



9.

Position the exhaust Y-pipe dual catalytic converter-to-exhaust intermediate pipe and install the new bolts.

Tighten the inner exhaust Y-pipe dual catalytic converter-to-exhaust intermediate pipe bolt.

Torque

: 46 lb.ft (63 Nm)

Tighten the outer exhaust Y-pipe dual catalytic converter-to-exhaust intermediate pipe bolt.

Torque

: 46 lb.ft (63 Nm)

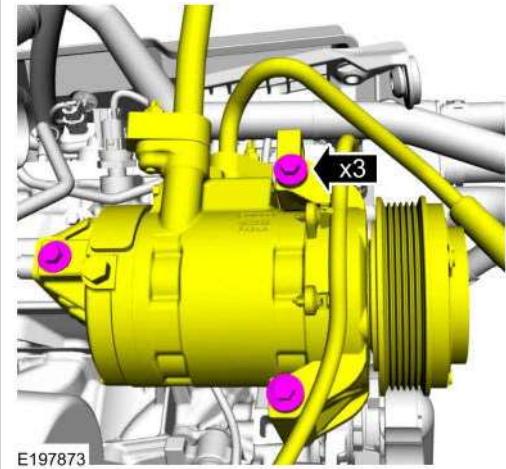


10.

Position the A/C compressor and install the bolts.

Torque

: 18 lb.ft (25 Nm)



11.

Install the following items:

RH fender splash shield. Refer to: Fender Splash Shield .

RH wheel and tire. Refer to: Wheel and Tire .

12.

1.

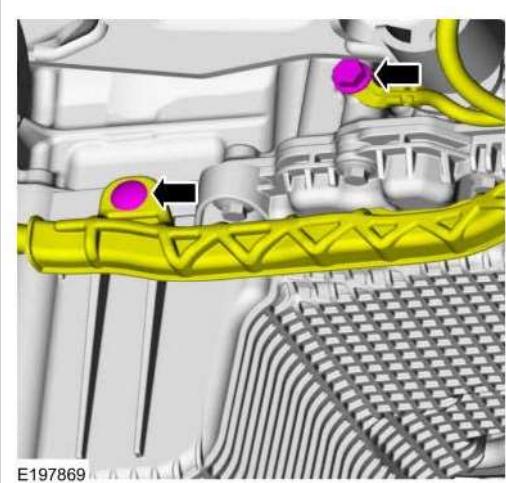
Install the pin-type retainer.

2.

Install the ground wire and bolt.

Torque

: 18 lb.ft (25 Nm)



13.

Install the following items:

Refer to: ACCESSORY DRIVE BELT

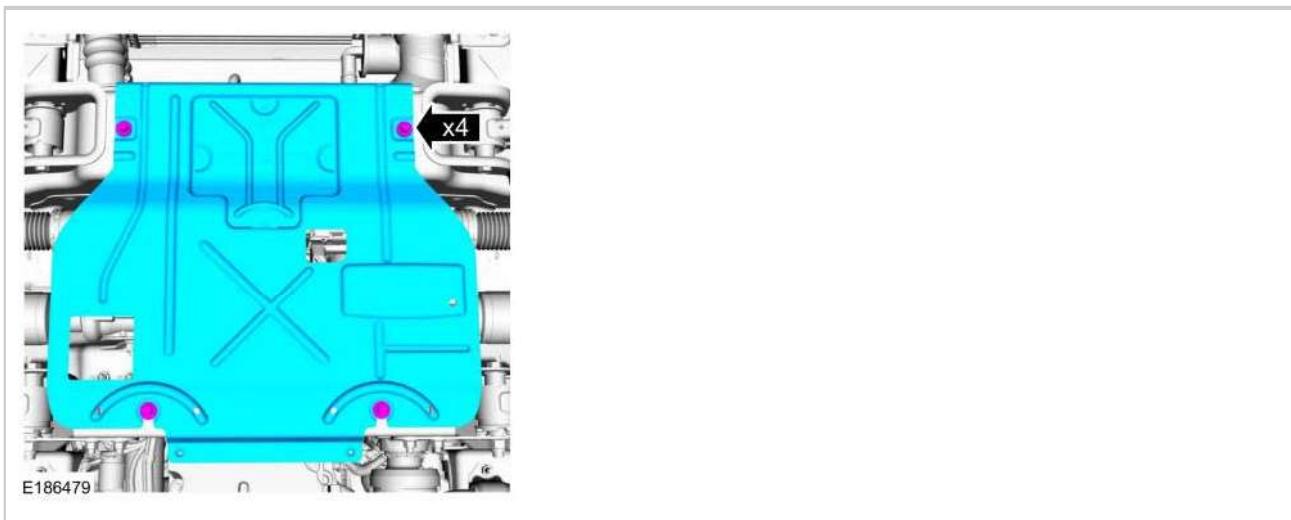
Refer to: STARTING SYSTEM .

14.

If equipped, install the skid plate and bolts.

Torque

: 30 lb.ft (40 Nm)



15.

If equipped, install the underbody shield and fasteners.

Torque

: 71 lb.in (8 Nm)

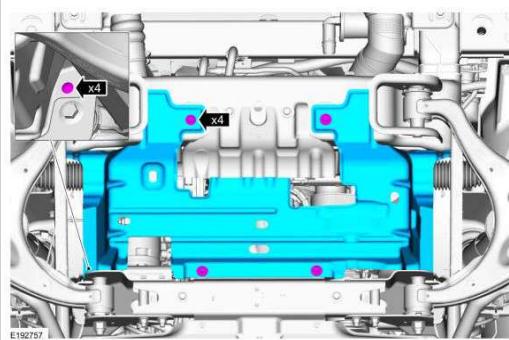


16.

If equipped, install the underbody shield and fasteners.

Torque

: 30 lb.ft (40 Nm)



17.

Install the following items:

Refer to: CHARGE AIR COOLER (CAC) OUTLET PIPE .

RH CAC intake pipe. Refer to: CHARGE AIR COOLER (CAC) INTAKE PIPE

Refer to: AIR CLEANER OUTLET PIPE LH

Refer to: AIR CLEANER OUTLET PIPE RH .

18.

Connect the battery ground cable. Refer to: Battery Disconnect and Connect .

19.

Check the exhaust system for leaks.

REMOVAL AND INSTALLATION > FLEXPLATE > REMOVAL

1.

Remove the transmission. Refer to: Transmission - 2.7L EcoBoost (238kW/324PS) .

2.

Remove the bolts and the flexplate.



REMOVAL AND INSTALLATION > FLEXPLATE > INSTALLATION

1.

1.

Position the flexplate on the crankshaft.

2.

Install the bolts then rundown the bolts one turn at a time in sequence shown until the flexplate is snug against the rear face of the crankshaft.

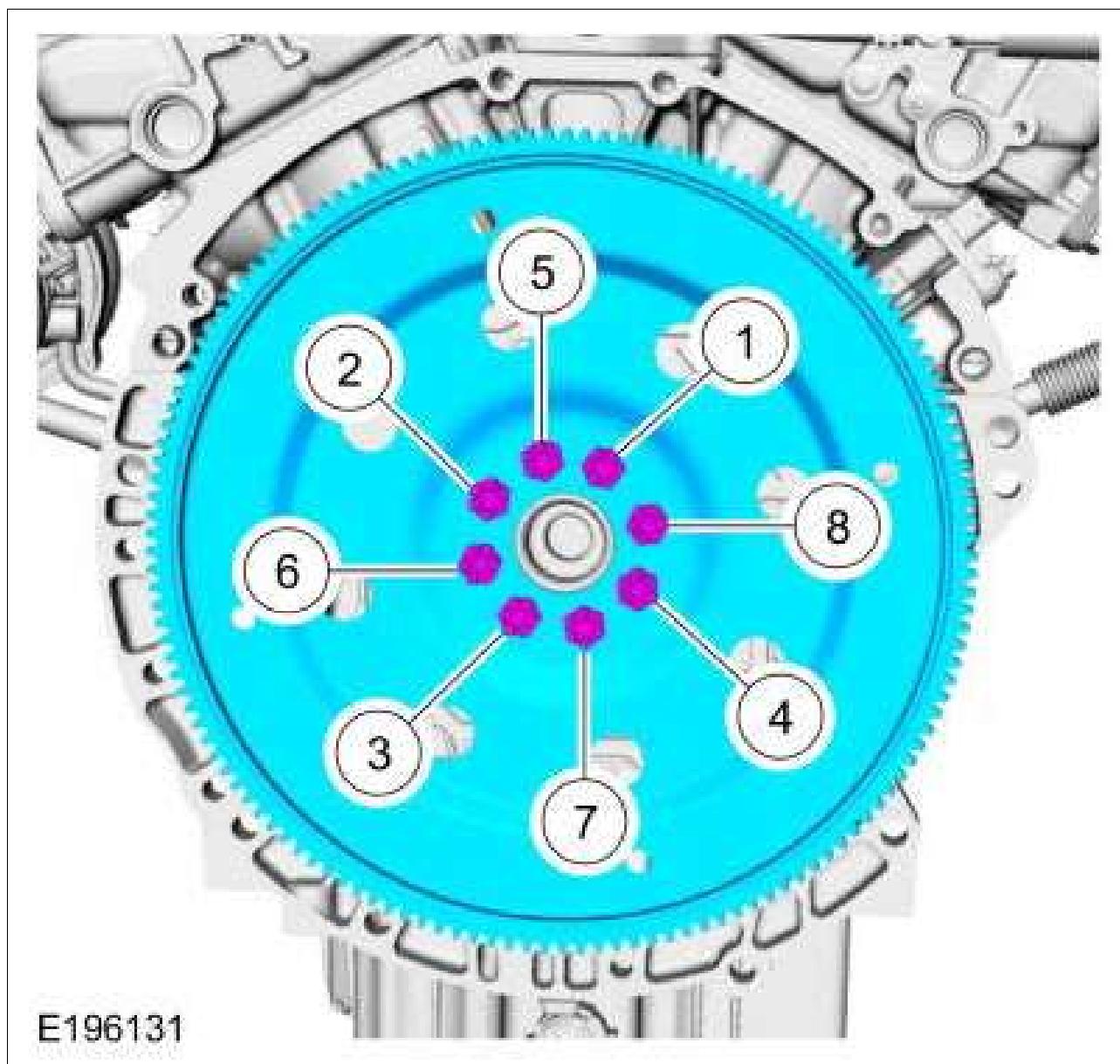
3.

Final tighten the bolts in sequence shown.

Torque

: 59 lb.ft (80 Nm)

Fig 1: Flexplate Bolts Tightening Sequence



Courtesy of FORD MOTOR CO.

2.

Install the transmission. Refer to: Transmission - 2.7L EcoBoost (238kW/324PS) .

3.

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

REMOVAL AND INSTALLATION > INTAKE MANIFOLD > REMOVAL

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

1.

Disconnect the battery ground cable. Refer to: Battery Disconnect and Connect .

2.

1.

Remove the nuts.

2.

Slide the engine appearance cover out of the retaining bracket.

If the engine appearance cover stud bolts are loosened or removed, they must be installed/tightened into the intake manifold.

Torque

: 62 lb.in (7 Nm)



3.

Remove the following items:

Refer to: AIR CLEANER OUTLET PIPE RH .

Refer to: AIR CLEANER OUTLET PIPE LH

Refer to: CHARGE AIR COOLER (CAC) OUTLET PIPE .

4.

1.

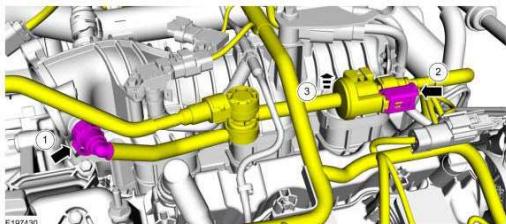
Disconnect the EVAP tube quick release coupling. Refer to: QUICK RELEASE COUPLING .

2.

Disconnect the EVAP purge valve electrical connector.

3.

Lift the EVAP purge valve off of the intake manifold mounting tab.



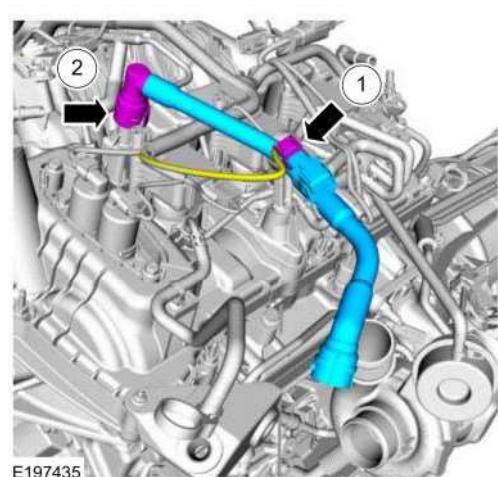
5.

1.

Disconnect the crankcase pressure sensor electrical connector.

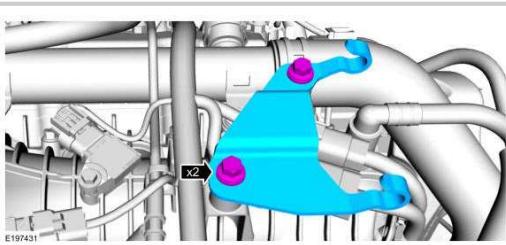
2.

Disconnect the PCV tube quick release coupling. Refer to: QUICK RELEASE COUPLING



6.

Remove the bolts and the engine appearance cover bracket.



7.

Disconnect the vacuum tube quick release coupling. Refer to: QUICK RELEASE COUPLING .



8.

Disconnect the engine wiring harness electrical connectors and retainers.



9.

1.

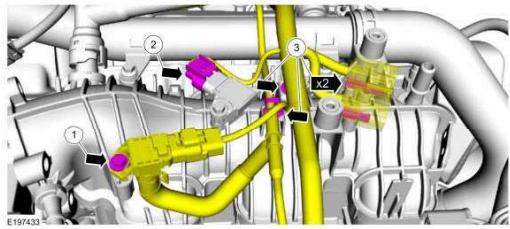
Remove the vacuum harness pressure sensor bolt.

2.

Disconnect the MAP sensor electrical connector.

3.

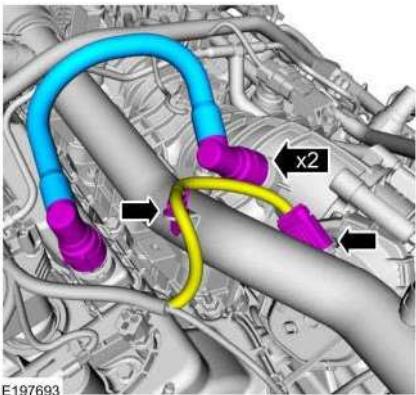
Detach the wiring harness and vacuum harness retainers.



10.

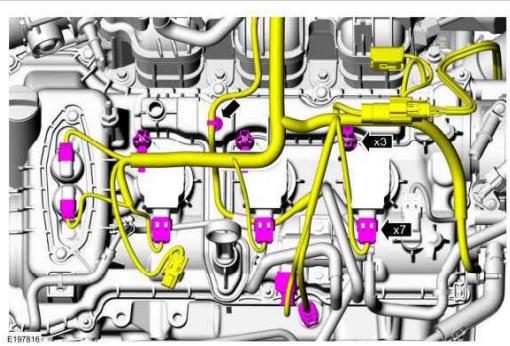
Disconnect the PCV tube quick release couplings and remove the tube. Refer to: QUICK RELEASE COUPLING

Disconnect the throttle body electrical connector and wiring harness retainer.



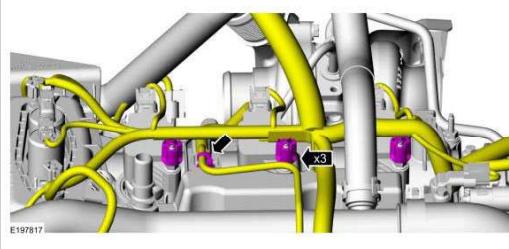
11.

Disconnect the engine wiring harness electrical connectors and detach the harness and vacuum hose retainers.



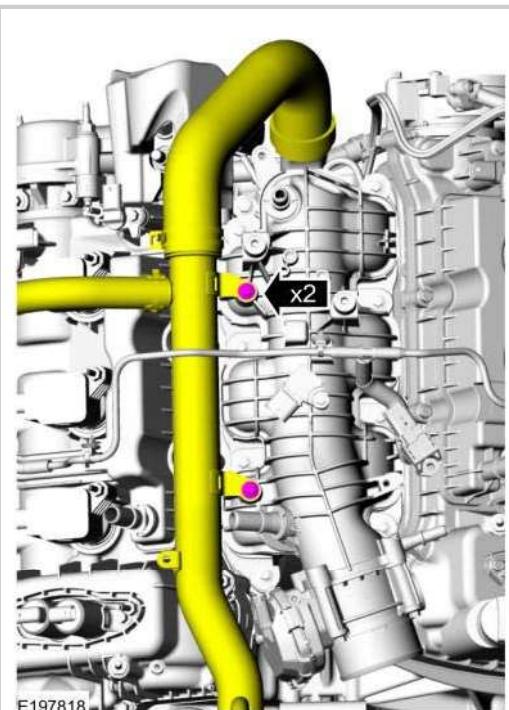
12.

Detach the engine wiring harness and vacuum hose retainers.



13.

Remove the bolts and position the coolant pipe aside.



14.

1.

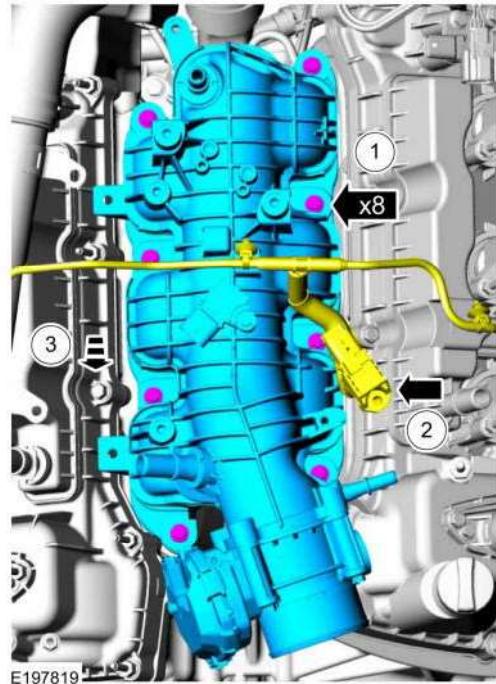
Loosen the bolts.

2.

Position the vacuum harness aside.

3.

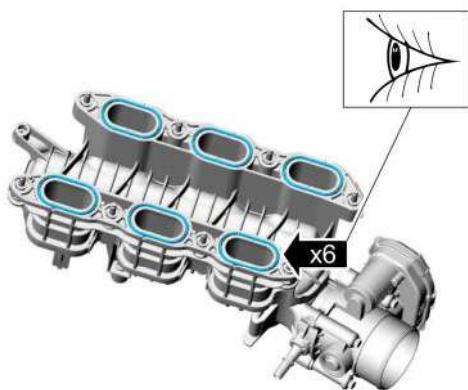
Remove the intake manifold.



15.

Remove and inspect the gaskets, replace as necessary.

Clean and inspect all sealing surfaces.

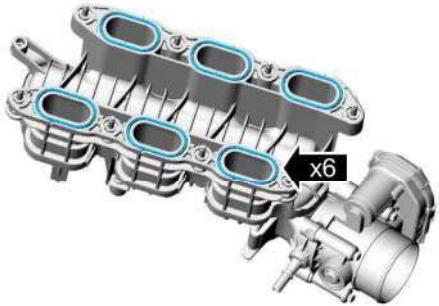


REMOVAL AND INSTALLATION > INTAKE MANIFOLD > INSTALLATION

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

1.

Install the gaskets.



E197821

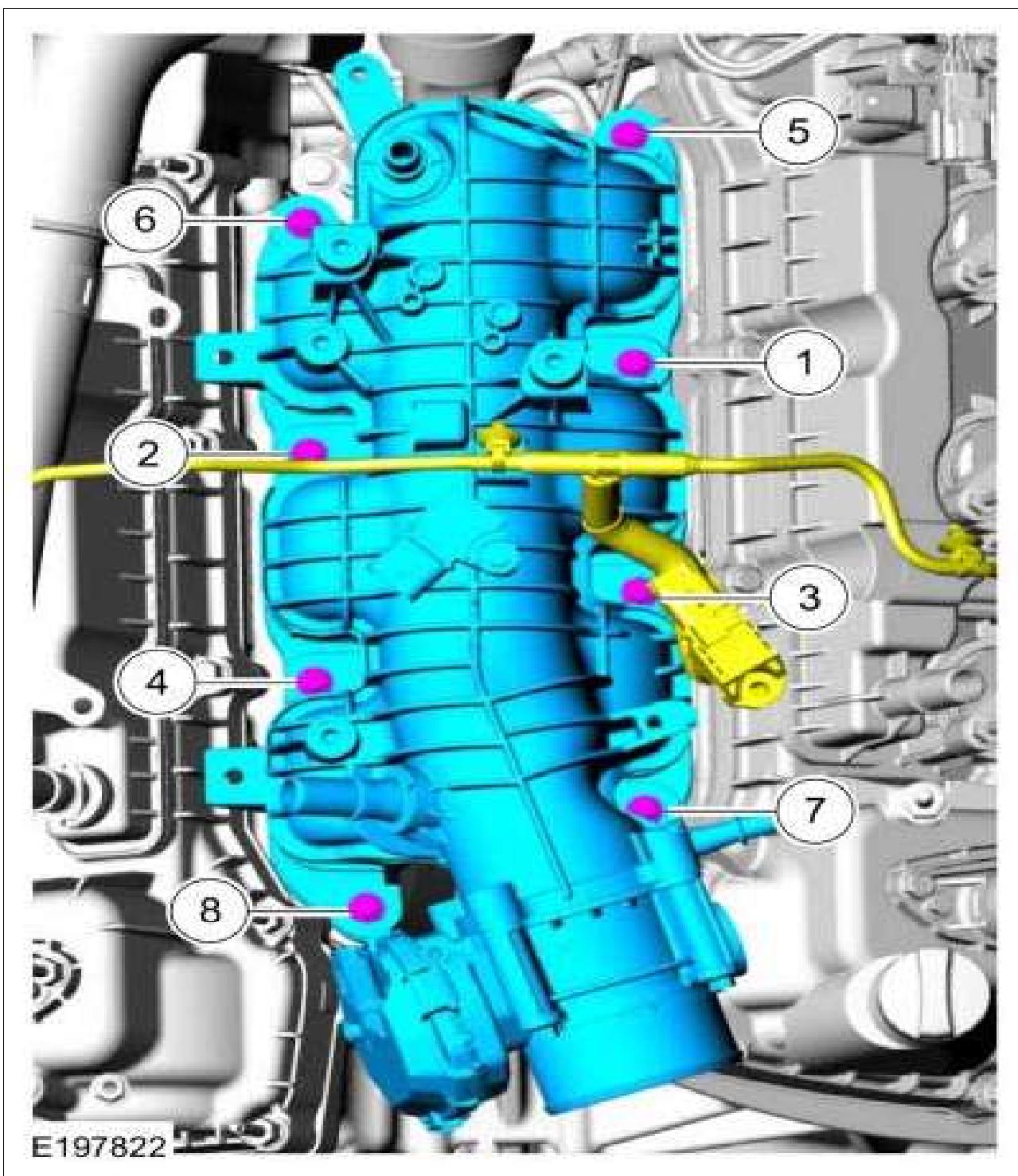
2.

Install the intake manifold and tighten the bolts.

Torque

: 89 lb.in (10 Nm)

Fig 1: Intake Manifold Bolts Tightening Sequence



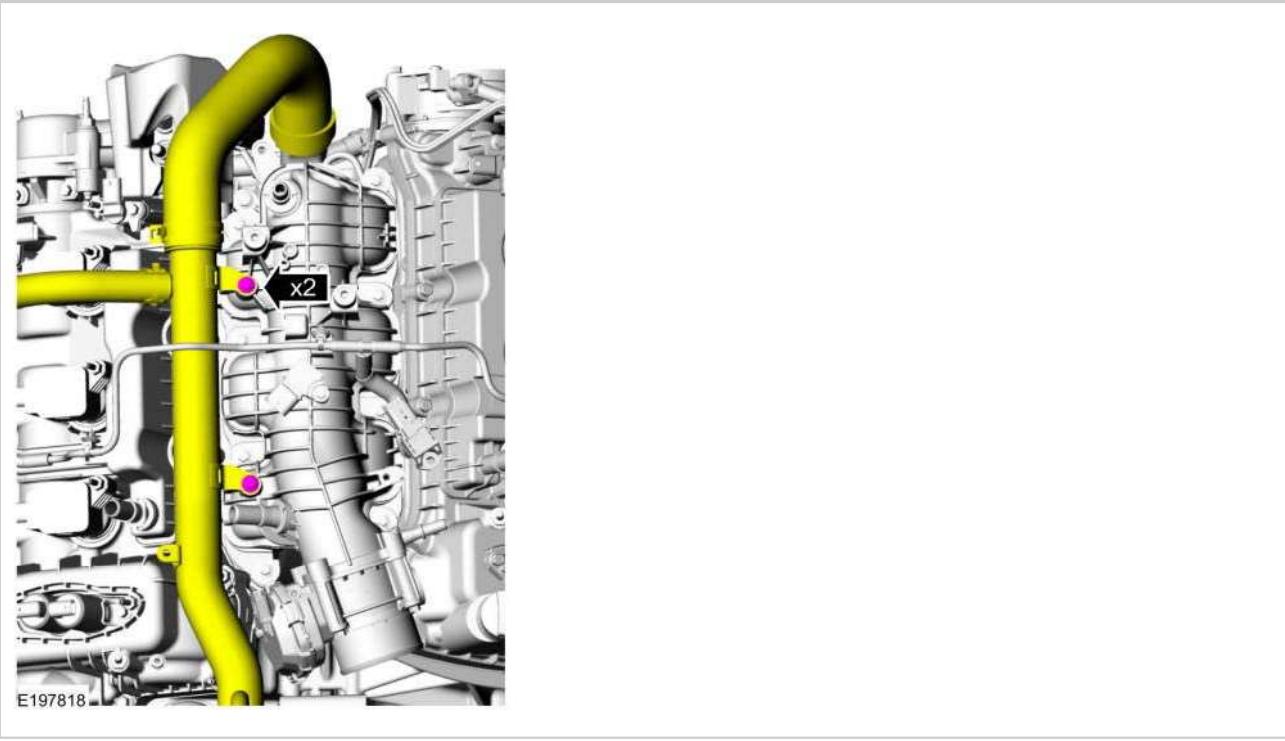
Courtesy of FORD MOTOR CO.

3.

Install the coolant pipe and the bolts.

Torque

: 97 lb.in (11 Nm)



4.

Attach the engine wiring harness and vacuum hose retainers.



5.

Connect the engine wiring harness electrical connectors and attach the harness and vacuum hose retainers.

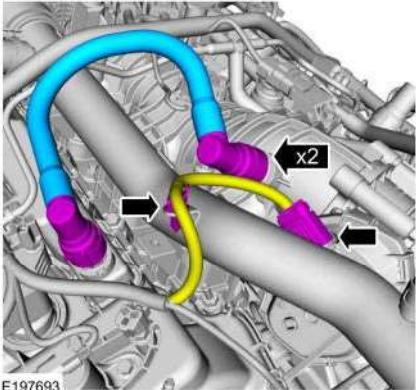


6.

Install the PCV tube and connect the quick release couplings. Refer to: QUICK RELEASE

COUPLING

Connect the throttle body electrical connector and wiring harness retainer.



7.

1.

Position the vacuum harness pressure sensor and install the bolt.

Torque

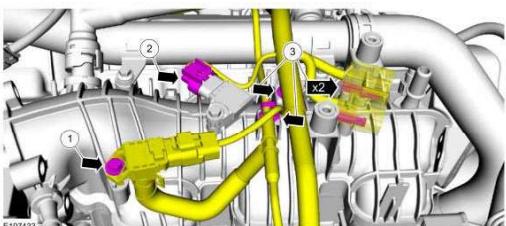
: 62 lb.in (7 Nm)

2.

Connect the MAP sensor electrical connector.

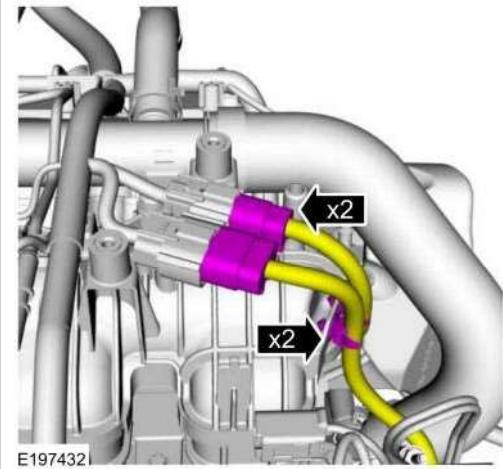
3.

Attach the wiring harness and vacuum harness retainers.



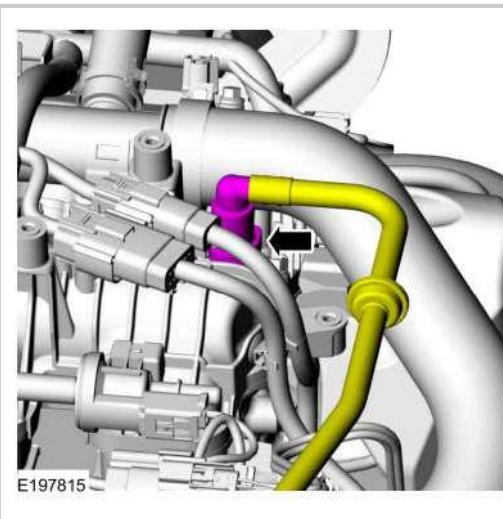
8.

Connect the engine wiring harness electrical connectors and retainers.



9.

Connect the vacuum tube quick release coupling. Refer to: QUICK RELEASE COUPLING

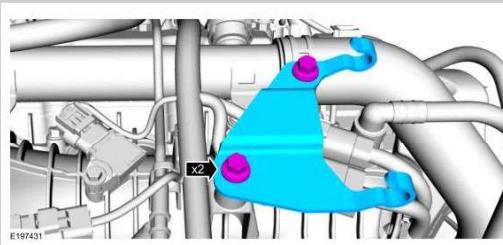


10.

Install the engine appearance cover bracket and the bolts.

Torque

: 97 lb.in (11 Nm)



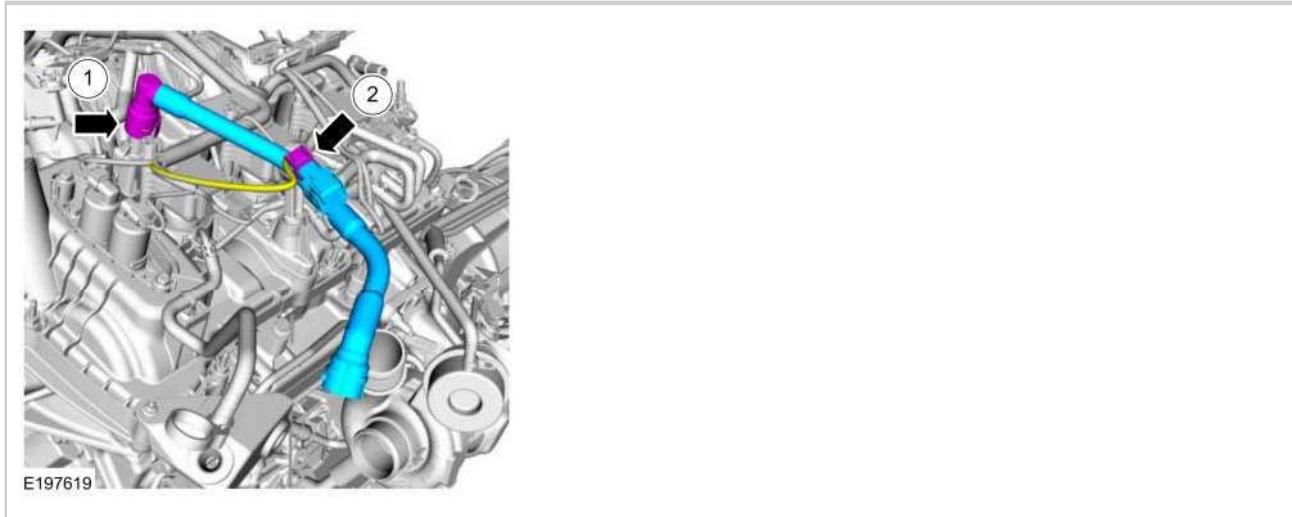
11.

1.

Connect the PCV tube quick release coupling. Refer to: QUICK RELEASE COUPLING

2.

Connect the crankcase pressure sensor electrical connector.



12.

1.

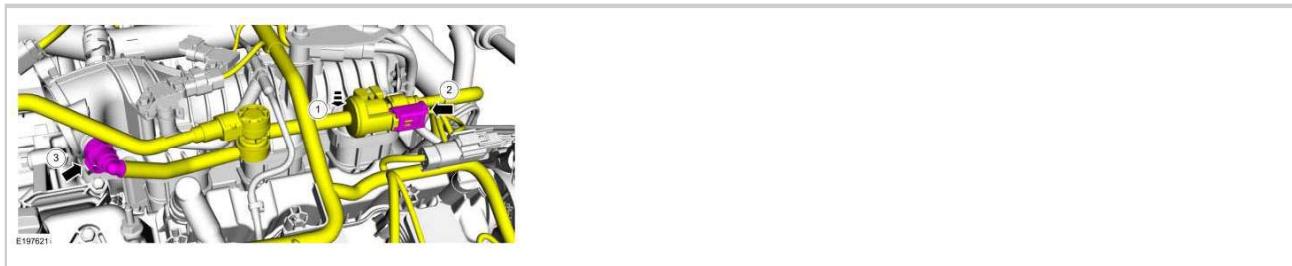
Slide the EVAP purge valve onto the intake manifold mounting tab.

2.

Connect the EVAP purge valve electrical connector.

3.

Connect the EVAP tube quick release coupling. Refer to: QUICK RELEASE COUPLING .



13.

Install the following items:

Refer to: CHARGE AIR COOLER (CAC) OUTLET PIPE .

Refer to: AIR CLEANER OUTLET PIPE LH .

Refer to: AIR CLEANER OUTLET PIPE RH .

14.

1.

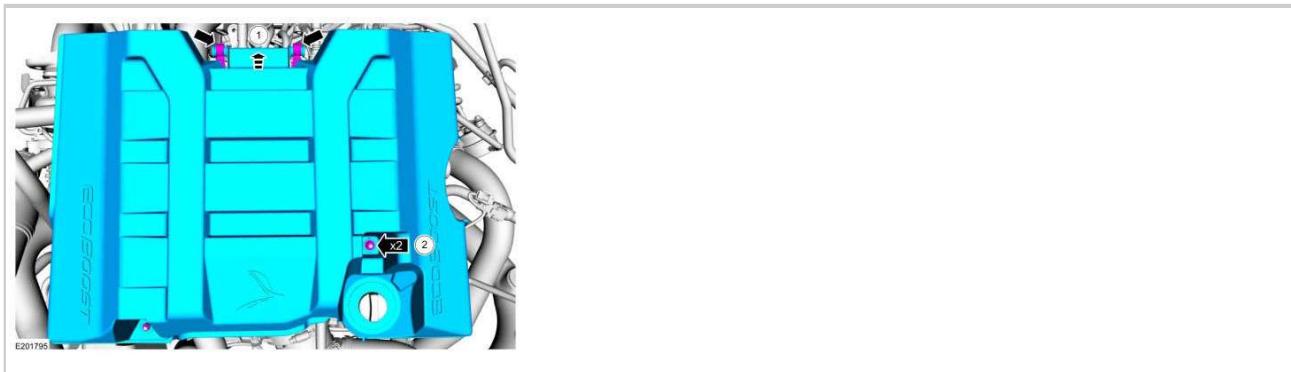
Slide the engine appearance cover into the retaining bracket.

2.

Install the nuts.

Torque

: 44 lb.in (5 Nm)



15.

Connect the battery ground cable. Refer to: Battery Disconnect and Connect .

REMOVAL AND INSTALLATION > OIL COOLER

Special Tool(s) / General Equipment

Oil Drain Equipment

Locking Pliers

Materials

Name	Specification
Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP	WSS-M2C946-A
Motorcraft ® Orange Prediluted Antifreeze/Coolant VC-3DIL-B	WSS-M97B44-D2

REMOVAL AND INSTALLATION > OIL COOLER > REMOVAL

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

1.

 **NOTE:** Use a shop towel when removing the oil filter housing to prevent oil from spilling on the engine or accessory drive belt.

1.

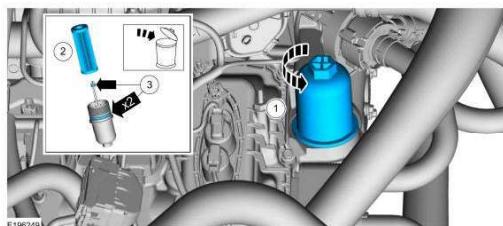
Loosen the oil filter housing and allow the oil to drain out of the housing and down into the engine.

2.

Remove the oil filter housing and discard the oil filter element.

3.

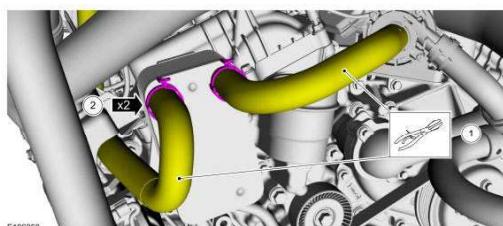
Remove and discard the O-ring seals.



2.

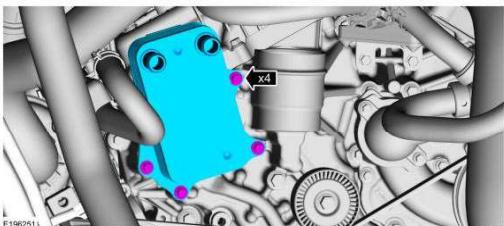
Using hose locking pliers, clamp the oil cooler coolant hoses. Use the General Equipment: Locking Pliers

Disconnect the coolant hoses.



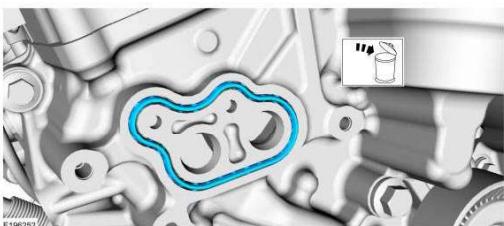
3.

Remove the bolts and the oil cooler.



4.

Remove and discard the gasket.

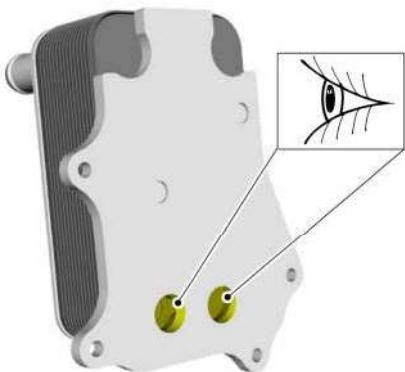


5.



NOTE: 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 ENGINE .

Inspect the oil cooler.



E196253

REMOVAL AND INSTALLATION > OIL COOLER > INSTALLATION

1.

Install a new gasket.

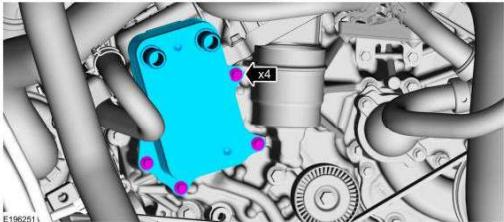


2.

Install the oil cooler and the bolts.

Torque

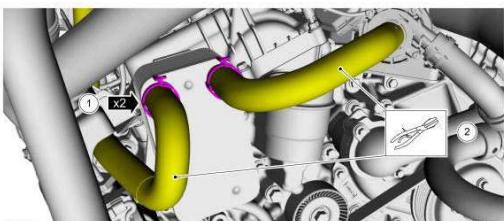
: 89 lb.in (10 Nm)



3.

Connect the coolant hoses.

Remove the hose locking pliers. Use the General Equipment: Locking Pliers



4.

 *NOTE: The drain plug should be removed and installed by hand, do not use tools.*

1.

Turn the oil drain plug by hand counterclockwise 120 degrees. Use the General Equipment: Oil Drain Equipment

2.

Pull the oil drain plug out of the oil pan.

3.

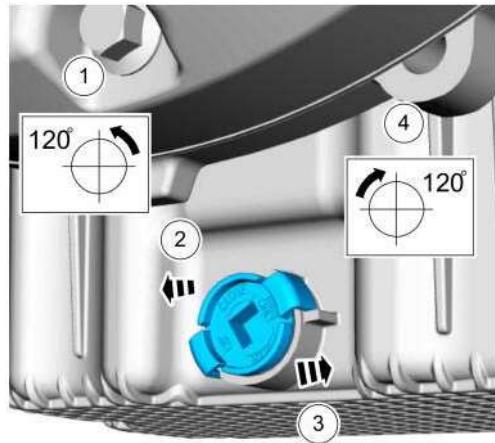
After the oil has drained, push the oil drain plug into the oil pan.

4.



NOTE: Overtightening will damage the oil drain plug and possibly the oil pan.

Turn the oil drain plug by hand clockwise 120 degrees.

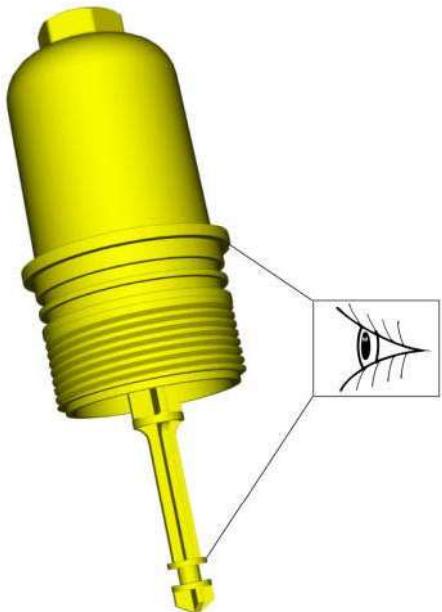


5.



*NOTE: If the filter housing stem is damaged or missing the oil will flow through the reservoir drain port and a **loss** of engine oil pressure will occur.*

Inspect the oil filter housing and stem for damage including cracks or separation of the stem from the housing. If damaged, a new oil filter housing assembly must be installed.



E227632

6.

 **NOTE:** Failure to install new oil filter housing-to-engine front cover seals may result in oil leakage.

Install new oil filter housing-to-engine front cover seals and lubricate with clean engine oil.

Material

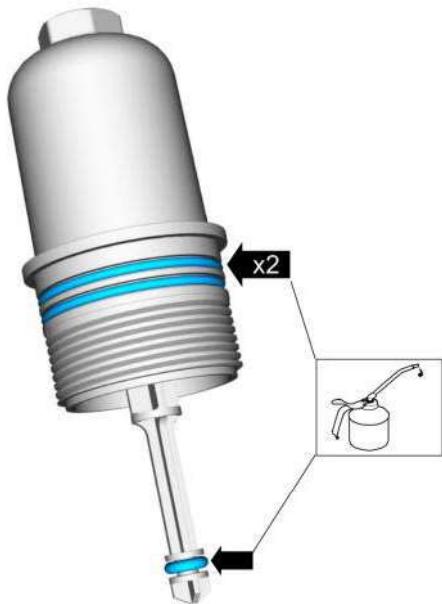
: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP
(WSS-M2C946-A)

 **NOTE:** Failure to install a new oil filter housing stem-to-oil reservoir drain port seal will result with the oil flowing through the reservoir drain port and a **loss** of engine oil pressure.

Install a new oil filter housing stem-to-oil reservoir drain port seal and lubricate with clean engine oil.

Material

: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP
(WSS-M2C946-A)



E227633

7.

1.

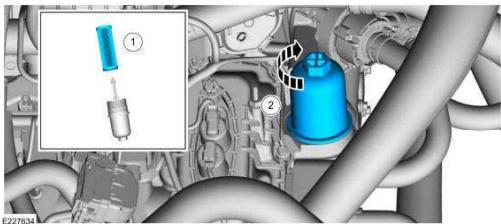
Install a new oil filter element.

2.

Install the oil filter housing.

Torque

: 18 lb.ft (24 Nm)



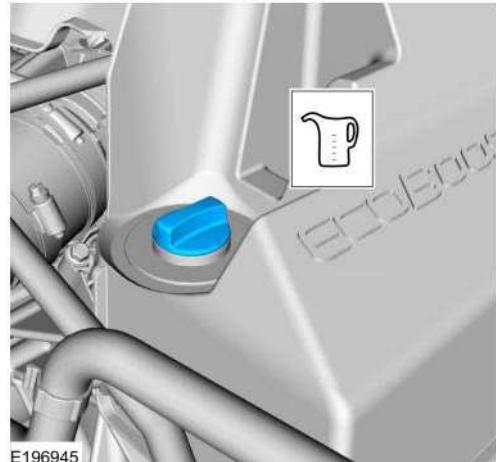
E227634

8.

Fill the engine with clean engine oil. Refer to: Specifications .

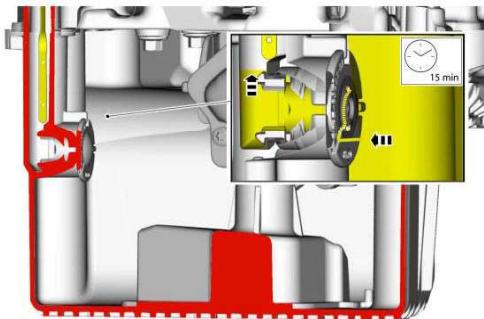
Material

: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP
(WSS-M2C946-A)



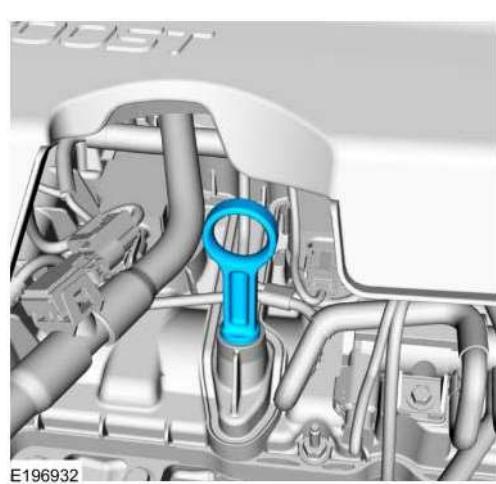
9.

After filling the engine with oil, the oil must flow from the main chamber of the oil pan, through a check valve into the smaller side chamber to correctly register the oil level on the oil level indicator. This may take up to 15 minutes.



10.

Check the oil level and adjust as necessary.



11.

Inspect and adjust the coolant level in the degas bottle

Material

: Motorcraft ® Orange Prediluted Antifreeze/Coolant / VC-3DIL-B (WSS-M97B44-D2)

REMOVAL AND INSTALLATION > OIL PAN

Special Tool(s) / General Equipment

Plastic Scraper
Oil Drain Equipment
Vehicle/Axle Stands

Materials

Name	Specification
Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil XO-5W30-QSP	WSS-M2C946-A
Motorcraft ® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft ® Silicone Gasket Remover ZC-30-A	-
Motorcraft ® Metal Surface Prep ZC-31-B	-
Metal Brake Parts Cleaner PM-4-A, PM-4-B	-

REMOVAL AND INSTALLATION > OIL PAN > REMOVAL



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

4x2/4x4

1.

With the vehicle in NEUTRAL, position it on a hoist. Refer to: Jacking and Lifting - Overview .

2.

Disconnect the battery ground cable. Refer to: Battery Disconnect and Connect .

3.

 **NOTE:** Use a shop towel when removing the oil filter housing to prevent oil from spilling on the engine or accessory drive belt.

1.

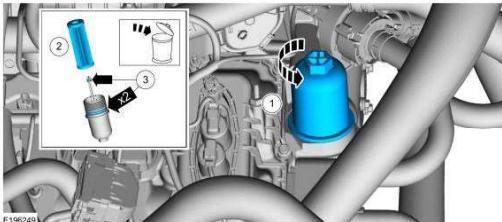
Loosen the oil filter housing and allow the oil to drain out of the housing and down into the engine.

2.

Remove the oil filter housing and discard the oil filter element.

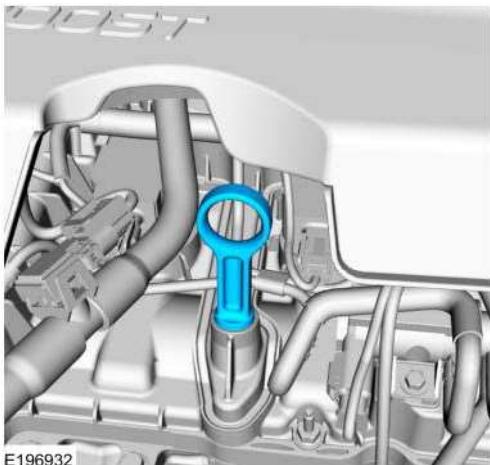
3.

Remove and discard the O-ring seals.



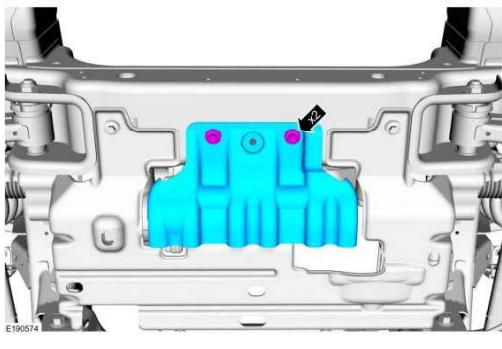
4.

Remove the oil level indicator.



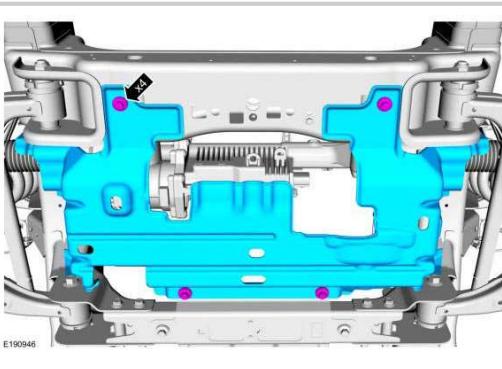
5.

If equipped, remove the bolts and the skid plate.



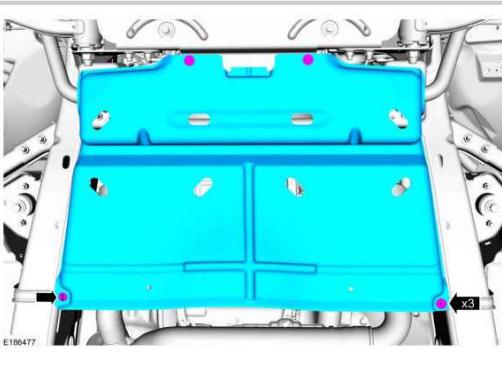
6.

If equipped, remove the fasteners and the underbody shield.



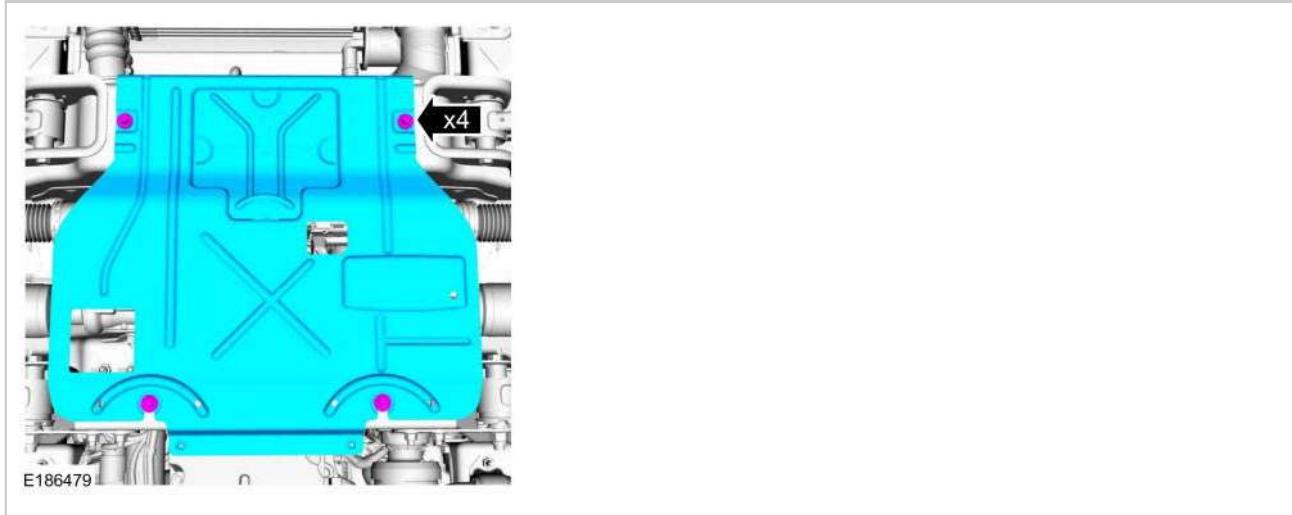
7.

If equipped, remove the fasteners and the underbody shield.



8.

If equipped, remove the bolts and the skid plate.



9.

Remove the nuts, bolts and the crossmember.



10.



NOTE: The drain plug should be removed and installed by hand, do not use tools.

1.

Turn the oil drain plug by hand counterclockwise 120 degrees. Use the General Equipment: Oil Drain Equipment

2.

Pull the oil drain plug out of the oil pan.

3.

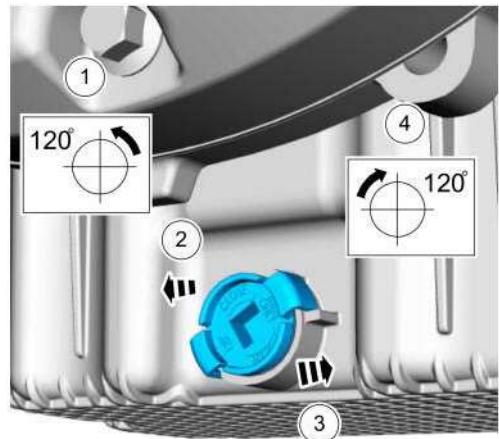
After the oil has drained, push the oil drain plug into the oil pan.

4.



NOTE: Overtightening will damage the oil drain plug and possibly the oil pan.

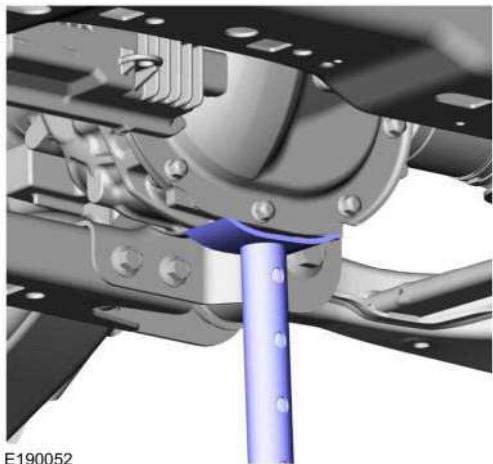
Turn the oil drain plug by hand clockwise 120 degrees.



4x4

11.

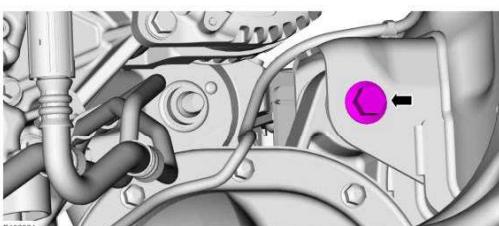
Using an adjustable stand, support the front axle. Use the General Equipment: Vehicle/Axle Stands



E190052

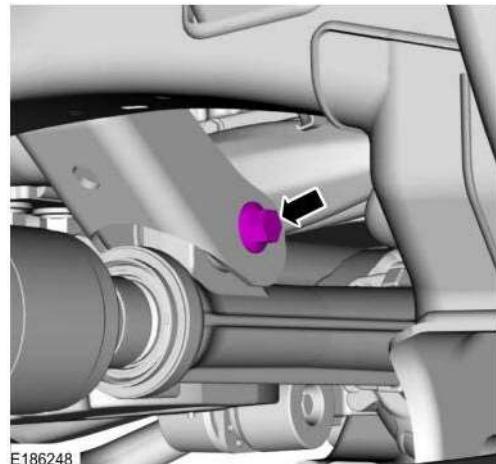
12.

Remove the upper front axle carrier mounting bushing bolt.



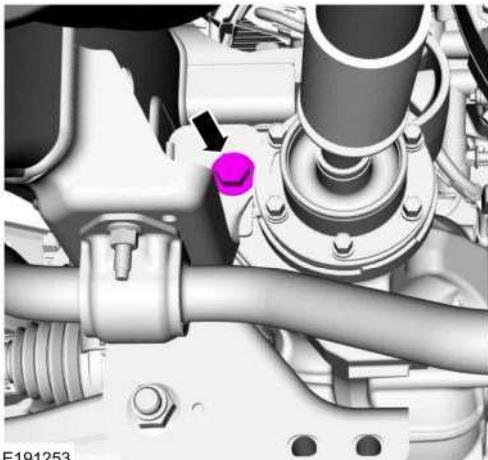
13.

Remove the axle shaft housing carrier bushing bolt.



14.

Remove the lower front axle carrier mounting bushing bolt.

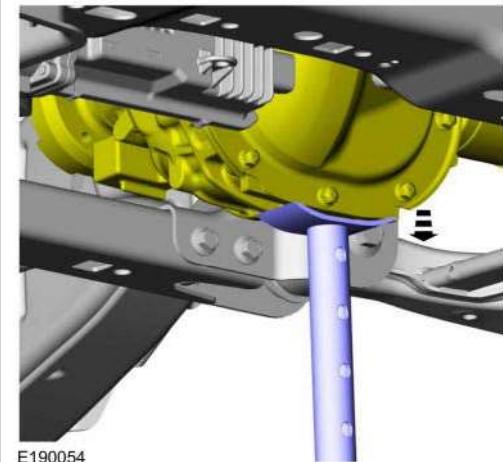


15.



NOTE: The axle can rest on the frame and the stand can be removed if necessary.

Using an adjustable stand, lower the axle to allow clearance for the oil pan to be removed. Use the General Equipment: Vehicle/Axle Stands



4x2/4x4

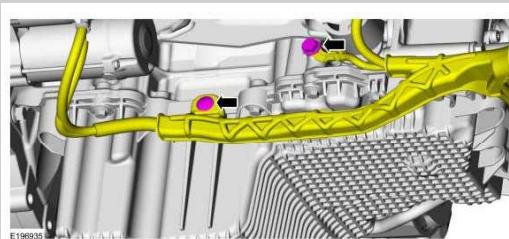
16.

1.

Remove the pin-type retainer.

2.

Remove the bolt and ground wire.



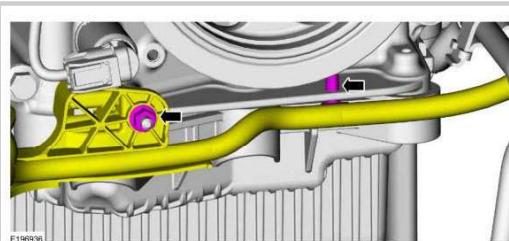
17.

1.

Remove the wiring harness retainer nut.

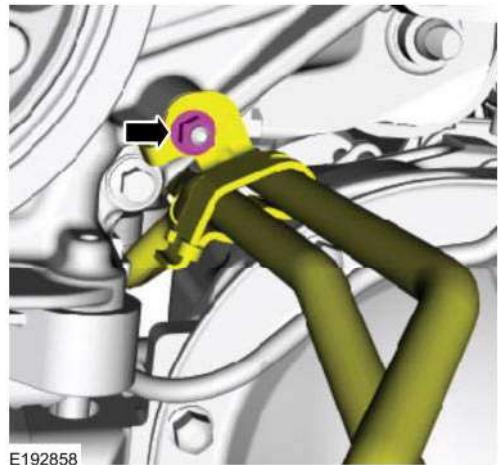
2.

Remove the pin-type retainer.



18.

Remove the transmission fluid cooler tube bracket nut.

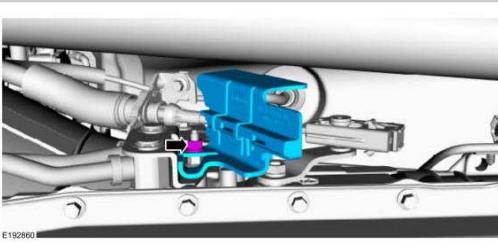


19.



NOTE: 4WD shown, 2WD similar.

Remove the nut and the heat shield.



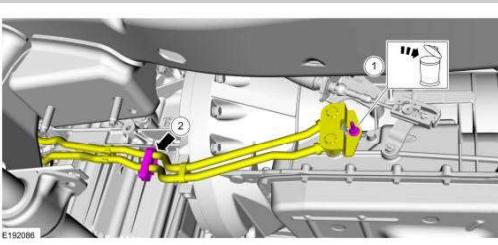
20.

1.

Remove and discard the transmission fluid cooler tube bracket stud bolt.

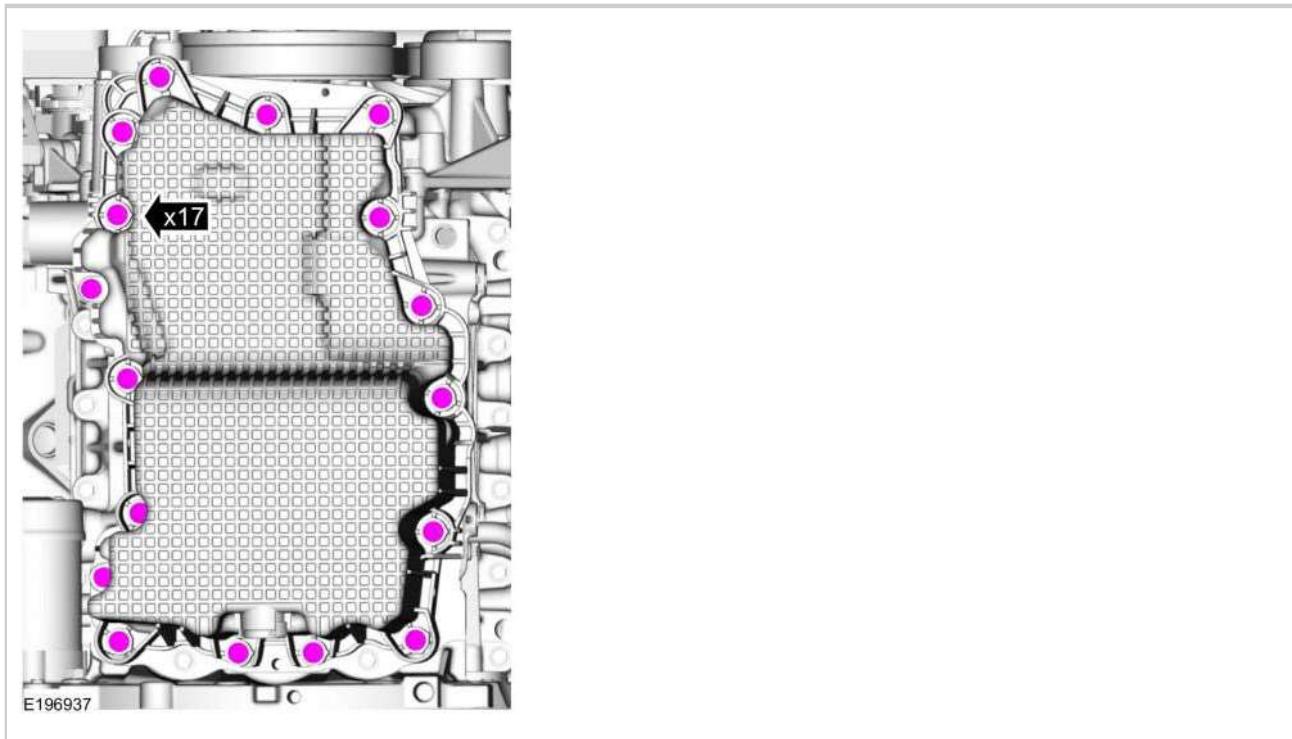
2.

Release the retainer and position aside the transmission cooler fluid cooler tubes.



21.

Remove the oil pan bolts.



22.

1.

Using a large flat-bladed screwdriver and the indicated pry pads, release the sealer and separate the oil pan from the bottom of the engine.

2.



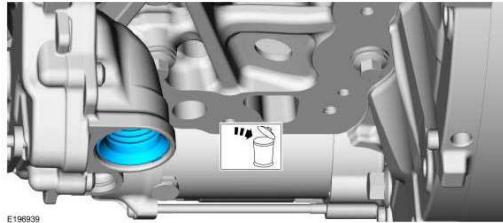
NOTE: Do not reuse the oil pan.

Remove and discard the oil pan.



23.

Remove and discard the oil pump seal.



24.

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

Make sure that the oil pan sealing surfaces of the cylinder block and engine front cover are free of foreign material. Refer to: RTV Sealing Surface Cleaning and Preparation . Use the General Equipment: Plastic Scraper

Material

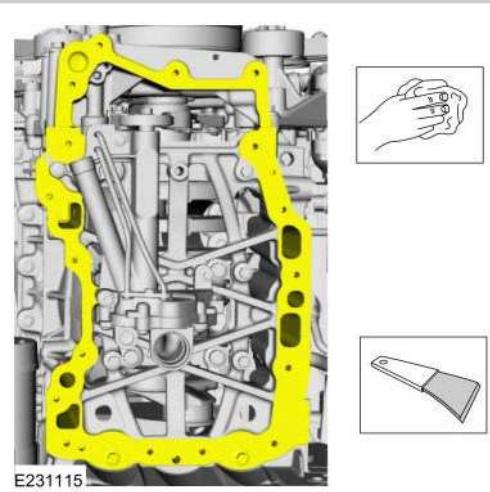
: Motorcraft ® Silicone Gasket Remover / ZC-30-A

Material

: Metal Brake Parts Cleaner / PM-4-A, PM-4-B

Material

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

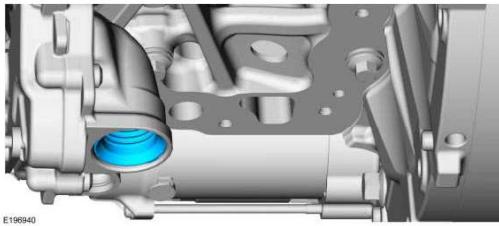


REMOVAL AND INSTALLATION > OIL PAN > INSTALLATION

4x2/4x4

1.

Install a new oil pump seal.



2.

 **NOTE:** Failure to use Motorcraft ® High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

 **NOTE:** The oil pan must be installed within 10 minutes of applying the sealer and the bolts must be installed and tightened to 2-5 Nm (18-44 lb-in) within 15 of applying the sealer. Final tightening of the bolts must be completed within 60 minutes of applying the sealer. Failure to follow this procedure can cause future oil leakage.

1.

Apply a 4.5 mm (0.18 in) bead of Motorcraft ® High Performance Engine RTV Silicone to the sealing surface of the new oil pan.

Material

: Motorcraft ® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)

2.

Apply a 9 mm (0.35 in) bead of Motorcraft ® High Performance Engine RTV Silicone to the engine front cover-to-cylinder block joint areas on the new oil pan.

Material

: Motorcraft ® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)

3.

Inspect the crankcase ventilation passages to make sure they are not blocked by any sealer applied.



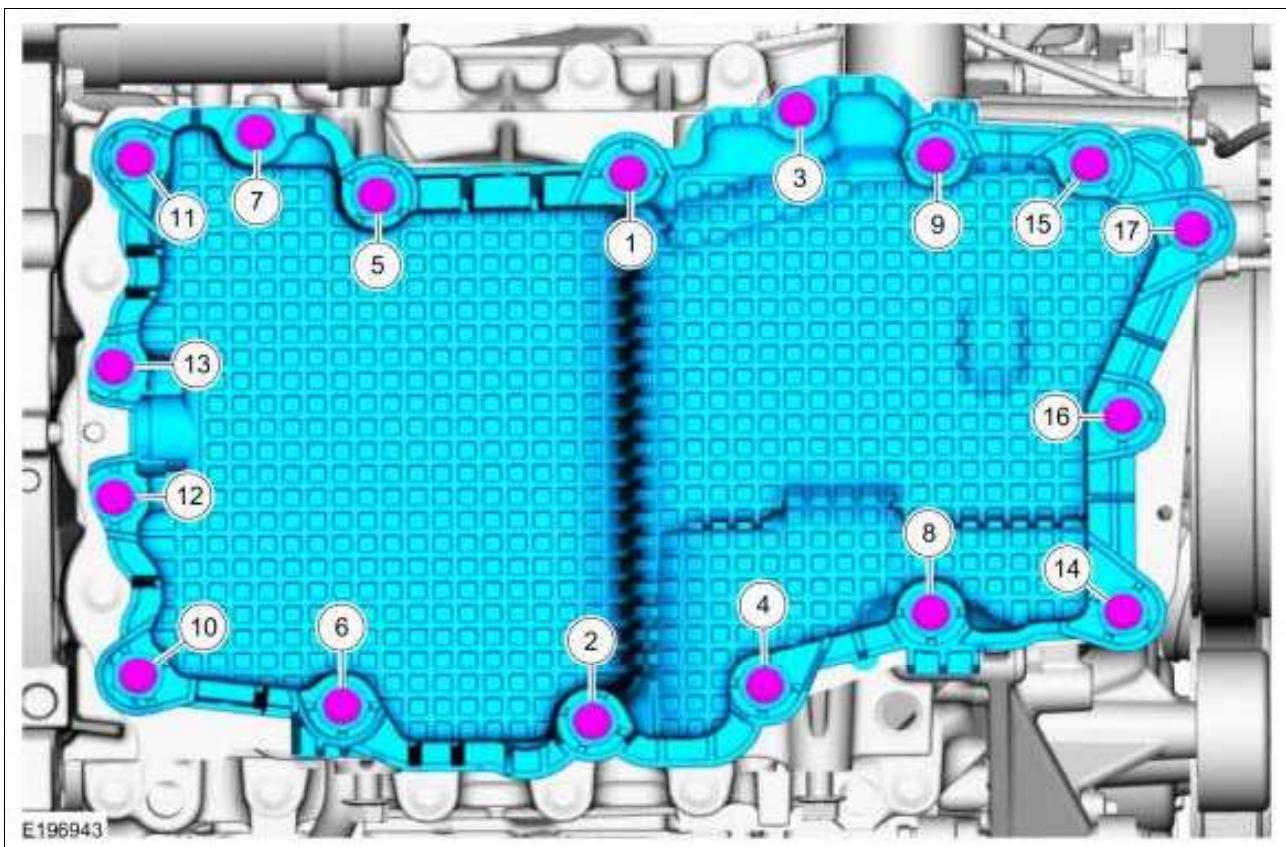
3.

Install the new oil pan and the bolts.

Torque

: 89 lb.in (10 Nm)

Fig 1: Oil Pan Bolts Tightening Sequence



Courtesy of FORD MOTOR CO.

4.



NOTE: Inspect the case and make sure the old transmission fluid cooler tube

O-rings are not stuck in the case.

Inspect the transmission fluid cooler O-ring seals. Install new O-ring seals if necessary.



E192862

5.

1.

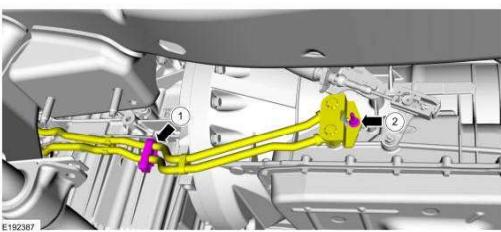
Position the transmission fluid cooler tubes and attach the retainer.

2.

Install the new transmission fluid cooler tube bracket stud bolt.

Torque

: 22 lb.ft (30 Nm)



6.

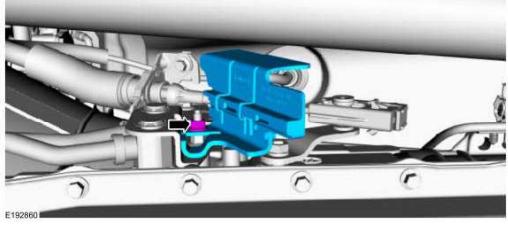


NOTE: 4WD shown, 2WD similar.

Install the heat shield and nut.

Torque

: 106 lb.in (12 Nm)

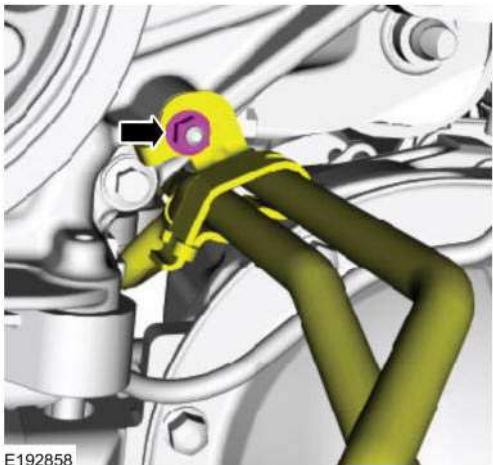


7.

Install the transmission fluid cooler tube bracket nut.

Torque

: 106 lb.in (12 Nm)



8.

1.

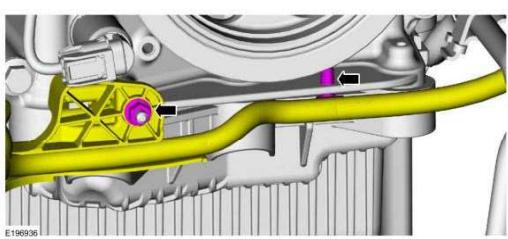
Install the wiring harness retainer nut.

Torque

: 106 lb.in (12 Nm)

2.

Install the pin-type retainer.



9.

1.

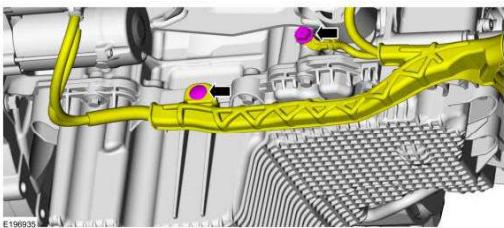
Install the pin-type retainer.

2.

Install the ground wire and bolt.

Torque

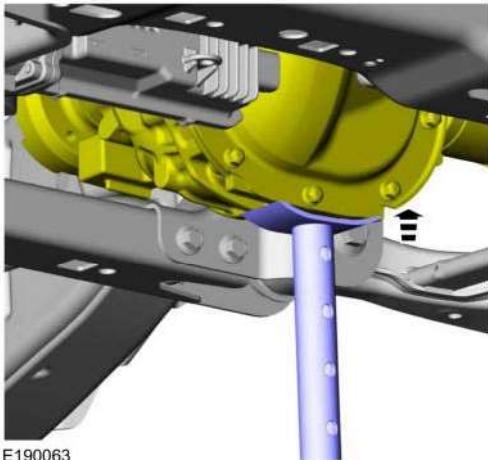
: 18 lb.ft (25 Nm)



4x4

10.

Using an adjustable stand, raise the front axle carrier into position. Use the General Equipment: Vehicle/Axle Stands

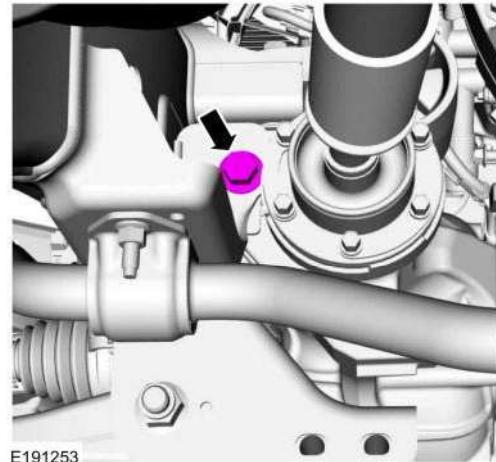


11.

Install the lower front axle carrier mounting bushing bolt.

Torque

: 85 lb.ft (115 Nm)

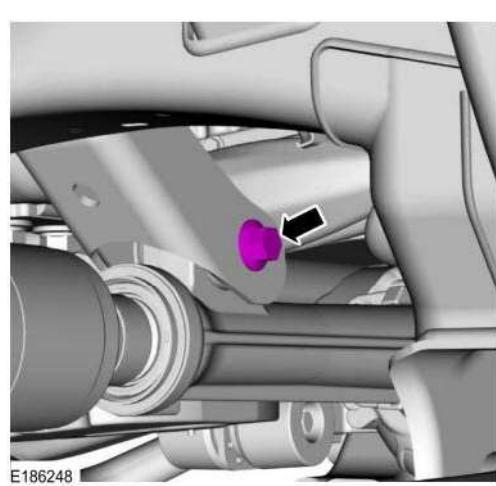


12.

Install the axle shaft housing carrier bushing bolt.

Torque

: 85 lb.ft (115 Nm)

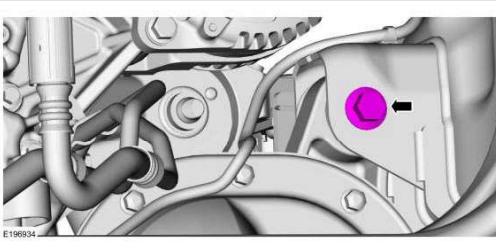


13.

Install the upper front axle carrier mounting bushing bolt.

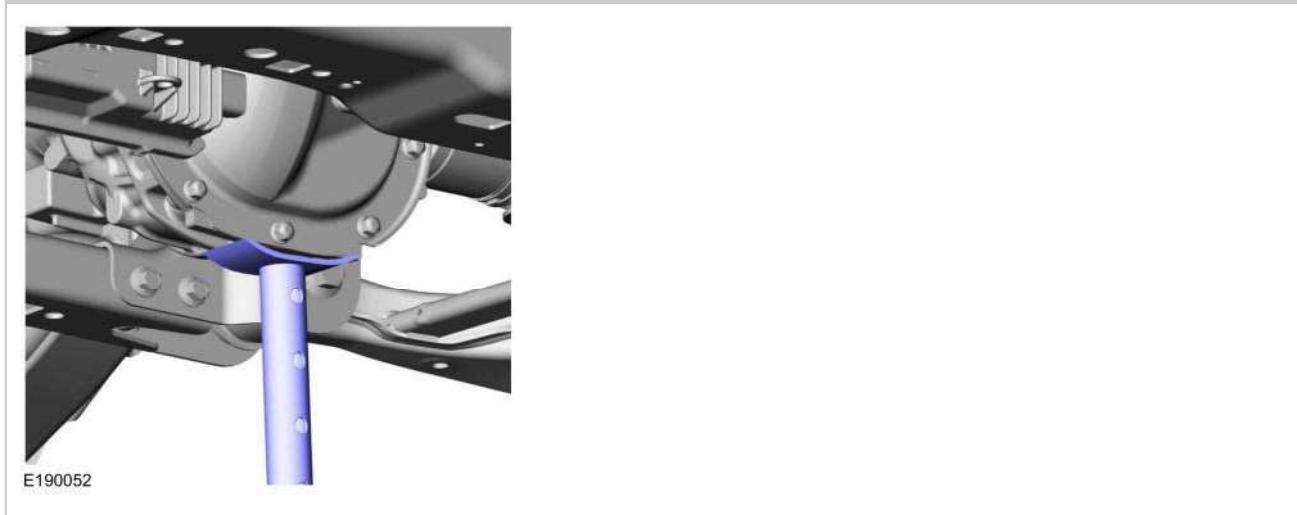
Torque

: 85 lb.ft (115 Nm)



14.

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



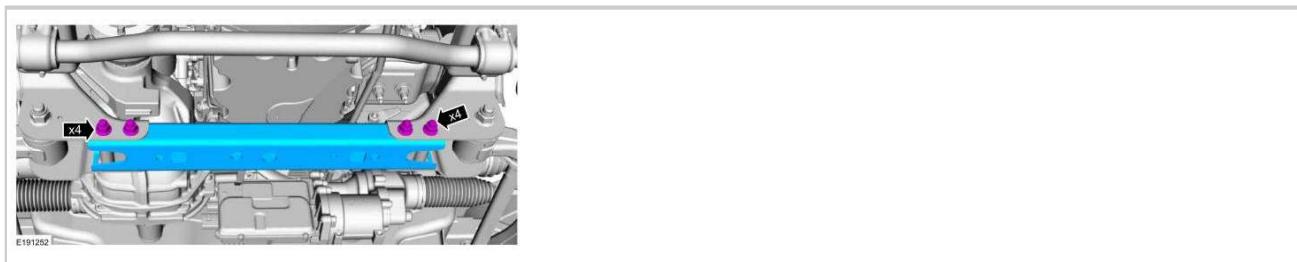
4x2/4x4

15.

Install the crossmember, bolts and the nuts.

Torque

: 66 lb.ft (90 Nm)

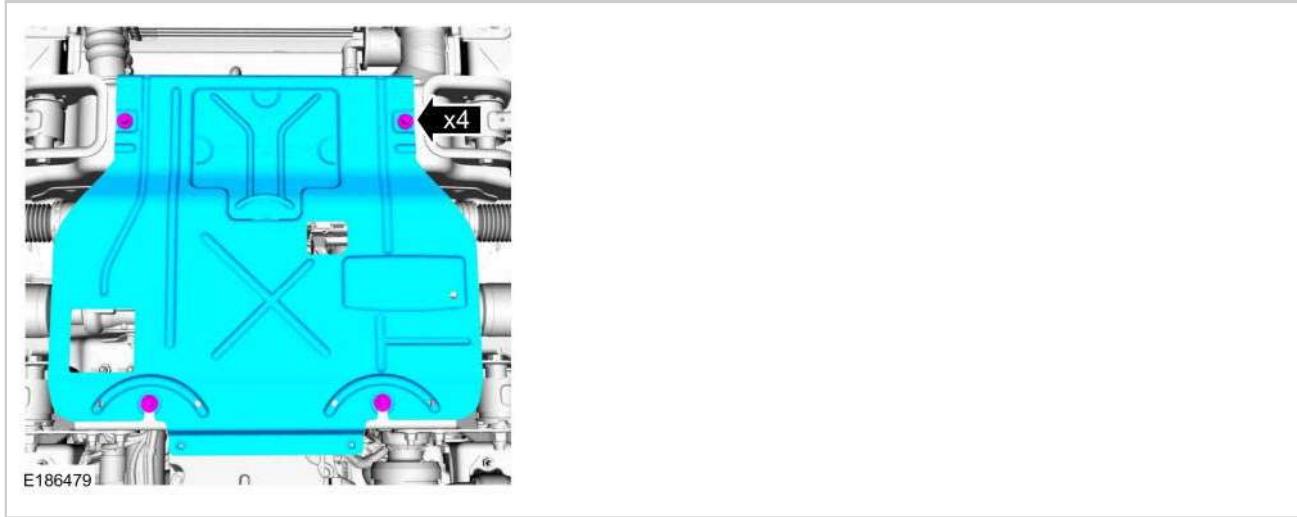


16.

If equipped, install the skid plate and bolts.

Torque

: 30 lb.ft (40 Nm)



17.

If equipped, install the underbody shield and fasteners.

Torque

: 71 lb.in (8 Nm)

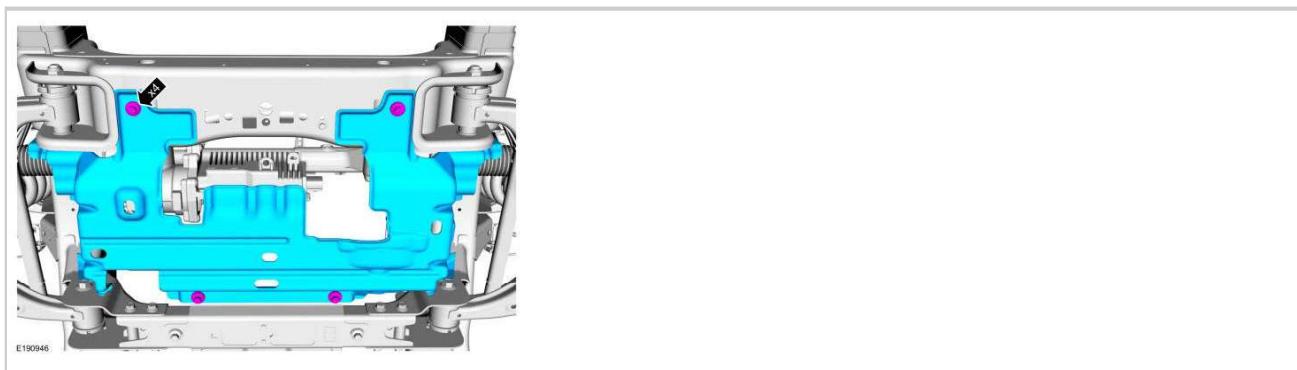


18.

If equipped, install the underbody shield and fasteners.

Torque

: 30 lb.ft (40 Nm)

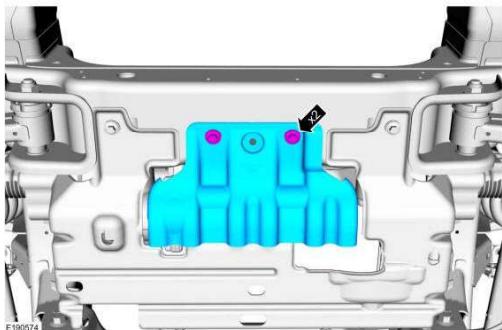


19.

If equipped, install the skid plate and bolts.

Torque

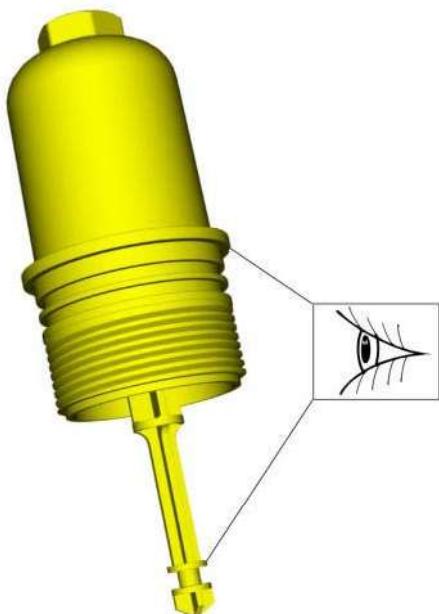
: 30 lb.ft (40 Nm)



20.

 **NOTE:** If the filter housing stem is damaged or missing the oil will flow through the reservoir drain port and a **loss** of engine oil pressure will occur.

Inspect the oil filter housing and stem for damage including cracks or separation of the stem from the housing. If damaged, a new oil filter housing assembly must be installed.



E227632

21.

 **NOTE:** Failure to install new oil filter housing-to-engine front cover seals may result in oil leakage.

Install new oil filter housing-to-engine front cover seals and lubricate with clean engine oil.

Material

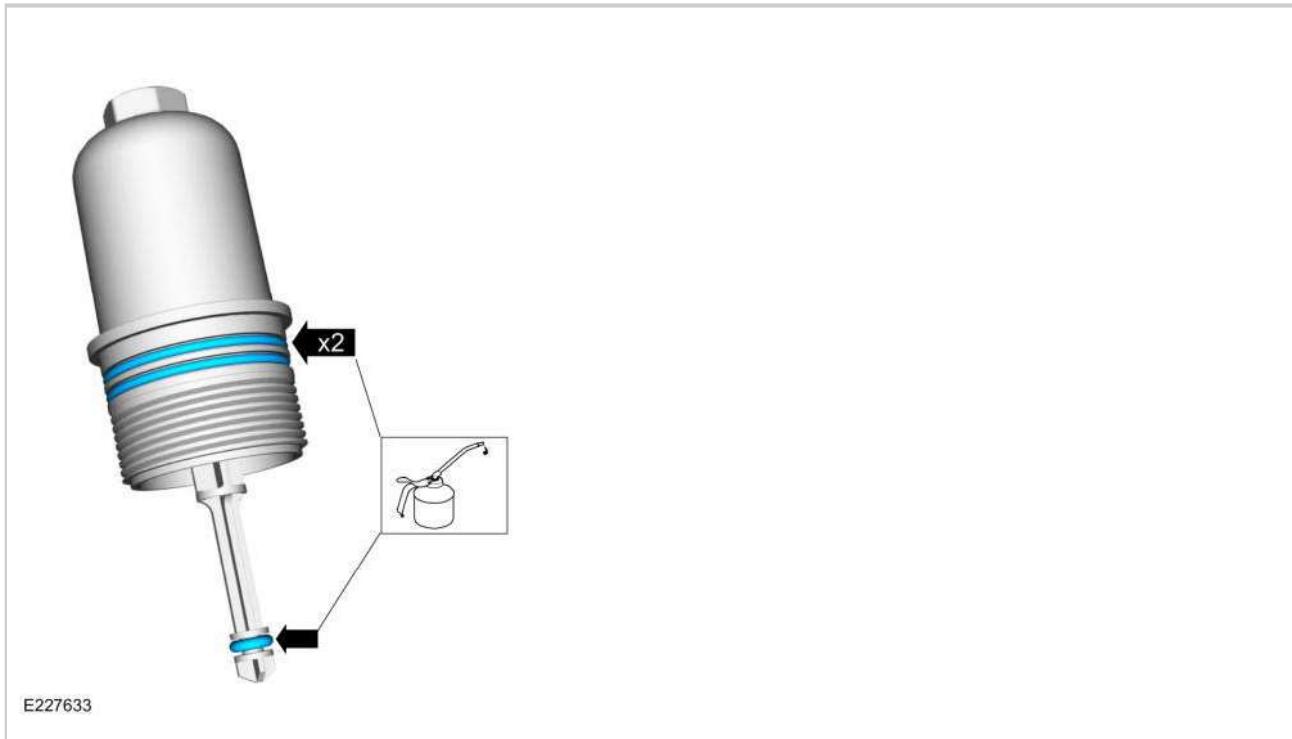
: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP (WSS-M2C946-A)

 **NOTE:** Failure to install a new oil filter housing stem-to-oil reservoir drain port seal will result with the oil flowing through the reservoir drain port and a **loss** of engine oil pressure.

Install a new oil filter housing stem-to-oil reservoir drain port seal and lubricate with clean engine oil.

Material

: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP (WSS-M2C946-A)



22.

1.

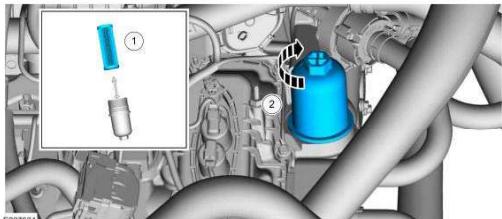
Install a new oil filter element.

2.

Install the oil filter housing.

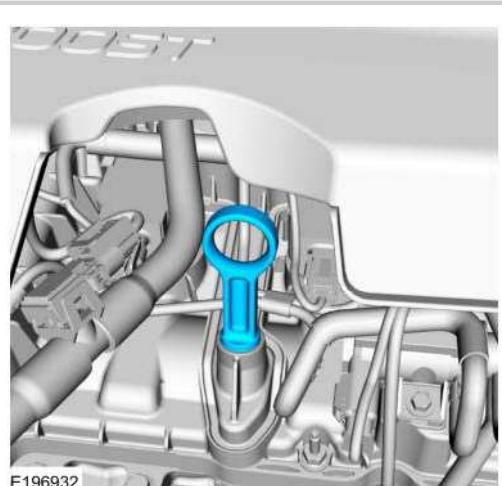
Torque

: 18 lb.ft (24 Nm)



23.

Install the oil level indicator.

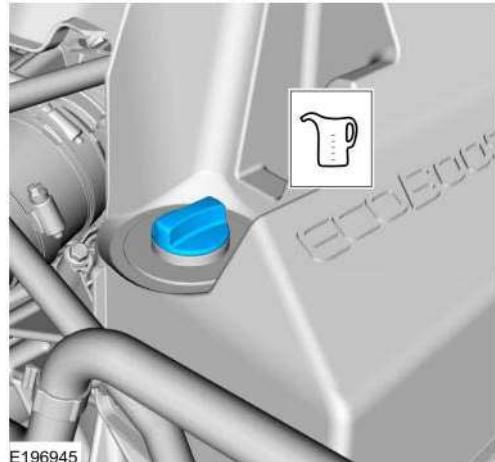


24.

Fill the engine with clean engine oil. Refer to: Specifications .

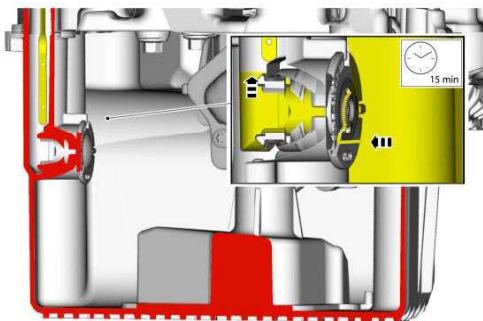
Material

: Motorcraft ® SAE 5W-30 Premium Synthetic Blend Motor Oil / XO-5W30-QSP
(WSS-M2C946-A)



25.

After filling the engine with oil, the oil must flow from the main chamber of the oil pan, through a check valve into the smaller side chamber to correctly register the oil level on the oil level indicator. This may take up to 15 minutes.



26.

Connect the battery ground cable. Refer to: Battery Disconnect and Connect .

27.

Check transmission fluid level. Refer to: Transmission Fluid Level Check .

REMOVAL AND INSTALLATION > OIL PUMP > REMOVAL



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

1.

With the vehicle in NEUTRAL, position it on a hoist. Refer to: Jacking and Lifting - Overview .

2.

Remove the oil pan. Refer to: Oil Pan .

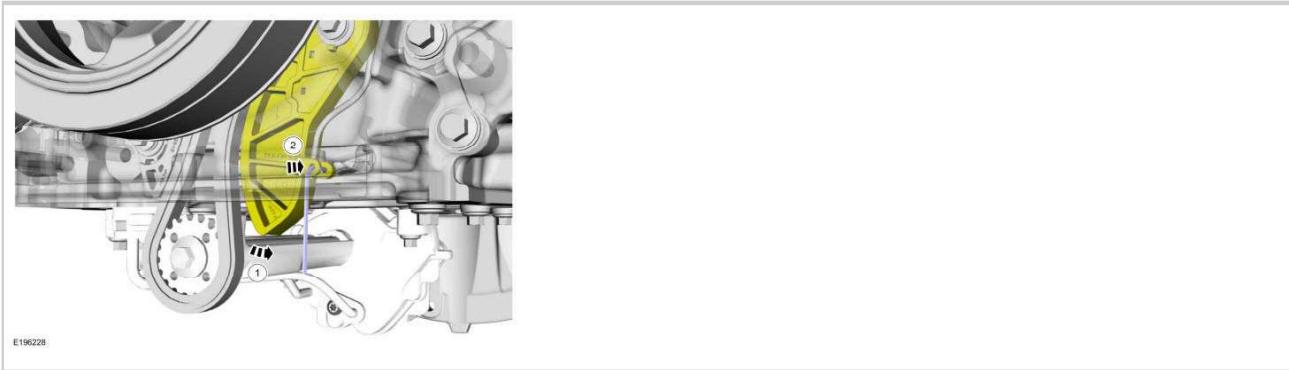
3.

1.

Rotate the oil pump drive chain tensioner counterclockwise.

2.

Insert a small hex wrench or pin into the holes of the tensioner to secure the end of the spring.



4.

1.

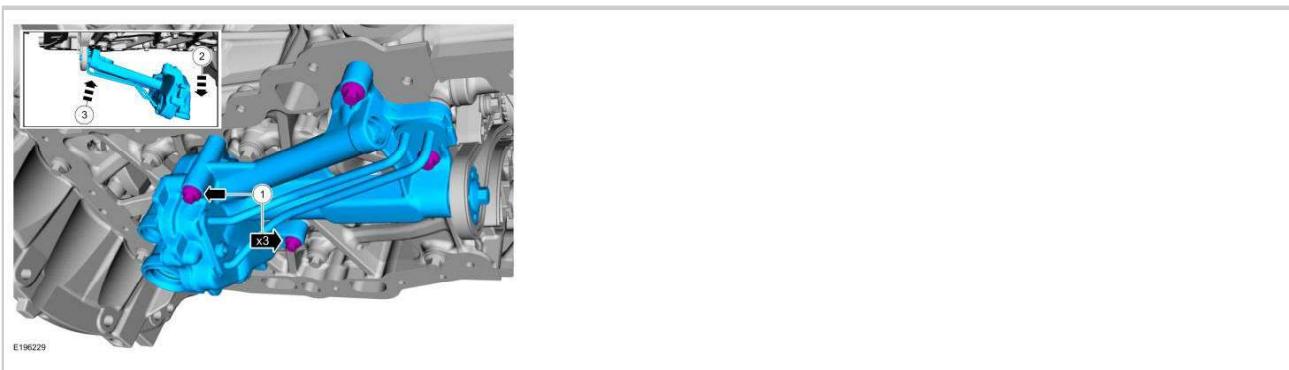
Remove the oil pump bolts.

2.

Lower the rear of the oil pump assembly.

3.

Separate the oil pump sprocket from the oil pump drive chain.



REMOVAL AND INSTALLATION > OIL PUMP > INSTALLATION

1.

1.

Install the oil pump sprocket into the oil pump drive chain.

2.

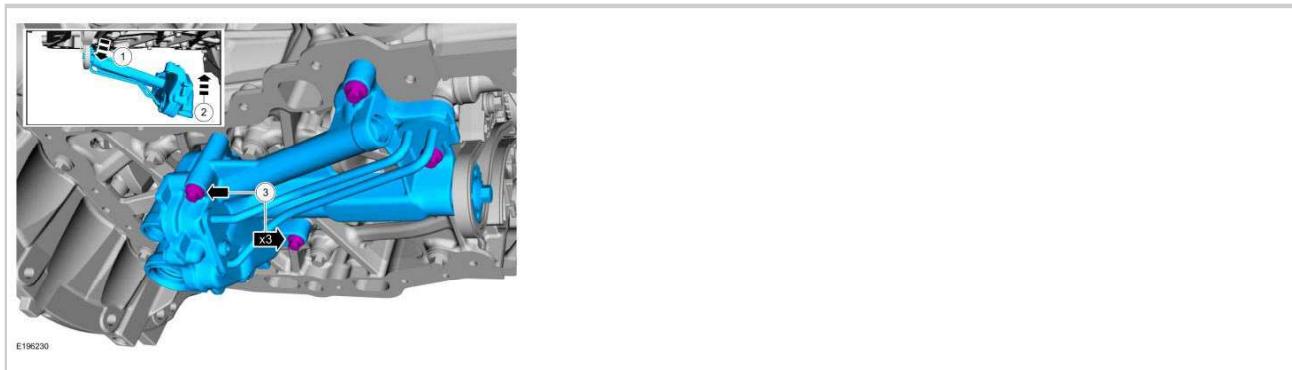
Raise the rear of the oil pump assembly into the installed position.

3.

Install the oil pump bolts.

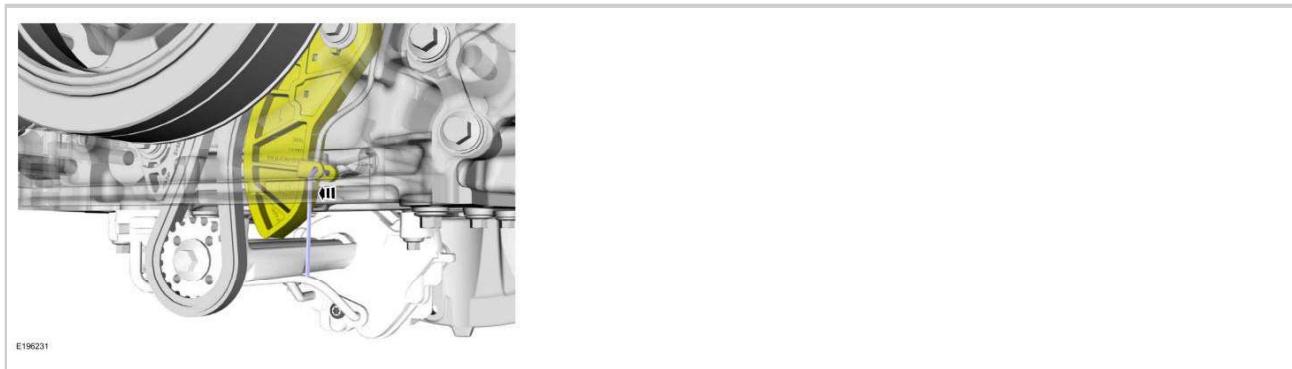
Torque

: Stage 1: 89 lb.in (10 Nm) Stage 2: 45 °



2.

Remove the pin.



3.

Install the oil pan. Refer to: Oil Pan .

REMOVAL AND INSTALLATION > TIMING CHAIN

Special Tool(s) / General Equipment

Flat-Bladed Screwdriver

Vise

Vise Jaw Protectors

REMOVAL AND INSTALLATION > TIMING CHAIN > REMOVAL

RH and LH timing chains

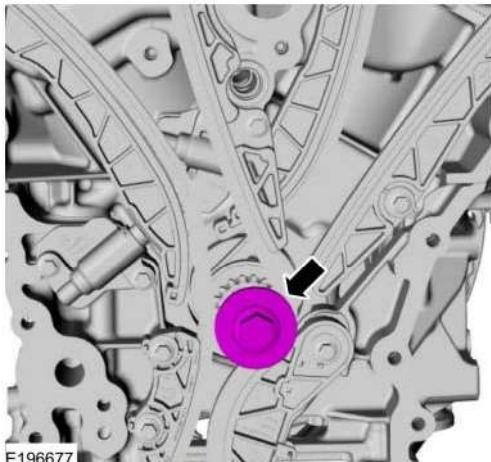
1.

Remove the engine front cover. Refer to: Engine Front Cover .

2.

 **NOTE:** Rotate the crankshaft utilizing only the original crankshaft pulley bolt. Failure to follow this direction may cause damage to the crankshaft and result in engine failure.

Install the original crankshaft pulley bolt.



3.

 **NOTE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the RH side the triangle marks are used.

1.

Rotate the crankshaft clockwise.

2.

Position the crankshaft sprocket keyway at the 11 o'clock position.

3.

Verify the **triangle** timing marks on the VCT units are at the 2 o'clock (intake) and 11 o'clock (exhaust) positions. If the **circle** timing marks are at these positions the crankshaft must be turned clockwise one revolution (360 degrees).



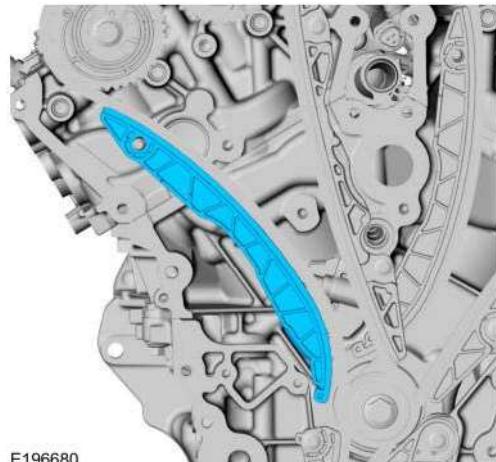
4.

Remove the bolts and the RH timing chain tensioner.



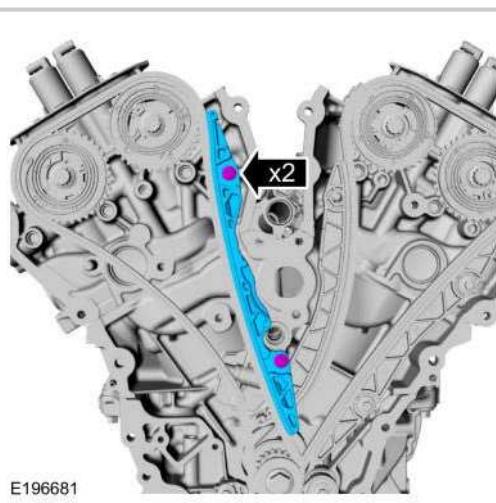
5.

Remove the RH timing chain tensioner arm.



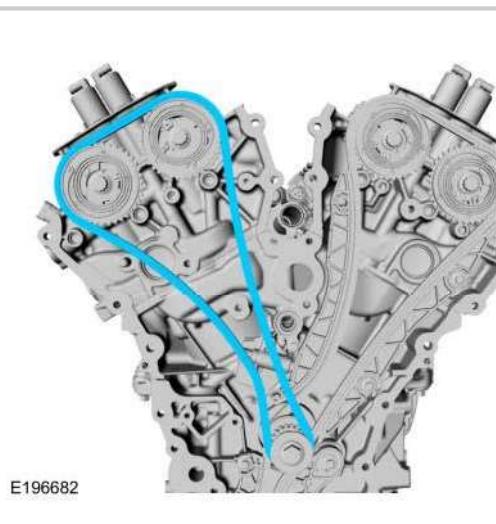
6.

Remove the bolts and the RH timing chain guide.



7.

Remove the RH timing chain.



8.

Remove the original crankshaft pulley bolt.



9.

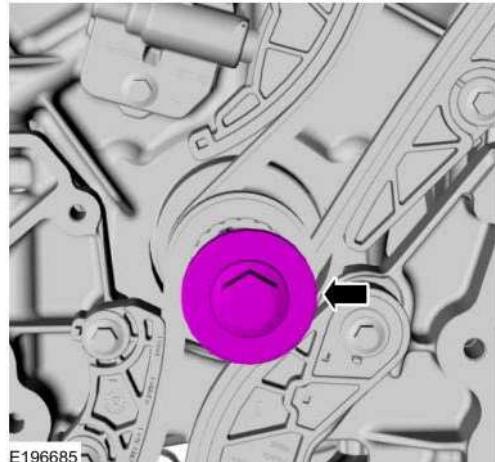
Remove the timing chain sprocket.



LH timing chain

10.

Install the original crankshaft pulley bolt.



11.

 **NOTE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the LH side the circle marks are used.

1.

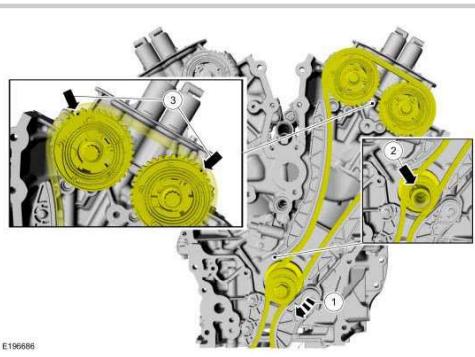
Rotate the crankshaft clockwise one revolution (360 degrees).

2.

Position the crankshaft sprocket keyway at the 11 o'clock position.

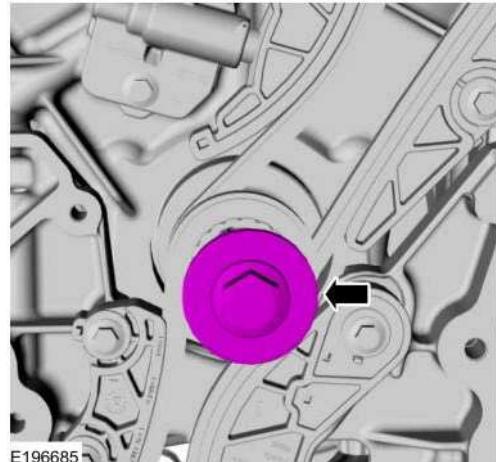
3.

The **circle** timing marks on the VCT units will be at the 10 o'clock (intake) and 12:30 (exhaust) positions.



12.

Remove the original crankshaft pulley bolt.



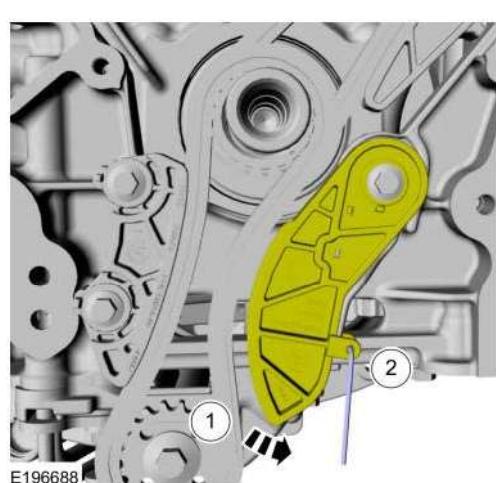
13.

1.

Rotate the oil pump drive chain tensioner counterclockwise.

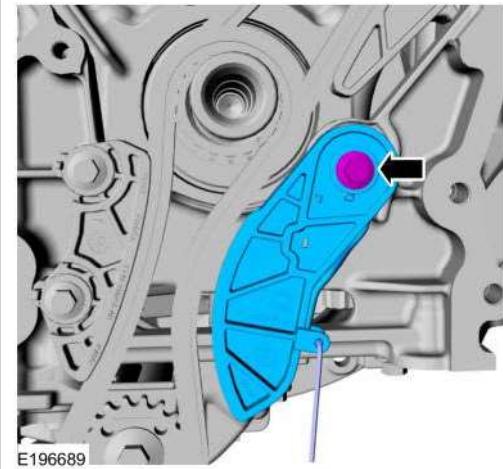
2.

Insert a small hex wrench or pin into the holes of the tensioner to secure the end of the spring.



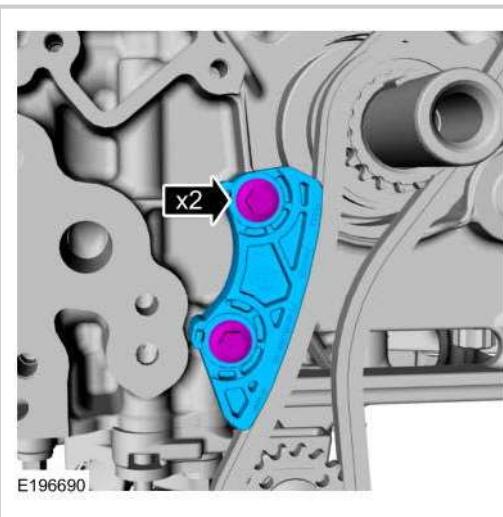
14.

Remove the bolt and oil pump drive chain tensioner.



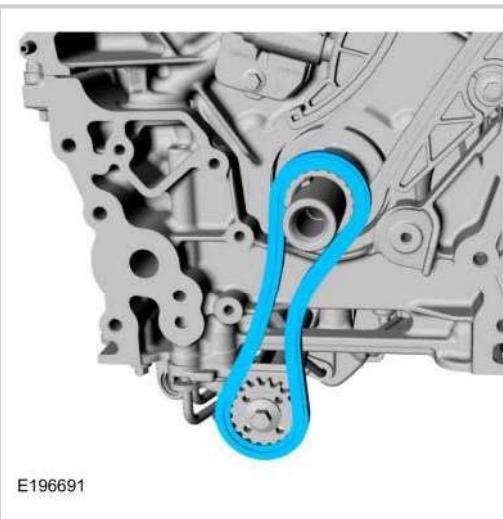
15.

Remove the bolts and oil pump drive chain guide.



16.

Remove the oil pump drive chain.



17.

Remove the bolts and the LH timing chain tensioner.



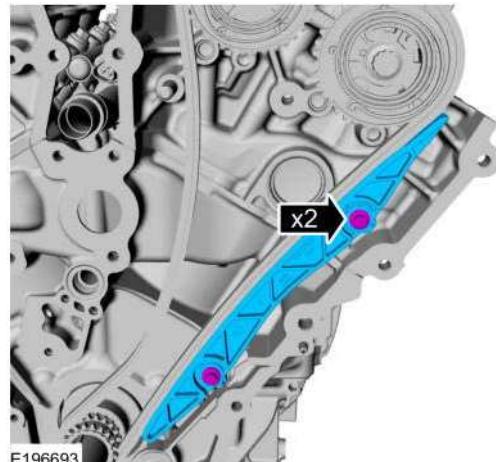
18.

Remove the LH timing chain tensioner arm.



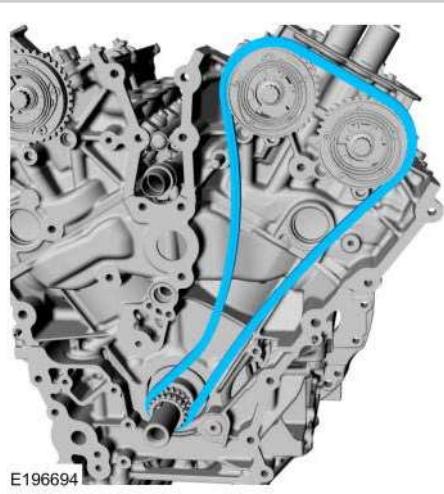
19.

Remove the bolts and the LH timing chain guide.



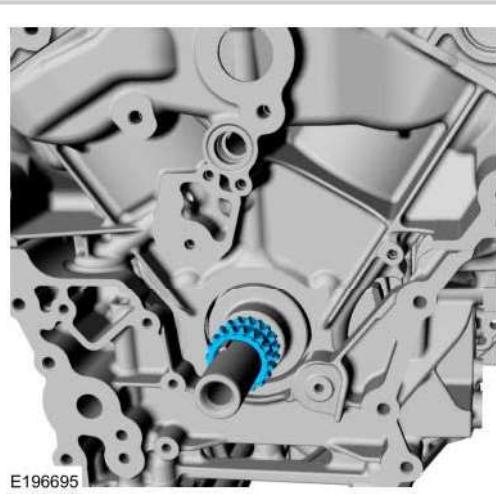
20.

Remove the LH timing chain.



21.

Remove the timing chain sprocket.



REMOVAL AND INSTALLATION > TIMING CHAIN > INSTALLATION

LH timing chain

1.

Install the timing chain sprocket.



2.

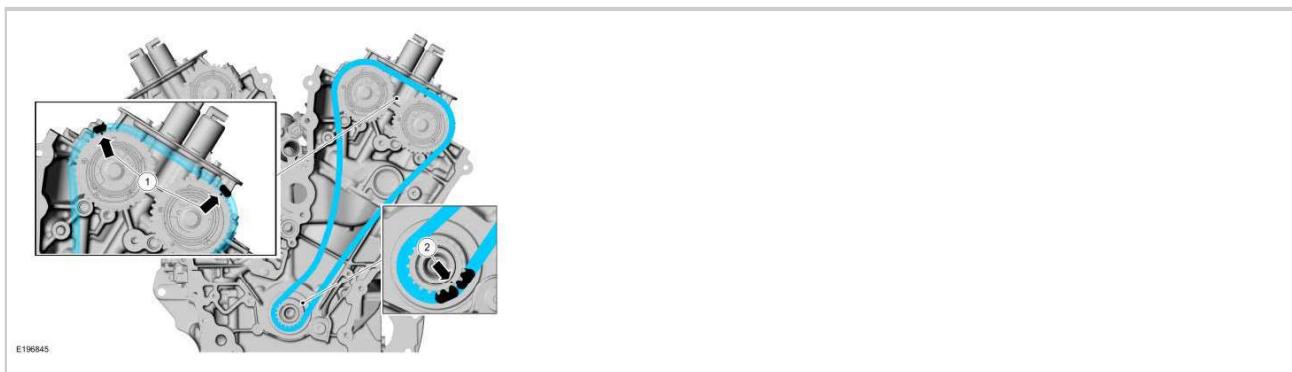
 **NOTE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the LH side the circle marks are used.

1.

Install the LH timing chain with the single colored links aligned with the **circle** timing marks on the VCT units.

2.

Install the double colored links so they straddle the timing mark on the crankshaft sprocket.



3.

Install the LH timing chain guide and bolts.

Torque

: 89 lb.in (10 Nm)



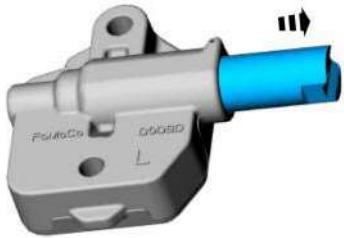
4.

Install the LH timing chain tensioner arm.



5.

Slide the tensioner cylinder out of the LH timing chain tensioner housing.



E196843

6.



NOTE: Use vise jaw protectors or cover the jaws of the vise with clean shop towels to prevent damage to the surface of the tensioner ratchet mechanism.

Mount the flat machined surfaces on the end of the tensioner cylinder into a vise.

1.

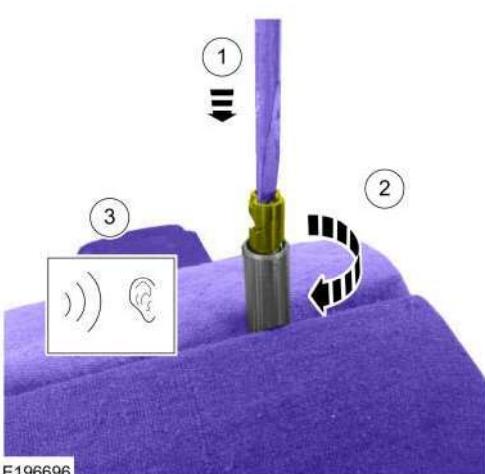
Using a flat-bladed screwdriver apply light downward pressure on the end of the tensioner ratchet mechanism. Use the General Equipment: Vise Use the General Equipment: Vise Jaw Protectors Use the General Equipment: Flat-Bladed Screwdriver

2.

Rotate the screwdriver clockwise approximately one turn.

3.

An audible click will be heard when the tensioner ratchet mechanism locks into place.



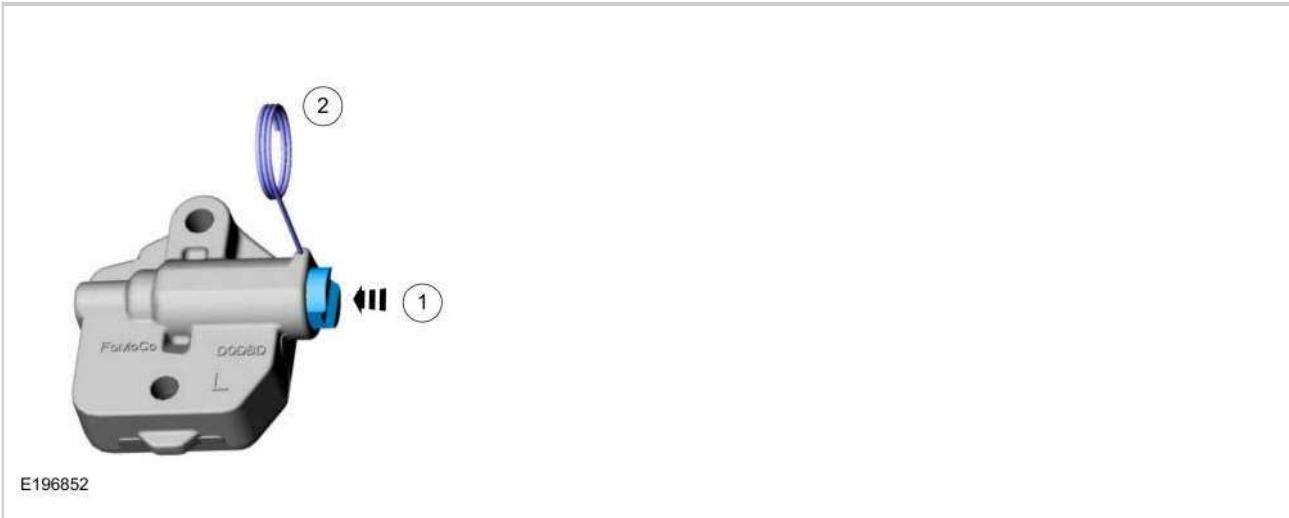
7.

1.

Slide the tensioner cylinder into the LH timing chain tensioner housing to the fully retracted position.

2.

Install a retaining pin into the hole in the housing to lock the cylinder in the retracted position.



8.

1.

Position the LH timing chain tensioner with the end of the tensioner correctly engaged to the tensioner arm.

2.

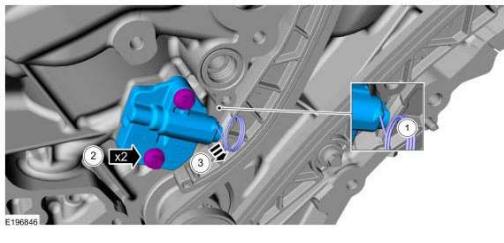
Install the bolts.

Torque

: 89 lb.in (10 Nm)

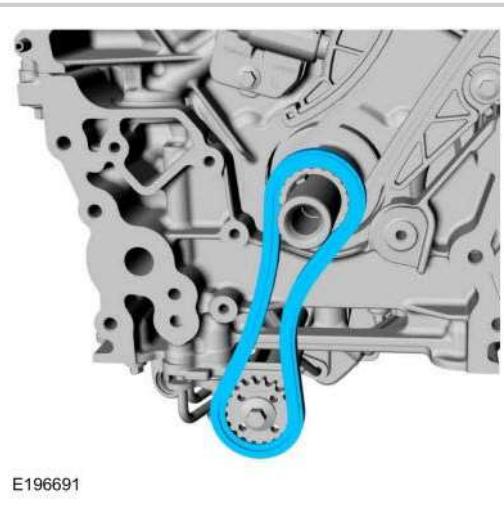
3.

Remove the pin.



9.

Install the oil pump drive chain.



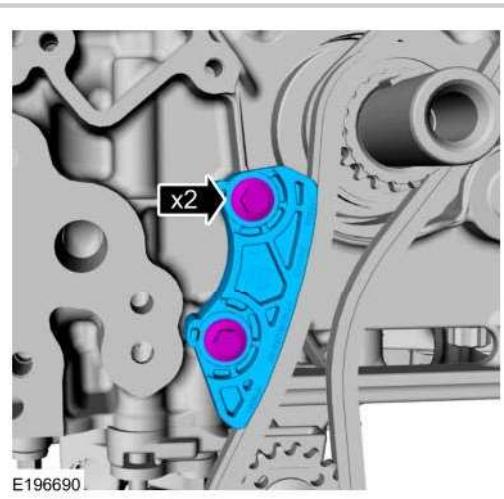
E196691

10.

Install oil pump drive chain guide and bolts.

Torque

: 89 lb.in (10 Nm)



E196690

11.

1.

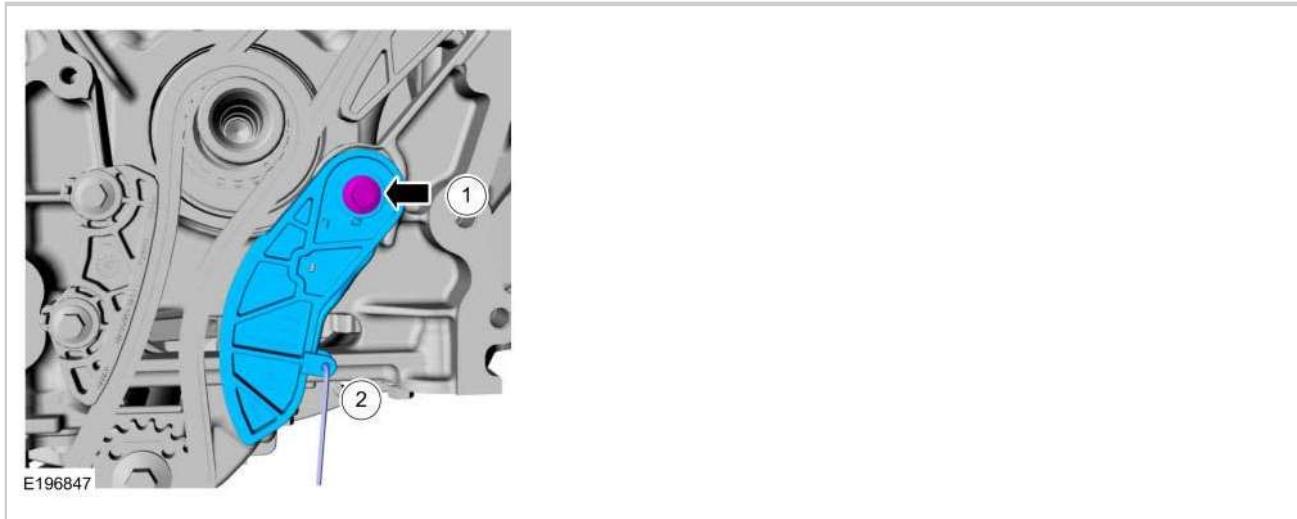
Install the oil pump drive chain tensioner and bolt.

Torque

: 89 lb.in (10 Nm)

2.

Remove the pin.



12.

Install the original crankshaft pulley bolt.



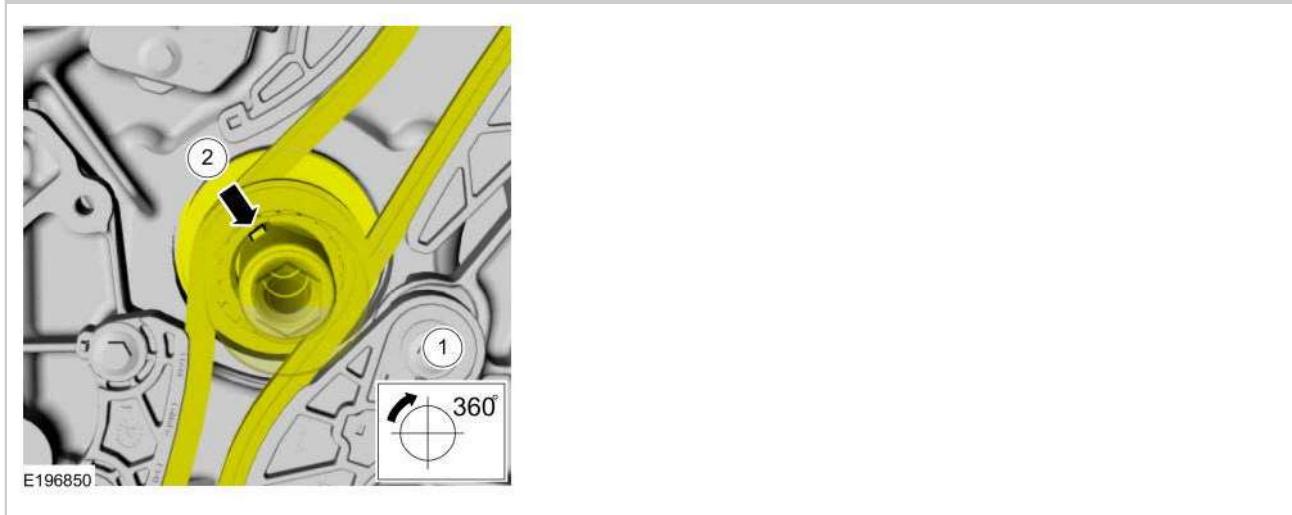
13.

1.

Rotate the crankshaft clockwise one revolution (360 degrees).

2.

Position the crankshaft sprocket keyway at the 11 o'clock position.



14.

Remove and discard the original crankshaft pulley bolt.



RH and LH timing chains

15.

Install the timing chain sprocket.



16.

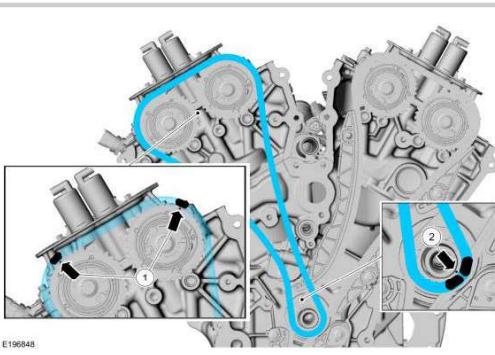
 **NOTE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the RH side the triangle marks are used.

1.

Install the RH timing chain with the single colored links aligned with the **triangle** timing marks on the VCT units.

2.

Install the double colored links so they straddle the timing mark on the crankshaft sprocket.



17.

Install the RH timing chain guide and bolts.

Torque

: 89 lb.in (10 Nm)



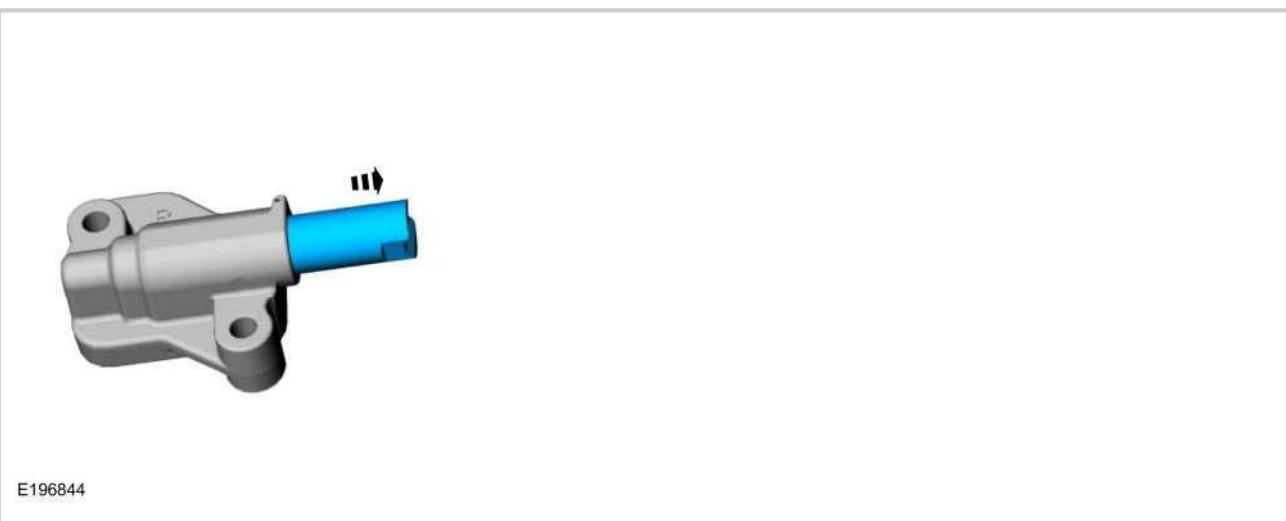
18.

Install the RH timing chain tensioner arm.



19.

Slide the tensioner cylinder out of the RH timing chain tensioner housing.



20.



NOTE: Use vise jaw protectors or cover the jaws of the vise with clean shop towels to prevent damage to the surface of the tensioner ratchet mechanism.

Mount the flat machined surfaces on the end of the tensioner cylinder into a vise.

1.

Using a flat-bladed screwdriver apply light downward pressure on the end of the tensioner ratchet mechanism. Use the General Equipment: Vise Use the General Equipment: Vise Jaw Protectors Use the General Equipment: Flat-Bladed Screwdriver

2.

Rotate the screwdriver clockwise approximately one turn.

3.

An audible click will be heard when the tensioner ratchet mechanism locks into place.



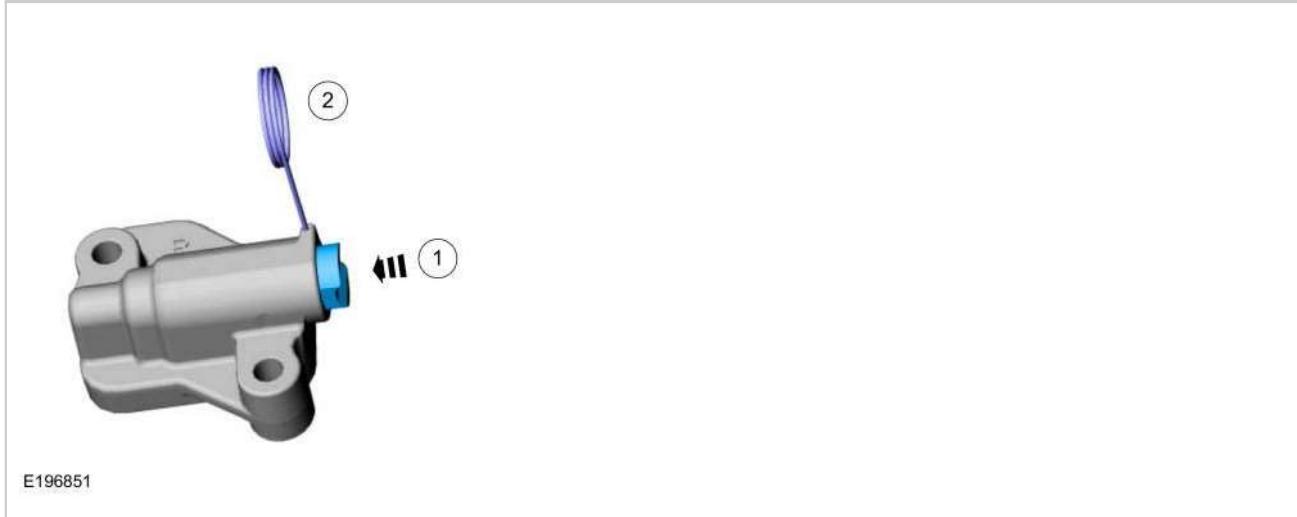
21.

1.

Slide the tensioner cylinder into the RH timing chain tensioner housing to the fully retracted position.

2.

Install a retaining pin into the hole in the housing to lock the cylinder in the retracted position.



22.

1.

Position the RH timing chain tensioner with the end of the tensioner correctly engaged to the tensioner arm.

2.

Install the bolts.

Torque

: 89 lb.in (10 Nm)

3.

Remove the pin.

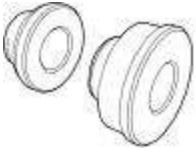


23.

Install the engine front cover. Refer to: Engine Front Cover .

REMOVAL AND INSTALLATION > VALVE COVER LH

Special Tool(s) / General Equipment

 E133913	205-153 (T80T-4000-W) Handle
 E175042	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
Plastic Scraper	

Materials

Name	Specification
Motorcraft ® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft ® Silicone Gasket Remover ZC-30-A	-
Motorcraft ® Metal Surface Prep ZC-31-B	-
Metal Brake Parts Cleaner PM-4-A, PM-4-B	-

REMOVAL AND INSTALLATION > VALVE COVER LH > REMOVAL



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

1.

With the vehicle in NEUTRAL, position it on a hoist. Refer to: Jacking and Lifting - Overview .

2.

Disconnect the battery ground cable. Refer to: Battery Disconnect and Connect .

3.

1.

Remove the nuts.

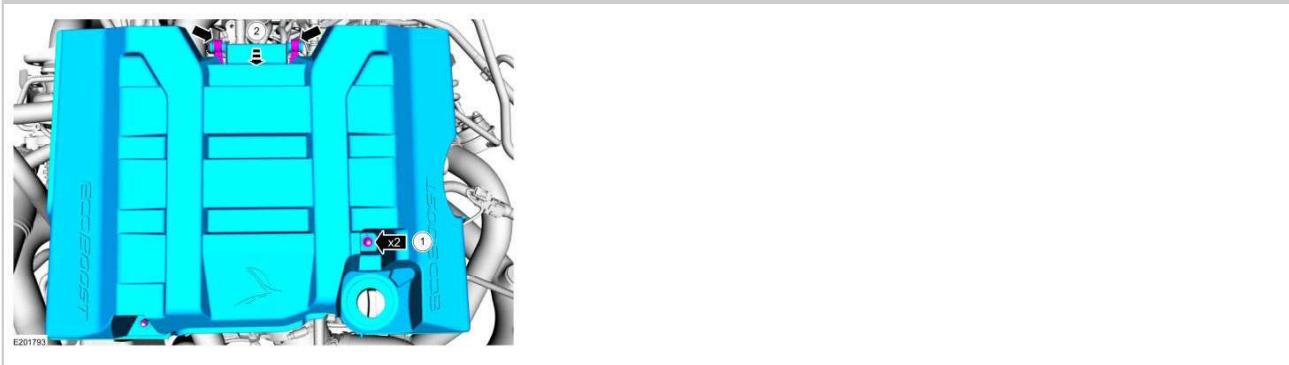
2.

Slide the engine appearance cover out of the retaining bracket.

If the engine appearance cover stud bolts are loosened or removed, they must be installed/tightened into the intake manifold.

Torque

: 62 lb.in (7 Nm)



4.

Remove the following items:

Refer to: AIR CLEANER .

Refer to: AIR CLEANER OUTLET PIPE LH

LH CAC intake pipe. Refer to: CHARGE AIR COOLER (CAC) INTAKE PIPE .

Refer to: THROTTLE BODY .

5.

1.

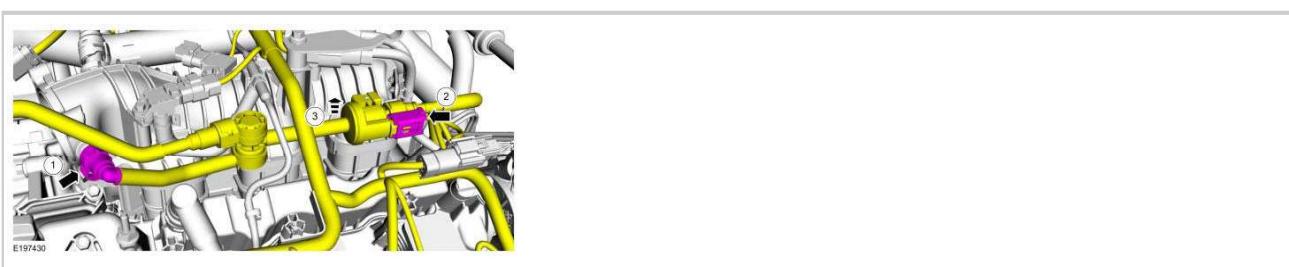
Disconnect the EVAP tube quick release coupling. Refer to: QUICK RELEASE COUPLING .

2.

Disconnect the EVAP purge valve electrical connector.

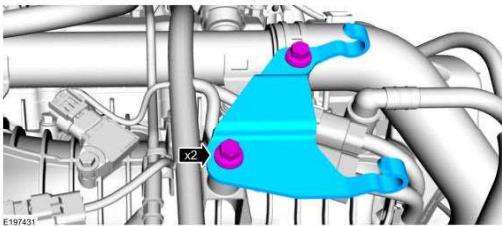
3.

Lift the EVAP purge valve off of the intake manifold mounting tab.



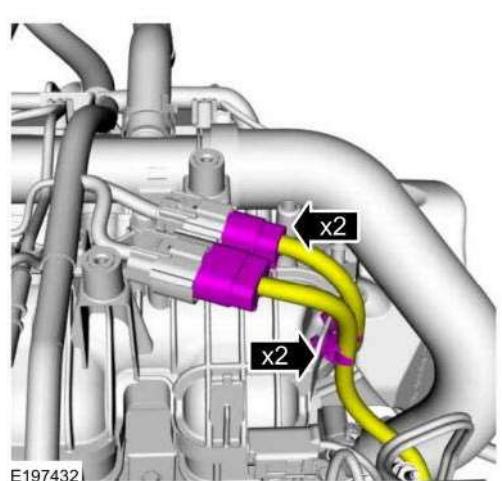
6.

Remove the bolts and the engine appearance cover bracket.



7.

Disconnect the engine wiring harness electrical connectors and retainers.



8.

1.

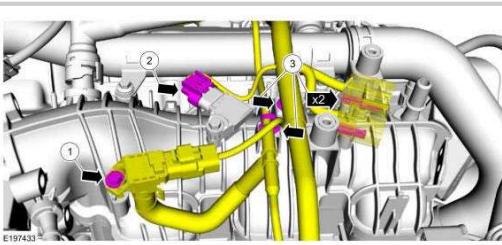
Remove the vacuum harness pressure sensor bolt.

2.

Disconnect the MAP sensor electrical connector.

3.

Detach the wiring harness and vacuum harness retainers.



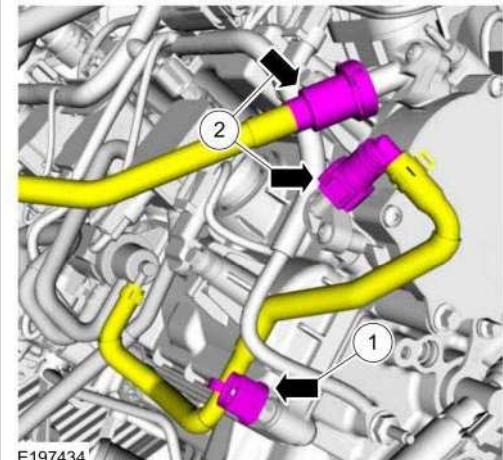
9.

1.

Detach the vacuum tube retainer.

2.

Disconnect the vacuum tube quick release couplings. Refer to: QUICK RELEASE COUPLING .



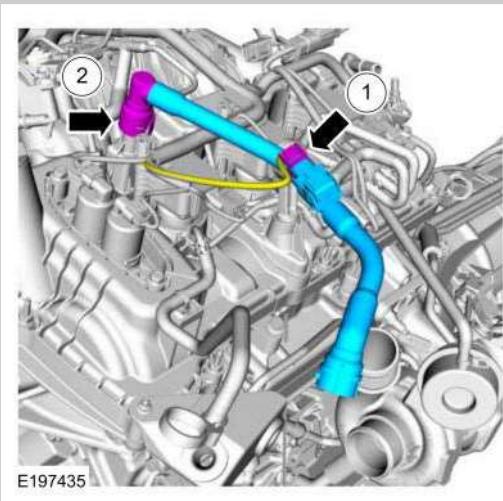
10.

1.

Disconnect the crankcase pressure sensor electrical connector.

2.

Disconnect the PCV tube quick release coupling. Refer to: QUICK RELEASE COUPLING



11.

1.

Disconnect the TC vacuum supply hose.

2.

Disconnect the engine wiring harness electrical connectors.

3.

Remove the bolts and position the TC control solenoid aside.

4.

Disconnect the vacuum hose retaining clip.

5.

Detach the vacuum hose retainers.



12.

Disconnect the VCT and CMP sensor electrical connectors.

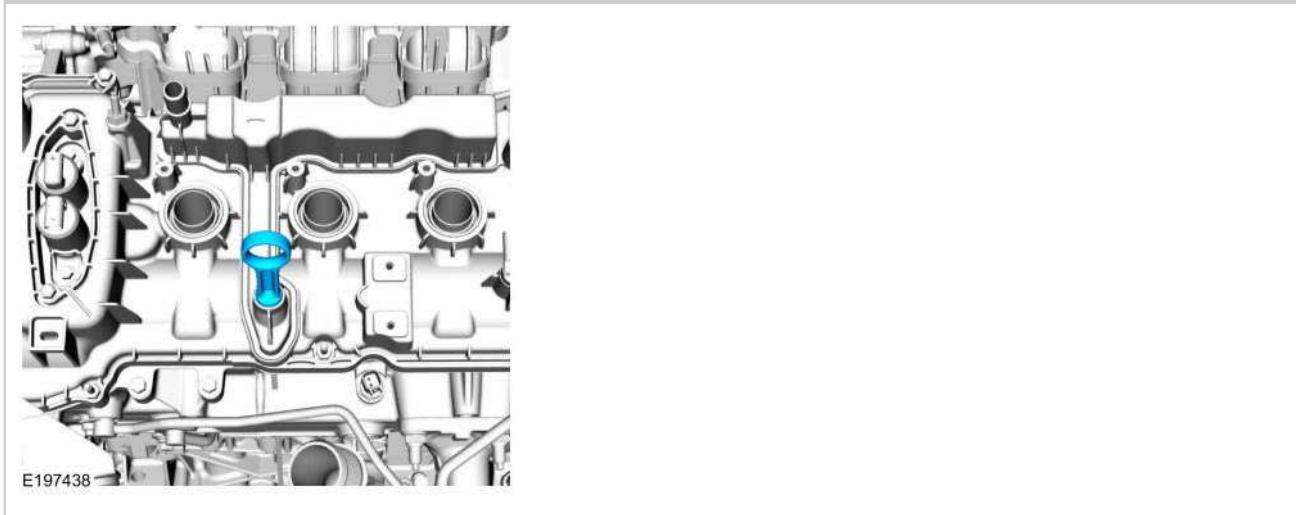


13.

Remove the LH coil-on-plugs. Refer to: IGNITION COIL-ON-PLUG

14.

Remove the oil level indicator.



15.

Remove the nuts and the bracket.



16.

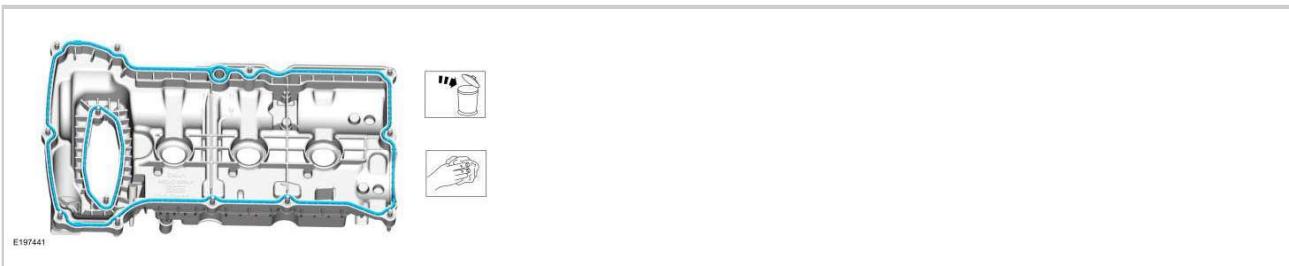
Loosen the fasteners and remove the valve cover.



17.

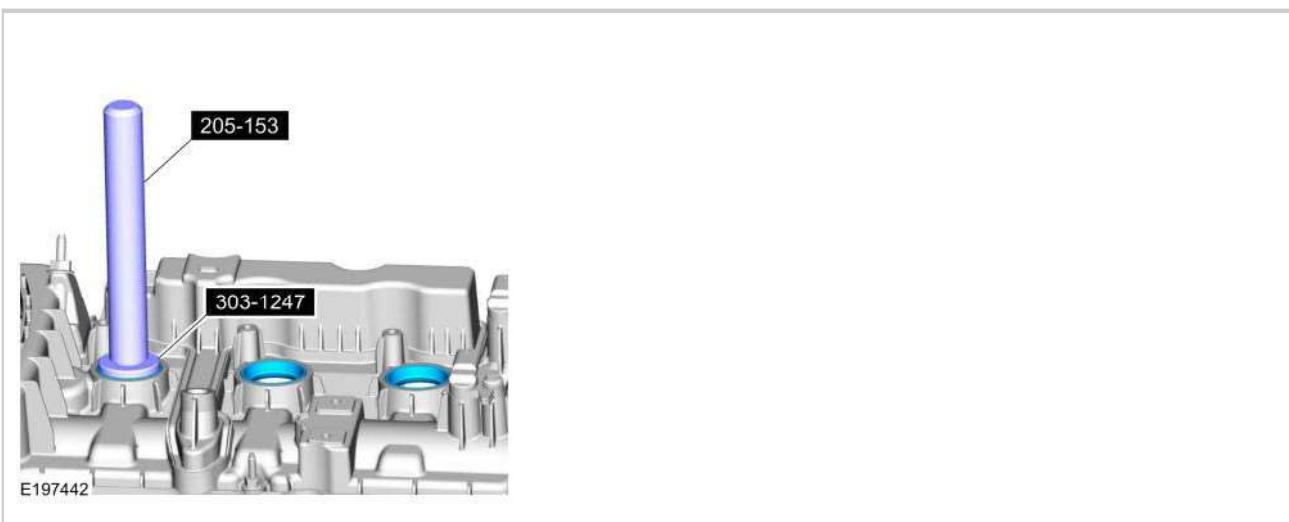
Remove and discard the gasket.

Clean the valve cover gasket groove with soap and water or a suitable solvent.



18.

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.



19.

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

Clean the valve cover mating surface of the cylinder head and engine front cover. Refer to: RTV Sealing Surface Cleaning and Preparation . Use the General Equipment: Plastic Scraper

Material

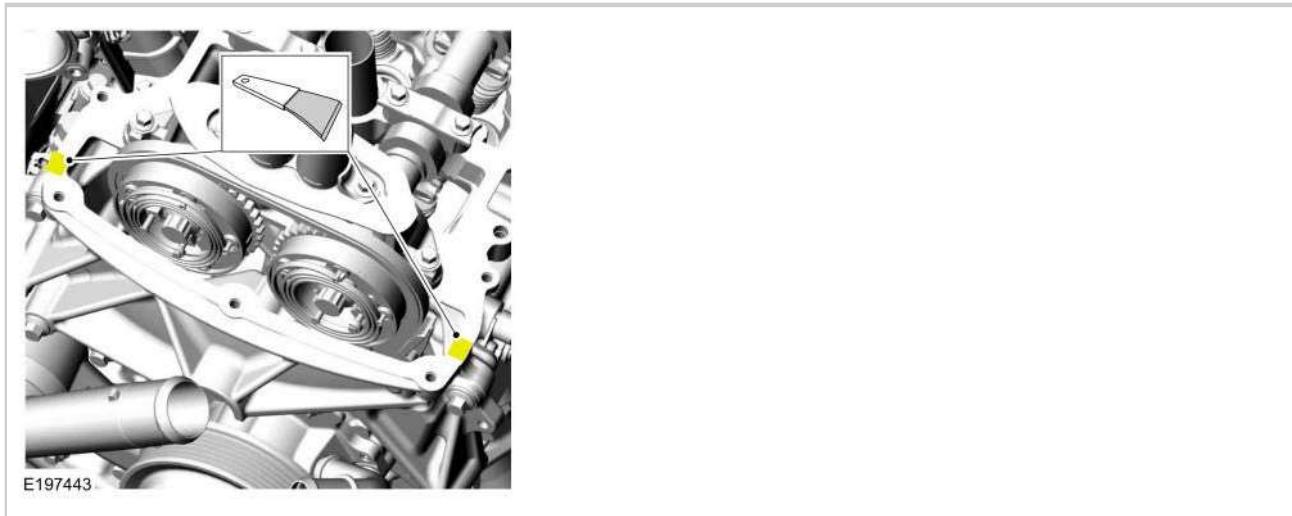
: Motorcraft ® Silicone Gasket Remover / ZC-30-A

Material

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

Material

: Metal Brake Parts Cleaner / PM-4-A, PM-4-B



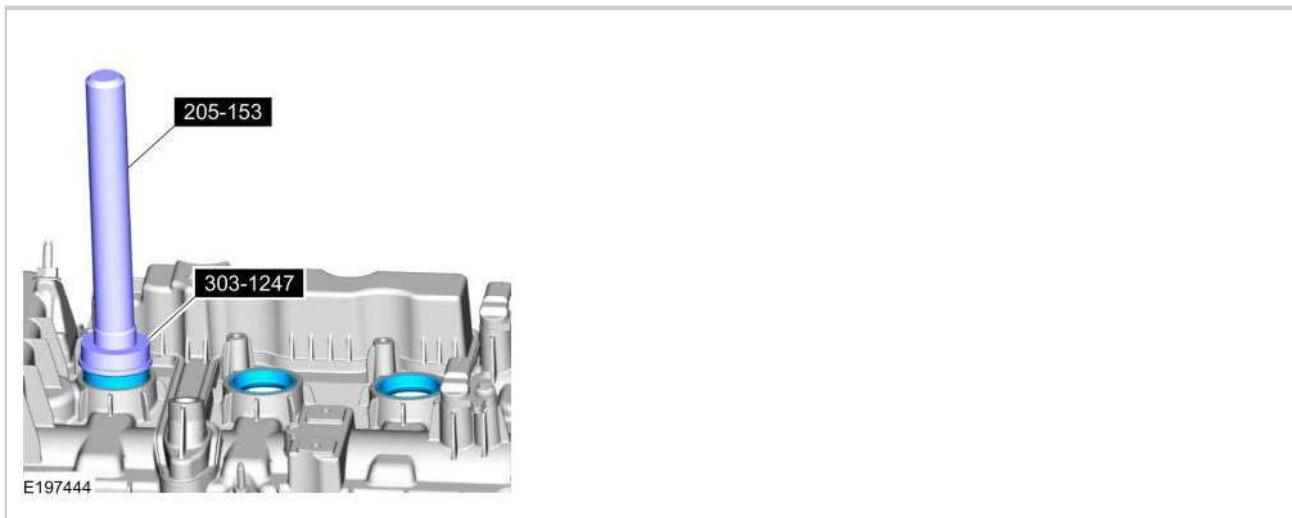
REMOVAL AND INSTALLATION > VALVE COVER LH > INSTALLATION

1.



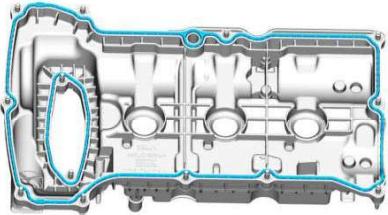
NOTE: Installation of new seals is only required if damaged seals were removed.

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.

Install a new gasket.



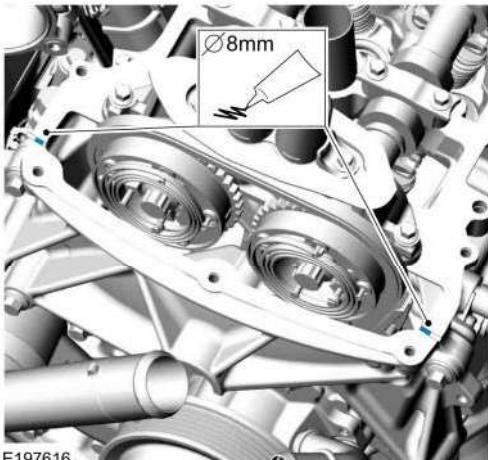
3.

 **NOTE:** If the valve cover is not installed and the fasteners tightened within 10 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of Motorcraft ® High Performance Engine RTV Silicone to the engine front cover-to-cylinder head joints.

Material

: Motorcraft ® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)



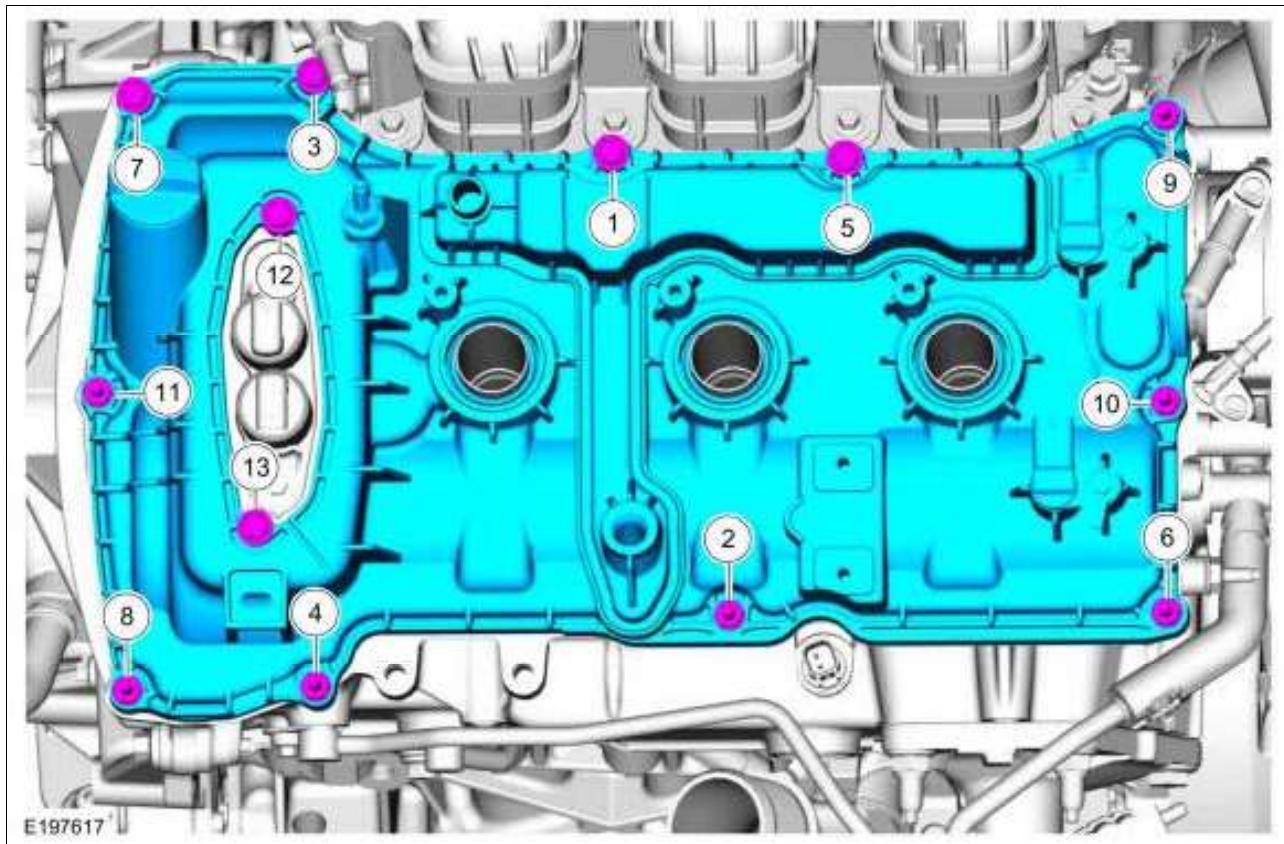
4.

Install the valve cover and tighten the bolts.

Torque

: 89 lb.in (10 Nm)

Fig 1: LH Valve Cover Bolts Tightening Sequence



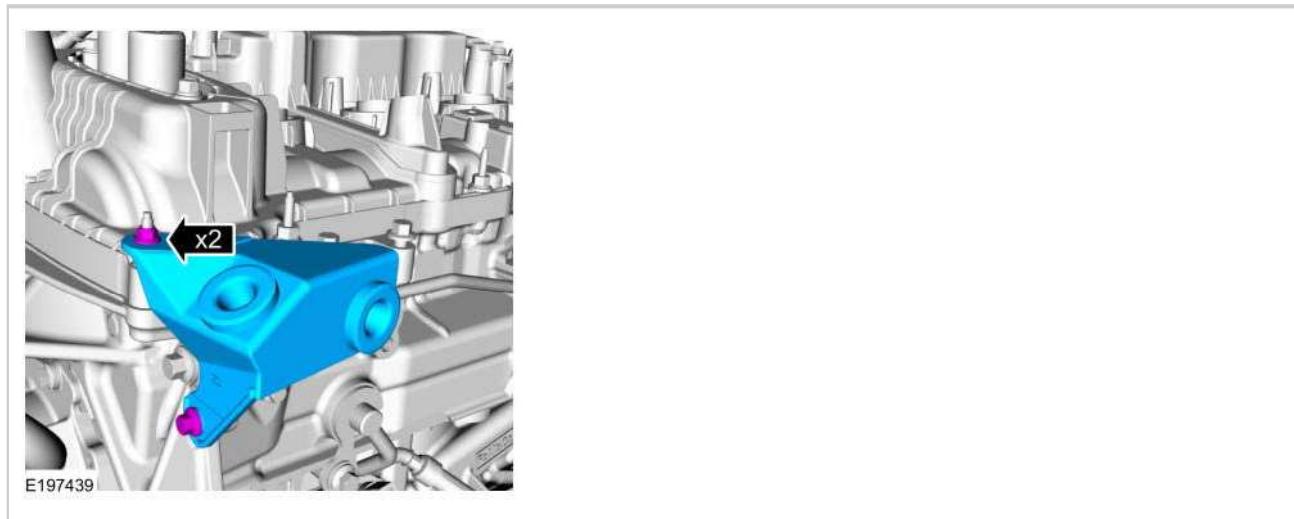
Courtesy of FORD MOTOR CO.

5.

Install the bracket and the nuts.

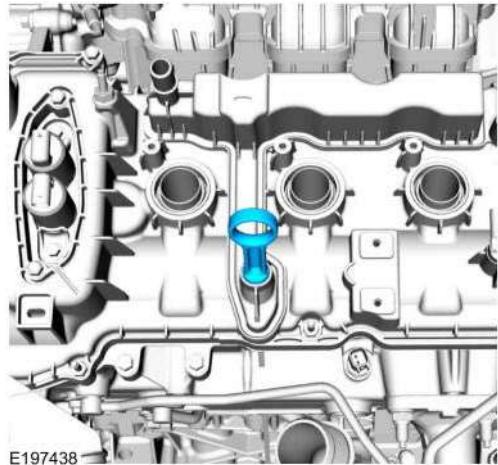
Torque

: 89 lb.in (10 Nm)



6.

Install the oil level indicator.

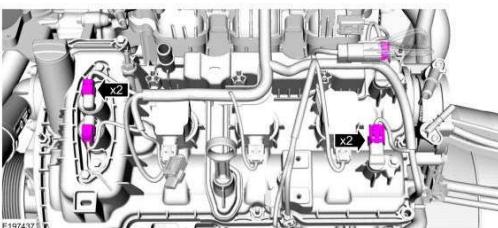


7.

Install the LH coil-on-plugs. Refer to: IGNITION COIL-ON-PLUG

8.

Connect the VCT and CMP sensor electrical connectors.



9.

1.

Attach the vacuum hose retainers.

2.

Connect the vacuum hose retaining clip.

3.

Install the TC control solenoid and the bolts.

Torque

: 62 lb.in (7 Nm)

4.

Connect the engine wiring harness electrical connectors.

5.

Connect the TC vacuum supply hose.



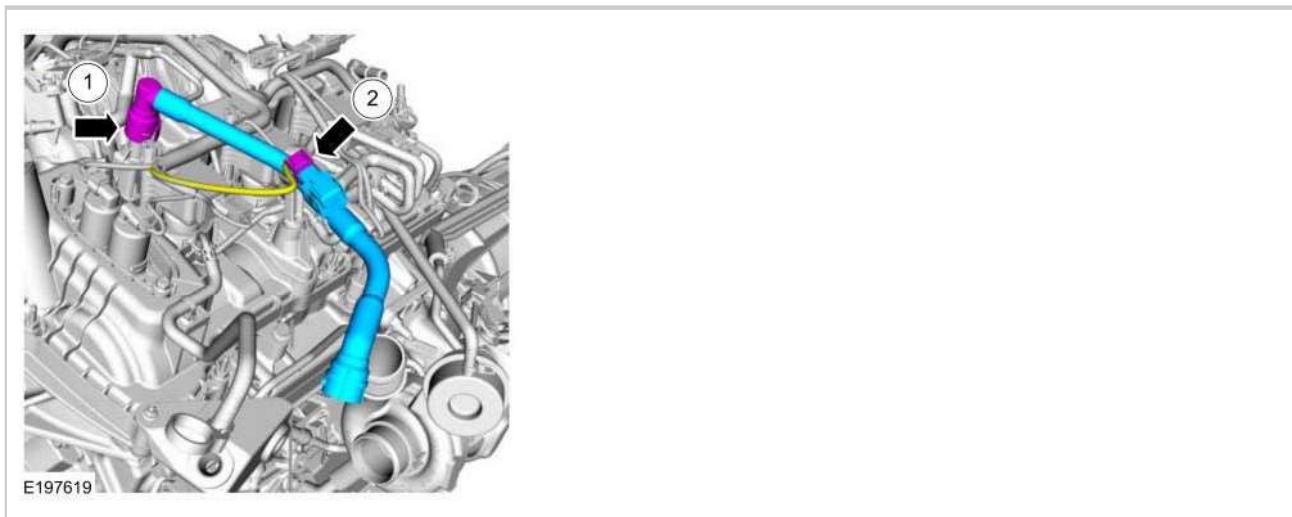
10.

1.

Connect the PCV tube quick release coupling. Refer to: QUICK RELEASE COUPLING

2.

Connect the crankcase pressure sensor electrical connector.



11.

1.

Connect the vacuum tube quick release couplings. Refer to: QUICK RELEASE COUPLING

2.

Attach the vacuum tube retainer.



12.

1.

Position the vacuum harness pressure sensor and install the bolt.

Torque

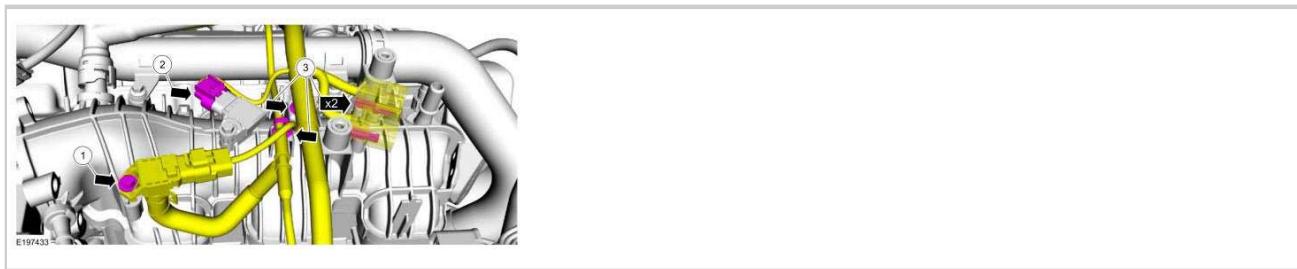
: 62 lb.in (7 Nm)

2.

Connect the MAP sensor electrical connector.

3.

Attach the wiring harness and vacuum harness retainers.



13.

Connect the engine wiring harness electrical connectors and retainers.

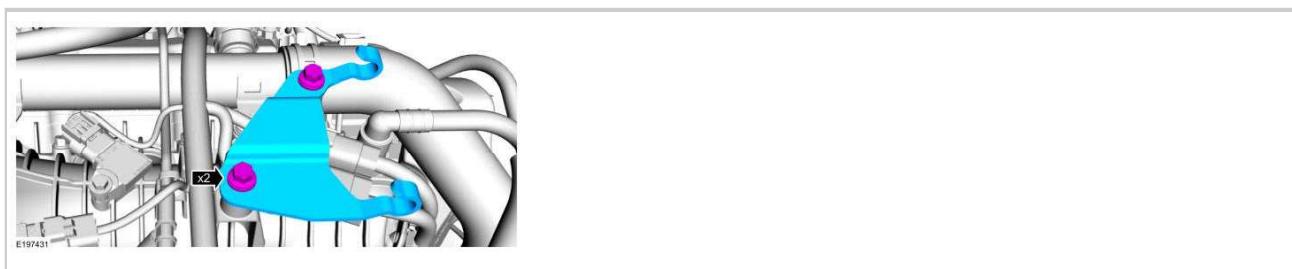


14.

Install the engine appearance cover bracket and the bolts.

Torque

: 97 lb.in (11 Nm)



15.

1.

Slide the EVAP purge valve onto the intake manifold mounting tab.

2.

Connect the EVAP purge valve electrical connector.

3.

Connect the EVAP tube quick release coupling. Refer to: QUICK RELEASE COUPLING



16.

Install the following items:

Refer to: THROTTLE BODY

LH CAC intake pipe. Refer to: CHARGE AIR COOLER (CAC) INTAKE PIPE .

Refer to: AIR CLEANER OUTLET PIPE LH .

Refer to: AIR CLEANER .

17.

1.

Slide the engine appearance cover into the retaining bracket.

2.

Install the nuts.

Torque

: 44 lb.in (5 Nm)



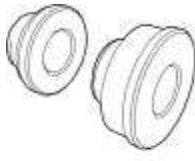
18.

Connect the battery ground cable. Refer to: Battery Disconnect and Connect .

REMOVAL AND INSTALLATION > VALVE COVER RH

Special Tool(s) / General Equipment

A photograph of a long, thin metal handle with a black grip at the top and a pointed end. Below it is the part number E133913.	205-153 (T80T-4000-W) Handle
--	------------------------------



E175042

303-1247 VCT Spark Plug Tube Seal Remover and
Installer TKIT-2006UF-FLM TKIT-2006UF-ROW

Plastic Scraper

Hose Clamp Remover/Installer

Materials

Name	Specification
Motorcraft ® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6
Motorcraft ® Silicone Gasket Remover ZC-30-A	-
Motorcraft ® Metal Surface Prep ZC-31-B	-
Metal Brake Parts Cleaner PM-4-A, PM-4-B	-

REMOVAL AND INSTALLATION > VALVE COVER RH > REMOVAL



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

1.

With the vehicle in NEUTRAL, position it on a hoist. Refer to: Jacking and Lifting - Overview .

2.

Drain the engine cooling system. Refer to: COOLING SYSTEM DRAINING AND VACUUM FILLING

3.

1.

Remove the nuts.

2.

Slide the engine appearance cover out of the retaining bracket.

If the engine appearance cover stud bolts are loosened or removed, they must be installed/tightened into the intake manifold.

Torque

: 62 lb.in (7 Nm)



4.

Remove the following items:

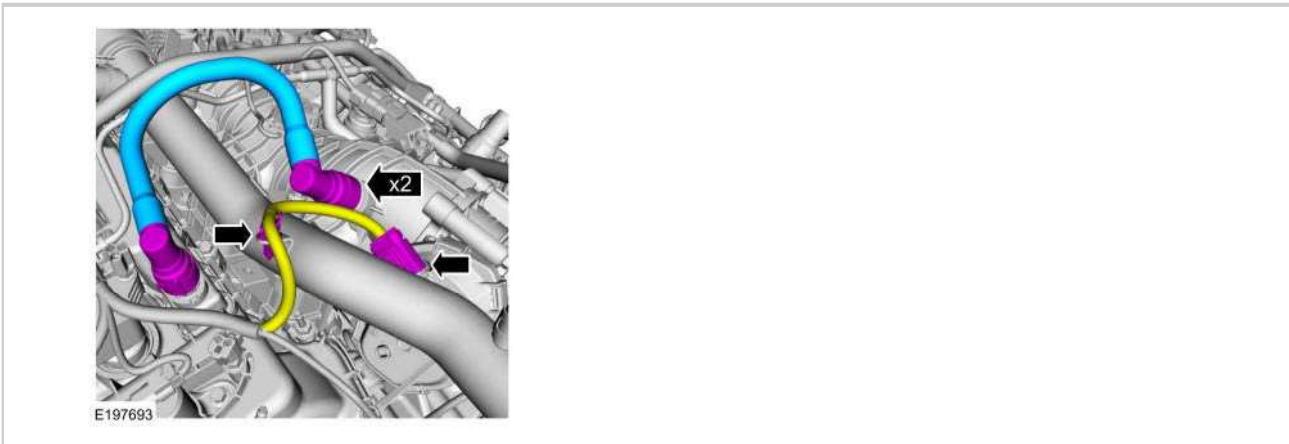
Refer to: AIR CLEANER OUTLET PIPE RH .

RH CAC intake pipe. Refer to: CHARGE AIR COOLER (CAC) INTAKE PIPE .

5.

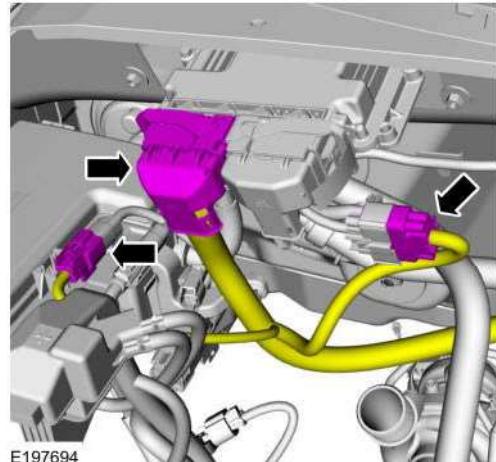
Disconnect the PCV tube quick release couplings and remove the tube. Refer to: QUICK RELEASE COUPLING

Disconnect the throttle body electrical connector and wiring harness retainer.



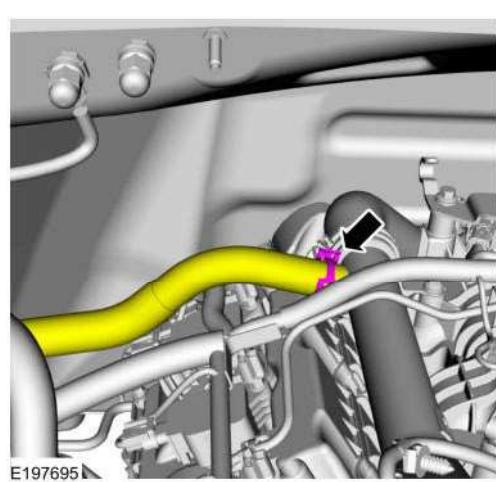
6.

Disconnect the engine wiring harness electrical connectors.



7.

Release the clamp and disconnect the heater hose. Use the General Equipment: Hose Clamp Remover/Installer



8.

1.

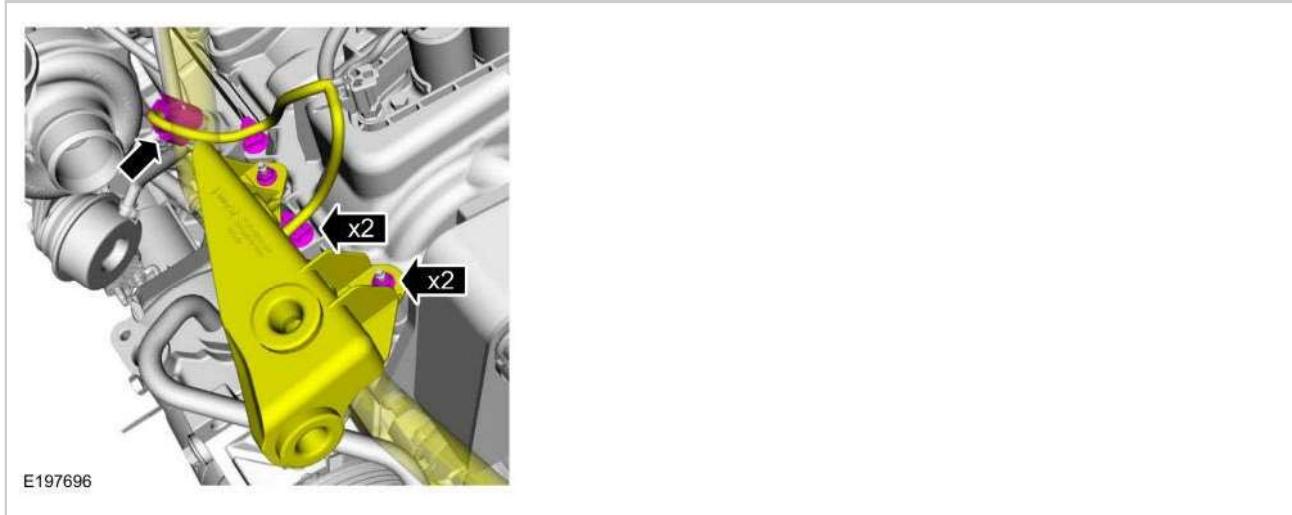
Remove the nuts and position the bracket and heater hose aside.

2.

Disconnect the EOP switch electrical connector.

3.

Detach the wiring harness retainers.



9.

1.

Disconnect VCT solenoid electrical connectors.

2.

Detach the wiring harness retainers.



10.

1.

Release the clamp and disconnect the coolant hose. Use the General Equipment: Hose Clamp Remover/Installer

2.

Remove the bolts and position the coolant pipe aside.



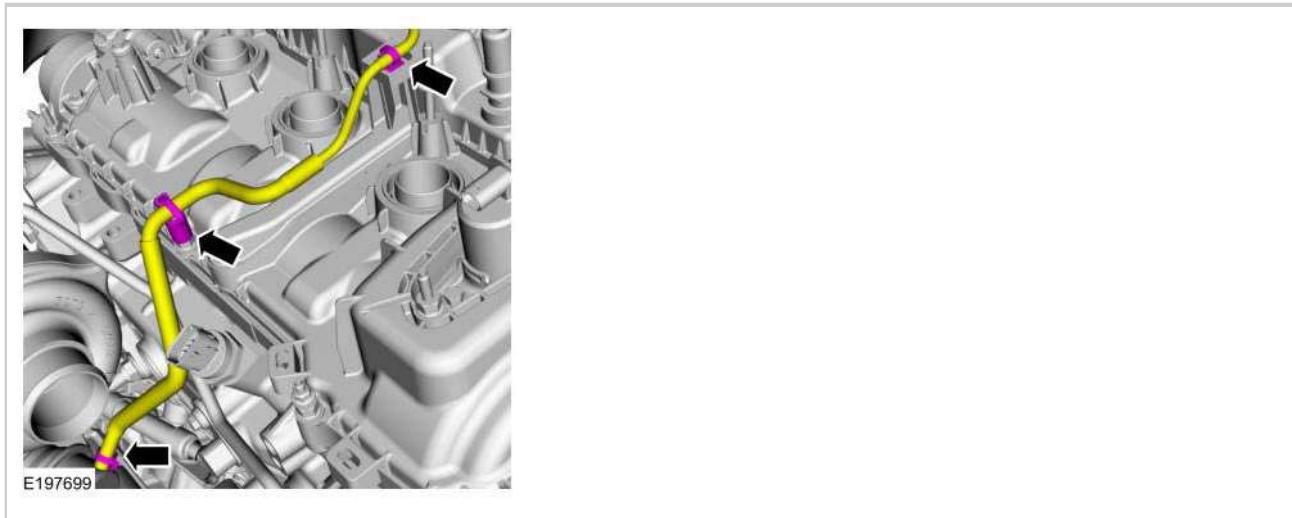
11.

Remove the RH coil-on-plugs. Refer to: IGNITION COIL-ON-PLUG

12.

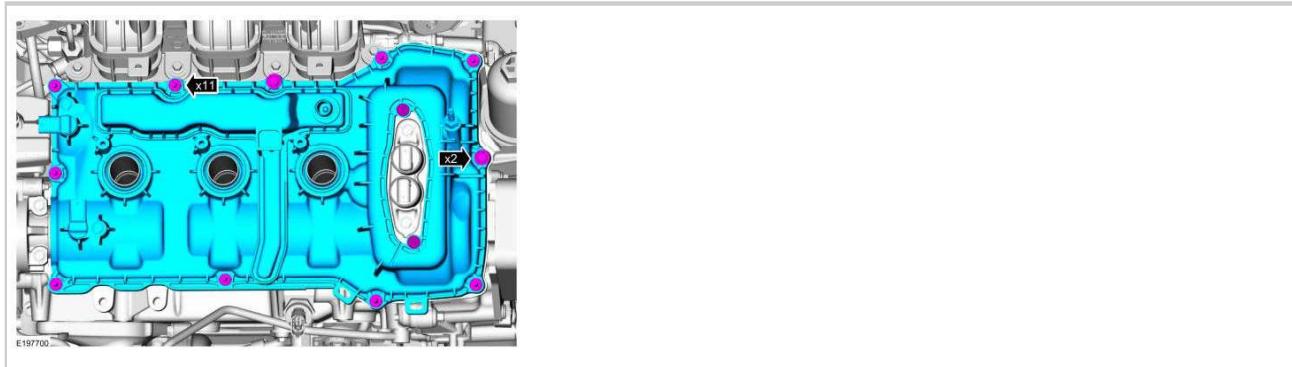
Disconnect the TC vacuum supply hose. Use the General Equipment: Hose Clamp Remover/Installer

Detach the vacuum hose retainers.



13.

Loosen the fasteners and remove the valve cover.



14.

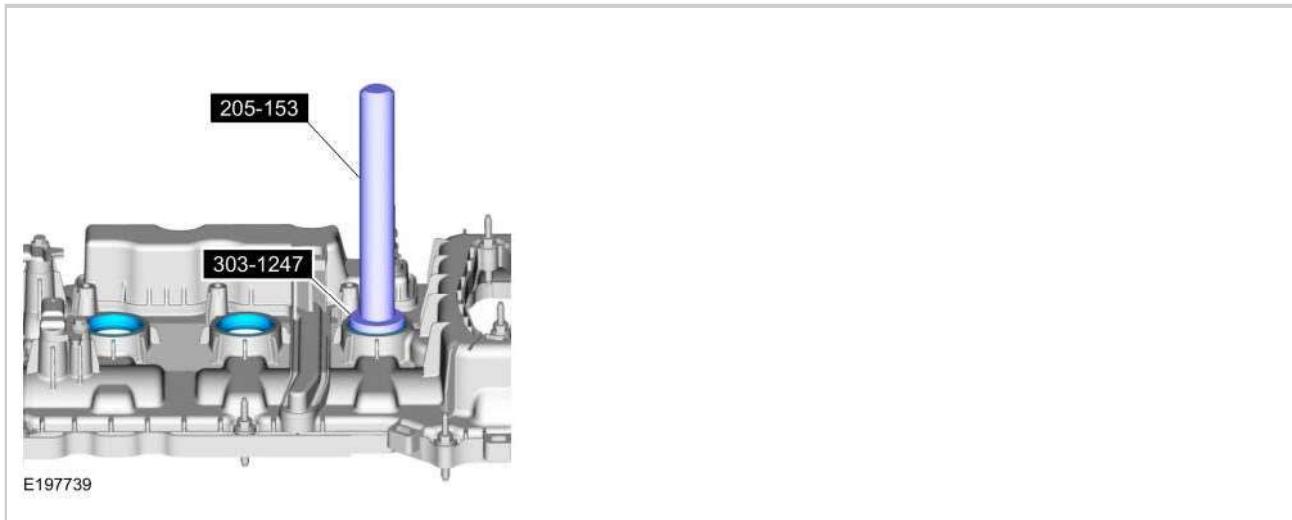
Remove and discard the gasket.

Clean the valve cover gasket groove with soap and water or a suitable solvent.



15.

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.



16.

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

Clean the valve cover mating surface of the cylinder head and engine front cover. Refer to: RTV Sealing Surface Cleaning and Preparation . Use the General Equipment: Plastic Scraper

Material

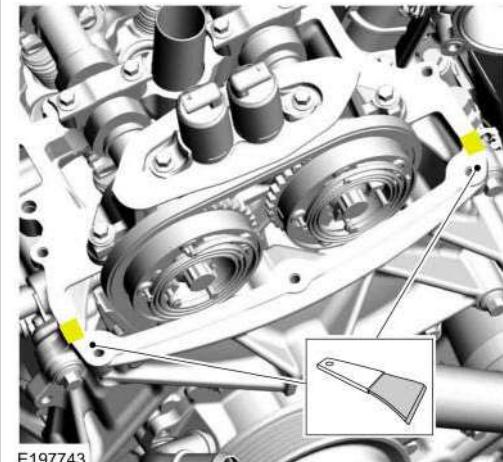
: Motorcraft ® Silicone Gasket Remover / ZC-30-A

Material

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

Material

: Metal Brake Parts Cleaner / PM-4-A, PM-4-B



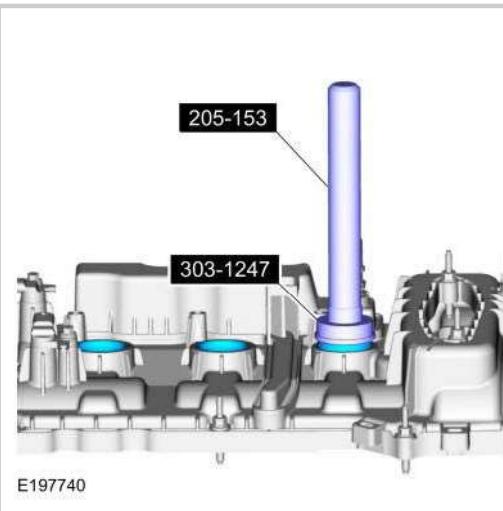
REMOVAL AND INSTALLATION > VALVE COVER RH > INSTALLATION

1.



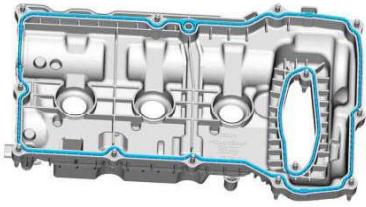
NOTE: Installation of new seals is only required if damaged seals were removed.

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.

Install a new gasket.



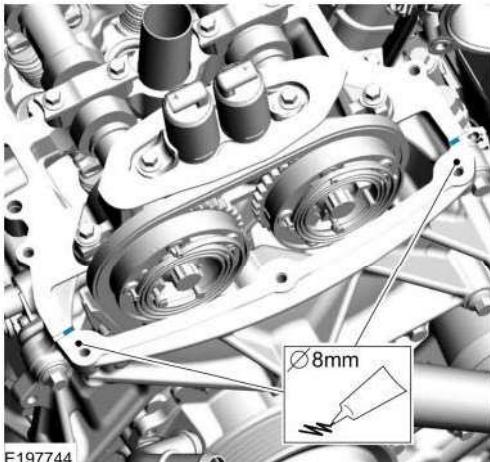
3.

 **NOTE:** If the valve cover is not installed and the fasteners tightened within 10 minutes, the sealant must be removed and the sealing area cleaned.

Apply an 8 mm (0.31 in) bead of Motorcraft ® High Performance Engine RTV Silicone to the engine front cover-to-cylinder head joints.

Material

: Motorcraft ® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)



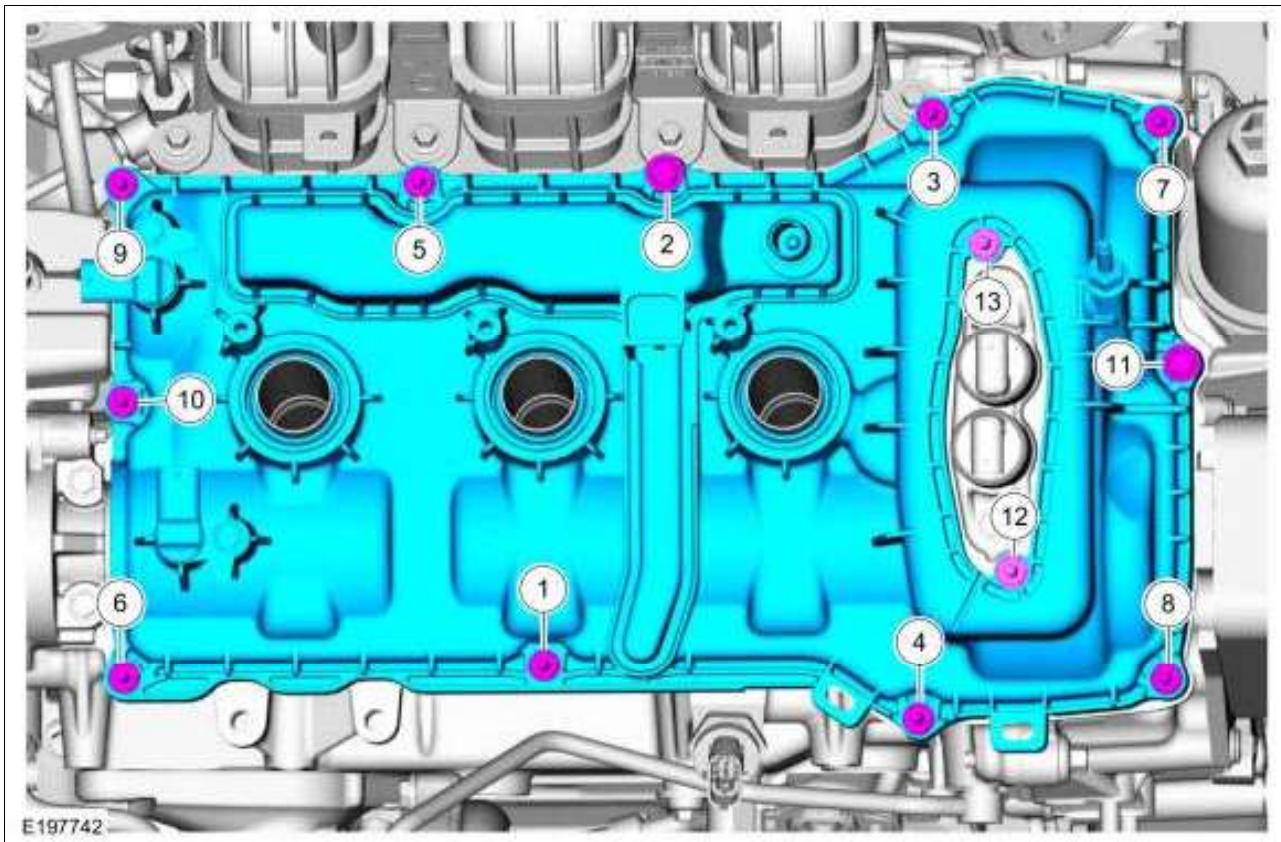
4.

Install the valve cover and tighten the bolts.

Torque

: 89 lb.in (10 Nm)

Fig 1: RH Valve Cover Bolts Tightening Sequence

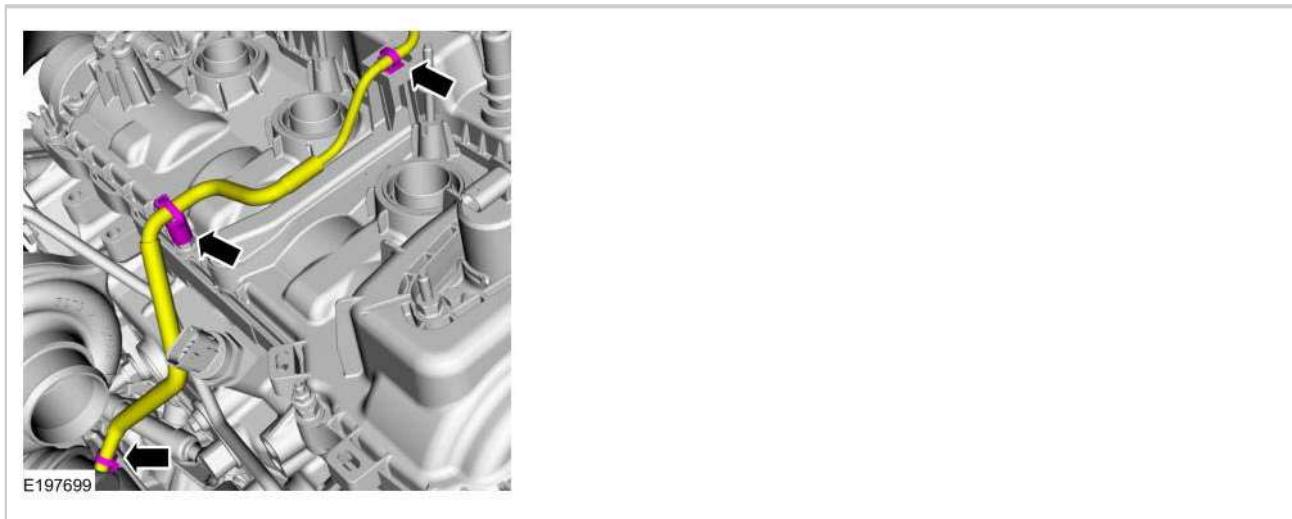


Courtesy of FORD MOTOR CO.

5.

Connect the TC vacuum supply hose. Use the General Equipment: Hose Clamp Remover/Installer

Attach the vacuum hose retainers.



6.

Install the RH coil-on-plugs. Refer to: IGNITION COIL-ON-PLUG .

7.

1.

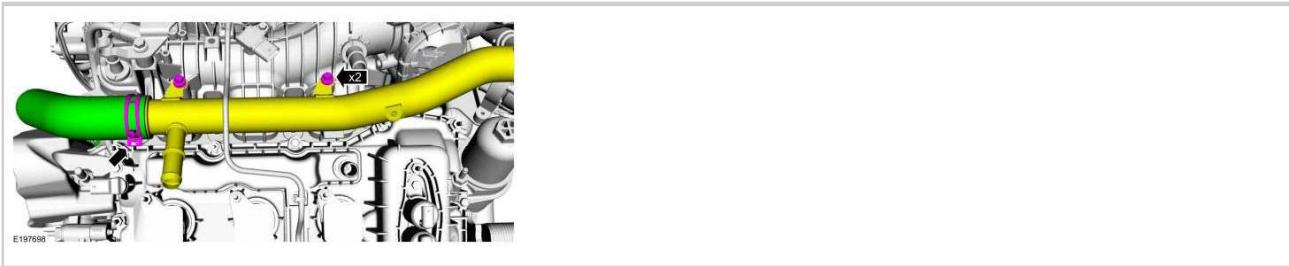
Install the coolant pipe and the bolts.

Torque

: 97 lb.in (11 Nm)

2.

Connect the coolant hose and clamp. Use the General Equipment: Hose Clamp Remover/Installer



8.

1.

Connect VCT solenoid electrical connectors.

2.

Attach the wiring harness retainers.



9.

1.

Connect the EOP switch electrical connector.

2.

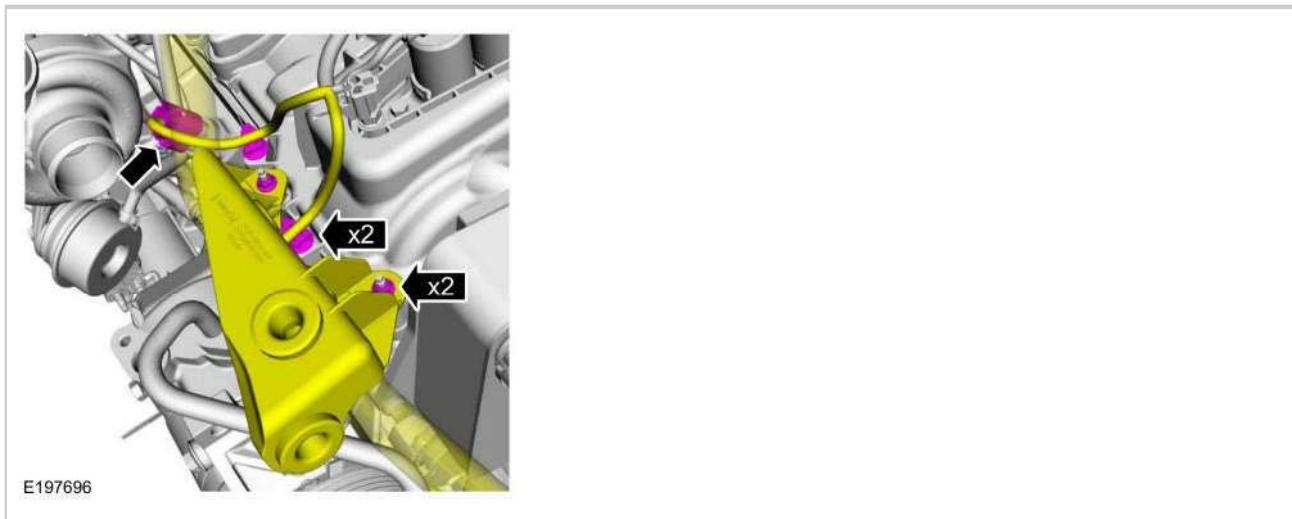
Attach the wiring harness retainers.

3.

Position the bracket with heater hose and install the nuts.

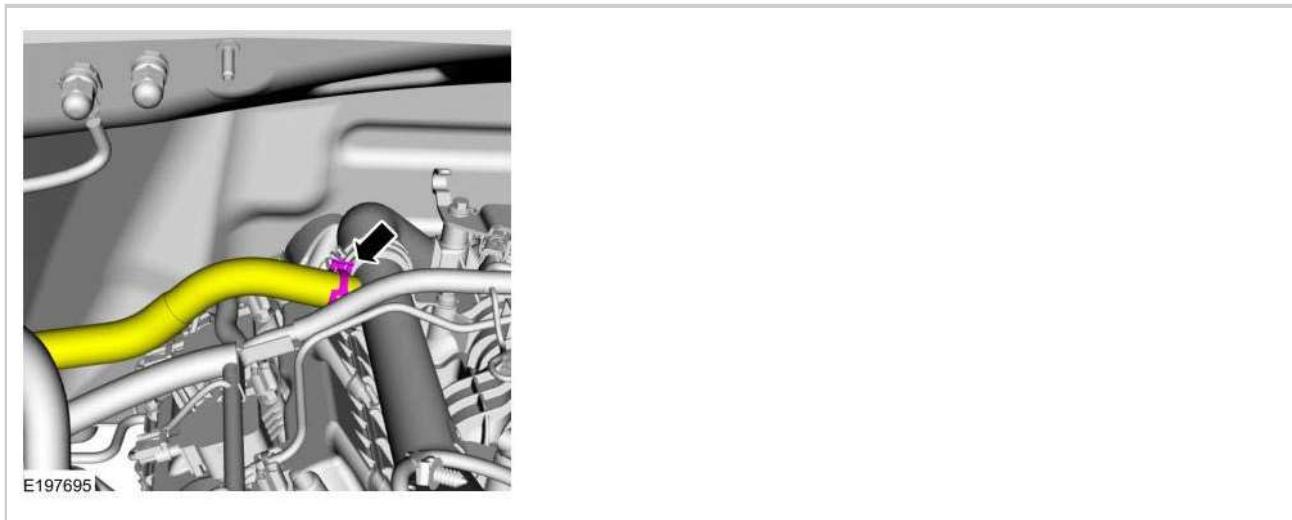
Torque

: 89 lb.in (10 Nm)



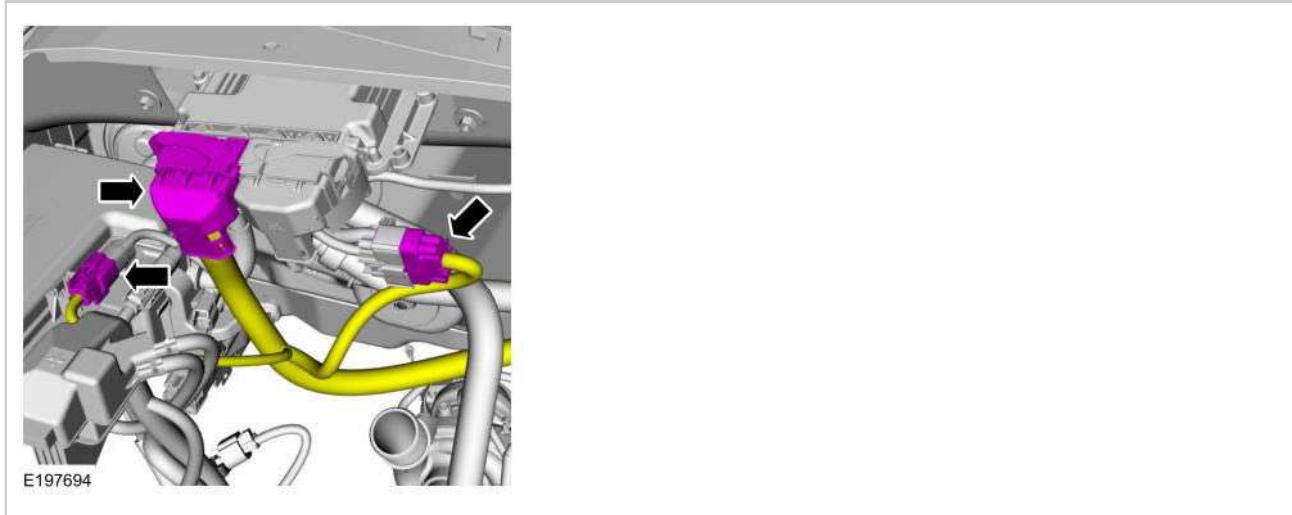
10.

Connect the heater hose and clamp. Use the General Equipment: Hose Clamp Remover/Installer



11.

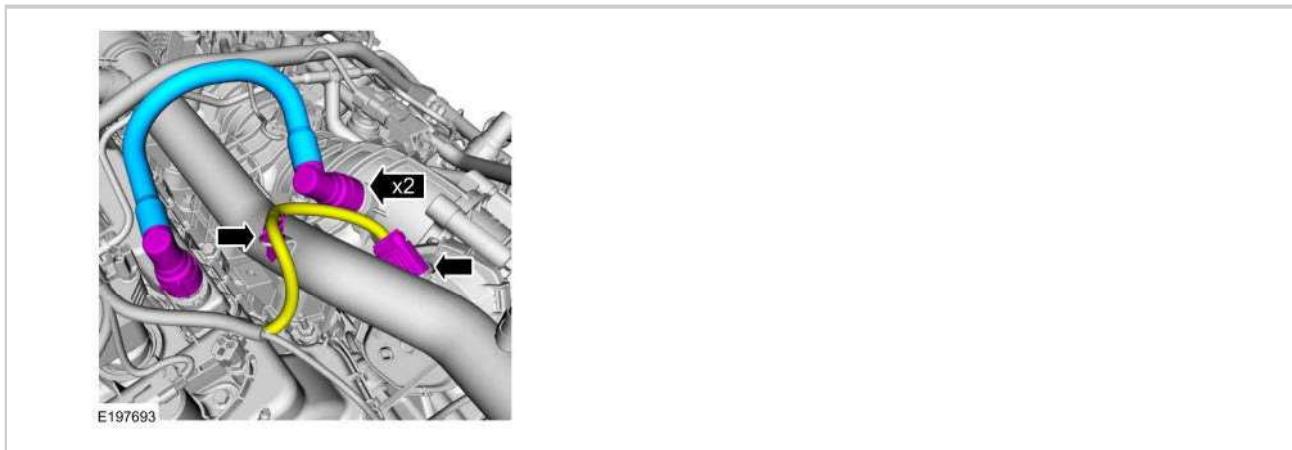
Connect the engine wiring harness electrical connectors.



12.

Install the PCV tube and connect the quick release couplings. Refer to: QUICK RELEASE COUPLING

Connect the throttle body electrical connector and wiring harness retainer.



13.

Install the following items:

RH CAC intake pipe. Refer to: CHARGE AIR COOLER (CAC) INTAKE PIPE

Refer to: AIR CLEANER OUTLET PIPE RH .

14.

1.

Slide the engine appearance cover into the retaining bracket.

2.

Install the nuts.

Torque

: 44 lb.in (5 Nm)

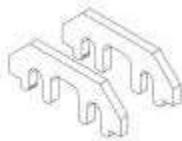


15.

Fill and bleed the engine cooling system. Refer to: COOLING SYSTEM DRAINING AND VACUUM FILLING .

REMOVAL AND INSTALLATION > VARIABLE CAMSHAFT TIMING (VCT) UNIT

Special Tool(s) / General Equipment



E216421

303-1248 Camshaft holding tools
TKIT-2006UF-FLM TKIT-2006UF-ROW

REMOVAL AND INSTALLATION > VARIABLE CAMSHAFT TIMING (VCT) UNIT > REMOVAL



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



NOTE: 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 .

2.

1.

Install Special Service Tool: 303-1248 Camshaft holding tools.

2.

Remove and discard the VCT unit bolts.

3.

Remove the VCT units.



Left hand units

3.

Remove the LH timing chain. Refer to: Timing Chain .

4.

1.

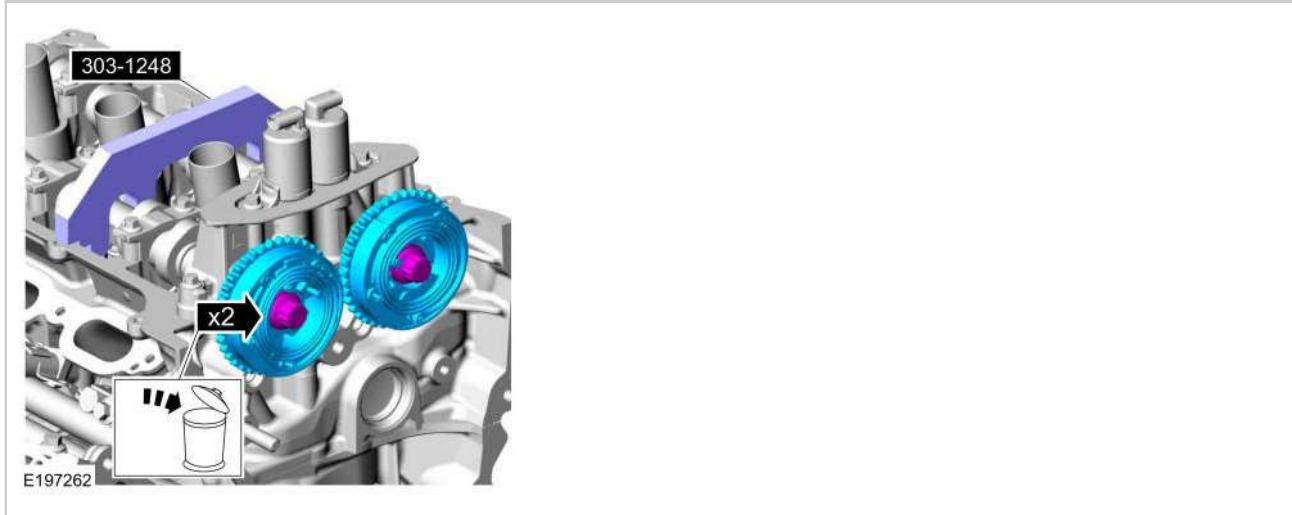
Install Special Service Tool: 303-1248 Camshaft holding tools.

2.

Remove and discard the VCT unit bolts.

3.

Remove the VCT units.



REMOVAL AND INSTALLATION > VARIABLE CAMSHAFT TIMING (VCT) UNIT > INSTALLATION

Left hand units

1.

 *NOTE: The VCT units have 2 timing marks on them, a triangle and a circle. For installation of the LH side the circle marks are used.*

1.

Install the VCT units. The **circle** timing marks on the VCT units will be at the 10 o'clock (intake) and 12:30 (exhaust) positions as shown in the illustration.

2.

Install the new VCT unit bolts.

Torque

: Stage 1: 30 lb.ft (40 Nm) Stage 2: Loosen: 360 ° Stage 3: 37 lb.ft (50 Nm) Stage 4: 90 °

3.

Remove Special Service Tool: 303-1248 Camshaft holding tools.