the lower compression ring.

1. The "O" mark on the ring pointing up toward the top of the piston.
2. Hook feature will point down toward the bottom of piston.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



7. Install the upper compression ring.

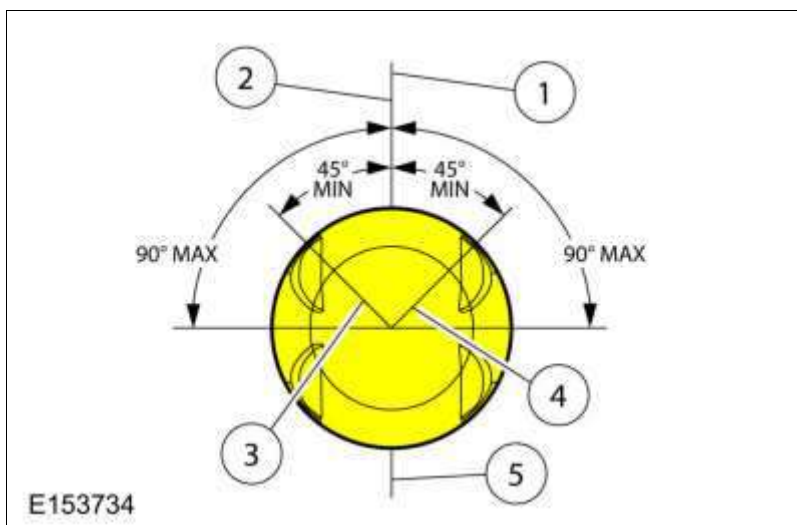
1. The "O" mark on the ring pointing up toward the top of the piston.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)

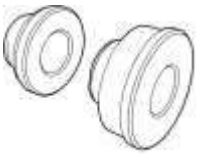


8. Position the piston ring gaps.

1. Center line of the piston parallel to the wrist pin bore.
2. Upper compression ring gap.
3. Upper oil control ring gap.
4. Lower oil control ring gap.
5. Oil control expander ring and lower compression ring gap.



**Engine**Base Part Number: [6L084](#)**Special Tool(s) / General Equipment**

 E133913	205-142 (T80T-4000-J) Installer, Differential Bearing Cone
 E133913	205-153 (T80T-4000-W) Handle
 E175042	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
 ST2980-A	303-1250 Seal Installer, Rear Main TKIT-2006UFFLM
 E216458	303-1531 Installer, Front Crank Seal and Damper
 E222985	303-335 (T88T-6701-A) Installer, Front Cover Oil Seal TKIT-1988-F TKIT-1988-FLM
	303-448 (T93P-6303-A) Holding Tool, Crankshaft TKIT-1993-FLM TKIT-1993-LM
	303-F047 Lifting Bracket, Engine
Strap Wrench	
Floor Crane	

Mounting Stand
Clutch Alignment Tool
Piston Ring Compressor

Materials

Name	Specification
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) VC-3-B (U.S.)	WSS-M97B44-D
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

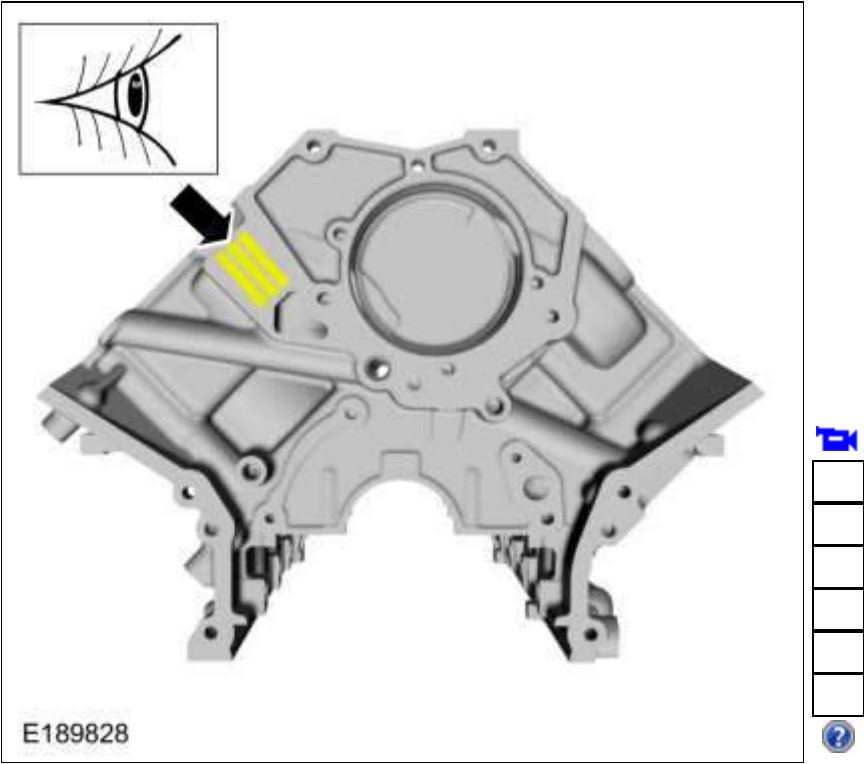
6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

NOTICE: The timing chain alignment procedure has changed from prior model year engines and must be followed exactly or damage to the engine will result.

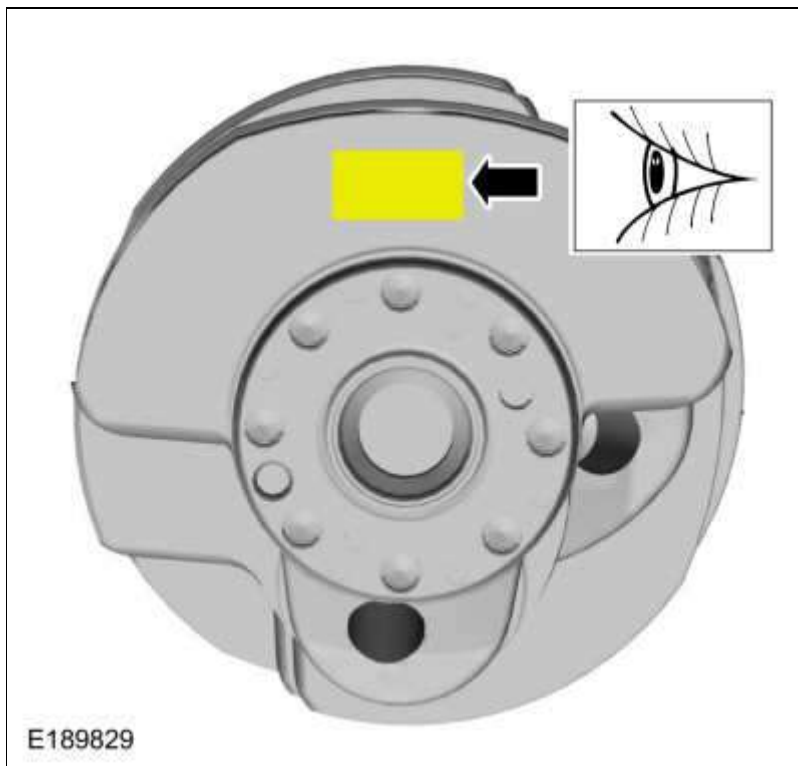
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: During engine assembly it may become necessary to check bearing clearances and end play. Refer to Section 303-00.

- 1. Record the main bearing code found on the front of the engine block.



- 2. Record the main bearing code found on the rear of the crankshaft.



3. **NOTE:** This chart is for selecting main bearings 1 and 5 only, the remaining bearings will be selected using a different chart in the next step.

Using the data recorded earlier and the Bearing Select Fit Chart, Standard Bearings, determine the required bearing grade for main bearings 1 and 5.

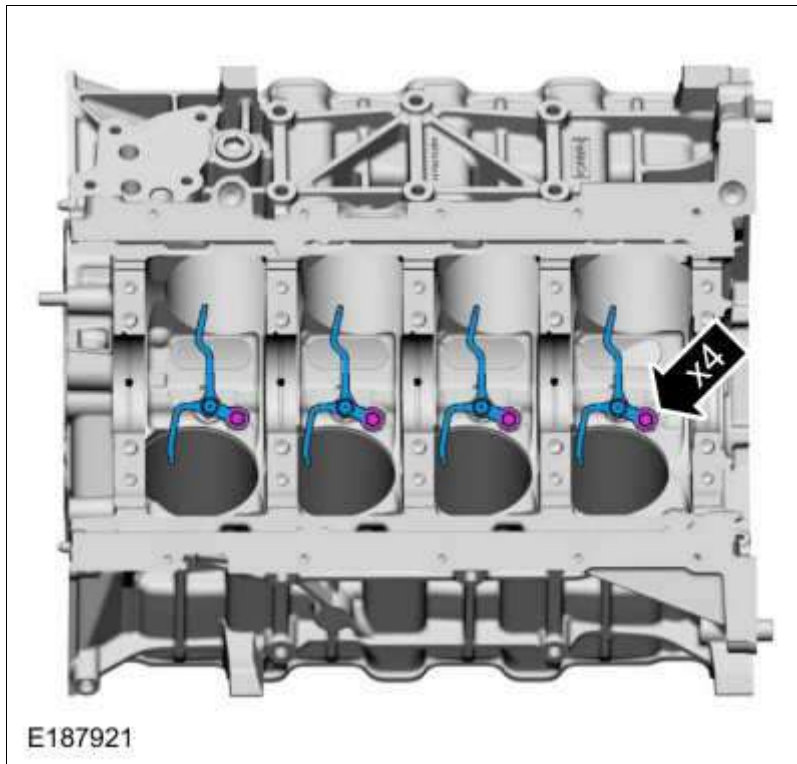
- Read the first letter of the engine block main bearing code and the first letter of the crankshaft main bearing code.
- Read down the column below the engine block main bearing code letter and across the row next to the crankshaft main bearing code letter, until the 2 intersect. This is the required bearing grade(s) for the No. 1 crankshaft main bearing.
- As an example, if the engine block code letter is "F" and the crankshaft code letter is "P", the correct bearing grade for this main bearing is a "1" for the upper bearing and a "2" for the lower bearing.
- Repeat the above steps using the fifth letter of the block and crankshaft codes to select the No. 5 bearing.

5. Install the piston cooling jets and bolts.

Torque:

Stage 1: 89 lb.in (10 Nm)

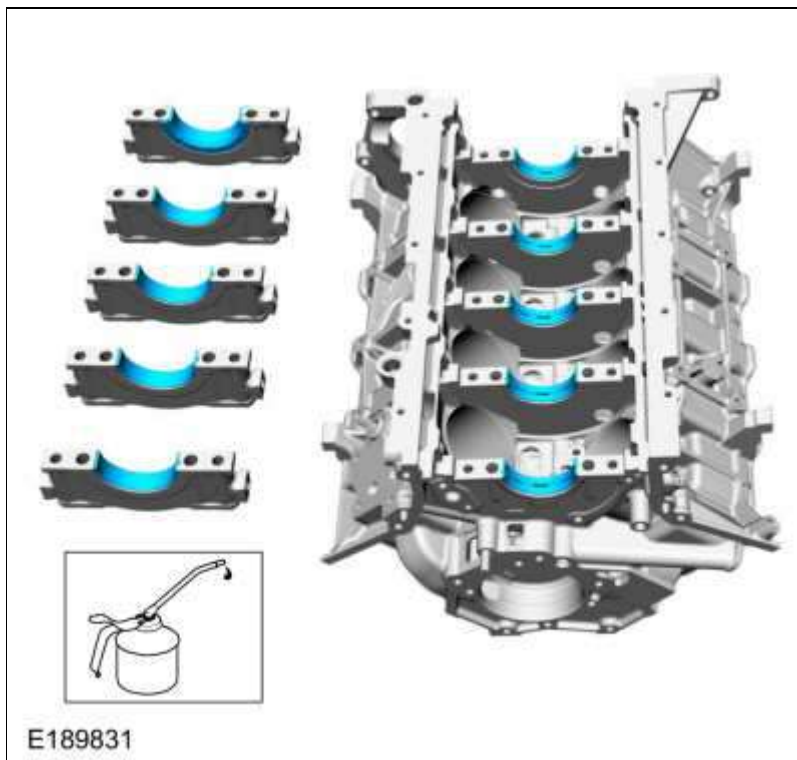
Stage 2: 45°



6. Install the crankshaft main bearings.

- Install the crankshaft upper main bearings into the cylinder block.
- Install the crankshaft lower main bearings and thrust bearing into the bearing caps.
- Make sure all oil passages are aligned.
- Lubricate all main bearings with clean engine oil.

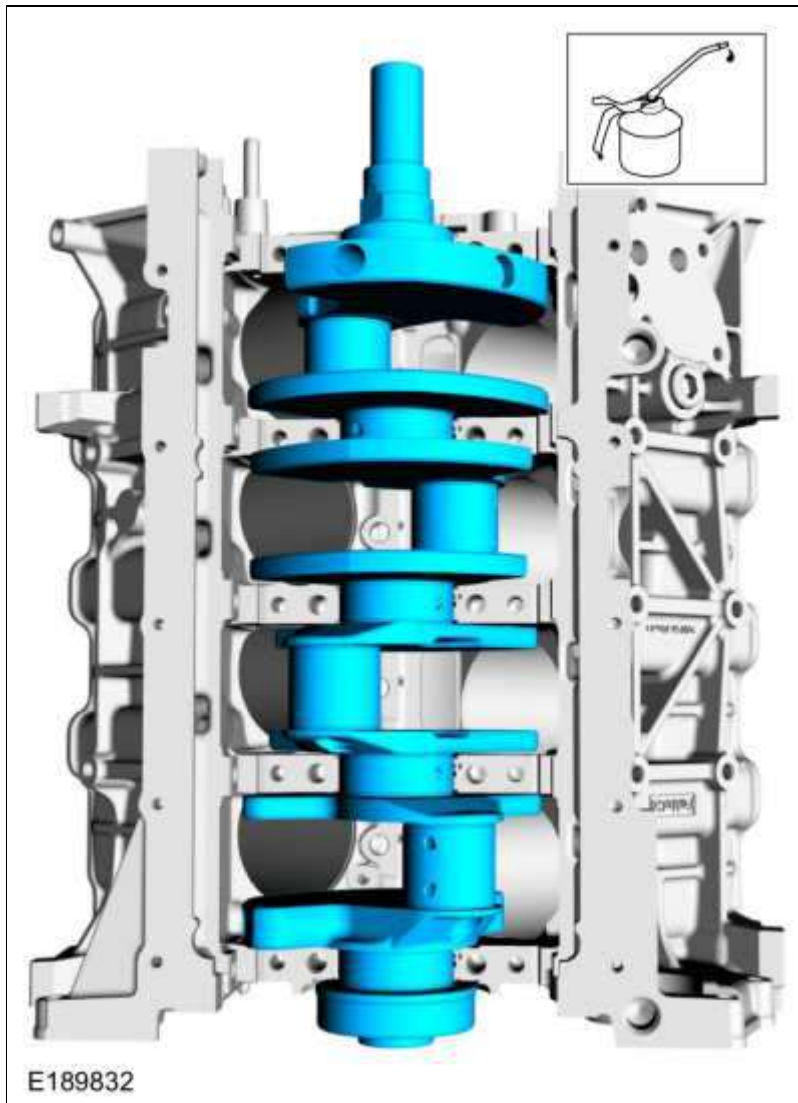
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



7. **NOTE:** Lubricate the crankshaft bearing journals with clean engine oil.

Install the crankshaft into the cylinder block.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)

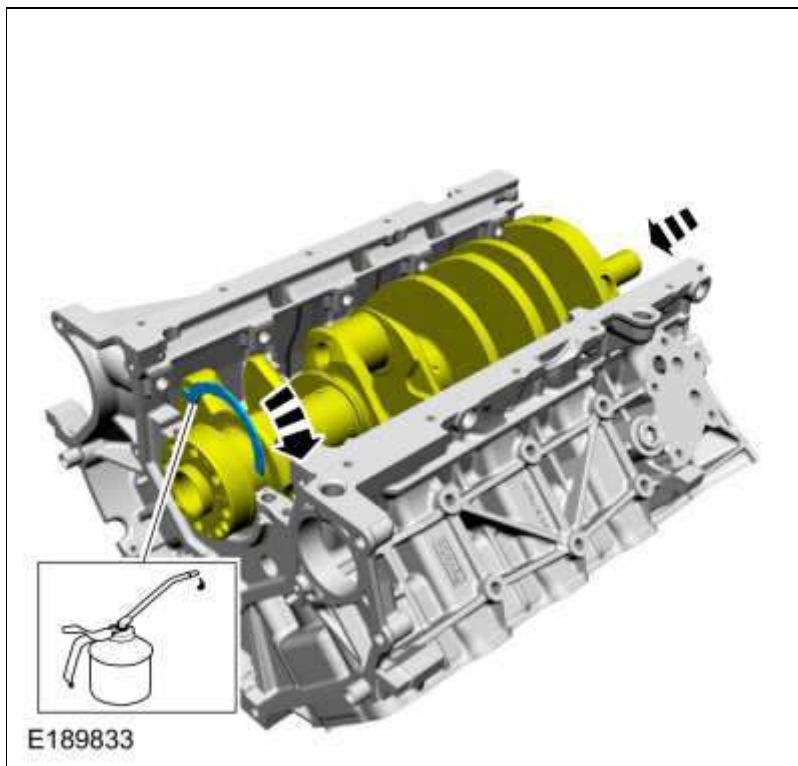


8. **NOTE:** The oil groove on the thrust washer must face toward the rear of the engine (against the crankshaft thrust surface).

NOTE: Lubricate the thrust washer with clean engine oil.

Push the crankshaft rearward and install the rear crankshaft upper thrust washer at the back of the No. 5 main boss.

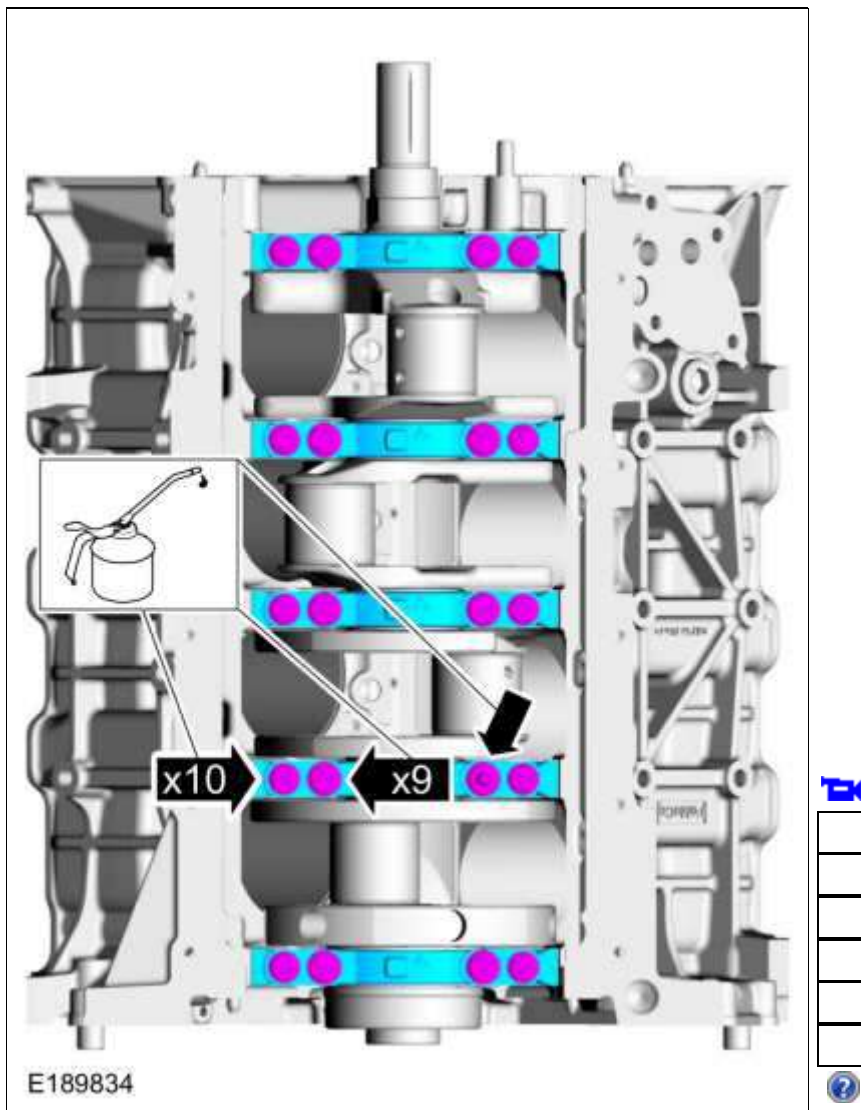
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



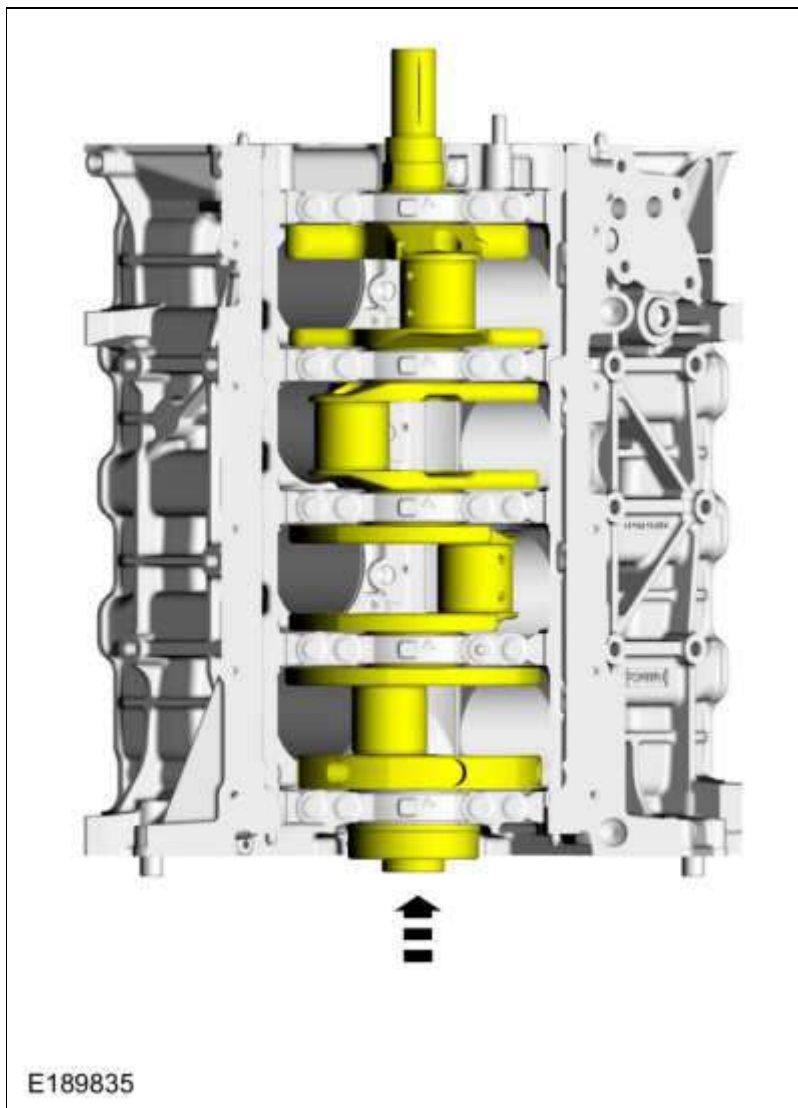
9. **NOTE:** Lubricate the fastener threads with clean engine oil.

Install the main bearing caps and fasteners on the cylinder block and, keeping the caps as square as possible, alternately draw the caps down evenly using the cap fasteners.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



10. Push the crankshaft forward to seat the crankshaft thrust washer.



11. Tighten the vertical main bearing cap fasteners.

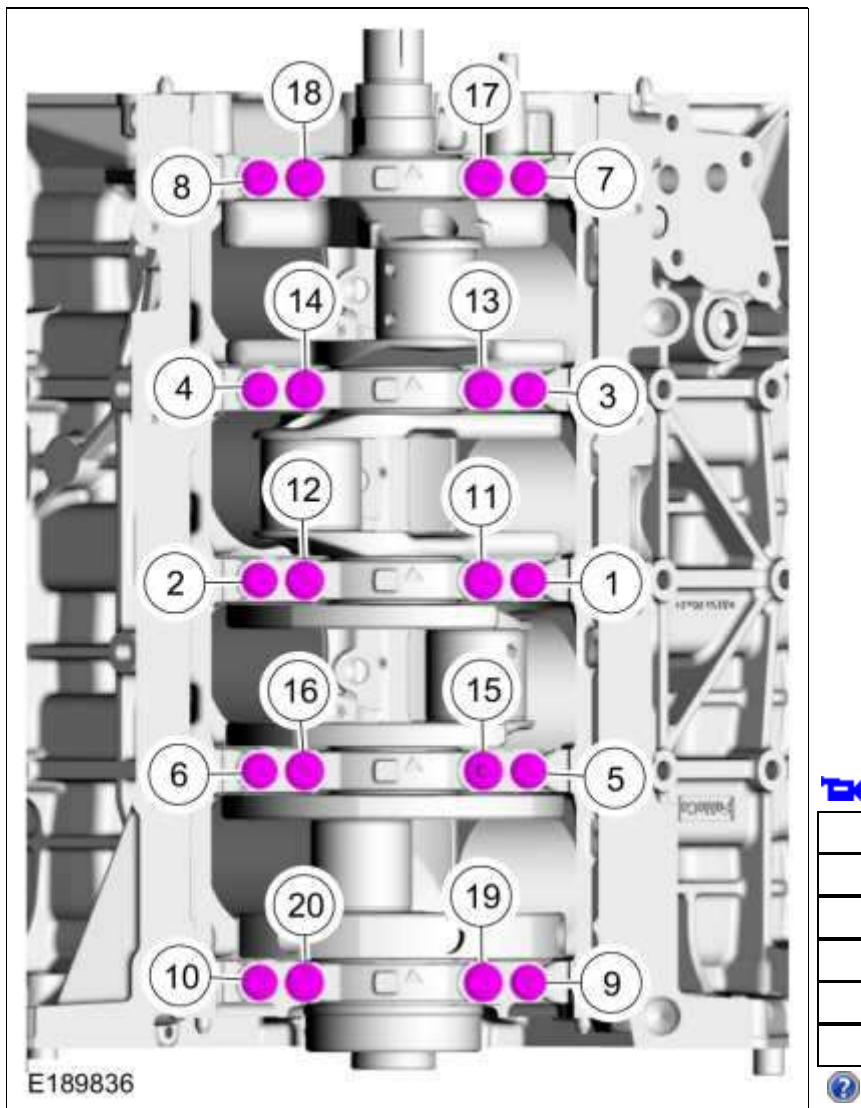
Torque:

Stage 1: 1 through 20: 177 lb.in (20 Nm)

Stage 2: 1 through 10: 30 lb.ft (40 Nm)

Stage 3: 11 through 20 : 48 lb.ft (65 Nm)

Stage 4: 1 through 20: 90°



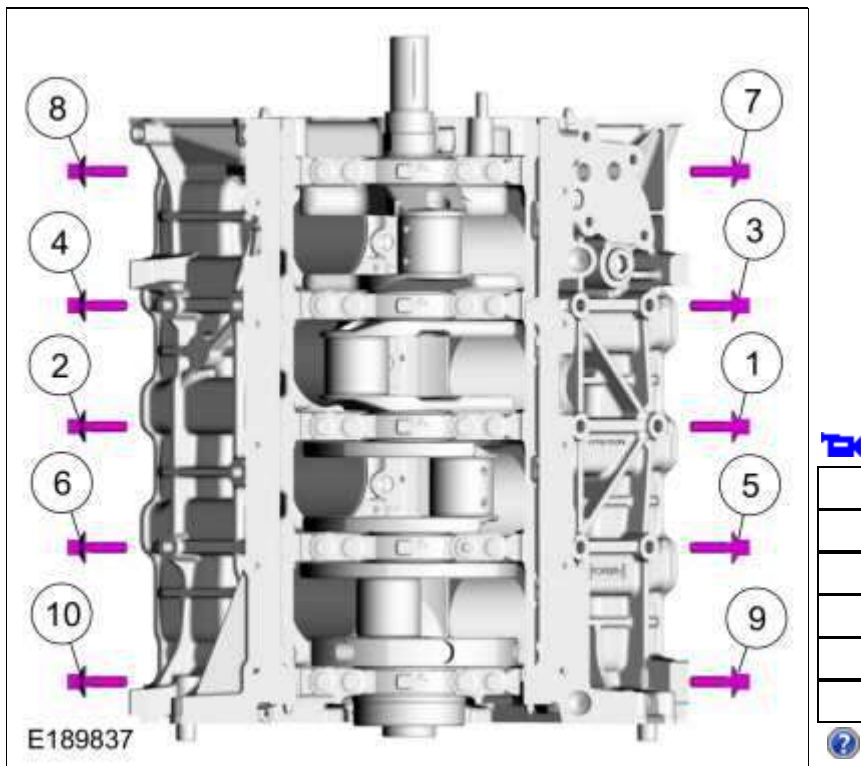
12. Install the cross-mounted main bearing cap fasteners.

Torque:

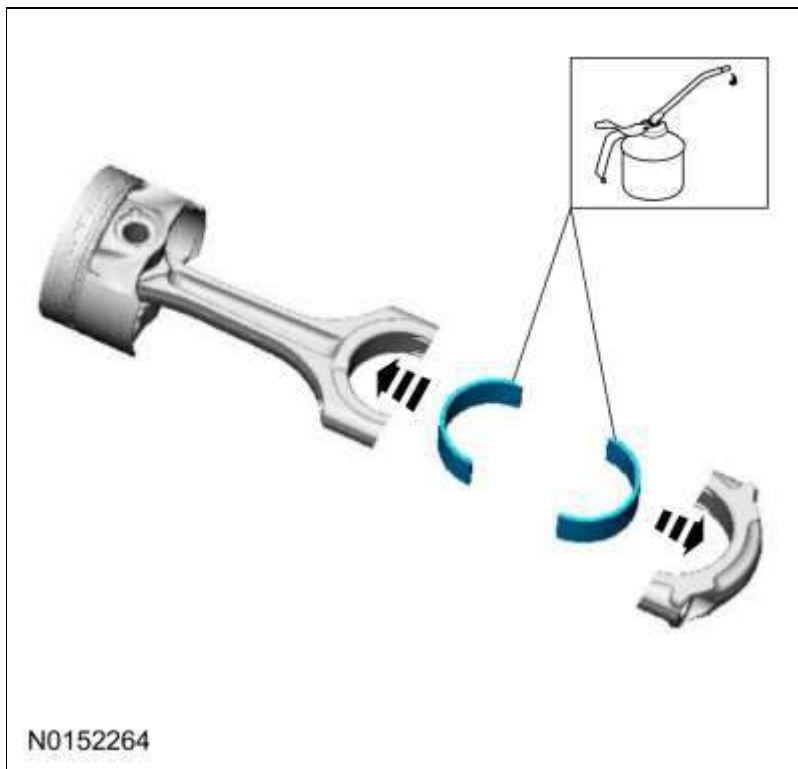
Stage 1: 89 lb.in (10 Nm)

Stage 2: 22 lb.ft (30 Nm)

Stage 3: 60°



13.
 - Check the crankshaft end play.
Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).
 - Check that crankshaft torque-to-turn does not exceed 6 Nm (53 lb-in).
 - Check the piston-to-cylinder block and piston ring clearances.
Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).
 - Assemble the pistons and position the piston ring gaps.
Refer to: [Piston](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Disassembly and Assembly of Subassemblies).
14. Lubricate with clean engine oil and install the connecting rod bearings.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



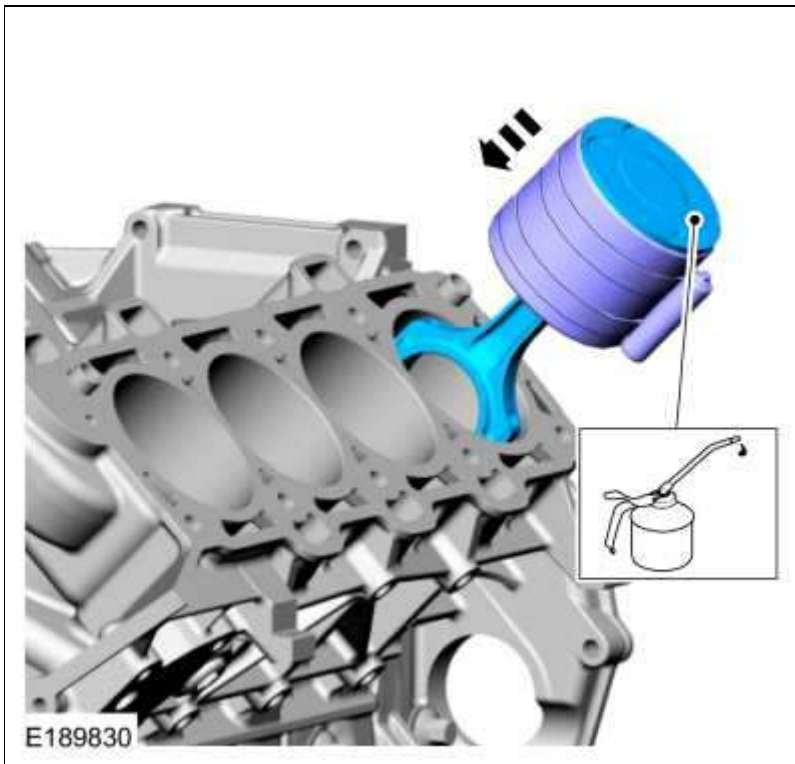
15. **NOTICE:** Do not allow the piston connecting rods to come in contact with the piston cooling jets or engine damage may occur.

NOTICE: 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.

NOTICE: 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 piston with clean engine oil.

- Using a piston ring compressor, install the piston.
Use the General Equipment: Piston Ring Compressor
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)

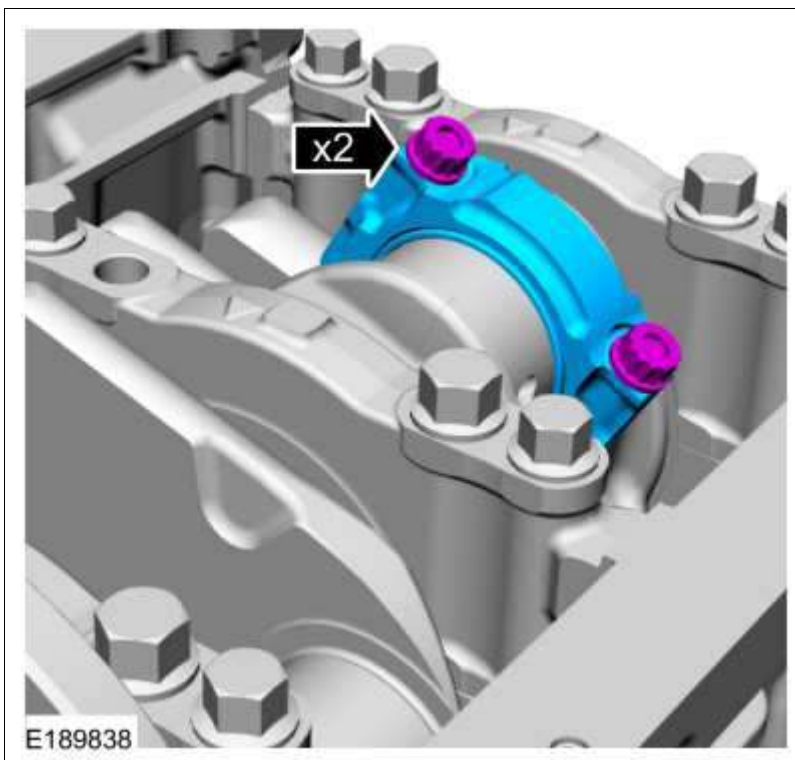


16. **NOTICE:** The rod cap installation must keep the same orientation as marked during disassembly or engine damage may occur.

NOTE: The connecting rod caps are of the "cracked" design and must mate with the connecting rod ends. Excessive bearing clearance will result if not mated correctly.

Install the connecting rod cap and bearing.

- Install the new bolts hand tight.



17. Repeat the previous 2 steps for each of the remaining pistons.

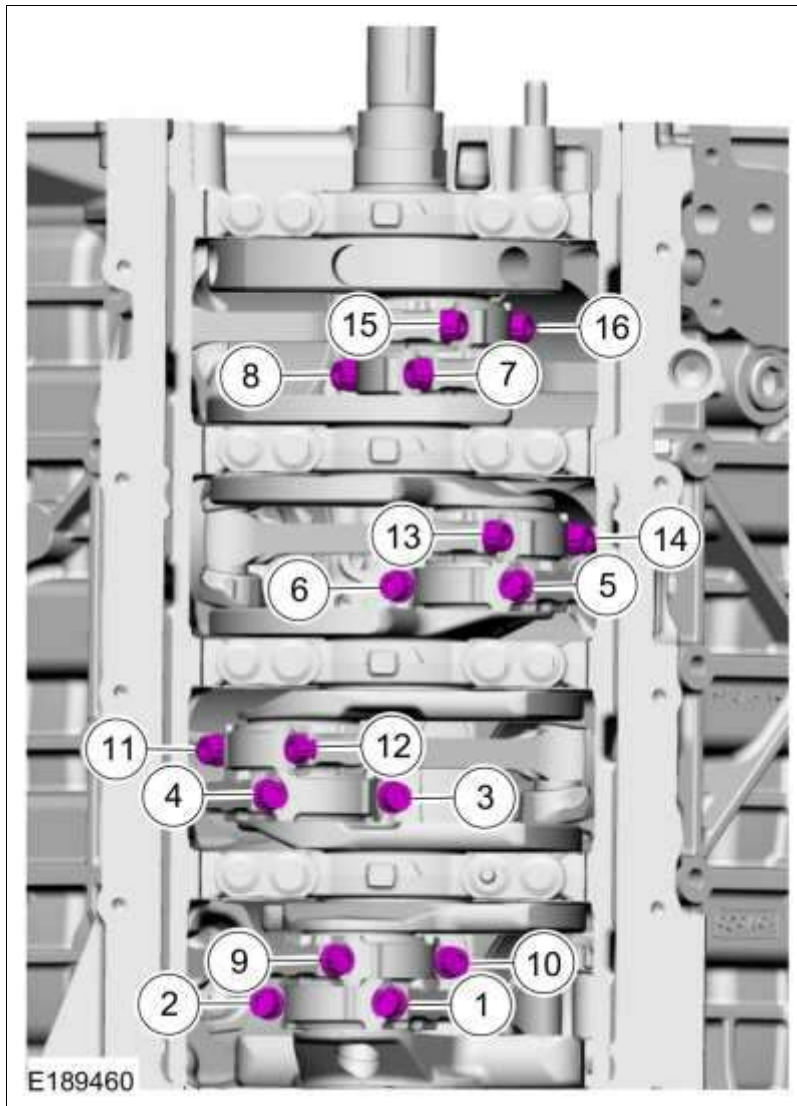
18. Tighten the connecting rod bolts.

Torque:

Stage 1: 177 lb.in (20 Nm)

Stage 2: 28 lb.ft (38 Nm)

Stage 3: 105°



19. **NOTE:** Oil pump must be held against the cylinder block until all bolts are tightened.

- Rotate the inner rotor of the oil pump assembly to align the flats on the crankshaft and slip the oil pump over the crankshaft until seated against the block.
- Rotate the oil pump until the bolt holes are aligned to the block and install the fasteners hand tight.

Torque:

Stage 1: A: 89 lb.in (10 Nm)

Stage 2: B: 18 lb.ft (25 Nm)

Stage 3: C: 89 lb.in (10 Nm)

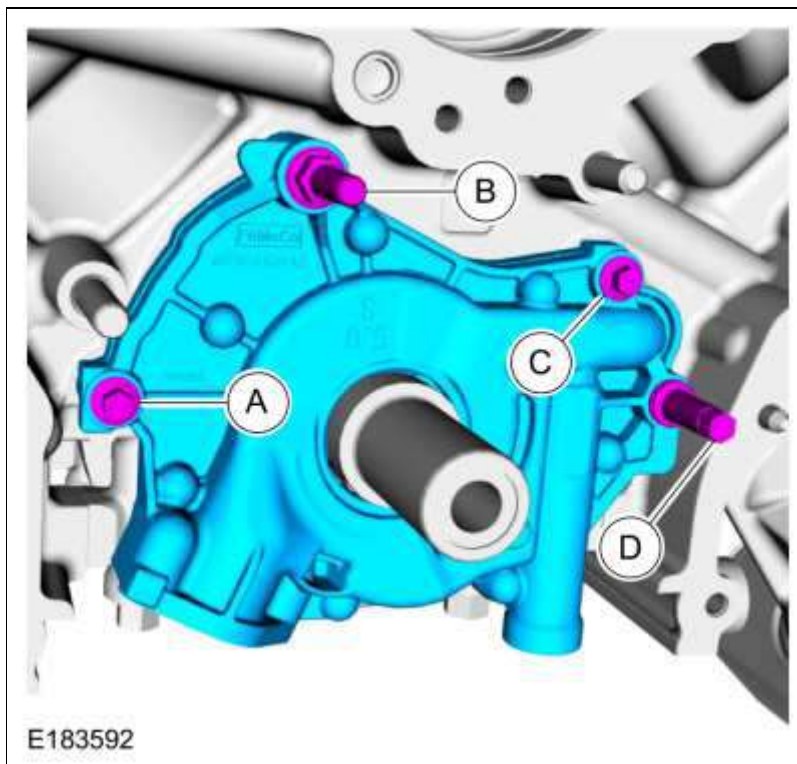
Stage 4: D: 177 lb.in (20 Nm)

Stage 5: A: 45°

Stage 6: B: 75°

Stage 7: C: 45°

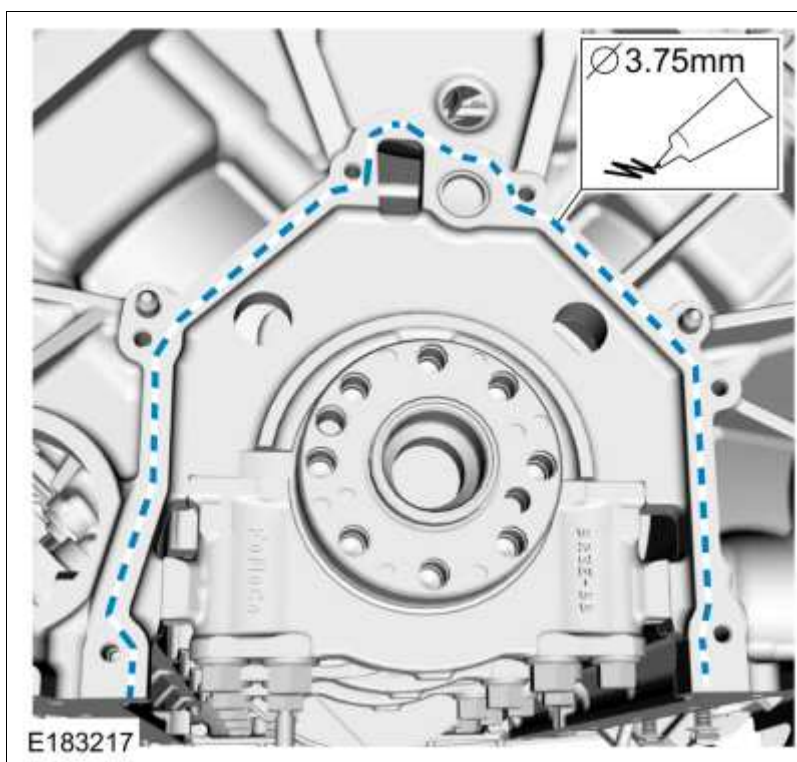
Stage 8: D: 60°



20. **NOTE:** If the rear crankshaft seal retaining plate is not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. Failure to follow this procedure may cause future oil leaks.

Apply a 3.75 mm (0.147 in) bead of silicone gasket and sealant to the rear crankshaft seal retainer mating surface on the engine block.

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)

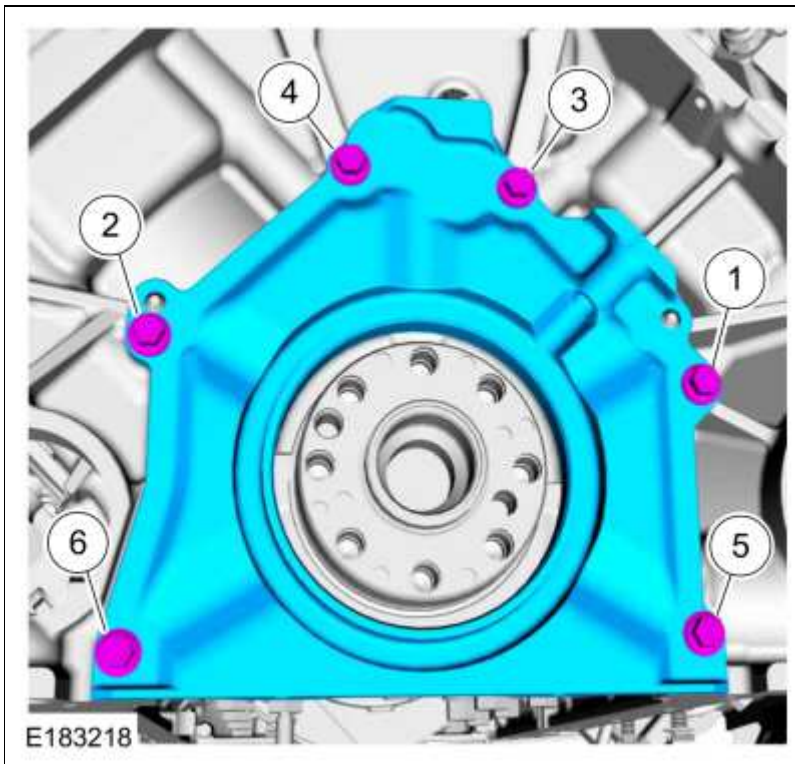


21. Install the crankshaft rear seal retainer plate and the bolts.

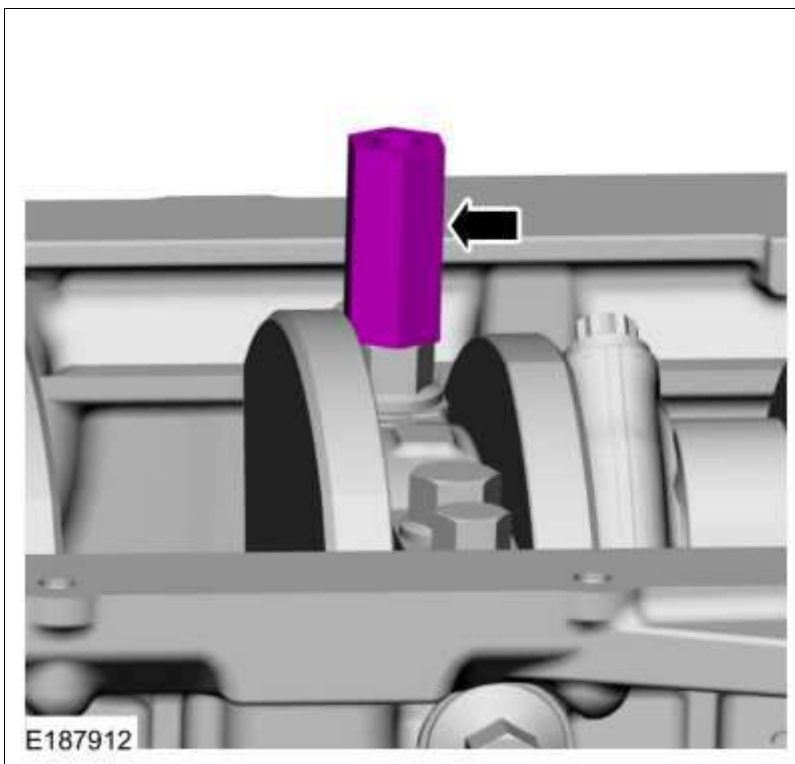
Torque:

Stage 1: 89 lb.in (10 Nm)

Stage 2: 45°



22. Install the oil pump screen and pickup tube spacer.
Torque: 18 lb.ft (25 Nm)

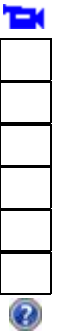
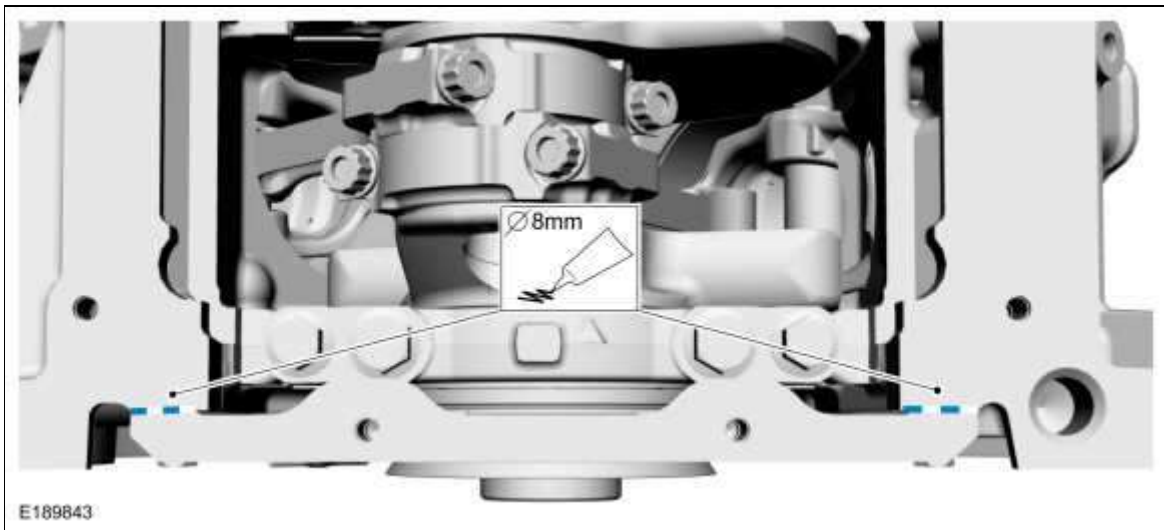


23. **NOTE:** If the oil pan is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Failure to follow this procedure can cause future oil leakage. If this timing cannot be met, tighten fasteners 7, 8, 9 and 10 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer and final torque all of the fasteners within 1 hour of applying the sealer.

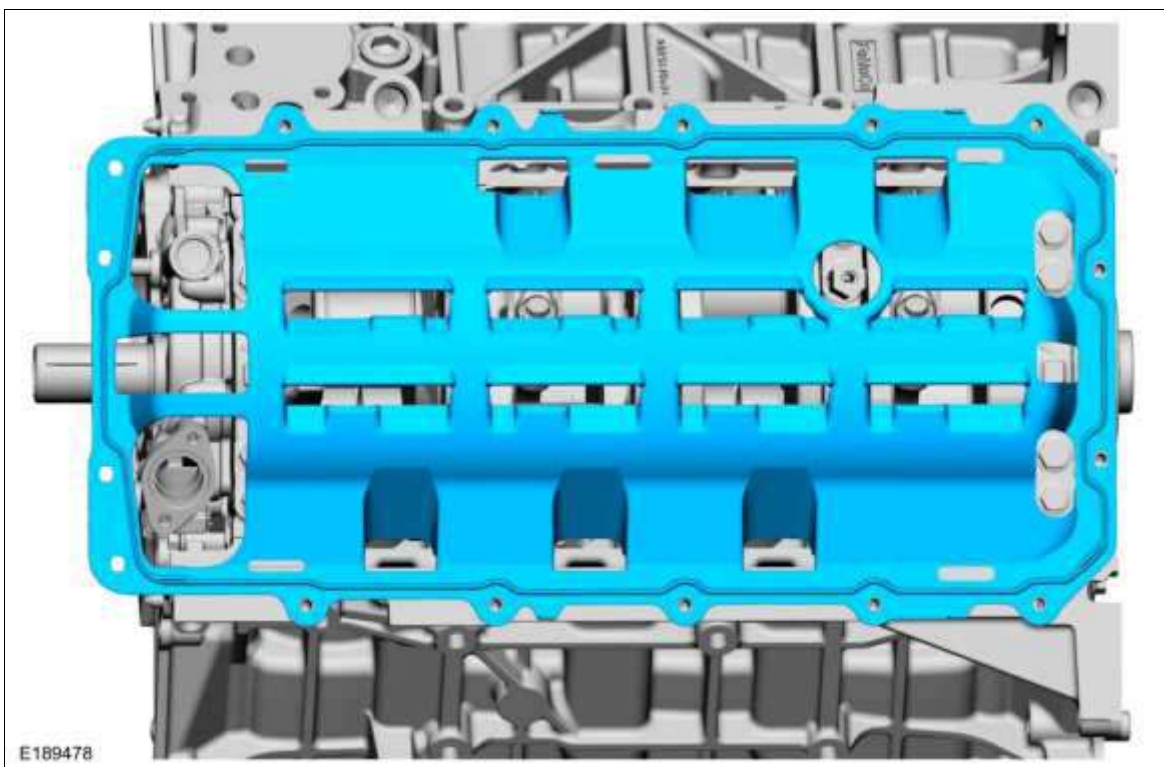
Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the crankshaft rear seal retainer plate-to-cylinder block sealing surfaces.

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)

Torque: 18 lb.ft (25 Nm)



24. Install the oil pan baffle and gasket.



25. Using a new O-ring seal, install the oil pump screen and pickup tube and the bolts.

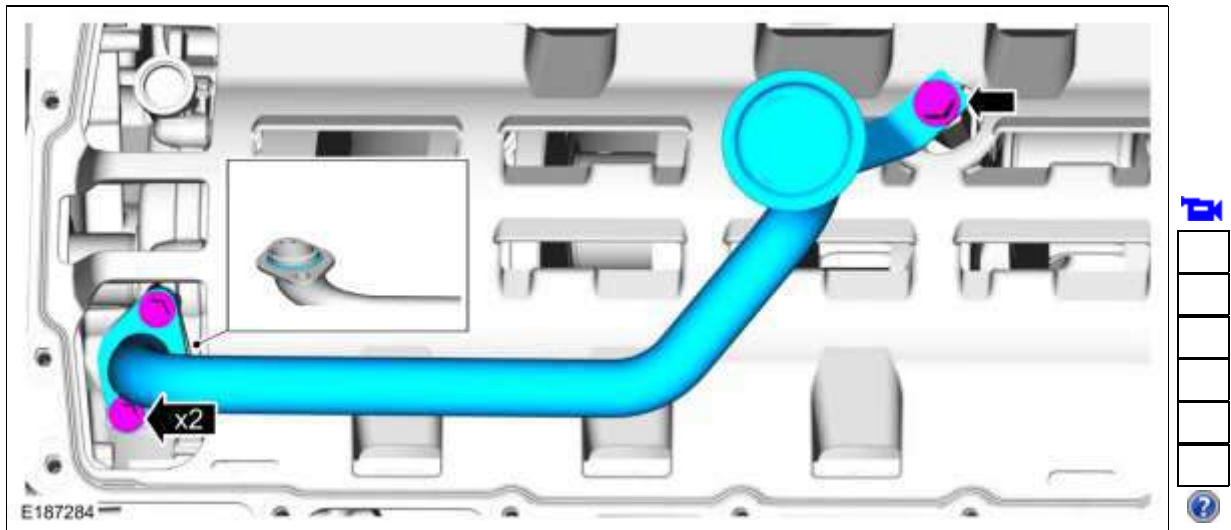
Torque:

Oil pump screen and pickup tube-to-oil pump bolts :

Stage 1: 89 lb.in (10 Nm)

Stage 2: 45°

Oil pump screen and pickup tube-to-spacer bolt : 18 lb.ft (25 Nm)



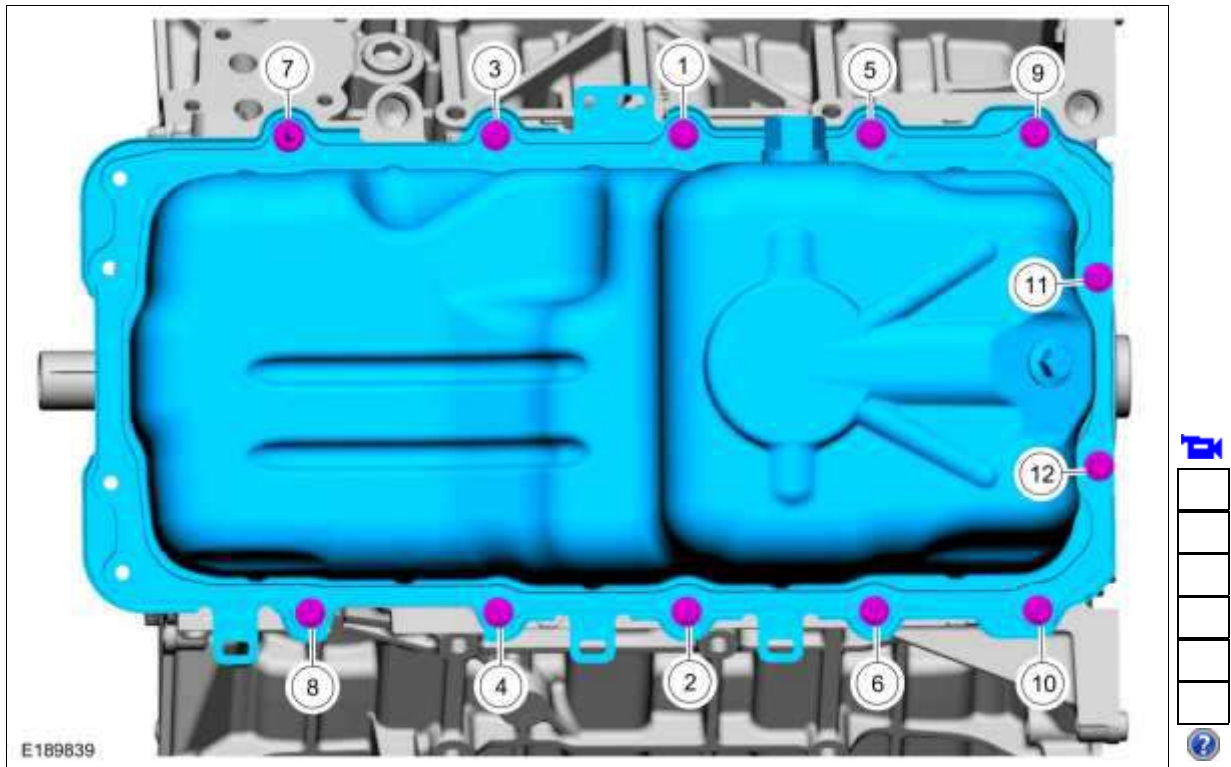
26. Install the oil pan and the fasteners.

Torque:

Stage 1: 18 lb.in (2 Nm)

Stage 2: 89 lb.in (10 Nm)

Stage 3: 45°

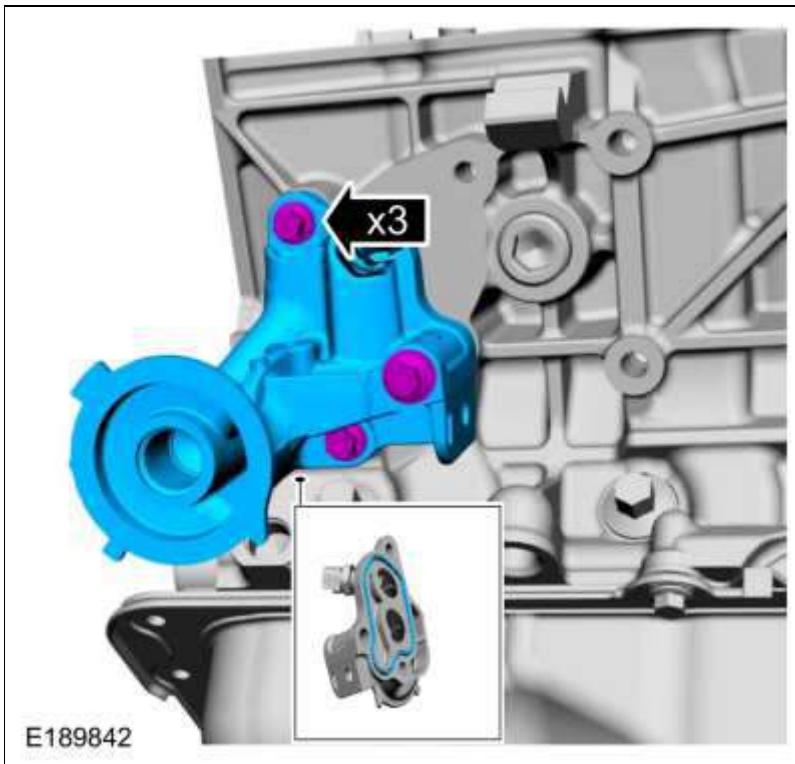


27. Using a new gasket, install the oil filter adapter and the bolts.

Torque:

Stage 1: 177 lb.in (20 Nm)

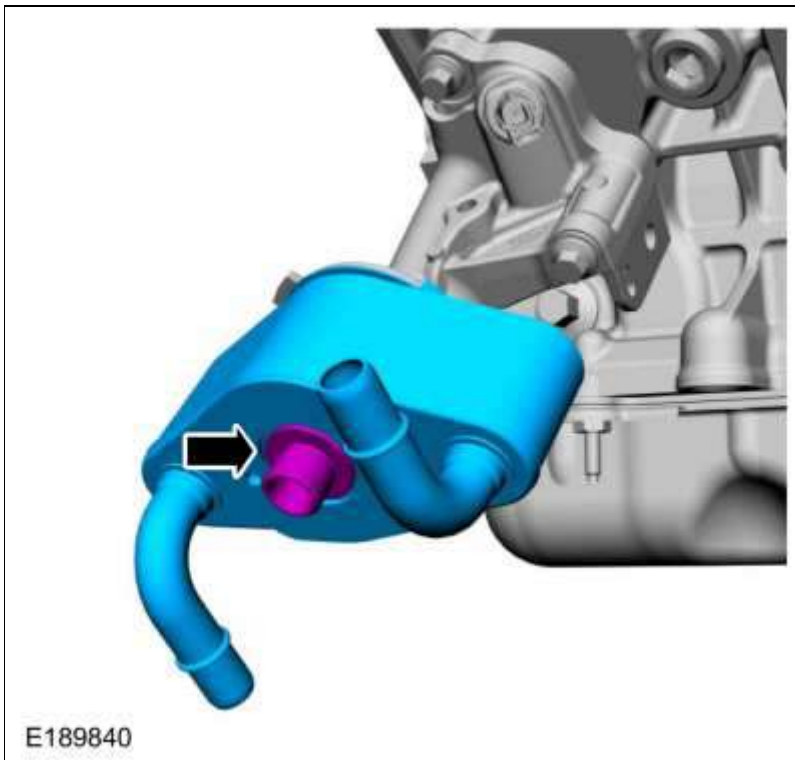
Stage 2: 60°



28. **NOTICE:** A new oil cooler must be installed or severe damage to the engine can occur.

Install a new oil cooler and the threaded fitting.

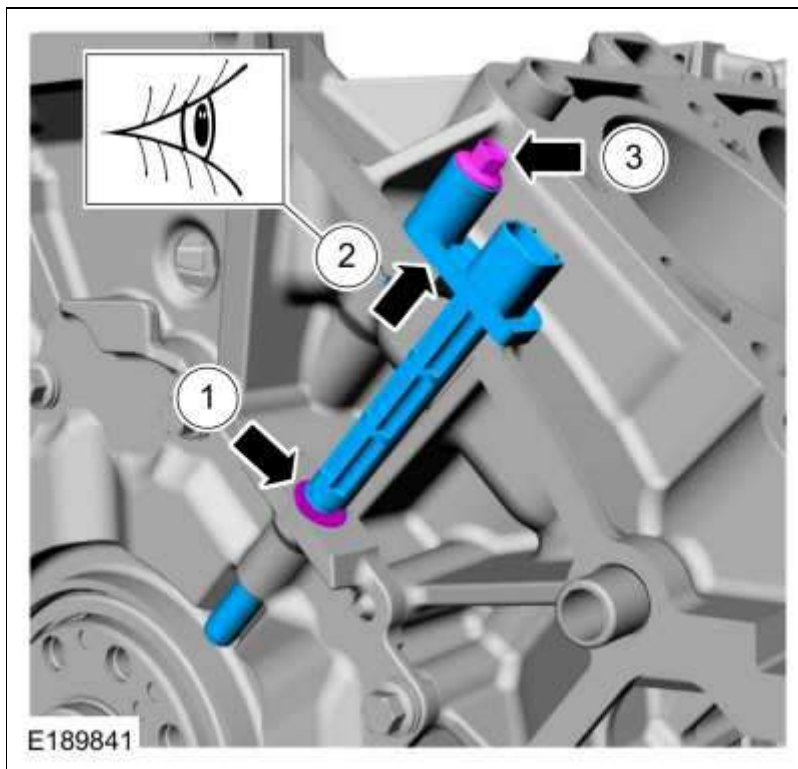
Torque: 43 lb.ft (58 Nm)



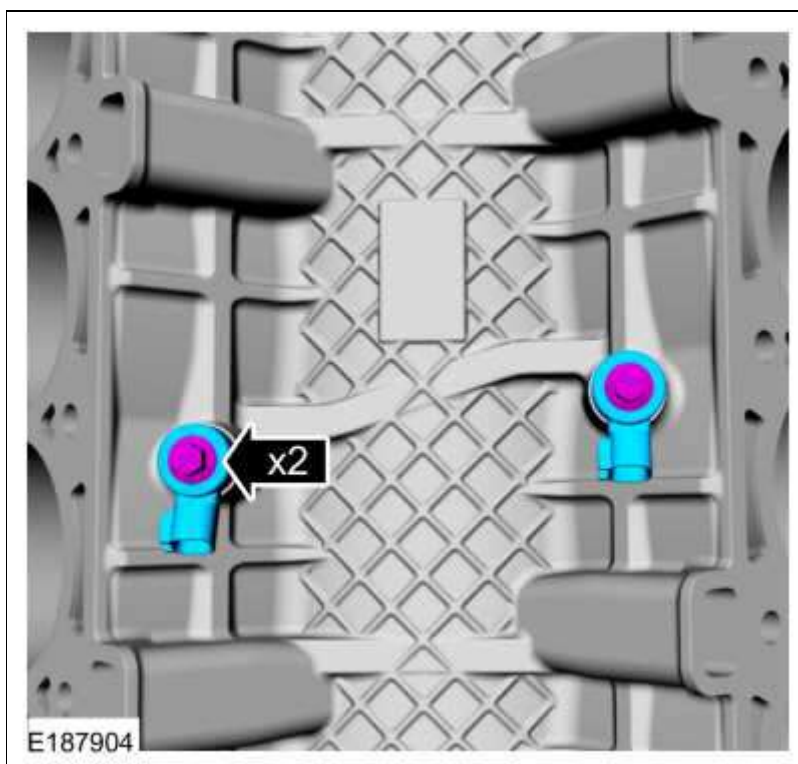
29. **NOTICE:** The CKP sensor must be positioned into the fitting on the crankshaft rear seal retainer plate and be flush against the boss on the engine block before the bolt is installed. If the CKP sensor is installed incorrectly, the CKP sensor can be damaged.

- Install the CKP sensor must be positioned into the fitting on the crankshaft rear seal retainer plate.
- Make sure the CKP sensor is flush with the engine block boss.
- Install the bolt.

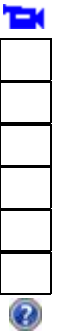
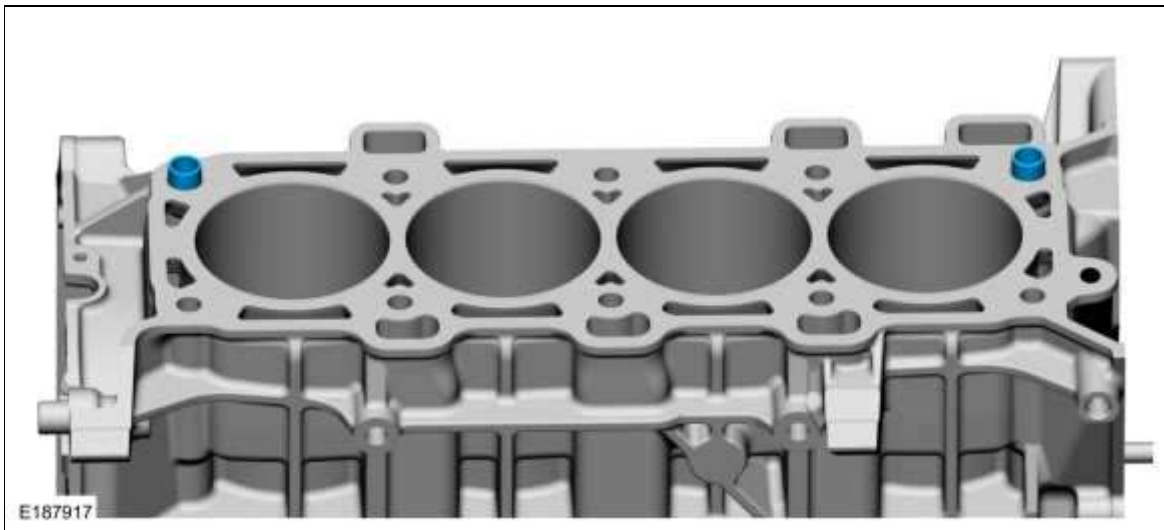
Torque: 89 lb.in (10 Nm)



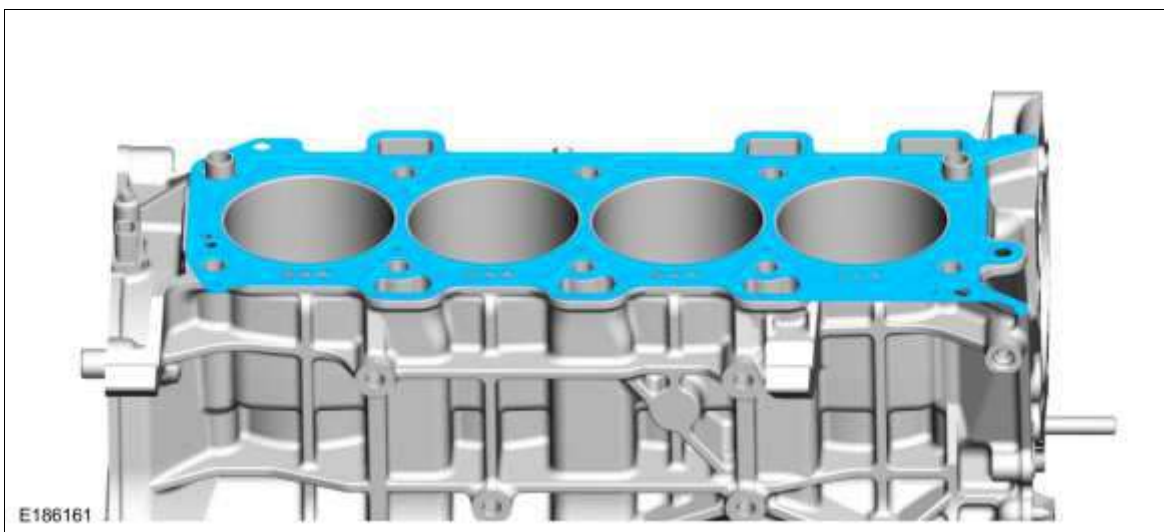
30. Install the KSs and the bolts.
Torque: 177 lb.in (20 Nm)



31. Install the dowels on the RH bank of the cylinder block.



32. Install a new RH cylinder head gasket.



33. **NOTE:** The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

Install the RH cylinder head and the new bolts.

Torque:

Stage 1: 18 lb.ft (25 Nm)

Stage 2: 55 lb.ft (75 Nm)

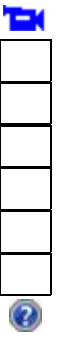
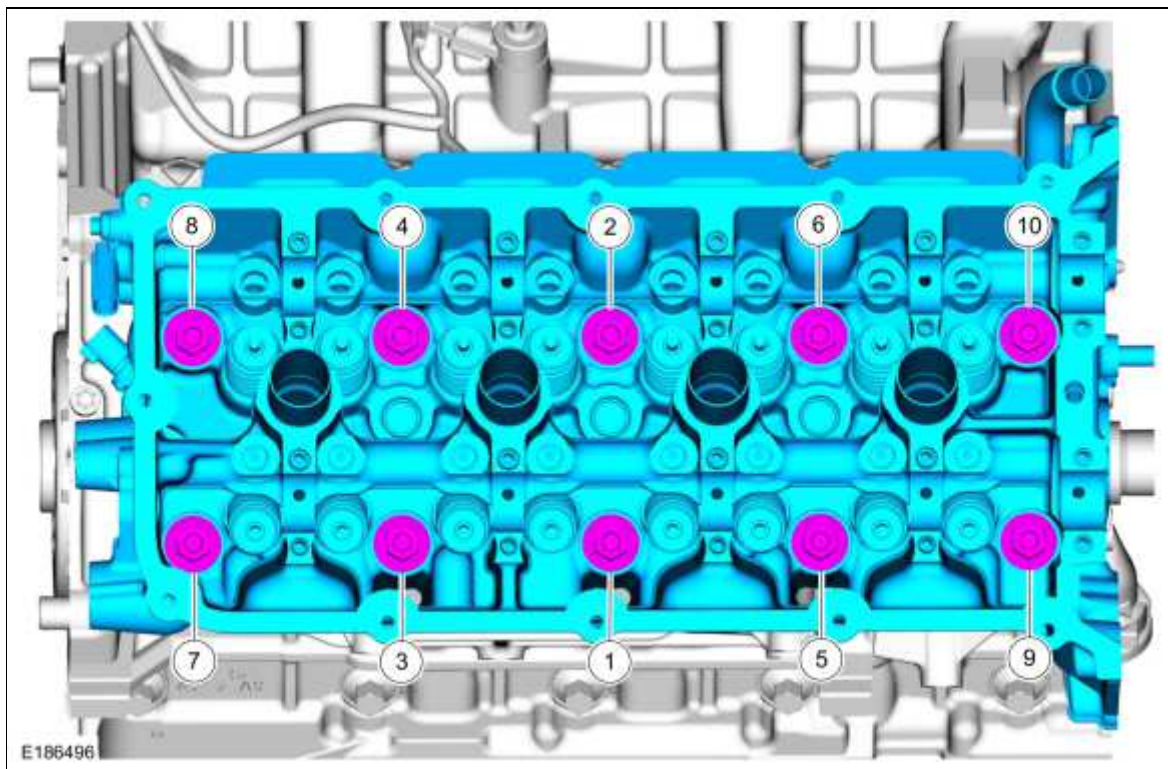
Stage 3: Loosen: 180°

Stage 4: 18 lb.ft (25 Nm)

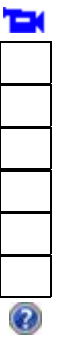
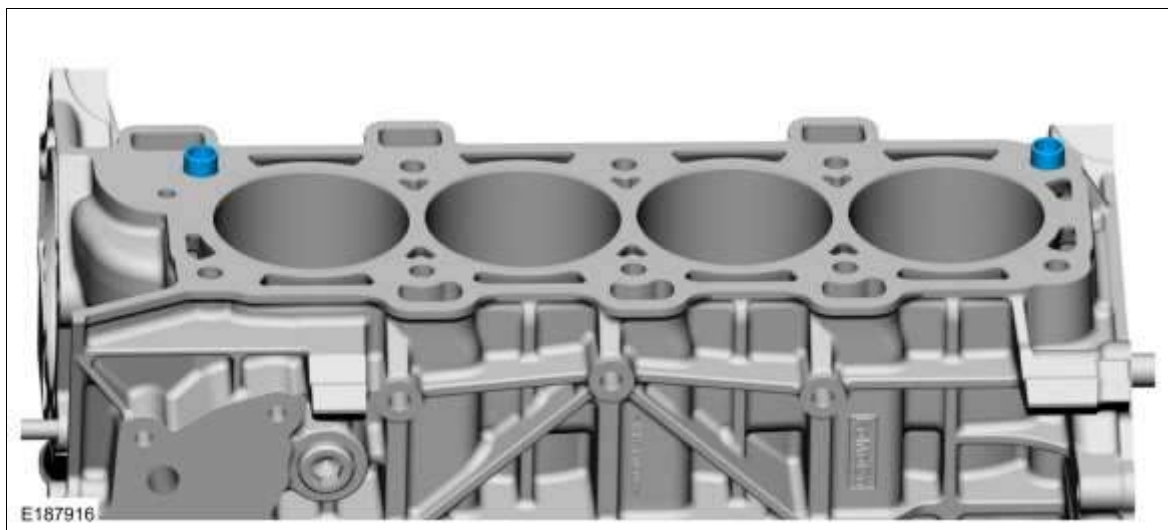
Stage 5: 26 lb.ft (35 Nm)

Stage 6: 90°

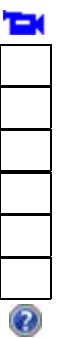
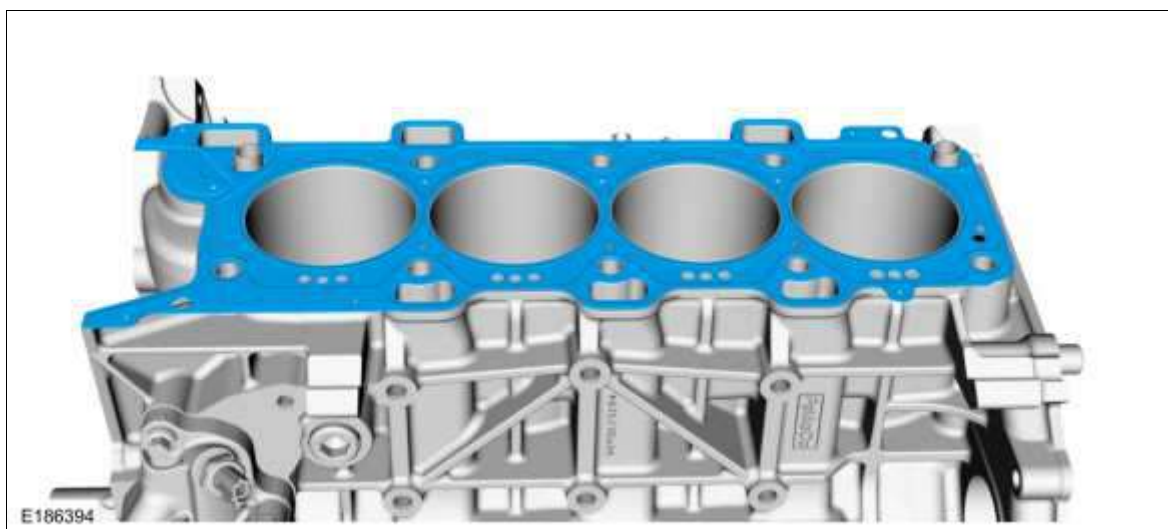
Stage 7: 90°



34. Install the dowels on the LH bank of the cylinder block.



35. Install a new LH cylinder head gasket.



36. **NOTE:** The cylinder head bolts are torque-to-yield and must not be reused. New cylinder head bolts must be installed.

Install the LH cylinder head and the new bolts.

Torque:

Stage 1: 18 lb.ft (25 Nm)

Stage 2: 55 lb.ft (75 Nm)

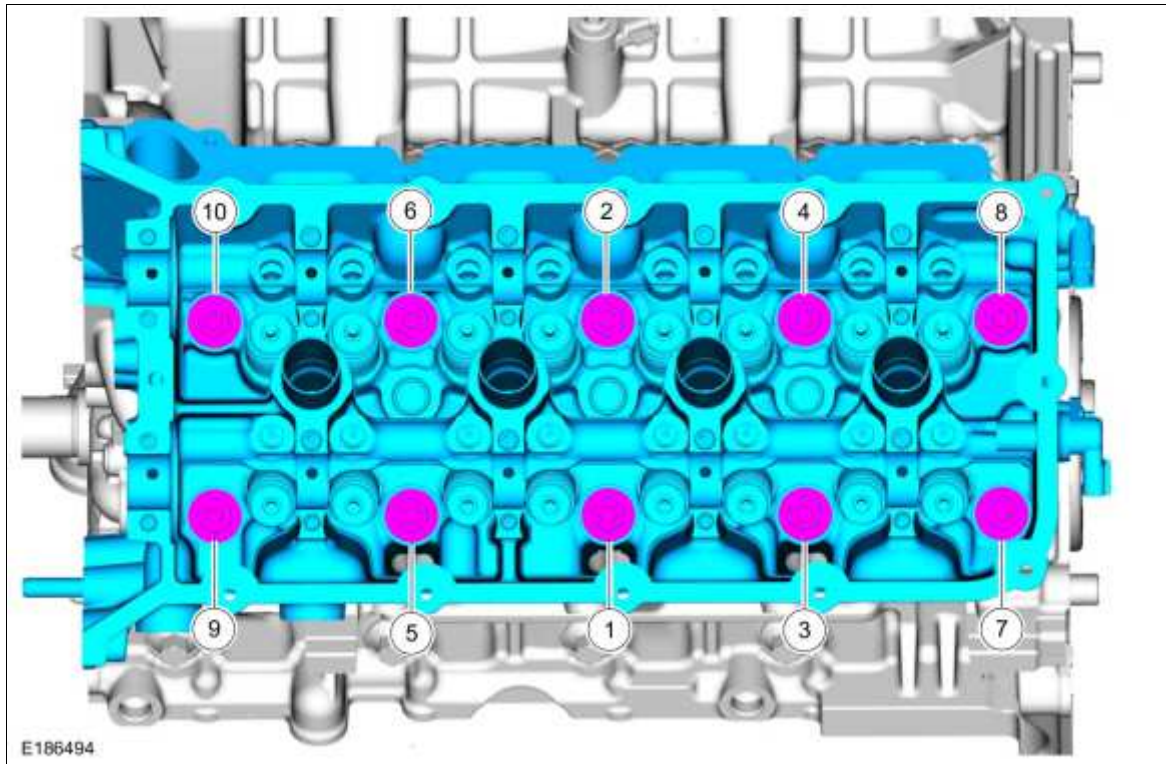
Stage 3: Loosen: 180°

Stage 4: 18 lb.ft (25 Nm)

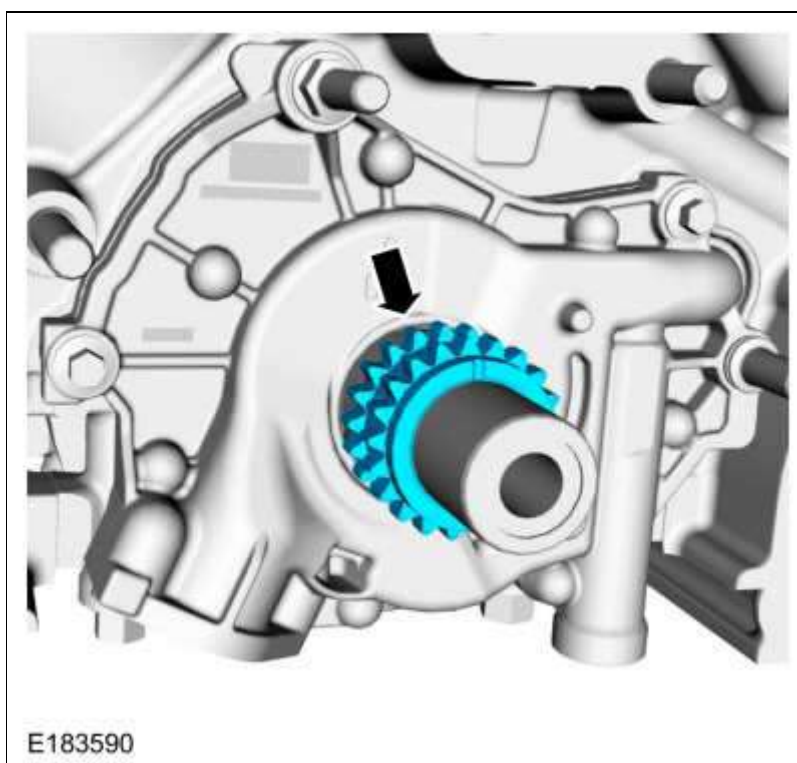
Stage 5: 26 lb.ft (35 Nm)

Stage 6: 90°

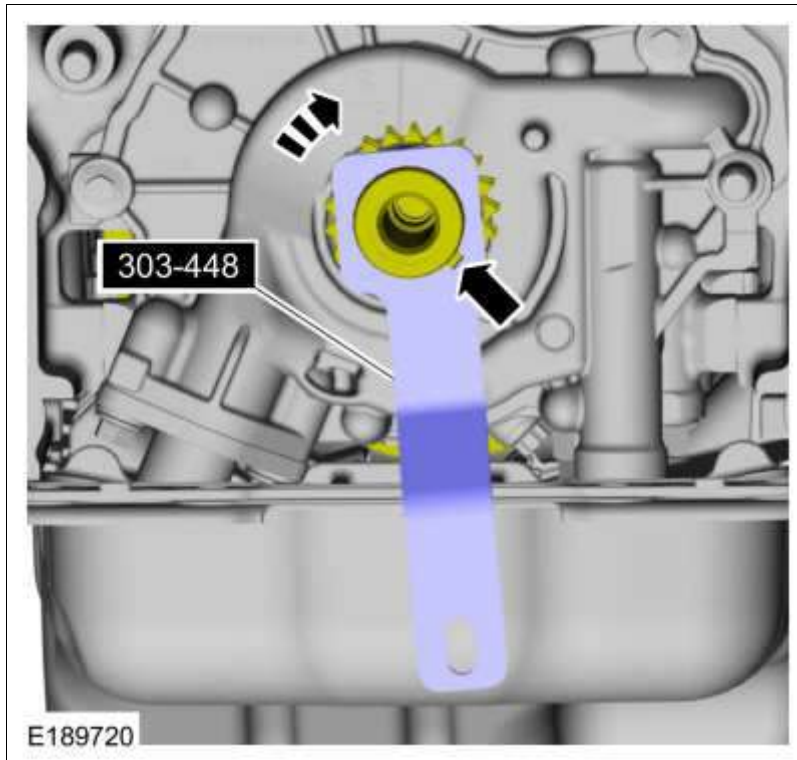
Stage 7: 90°



37. Install the crankshaft sprocket.



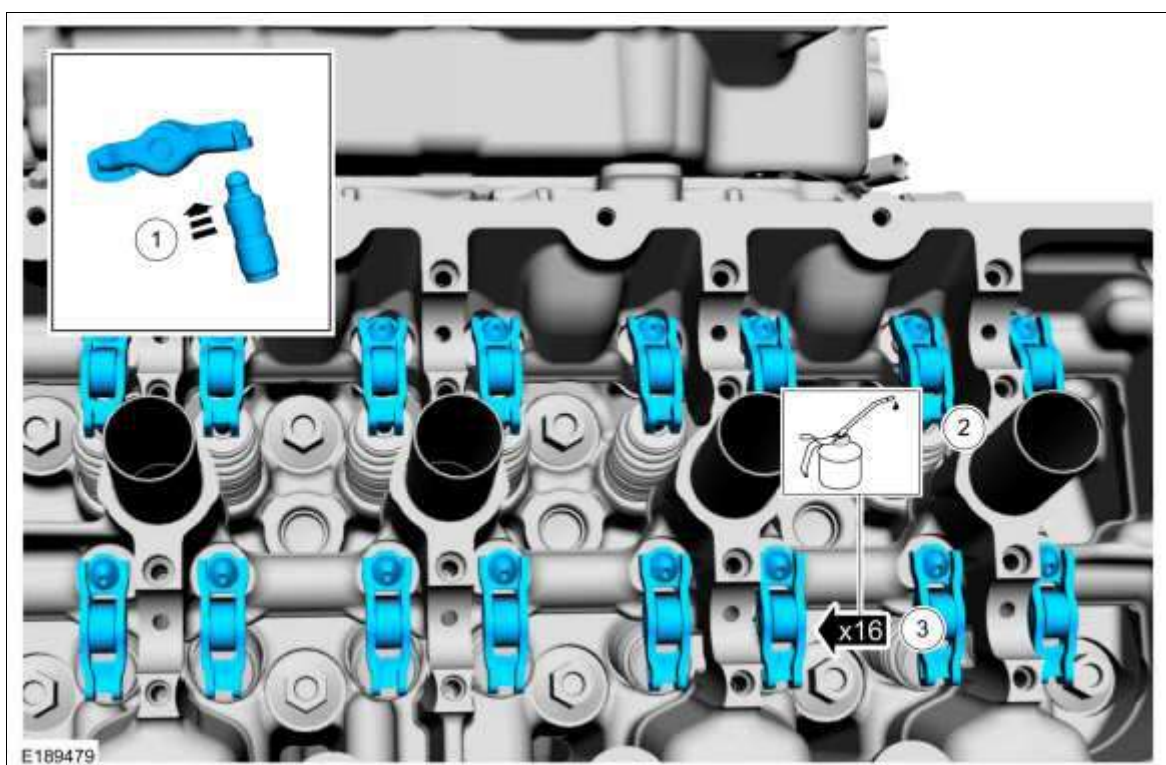
38. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 5 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



NOTICE: The LH camshafts, VCT units and timing chains must be installed first. Only turn the crankshaft as instructed. Failure to do so may result in the camshafts installed out of phase and serious damage to the engine will result.

39. **NOTE:** If the components are to be reinstalled, they must be installed in their original locations.

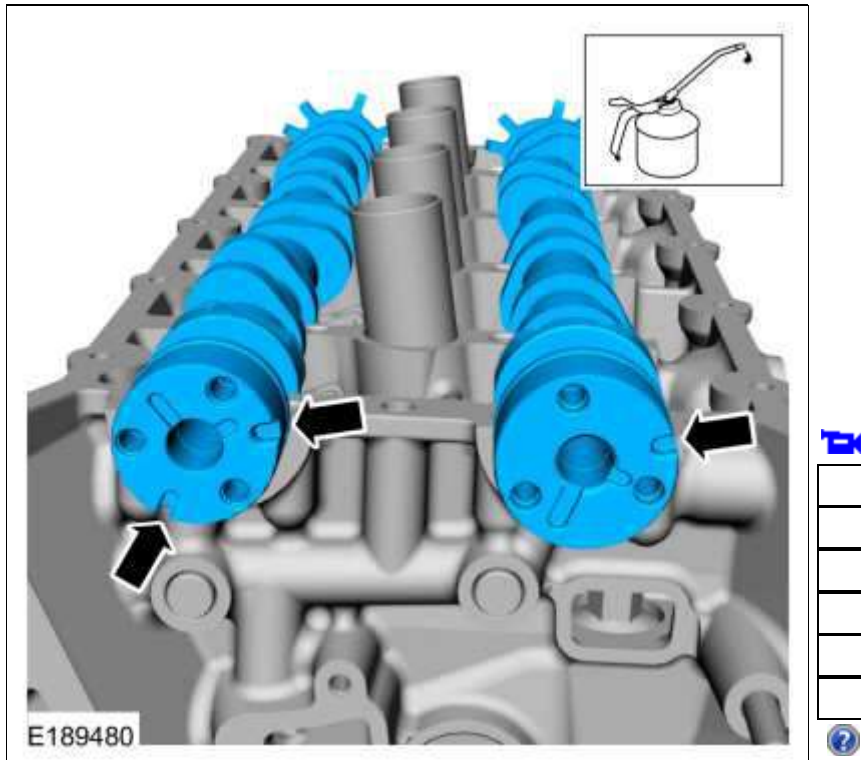
1. Assemble the hydraulic lash adjusters onto the spring clips on the camshaft roller followers.
2. Lubricate the camshaft roller follower and hydraulic lash adjuster assemblies with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)
3. Install the camshaft roller follower and hydraulic lash adjuster assemblies.



40. **NOTE:** Lubricate the camshafts with clean engine oil prior to installation.

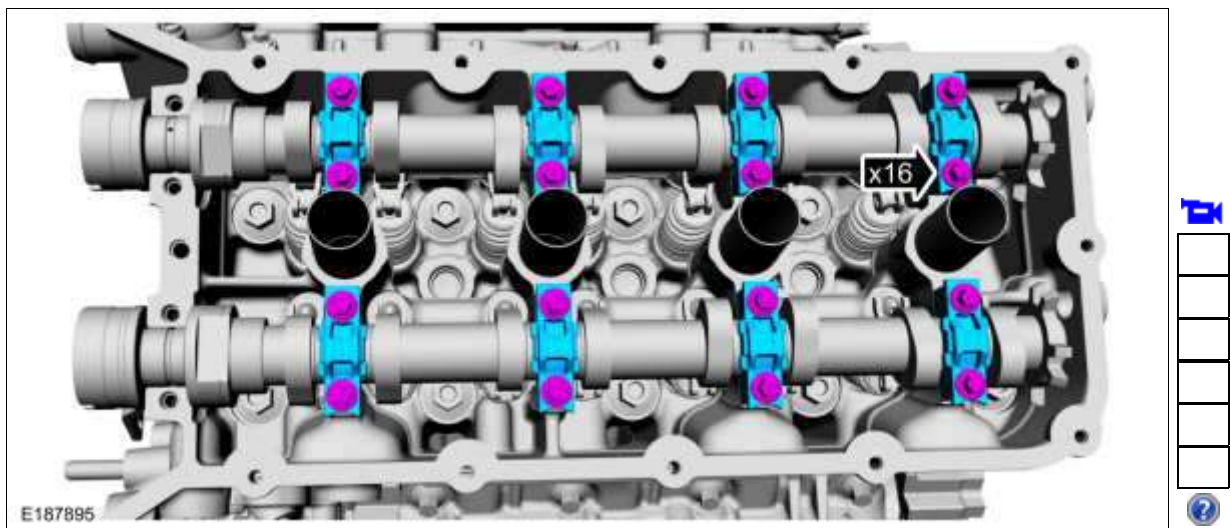
Install the LH intake and exhaust camshafts in the neutral position. Align the D-slots as shown in the illustration.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



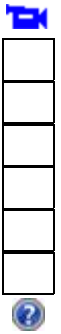
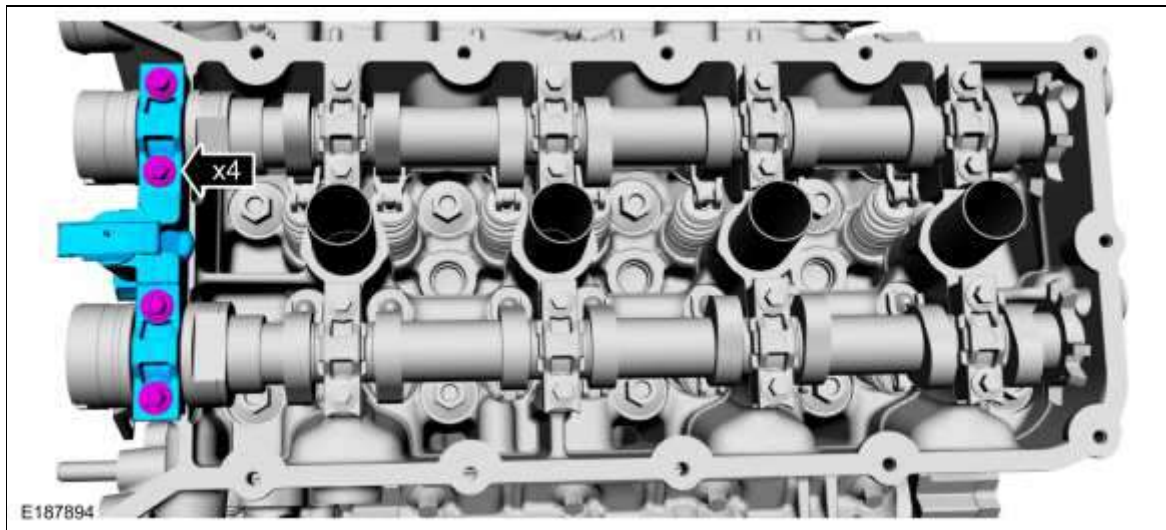
41. **NOTE:** Do not tighten at this time.

Install the camshaft bearing caps and the bolts.



42. **NOTE:** Do not tighten at this time.

Install the front camshaft bearing mega cap and the bolts.

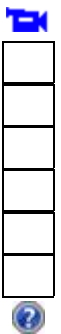
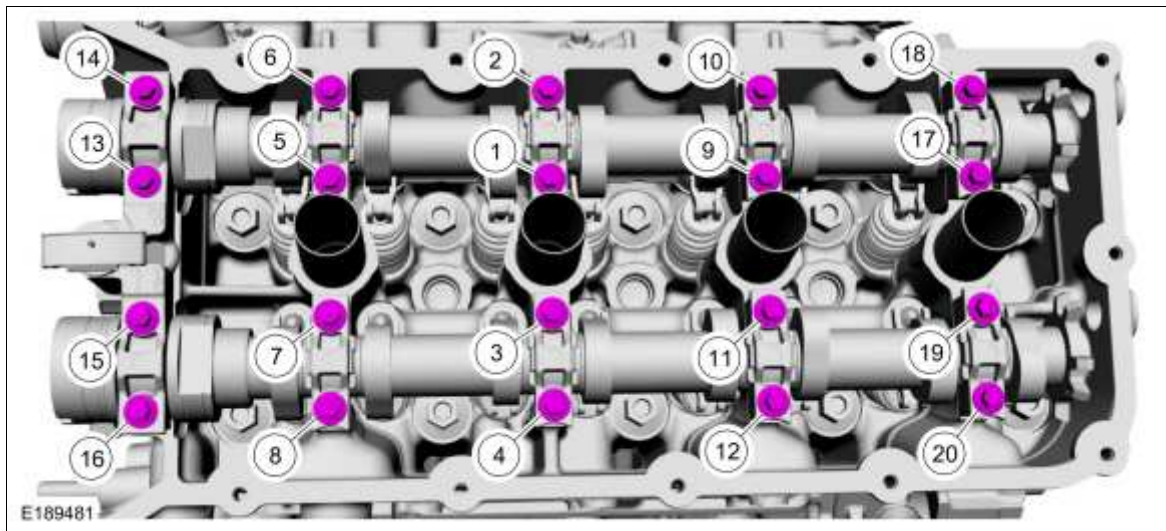


43. Tighten the bolts.

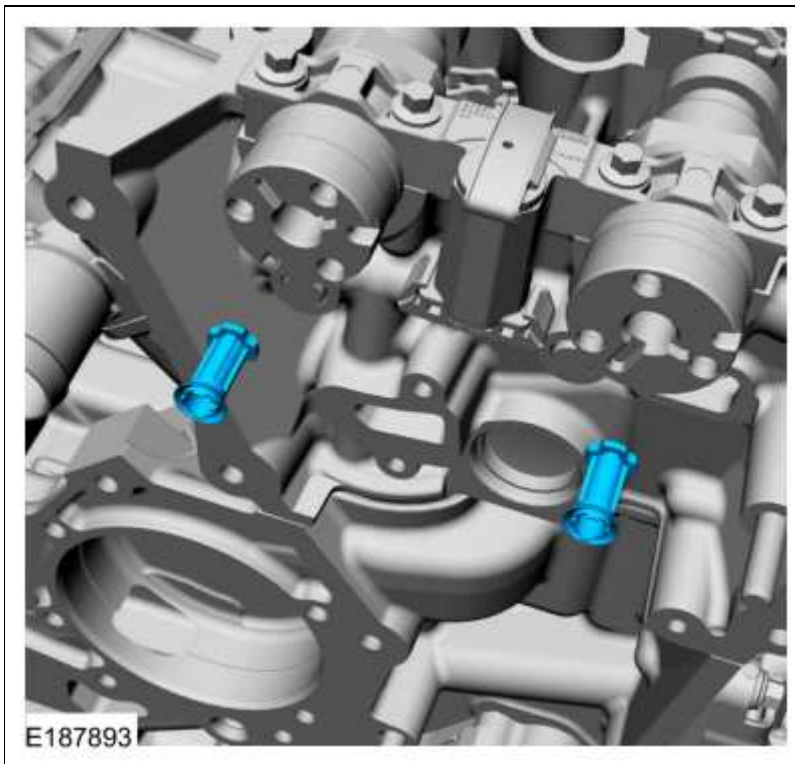
Torque:

Stage 1: 53 lb.in (6 Nm)

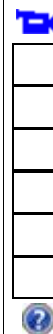
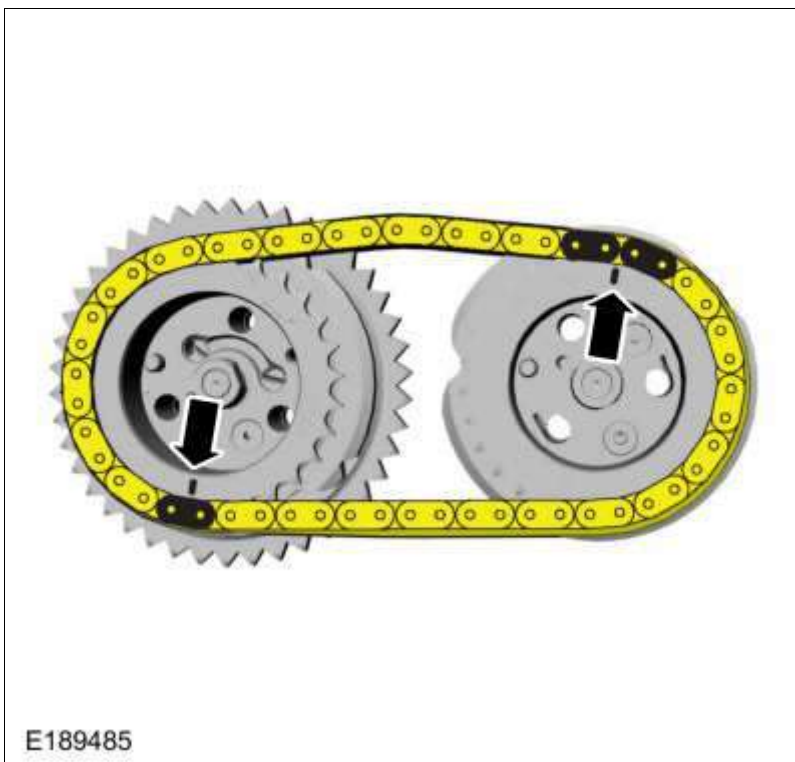
Stage 2: 45°



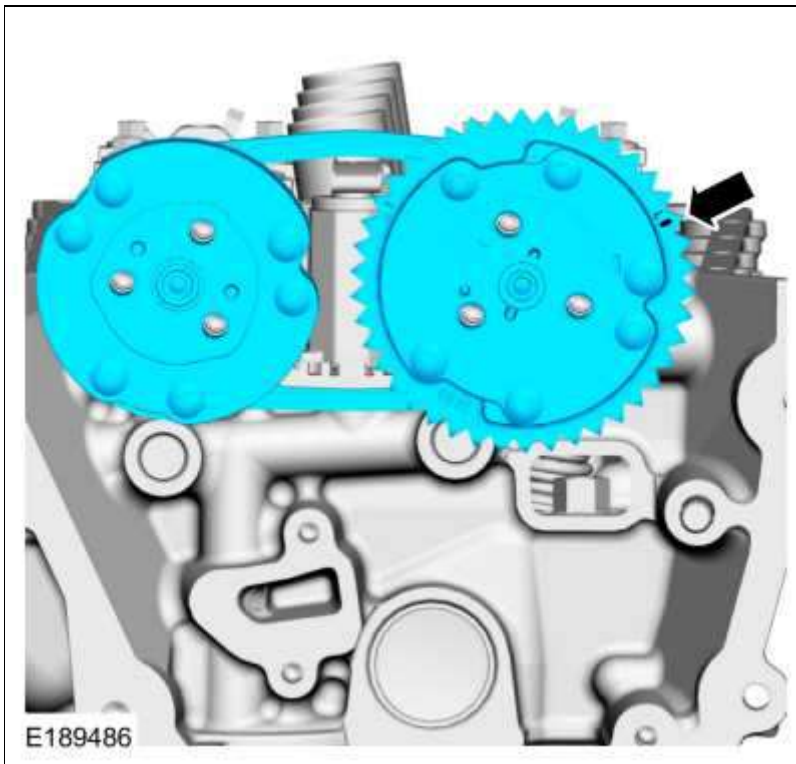
44. Install new VCT system oil filters into the camshafts.



45. Position the secondary timing chain onto the VCT assemblies. Align the colored links on the secondary timing chain with the timing marks on the VCT assemblies as shown in the illustration.
- The timing mark on the intake VCT assembly should align between the 2 consecutive colored links.
 - The timing mark on the exhaust VCT assembly should align with the single colored link.



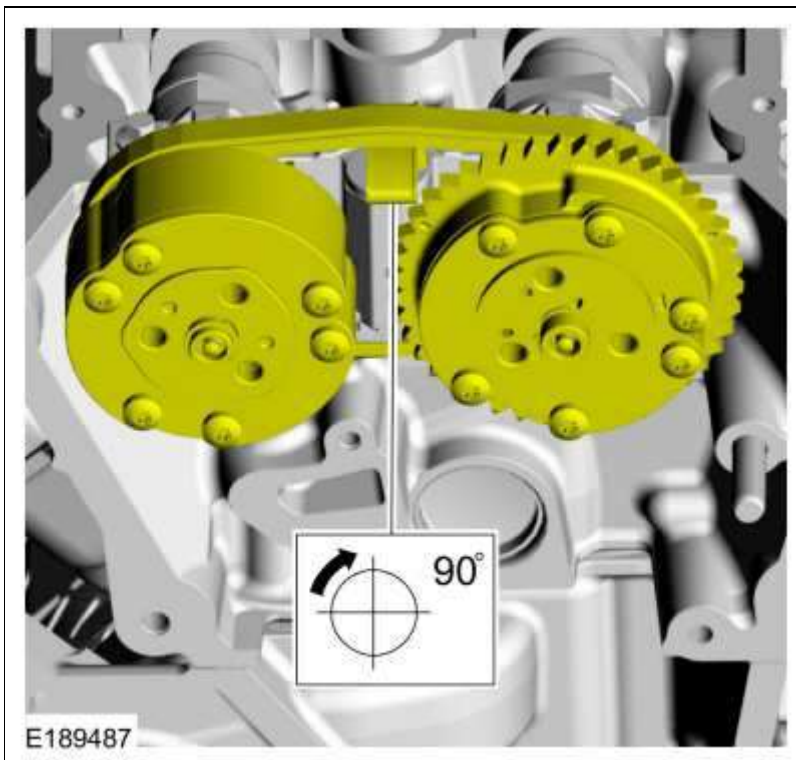
46. Install the VCT assemblies and the secondary timing chain onto the camshafts. The timing mark on the exhaust VCT assembly should be approximately in the 2 o'clock position.



47. **NOTE:** It may be necessary to rotate the exhaust camshaft slightly (using a wrench on the flats of the camshaft) to seat the VCT assemblies onto the camshafts.

Rotate the secondary timing chain tensioner 90 degrees so the ramped area is facing forward and fully seat the VCT assemblies onto the camshafts.

- If the secondary timing chain is not centered over the tensioner, reposition the VCT assemblies until they are fully seated on the camshafts.



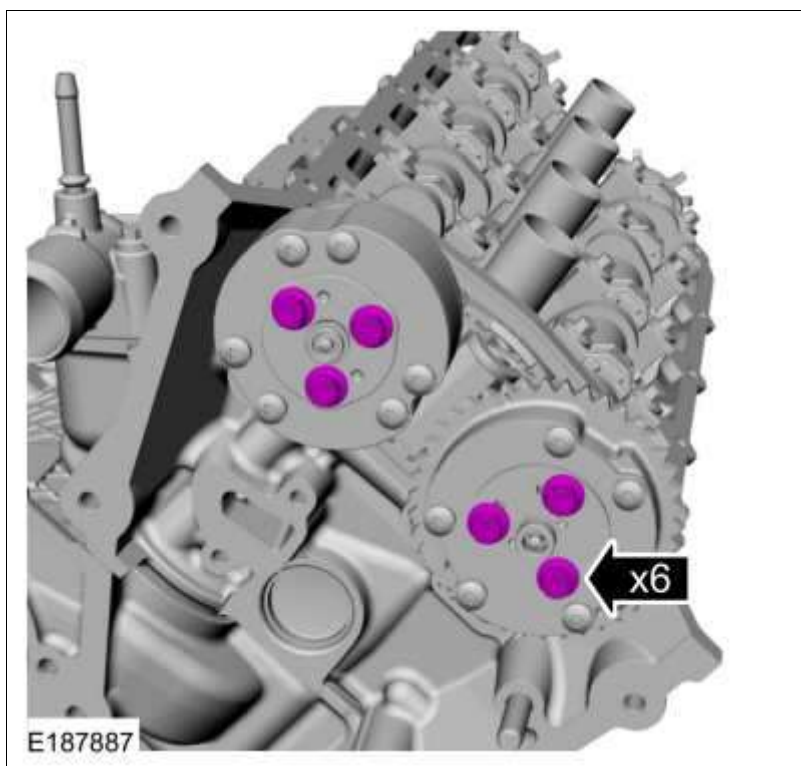
48. **NOTE:** Use a wrench on the flats of the camshaft to hold the camshafts while tightening the VCT assembly bolts.

Install the intake and the exhaust VCT assembly bolts.

Torque:

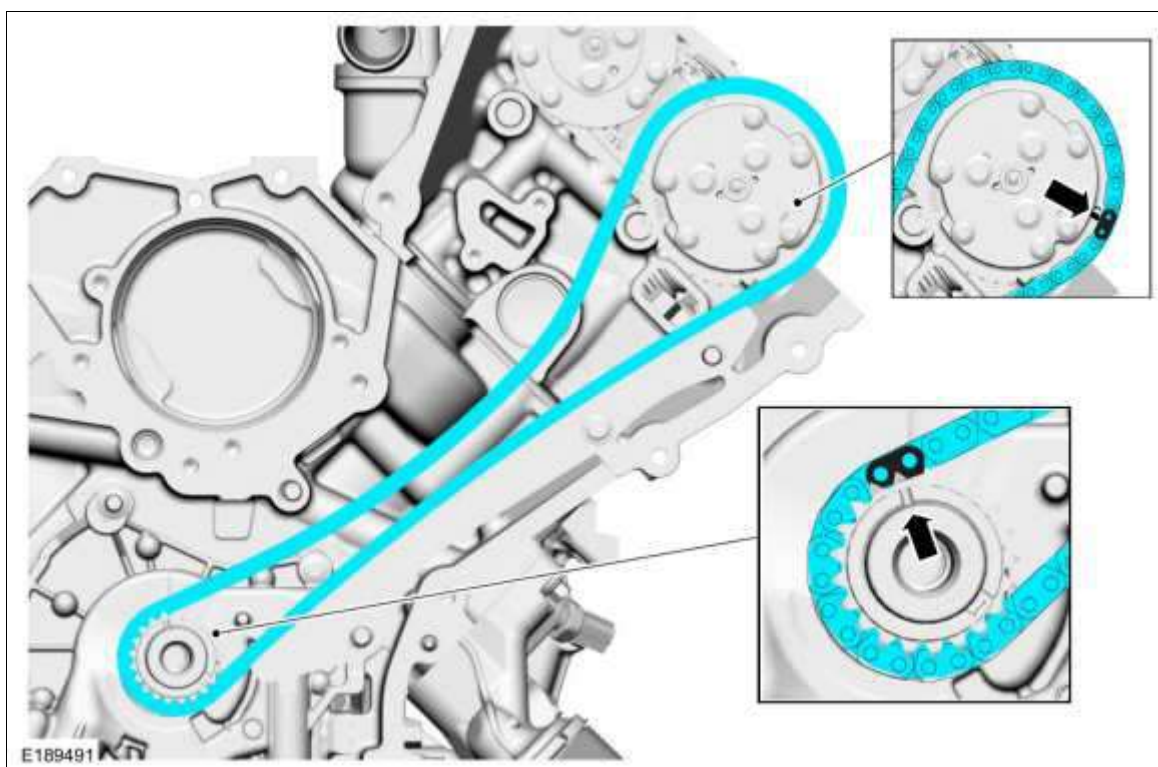
Stage 1: 133 lb.in (15 Nm)

Stage 2: 90°



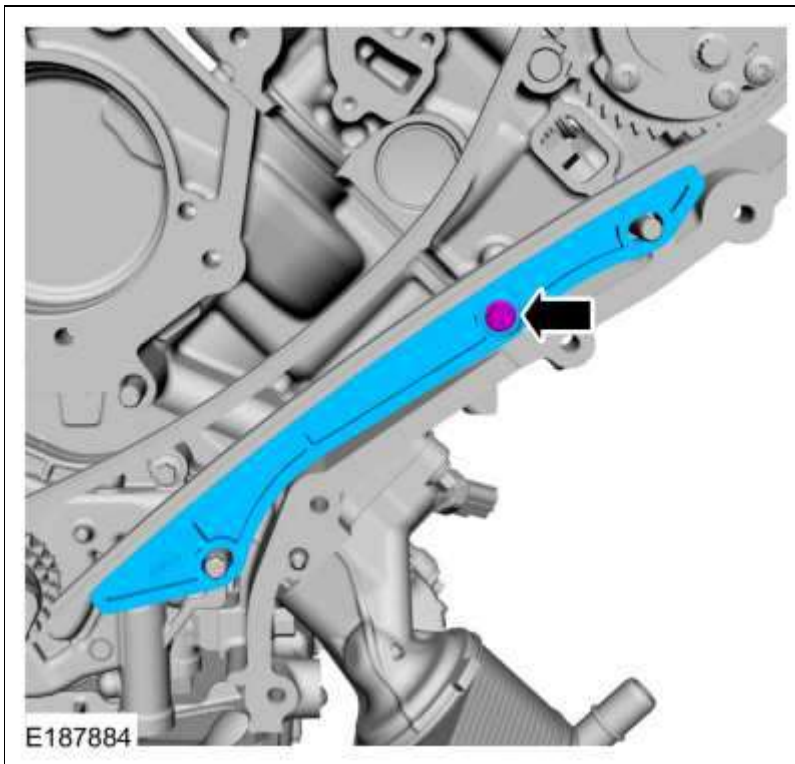
49. Install the LH timing chain.

- Align the colored link on the timing chain with the timing mark on the LH VCT assembly.
- Align the remaining colored link on the timing chain with the timing mark on the crankshaft sprocket.



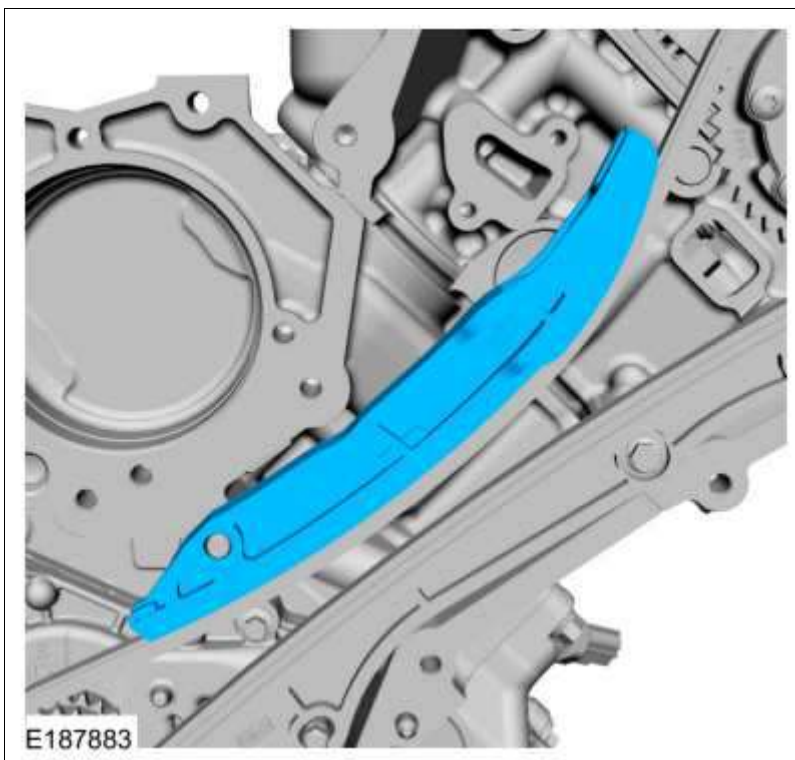
50. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the LH timing chain guide. Return the crankshaft keyway to the 5 o'clock position after installing the LH timing chain guide.

Install the LH timing chain guide and bolt.
Torque: 89 lb.in (10 Nm)

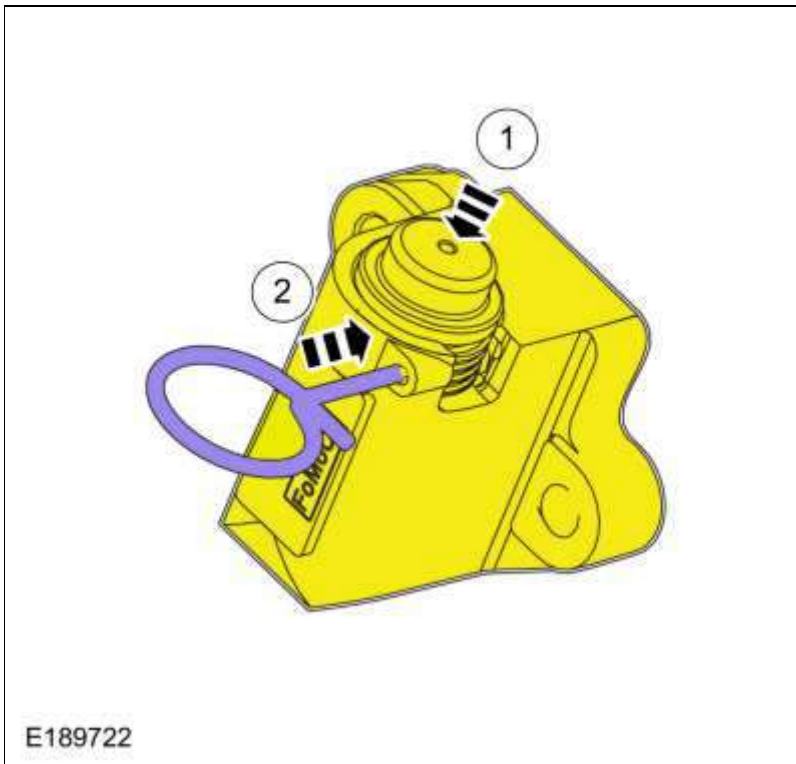


51. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the LH timing chain arm. Return the crankshaft keyway to the 5 o'clock position after installing the LH timing chain arm.

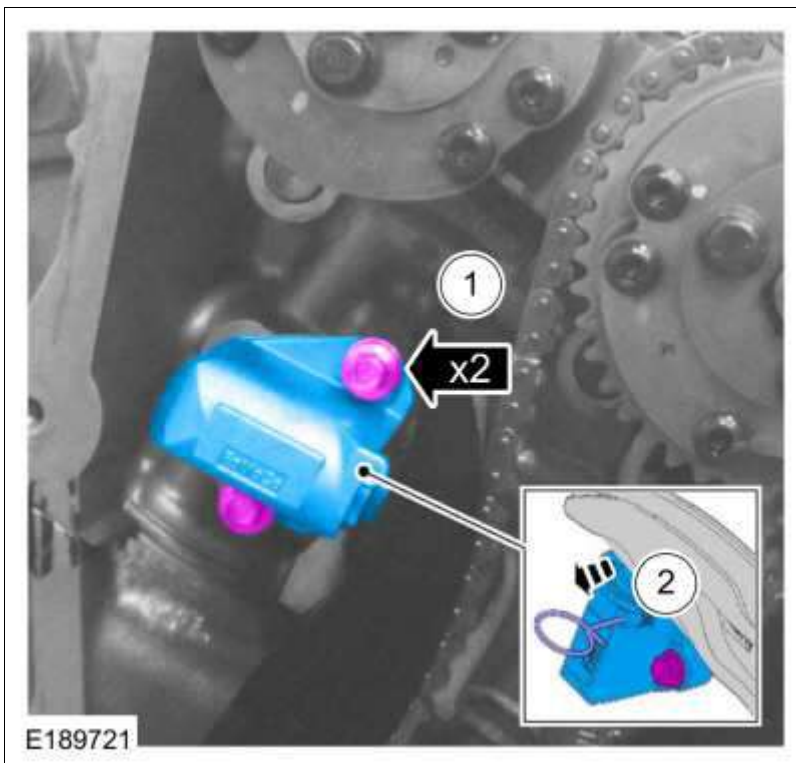
Install the LH timing chain tensioner arm.



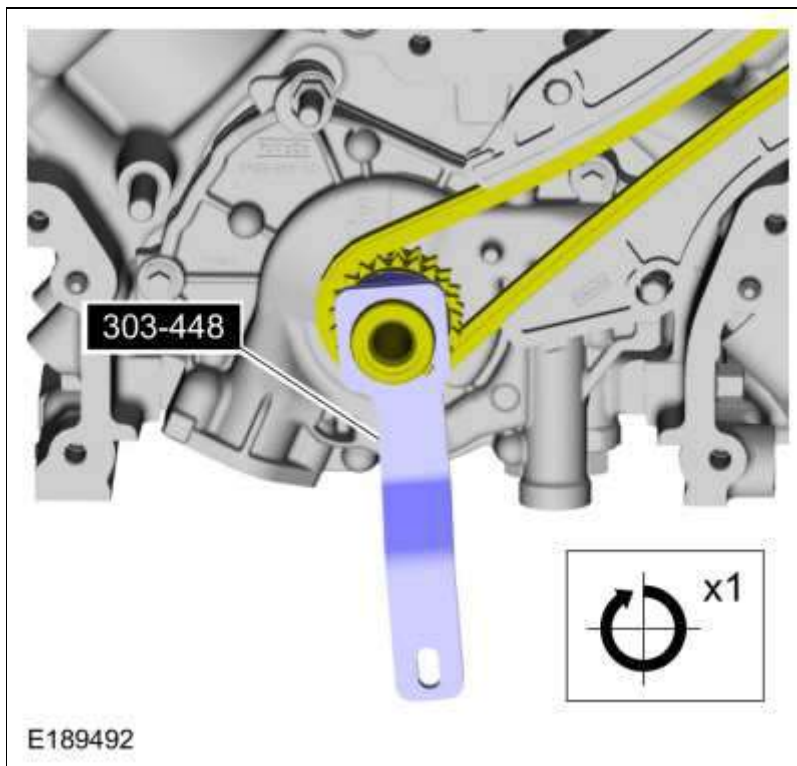
52.
 1. Compress the primary timing chain tensioner plunger, using an edge of a vise.
 2. Install a suitable pin into the hole of the tensioner housing to hold the plunger in place during installation.



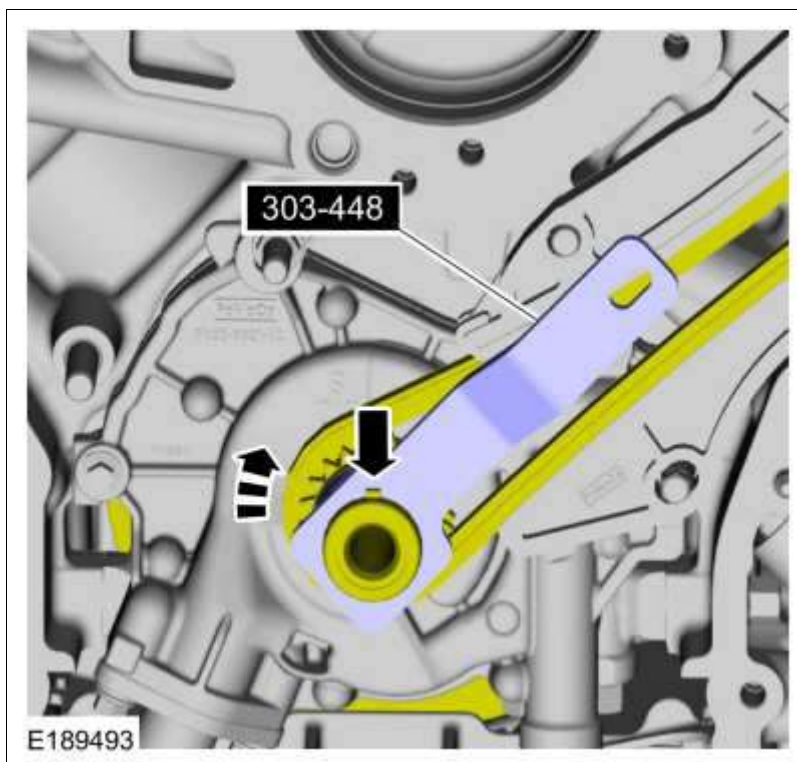
53. 1. Install the LH primary timing chain tensioner and bolts.
Torque: 89 lb.in (10 Nm)
 2. Remove the holding pin from the tensioner.



54. Using the special tool, rotate the crankshaft clockwise one complete revolution.
 Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).

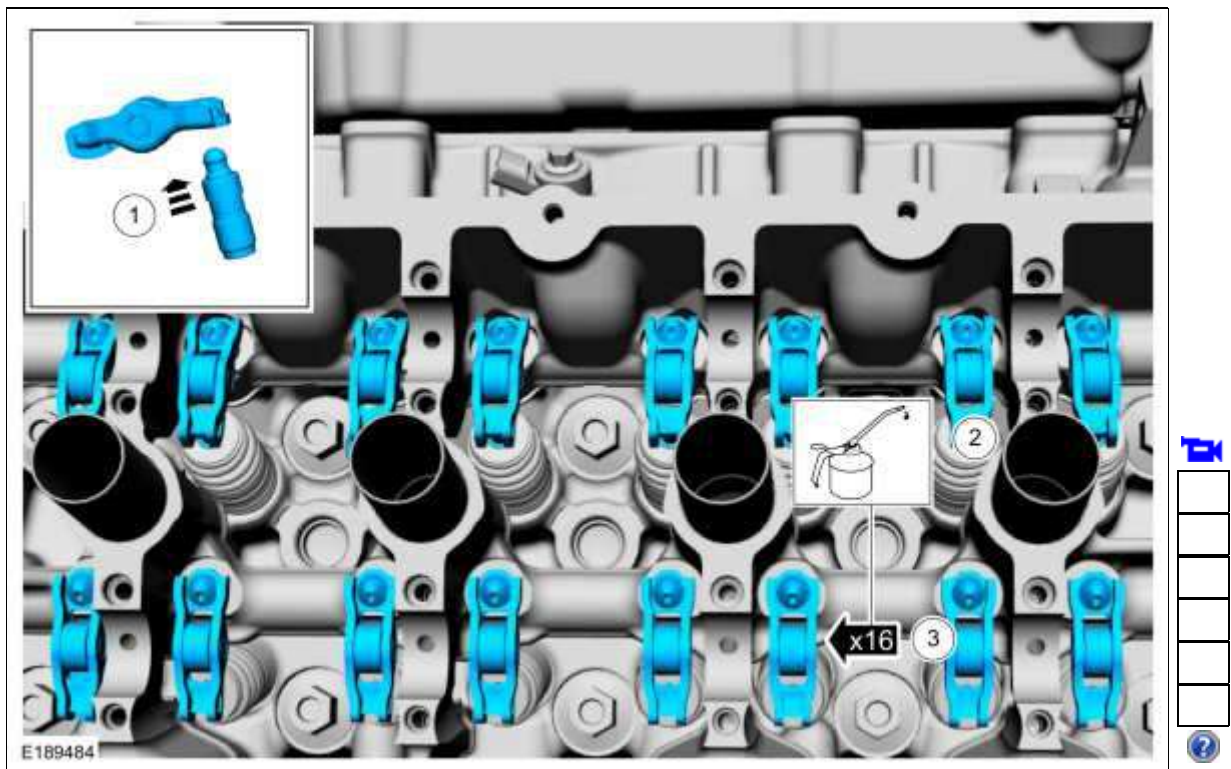


55. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 12 o'clock position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).



56. **NOTE:** If the components are to be reinstalled, they must be installed in their original locations.

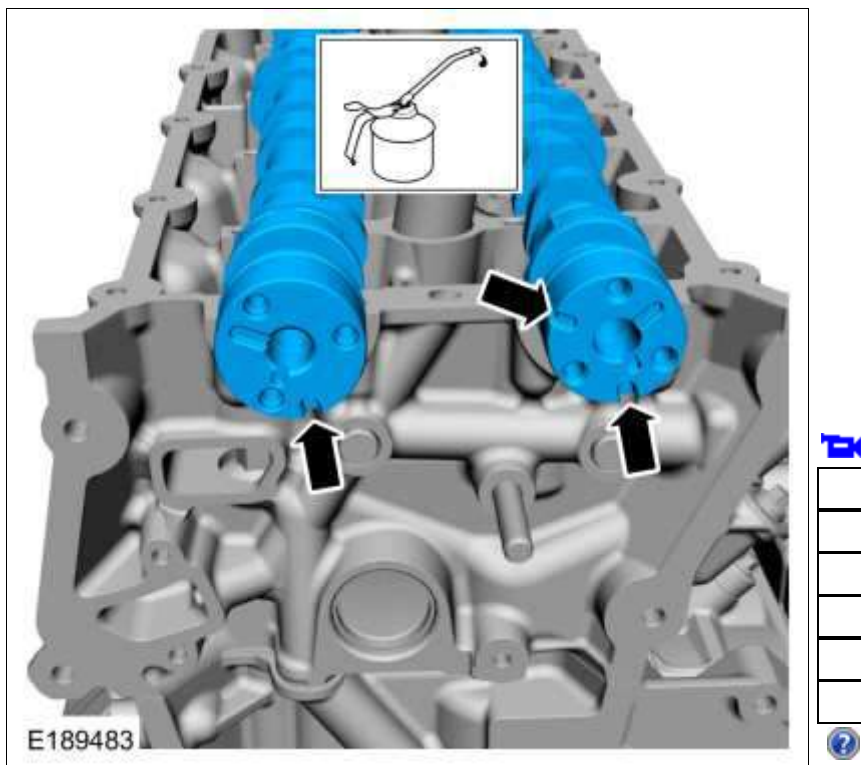
1. Assemble the hydraulic lash adjusters onto the spring clips on the camshaft roller followers.
2. Lubricate the camshaft roller follower and hydraulic lash adjuster assemblies with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)
3. Install the camshaft roller follower and hydraulic lash adjuster assemblies.



57. **NOTE:** Lubricate the camshafts with clean engine oil prior to installation.

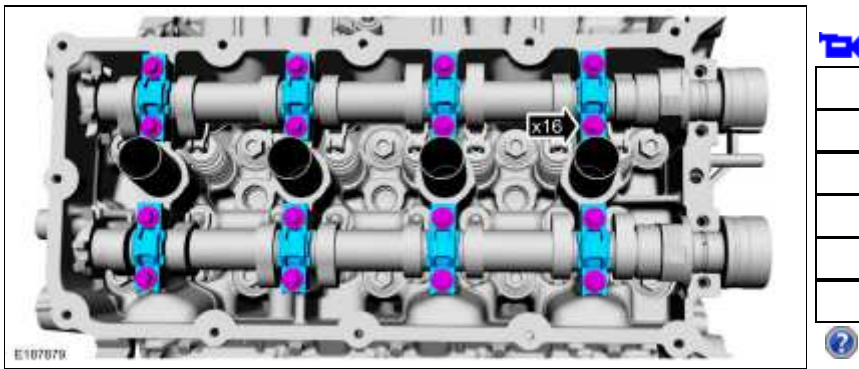
Install the RH intake and exhaust camshafts in the neutral position. Align the D-slots as shown in the illustration.

Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



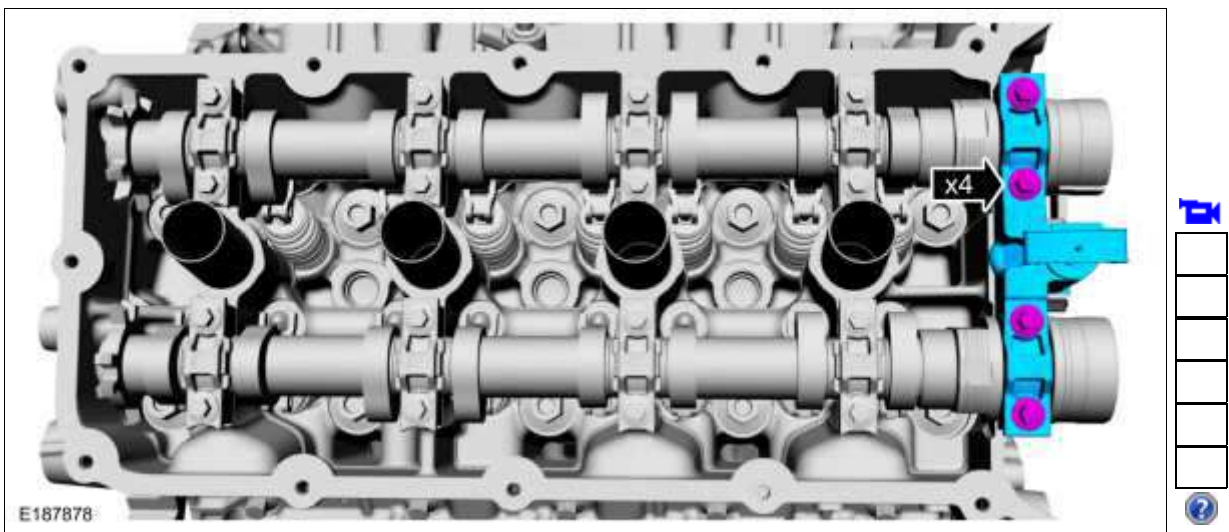
58. **NOTE:** Do not tighten at this time.

Install the camshaft bearing caps and the bolts.



59. **NOTE:** Do not tighten at this time.

Install the front camshaft bearing mega cap and the bolts.

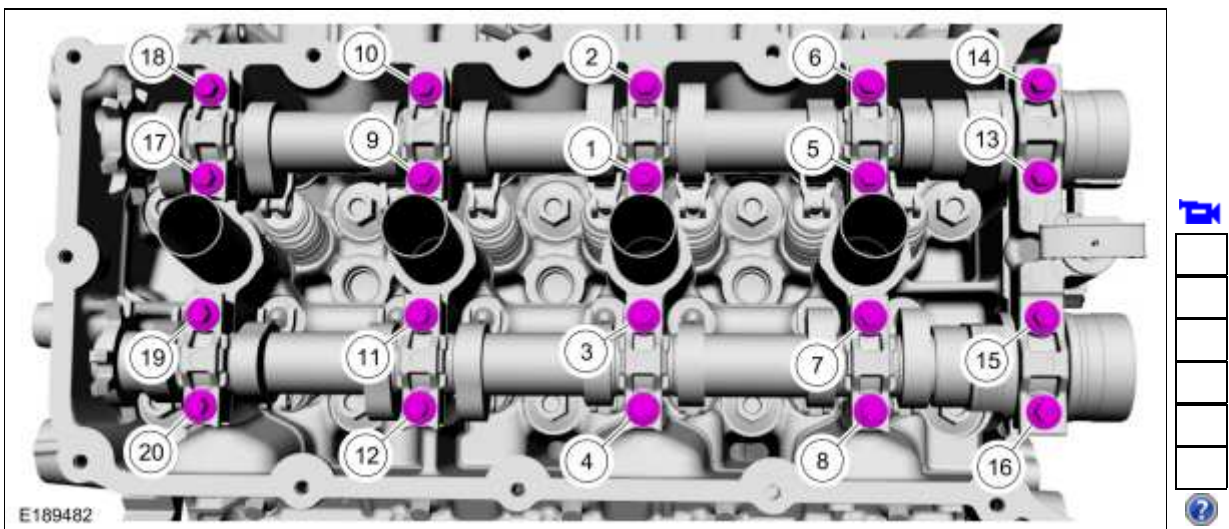


60. Tighten the bolts.

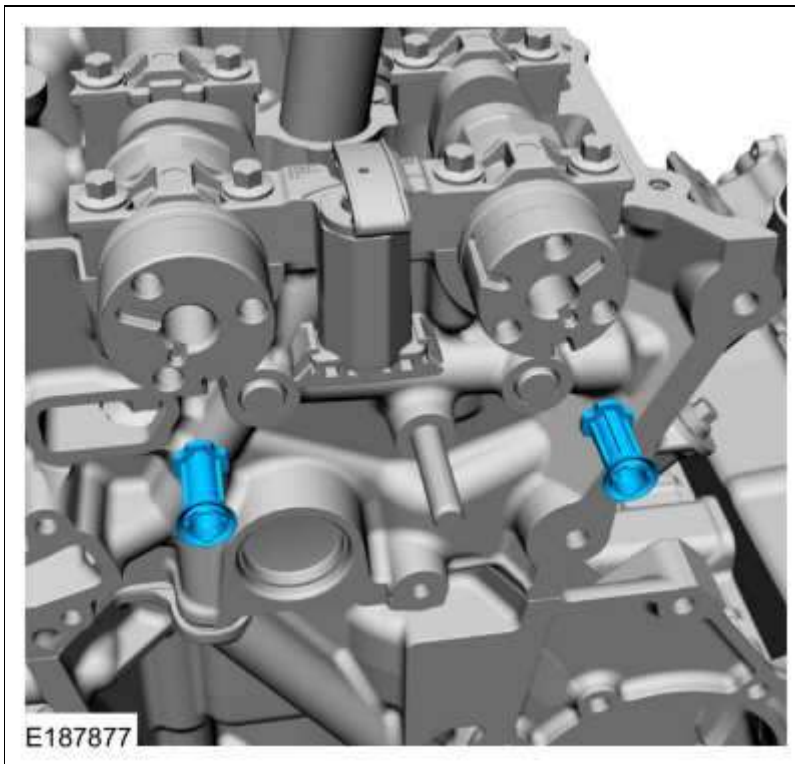
Torque:

Stage 1: 53 lb.in (6 Nm)

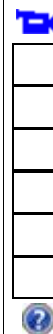
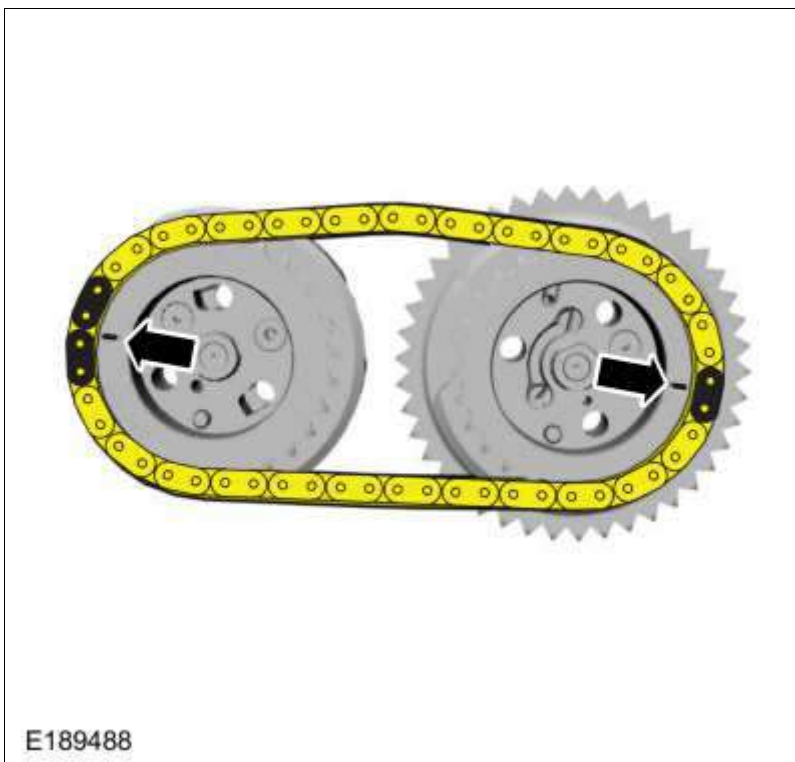
Stage 2: 45°



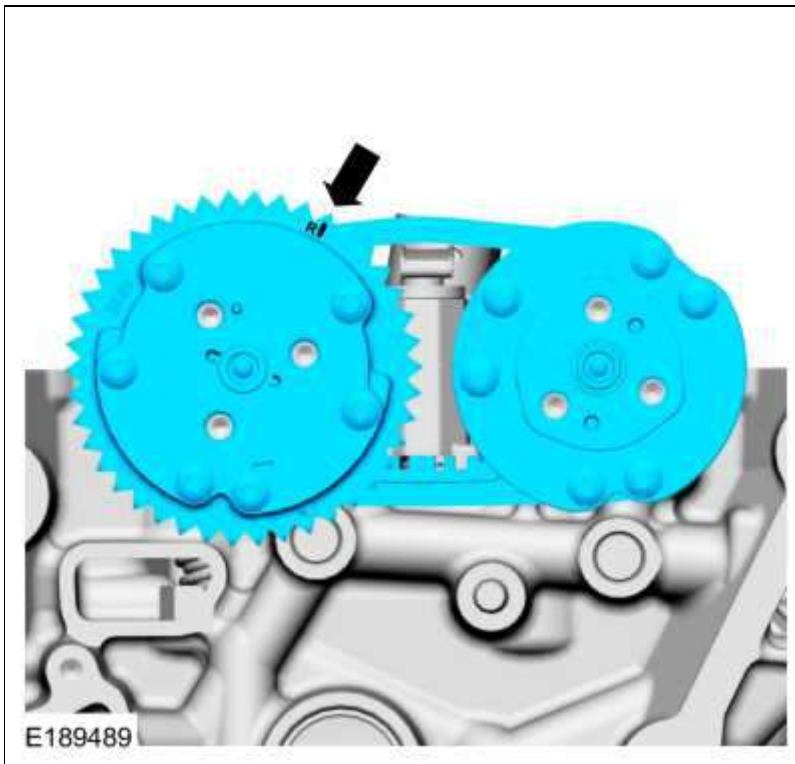
61. Install the VCT system oil filters into the camshafts.



62. Position the secondary timing chain onto the VCT assemblies. Align the colored links on the secondary timing chain with the timing marks on the VCT assemblies as shown in the illustration.
- The timing mark on the intake VCT assembly should align between the 2 consecutive colored links.
 - The timing mark on the exhaust VCT assembly should align with the single colored link.



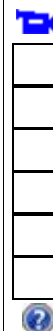
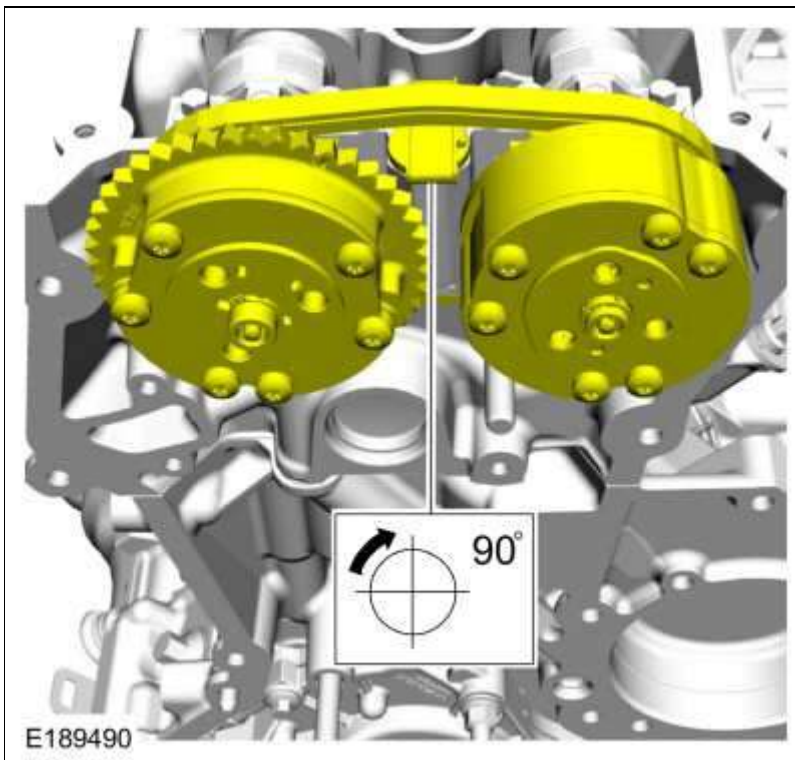
63. Install the VCT assemblies and the secondary timing chain onto the camshafts. The timing mark on the exhaust VCT assembly should be approximately in the 1 o'clock position.



64. **NOTE:** It may be necessary to rotate the exhaust camshaft slightly (using a wrench on the flats of the camshaft) to seat the VCT assemblies onto the camshafts.

Rotate the secondary timing chain tensioner 90 degrees so the ramped area is facing forward and fully seat the VCT assemblies onto the camshafts.

- If the secondary timing chain is not centered over the tensioner, reposition the VCT assemblies until they are fully seated on the camshafts.



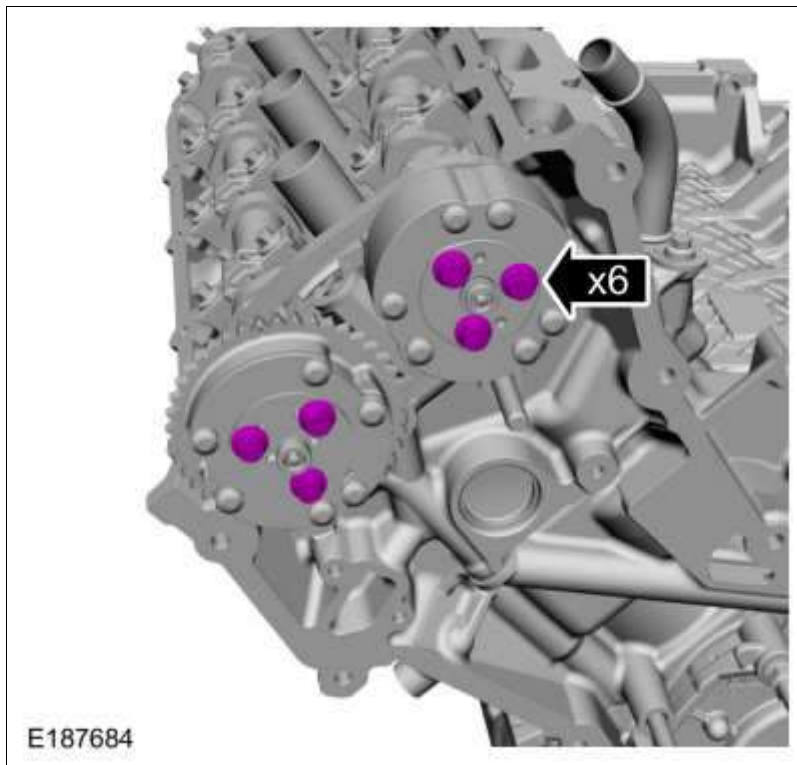
65. **NOTE:** Use a wrench on the flats of the camshaft to hold the camshafts while tightening the VCT assembly bolts.

Install the intake and the exhaust VCT assembly bolts.

Torque:

Stage 1: 133 lb.in (15 Nm)

Stage 2: 90°



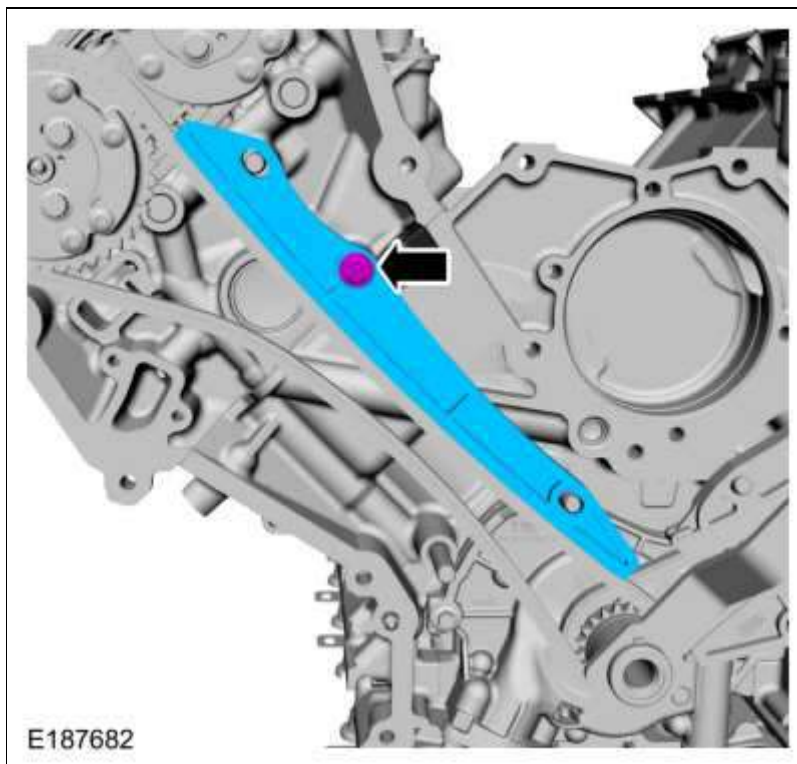
66. Install the RH timing chain.

- Align the colored link on the timing chain with the timing mark on the RH VCT assembly.
- Align the remaining colored link on the timing chain with the timing mark on the crankshaft sprocket.



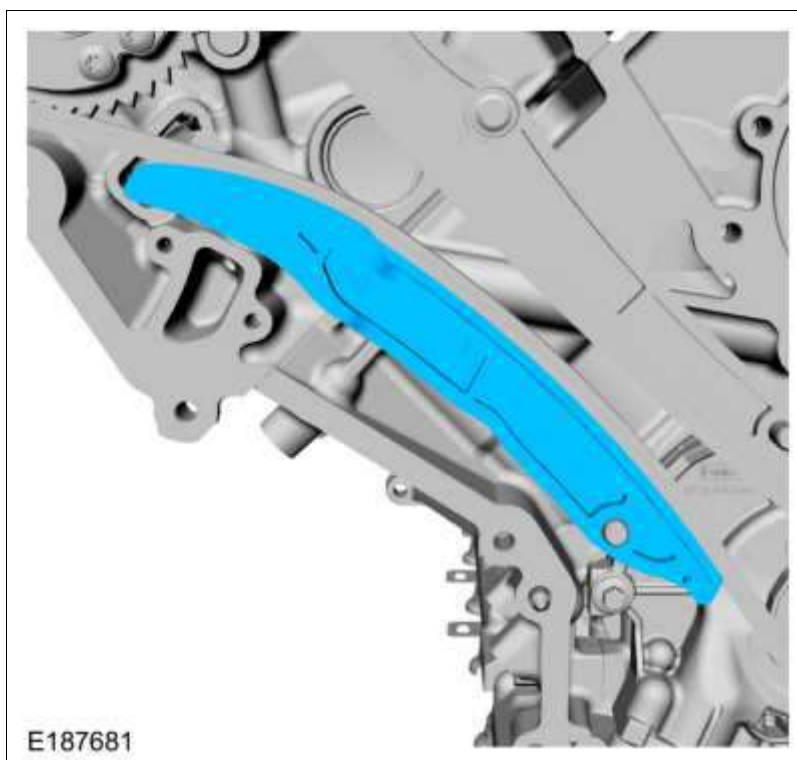
67. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the RH timing chain guide. Return the crankshaft keyway to the 12 o'clock position after installing the RH timing chain guide.

Install the RH timing chain guide and bolt.
Torque: 89 lb.in (10 Nm)

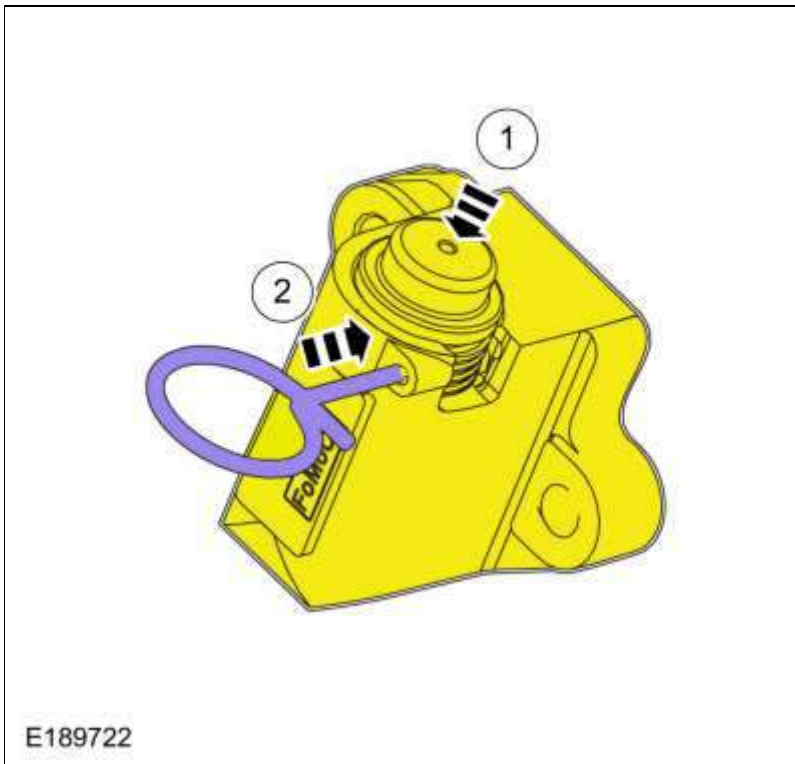


68. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to install the RH timing chain arm. Return the crankshaft keyway to the 12 o'clock position after installing the RH timing chain arm.

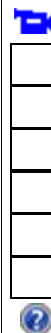
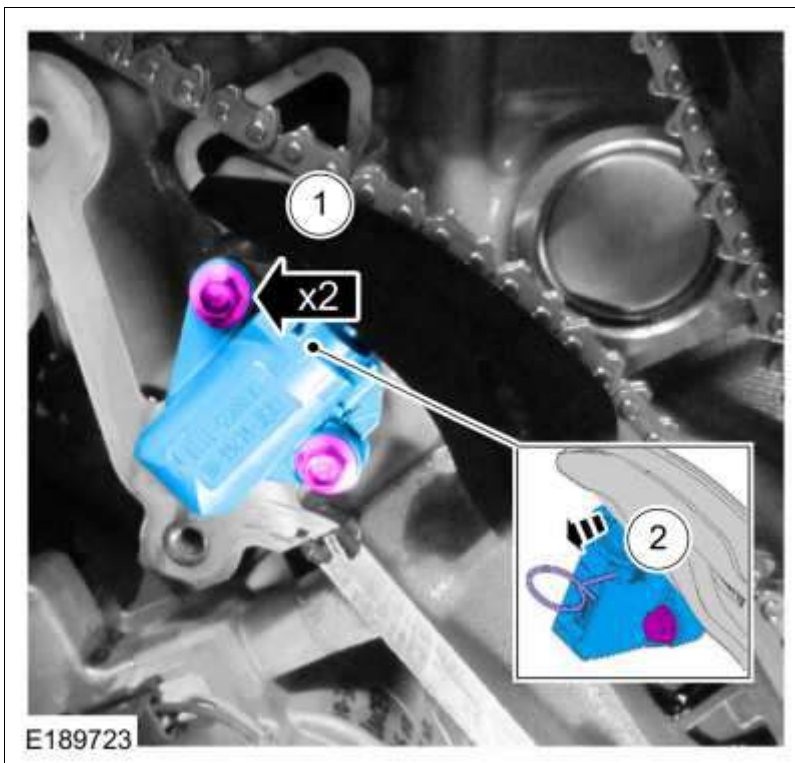
Install the RH timing chain tensioner arm.



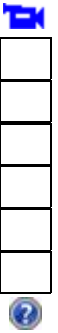
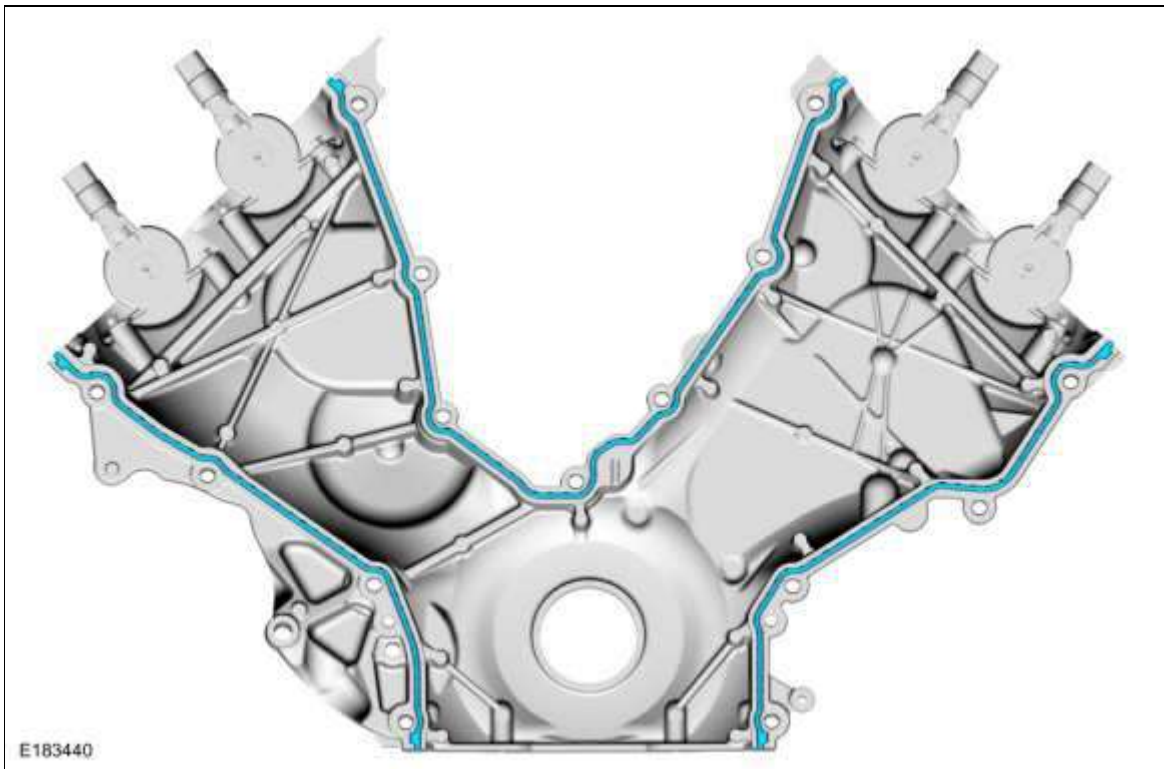
69.
 1. Compress the primary timing chain tensioner plunger, using an edge of a vise.
 2. Install a suitable pin into the hole of the tensioner housing to hold the plunger in place during installation.



70. 1. Install the RH primary timing chain tensioner and bolts.
Torque: 89 lb.in (10 Nm)
 2. Remove the holding pin from the tensioner.



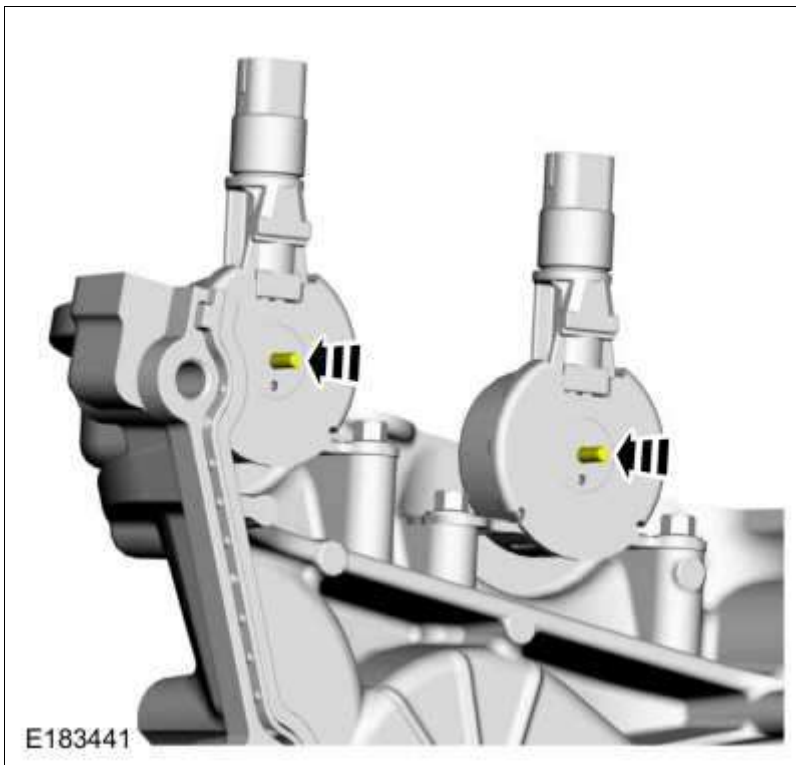
71. Install new gaskets on the engine front cover.



72. **NOTICE:** The VCT variable force solenoid pins must be fully depressed to avoid interference with the VCT valve tips when installing the engine front cover. Failure to follow these instructions can result in damage to the engine.

NOTE: RH shown, LH similar.

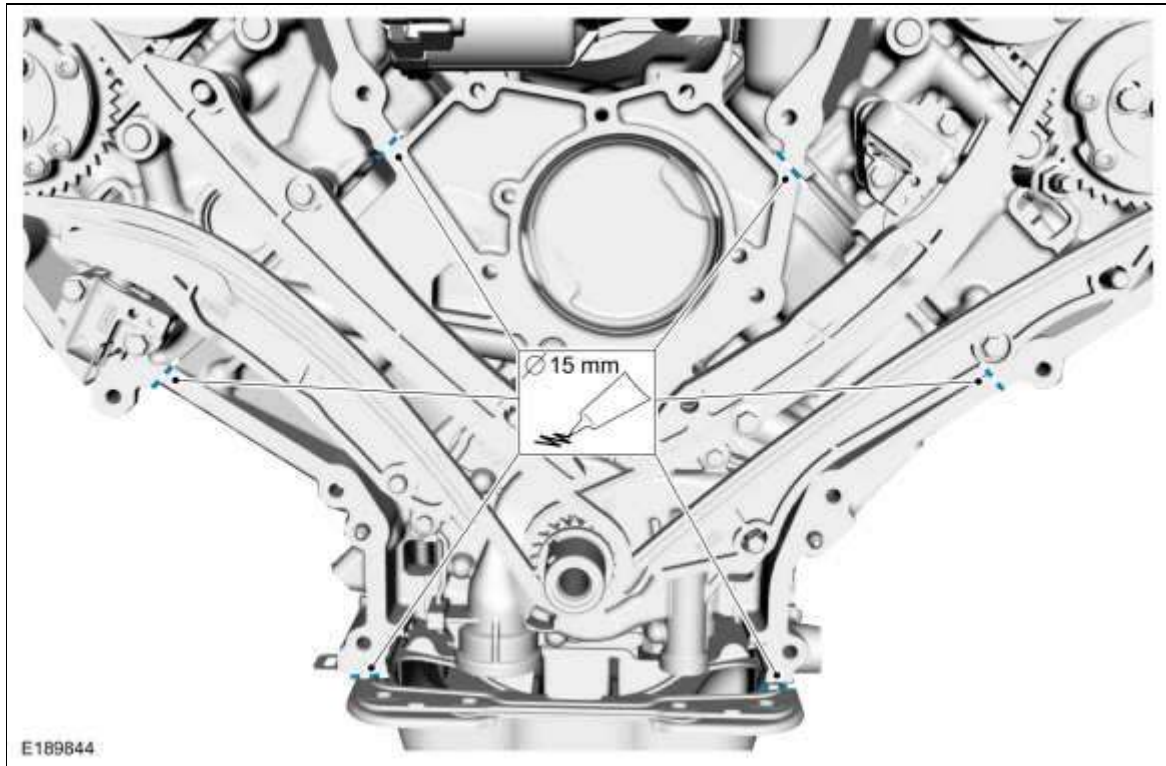
Fully depress the VCT variable force solenoid pins.



73. **NOTICE:** The engine front cover must be installed and all fasteners final tightened within 5 minutes of applying the sealer. If this cannot be accomplished, install the engine front cover and tighten fasteners 6, 7, 8, 9, 10 and 11 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer. All of the fasteners must then be final tightened within 1 hour of applying the sealer. If this time limit is exceeded, all sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

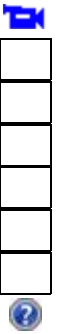
Apply a 15 mm (0.59 in) diameter drop of silicone gasket and sealant to the cylinder head-to-cylinder block joints and the oil pan-to-cylinder block joints.

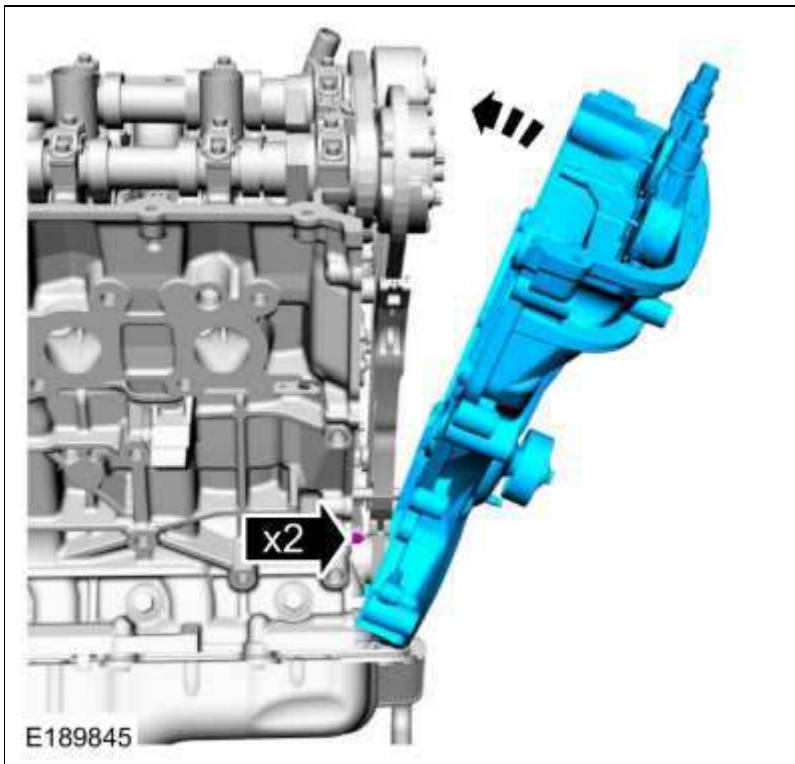
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



74. **NOTE:** Make sure that the engine front cover gaskets are in place on the engine front cover before installation.

Position the engine front cover onto the dowels.



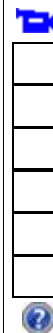
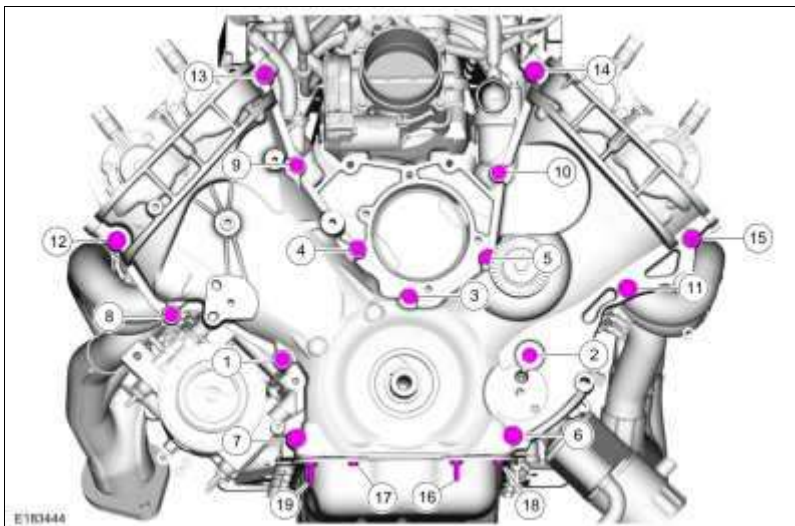


75. **NOTICE:** The engine front cover must be installed and all fasteners final tightened within 5 minutes of applying the sealer. If this cannot be accomplished, install the engine front cover and tighten fasteners 6, 7, 8, 9, 10 and 11 to 8 Nm (71 lb-in) within 5 minutes of applying the sealer. All of the fasteners must then be final tightened within 1 hour of applying the sealer. If this time limit is exceeded, all sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

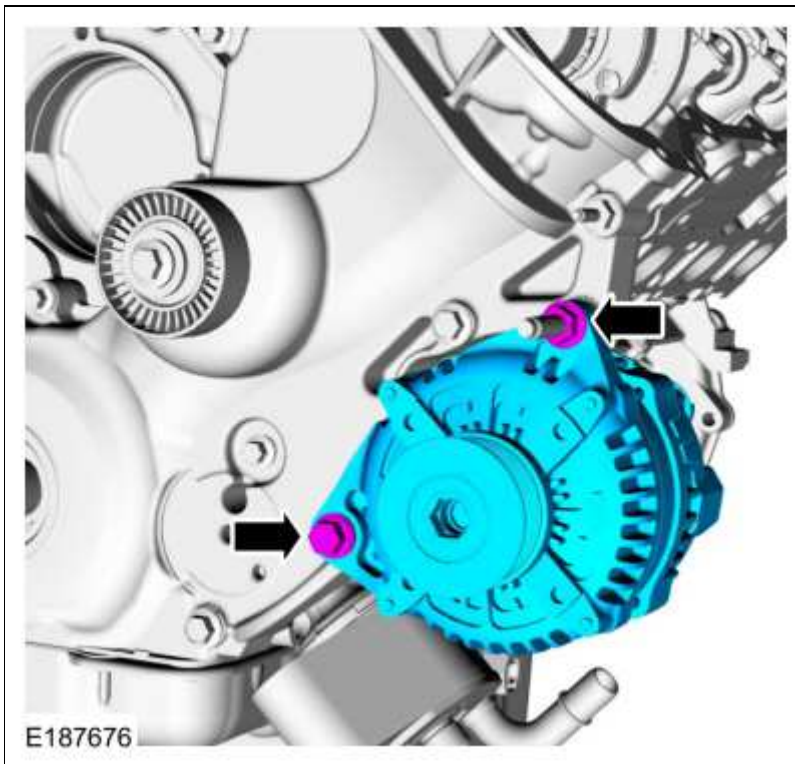
Install the bolts and stud bolts.

Torque:

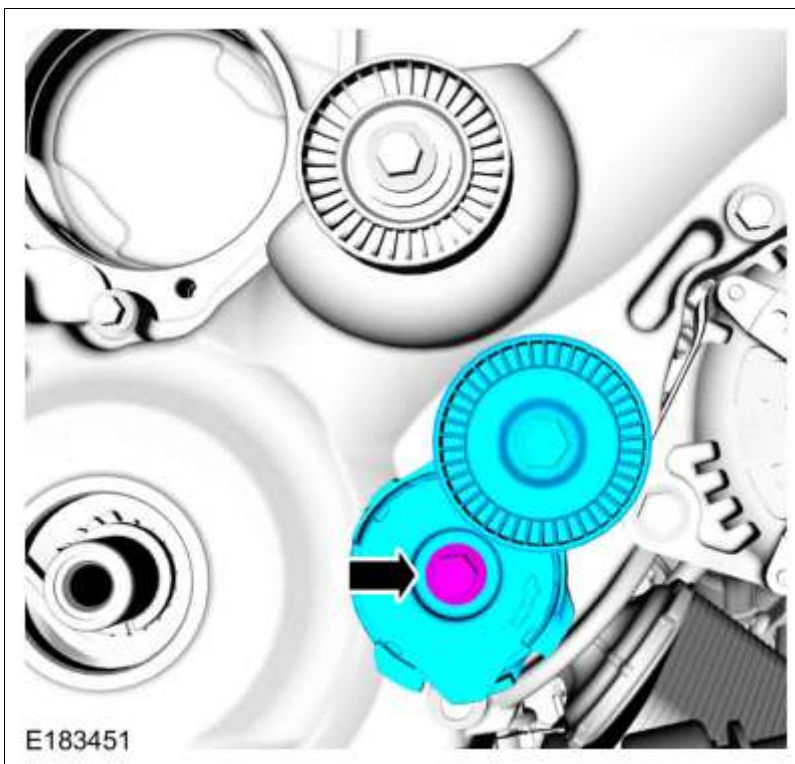
- Stage 1: Fasteners 1-15 : 18 lb.ft (25 Nm)
- Stage 2: Fasteners 16-19 : 89 lb.in (10 Nm)
- Stage 3: Fasteners 1-15 : 60°
- Stage 4: Fasteners 16-19 : 45°



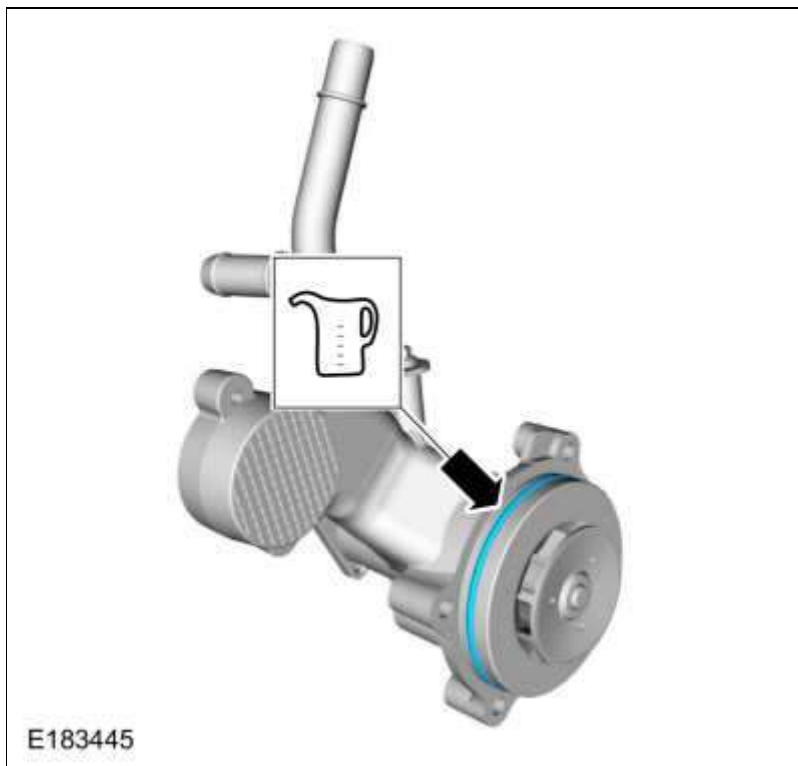
76. Install the generator, the bolt and the nut.
Torque: 35 lb.ft (48 Nm)



77. Install the accessory drive belt tensioner and bolt.
Torque: 35 lb.ft (48 Nm)



78. Install a new coolant pump O-ring seal and lubricate with clean engine coolant.
Material: Motorcraft® Orange Antifreeze/Coolant Concentrated (U.S.) / VC-3-B (U.S.) (WSS-M97B44-D)

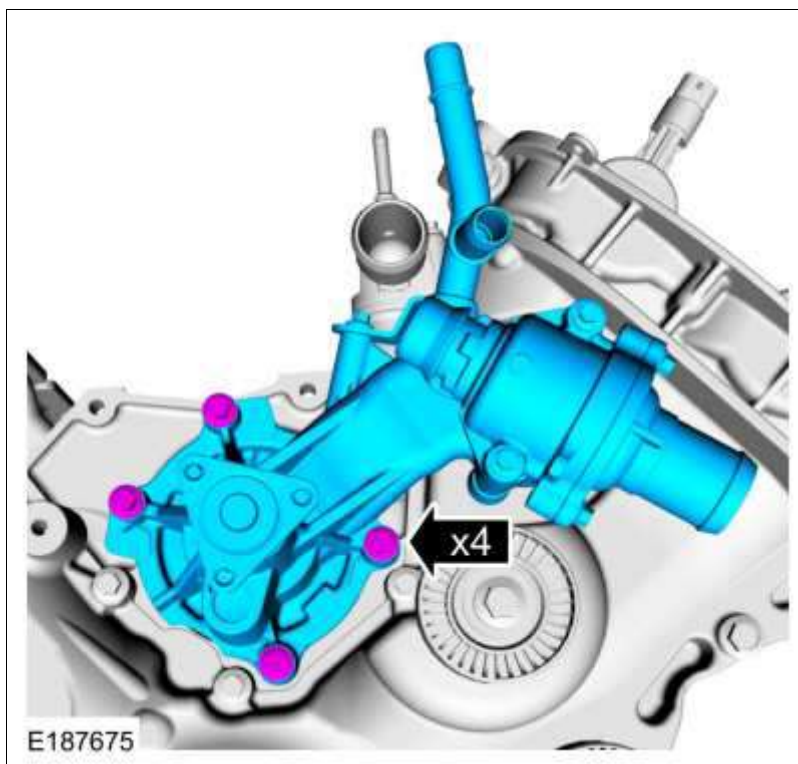


79. Install the coolant pump and bolts.

Torque:

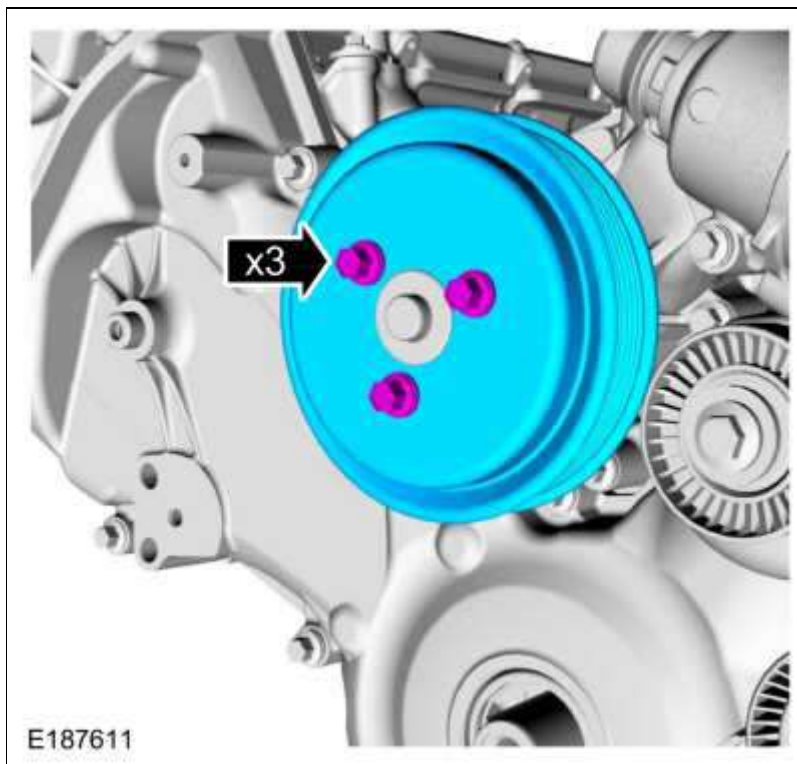
Stage 1: 177 lb.in (20 Nm)

Stage 2: 60°

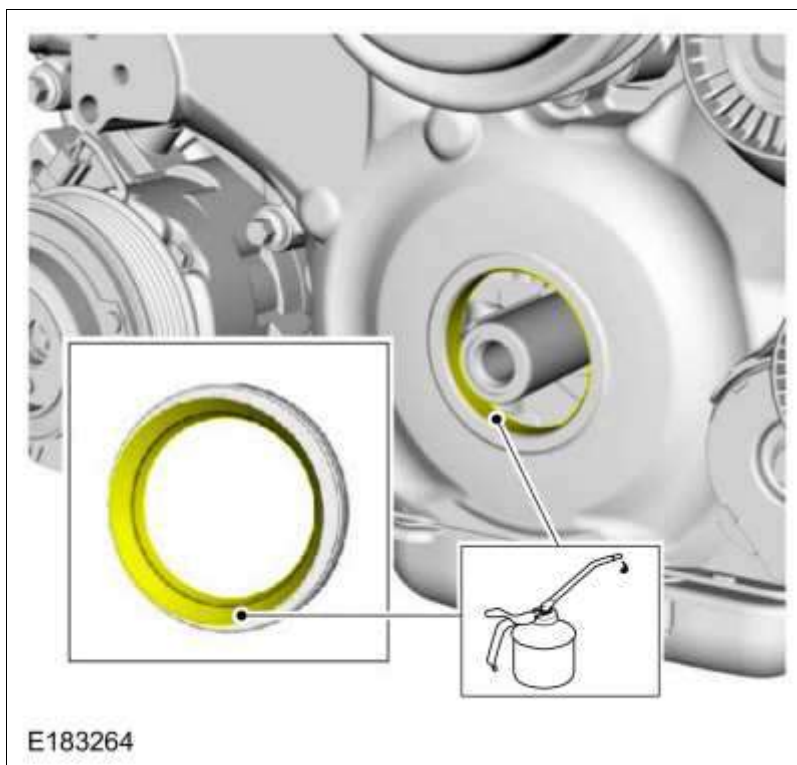


80. Install the coolant pump pulley and the bolts.

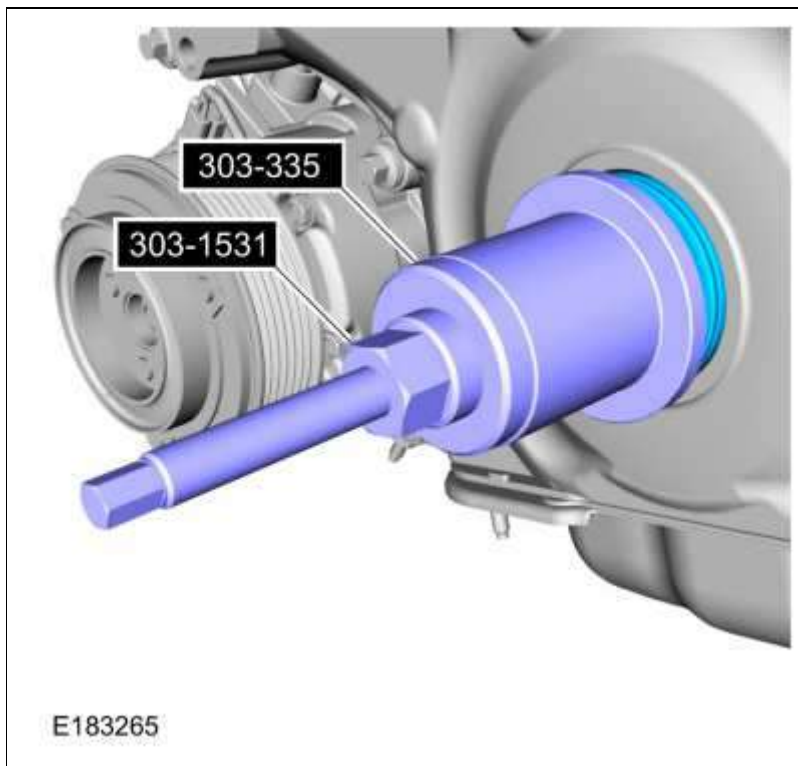
Torque: 18 lb.ft (25 Nm)



81. Lubricate the engine front cover bore and the crankshaft front oil seal inner lip with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



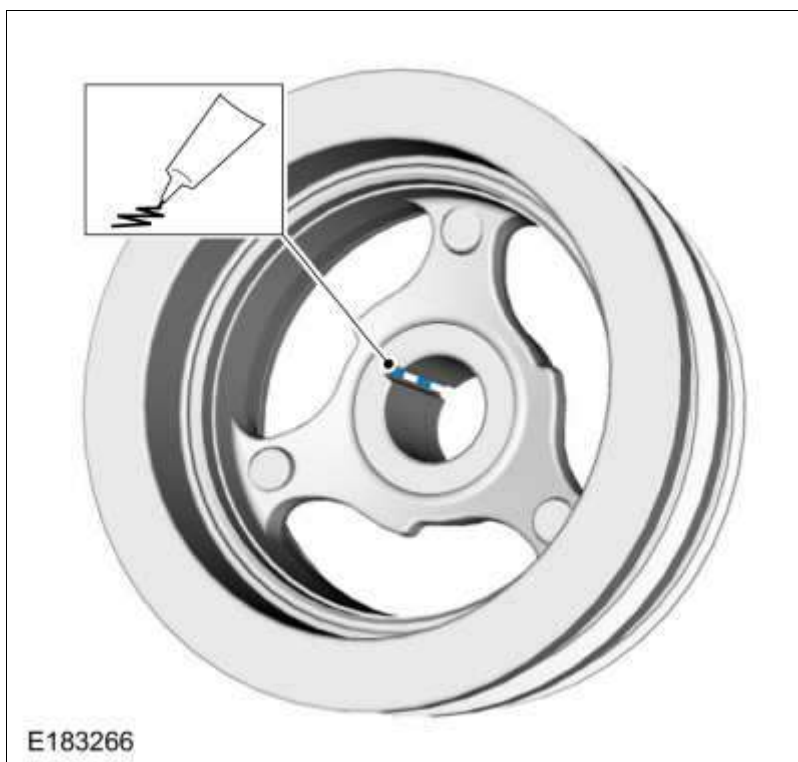
82. Using the special tools, install the new crankshaft front oil seal.
 Use Special Service Tool: [303-335 \(T88T-6701-A\) Installer, Front Cover Oil Seal.](#) , [303-1531 Installer, Front Crank Seal and Damper.](#)



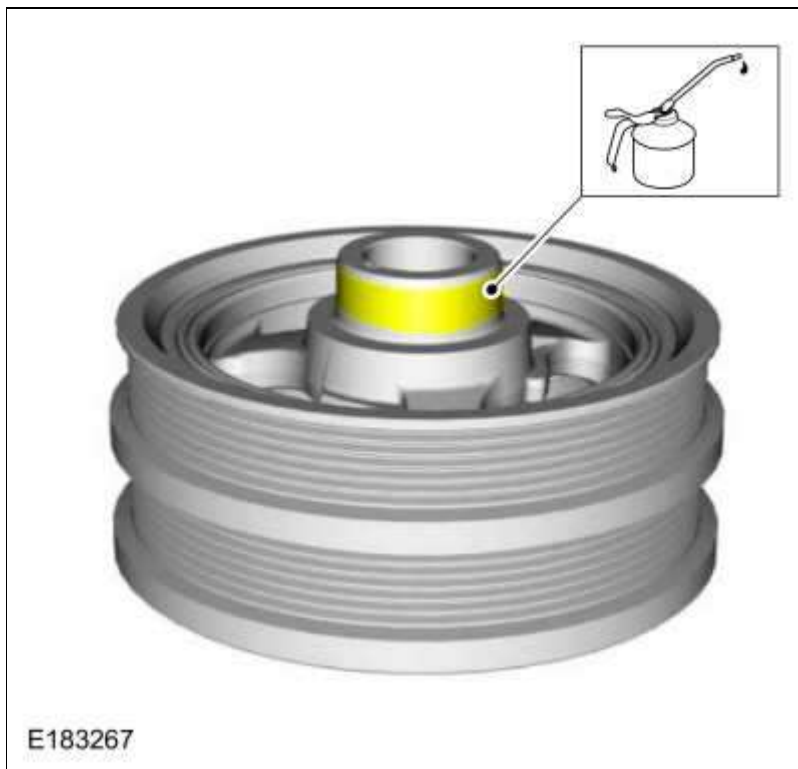
83. **NOTE:** If not secured within 5 minutes, the sealant must be removed and the sealing area cleaned. Failure to follow this procedure can cause future oil leakage.

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

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)

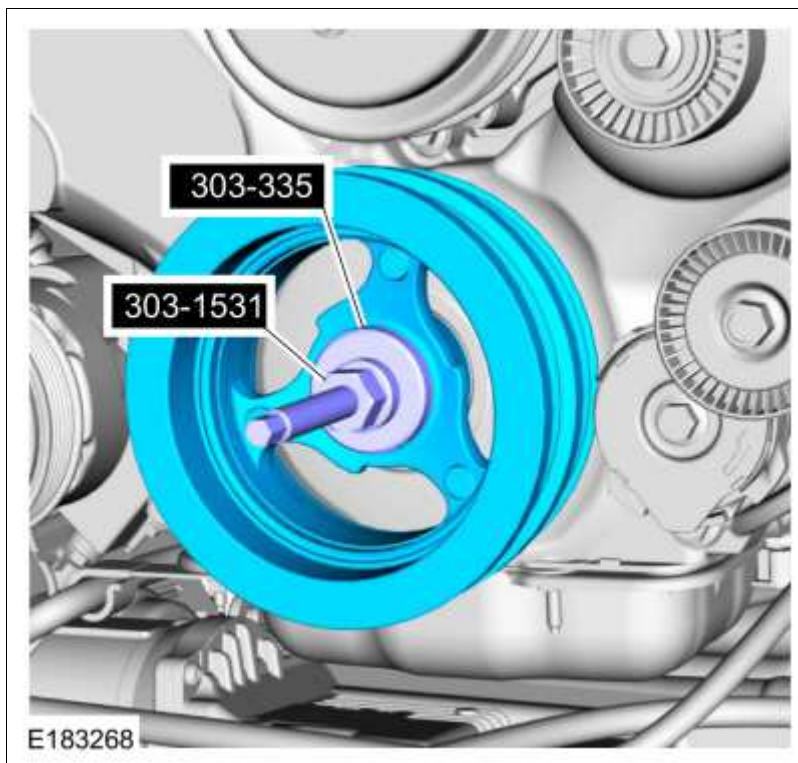


84. Lubricate the crankshaft pulley sealing surface with clean engine oil prior to installation.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



85. Using the special tools, install the crankshaft pulley.

Use Special Service Tool: [303-335 \(T88T-6701-A\) Installer, Front Cover Oil Seal.](#) , [303-1531 Installer, Front Crank Seal and Damper.](#)



86. Using the Strap Wrench, install a new crankshaft pulley bolt and the original washer.

Use the General Equipment: Strap Wrench

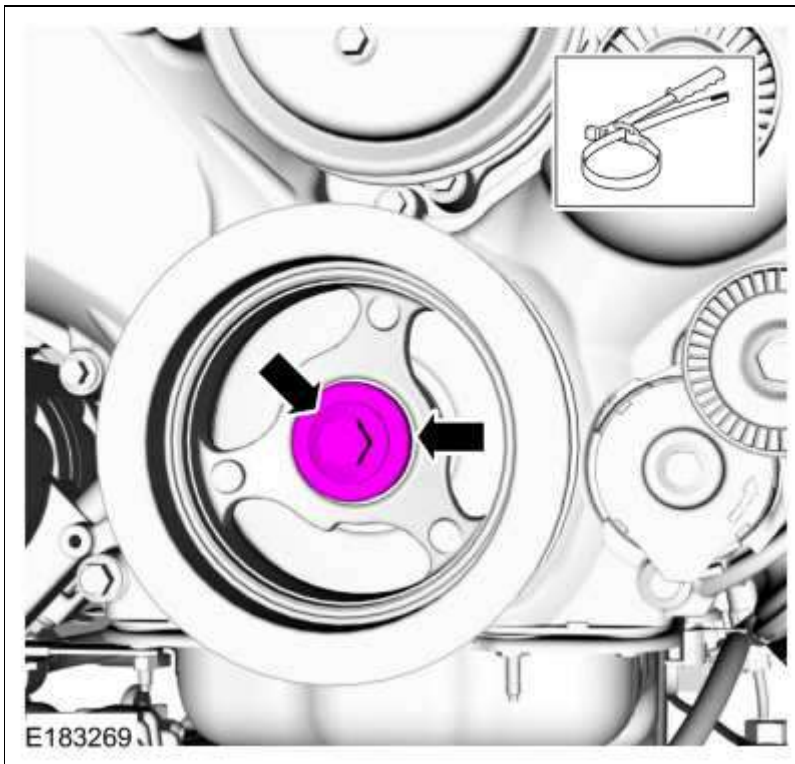
Torque:

Stage 1: 103 lb.ft (140 Nm)

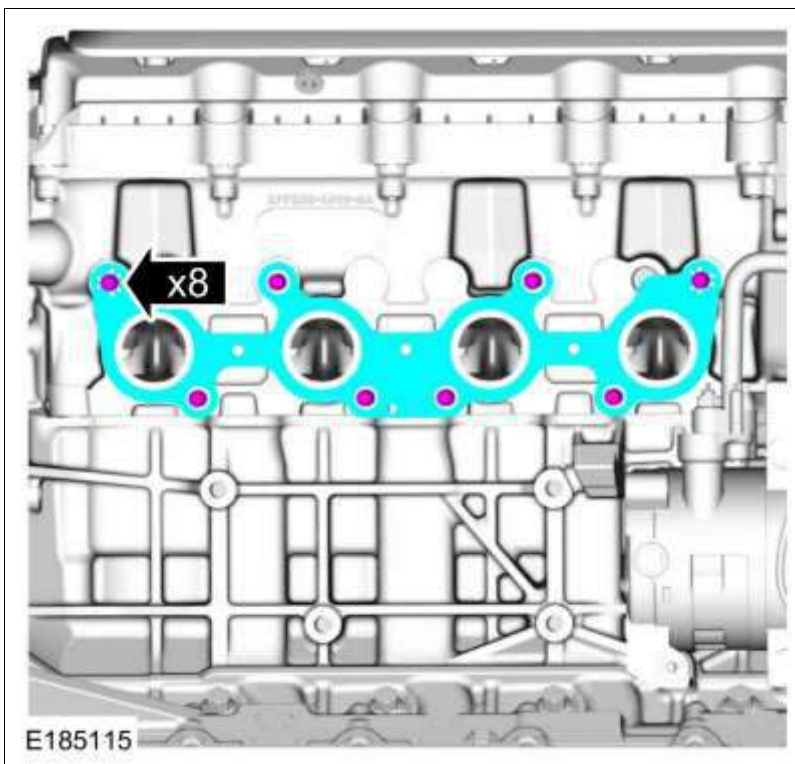
Stage 2: Loosen: 360°

Stage 3: 74 lb.ft (100 Nm)

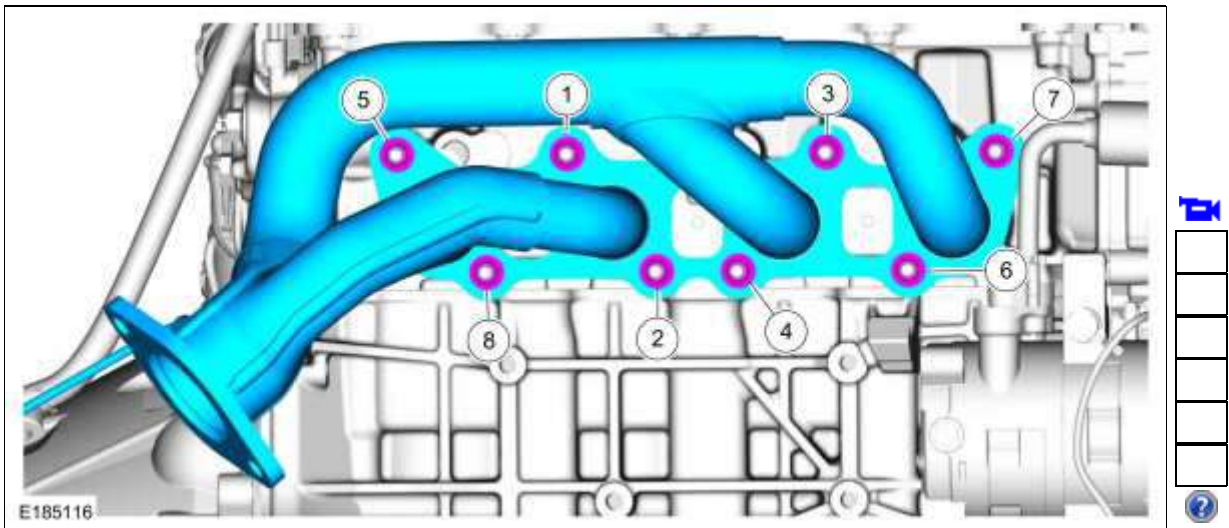
Stage 4: 90°



87. Install new studs and new gasket.
Torque: 159 lb.in (18 Nm)



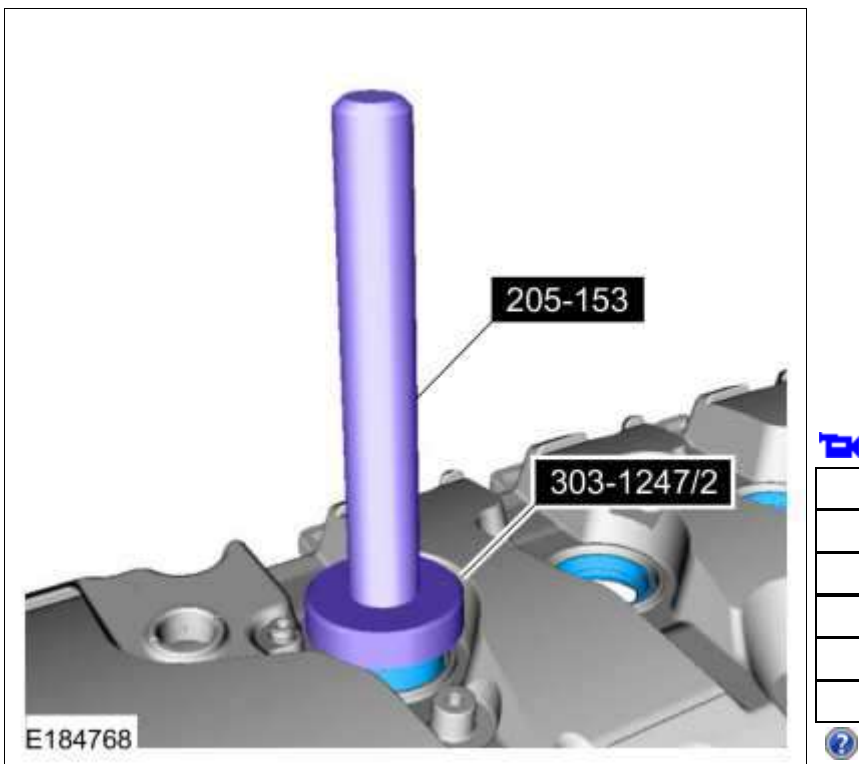
88. Install the exhaust manifold.
- Install the new nuts.
- Torque:
- Stage 1: 159 lb.in (18 Nm)
 - Stage 2: 18 lb.ft (24 Nm)



89. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new spark plug tube seals into the LH valve cover.

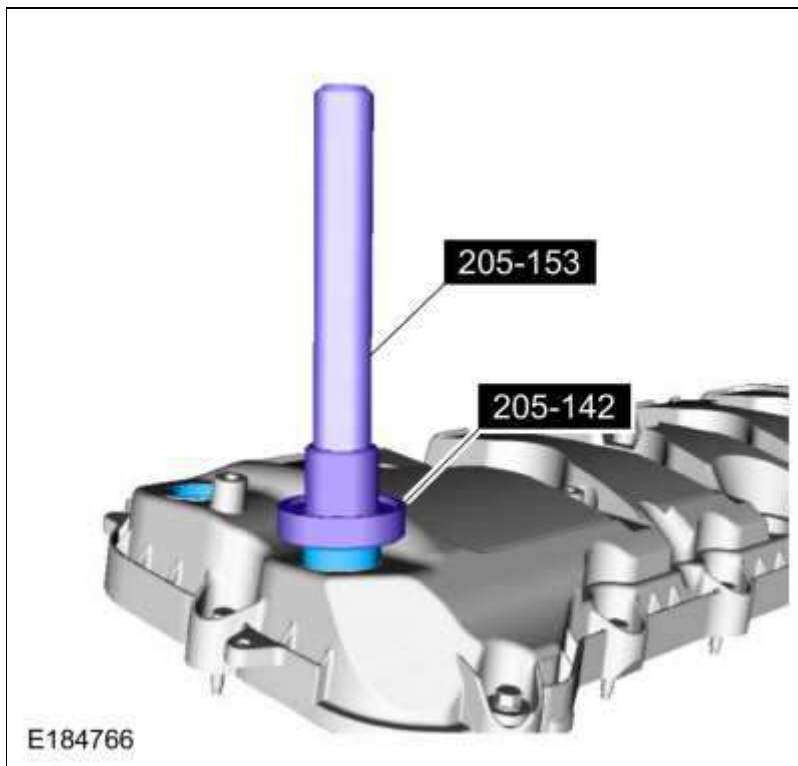
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer](#).



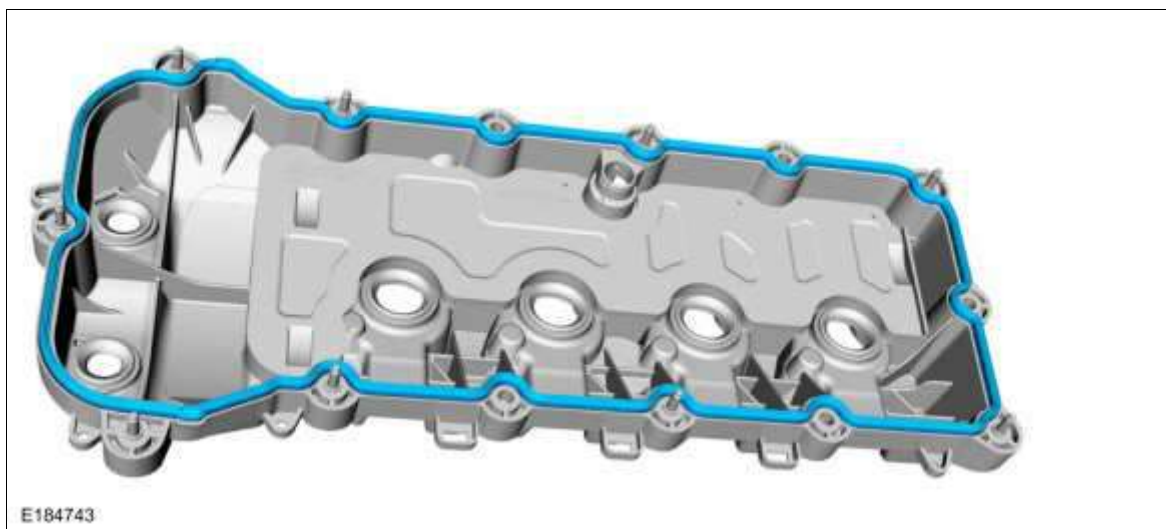
90. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new VCT variable force solenoid seals into the LH valve cover.

Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone](#).



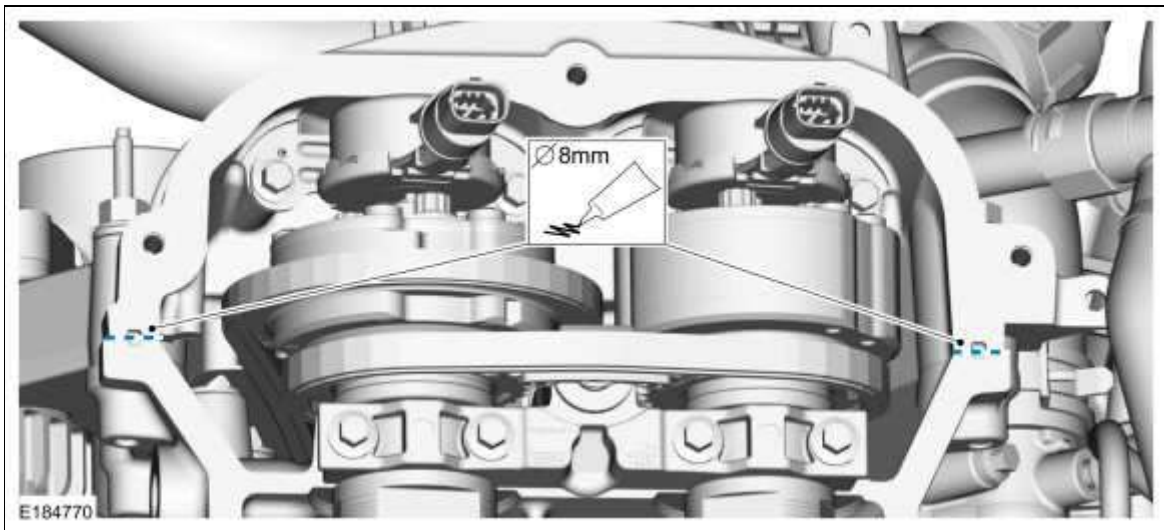
91. Install a new gasket onto the LH valve cover.



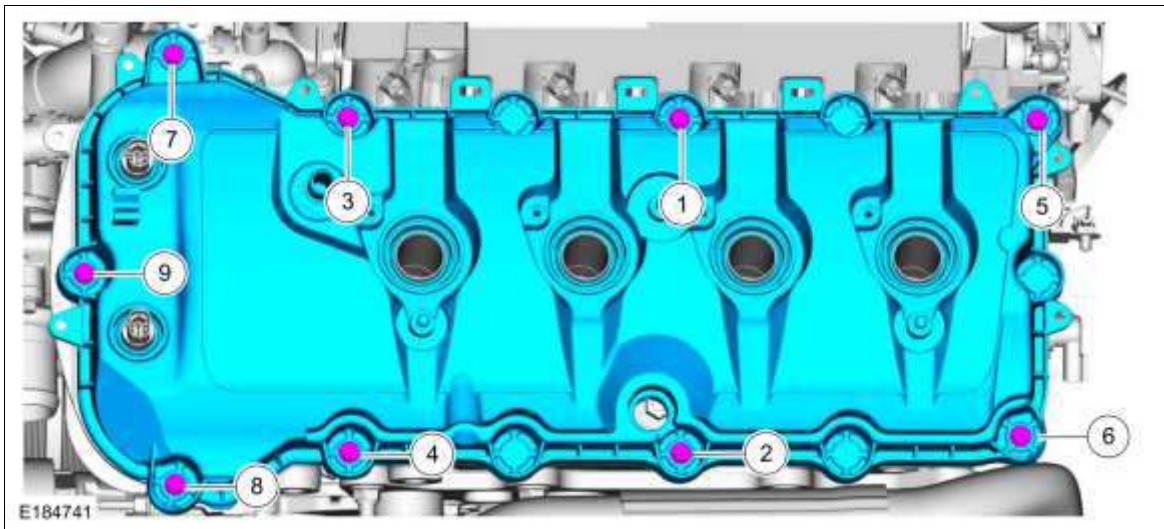
92. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the engine front cover-to-LH cylinder head joints.

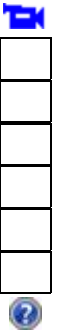
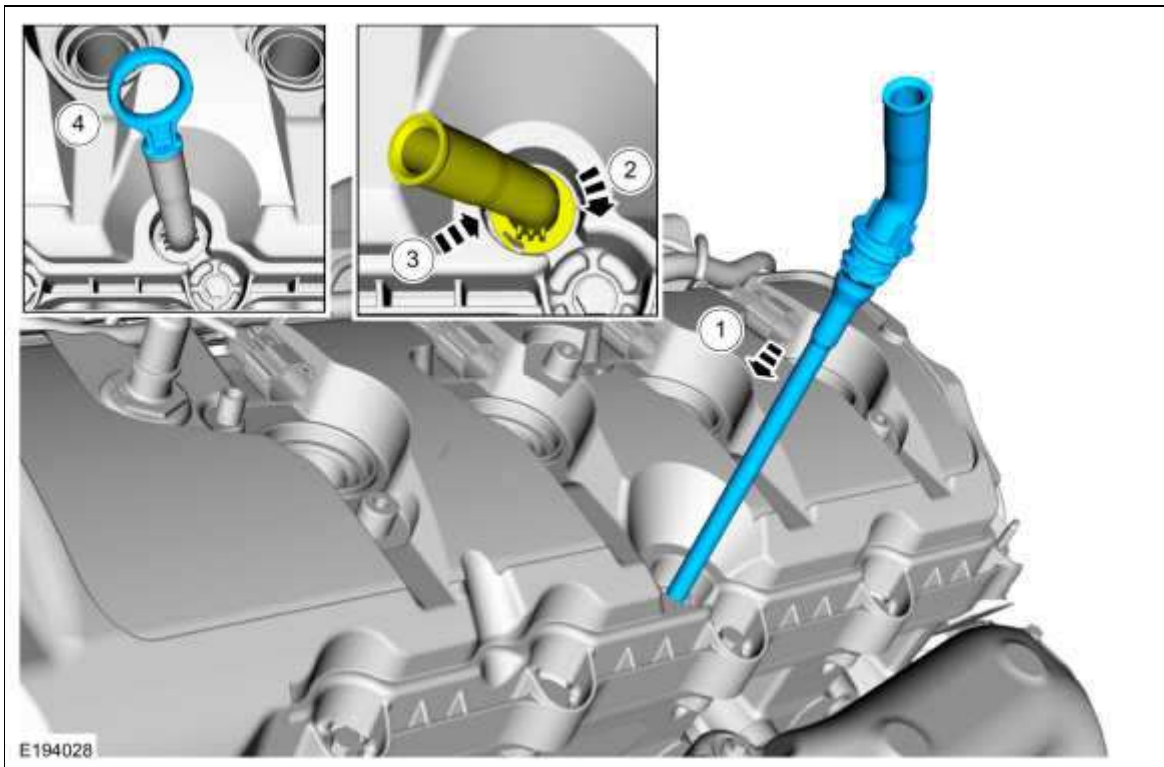
Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



93. Install the LH valve cover and tighten the bolts.
Torque: 89 lb.in (10 Nm)



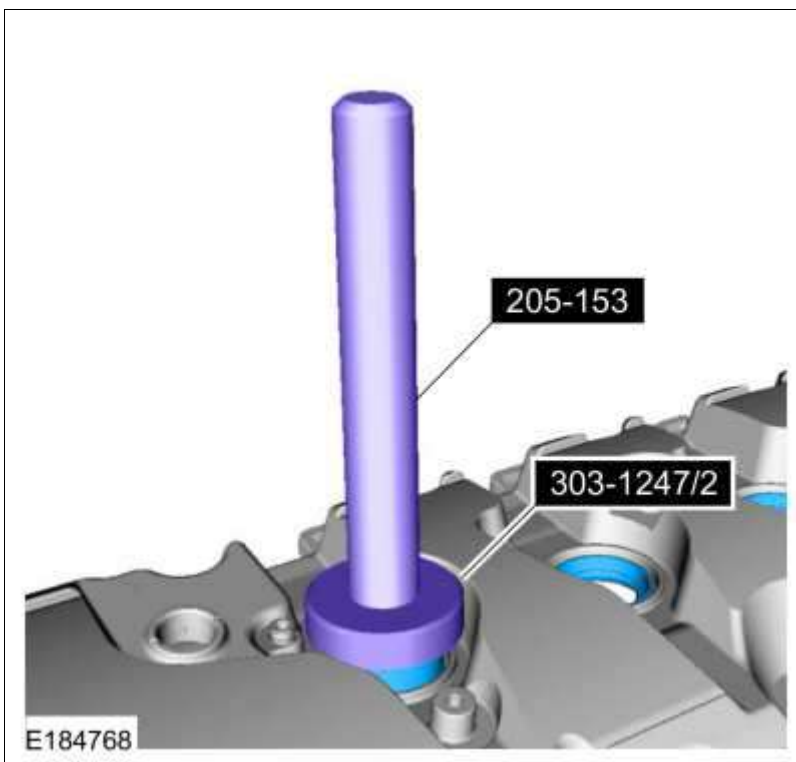
94.
 1. Push the oil level indicator tube into the engine.
 2. Rotate the oil level indicator tube clockwise.
 3. Verify the tab is locked in place.
 4. Install the oil level indicator.



95. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new spark plug tube seals into the RH valve cover.

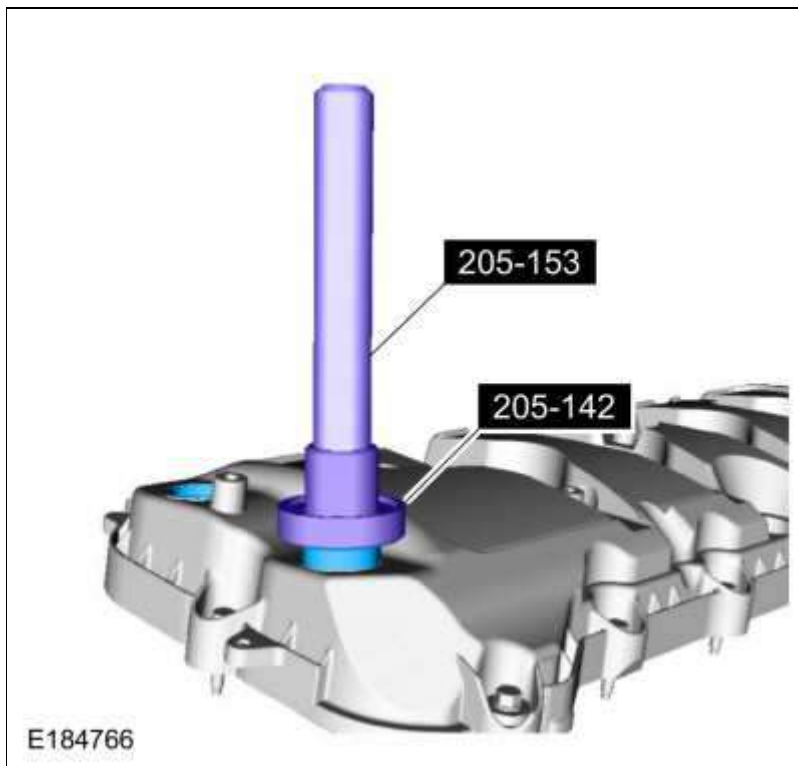
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer.](#)



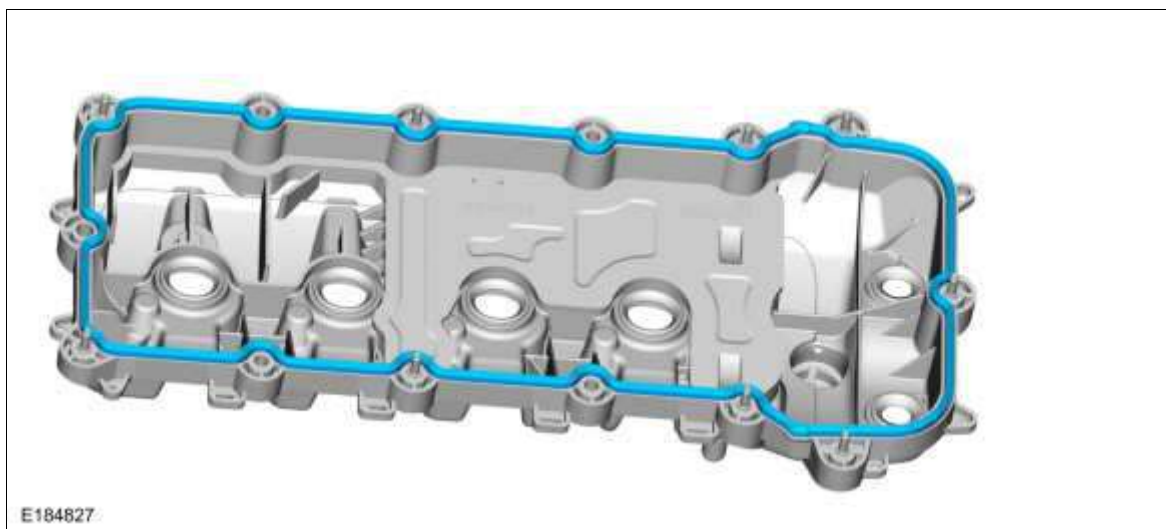
96. **NOTE:** Installation of new seals is only required if damaged seals were removed.

Using the special tools, install new VCT variable force solenoid seals into the RH valve cover.

Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone.](#)



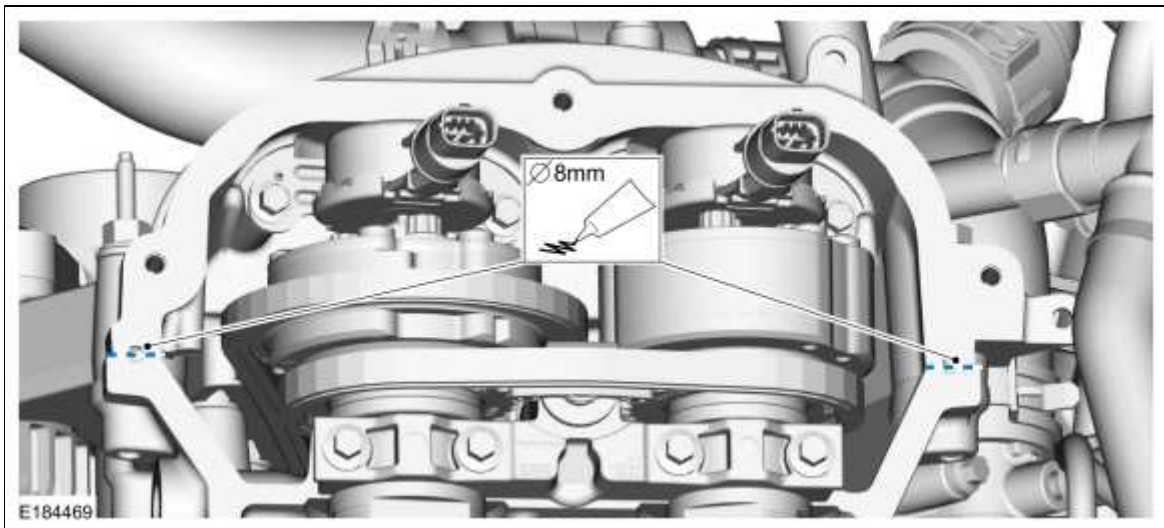
97. Install a new gasket onto the RH valve cover.



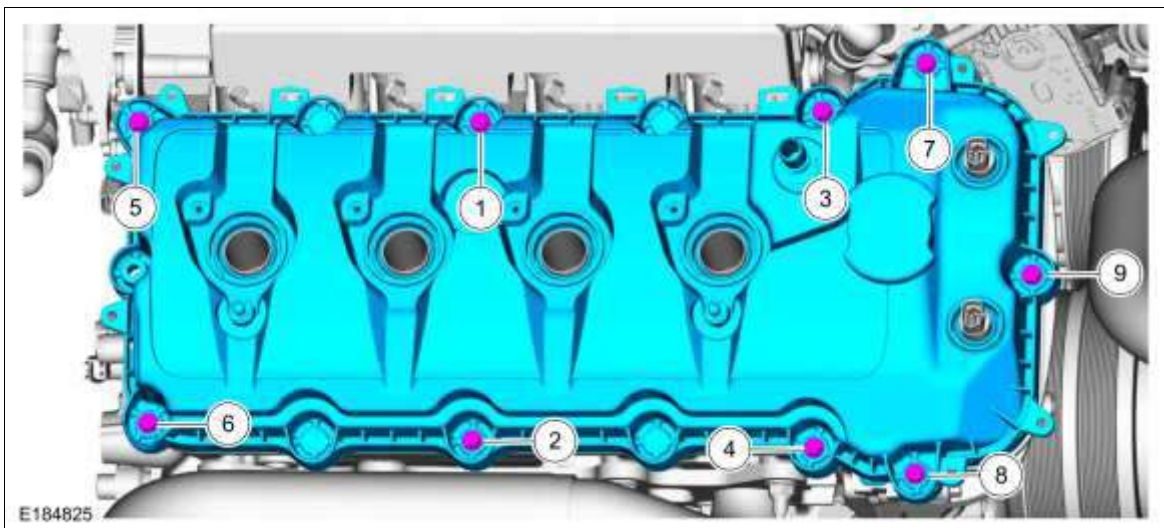
98. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 5 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of silicone gasket and sealant to the engine front cover-to-RH cylinder head joints.

Material: Silicone Gasket and Sealant / TA-30 (WSE-M4G323-A4)



99. Install the RH valve cover and tighten the bolts.
Torque: 89 lb.in (10 Nm)



100. **NOTE:** When installing ignition coils, apply a small amount of silicone brake caliper grease and dielectric compound to the inside of the ignition coil boots before installation.

Install the ignition coils and the bolts.

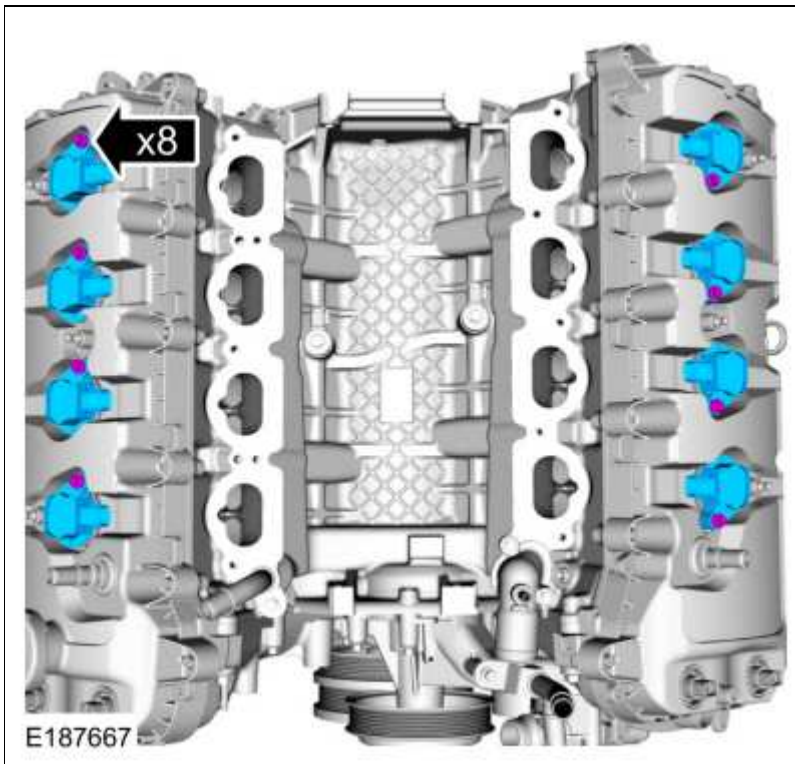
Install the ignition coils and the bolts.

Material: Silicone Brake Caliper Grease and Dielectric Compound / XG-3-A (ESE-M1C171-A)

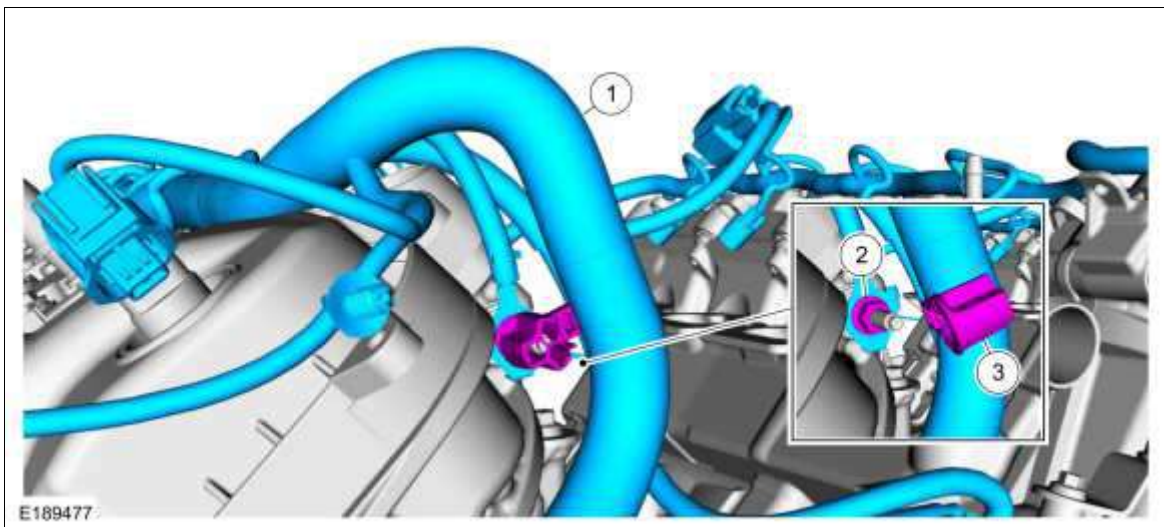
Torque:

Stage 1: 62 lb.in (7 Nm)

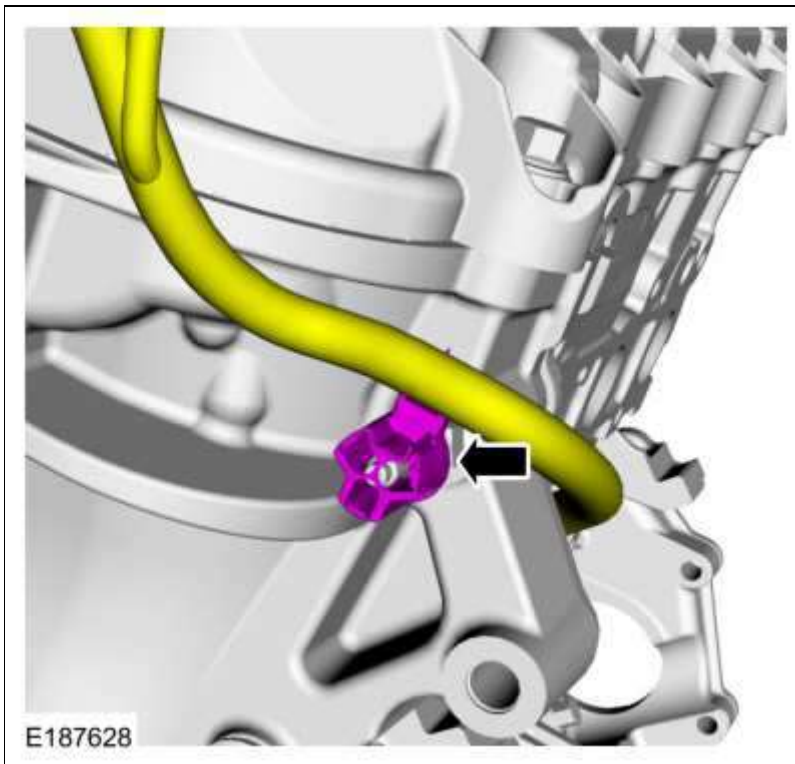
Stage 2: 50°



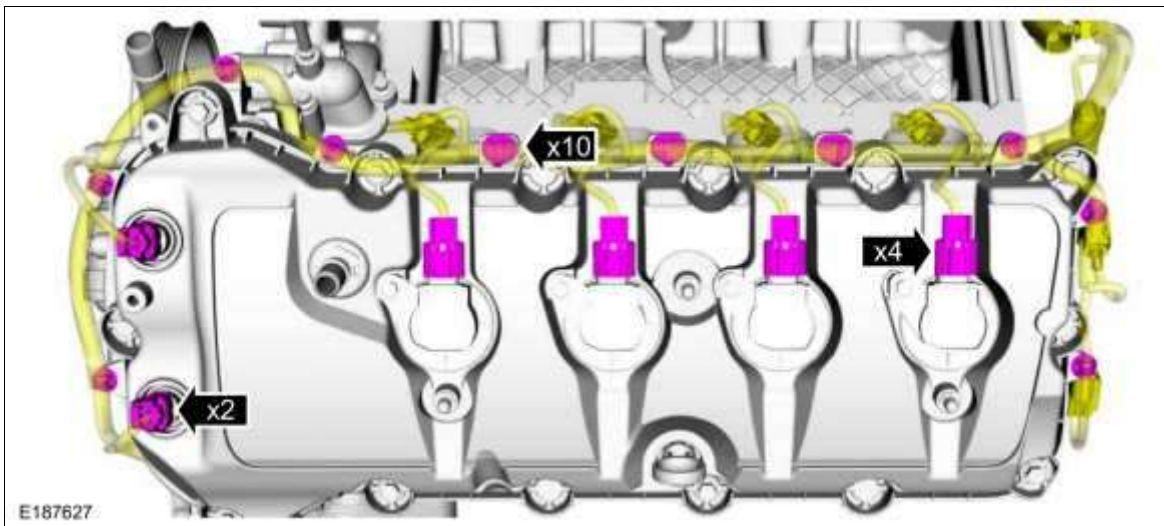
- 101.
- Position the wiring harness on the engine.
 - Install the ground wire and the nut.
 - Attach the wiring harness retainer to the engine front cover stud bolt.
- Torque: 89 lb.in (10 Nm)*



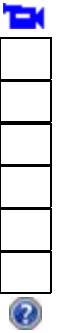
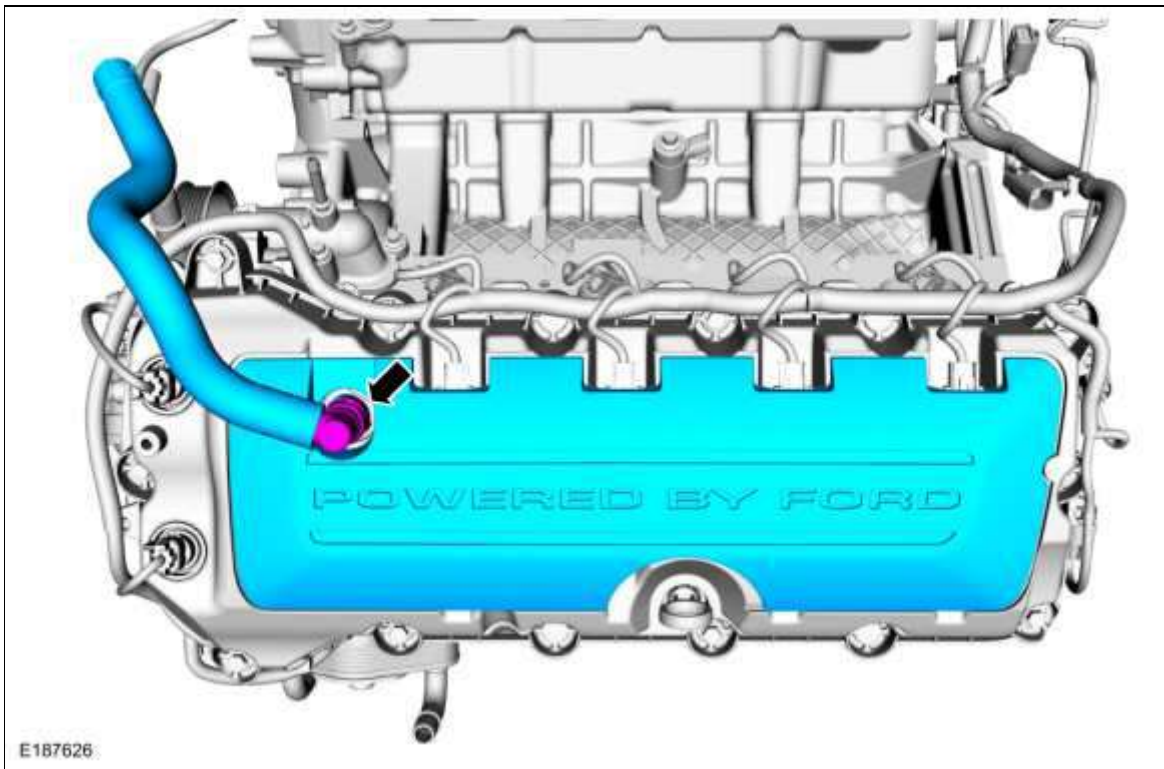
102. Attach the wiring harness retainer to the engine front cover stud bolt.



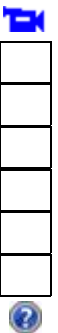
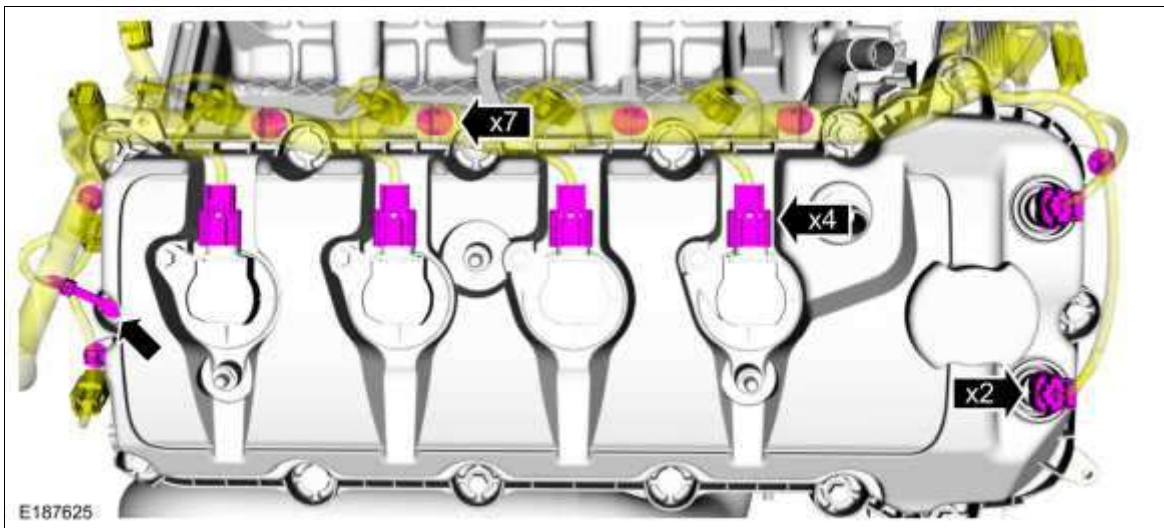
103. Connect the wiring harness electrical connectors and retainers.



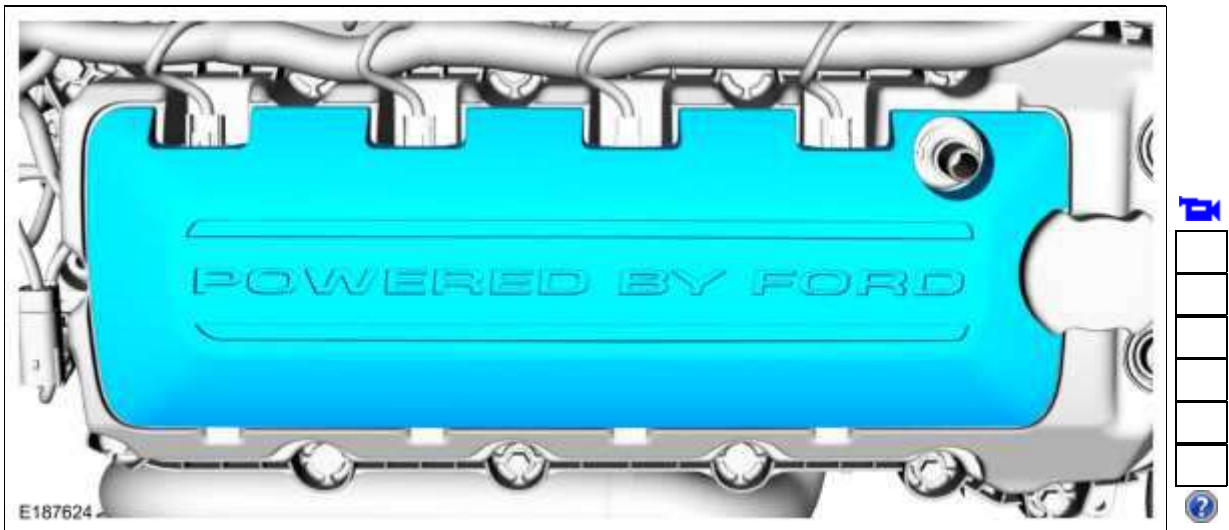
- 104.
- Install the LH spark plug cover.
 - Install the crankcase ventilation tube.
- Refer to: [Quick Release Coupling](#) (310-00C Fuel System - General Information - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).



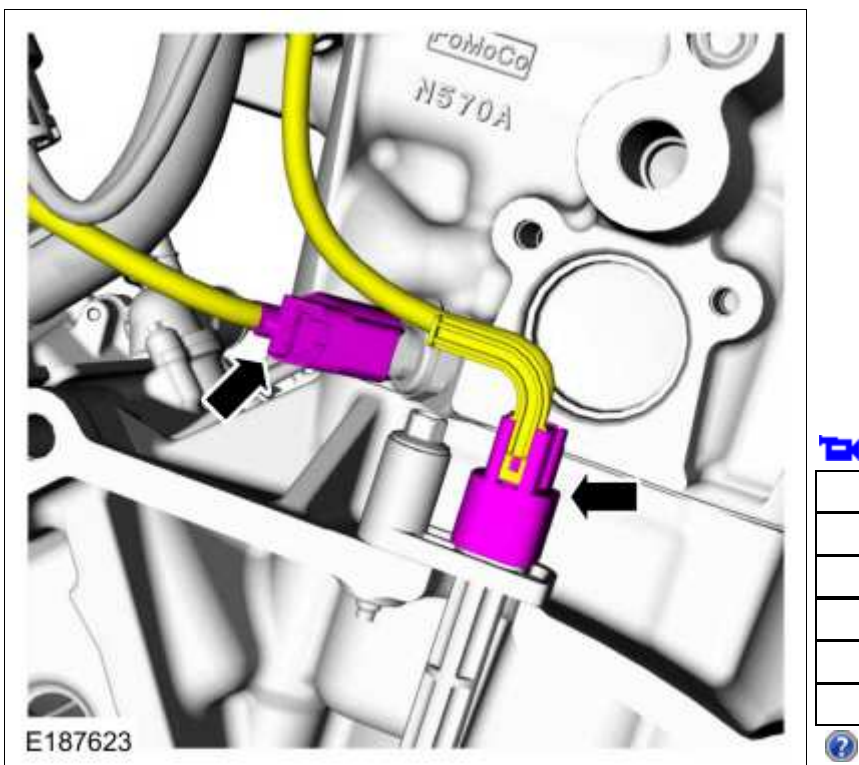
105. **NOTE:** Engine equipped with automatic transmission shown, manual transmission engine similar.
Connect the wiring harness electrical connectors and retainers.



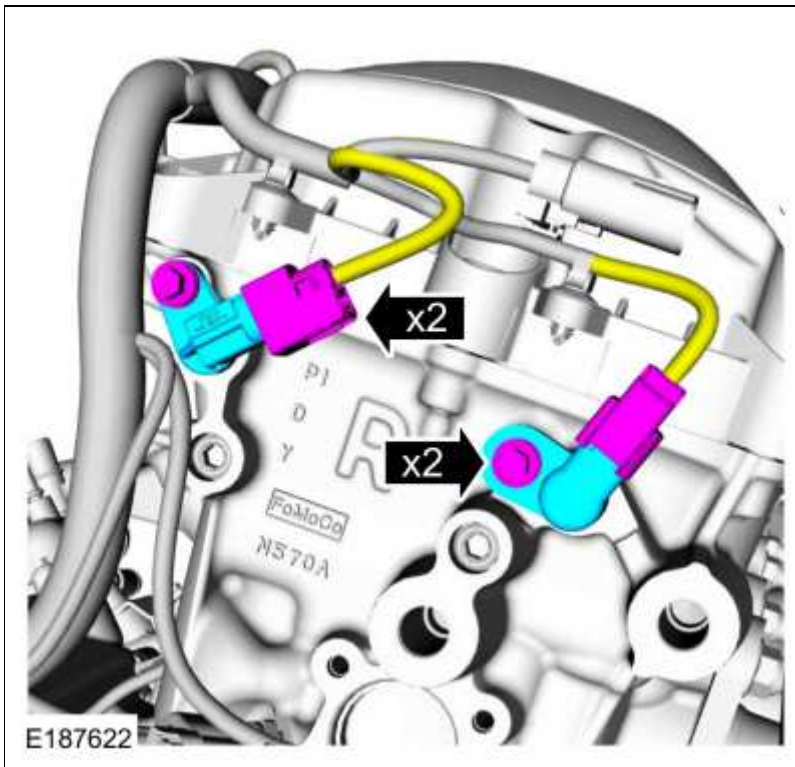
106. Install the spark plug cover.



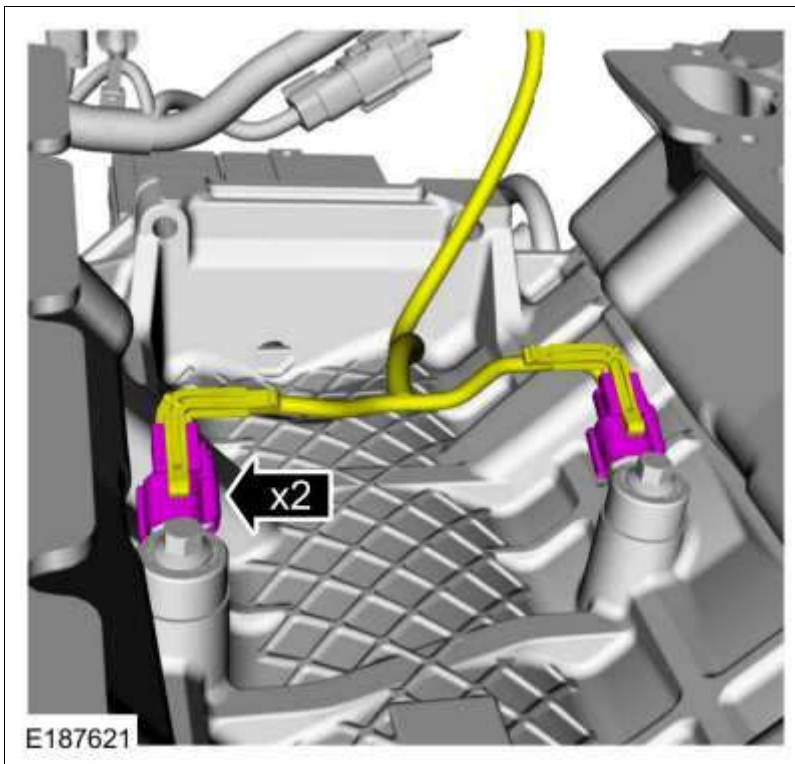
107. Connect the CHT sensor and the CKP sensor electrical connectors.



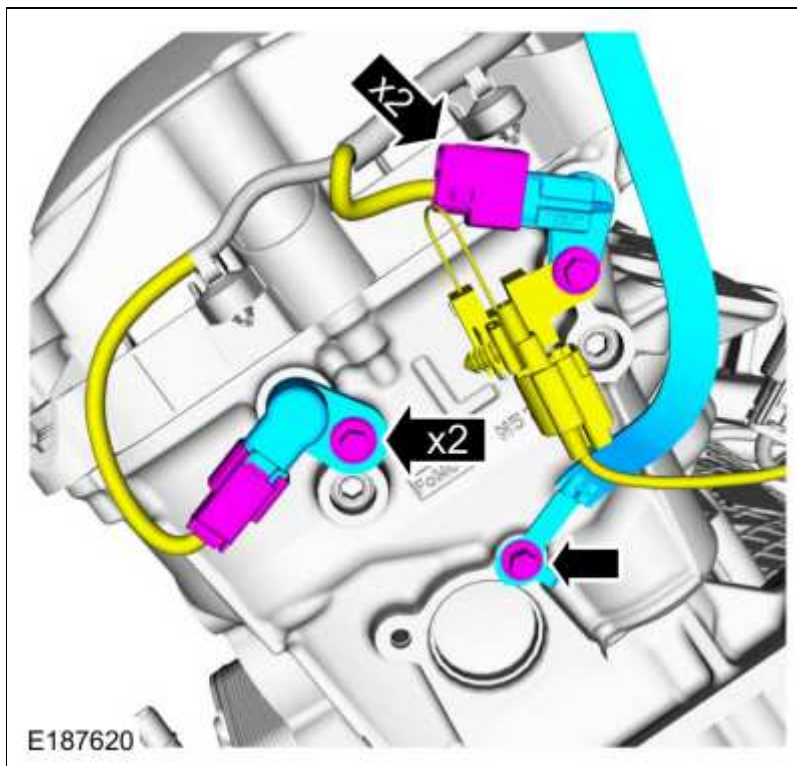
- 108.
- Install the RH camshaft position sensors and the bolts.
Torque: 89 lb.in (10 Nm)
 - Connect the RH camshaft position sensor electrical connectors.



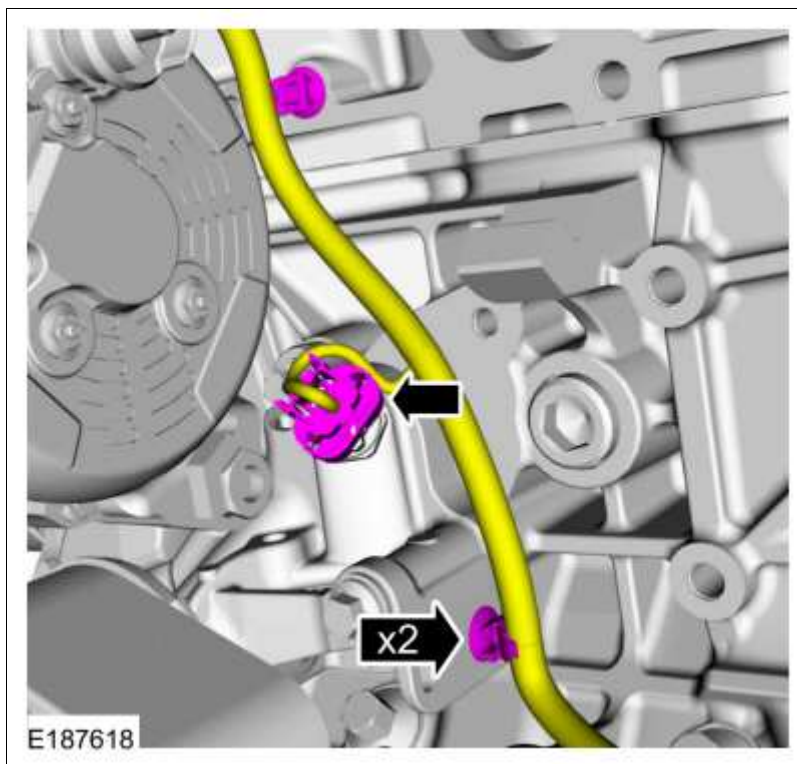
109. Connect the KS electrical connectors.



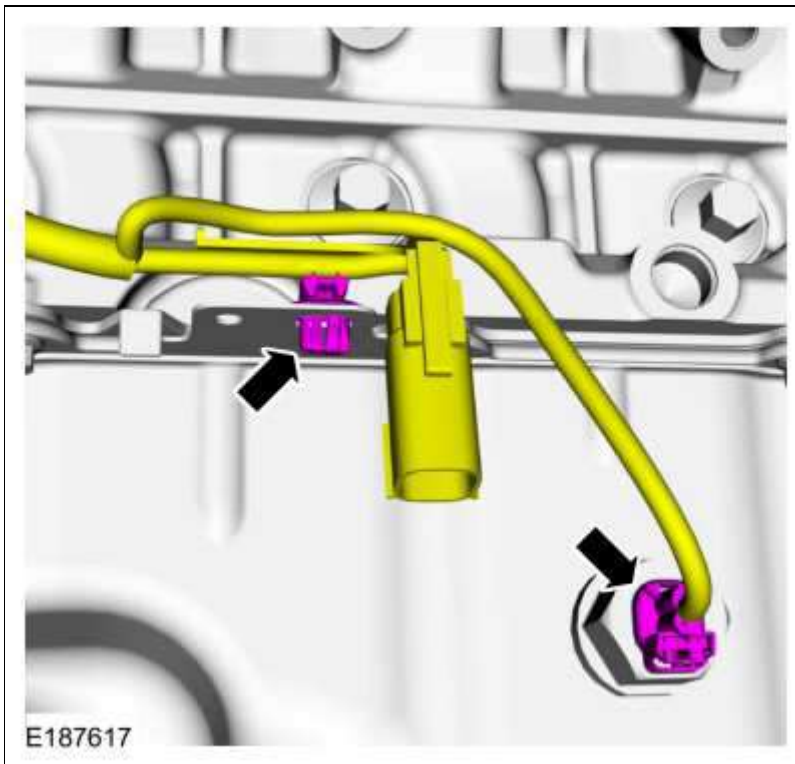
- 110.
- Install the LH camshaft position sensors and the bolts.
Torque: 89 lb.in (10 Nm)
 - Position the ground wire and install the bolt.
Torque: 106 lb.in (12 Nm)
 - Connect the LH camshaft position sensor electrical connectors.



111. Connect the EOP) switch electrical connector and the wiring harness retainers.

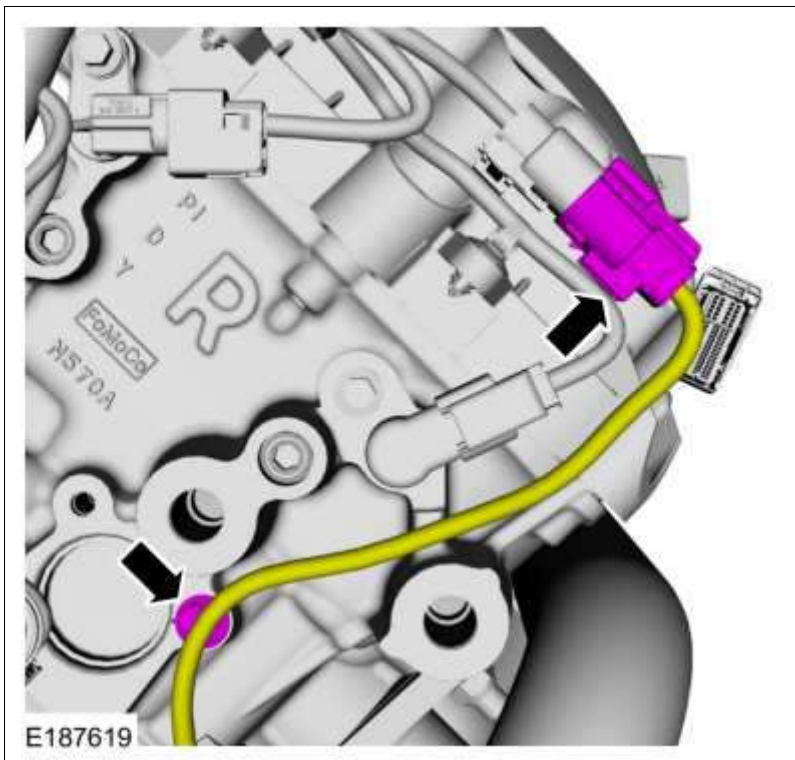


112. Connect the engine oil level sensor electrical connector and the wiring harness retainer.



113. **NOTE:** Manual transmission engine shown, automatic transmission engine similar.

Connect the theRH HO2S electrical connector and wiring harness retainer.

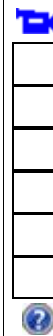


114. Install the special tool and remove the engine from the engine stand using a floor crane.

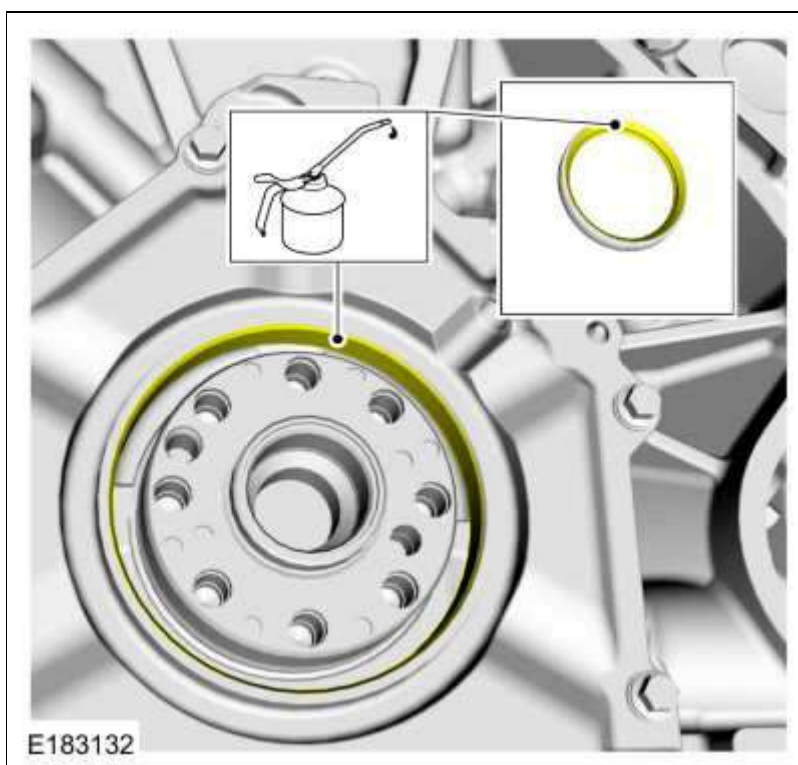
Install Special Service Tool: [303-F047 Lifting Bracket, Engine](#).

Use the General Equipment: Floor Crane

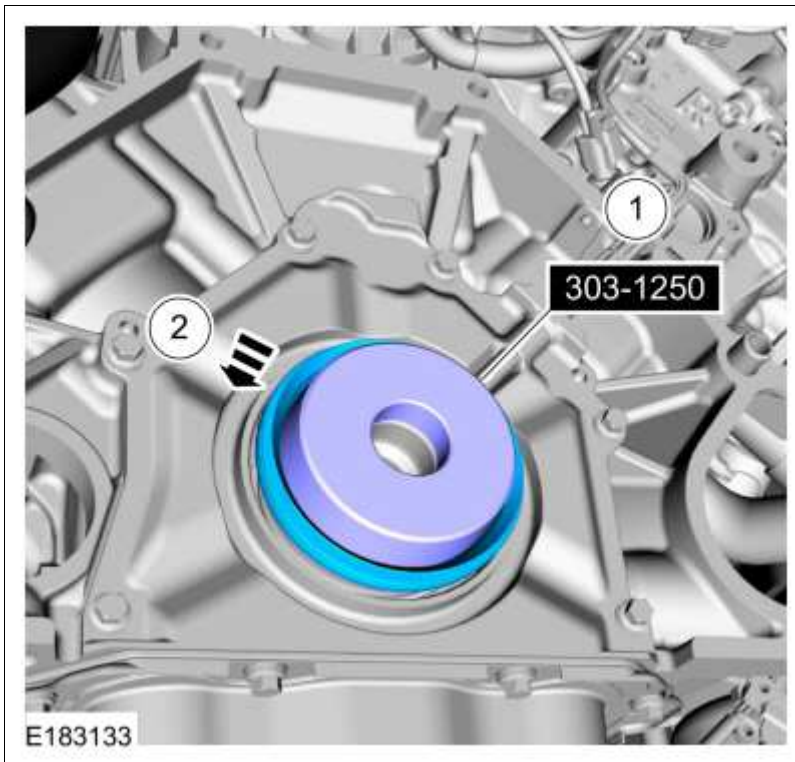
Use the General Equipment: Mounting Stand



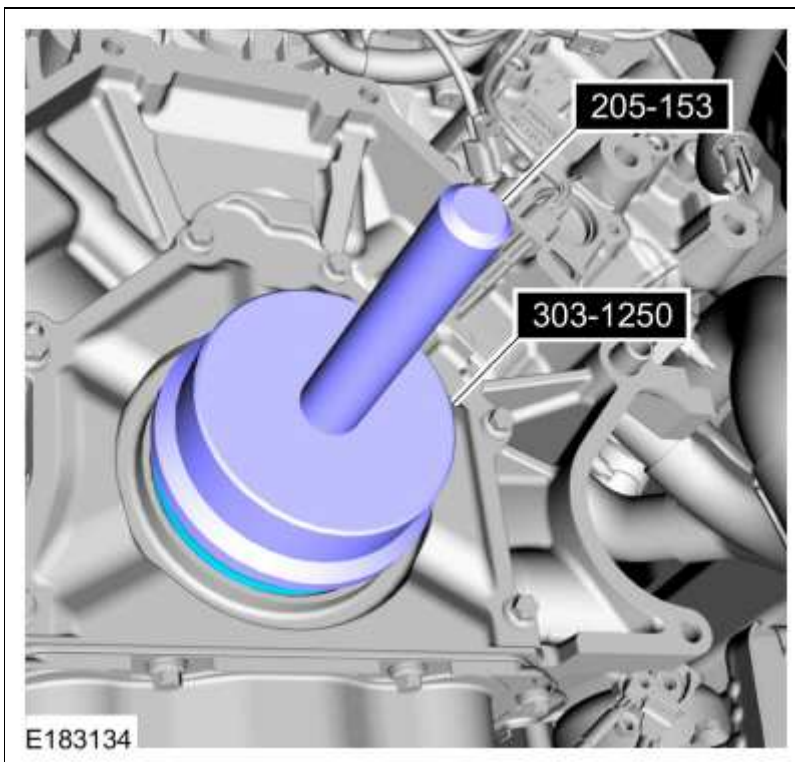
115. Lubricate the seal bore and the seal lips with clean engine oil.
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



- 116.
- Position the special tool onto the end of the crankshaft.
Use Special Service Tool: [303-1250 Seal Installer, Rear Main.](#)
 - Slide the new crankshaft rear seal onto the tool.

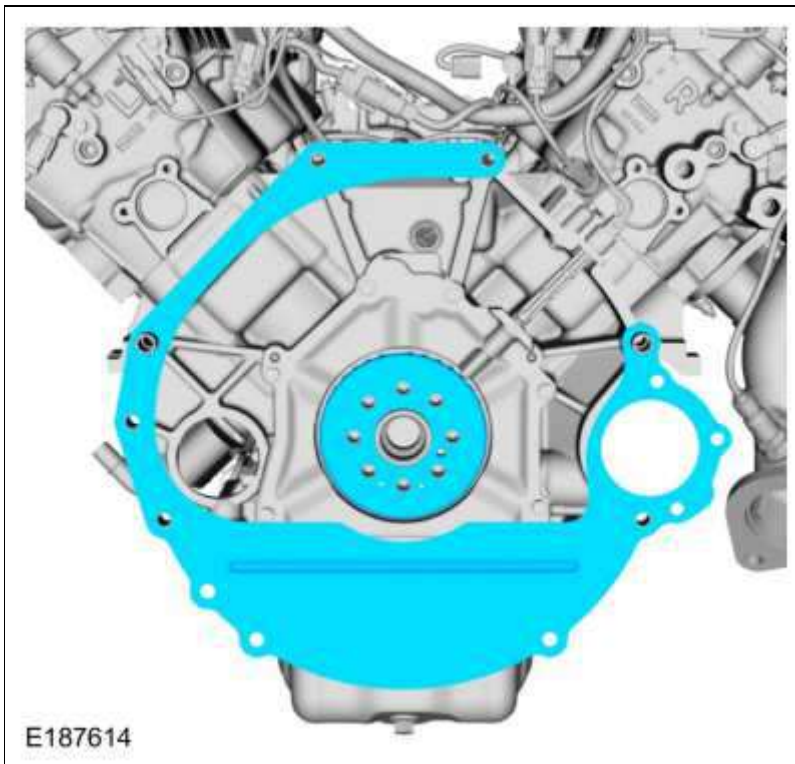


117. Using the special tools, install the crankshaft rear seal.
- Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1250 Seal Installer, Rear Main.](#)



118. **NOTE:** Engine equipped with manual transmission shown, automatic transmission engine similar.

Install the engine-to-transmission spacer plate and the crankshaft sensor ring.



6-Speed Manual Transmission - MT82

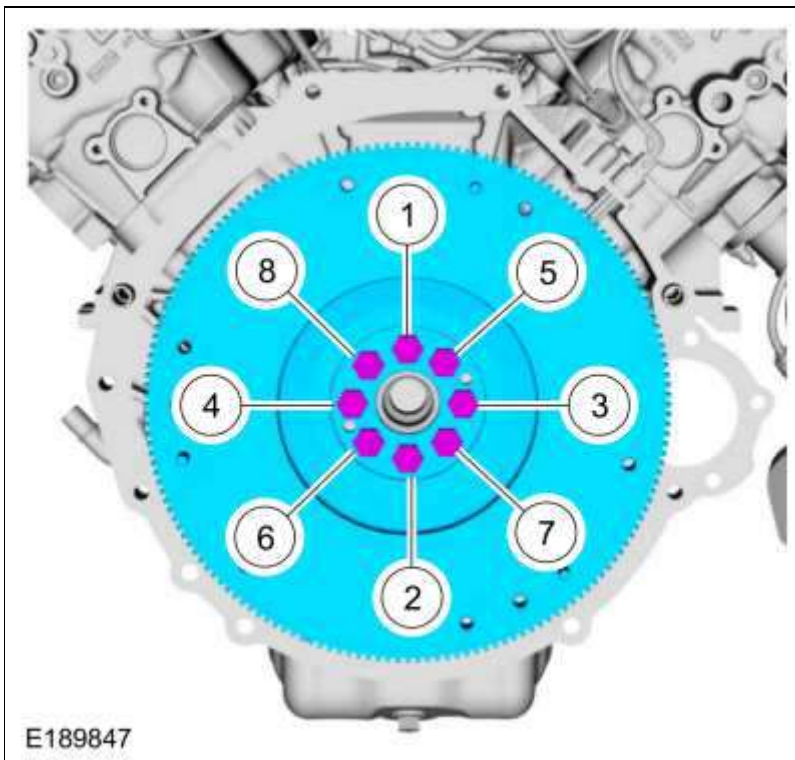
119. Install the flywheel and the bolts.

Torque:

Stage 1: 89 lb.in (10 Nm)

Stage 2: 177 lb.in (20 Nm)

Stage 3: 60°



120. **NOTICE:** If installing a new pressure plate and/or flywheel, align the paint dot on the pressure plate as close as possible to the paint dot on the flywheel or a clutch system vibration can occur.

NOTICE: If installing the original pressure plate, align it using the index-marks made during removal or a clutch system vibration can occur.

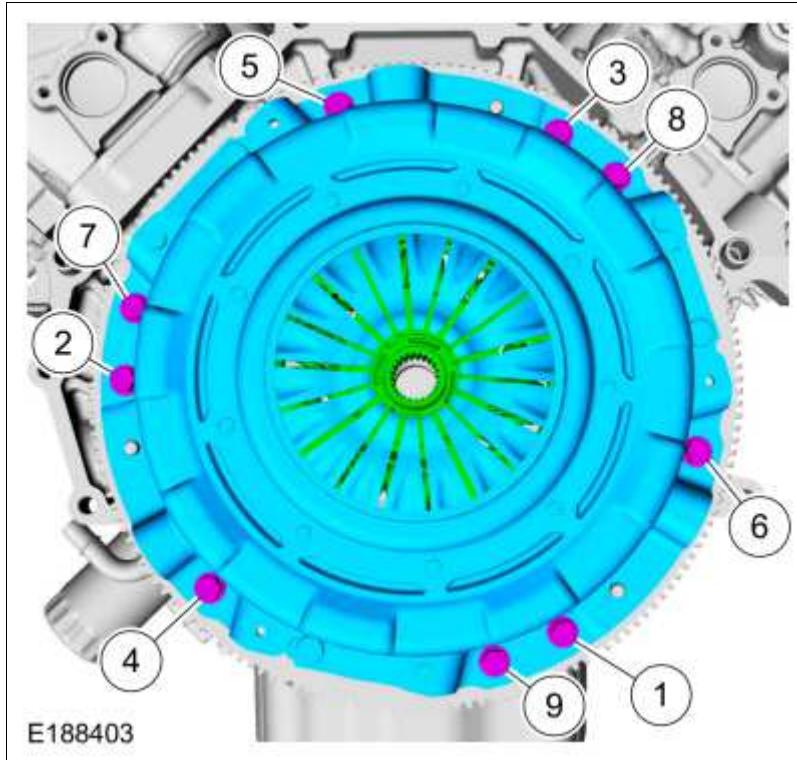
Using a clutch aligner, position the clutch disc on the flywheel. If installing the original pressure plate, align the pressure plate to the flywheel using the index-marks made during removal. If installing a new pressure plate, align the pressure plate to the flywheel using the paint dots. Install new pressure plate bolts by turning the bolts 1 turn at a time in a star pattern until the clutch is fully secured.

Use the General Equipment: Clutch Alignment Tool

Torque:

Stage 1: 34 lb.ft (46 Nm)

Stage 2: 60°



6-Speed Automatic Transmission - 6R80

121. Install the flexplate and the bolts.

Torque:

Stage 1: 177 lb.in (20 Nm)

Stage 2: 60°



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Engine

Base Part Number: [6L084](#)

Special Tool(s) / General Equipment

	303-F047 Lifting Bracket, Engine
	303-F072 Support Bar, Engine
Magnetic Socket	
Floor Crane	
Trolley Jack	
Wooden Block	

Materials

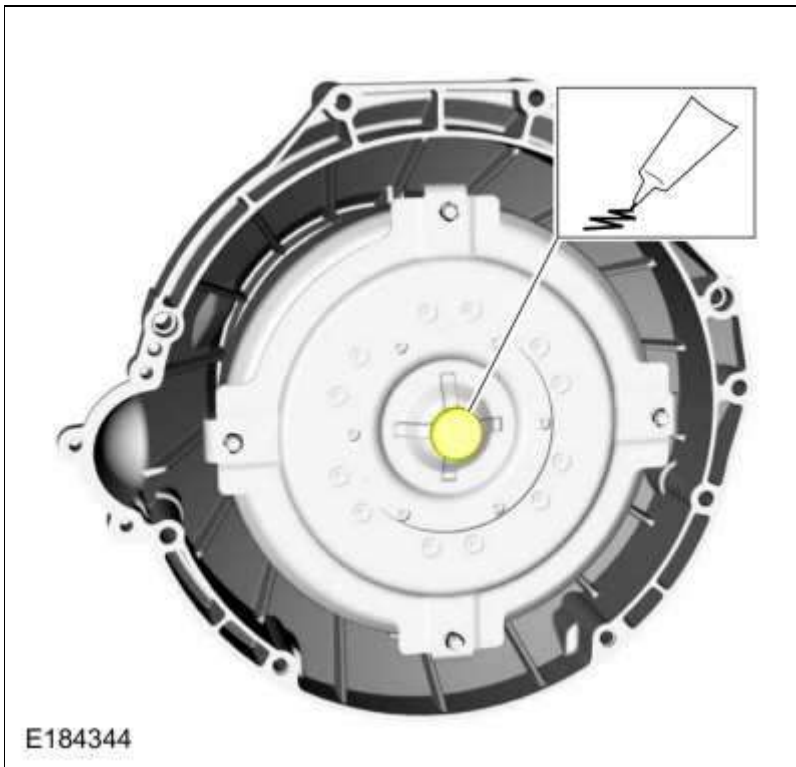
Name	Specification
Motorcraft® Multi-Purpose Grease Spray XL-5-A	ESB-M1C93-B
Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) XO-5W20-QSP (U.S.)	WSS-M2C945-A

6-Speed Automatic Transmission - 6R80

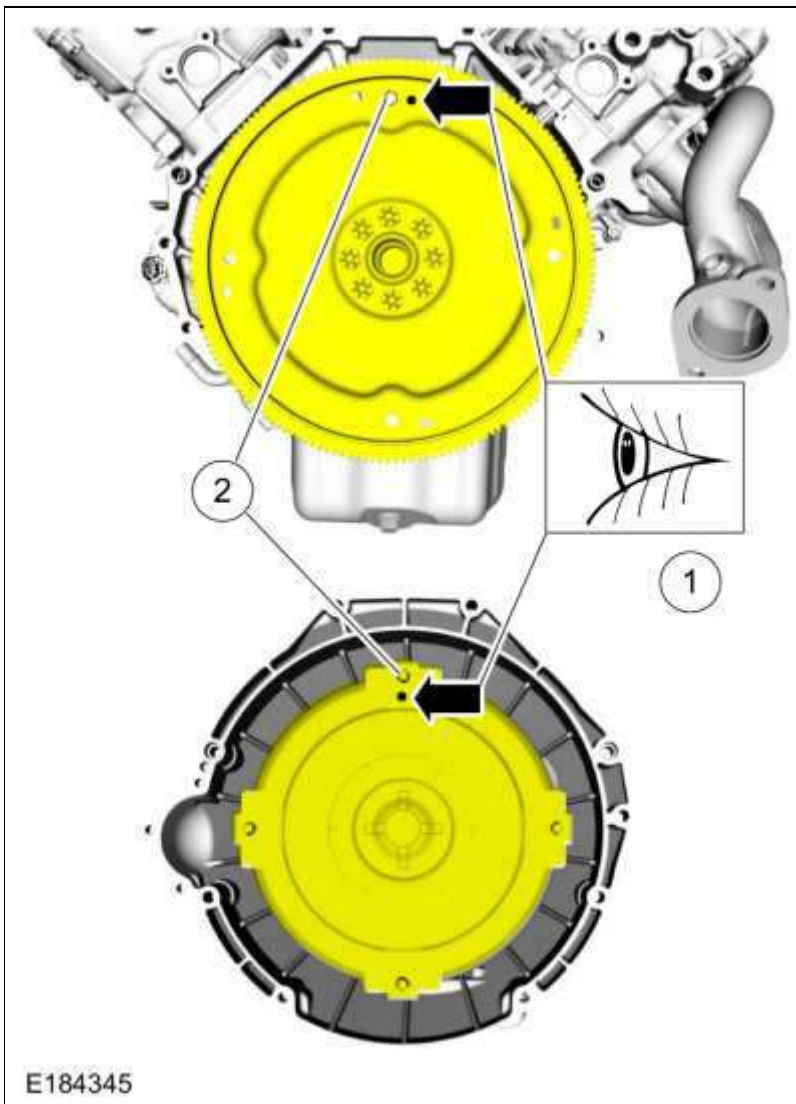
- NOTE:** Prior to installation of the engine, the torque converter pilot hub must be lubricated with multi-purpose grease or damage to the torque converter or the engine crankshaft can occur.

Lubricate the torque converter pilot hub with multi-purpose grease.

Material: Motorcraft® Multi-Purpose Grease Spray / XL-5-A (ESB-M1C93-B)



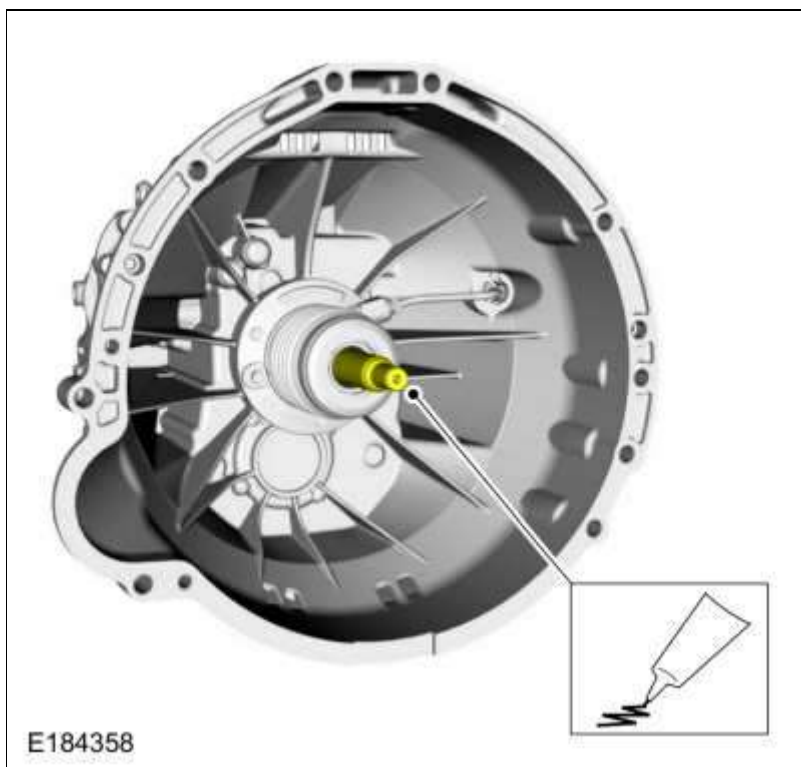
- 2.
- Inspect the torque converter stud and flexplate for paint marks.
 - Align the torque converter stud and flexplate hole near the paint marks to the 12 o'clock position.



6-Speed Manual Transmission - MT82

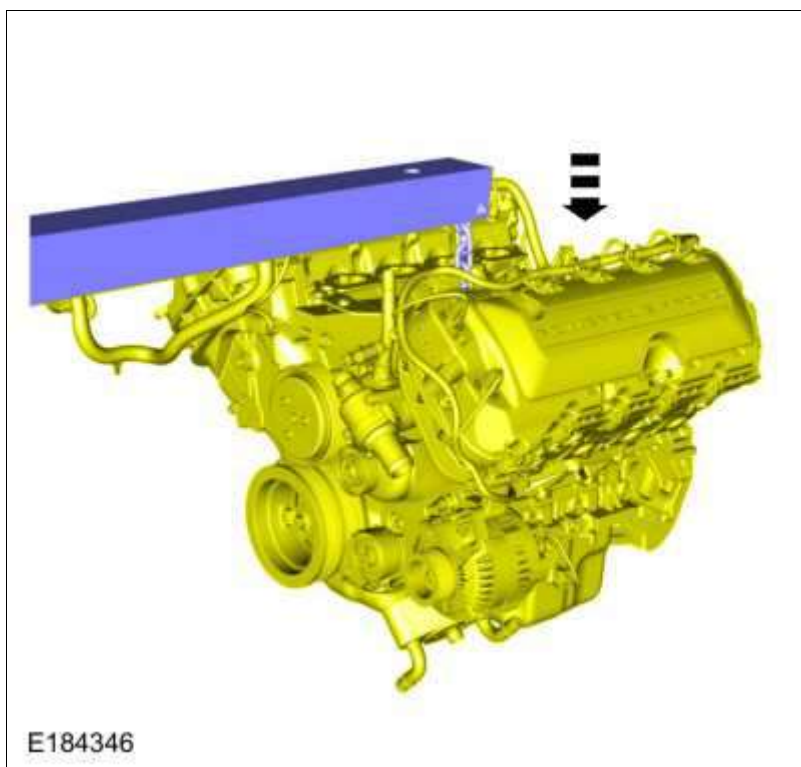
3. Lubricate the input shaft with multi-purpose grease.

Material: Motorcraft® Multi-Purpose Grease Spray / XL-5-A (ESB-M1C93-B)

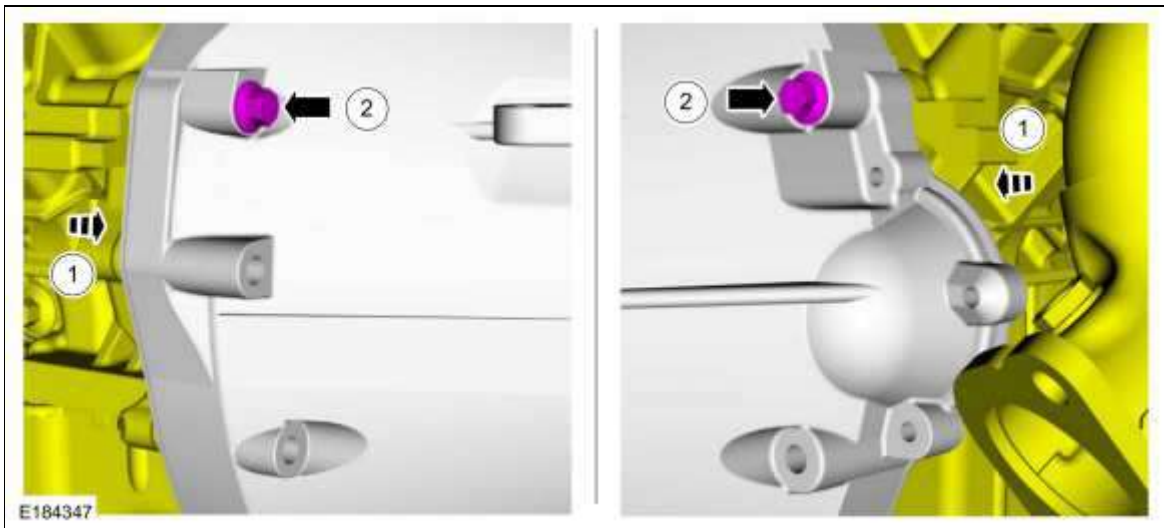


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

4. With the aid of an assistant, use the Floor Crane to install the engine into the vehicle.
Use the General Equipment: Floor Crane

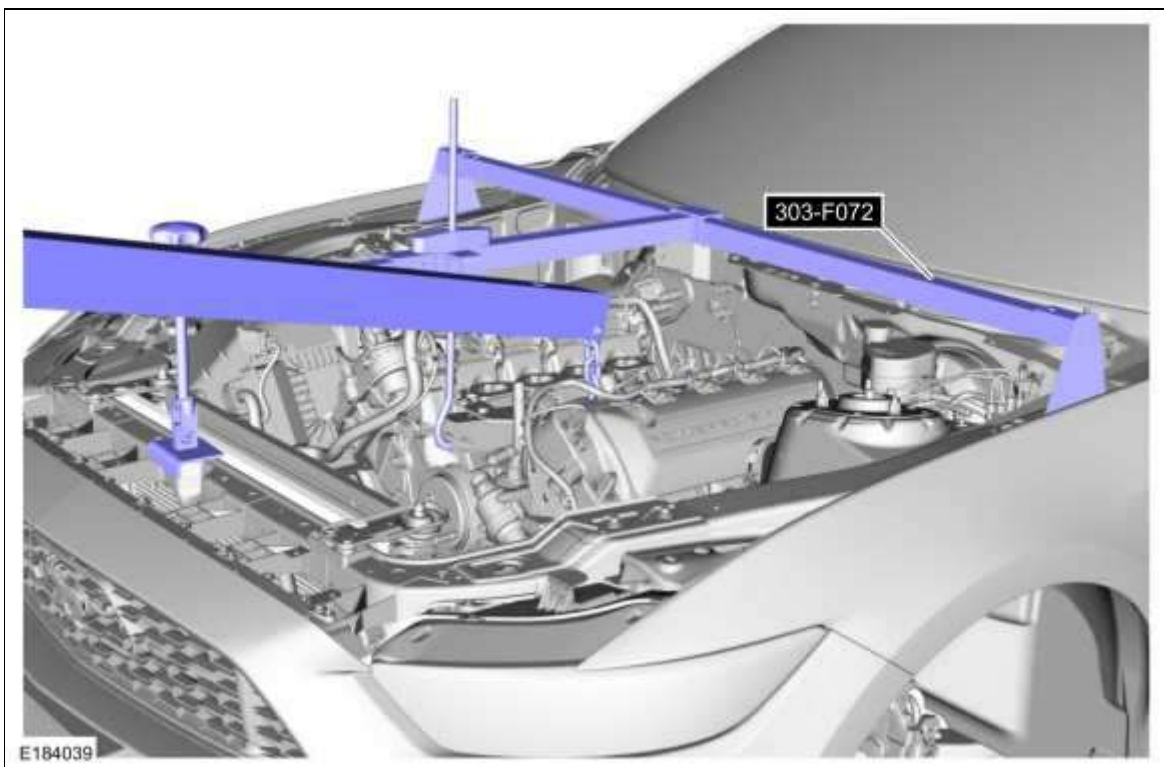


5.
 1. Align the engine to the transmission.
 2. Draw the engine and transmission together using the bolts.
- Torque:* 35 lb.ft (48 Nm)

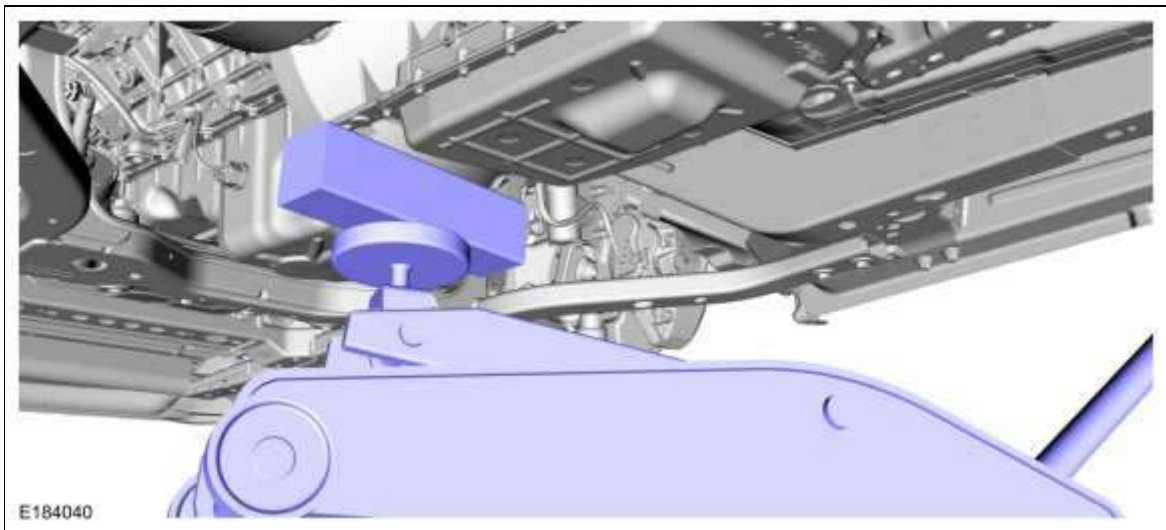


6. **NOTICE:** Do not position the legs of the Engine Support Bar on the fenders. Instead, the legs should be positioned on the body structure. Failure to follow these instructions may result in body damage.

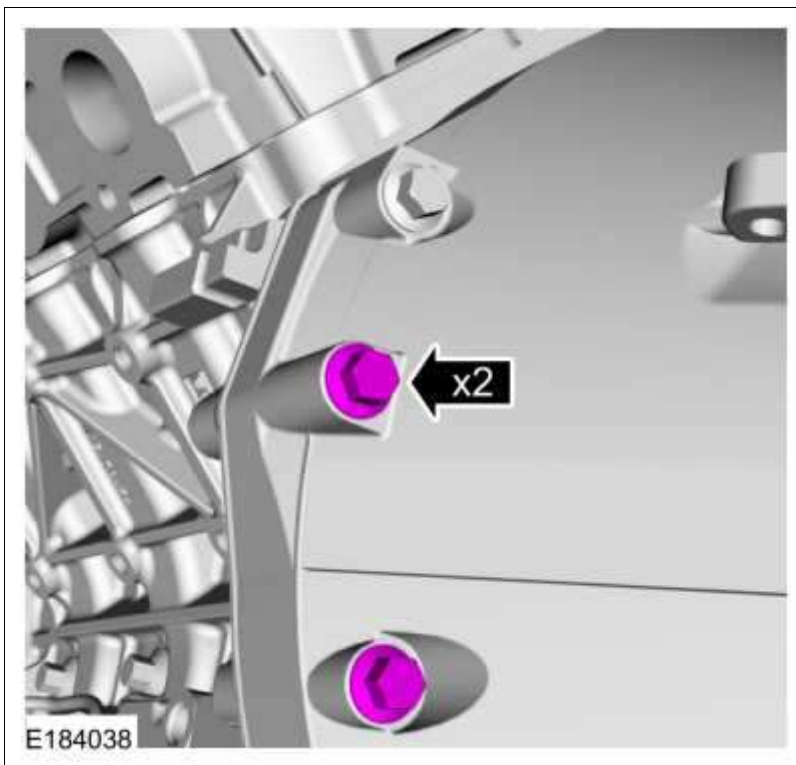
1. Install the special tools.
Use Special Service Tool: [303-F072 Support Bar, Engine](#).
2. Once the engine is supported by the Engine Support Bar, remove the Floor Crane.
Use the General Equipment: Floor Crane



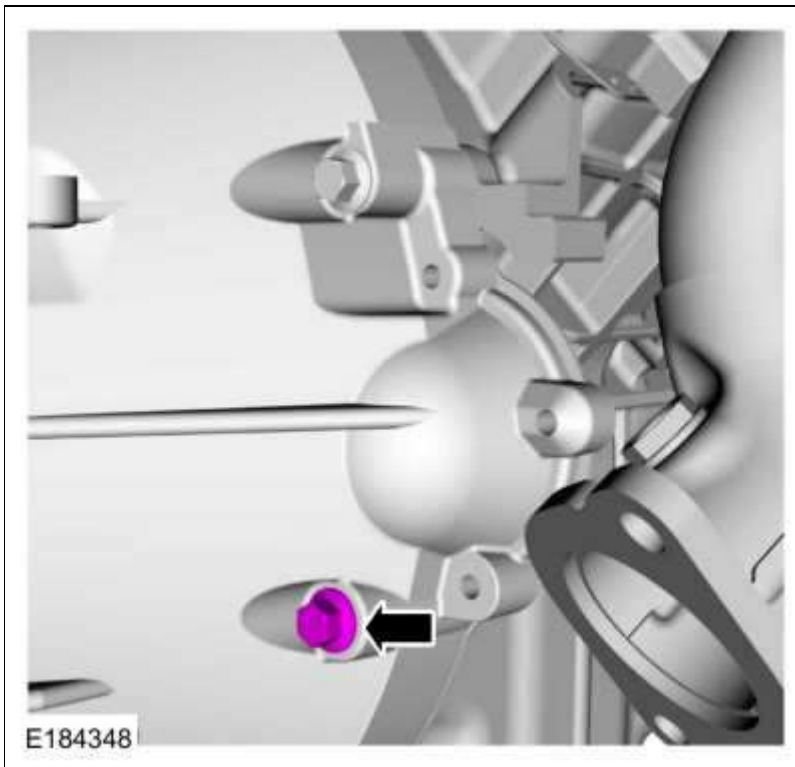
7. Remove the jack and wooden block.
Use the General Equipment: Wooden Block
Use the General Equipment: Trolley Jack



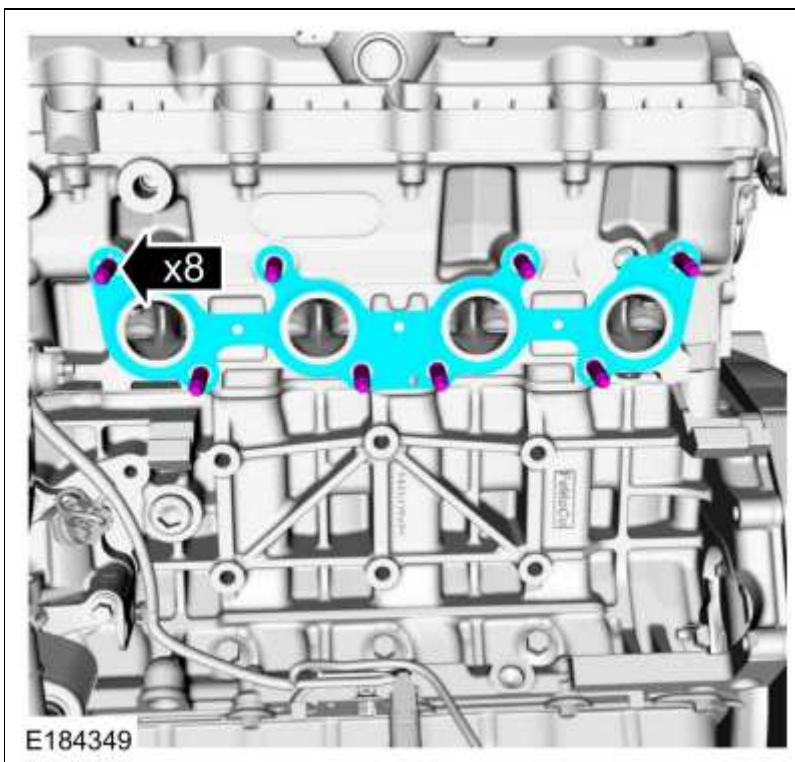
8. Install LH transmission-to-engine bolts.
Torque: 35 lb.ft (48 Nm)



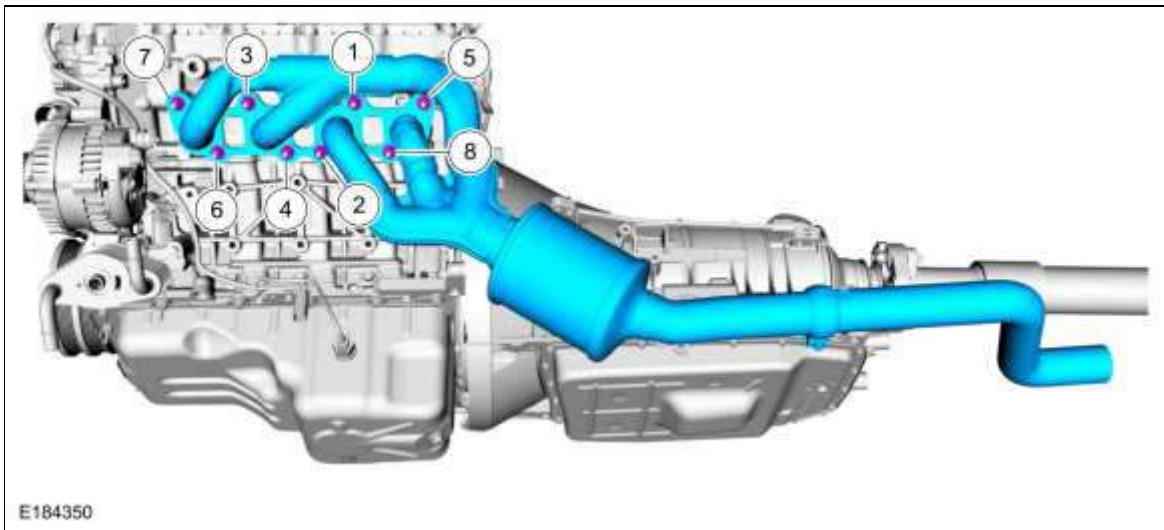
9. Install the RH transmission-to-engine bolt.



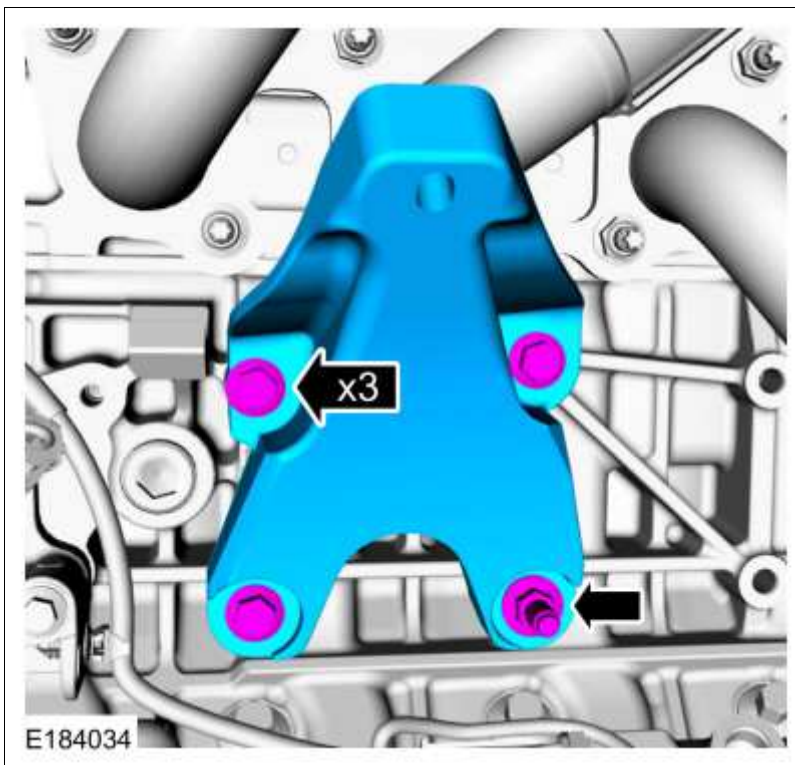
10. Install new studs and new gasket.
Torque: 18 lb.ft (25 Nm)



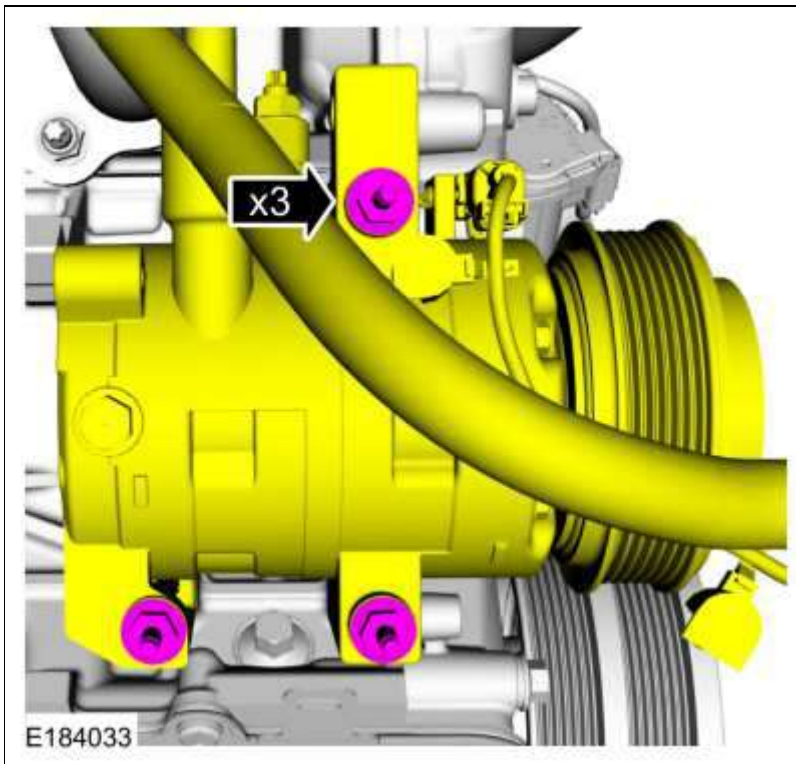
11. Install the LH catalytic converter.
 • Install the new nuts.
Torque:
 Stage 1: 18 lb.ft (24 Nm)
 Stage 2: 24 lb.ft (32 Nm)



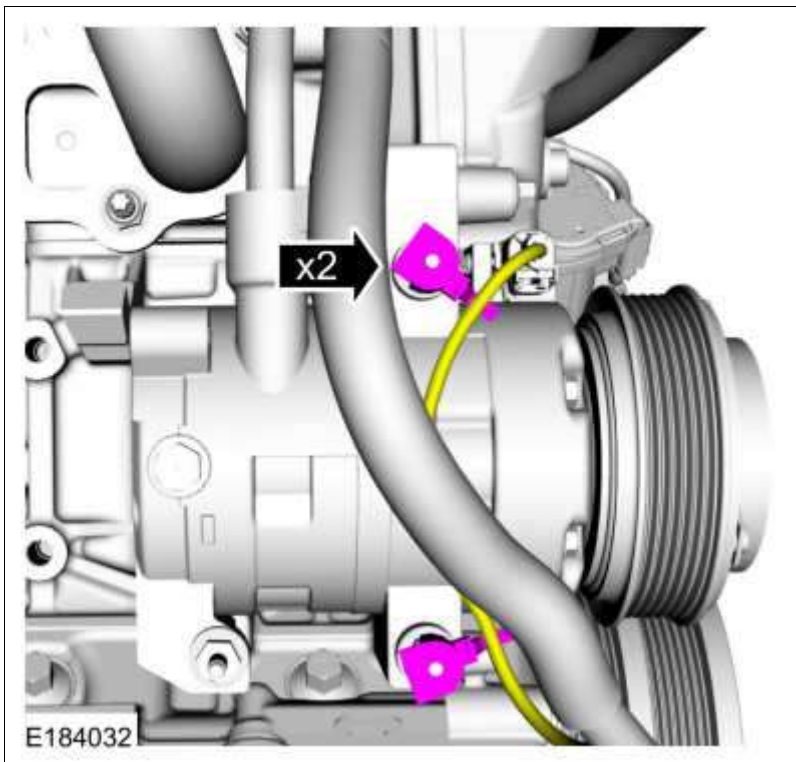
12. Install the LH engine mount bracket, bolts and stud bolt.
Torque: 41 lb.ft (55 Nm)



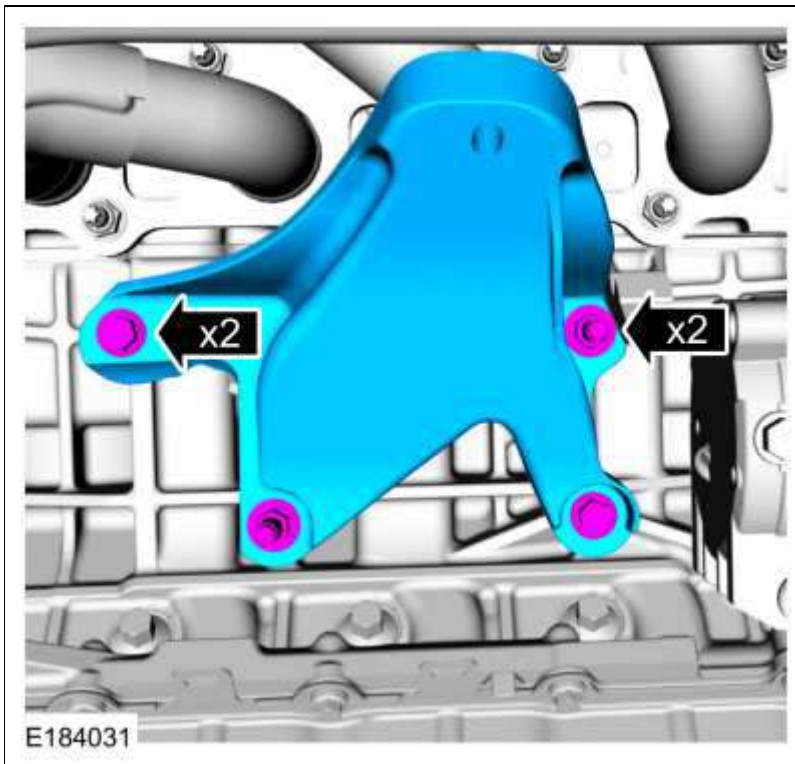
13. Install the A/C compressor and the stud bolts.
Torque: 18 lb.ft (25 Nm)



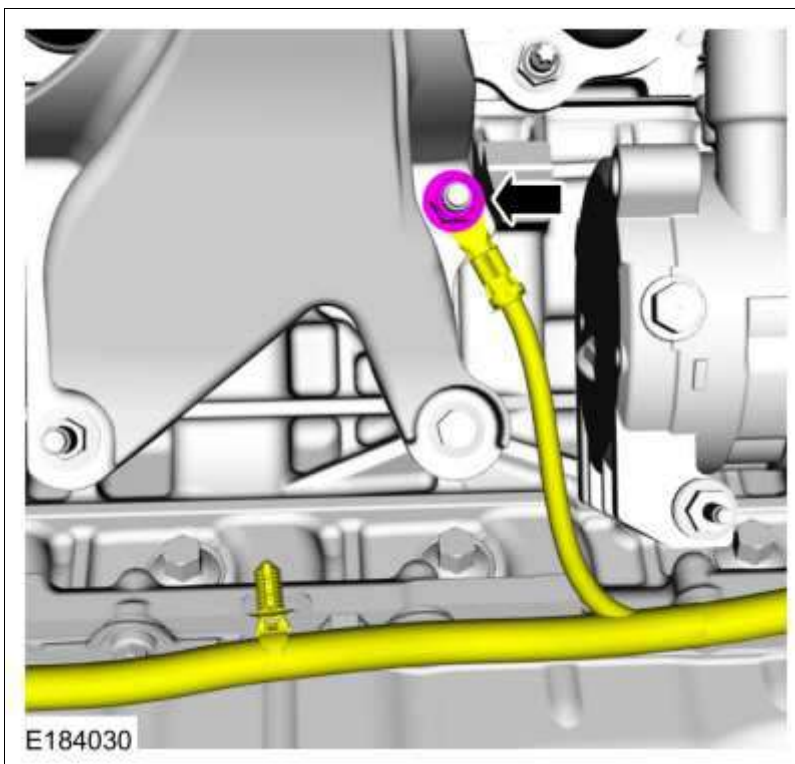
14. Attach the wiring harness retainers to the A/C compressor stud bolts.



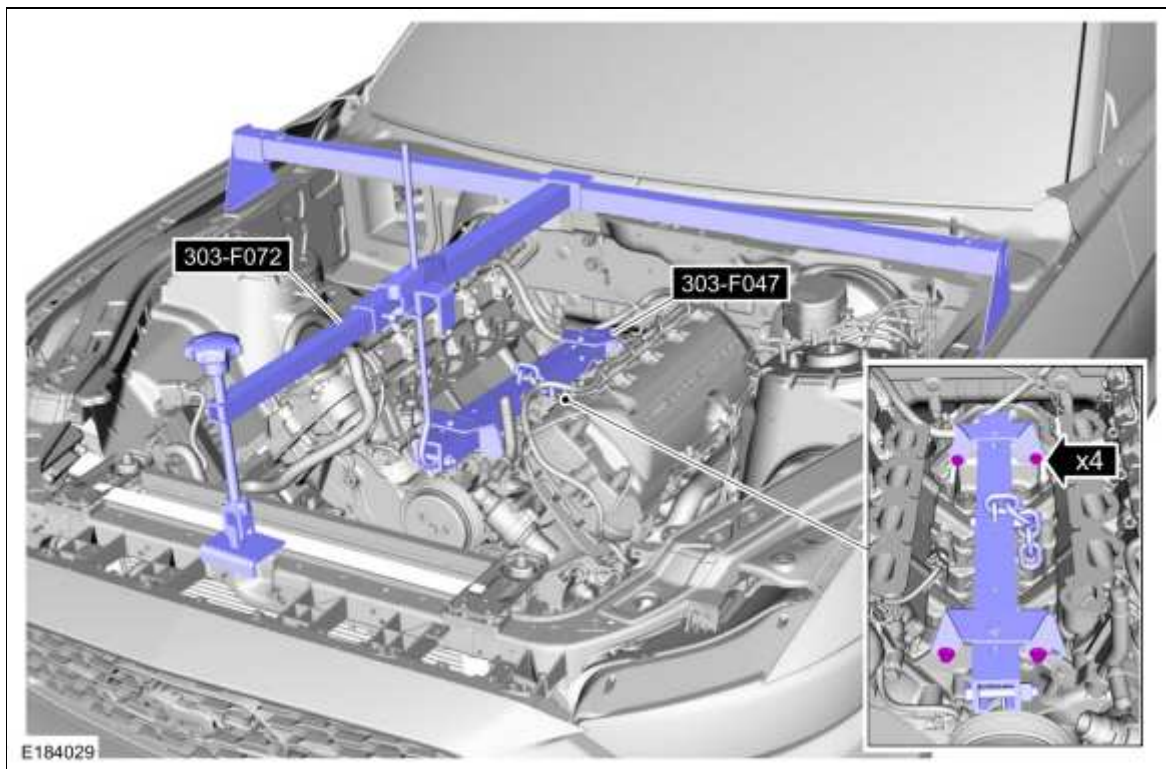
15. Install the RH engine mount bracket, bolts and stud bolts.
Torque: 41 lb.ft (55 Nm)



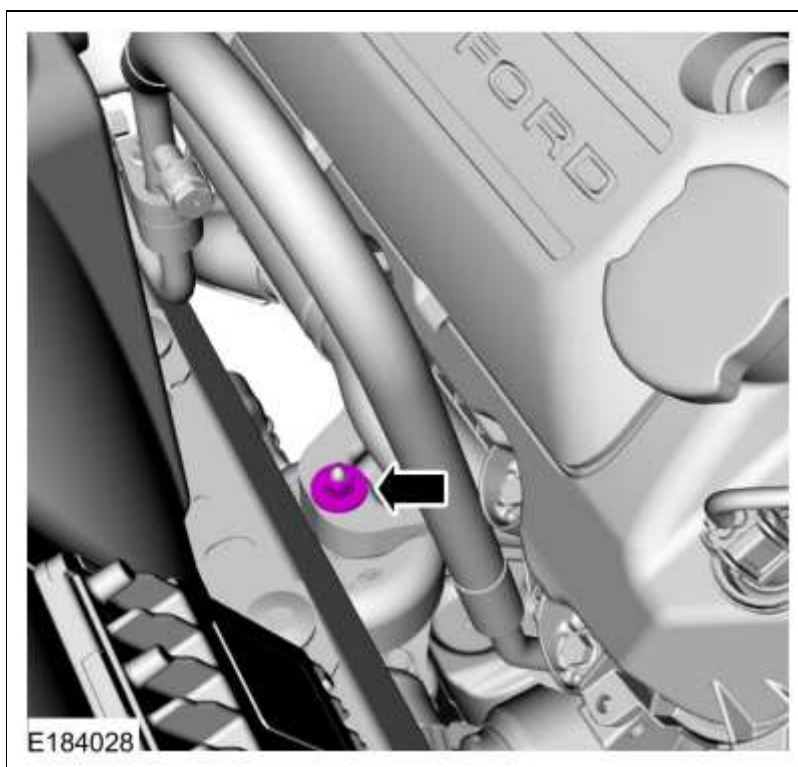
16. Install the ground strap and nut onto the RH engine mount bracket stud bolt.
Torque: 35 lb.ft (48 Nm)



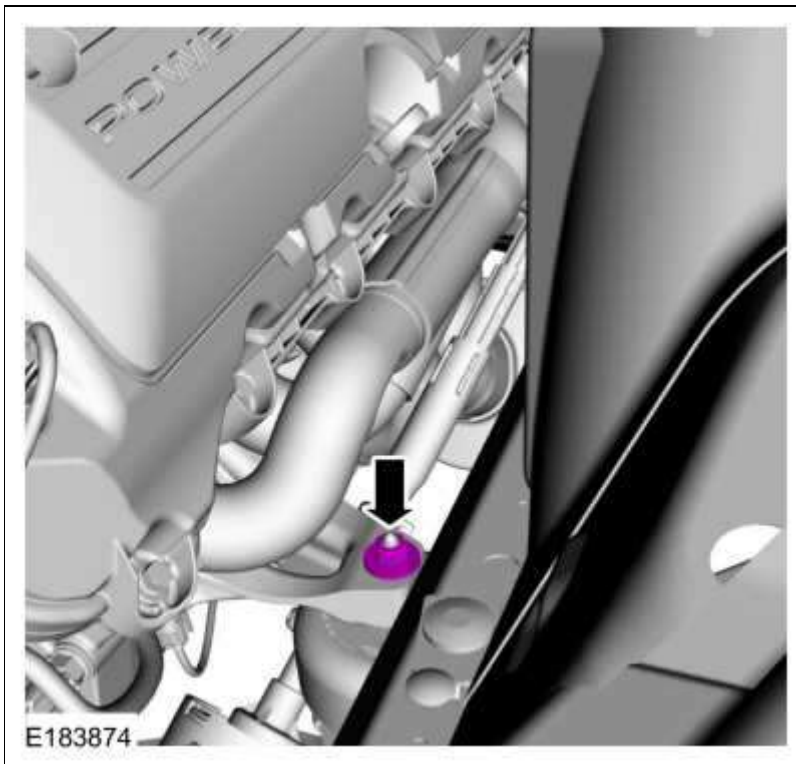
17. Lower the engine onto the engine mounts and remove the special tools
 Use Special Service Tool: [303-F072 Support Bar, Engine.](#) , [303-F047 Lifting Bracket, Engine.](#)



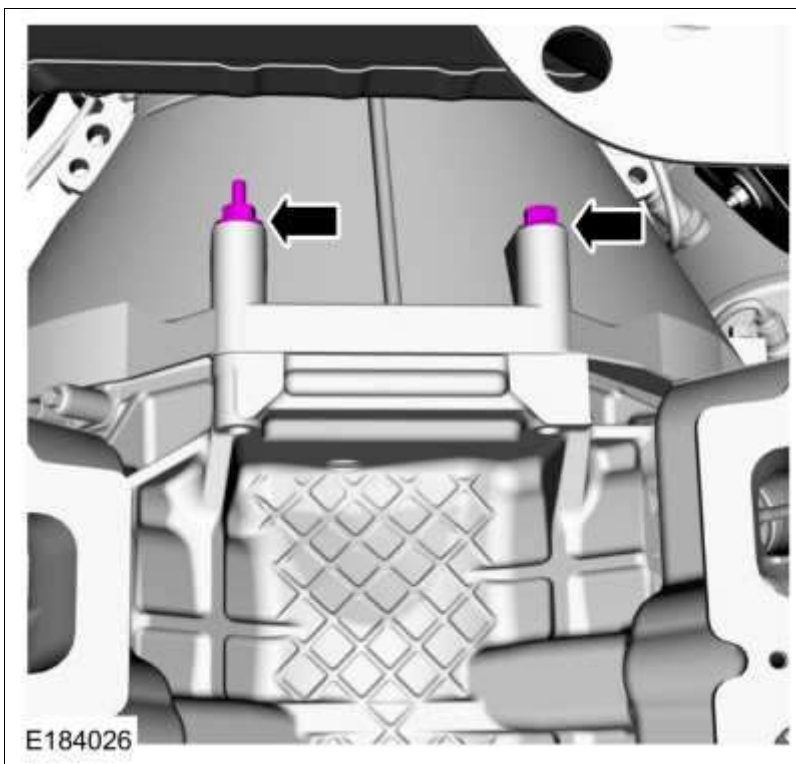
18. Install the RH engine mount nut.
Torque: 46 lb.ft (63 Nm)



19. Install the LH engine mount nut.
Torque: 46 lb.ft (63 Nm)

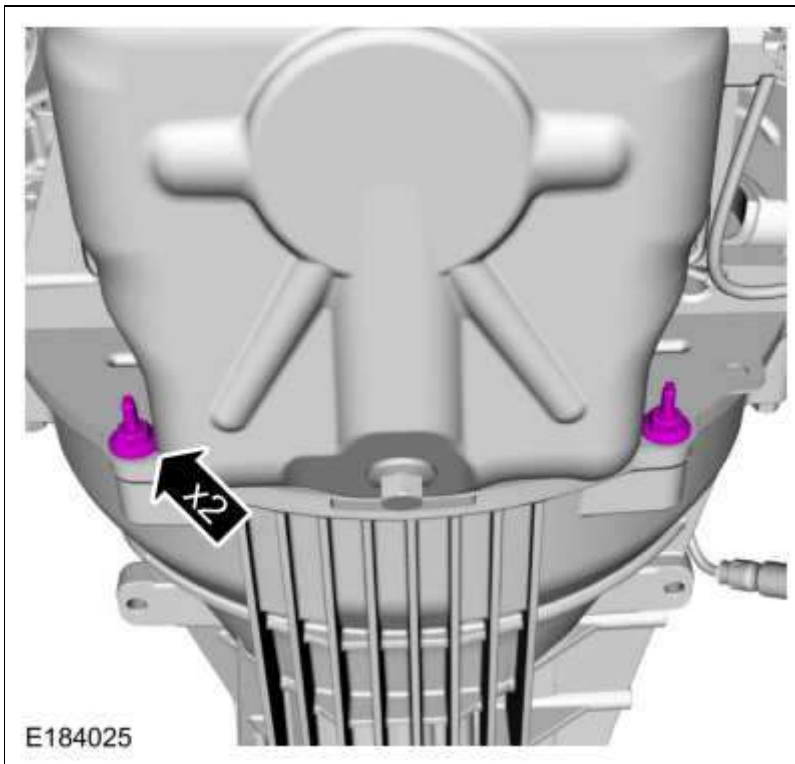


20. Install the top transmission-to-engine bolt and stud bolt.
Torque: 35 lb.ft (48 Nm)



6-Speed Manual Transmission - MT82

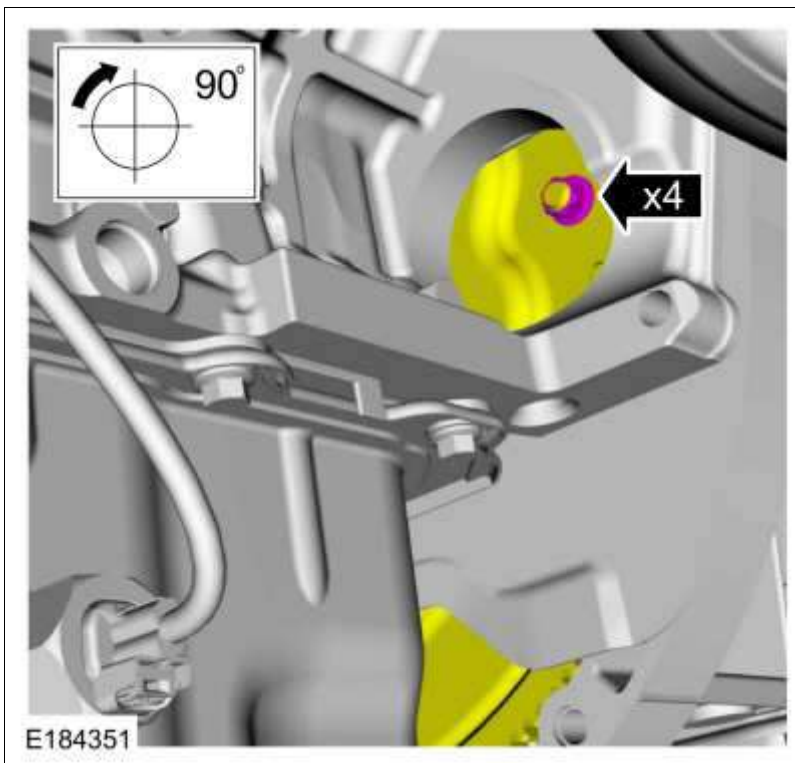
21. Install the engine rear cover plate stud bolts.
Torque: 35 lb.ft (48 Nm)



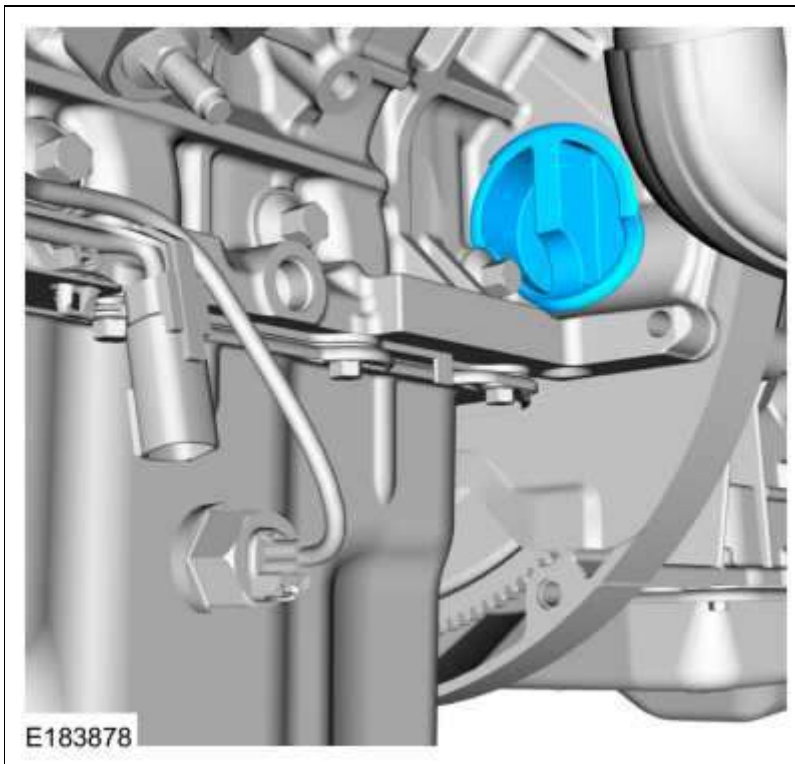
6-Speed Automatic Transmission - 6R80

22. **NOTE:** Only rotate the crankshaft in a clockwise direction.

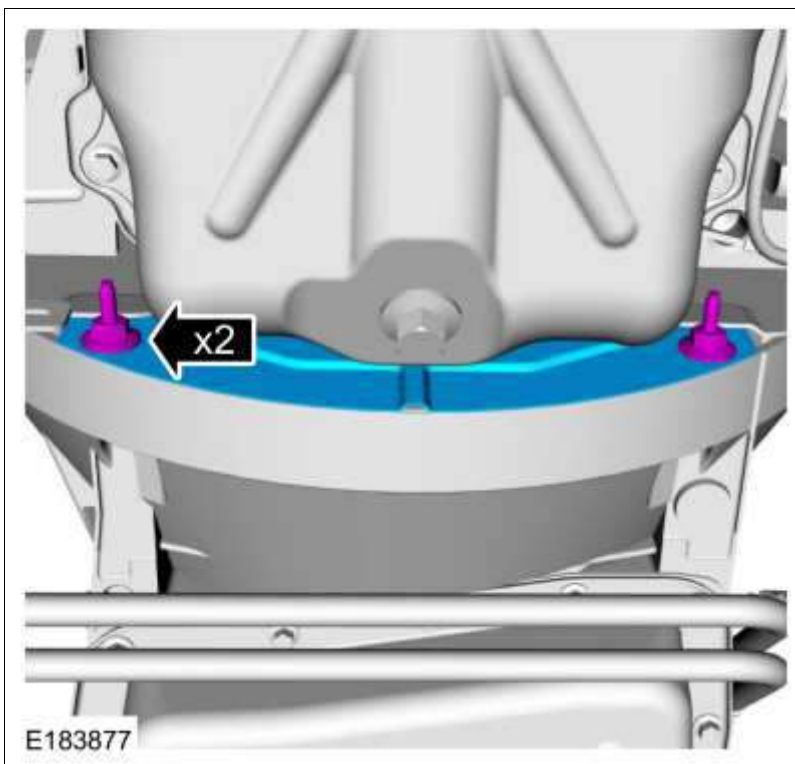
Install the new torque converter nuts.
 Use the General Equipment: Magnetic Socket
 Torque: 35 lb.ft (48 Nm)



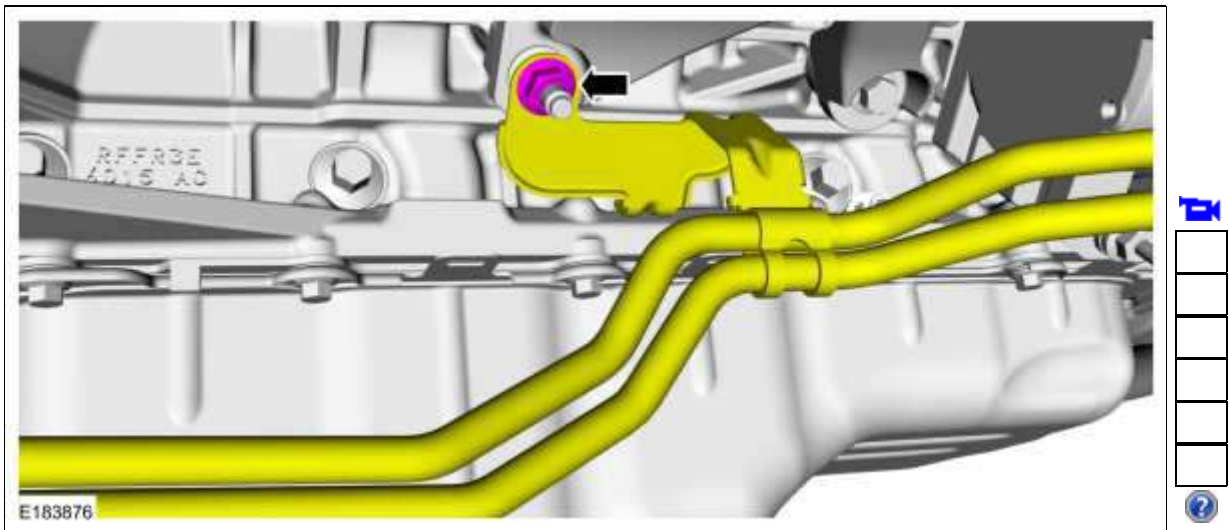
23. Install the rubber access plug.



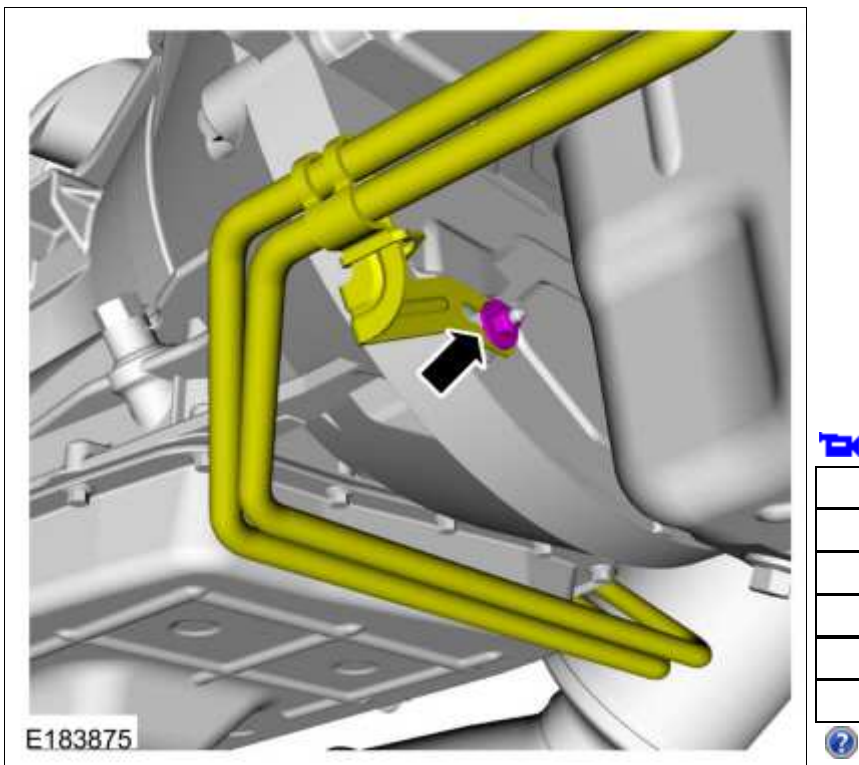
24. Install the flexplate inspection cover and the stud bolts.
Torque: 35 lb.ft (48 Nm)



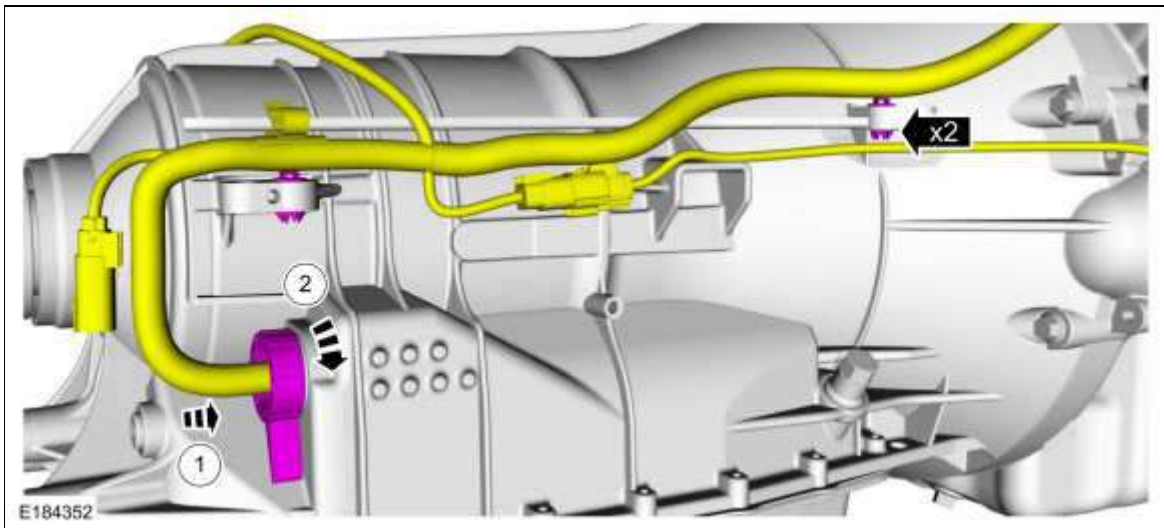
25. Install the transmission cooling tube bracket and nut.
Torque: 35 lb.ft (48 Nm)



26. Install the transmission cooling tube bracket and nut.
Torque: 124 lb.in (14 Nm)



- 27.
- Push the transmission electrical connector in to connect.
 - Rotate the transmission electrical connector.
 - Position the wiring harness and attach the retainers.

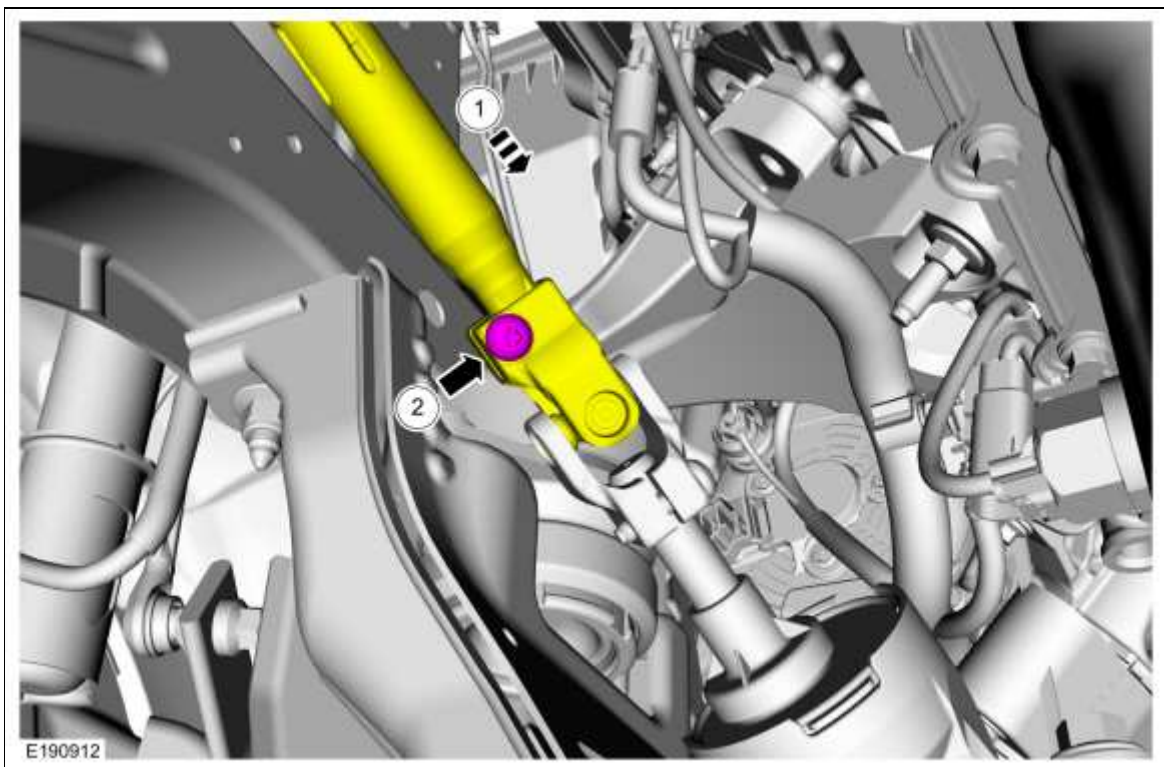


6-Speed Automatic Transmission - 6R80/6-Speed Manual Transmission - MT82

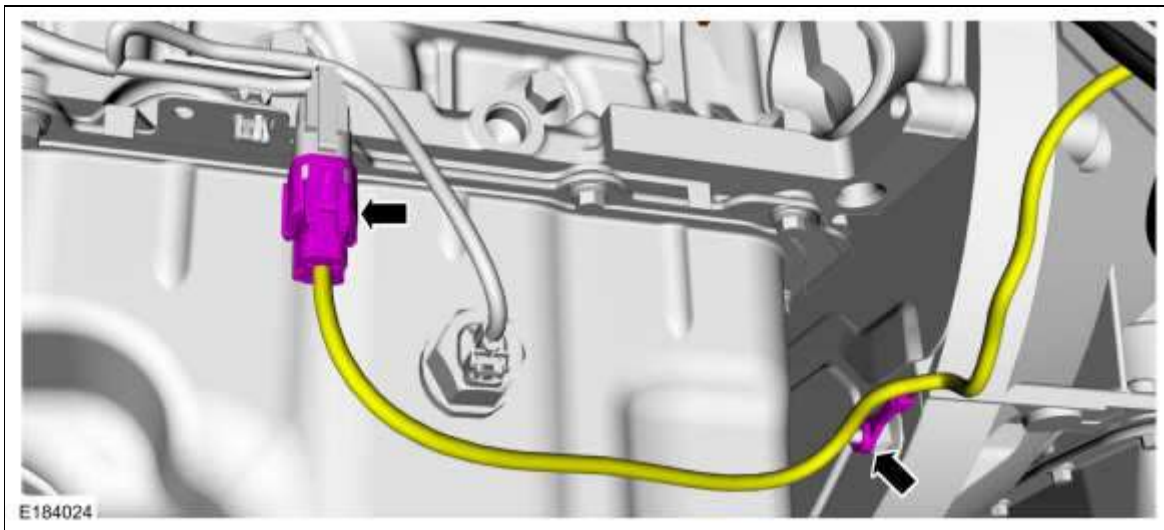
28. **⚠ WARNING: DO NOT** hammer, pry or force steering column and column shafts during installation or removal. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

⚠ WARNING: DO NOT attempt to remove or install the steering column lower u-joint at the steering gear without first loosening the steering column dash seal and fasteners. Failure to follow this instruction may cause damage to steering components that could lead to loss of steering control during vehicle operation and could result in serious personal injury or death.

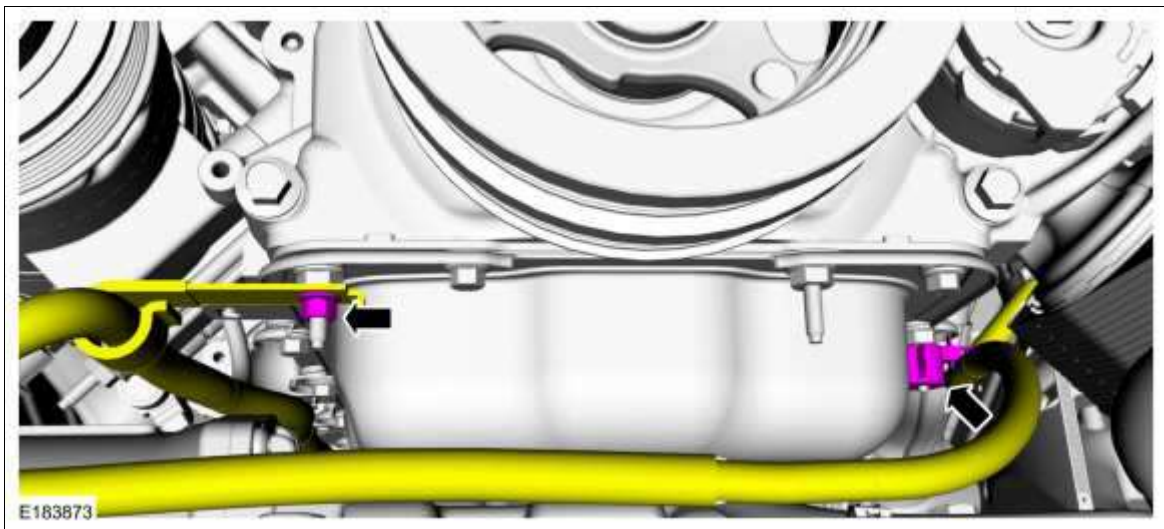
1. Connect the steering column shaft to the steering gear universal joint.
 2. Install the new steering column shaft bolt.
- Torque: 22 lb.ft (30 Nm)*



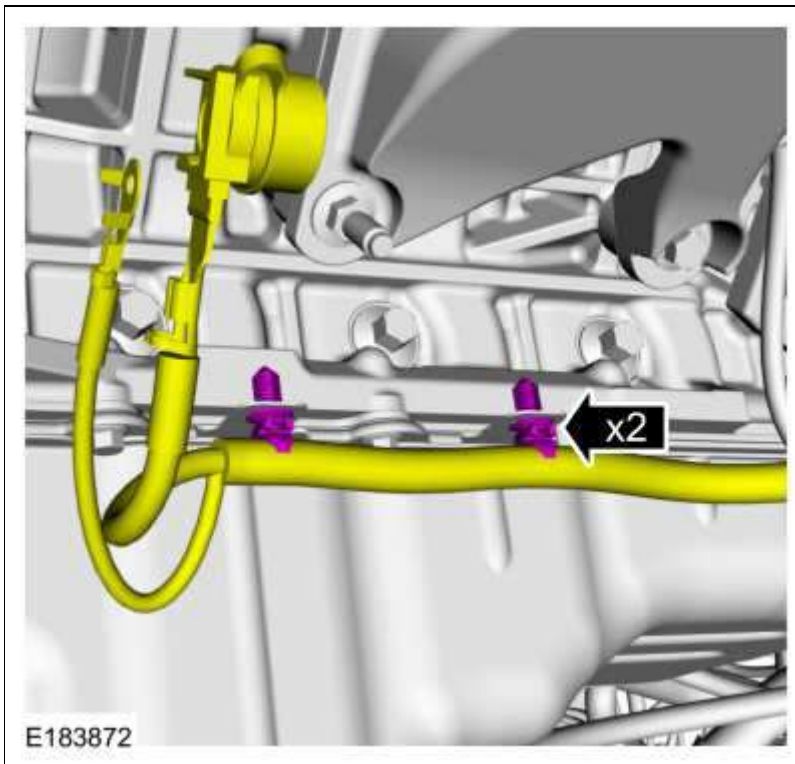
29. Inspect the steering column lower shaft.
Refer to: [Steering Column Collapsed Check](#) (211-04 Steering Column, General Procedures).
30. Connect the LH HO2S electrical connector and wiring harness retainer.



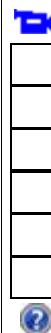
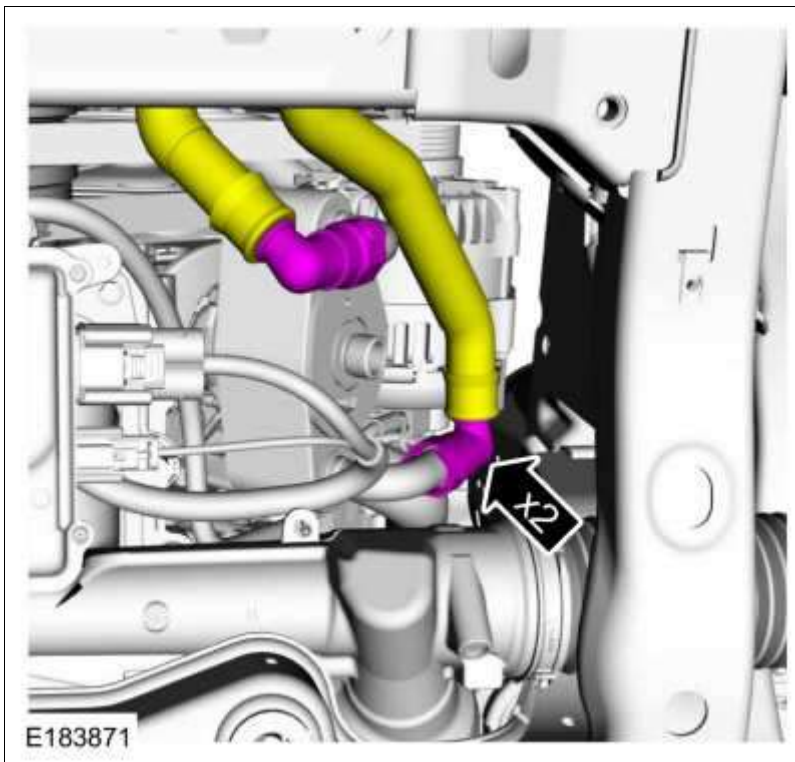
- 31.
- Attach the wiring harness retainer to the oil pan stud bolt.
 - Install the wiring harness retainer and the nut.
- Torque: 124 lb.in (14 Nm)*



32. Attach the wiring harness retainers to the oil pan.



33. Connect the oil cooler hoses.



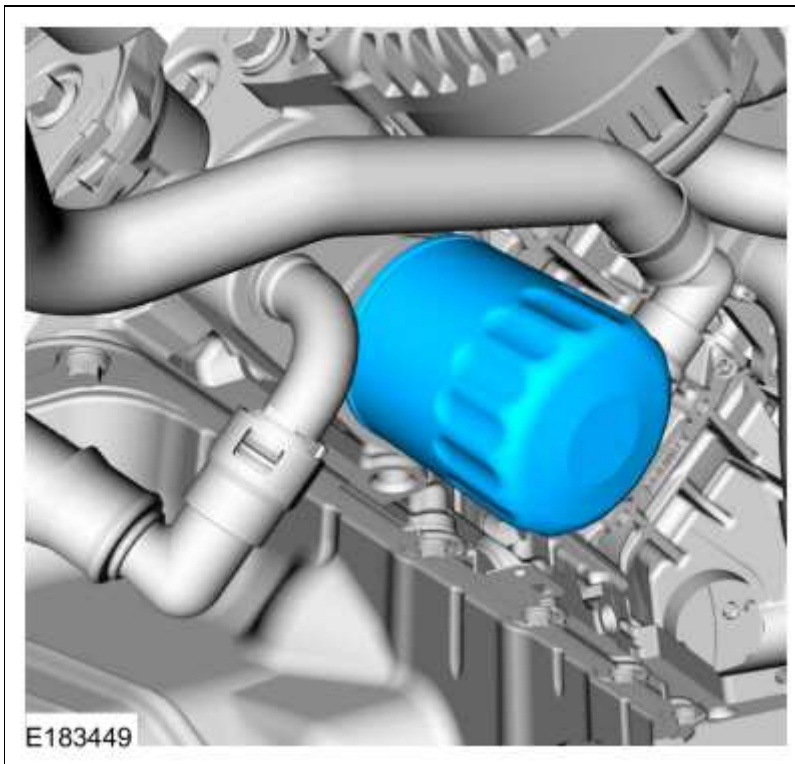
34. **NOTE:** Do not lubricate the O-ring seal.

Install a new oil filter.

Torque:

Stage 1: 44 lb.in (5 Nm)

Stage 2: 180°



35. **NOTE:** Vehicles are equipped with either an underbody shield or a subframe bracket and underbody shield assembly.

1. Install the underbody shield and the bolts.

Torque:

A: 97 lb.in (11 Nm)

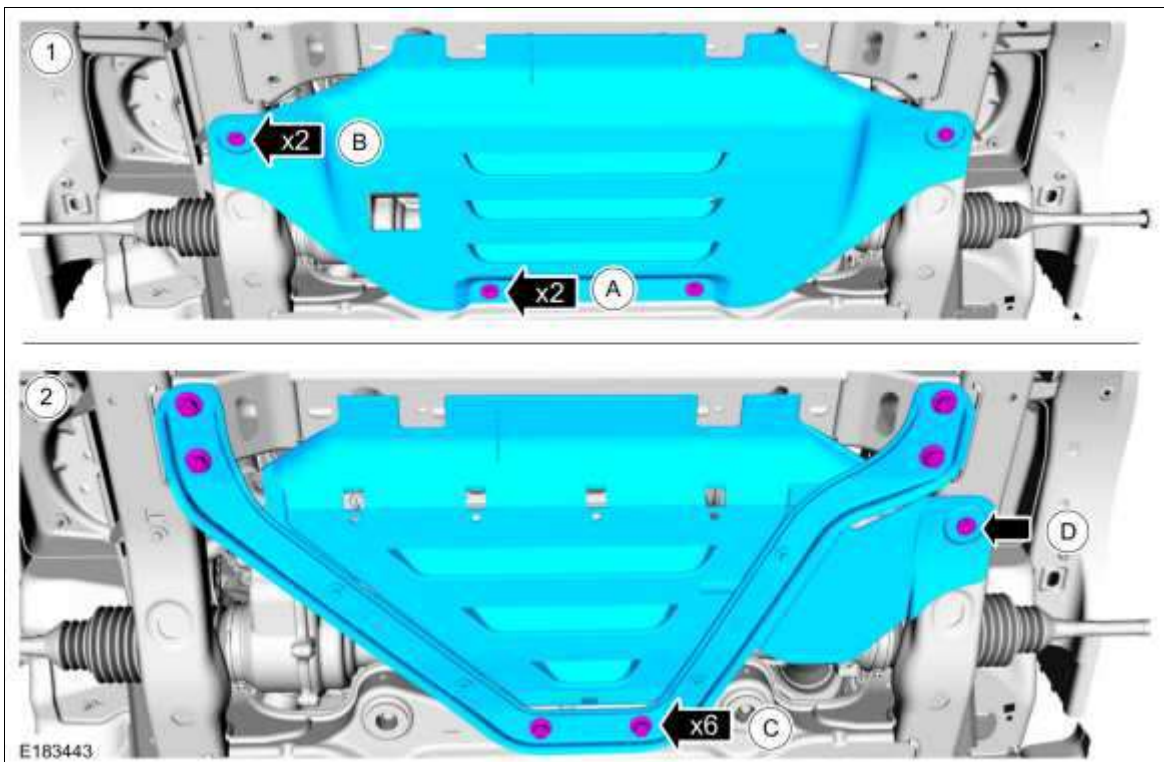
B: 18 lb.in (2 Nm)

2. Install the subframe bracket and underbody shield assembly and the bolts.

Torque:

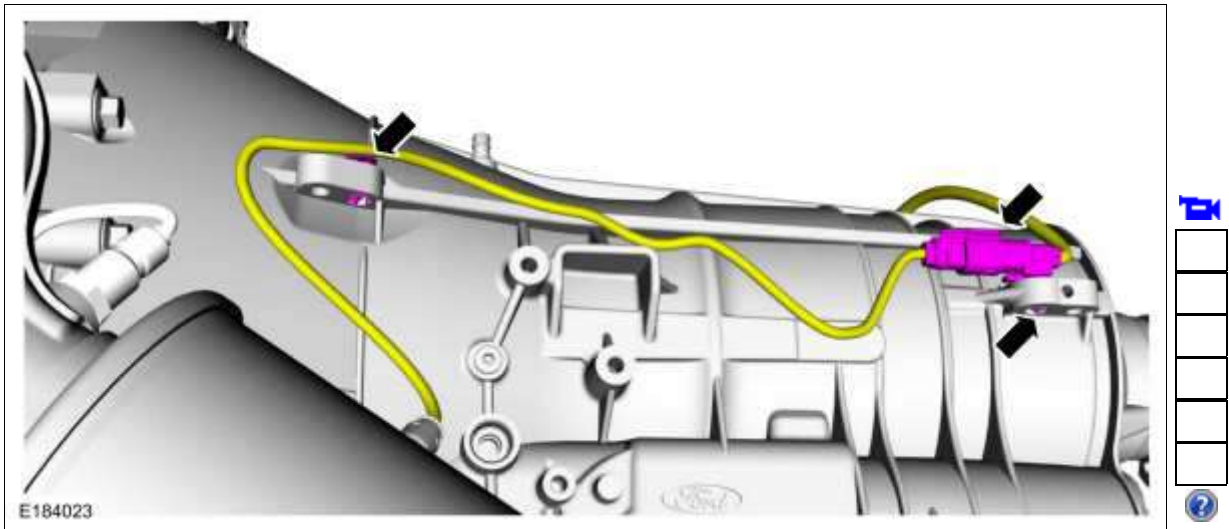
C: 46 lb.ft (63 Nm)

D: 18 lb.in (2 Nm)



36. **NOTE:** Automatic transmission shown, manual transmission similar.

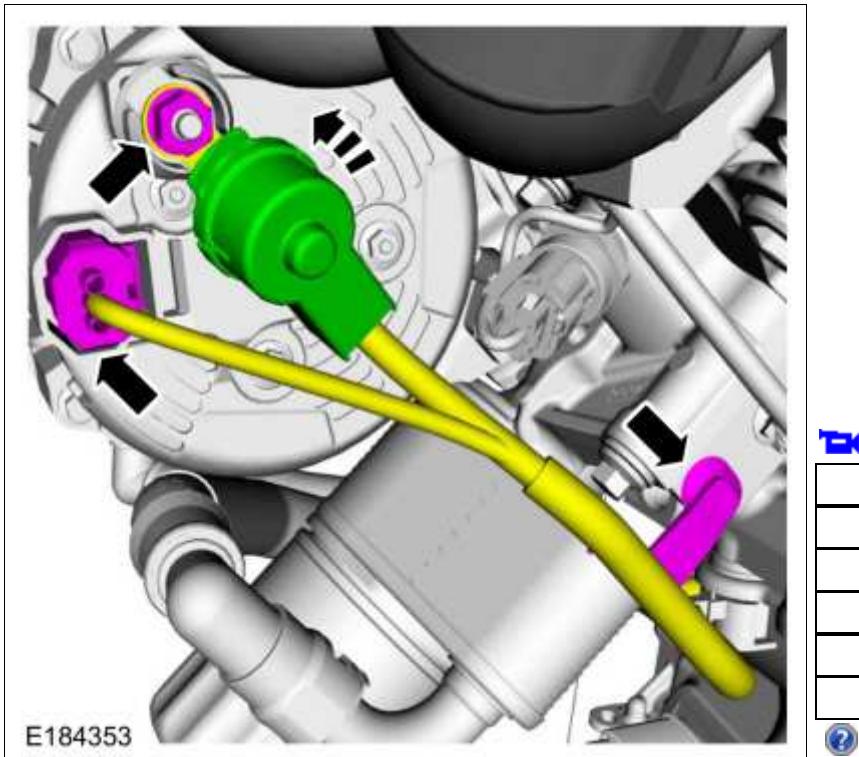
Connect the LH catalyst monitor sensor electrical connector and attach the wiring harness retainers.



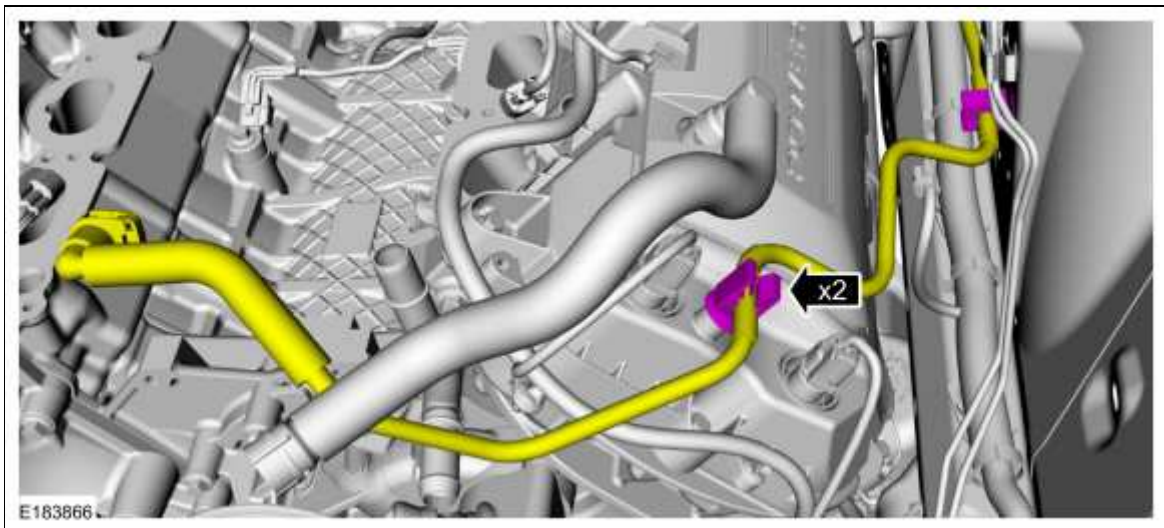
37. Install the following items:

1. Refer to: [Starter Motor](#) (303-06C Starting System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Catalytic Converter RH](#) (309-00C Exhaust System - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

- 38.
- Attach the wiring harness retainer.
 - Connect the wiring harness electrical connector.
 - Connect the B+ cable and install the nut.
Torque: 159 lb.in (18 Nm)
 - Position the cover.



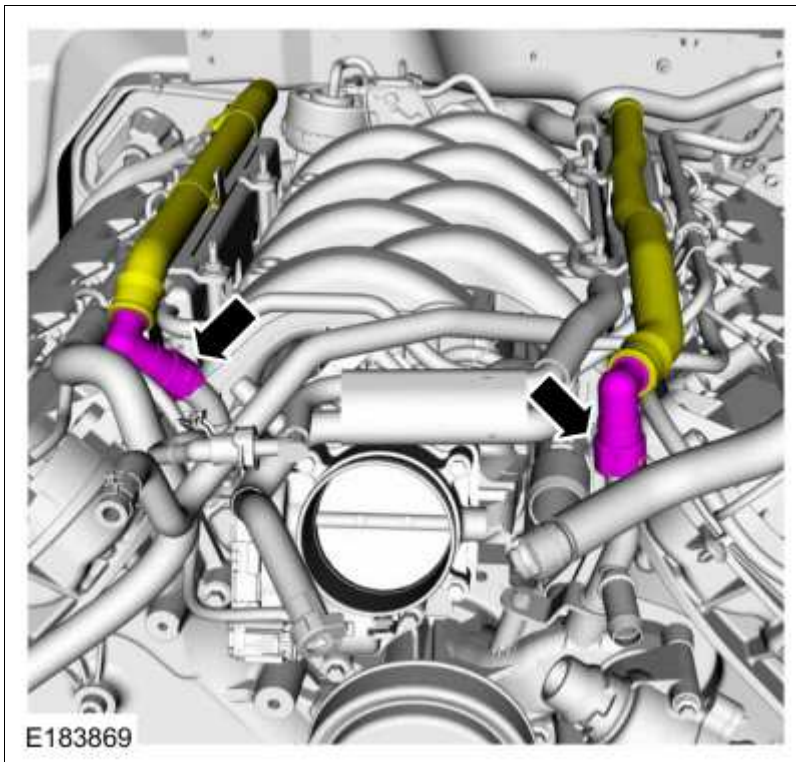
39. Attach the EVAP tube to the LH valve cover and the LH inner fender.



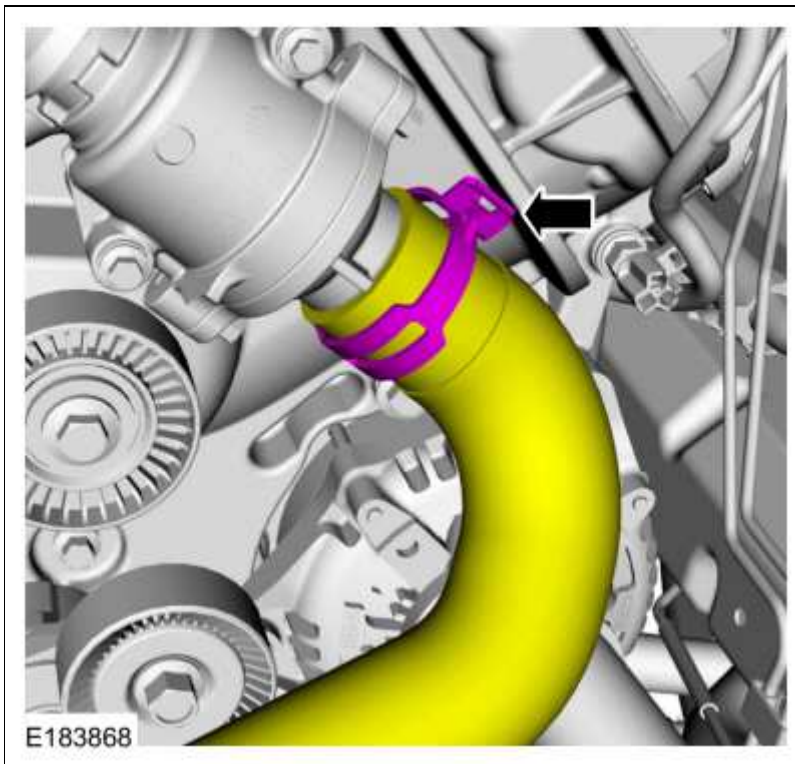
40. Install the intake manifold.

Refer to: [Intake Manifold](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

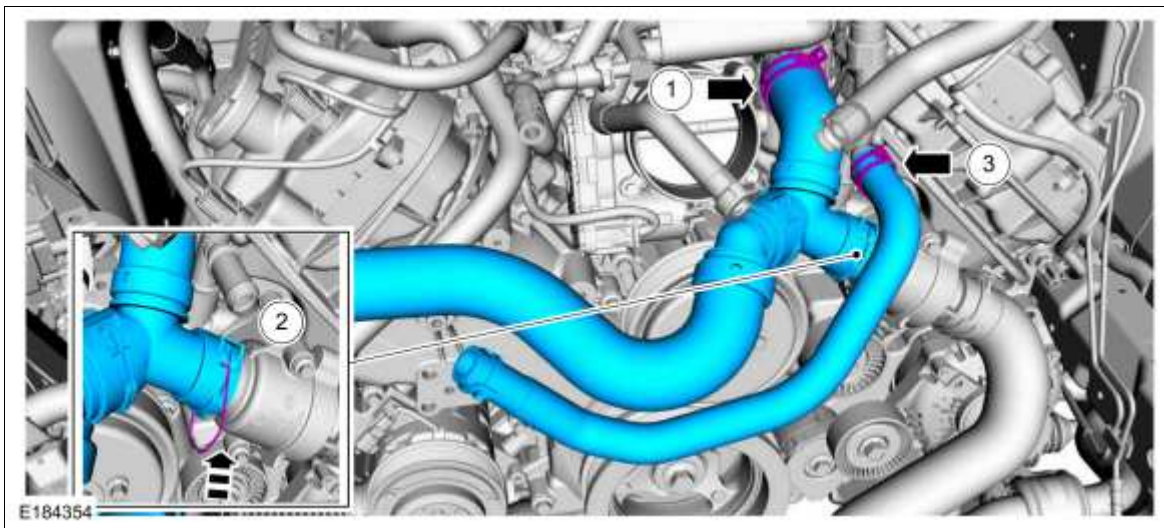
41. Connect the heater hose quick connect couplings.



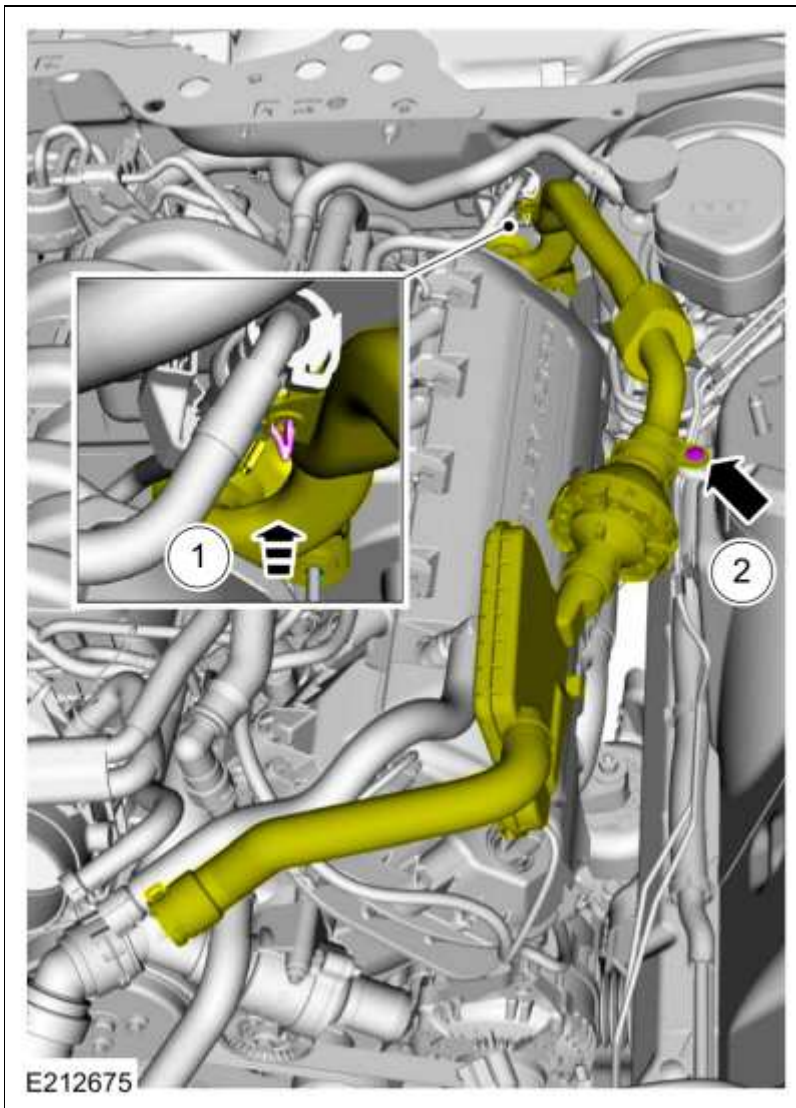
42. Connect the lower radiator hose to the thermostat housing assembly.



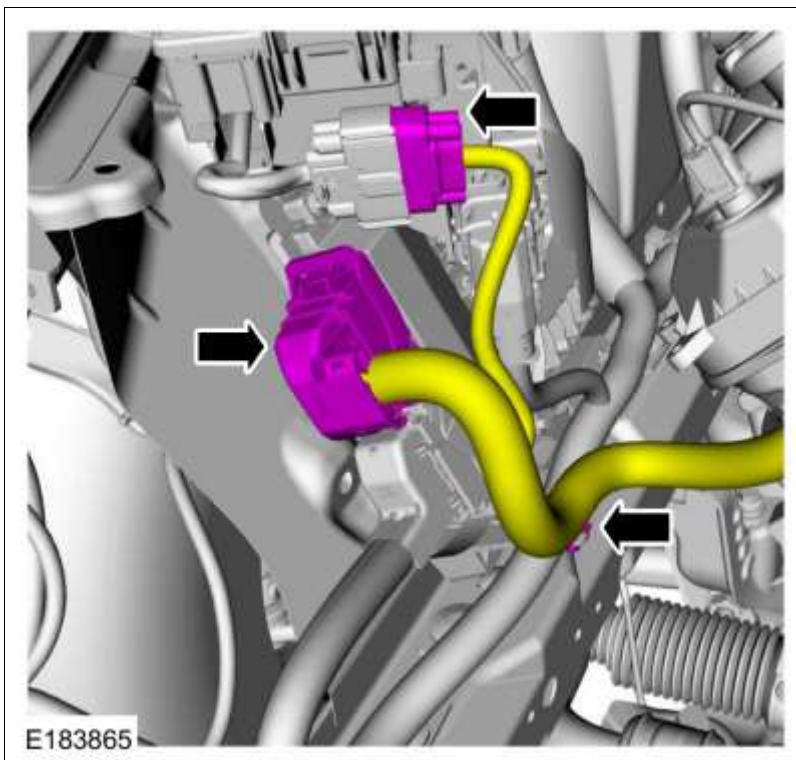
- 43.
1. Install the coolant bypass T assembly and clamp onto the engine.
 2. Slide the spring clip until it hits the stop on the hose fitting.
 3. Install the degas bottle hose and clamp.



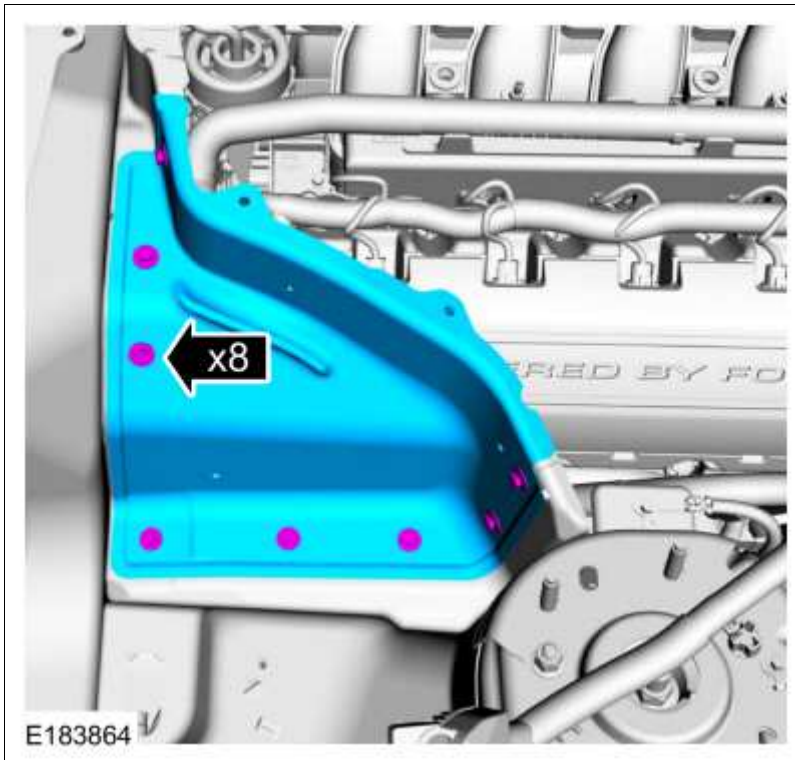
- 44.
1. Position the sound enhancement pipe onto the retainer.
 2. Install the pin-type retainer.



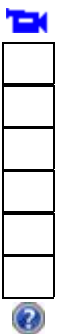
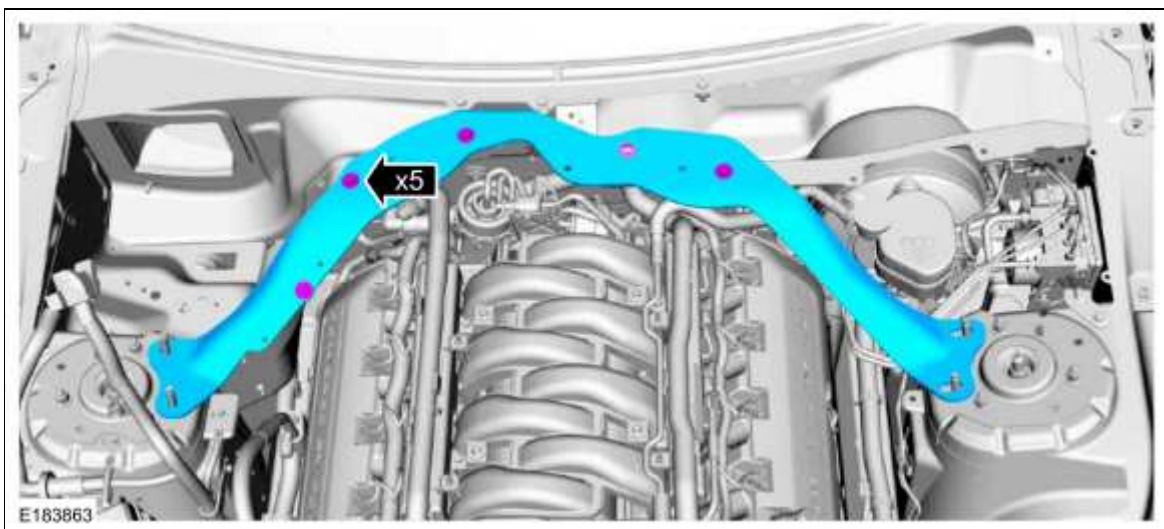
45. Connect the top PCM electrical connector, the 16 pin electrical connector and attach the wiring harness retainers to the PCM bracket.



46. Install the battery heat shield and fasteners.
Torque: 80 lb.in (9 Nm)

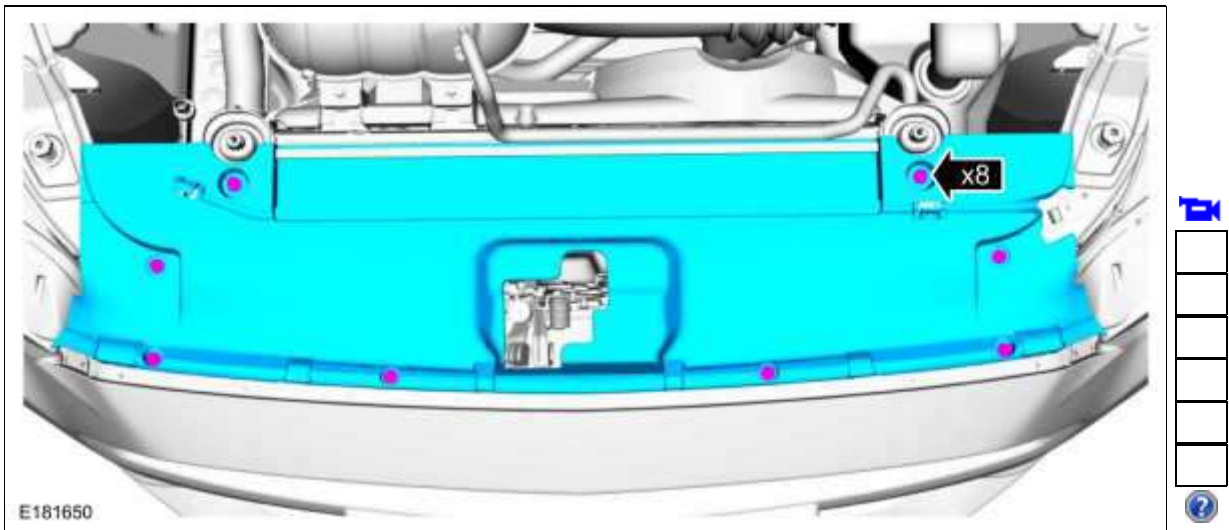


47. Install the cowl extension and fasteners.
Torque: 26 lb.ft (35 Nm)



48. Install the following items:
1. Refer to: [Cowl Panel Grille](#) (501-02 Front End Body Panels, Removal and Installation).
 2. Refer to: [Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
 3. Refer to: [Air Conditioning \(A/C\) Compressor Belt](#) (303-05C Accessory Drive - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 4. Refer to: [Cooling Fan Motor and Shroud](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
 5. Refer to: [Degas Bottle](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

49. Install the radiator top shield and the retainers.

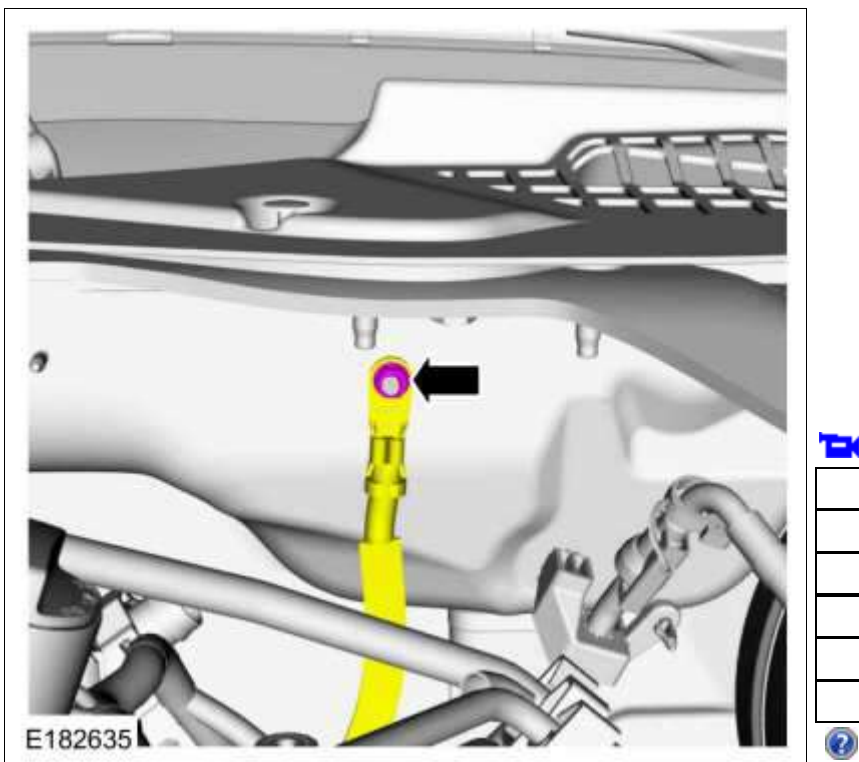


50. Install the following items:

1. Refer to: [Air Cleaner](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).
2. Refer to: [Air Cleaner Outlet Pipe](#) (303-12C Intake Air Distribution and Filtering - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Removal and Installation).

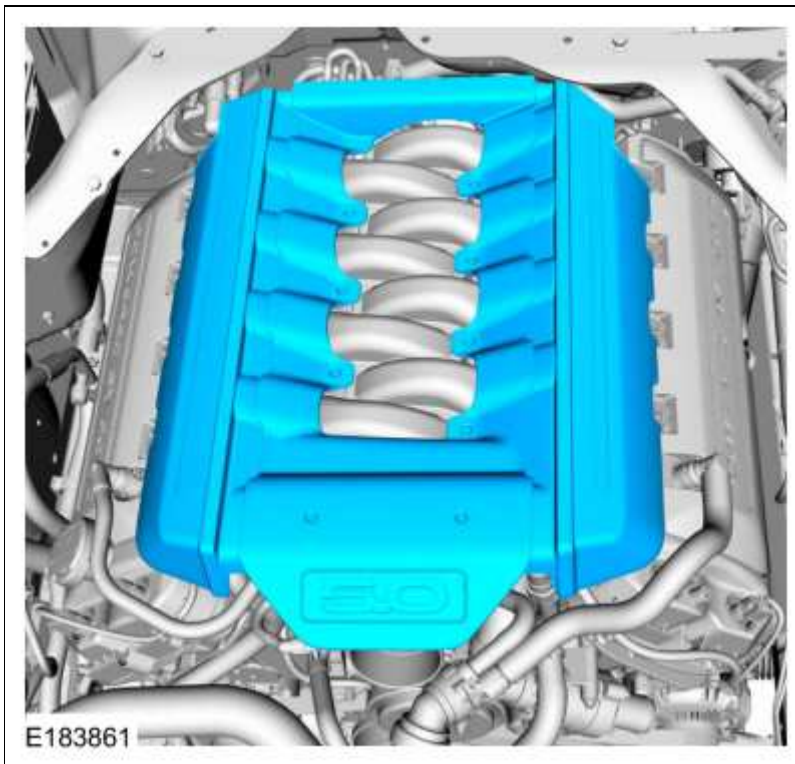
51. Install the engine ground wire and nut.

Torque: 80 lb.in (9 Nm)

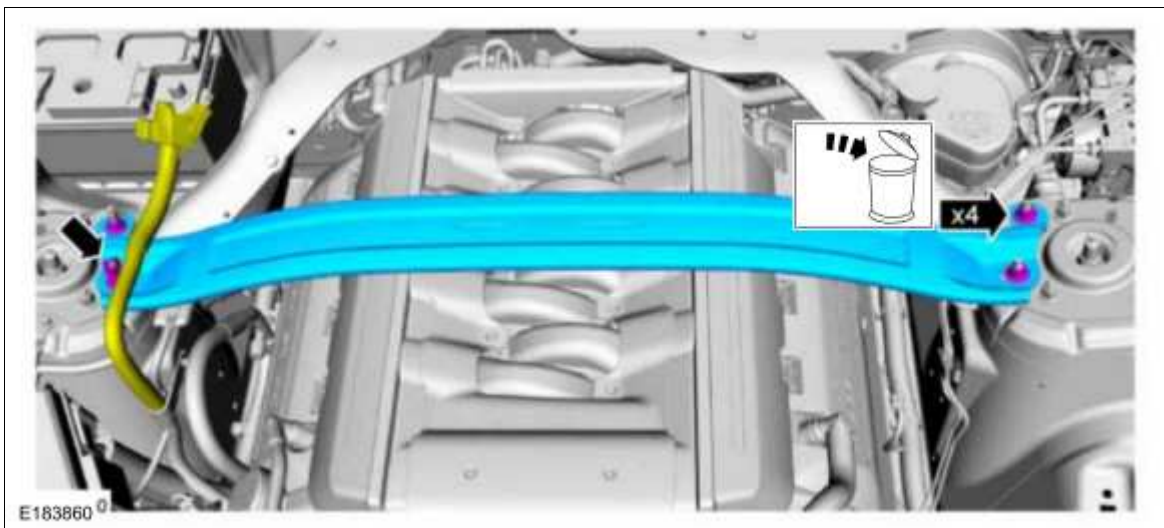


52. **NOTE:** The engine appearance cover rubber grommets may remain on the cover. If so, remove the grommets from the cover and install them on the intake manifold before installing the cover.

Install the engine appearance cover.

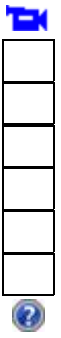
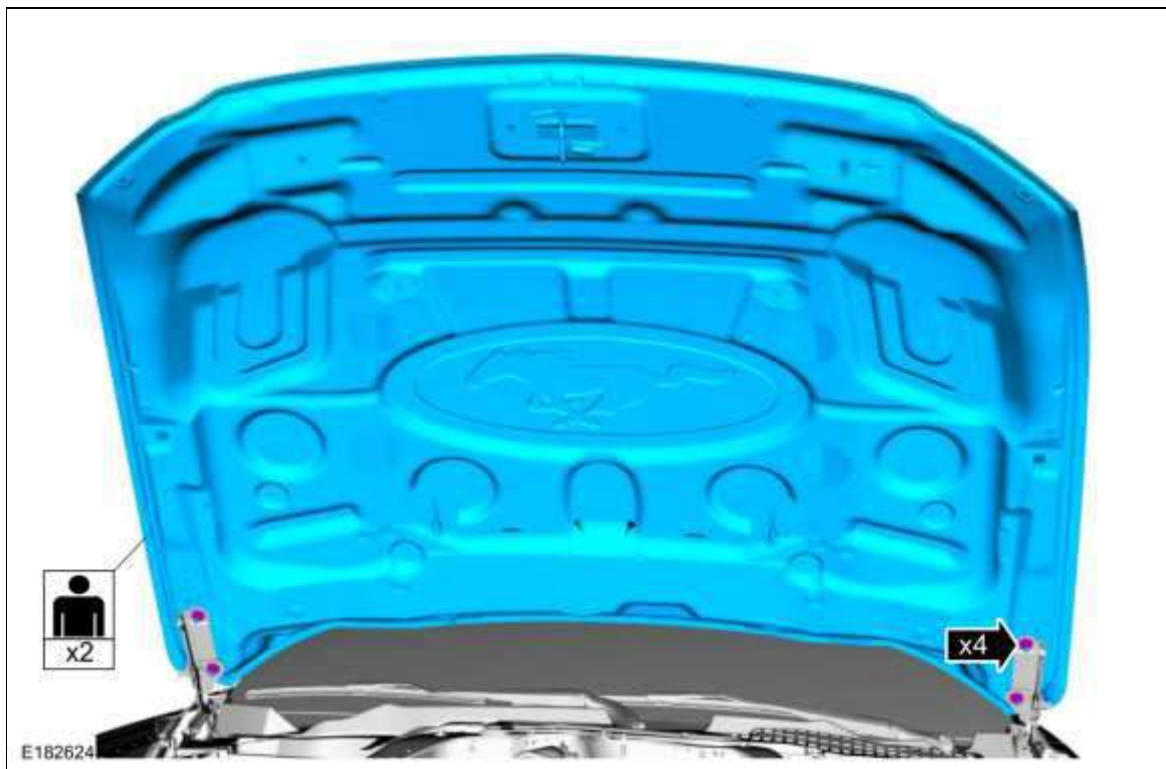


- 53.
- If equipped, install the strut tower cross brace and nuts.
Torque: 41 lb.ft (55 Nm)
 - Attach the wiring harness retainer.

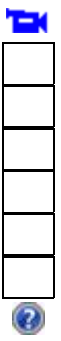
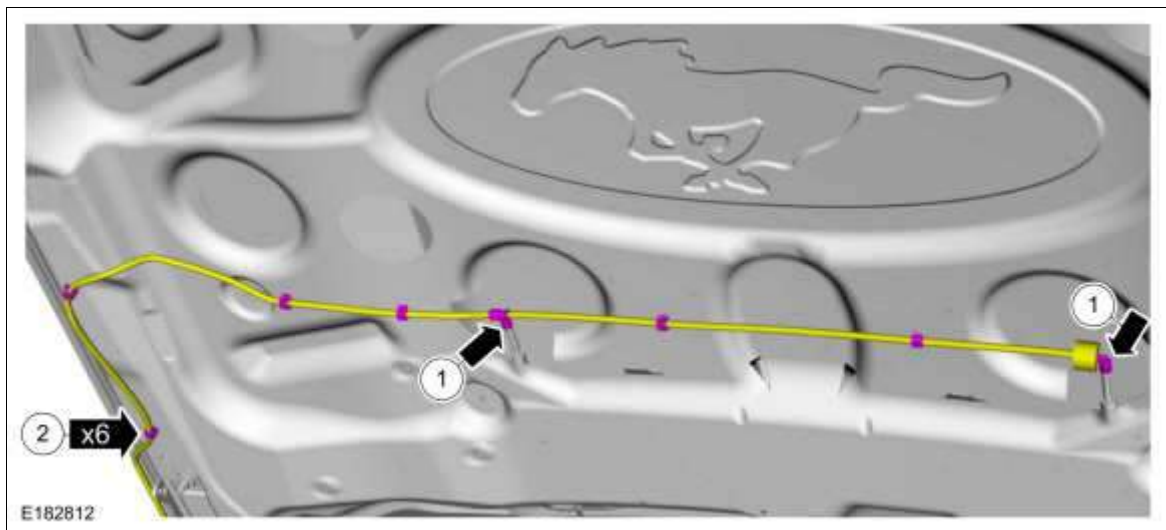


54. **NOTE:** Use the index-mark for location to aid in hood installation.

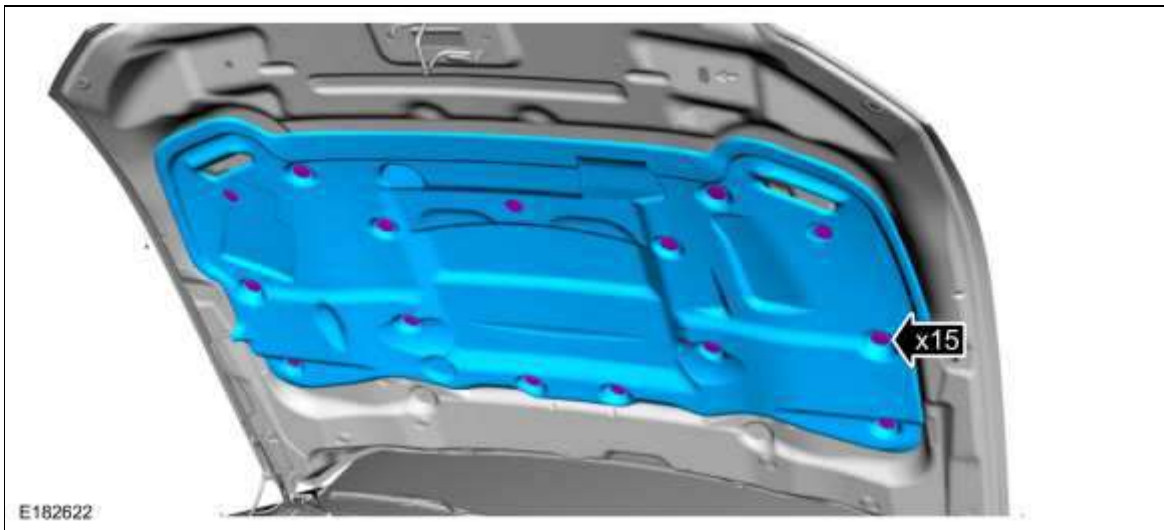
Install the hood and the nuts.
Torque: 62 lb.in (7 Nm)



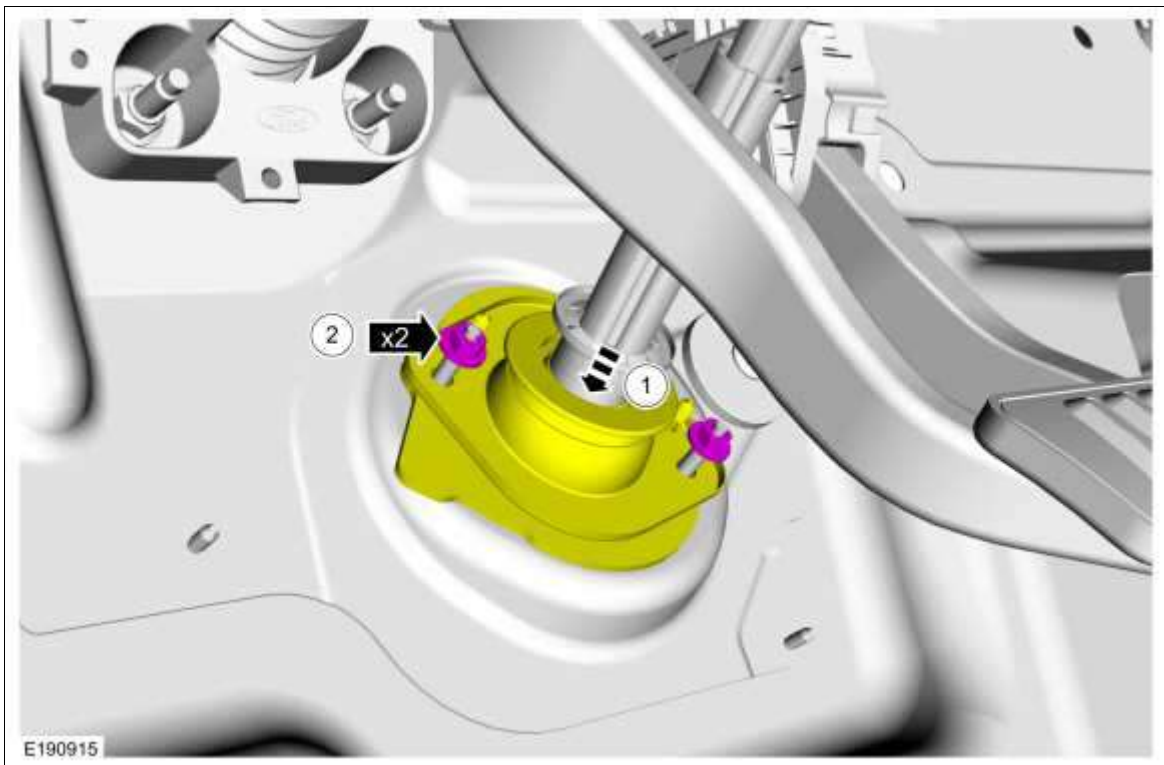
55.
 1. Connect the windshield washer hose C-Lock Couplers.
 2. Attach the windshield washer hose retainers.



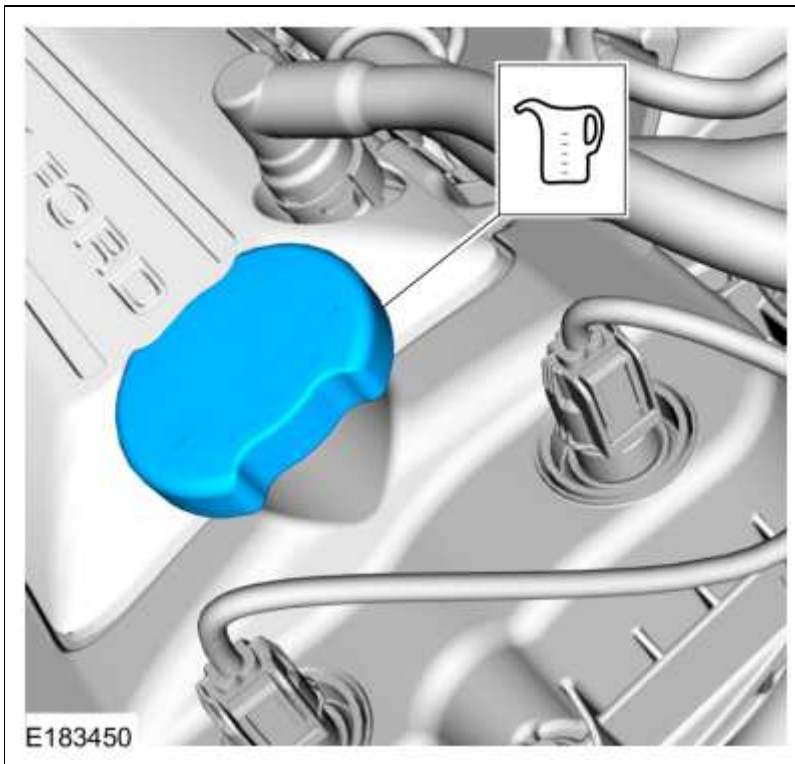
56. Install the hood insulation and the pin-type retainers.



- 57.
1. Position the steering column dash seal.
 2. Tighten the steering column dash seal nuts.
Torque: 80 lb.in (9 Nm)



58. Fill the engine with clean engine oil.
Refer to: [Specifications](#) (303-01C Engine - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), Specifications).
Material: Motorcraft® SAE 5W-20 Premium Synthetic Blend Motor Oil (U.S.) / XO-5W20-QSP (U.S.) (WSS-M2C945-A)



59. Connect the battery ground and positive cables.
Refer to: [Battery Disconnect and Connect](#) (414-01 Battery, Mounting and Cables, General Procedures).
60. Fill and bleed the engine cooling system.
Refer to: [Cooling System Draining and Vacuum Filling](#) (303-03C Engine Cooling - 5.0L 32V Ti-VCT/5.0L Ti-VCT V8 (308kW/418PS), General Procedures).
61. After completing the repairs, perform the Misfire Monitor Neutral Profile Correction procedure using a diagnostic scan tool.