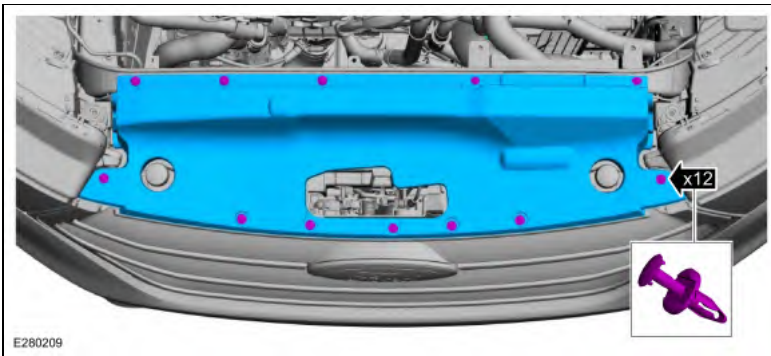
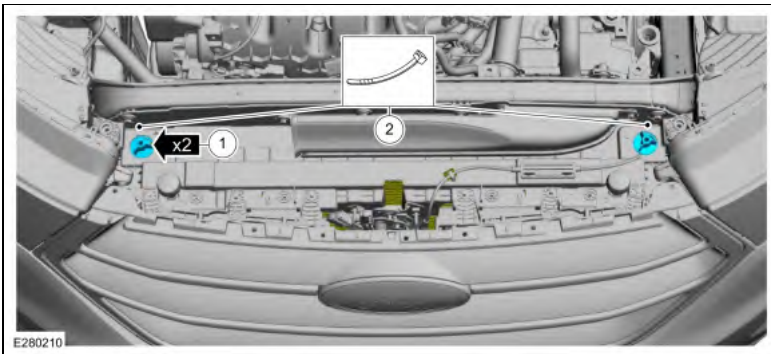


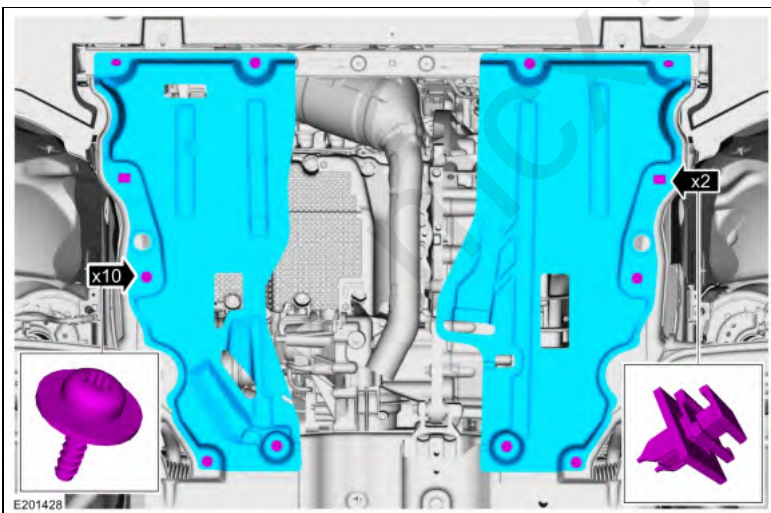


7. **NOTICE:** Make sure the cooling module is secure before removing the bottom cooling module support panel.

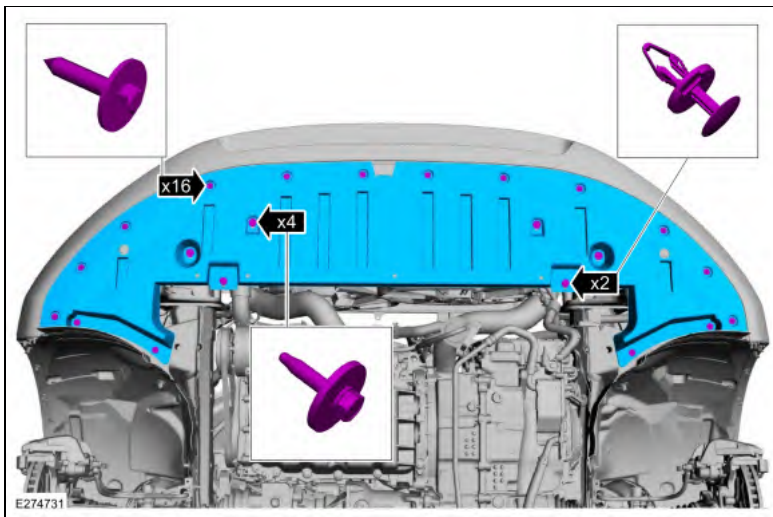
1. Remove the upper cooling module support brackets.
2. Using cable ties or mechanics wire through the upper location holes, to support the cooling module.
Use the General Equipment: Cable Ties



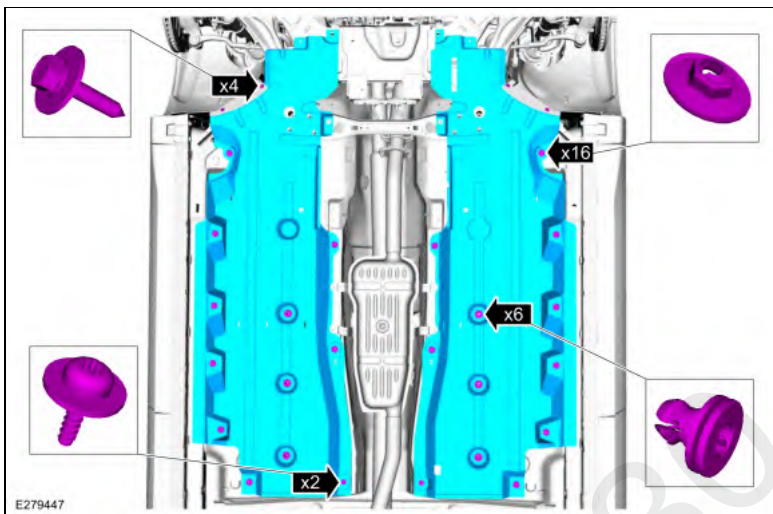
8. Remove the following items:
 1. Front fender splash shields.
Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
 2. Front headlamp leveling sensor.
Refer to: Headlamp Leveling Sensor (417-01 Exterior Lighting, Removal and Installation).
9. Remove the retainers and the underbody shield.



10. Remove the retainers and the front underbody shield.

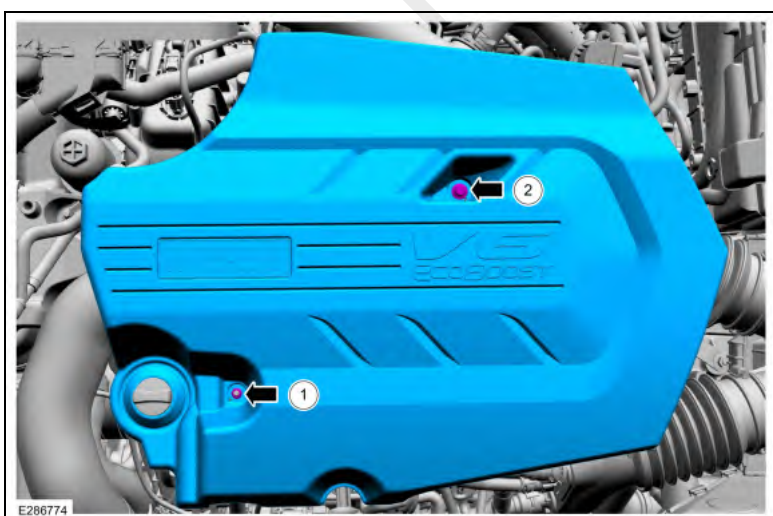


11. Remove the retainers and the underbody shields.



12. Drain the engine cooling system
Refer to: Engine Cooling System Draining, Vacuum Filling and Bleeding (303-03B Engine Cooling - 2.7L EcoBoost (238kW/324PS), General Procedures).

- 13.
1. Remove the nut.
 2. Remove the bolt.
 - Remove the engine appearance cover.
 - If the engine appearance cover stud bolt is loosened or removed, it must be installed/tightened.
Torque: 62 lb.in (7 Nm)



14. Remove the following items:
1. Degas bottle.
Refer to: Degas Bottle (303-03B Engine Cooling - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 2. Air cleaner.
Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 3. LH air cleaner outlet pipe.

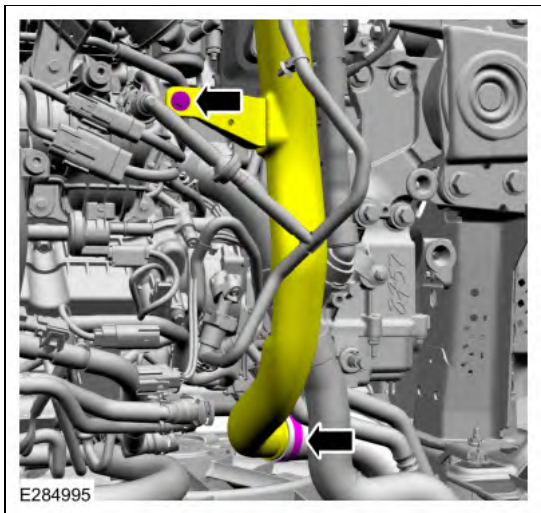
Refer to: Air Cleaner Outlet Pipe LH (303-12B Intake Air Distribution and Filtering - 2.7L EcoBoost (238kW/324PS), Removal and Installation).

4. Upper RH air cleaner outlet pipe.

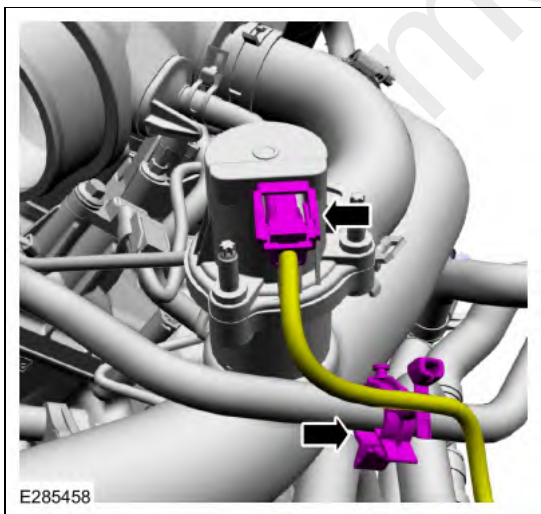
Refer to: Air Cleaner Outlet Pipe RH (303-12B Intake Air Distribution and Filtering - 2.7L EcoBoost (238kW/324PS), Removal and Installation).

15. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

1. Loosen the clamp, remove the bolt and disconnect the CAC inlet pipe.
- Cover all open ports.

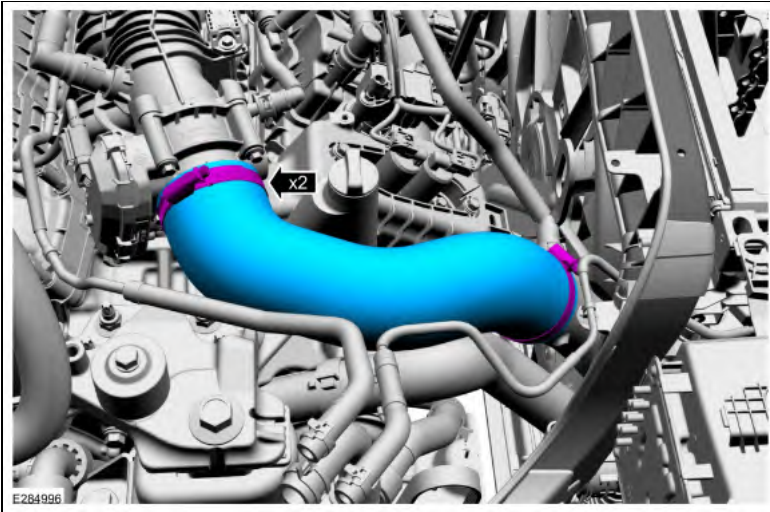


16. Disconnect the wiring harness electrical connector and detach the retainer.



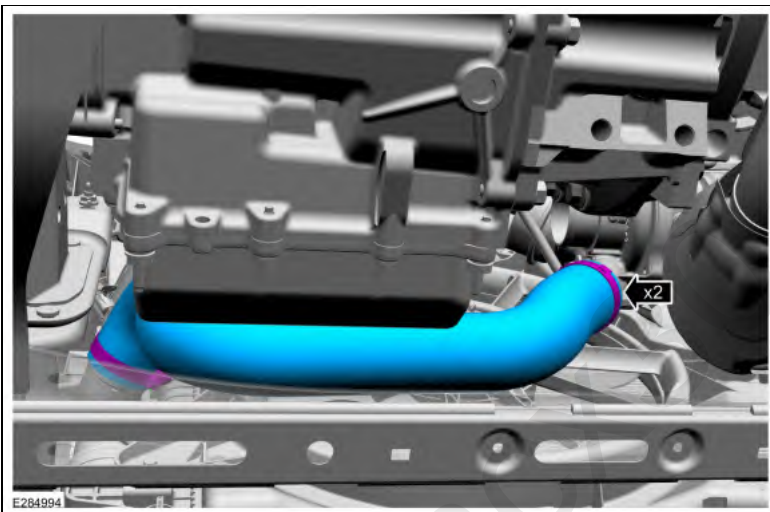
17. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

1. Loosen the clamps and remove the CAC outlet pipe.
- Cover all open ports.

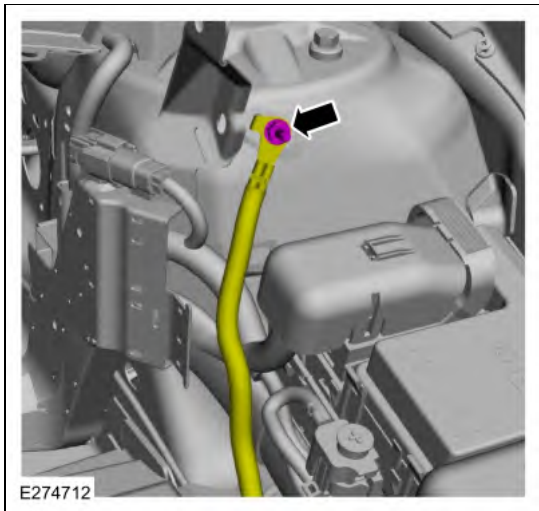


18. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

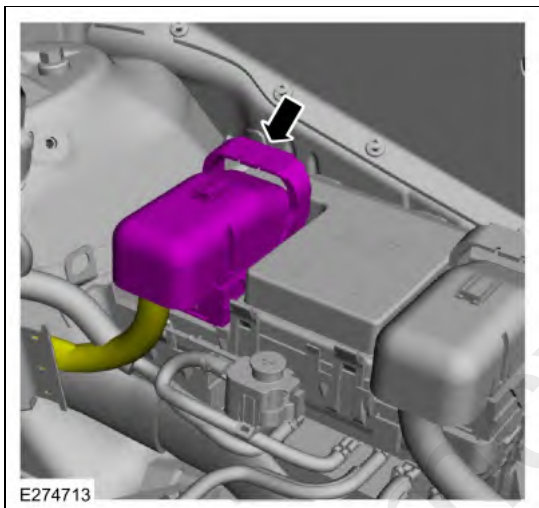
1. Loosen the clamps and remove the CAC inlet pipe.
 - Cover all open ports.



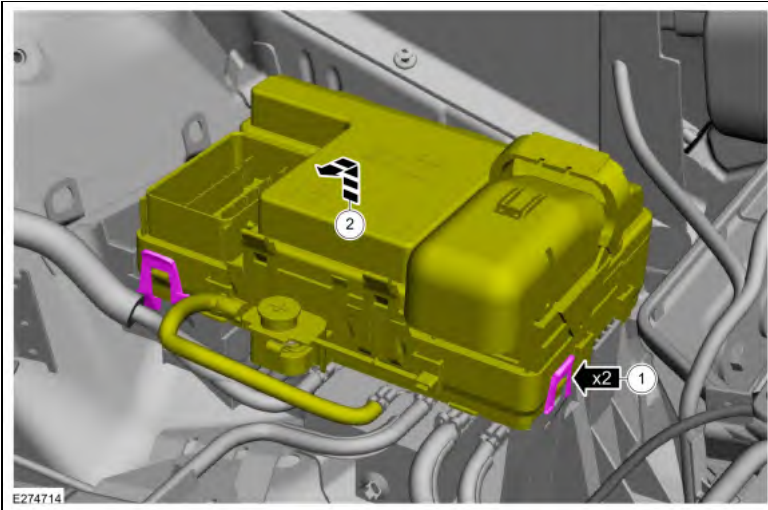
19. Remove the following items:
 1. Accessory drive belt tensioner.
Refer to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 2. Battery tray.
Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
20. Remove the stud bolt and position aside the ground cable.



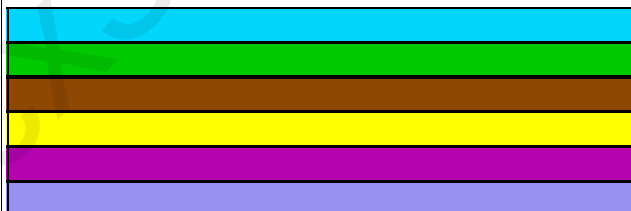
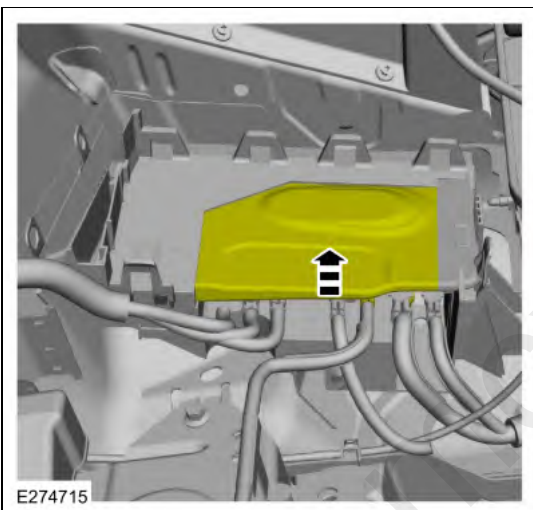
21. Disconnect the junction box electrical connector.



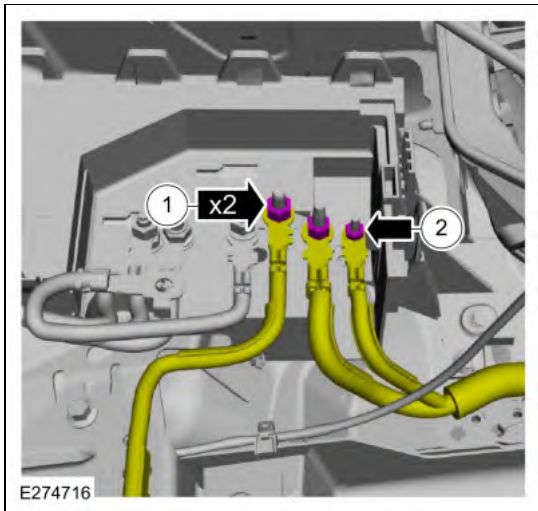
- 22.
1. Release the tabs.
 2. Lift and position top part of junction box aside.



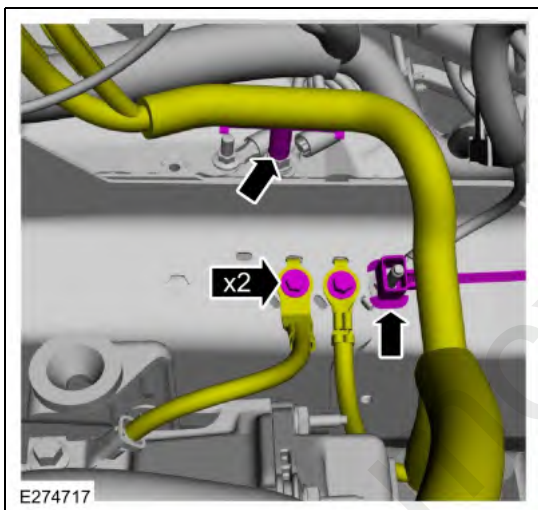
23. Open the junction box cover.



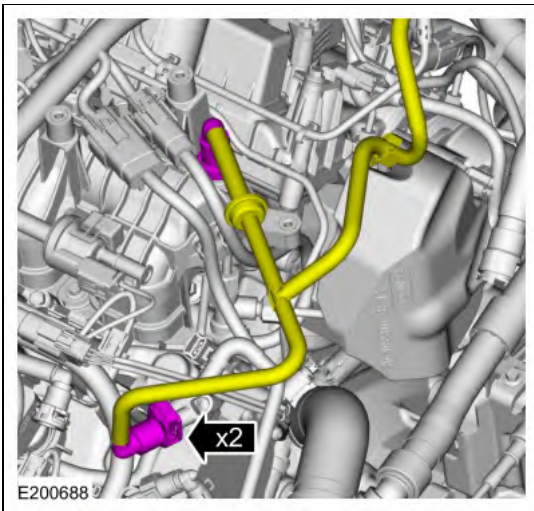
24. Remove the nuts and disconnect the electrical wiring harness.



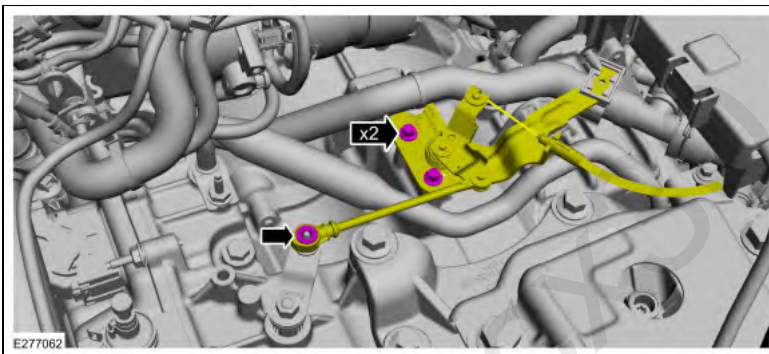
25. Remove the bolts and detach the wiring harness retainers.



26. Disconnect the vacuum tube quick release couplings and position the tube aside.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .

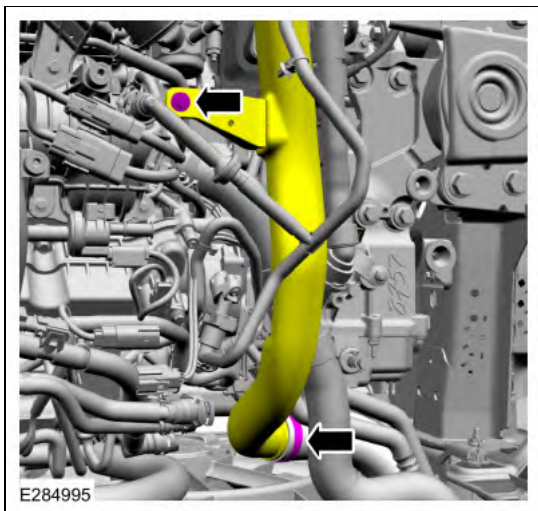


- 27.
1. Detach the cable from the manual control lever.
 2. Remove the bolts and position the cable aside.

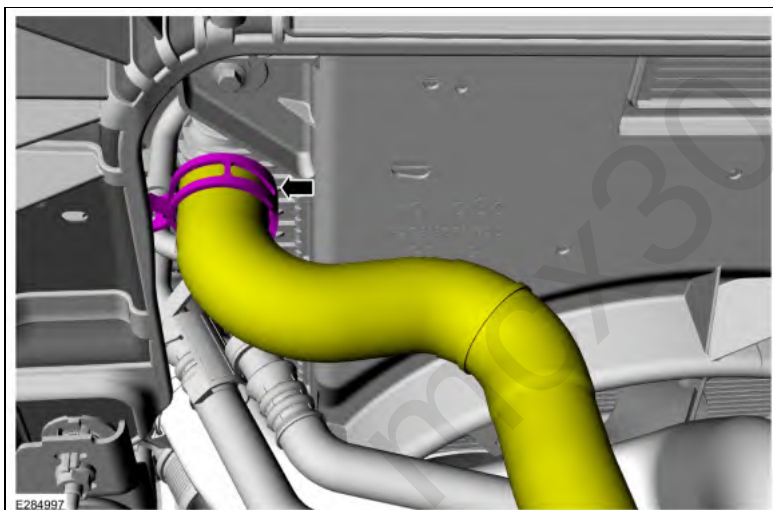


28. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

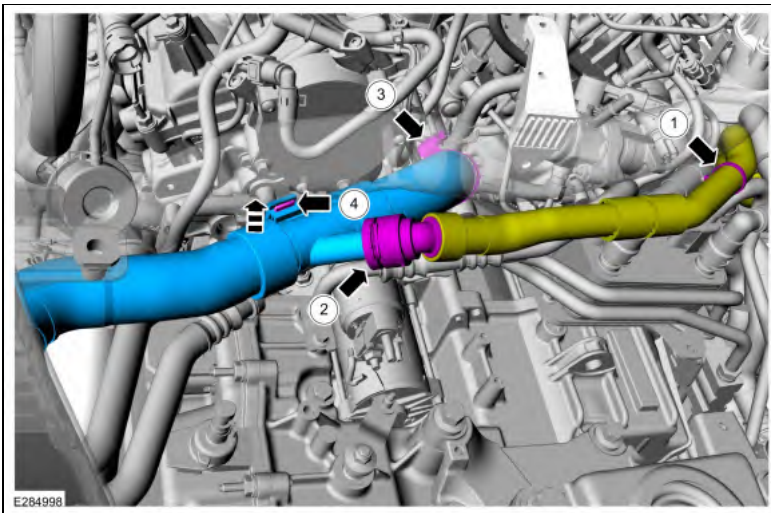
1. Loosen the clamp, remove the bolt and disconnect the CAC inlet pipe.
 - Cover all open ports.



29. Loosen the clamp and disconnect the upper radiator hose.
Use the General Equipment: Hose Clamp Remover/Installer

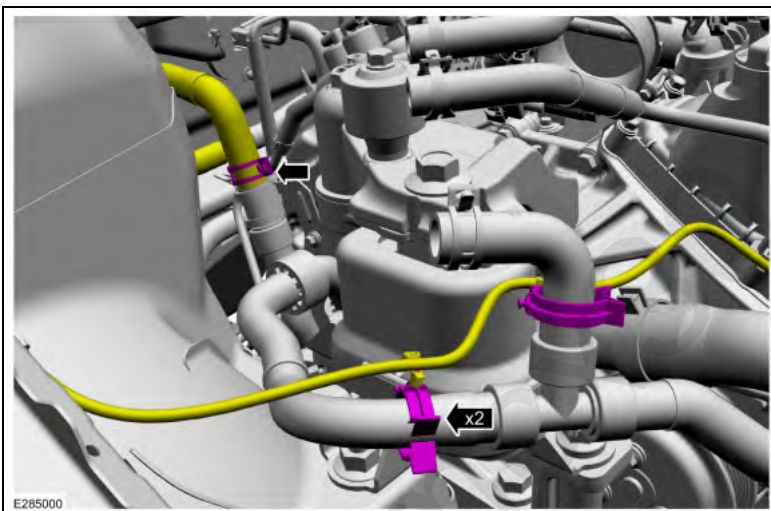


- 30.
1. Detach the heater hose retainer.
 2. Disconnect the heater hose coupling.
 3. Loosen the radiator hose clamp.
 4. Remove the radiator hose off of the retaining tab.



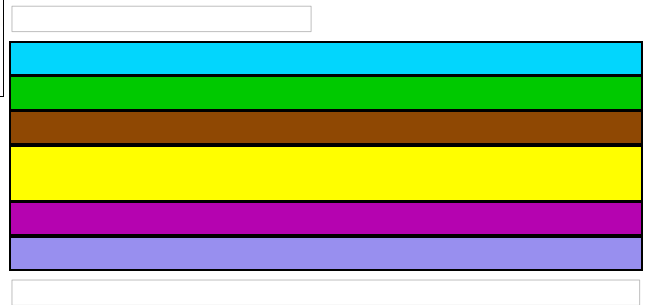
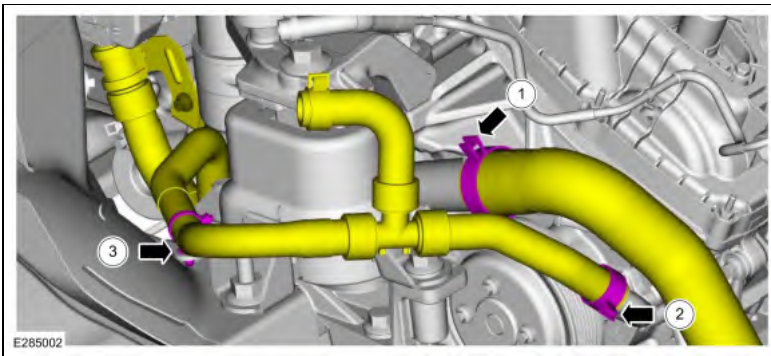
31.

1. Release the clamp and disconnect the heater hose.
Use the General Equipment: Hose Clamp Remover/Installer
2. Detach the wiring harness retainers.

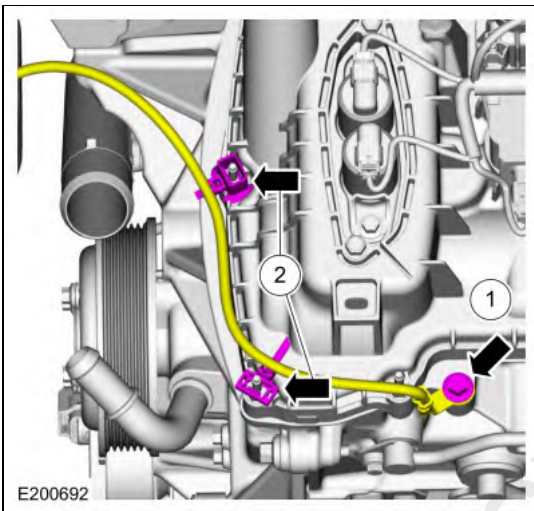


32.

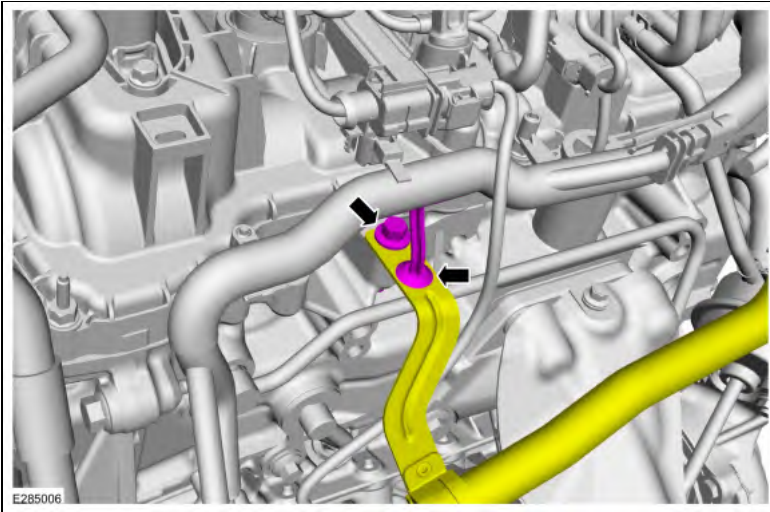
1. Release the clamp and disconnect the lower radiator hose.
Use the General Equipment: Hose Clamp Remover/Installer
2. Release the clamp and disconnect the heater hose.
3. Detach the heater hose retainer.



- 33.
1. Remove the ground wire bolt.
 2. Detach the retainers and position the ground wire aside.

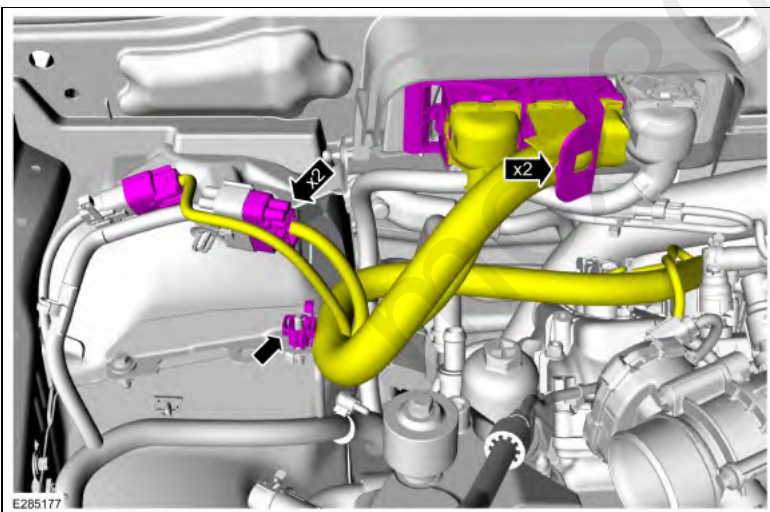


- 34.
- Detach the wiring harness retainer.
 - Remove the bolt and position the bracket aside.



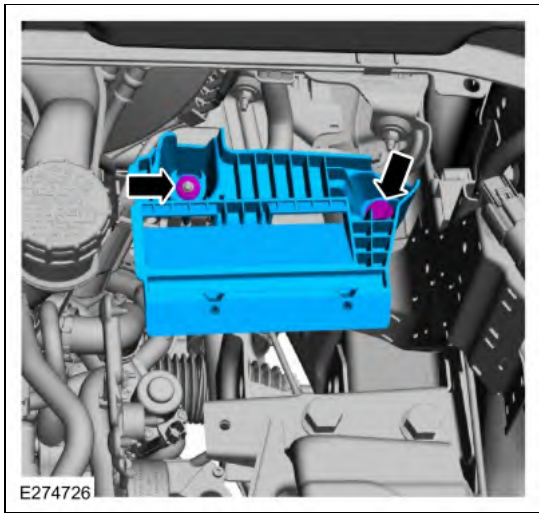
35.

- Disconnect the PCM electrical connectors.
- Disconnect the engine harness electrical connectors and detach the retainer.

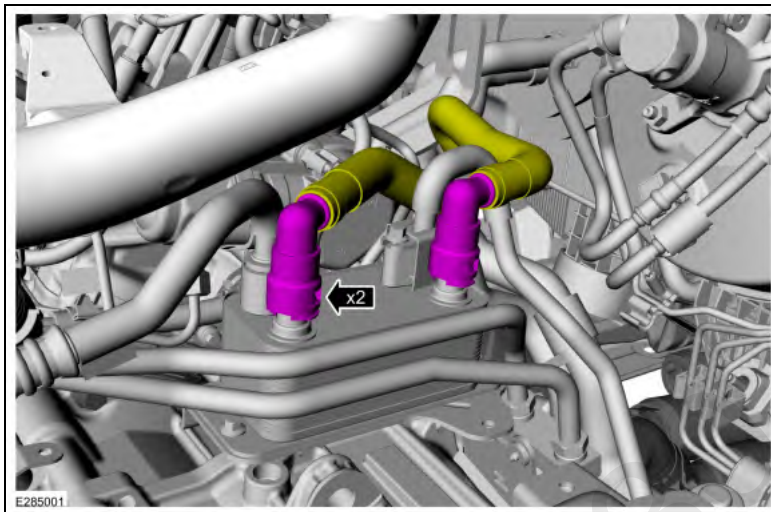


36.

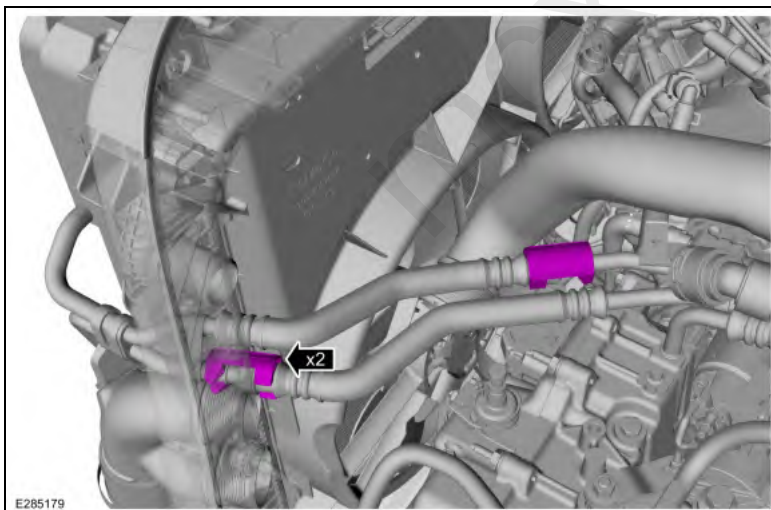
1. Remove the high-pressure fuel pump insulator.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
2. Disconnect the high-pressure fuel pump fuel supply tube quick release coupling.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
3. Detach the EVAP tube retainer.
4. Disconnect the EVAP tube quick release coupling
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .



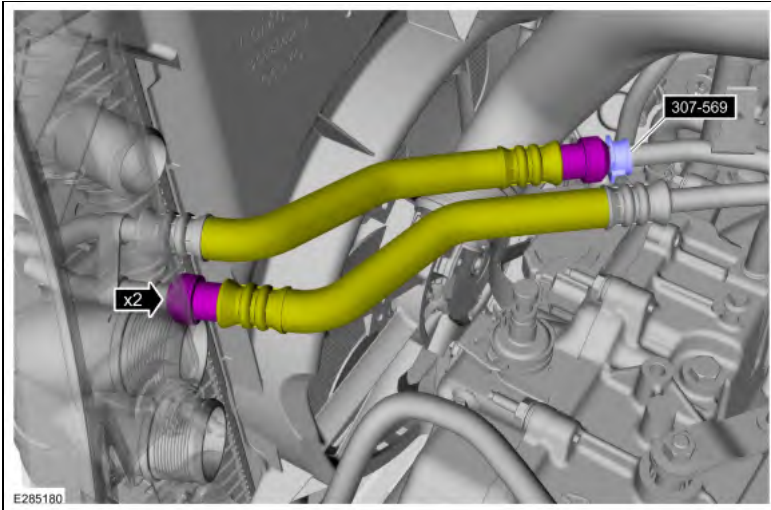
40. Disconnect the coolant tube couplings.



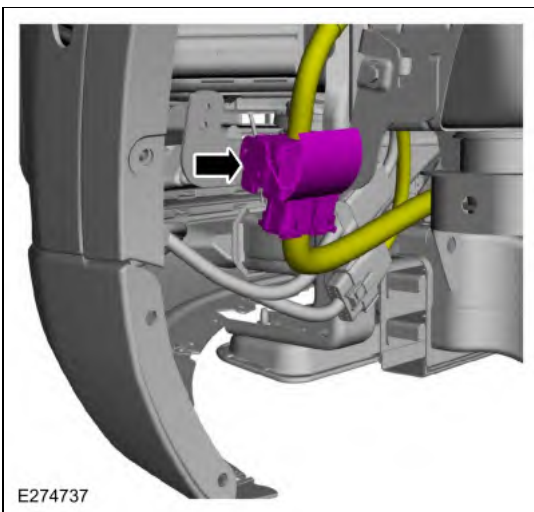
41. Remove the transmission fluid cooler tube secondary latches.



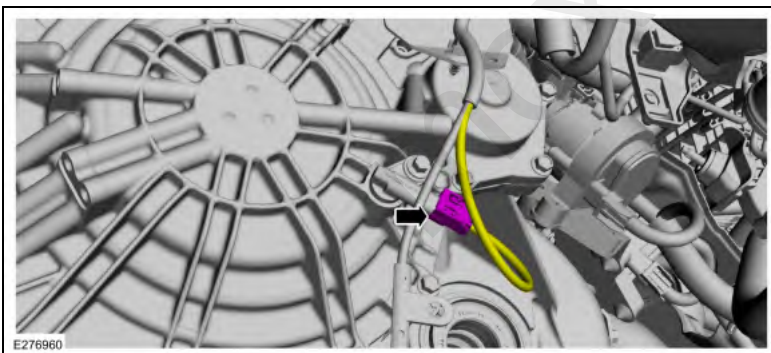
42. Using the special tool, disconnect the transmission fluid cooler tubes.
Use Special Service Tool: 307-569 Disconnect Tool TOC Line (1/2).



43. Detach and disconnect the wiring harness electrical connector.

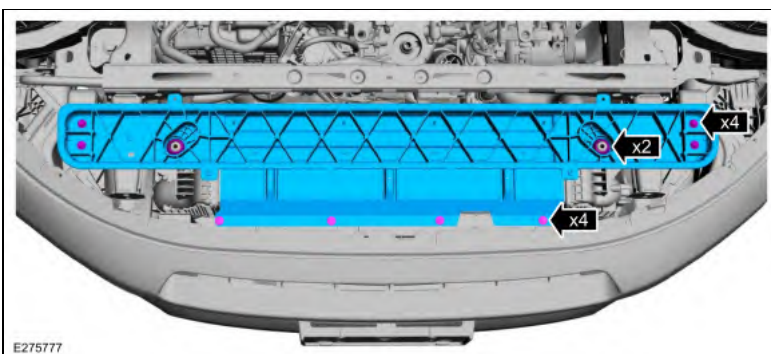


44. Disconnect the TSS sensor.

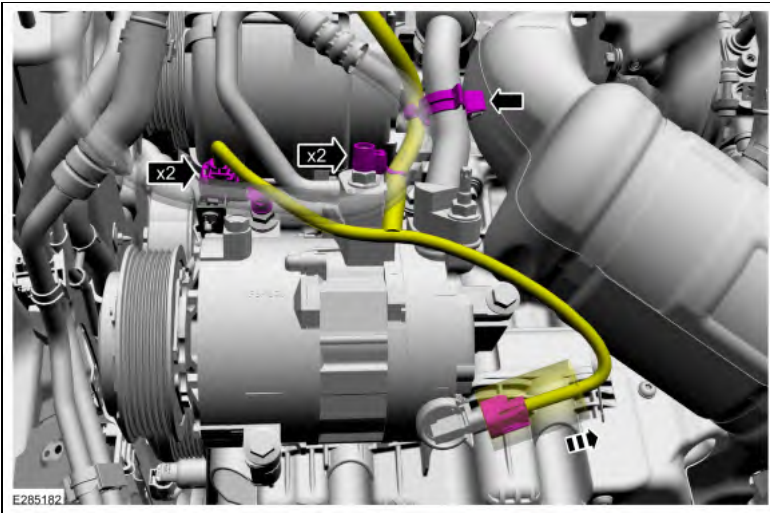


45. **NOTICE: Make sure the cooling module is secure.**

- Remove the pin-type retainers.
- Remove the bolts and the cooling module support panel.



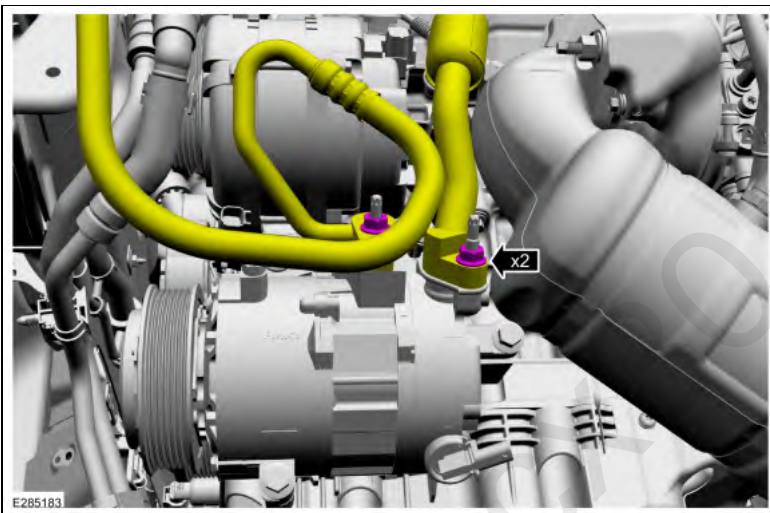
46. Detach the wiring harness retainers, slide up the insulator and disconnect the electrical connectors.



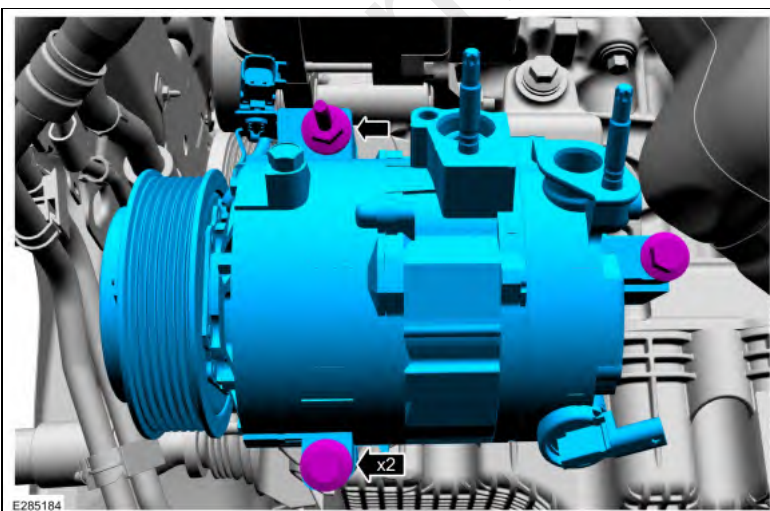
47. **NOTICE:** During the removal of components, cap, tape or otherwise appropriately protect all openings to prevent the ingress of dirt or other contamination. Remove protective materials prior to installation.

Remove the A/C compressor inlet and outlet line nuts and disconnect the fittings.

- Discard the O-ring seals and gaskets.
- Make sure to cover any open ports to prevent debris from entering the system.

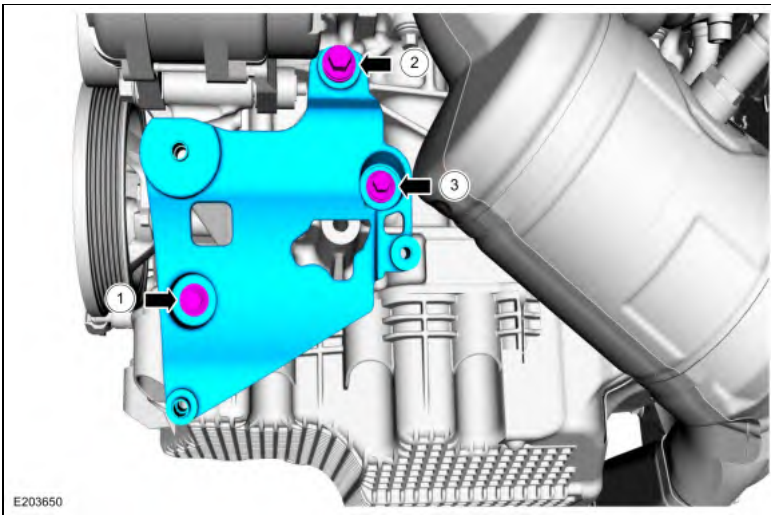


48. Remove the bolts, stud bolt and the A/C compressor.

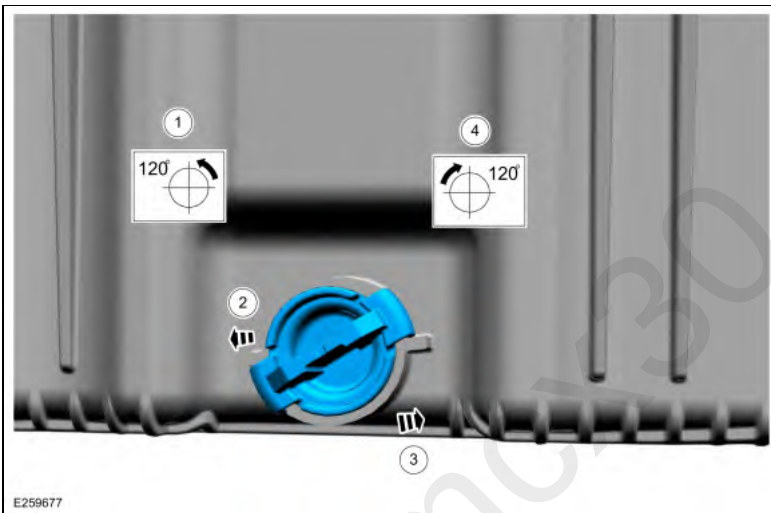


49.

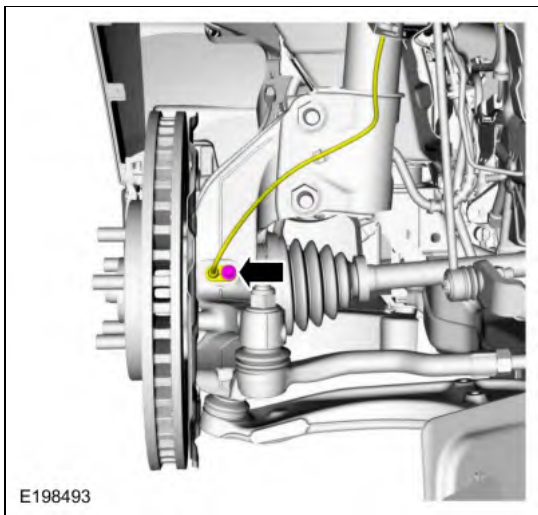
1. Remove the M8 x 50mm bolt.
2. Remove the M10 x 43mm bolt.
3. Remove the M8 x 30mm bolt and the A/C compressor mounting bracket.



- 50.
1. Turn the oil drain plug 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. **NOTICE: Overtightening will damage the oil drain plug.**
Turn the oil drain plug clockwise 120 degrees.

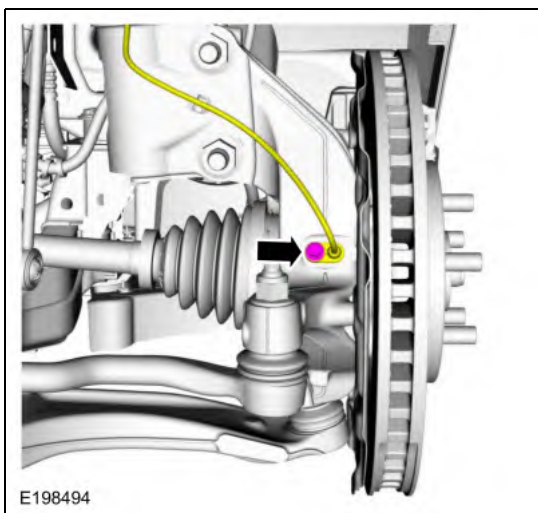


51. **NOTE:** Make sure that the sensor housing area is clean and free of foreign material before the sensor is removed. Using compressed air, clean the sensor housing area.
- Remove the bolt and the LH anti-lock sensor.



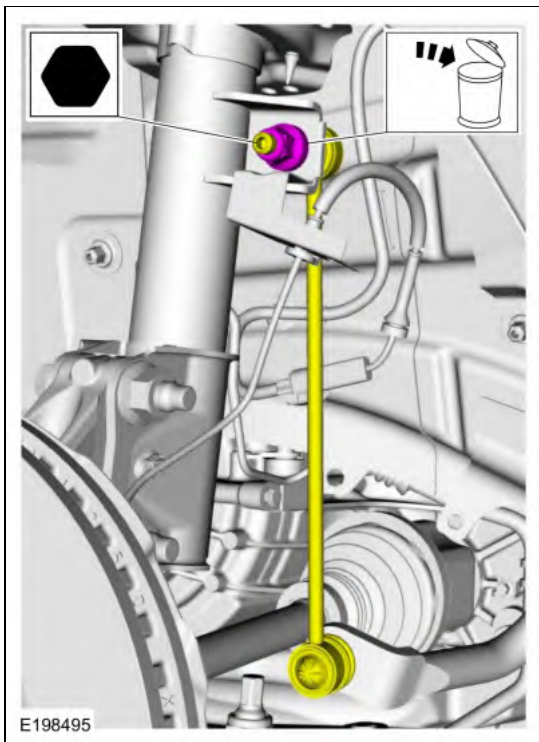
52. **NOTE:** Make sure that the sensor housing area is clean and free of foreign material before the sensor is removed. Using compressed air, clean the sensor housing area.

Remove the bolt and the RH anti-lock sensor.



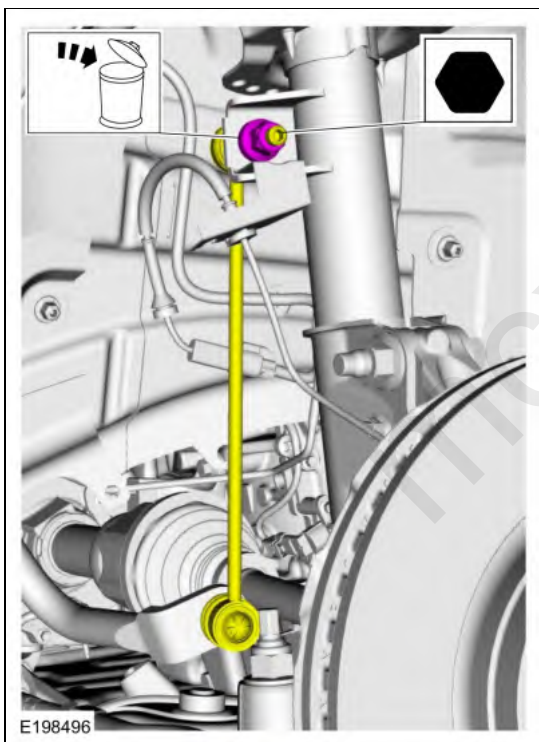
53. **NOTICE:** Use the internal or external hex-holding feature to prevent the ball and stud from turning while removing or installing the stabilizer bar link nuts. The link boot seal must not be allowed to twist while tightening the link nuts or damage to the boot seal will occur.

Remove and discard the nut and position the LH sway bar link aside.



54. **NOTICE:** Use the internal or external hex-holding feature to prevent the ball and stud from turning while removing or installing the stabilizer bar link nuts. The link boot seal must not be allowed to twist while tightening the link nuts or damage to the boot seal will occur.

Remove and discard the nut and position the RH sway bar link aside.

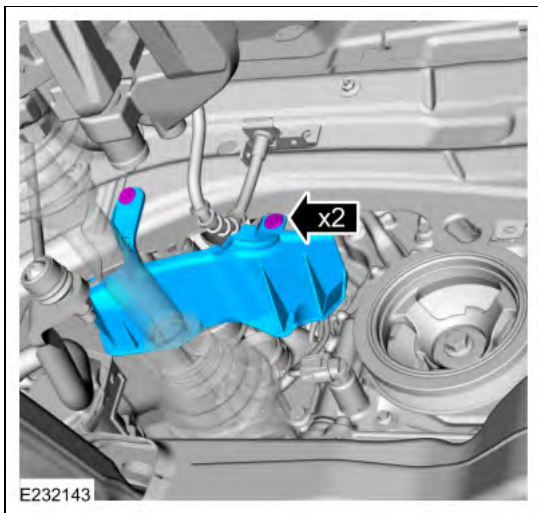


55. **NOTICE:** Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

Remove the front brake discs.

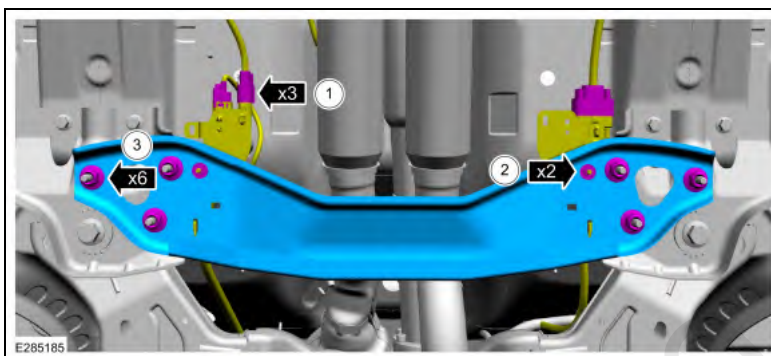
Refer to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).

56. Remove the retainers and the shield.



57.

1. If equipped, disconnect the wiring harness electrical connectors.
2. If equipped, remove the nuts and position the wiring harness support bracket(s) aside.
3. Remove the nuts and the subframe support bracket.



58. Remove the following items:

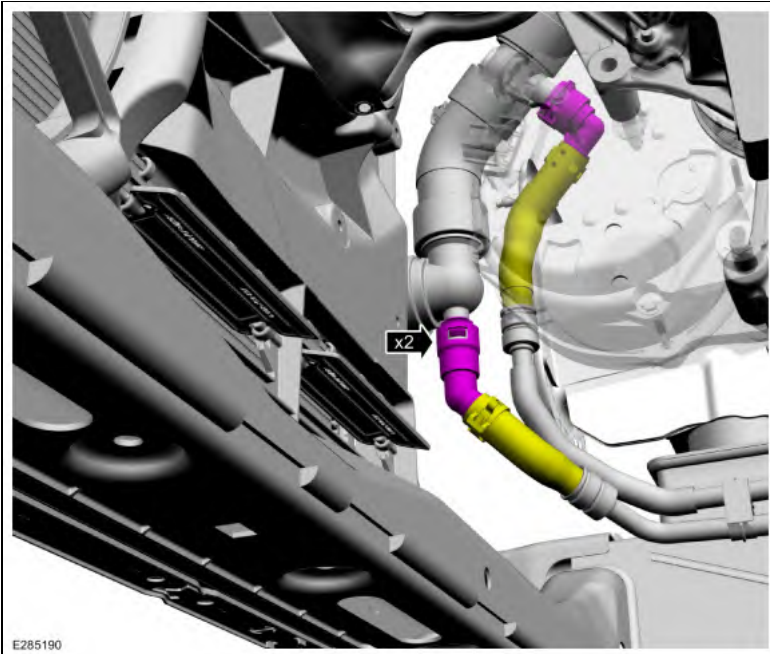
1. Exhaust flexible pipes.
Refer to: Exhaust Flexible Pipe (309-00B Exhaust System - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
2. LH catalytic converter.
Refer to: Catalytic Converter LH (309-00B Exhaust System - 2.7L EcoBoost (238kW/324PS), Removal and Installation).

LHD AWD

59. Remove the driveshaft.

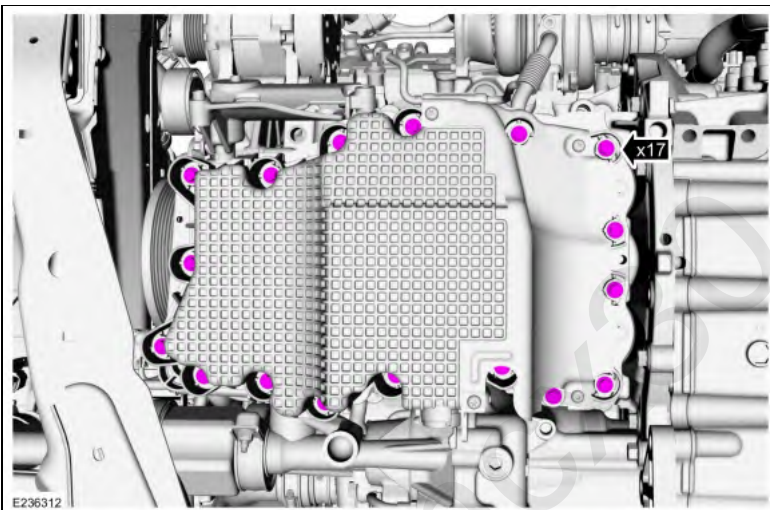
Refer to: Rear Driveshaft - 2.0L EcoBoost (177kW/240PS) & MI4 (205-01 Driveshaft, Removal and Installation).

60. Disconnect the transfer case coolant hose quick connect couplings.



LHD AWD/LHD FWD

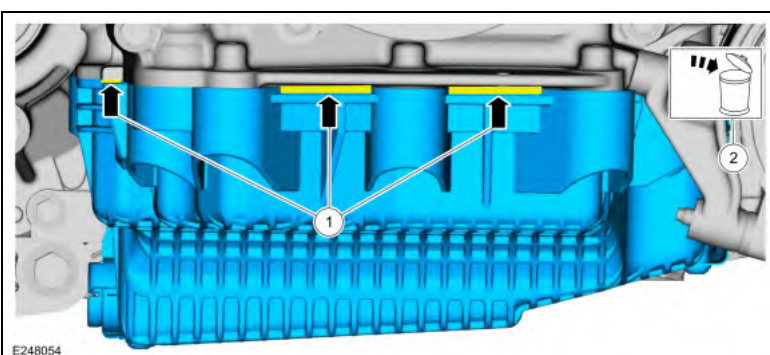
61. Remove the oil pan bolts.



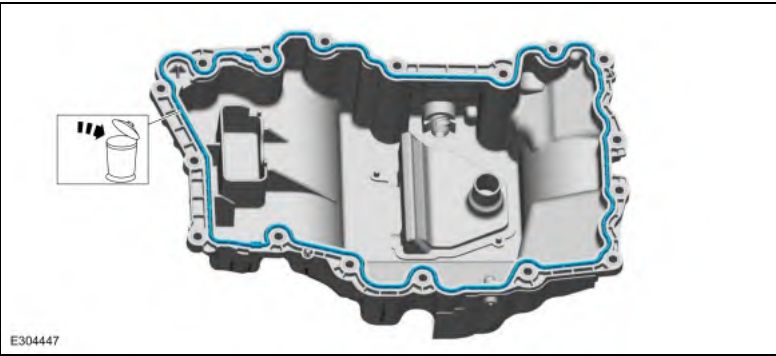
62. 1. Using a large flat-bladed screwdriver and the indicated pry pads, release the sealer and separate the oil pan from the bottom of the engine.

2. **NOTE:** Do not reuse the oil pans sealed by Motorcraft® High Performance Engine RTV Silicone. Oil pans sealed by Motorcraft® High Performance Engine RTV Silicone are to be removed and discarded. The replacement oil pan will have a press-in-place gasket.

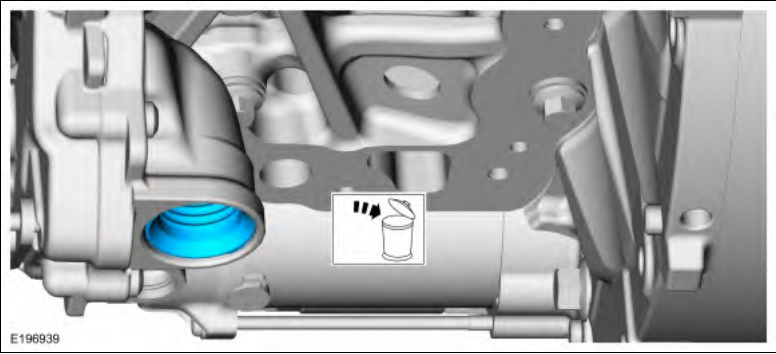
Remove the oil pan. Discard the oil pan if it is sealed with Motorcraft® High Performance Engine RTV Silicone.



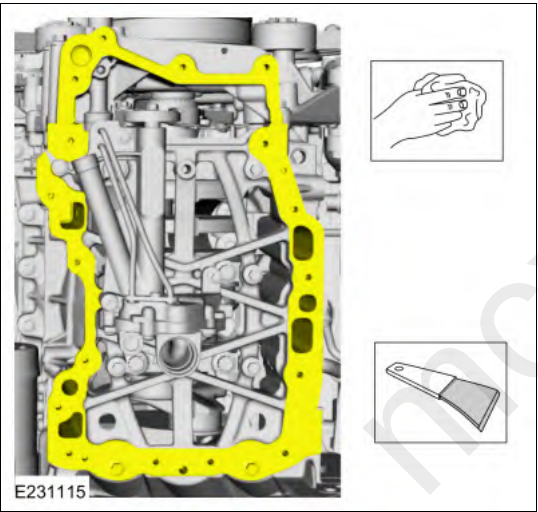
63. If equipped, remove and discard the oil pan press-in-place gasket.



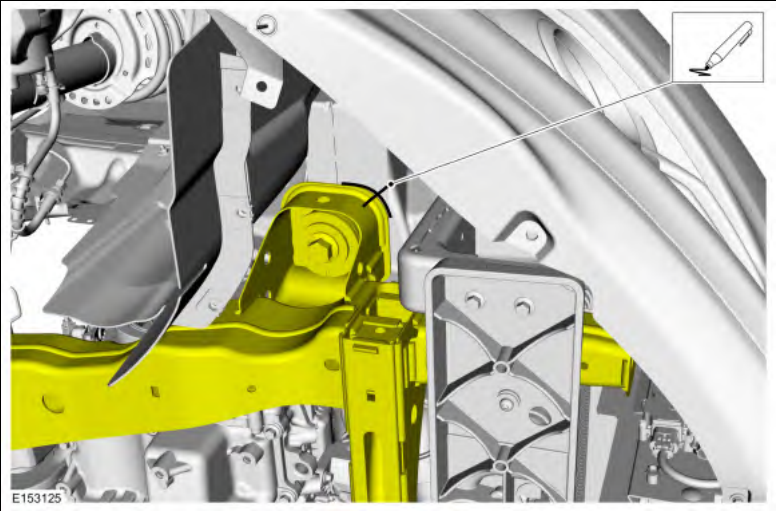
64. Remove and discard the oil pump seal.



65. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper

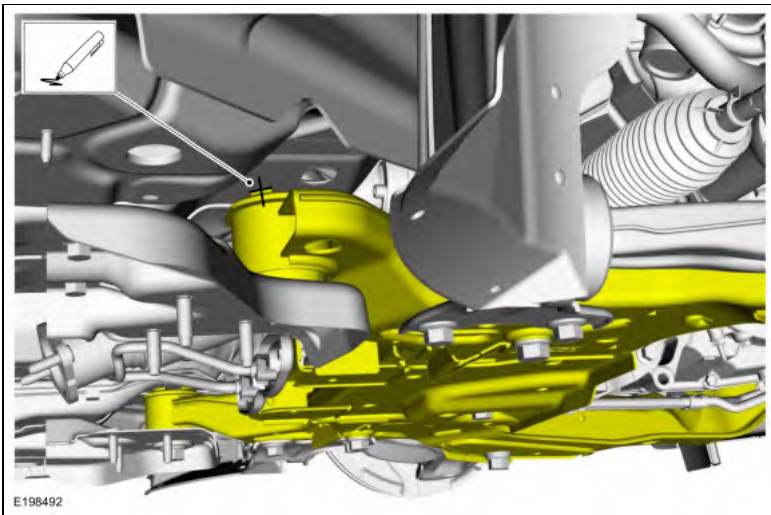


66. Mark the subframe location.



67. Mark the subframe location.



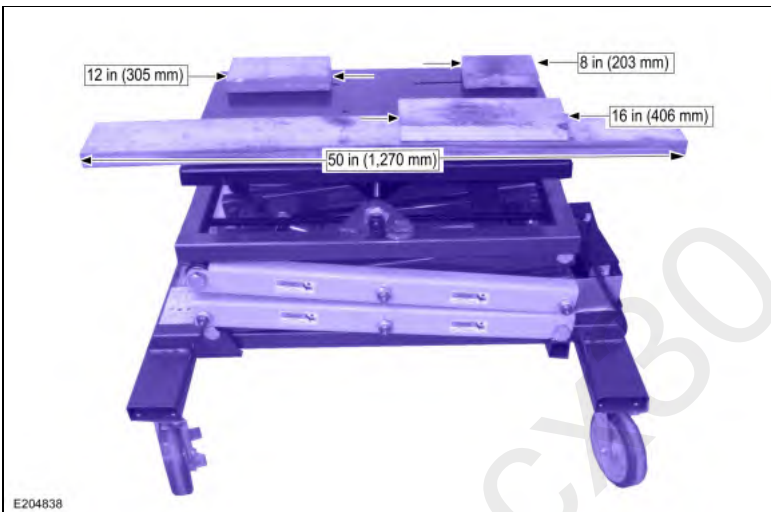


68. **NOTICE:** The boards must be positioned to properly support the engine, transmission and subframe, and allow clearance between the powertrain jack and the exhaust components to prevent damage.

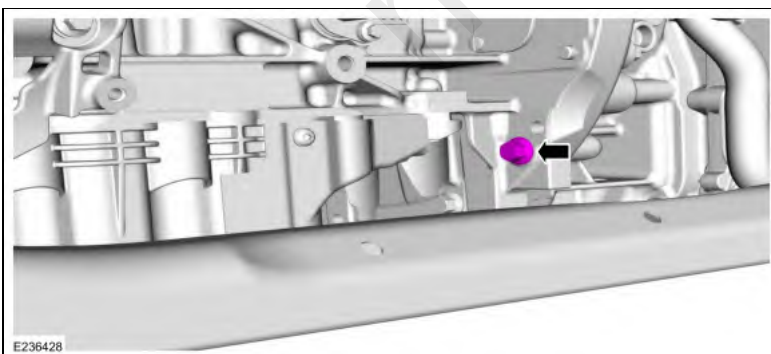
Position lengths of 2 x 6 boards on the powertrain jack to support the powertrain and subframe.

Use the General Equipment: Powertrain Jack

Use the General Equipment: Wooden Block



69. Remove the engine-to-transmission bolt.



70.

1. **NOTE:** Position a board under the cylinder block rail.

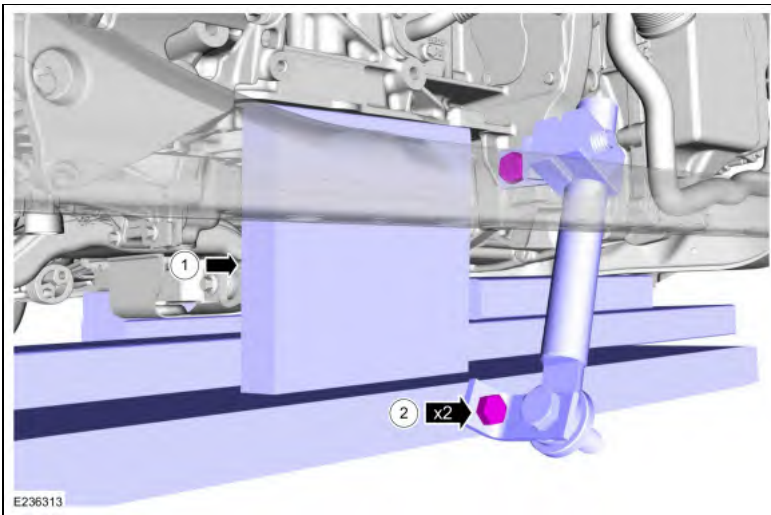
Position the powertrain jack and boards under the powertrain and subframe.

Use the General Equipment: Powertrain Jack

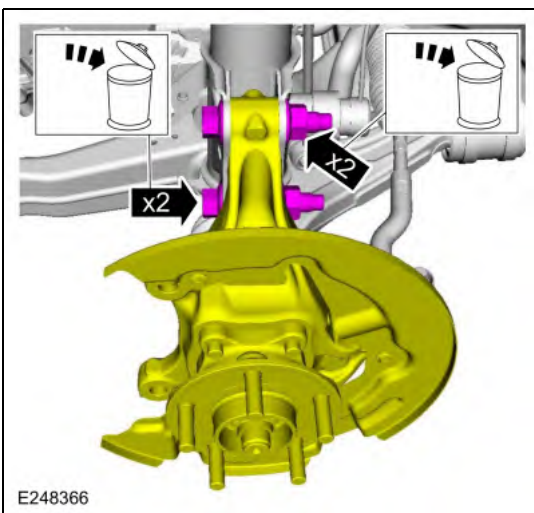
Use the General Equipment: Wooden Block

2. Install.

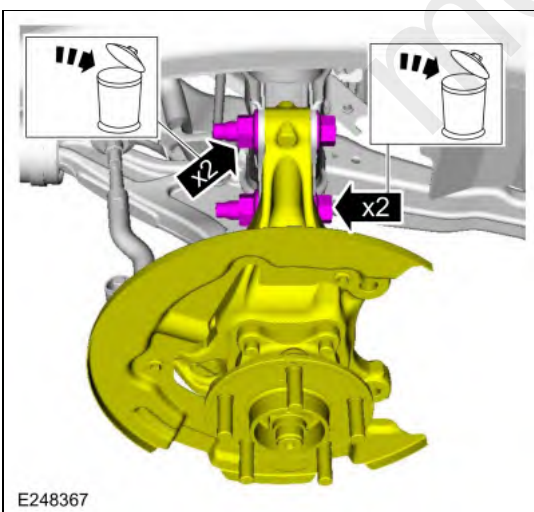
Use the General Equipment: Adjustable Mounting Arm



71. Remove and discard the nuts and bolts.
- Separate the LH knuckle from the strut.



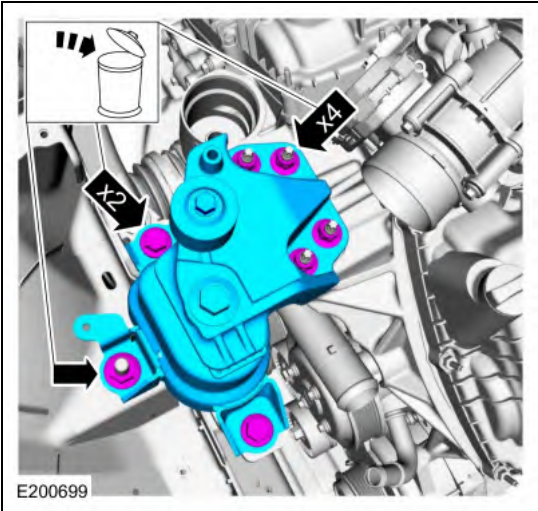
72. Remove and discard the nuts and bolts.
- Separate the RH knuckle from the strut.



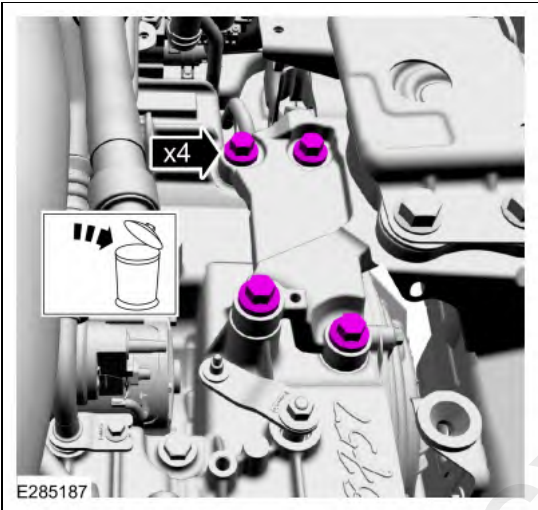
73. **NOTICE:** The engine mount and bracket are serviced as an assembly. Do not remove the engine mount bracket-to-engine mount bolt, this fastener is not

serviceable.

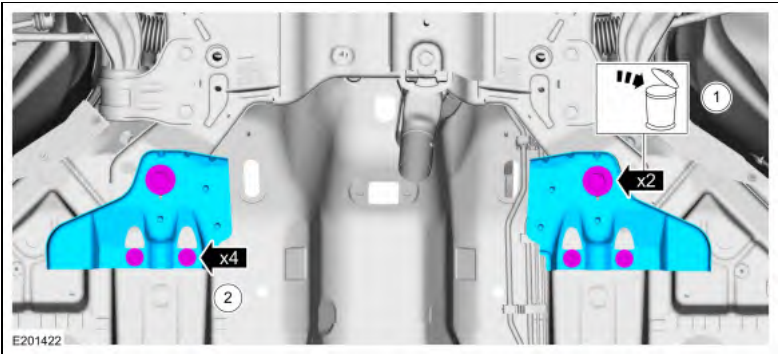
- Remove and discard the nut and bolts.
- Remove the engine mount and bracket assembly.



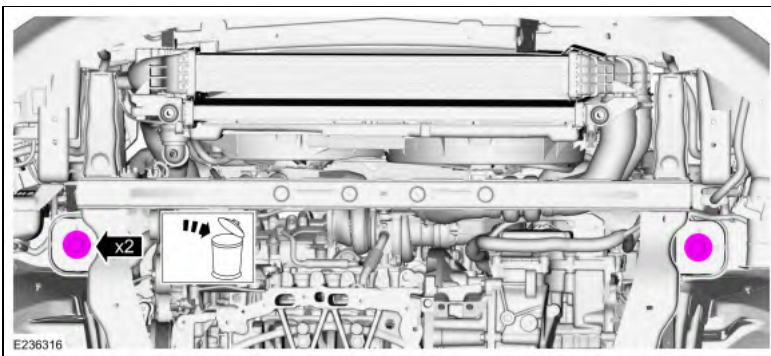
74. Remove and discard the transmission mount bolts.



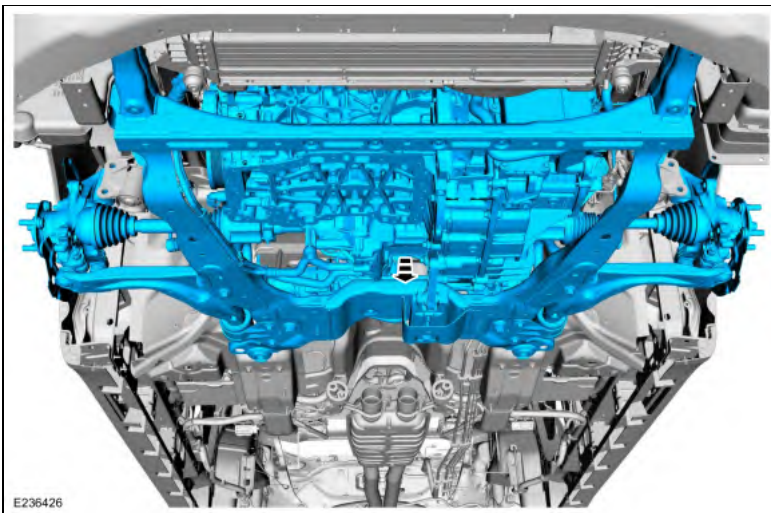
- 75.
1. Remove and discard the subframe bolts.
 2. Remove the bolts and the subframe brackets.



76. Remove and discard the subframe bolts.

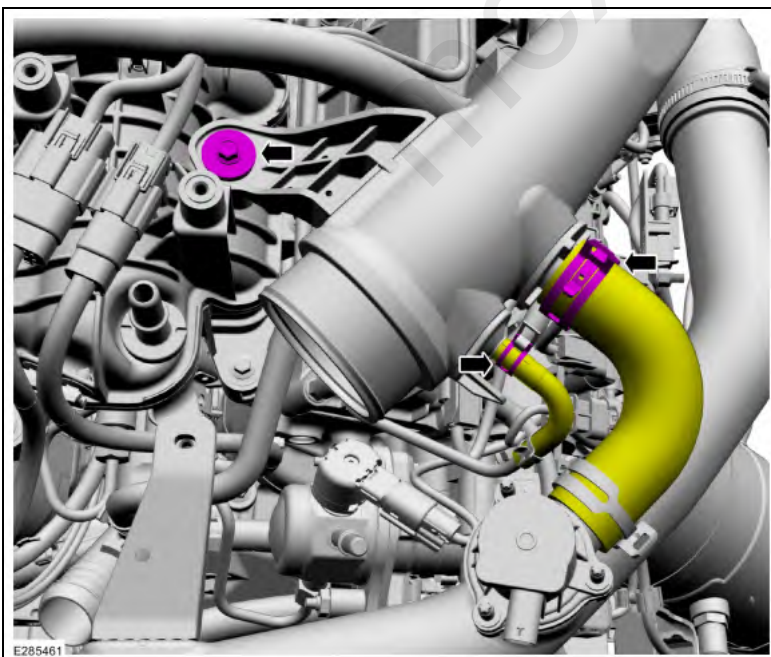


77. Using the powertrain jack, lower the powertrain and subframe as an assembly.
Use the General Equipment: Powertrain Jack



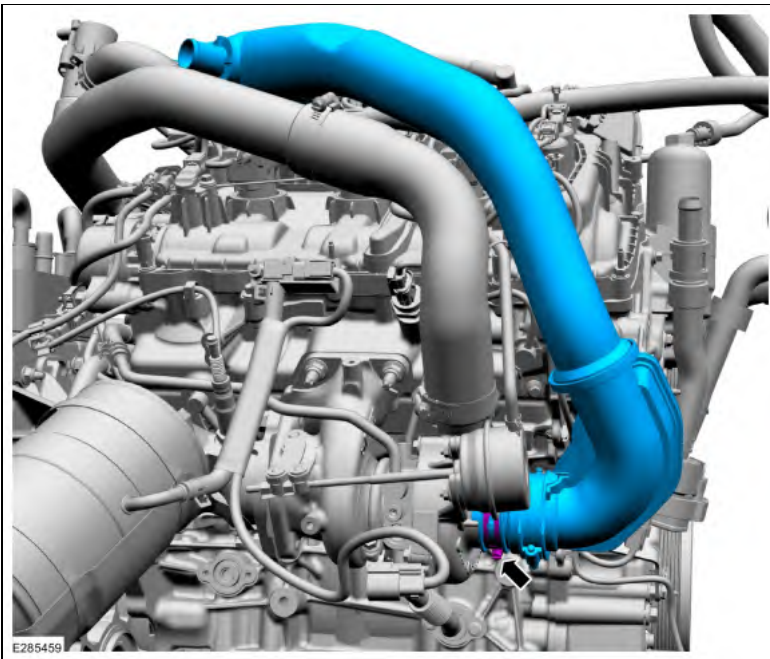
78. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

1. Remove the bolt.
2. Release the clamps and disconnect the hoses.
Use the General Equipment: Hose Clamp Remover/Installer
- Cover all open ports.



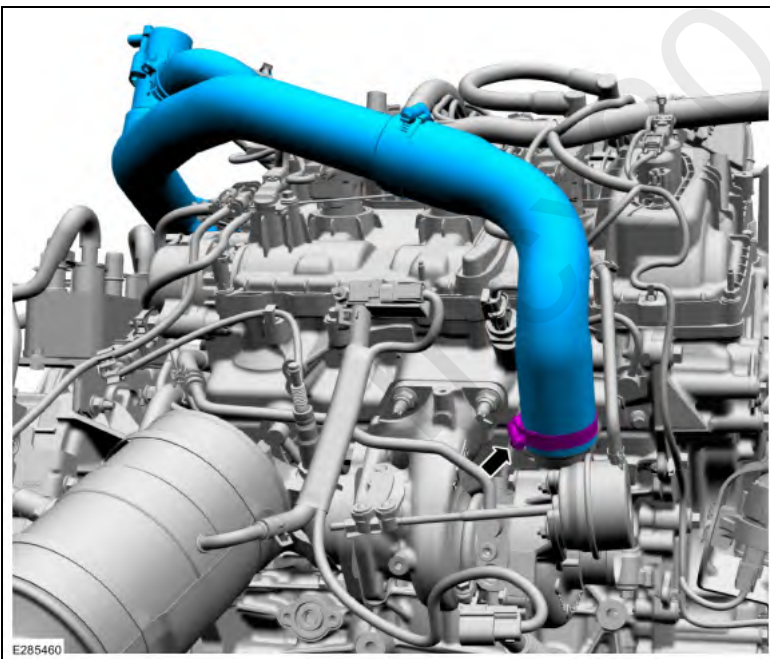
79. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

1. Loosen the clamp and remove the turbocharger intake pipe.
• Cover all open ports.

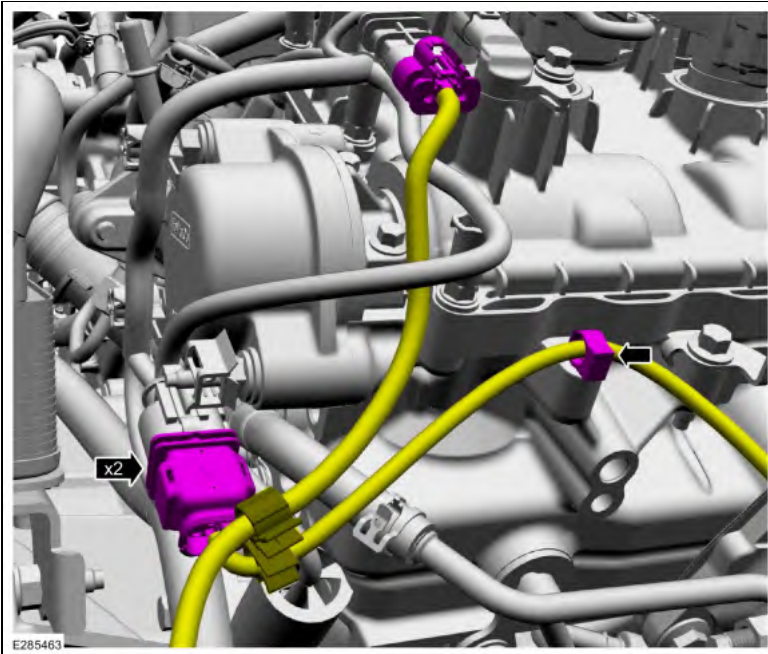


80. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

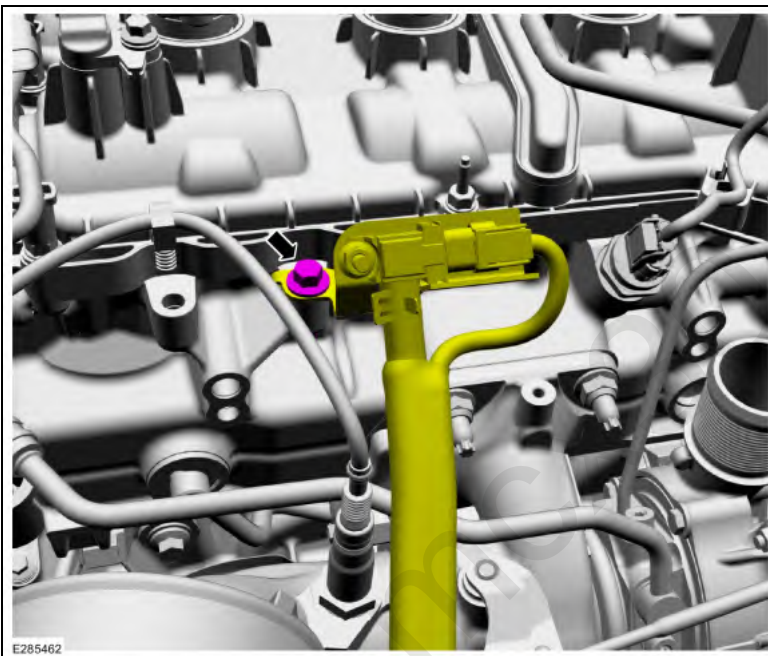
1. Loosen the clamp and remove the turbocharger outlet pipe.
 - Cover all open ports.



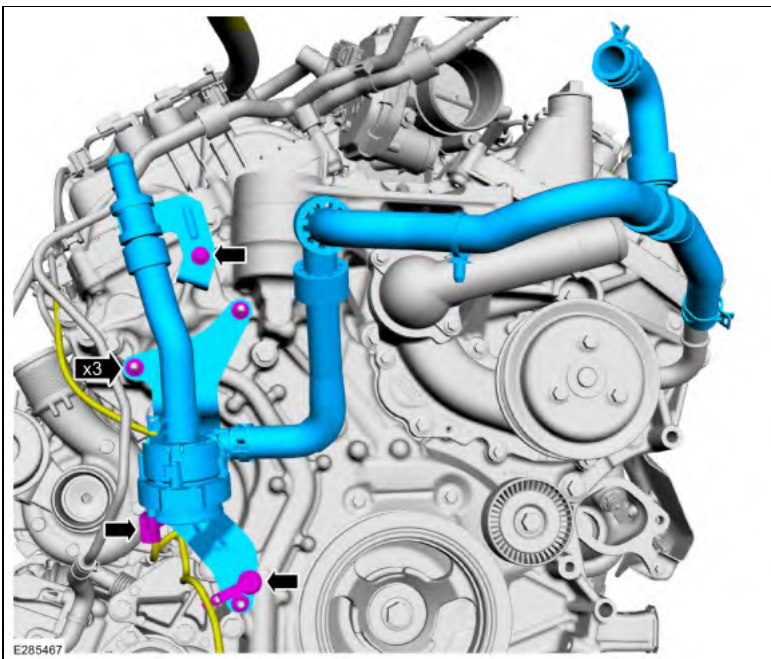
- 81.
- Disconnect the HO2S and the catalyst monitor sensor electrical connectors.
 - Detach the wiring harness retainer.



82. If equipped, remove the bolt and position the transducer aside.

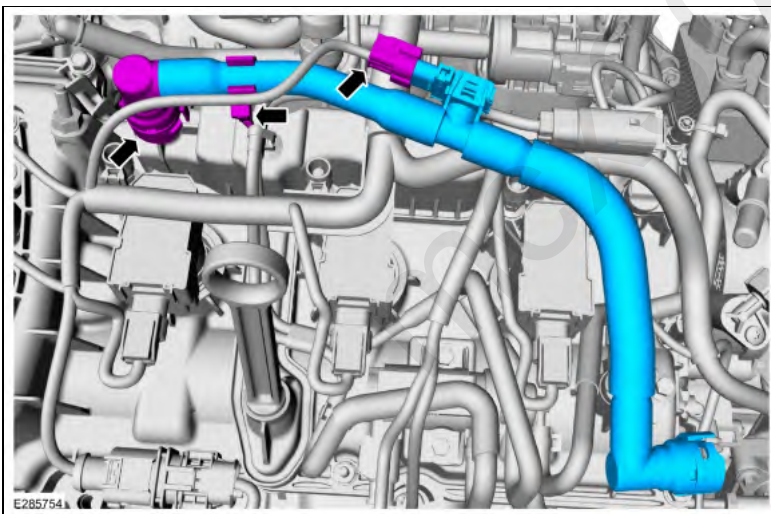


- 83.
- Disconnect the coolant pump electrical connector.
 - Detach the wiring harness retainer.
 - Remove the nuts, bolt and the coolant pump and hose assembly.



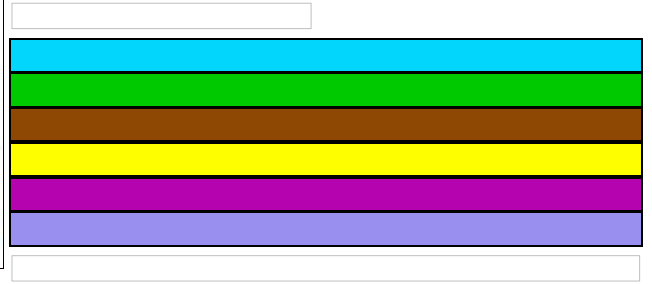
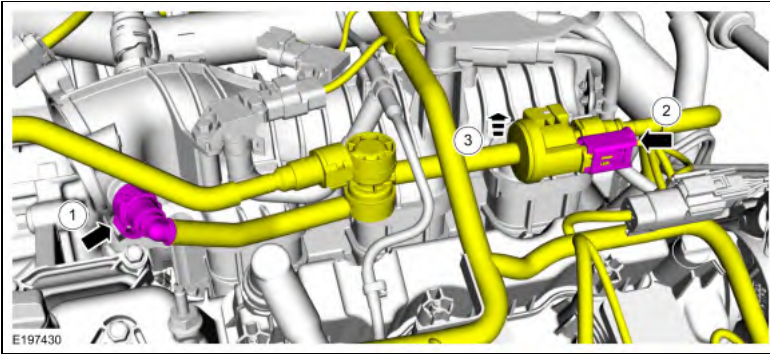
84.

- Disconnect the crankcase pressure sensor electrical connector.
- Detach the PCV tube retainer.
- Disconnect the PCV tube quick release coupling and remove the tube.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .

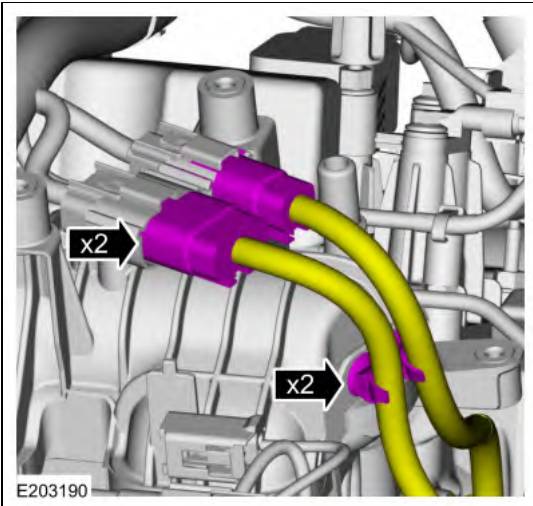


85.

1. Disconnect the EVAP tube quick release coupling.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
2. Disconnect the EVAP purge valve electrical connector.
3. Lift the EVAP purge valve off of the intake manifold mounting tab.

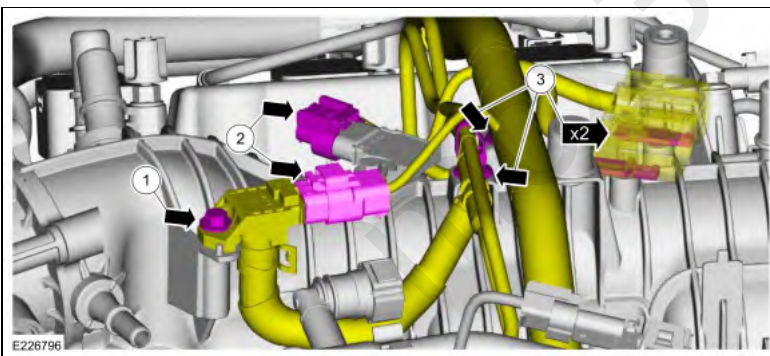


86. Disconnect the engine wiring harness electrical connectors and retainers.



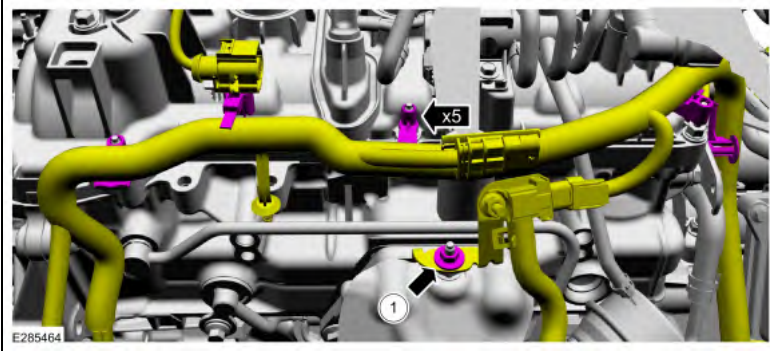
87.

1. Remove the vacuum harness pressure sensor bolt.
2. Disconnect the wiring harness electrical connectors.
3. Detach the wiring harness and vacuum harness retainers.

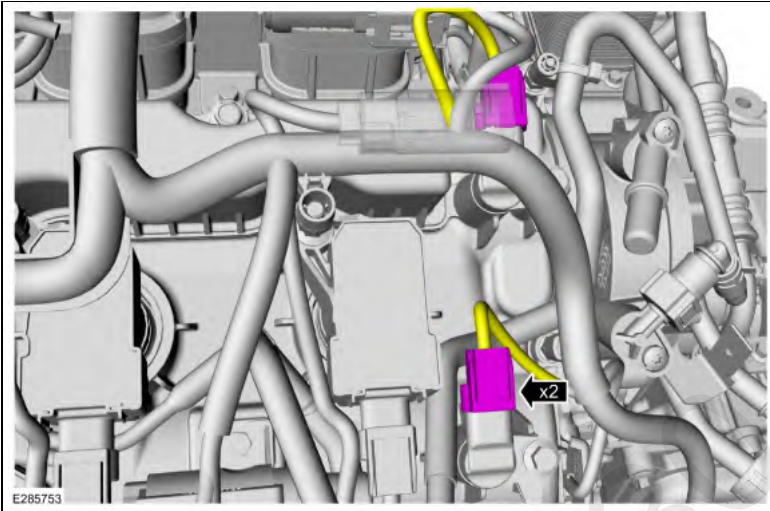


88.

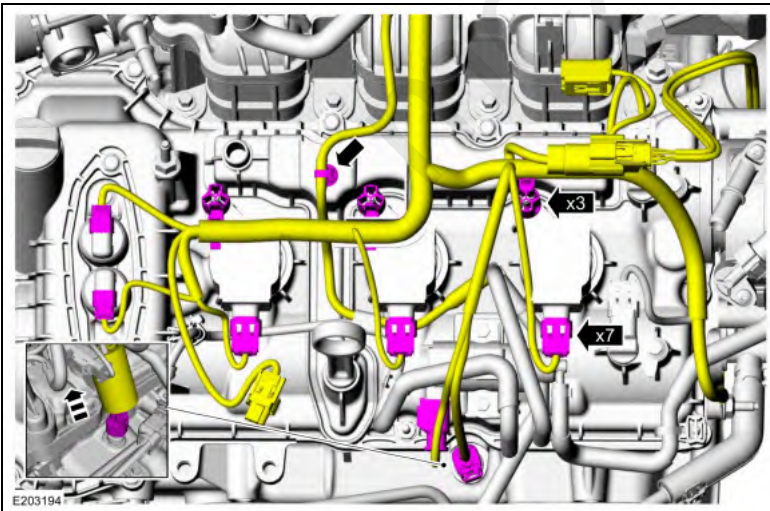
1. If equipped, remove the nut and position the transducer aside.
 - Detach the retainers and position the battery cable aside.



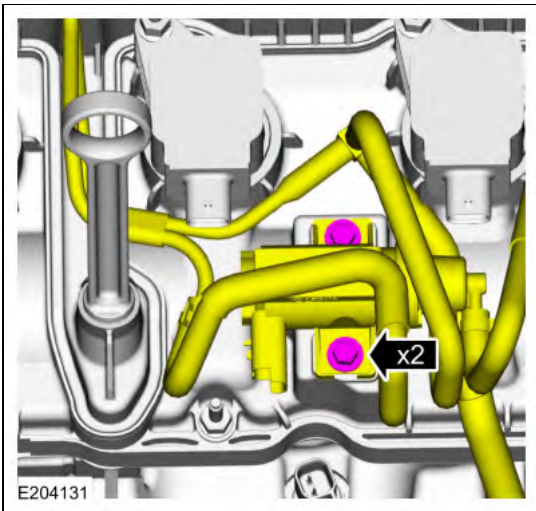
89. Disconnect theCMP electrical connectors.



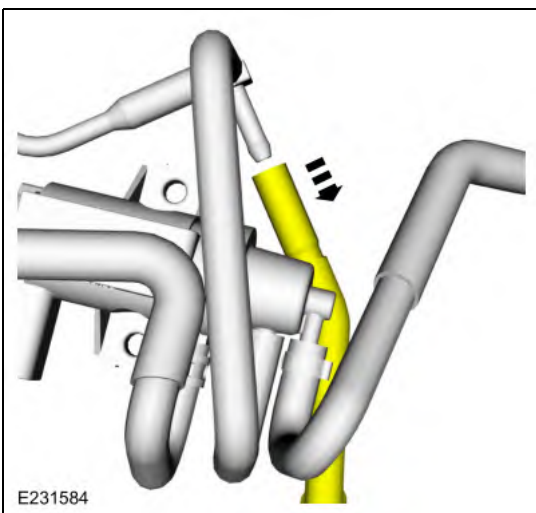
- 90.
- Slide the insulator up to access the CHT electrical connector.
 - Disconnect the engine wiring harness electrical connectors and detach the harness and vacuum hose retainers.



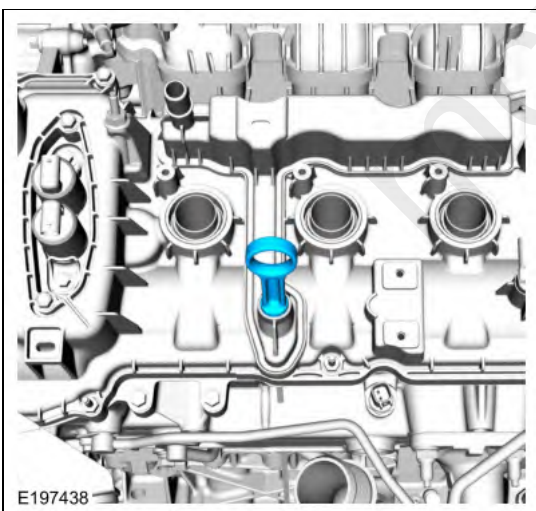
91. Remove the bolts and position TC boost solenoid aside.



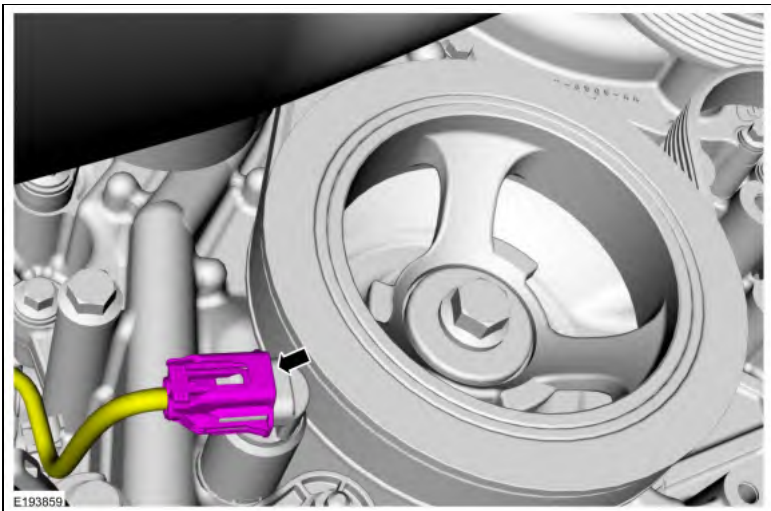
92. Disconnect the TC vacuum supply hose.



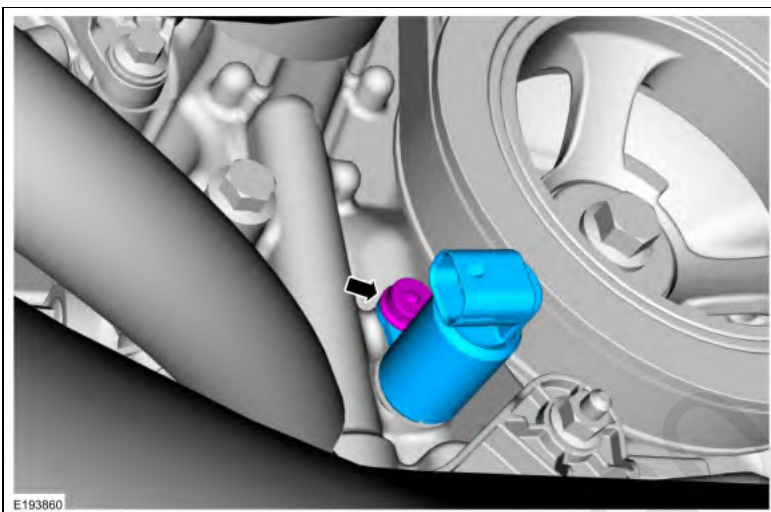
93. Remove the oil level indicator.



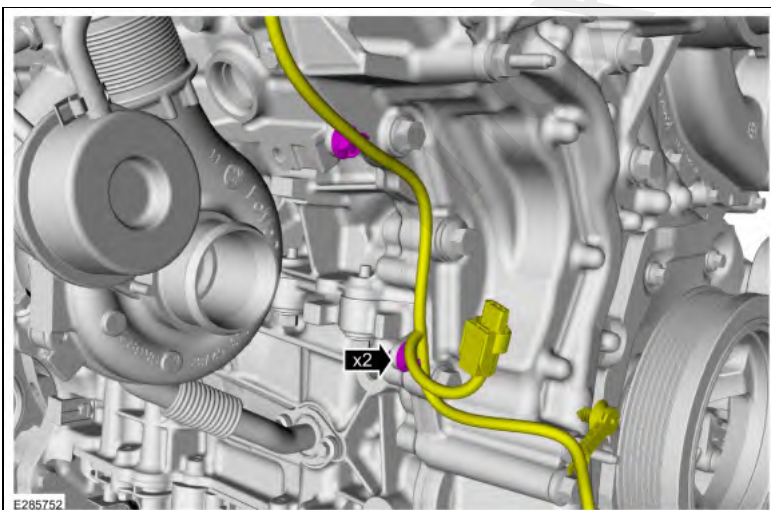
94. Disconnect the oil pressure control solenoid electrical connector.



95. Remove the retainer and the oil pressure control solenoid.

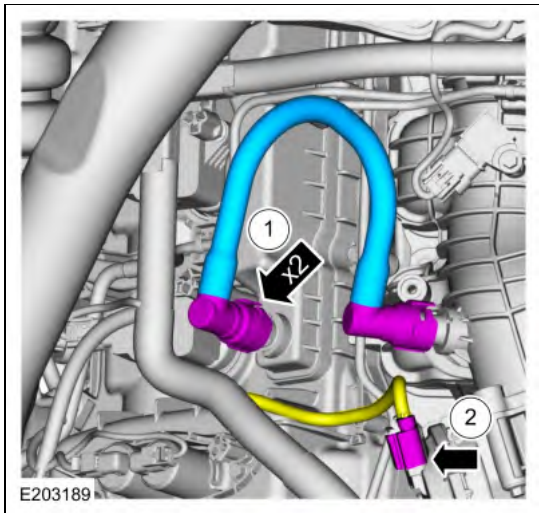


96. Detach the wiring harness retainers.

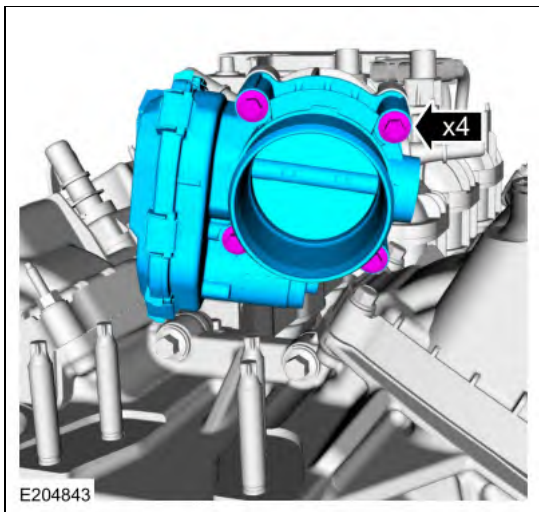


97.

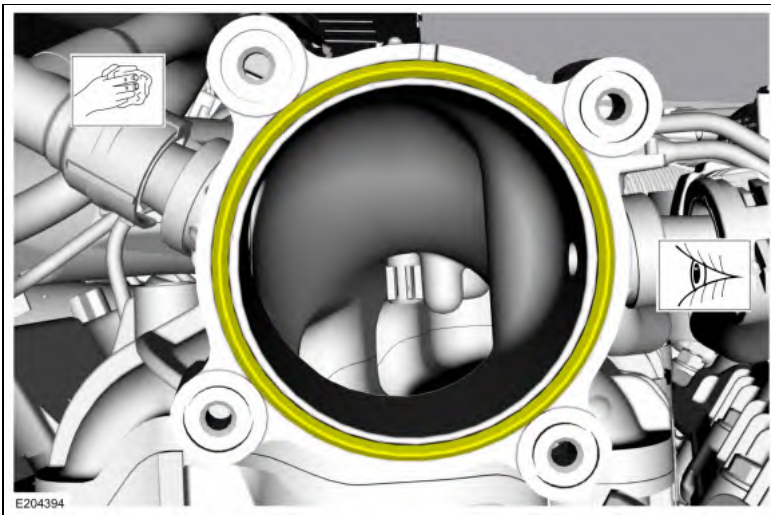
1. Disconnect the PCV tube quick release couplings and remove the tube.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
2. Disconnect the throttle body electrical connector.



98. Remove the bolts and the throttle body.

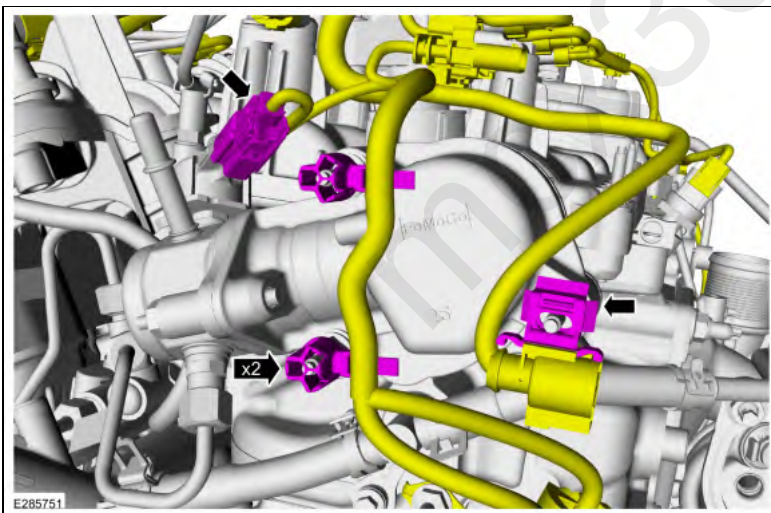


99. Inspect the throttle body gasket and replace as needed.



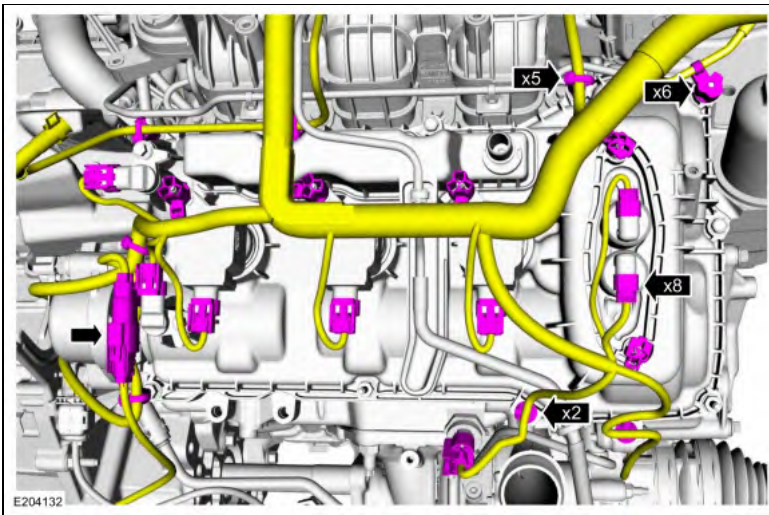
100.

- Disconnect the high pressure fuel pump electrical connector.
- Detach the wiring harness retainers.



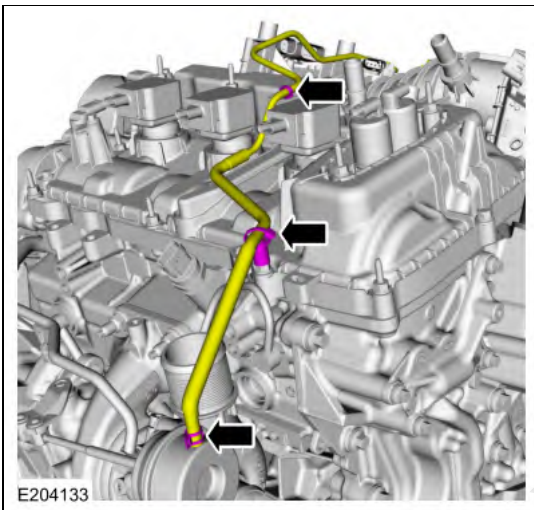
101.

- Disconnect the engine wiring harness electrical connector and retainers.
- Detach the vacuum tube and coolant tube retainers.



102.

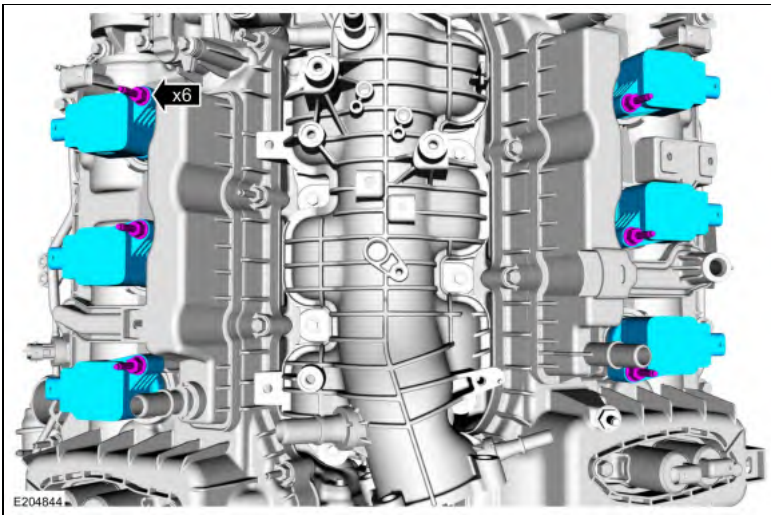
- Disconnect the TC vacuum supply tube.
Use the General Equipment: Hose Clamp Remover/Installer
- Detach the vacuum tube retainers.



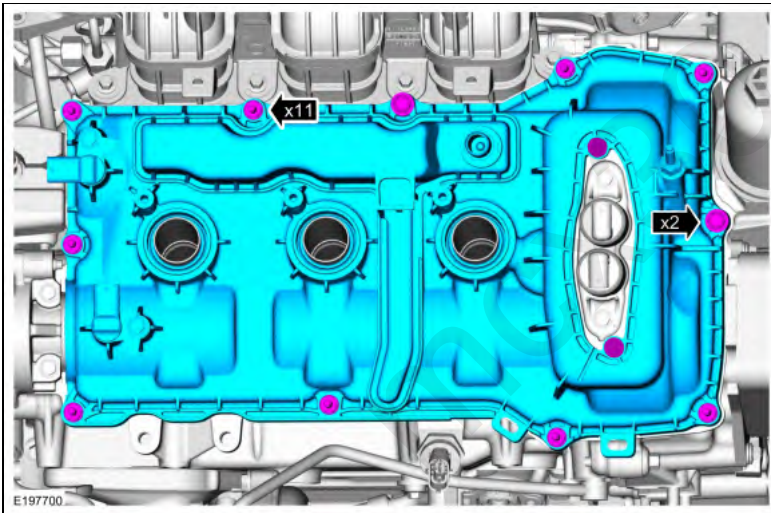
103. **NOTE:** Use compressed air to remove any foreign material from the ignition coil-on-plugs and surrounding area before removing the ignition coil-on-plugs.

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

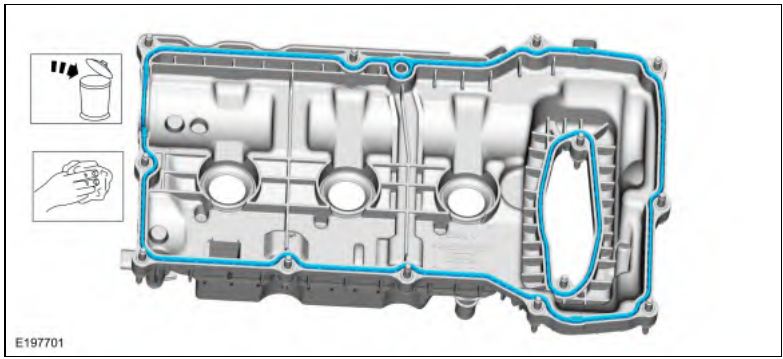
Remove the bolts and the coil-on-plug assemblies.



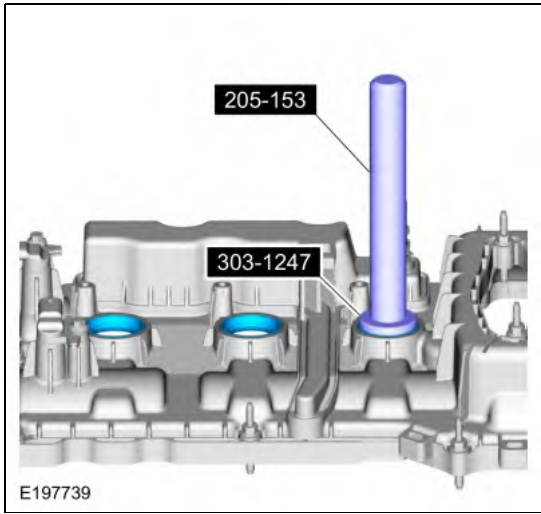
104. Loosen the fasteners and remove the valve cover.



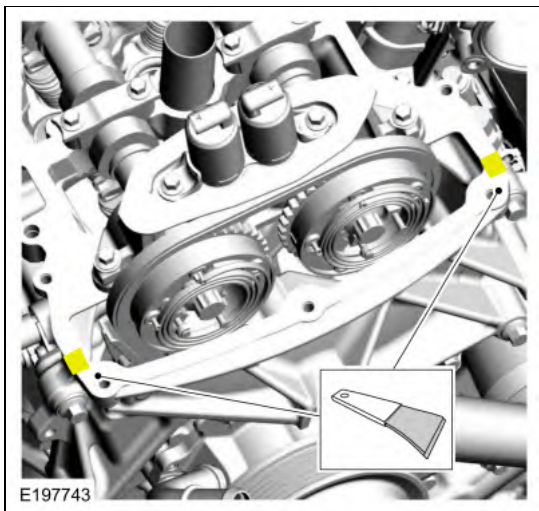
105. Remove and discard the gasket.
- Clean the valve cover gasket groove with soap and water or a suitable solvent.



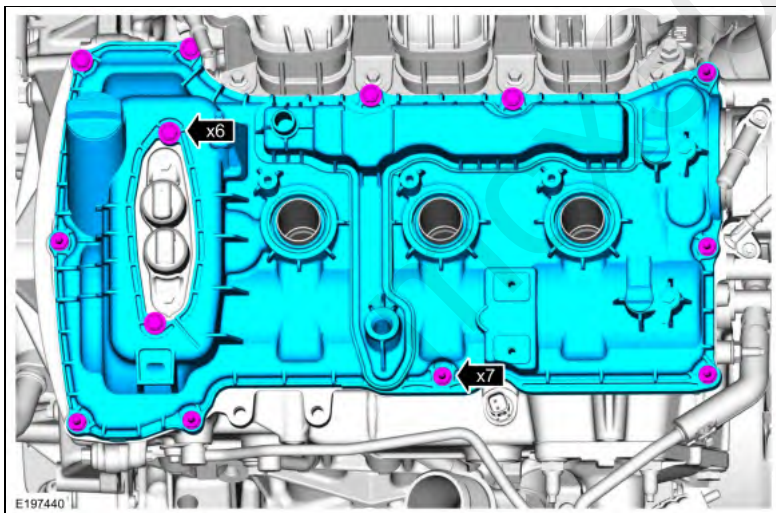
106. Inspect the spark plug seals. Remove any damaged seals using the special tools.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 303-1247 VCT Spark Plug Tube Seal Remover and Installer.



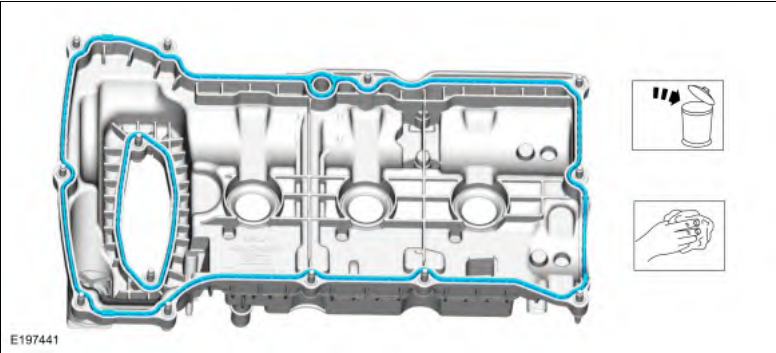
107. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper



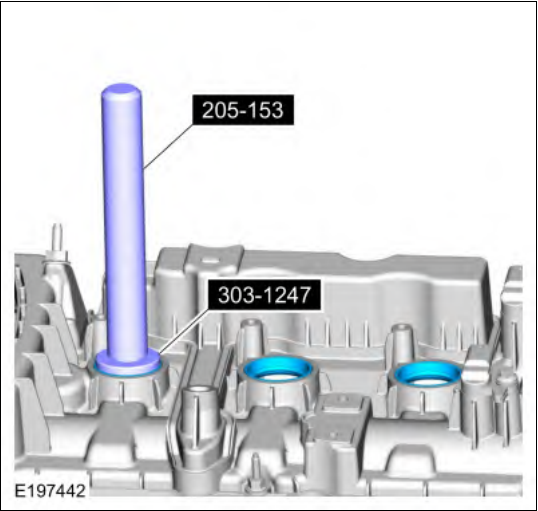
108. Loosen the fasteners and remove the valve cover.



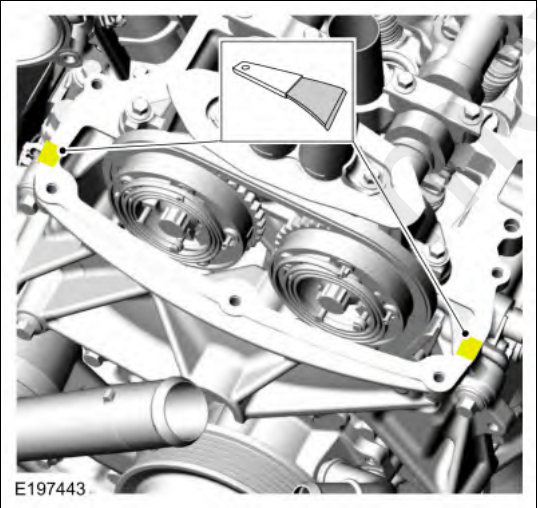
- 109.
- Remove and discard the gasket.
 - Clean the valve cover gasket groove with soap and water or a suitable solvent.



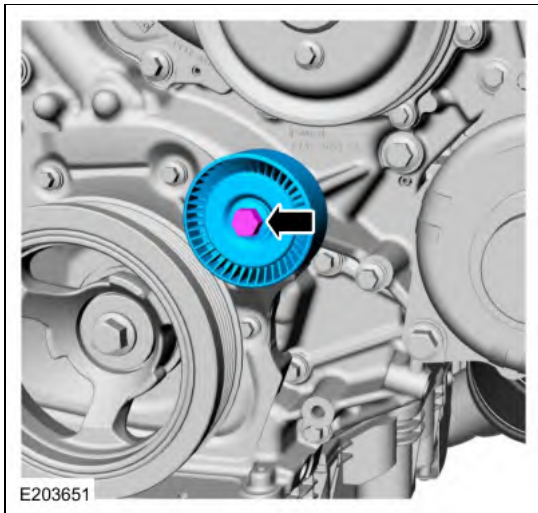
110. Inspect the spark plug seals. Remove any damaged seals using the special tools.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 303-1247 VCT Spark Plug Tube Seal Remover and Installer.



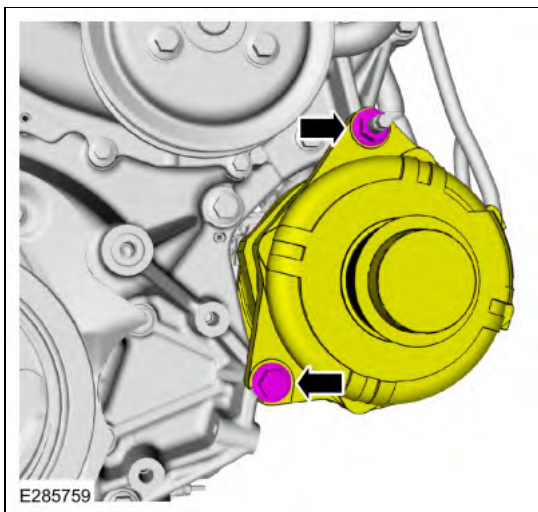
111. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper



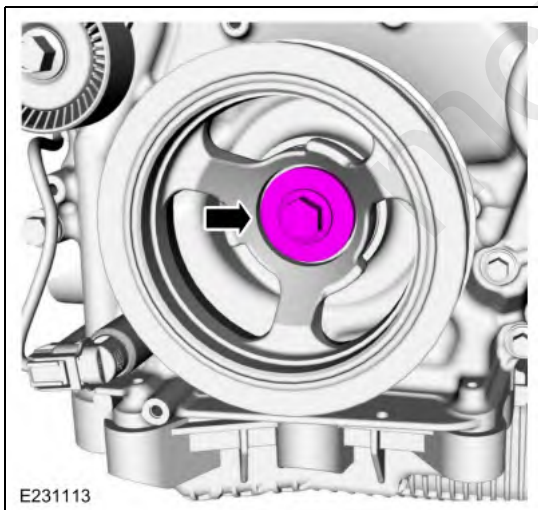
112. Remove the bolt and the idler pulley.



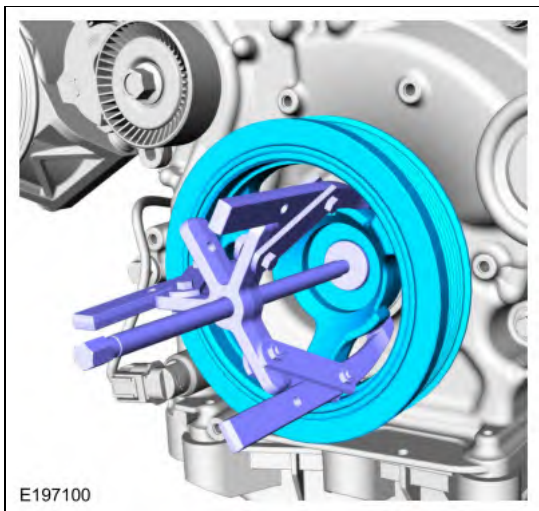
113. Remove the nut, the bolt and position the generator aside.



114. Remove the crankshaft pulley bolt.



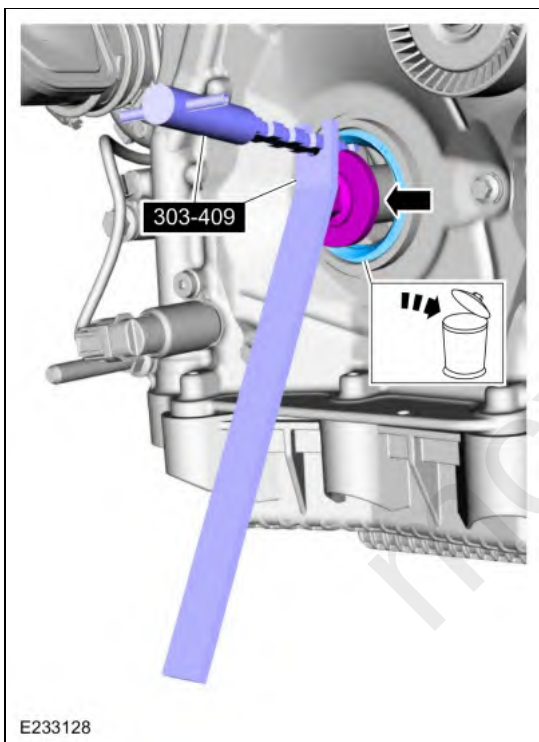
115. Using the 3 Leg Puller and a step plate, remove the crankshaft pulley.
Use the General Equipment: Three Leg Puller



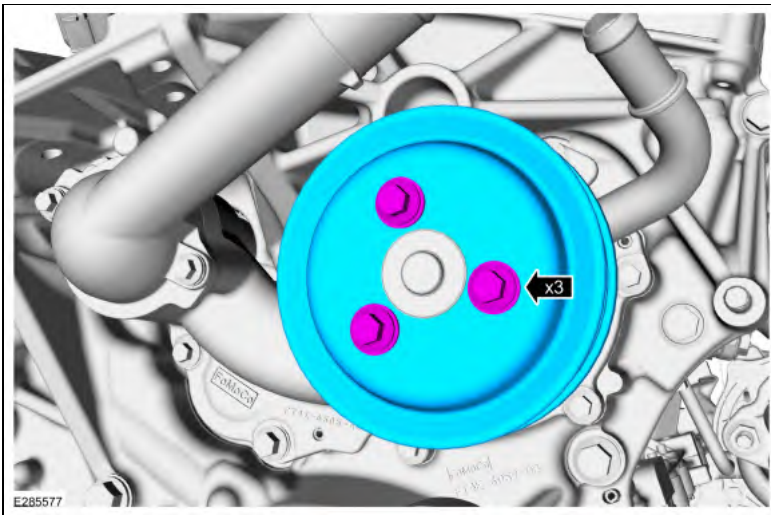
116. **NOTICE:** Use care not to damage the engine front cover or the crankshaft when removing the seal.

1. Install the crankshaft pulley bolt.
2. Using the special tool, remove and discard the crankshaft front oil seal.
Use Special Service Tool: 303-409 (T92C-6700-CH) Remover, Crankshaft Seal.
3. **NOTE:** Retain the original crankshaft pulley bolt for turning the crankshaft while the pulley is removed.

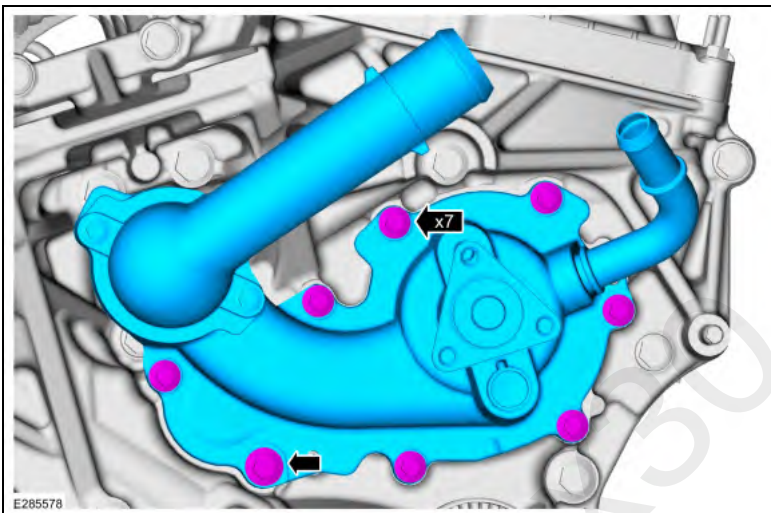
Remove the crankshaft pulley bolt.



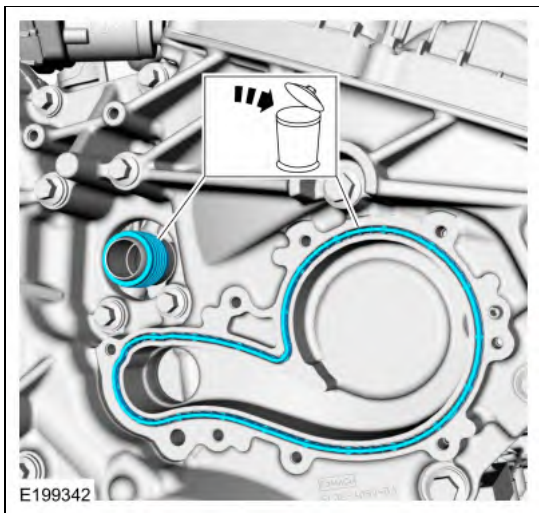
117. Remove the bolts and the coolant pump pulley.



118. Remove the bolts and the coolant pump.

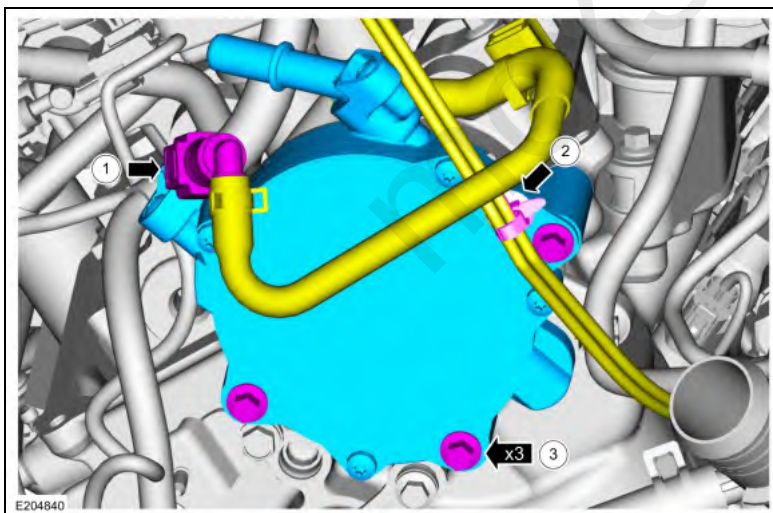


119. Remove and discard the coolant pump gasket and seal.

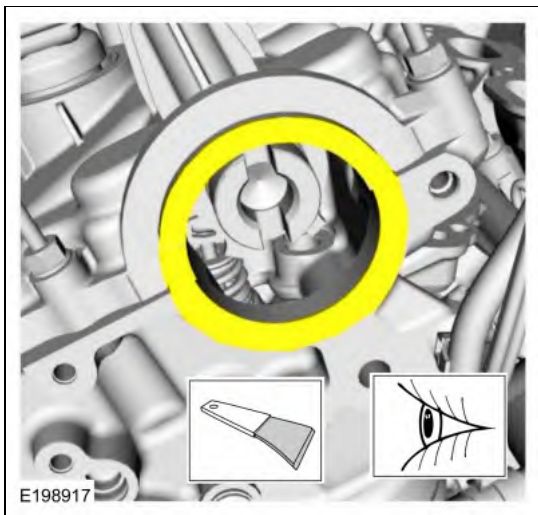


120.

1. Disconnect the vacuum tube.
2. Detach the wiring harness retainer.
3. Remove the bolts and the brake vacuum pump.

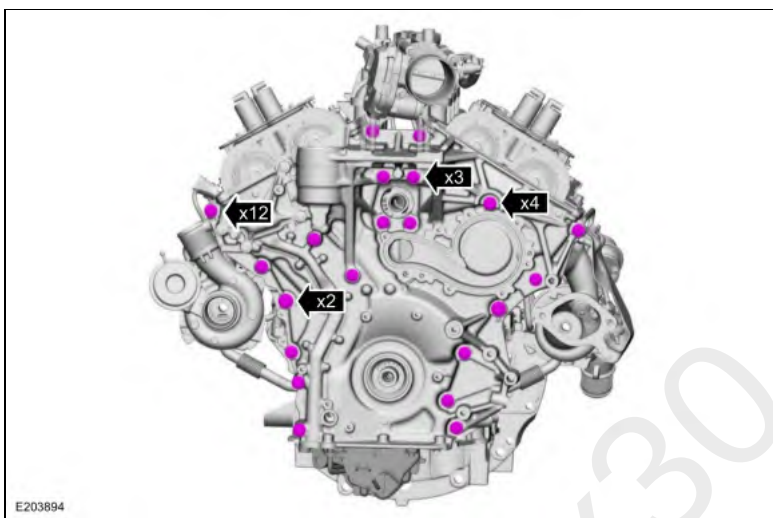


121. Clean and prepare the RTV sealing surface.
 Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).
 Use the General Equipment: Plastic Scraper

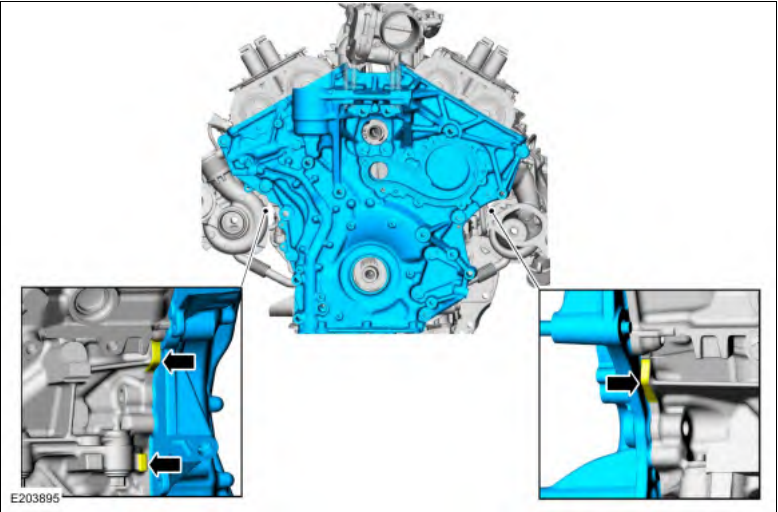


122. **NOTE:** There are 4 different types of fasteners, note location of each fastener for assembly.

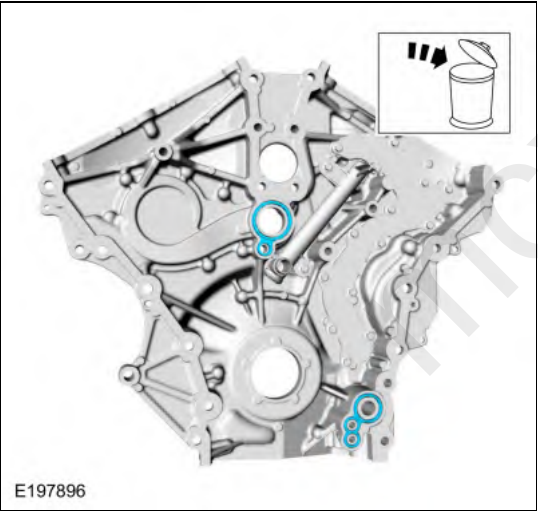
Remove the engine front cover fasteners.



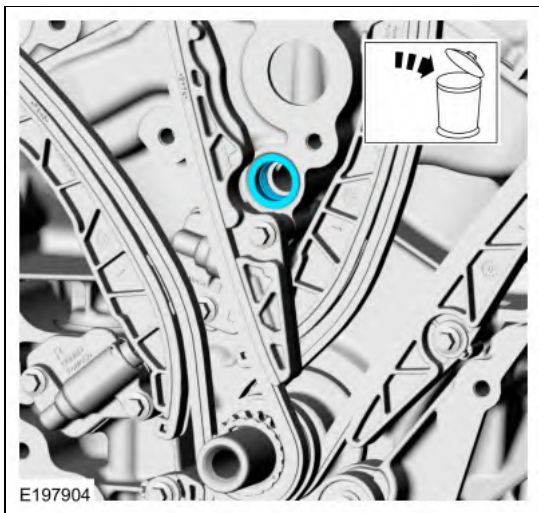
123. Using a large flat-bladed screwdriver and the indicated pry pads, release the sealer and remove the engine front cover.
Use the General Equipment: Flat-Bladed Screwdriver



124. Remove and discard the engine front cover gaskets.

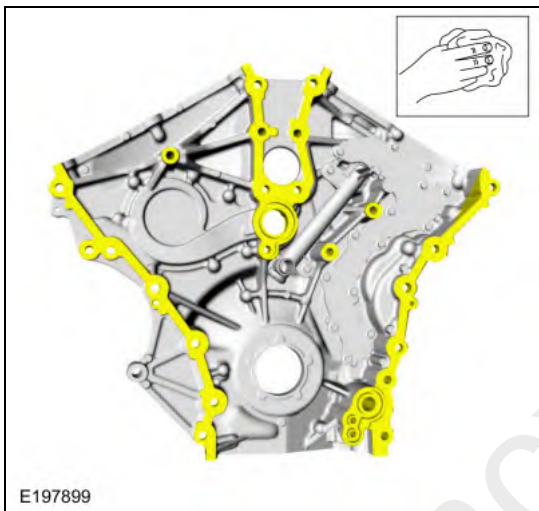


125. Remove and discard the oil gallery seal (6G068).

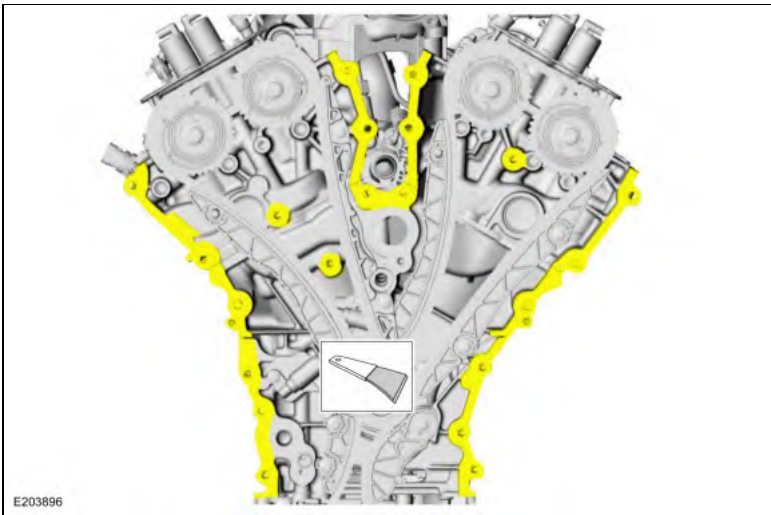


126.

- Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).

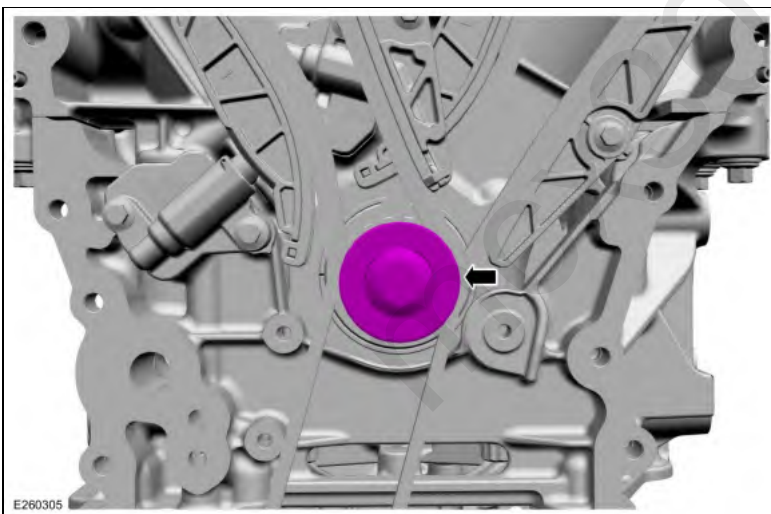


127. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).
Use the General Equipment: Plastic Scraper



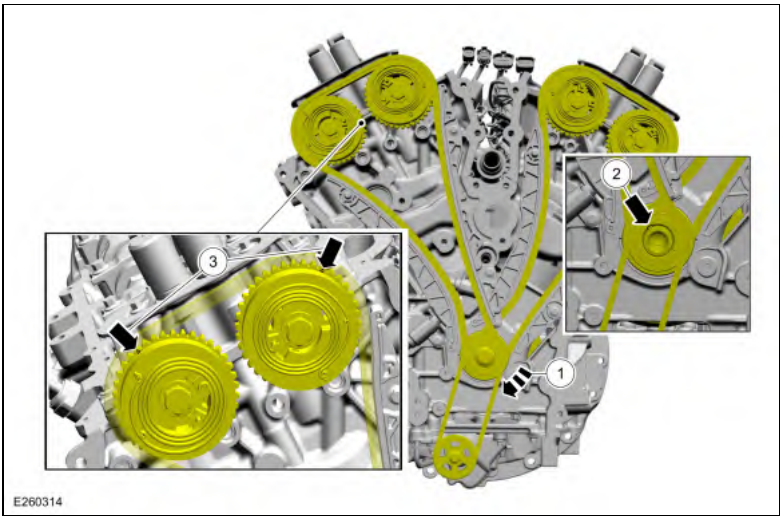
128. **NOTICE:** Rotate the crankshaft utilizing only the original crankshaft pulley bolt. Failure to follow this direction may cause damage to the crankshaft and result in engine failure.

Install the original crankshaft pulley bolt.

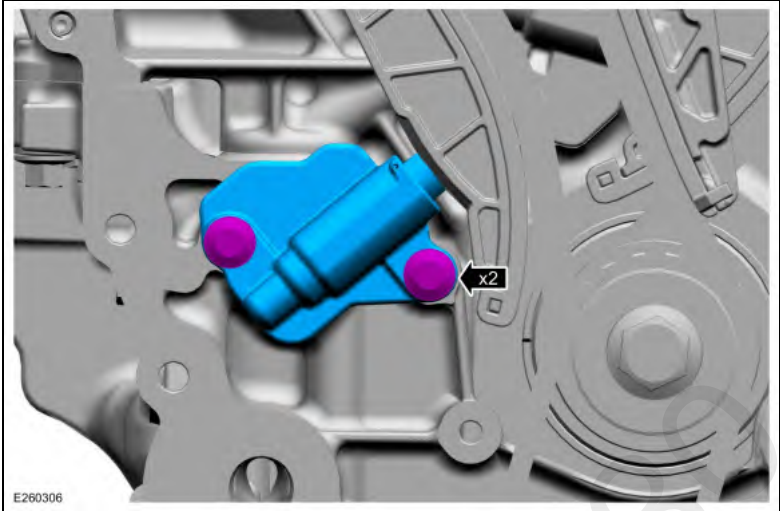


129. **NOTICE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the RH side the triangle marks are used.

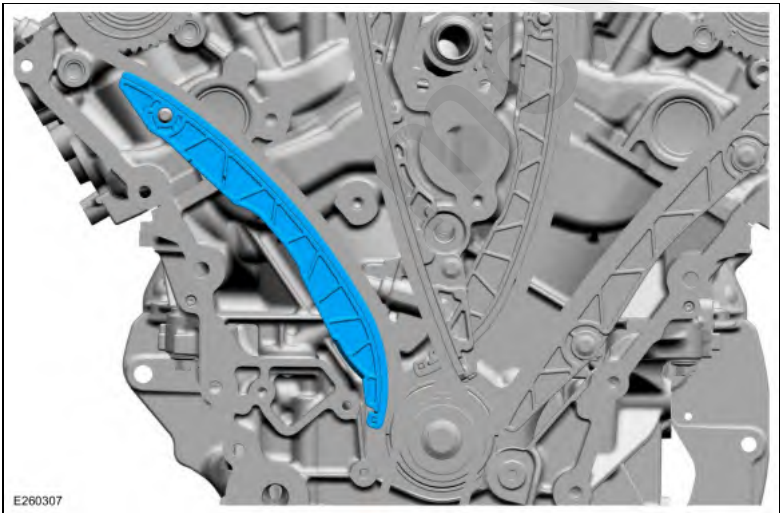
1. Rotate the crankshaft clockwise.
2. Position the crankshaft sprocket keyway at the 11 o'clock position.
3. Verify the **triangle** timing marks on the VCT units are at the 2 o'clock (intake) and 11 o'clock (exhaust) positions. If the **circle** timing marks are at these positions the crankshaft must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



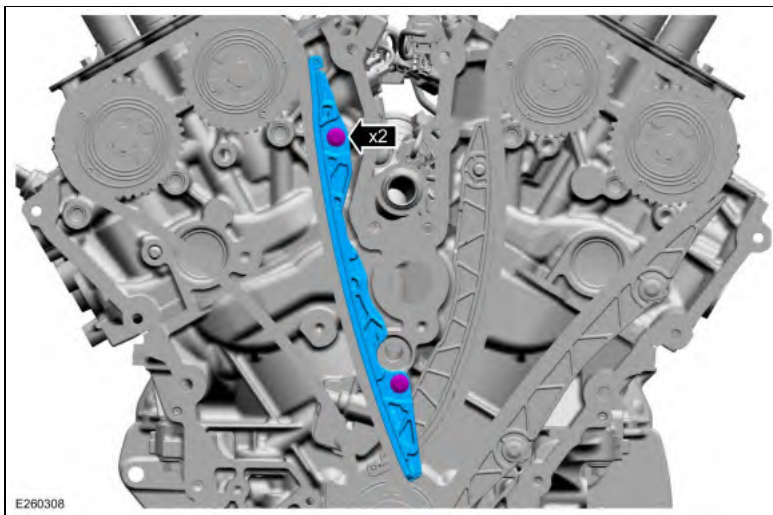
130. Remove the bolts and the RH timing chain tensioner.



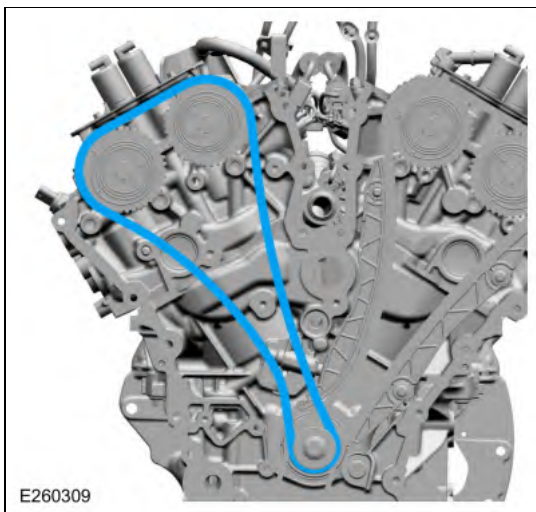
131. Remove the RH timing chain tensioner arm.



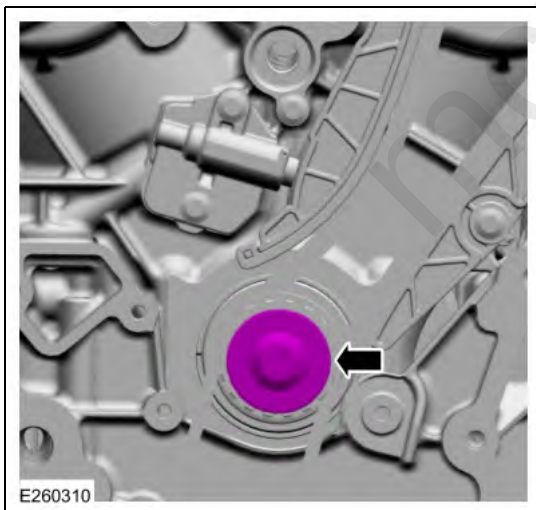
132. Remove the bolts and the RH timing chain guide.



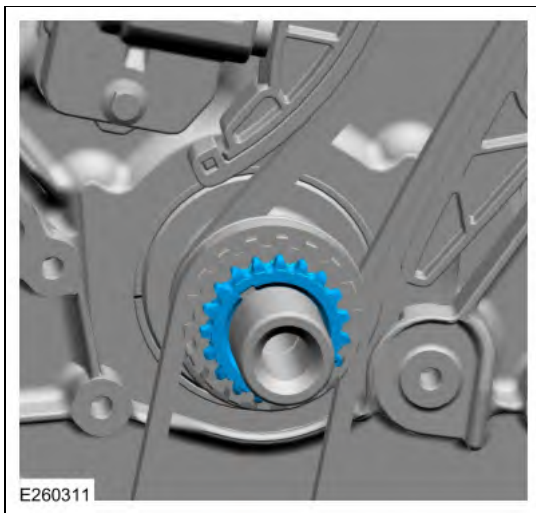
133. Remove the RH timing chain.



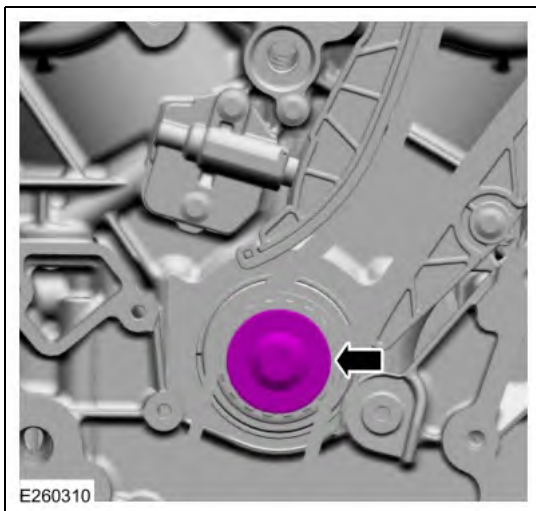
134. Remove the original crankshaft pulley bolt.



135. Remove the timing chain sprocket.



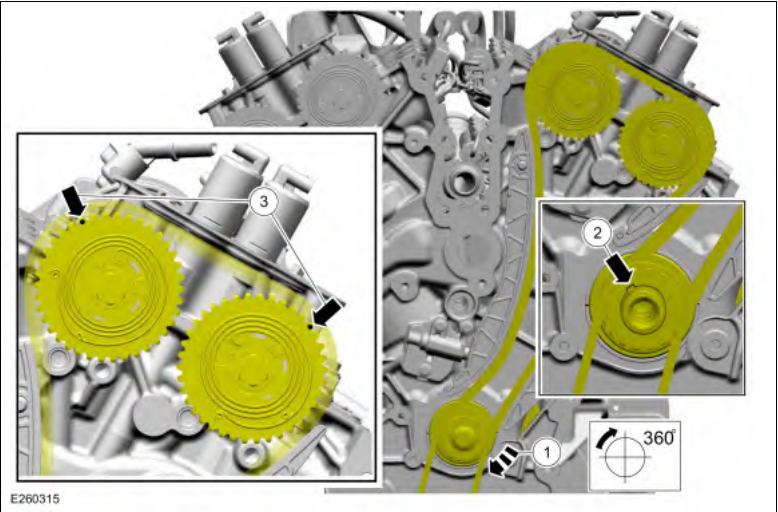
136. Install the original crankshaft pulley bolt.



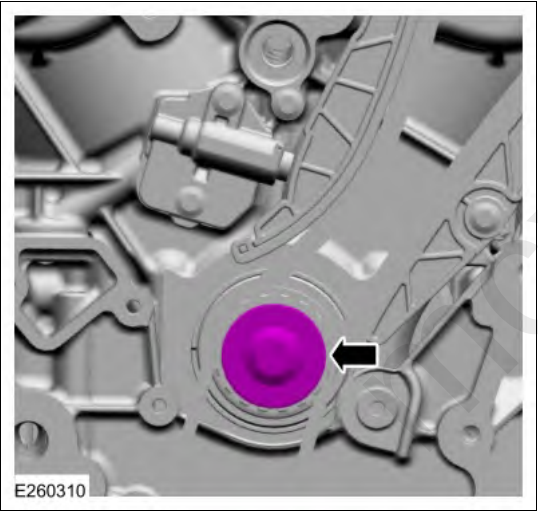
137. **NOTICE: The crankshaft must be rotated clockwise one revolution (360 degrees). Failure to do so will result in incorrect camshaft timing.**

NOTICE: 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.

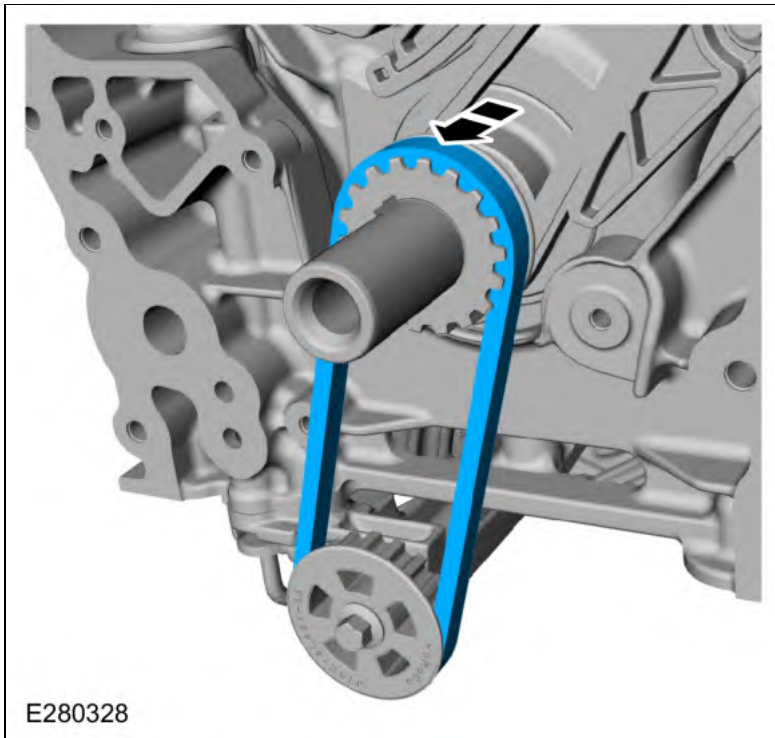
1. Rotate the crankshaft clockwise one revolution (360 degrees).
2. Position the crankshaft sprocket keyway at the 11 o'clock position.
3. The **circle** timing marks on the VCT units will be at the 10 o'clock (intake) and 12:30 (exhaust) positions.



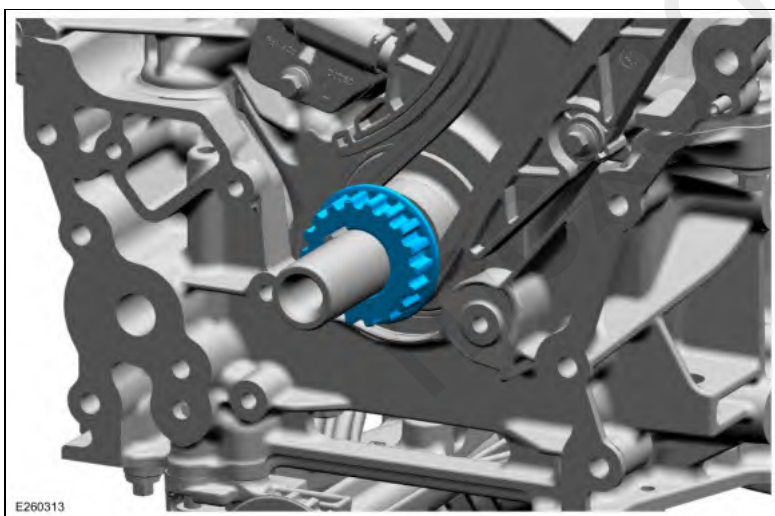
138. Remove the original crankshaft pulley bolt.



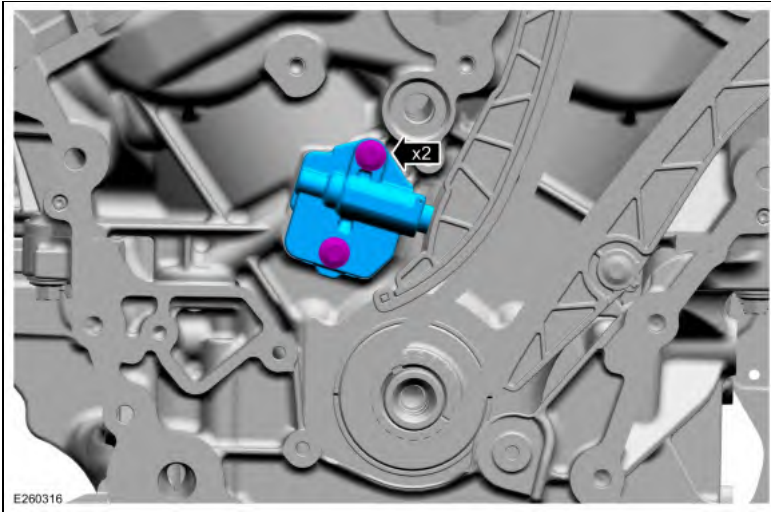
139. Slide the oil pump drive belt off of the crankshaft sprocket and remove the belt.



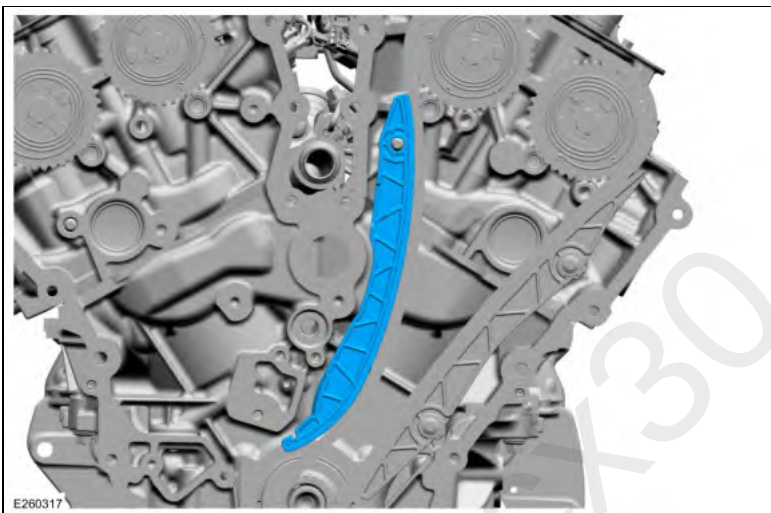
140. Remove the crankshaft sprocket.



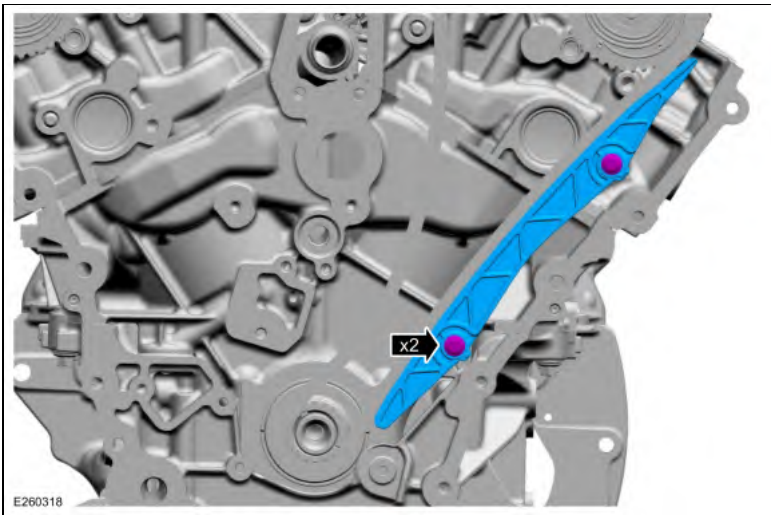
141. Remove the bolts and the LH timing chain tensioner.



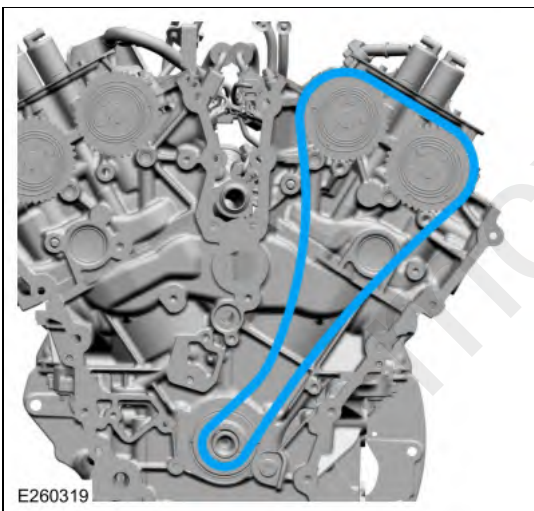
142. Remove the LH timing chain tensioner arm.



143. Remove the bolts and the LH timing chain guide.

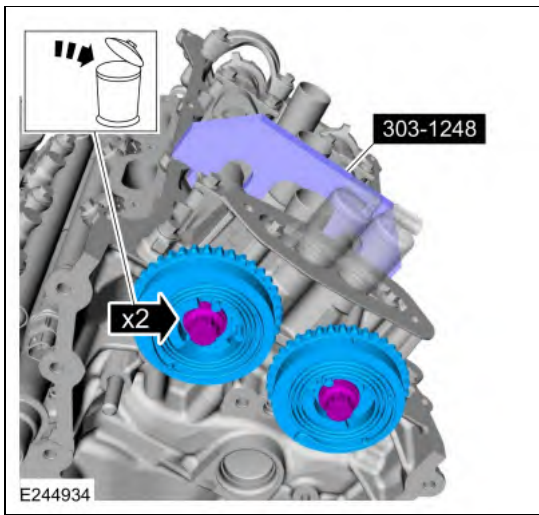


144. Remove the LH timing chain.



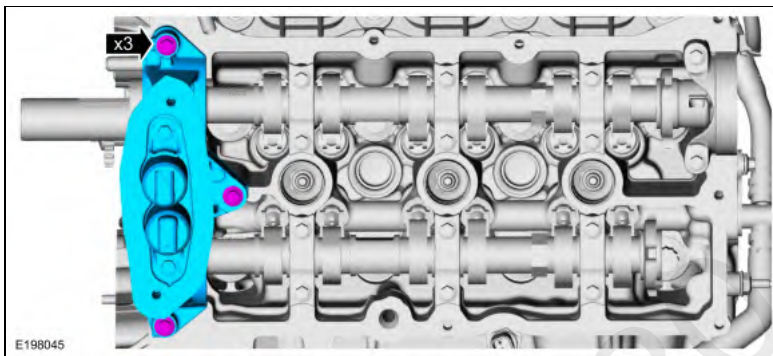
145.

1. Install Special Service Tool: 303-1248 Camshaft holding tools.
2. Remove and discard the VCT unit bolts.
3. Remove the VCT units.

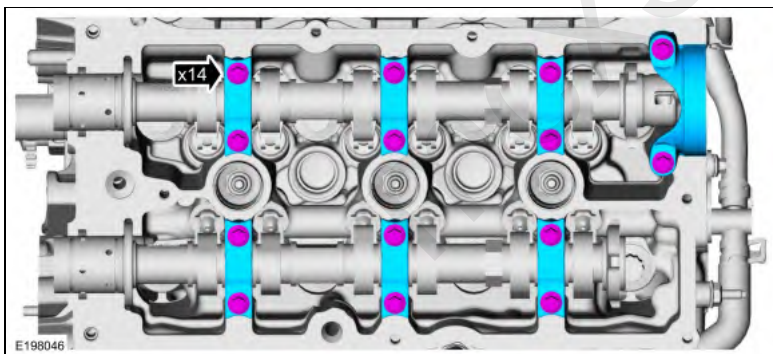


146. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

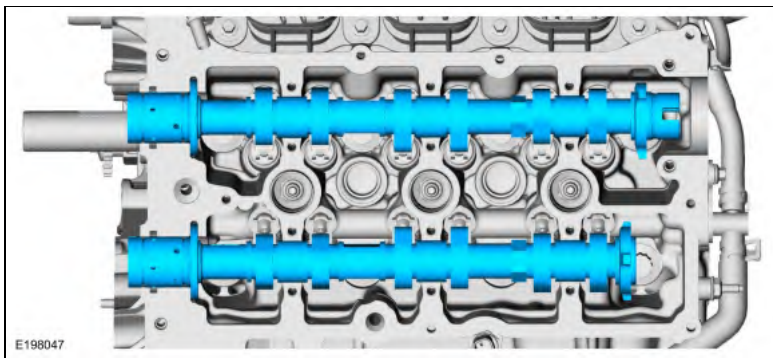
Remove the bolts and the front camshaft bearing mega cap.



147. Remove the bolts and the camshaft bearing caps.

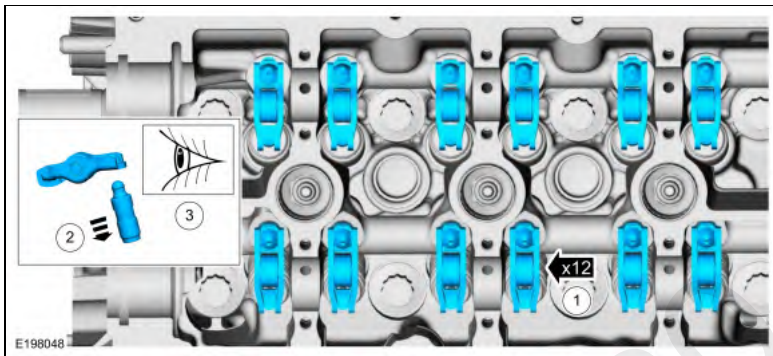


148. Remove the intake and exhaust camshafts.



149.

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.



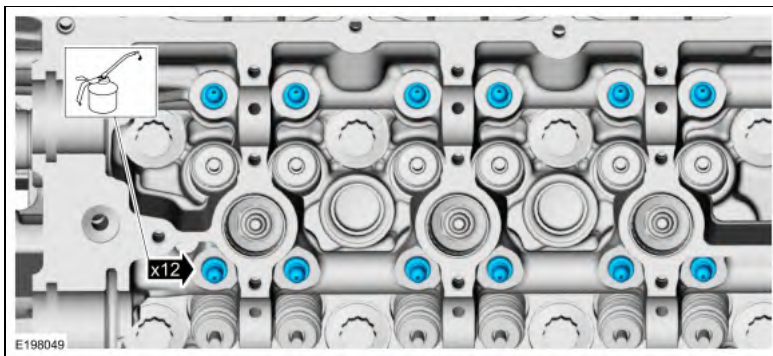
Installation

LHD AWD/LHD FWD

1. **NOTICE: Do not install the camshaft roller followers at this time. The roller followers will be installed later in the procedure. If the roller followers are installed prior to the camshafts, the camshaft caps can become distorted during the camshaft tightening process and result in upper end engine noise or severe damage to the engine.**

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

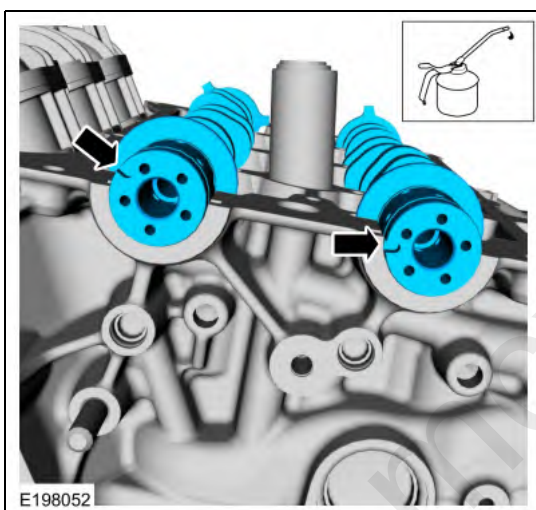
1. Lubricate the hydraulic lash adjusters with clean engine oil.
2. Install the hydraulic lash adjusters.



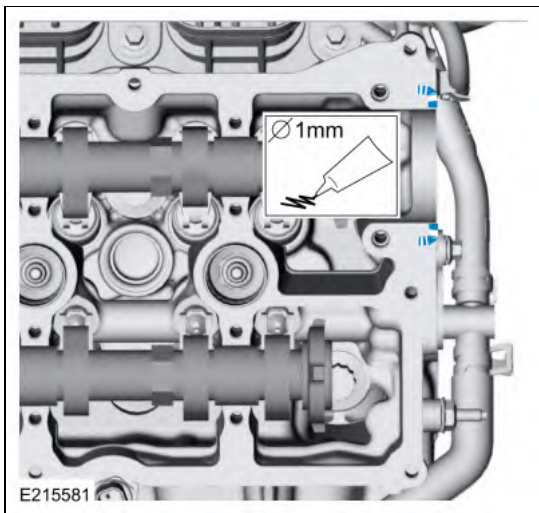
2. **NOTE:** Lubricate the camshafts with clean engine oil prior to installation.

NOTE: It is not necessary to position the scarf-cut seal ends when installing the camshafts.

Install the intake and exhaust camshafts in the neutral position. Align the D-slots as shown in the illustration.

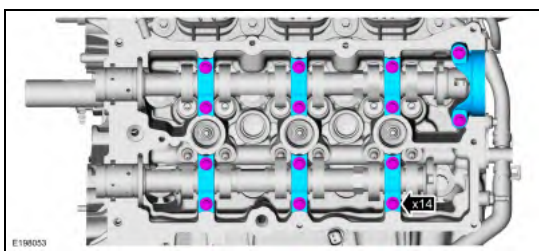


3. Apply a 1 mm bead of sealant to the rear camshaft cap mounting surface of the cylinder head.
 Material: Flange Sealant / CU7Z-19B508-A (WSS-M2G348-A11)



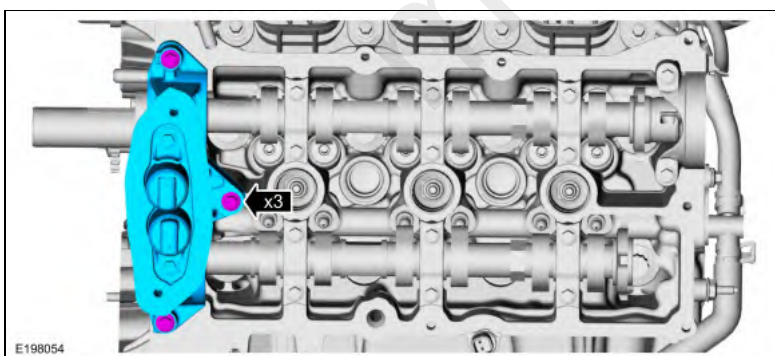
4. **NOTE:** Do not tighten at this time.

Install the camshaft bearing caps and the bolts.

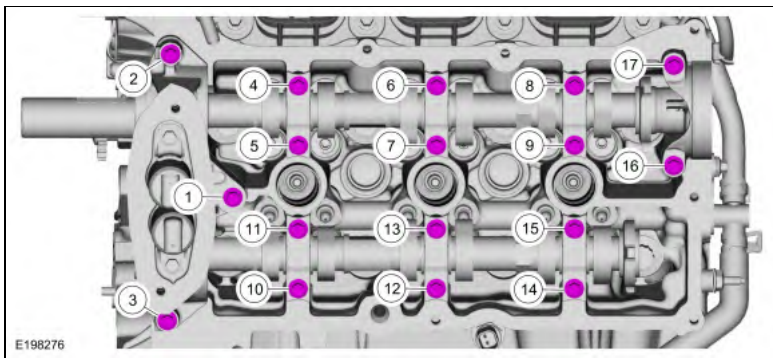


5. **NOTE:** Do not tighten at this time.

Install the front camshaft bearing mega cap and the bolts.



6. Tighten the bolts.
Torque: 133 lb.in (15 Nm)



7. **NOTICE:** 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.
Install Special Service Tool: 303-1248 Camshaft holding tools.
2. Install the new VCT unit bolts.

Torque:

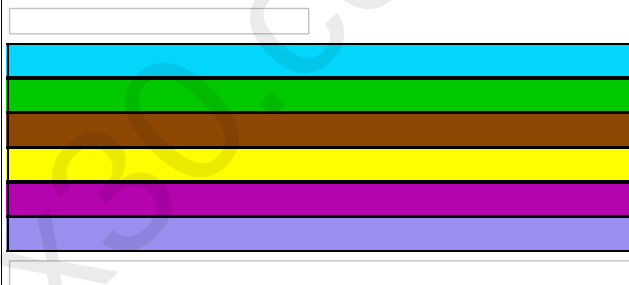
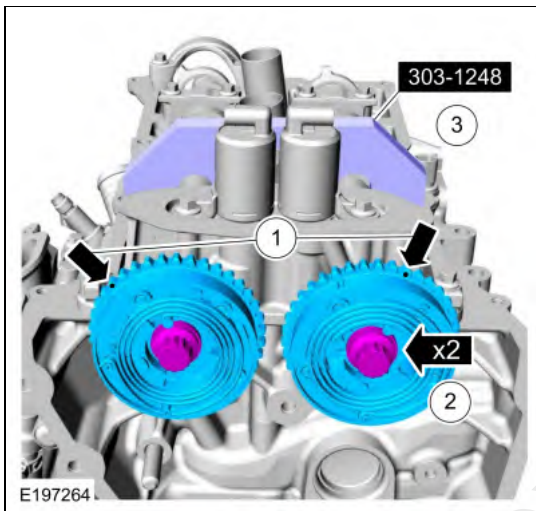
Stage 1: 30 lb.ft (40 Nm)

Stage 2: Loosen: 360°

Stage 3: 37 lb.ft (50 Nm)

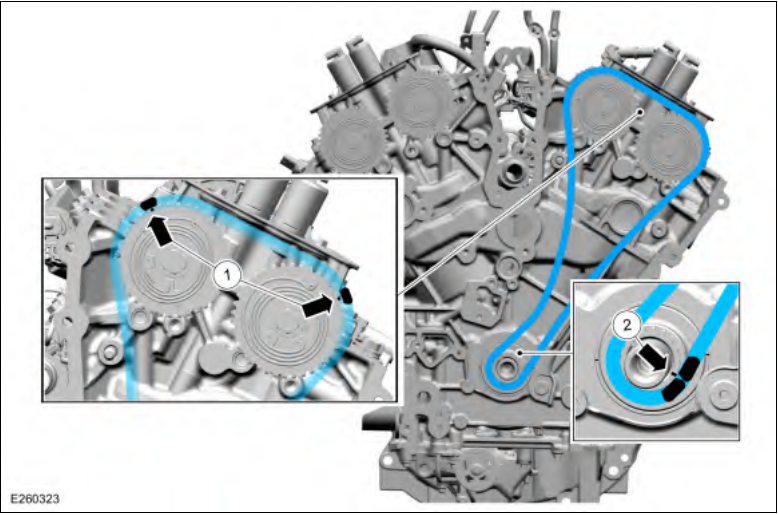
Stage 4: 90°

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

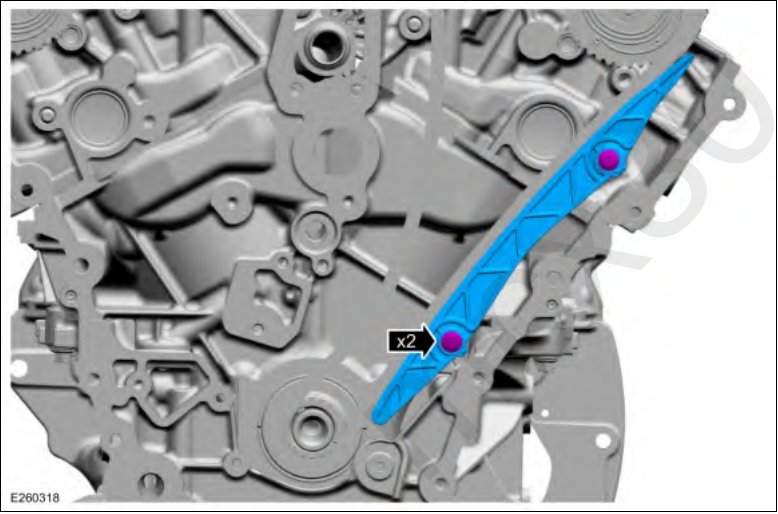


8. **NOTICE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the LH side the circle marks are used.

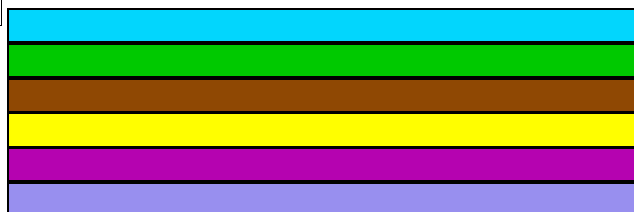
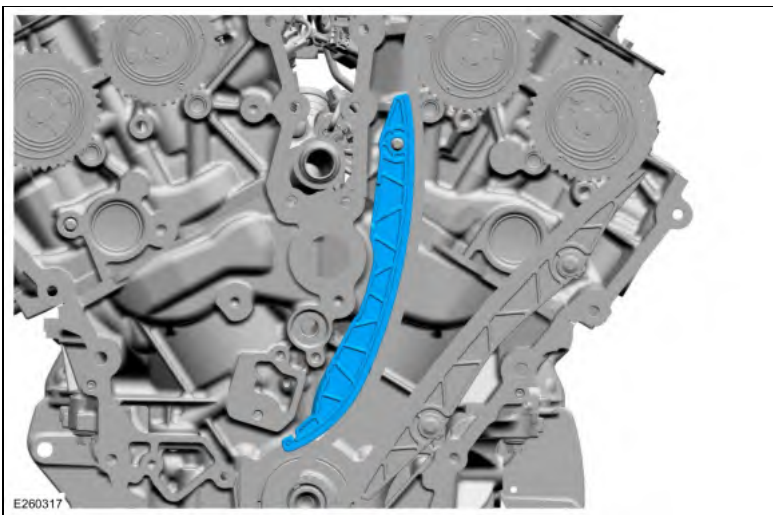
1. Install the LH timing chain with the single colored links aligned with the **circle** timing marks on the VCT units.
2. Install the double colored links so they straddle the timing mark on the crankshaft sprocket.



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



10. Install the LH timing chain tensioner arm.



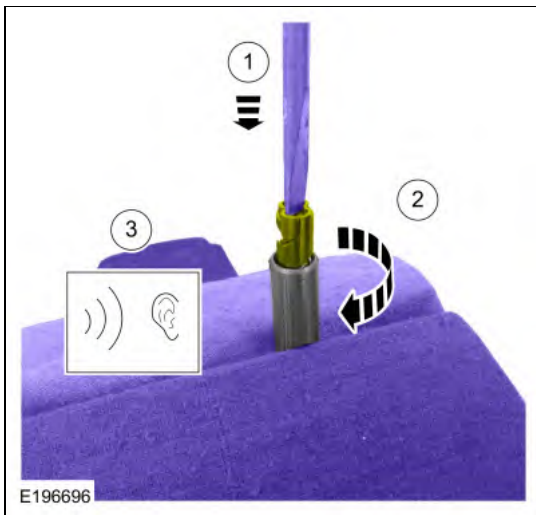
11. Slide the tensioner cylinder out of the LH timing chain tensioner housing.



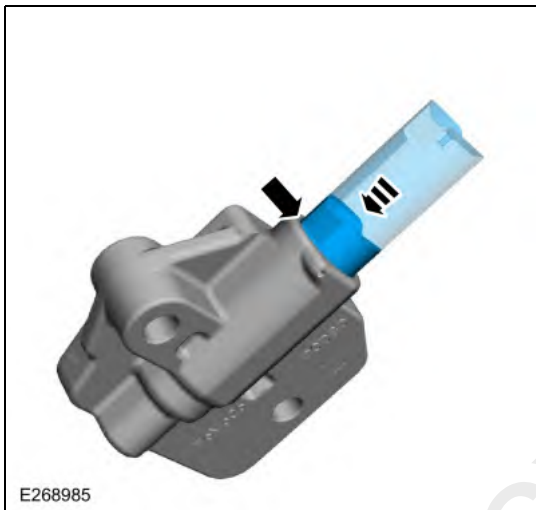
12. **NOTICE:** Use vise jaw protectors or cover the jaws of the vise with clean shop towels to prevent damage to the surface of the tensioner ratchet mechanism.

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

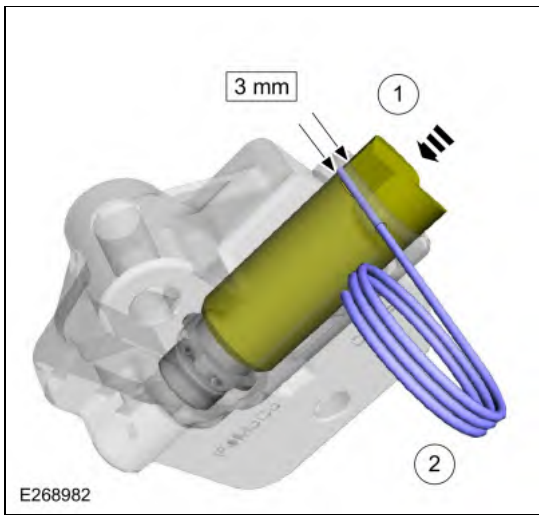
1. Using a flat-bladed screwdriver apply light downward pressure on the end of the tensioner ratchet mechanism.
 Use the General Equipment: Vise
 Use the General Equipment: Vise Jaw Protectors
 Use the General Equipment: Flat-Bladed Screwdriver
2. Rotate the screwdriver clockwise approximately one turn.
3. An audible click will be heard when the tensioner ratchet mechanism locks into place.



13. Slide the tensioner cylinder into the tensioner housing until it contacts the bottom of the bore. The shoulder of the tensioner cylinder will be flush with the top of the housing.

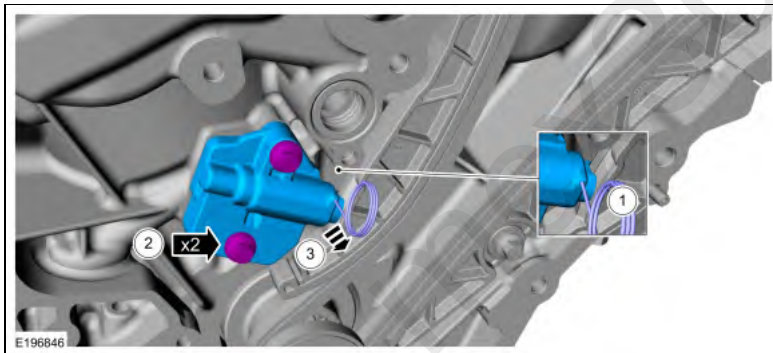


- 14.
1. Firmly press the tensioner cylinder into the tensioner housing until the shoulder of the tensioner cylinder is approximately 3 mm (0.125 in) below the top of the housing.
 2. Install a retaining pin into the hole in the housing to lock the tensioner cylinder in the retracted position.

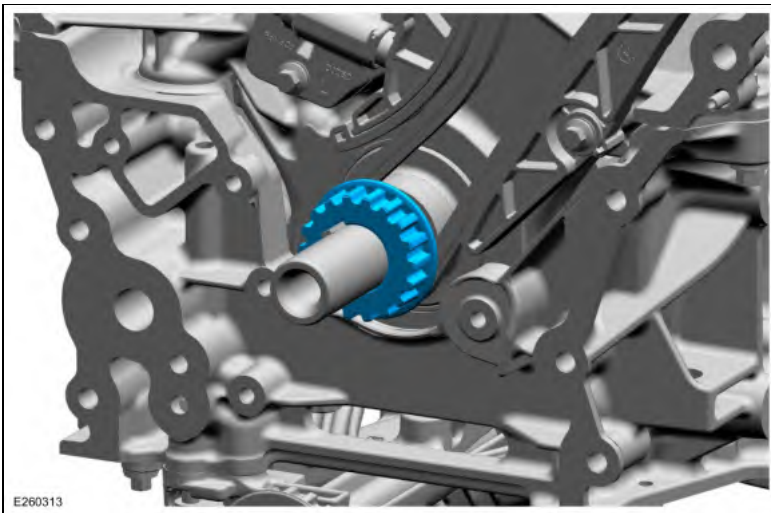


15.

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 to allow the tensioner cylinder to extend and press against the timing chain tensioner arm.

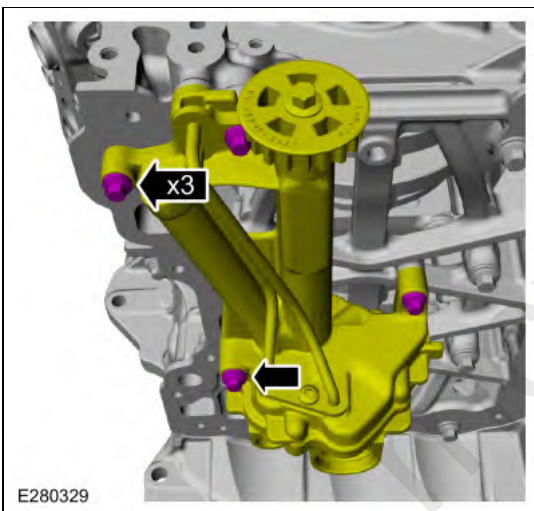


16. Install the crankshaft sprocket.



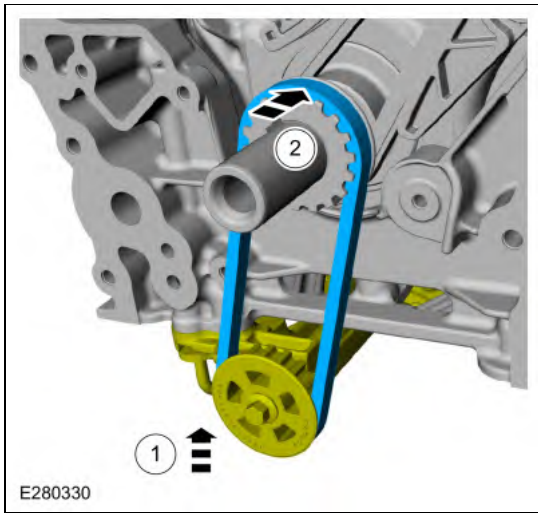
17. **NOTE:** Loosening the oil pump bolts will aid in the installation of the oil pump drive belt.

Loosen the oil pump bolts 3 turns.

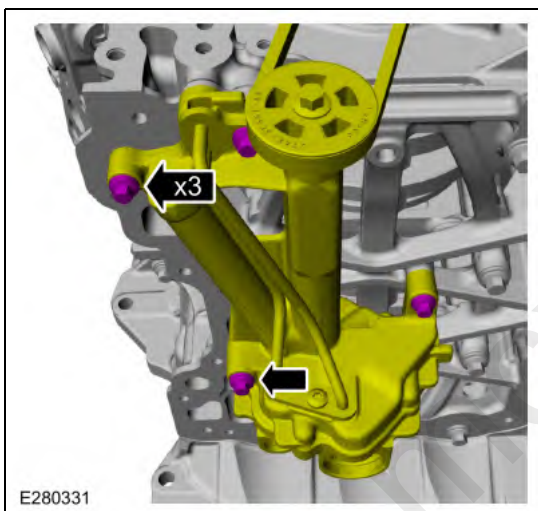


18.

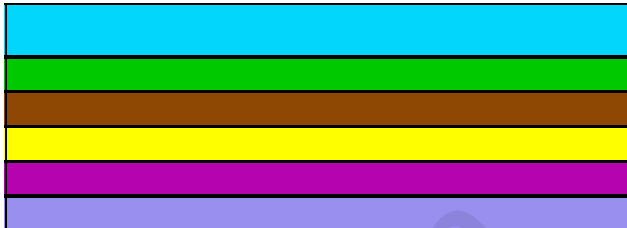
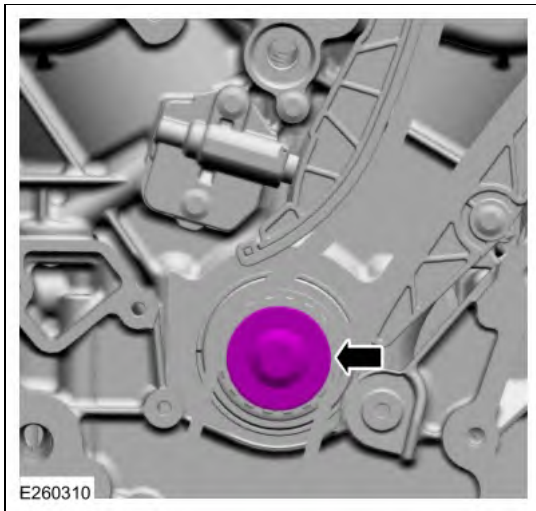
1. Position the oil pump drive belt onto the oil pump sprocket and raise the front of the oil pump.
2. Slide the oil pump drive belt onto the crankshaft sprocket.



19. Tighten the oil pump bolts.
Torque:
 Stage 1: 89 lb.in (10 Nm)
 Stage 2: 45°

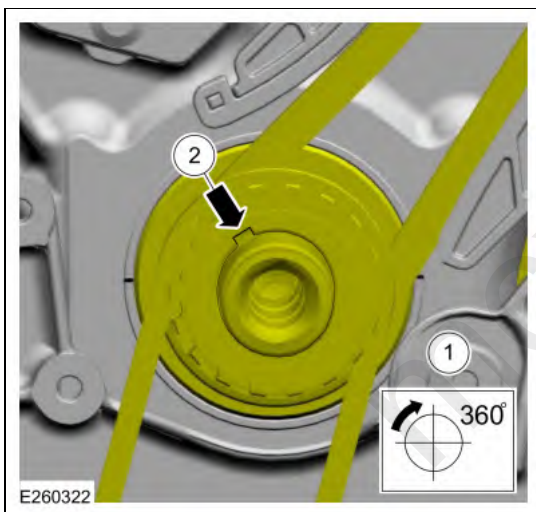


20. Install the original crankshaft pulley bolt.

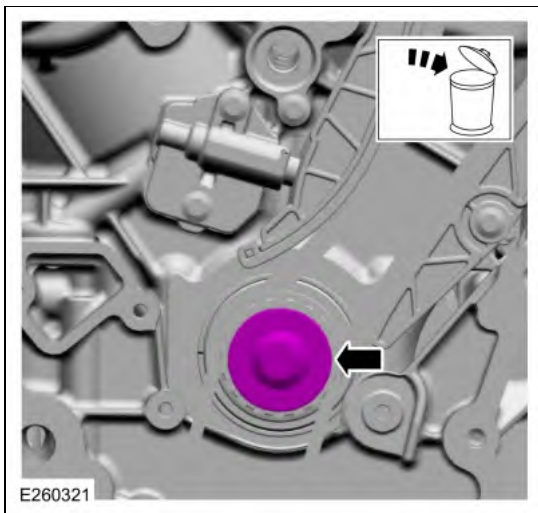


21. **NOTICE:** The crankshaft must be rotated clockwise one revolution (360 degrees). Failure to do so will result in incorrect camshaft timing.

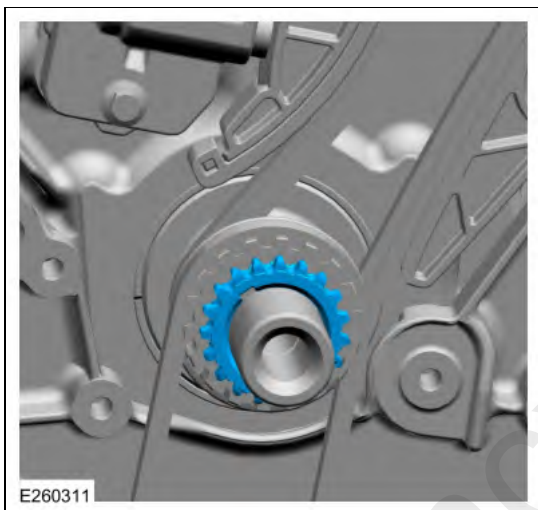
1. Rotate the crankshaft clockwise one revolution (360 degrees).
2. Position the crankshaft sprocket keyway at the 11 o'clock position.



22. Remove and discard the original crankshaft pulley bolt.

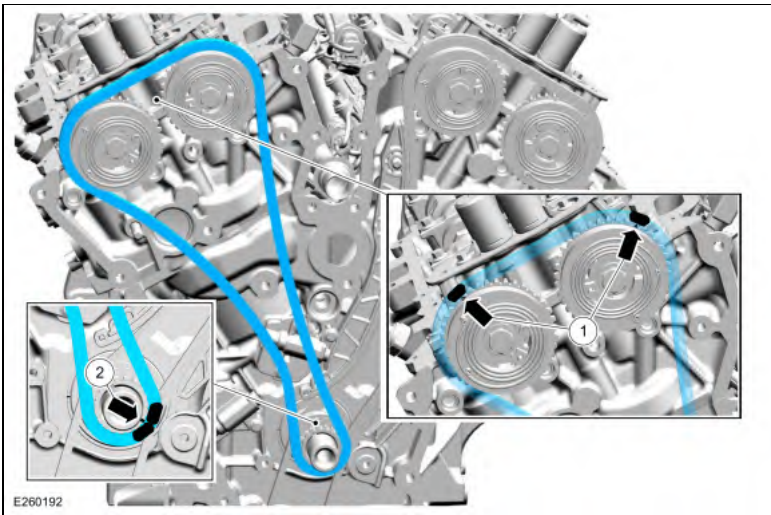


23. Install the timing chain sprocket.



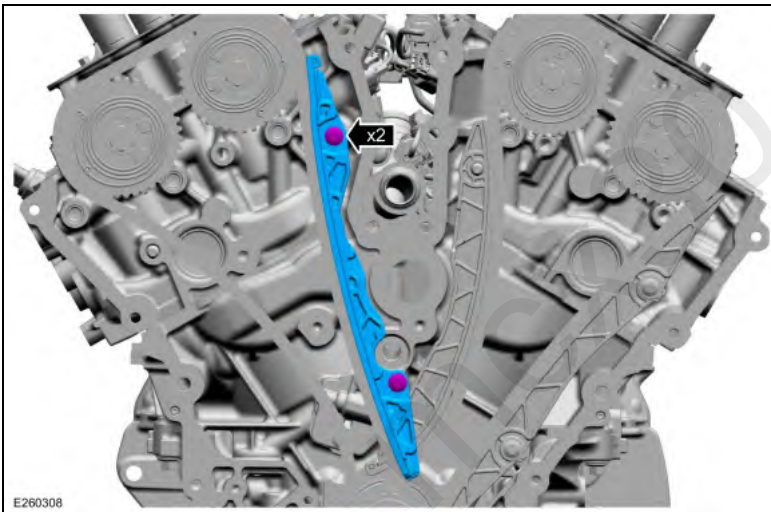
24. **NOTICE:** The VCT units have 2 timing marks on them, a triangle and a circle. For removal and installation of the RH side the triangle marks are used.

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.



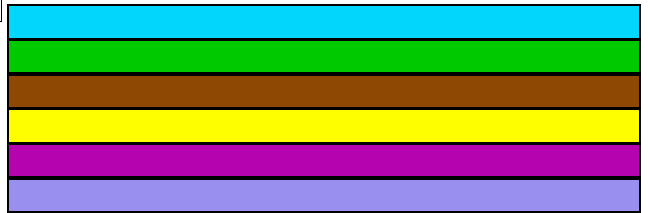
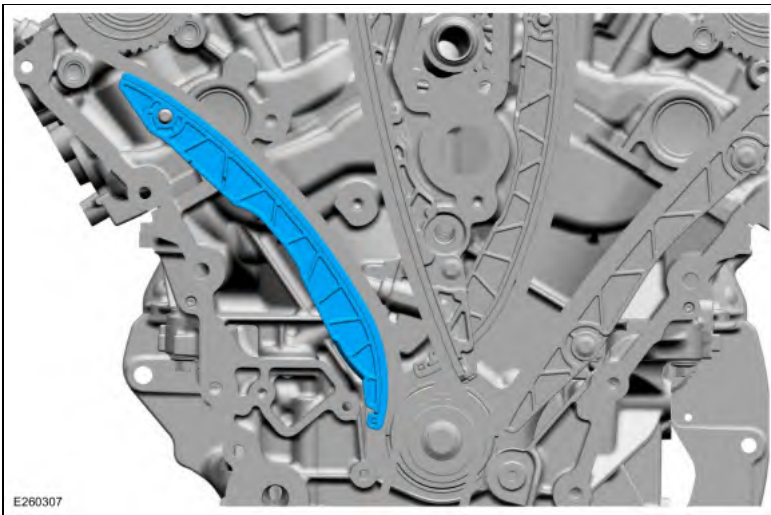


25. Install the RH timing chain guide and bolts.
Torque: 89 lb.in (10 Nm)

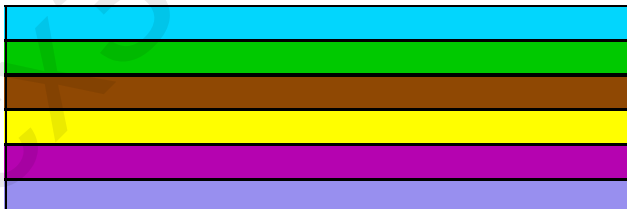
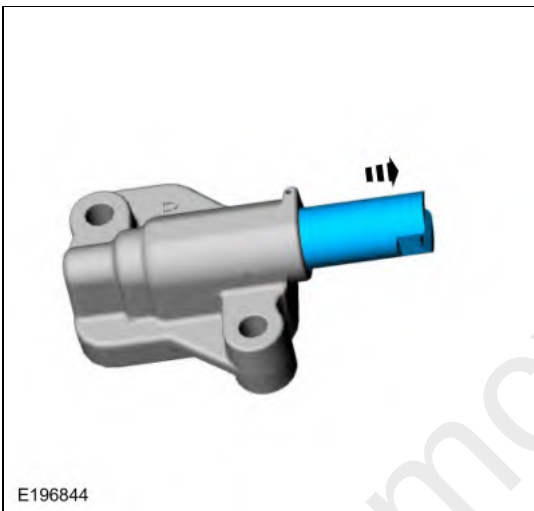




26. Install the RH timing chain tensioner arm.



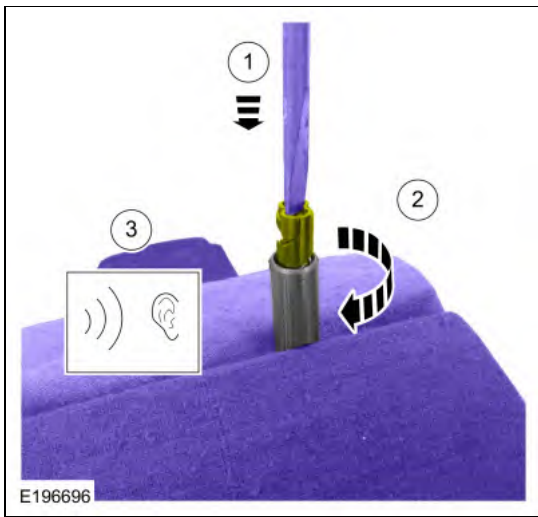
27. Slide the tensioner cylinder out of the RH timing chain tensioner housing.



28. **NOTICE:** 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.

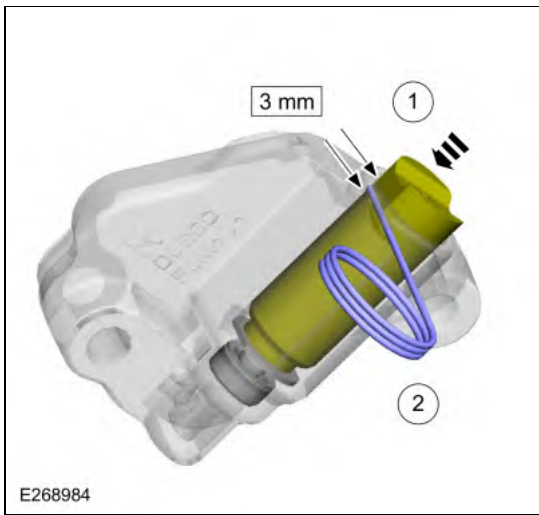
1. Using a flat-bladed screwdriver apply light downward pressure on the end of the tensioner ratchet mechanism.
 Use the General Equipment: Vise
 Use the General Equipment: Vise Jaw Protectors
 Use the General Equipment: Flat-Bladed Screwdriver
2. Rotate the screwdriver clockwise approximately one turn.
3. An audible click will be heard when the tensioner ratchet mechanism locks into place.



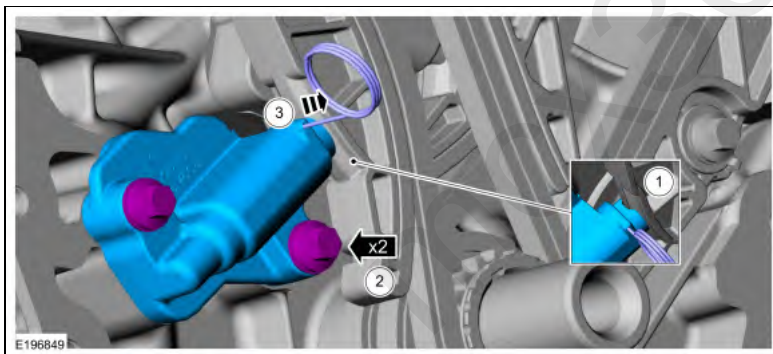
29. Slide the tensioner cylinder into the tensioner housing until it contacts the bottom of the bore. The shoulder of the tensioner cylinder will be flush with the top of the housing.



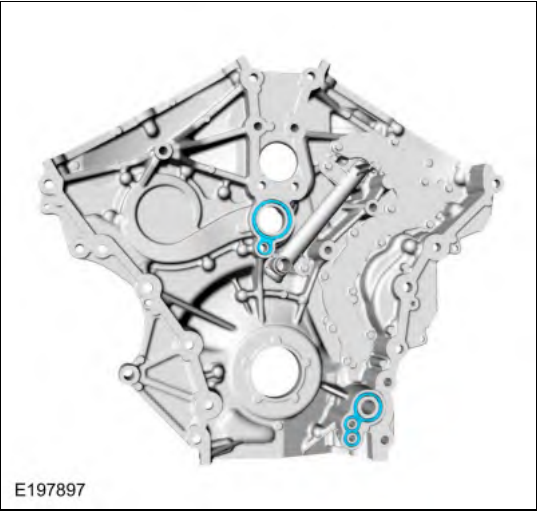
- 30.
1. Firmly press the tensioner cylinder into the tensioner housing until the shoulder of the tensioner cylinder is approximately 3 mm (0.125 in) below the top of the housing.
 2. Install a retaining pin into the hole in the housing to lock the tensioner cylinder in the retracted position.



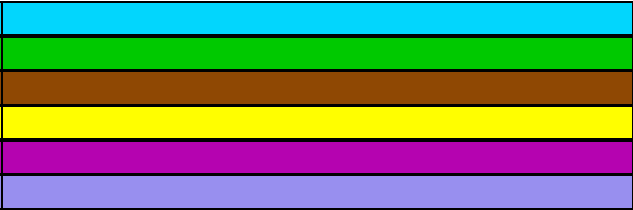
- 31.
1. Position the RH timing chain tensioner with the end of the tensioner correctly engaged to the tensioner arm.
 2. Install the bolts.
Torque: 89 lb.in (10 Nm)
 3. Remove the pin to allow the tensioner cylinder to extend and press against the timing chain tensioner arm.



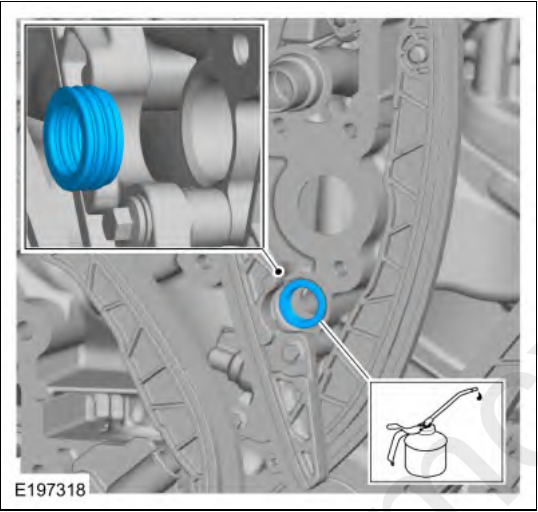
32. Install new engine front cover gaskets.



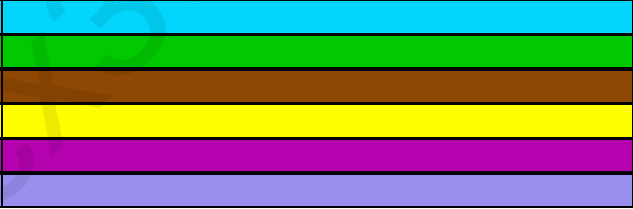
E197897



33. Lubricate and install a new oil gallery seal (6G068).



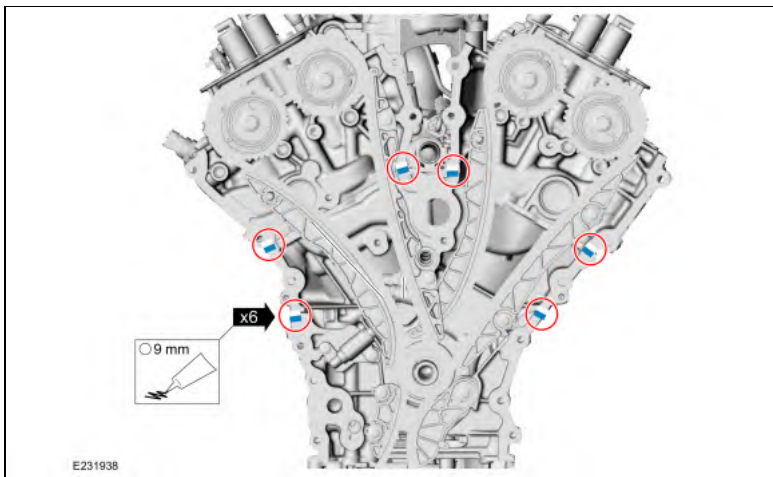
E197318



34. **NOTICE:** 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 engine front cover 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.

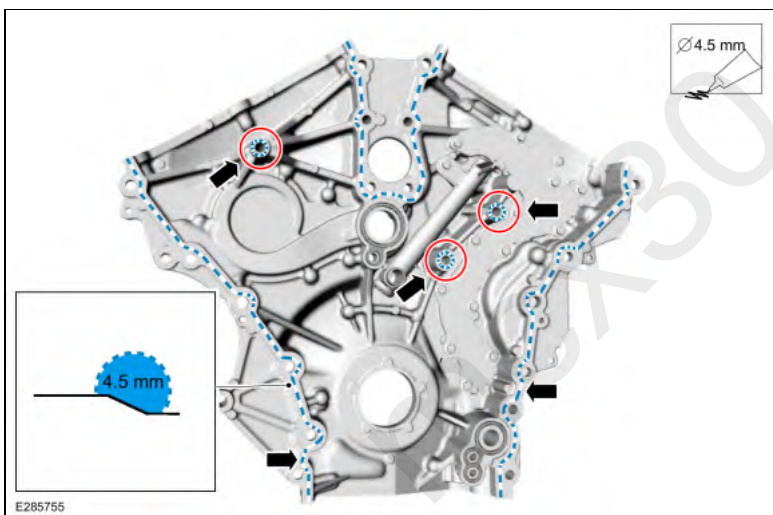
Apply a 9 mm (0.35 in) bead of Motorcraft® High Performance Engine RTV Silicone to the cylinder block skirt-to-cylinder block joint and the cylinder head-to-cylinder block joint areas as indicated.
Material: Motorcraft® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)



35. **NOTICE:** 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 engine front cover 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.

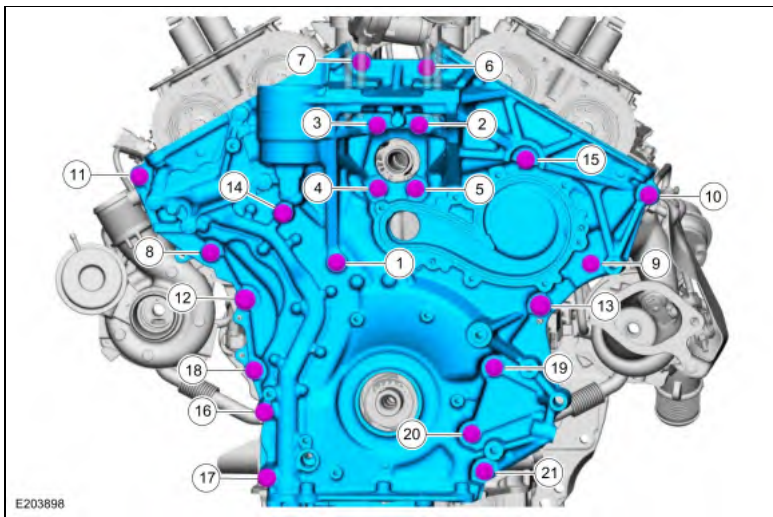
1. Apply a 4.5 mm (0.18 in) bead of Motorcraft® High Performance Engine RTV Silicone to the engine front cover sealing surfaces of the inner bolt bosses.
Material: Motorcraft® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)
2. Apply a 4.5 mm (0.18 in) bead of Motorcraft® High Performance Engine RTV Silicone to the chamfer of the engine front cover sealing surfaces.
Material: Motorcraft® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)



36. Install the engine front cover and the fasteners.

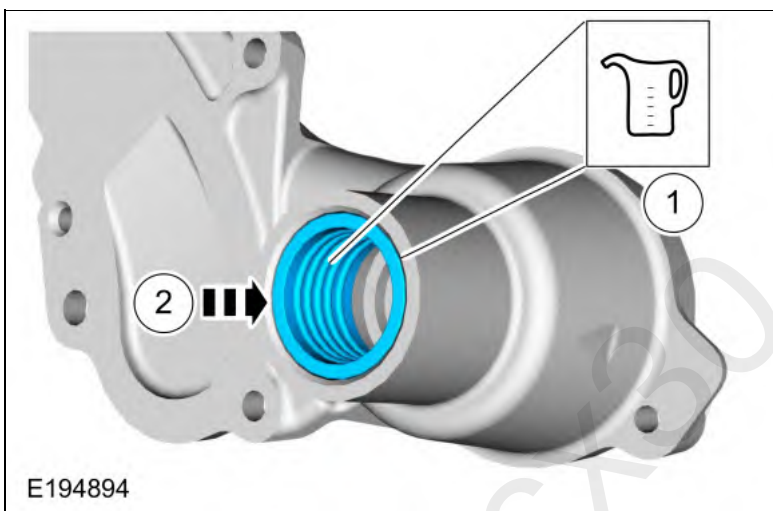
Torque:

- Stage 1: Tighten bolts 1 thru 11 to: 18 lb.ft (24 Nm)
- Stage 2: Tighten bolts 12 thru 13 to: 35 lb.ft (48 Nm)
- Stage 3: Tighten bolts 14 thru 21 to: 18 lb.ft (24 Nm)



37.

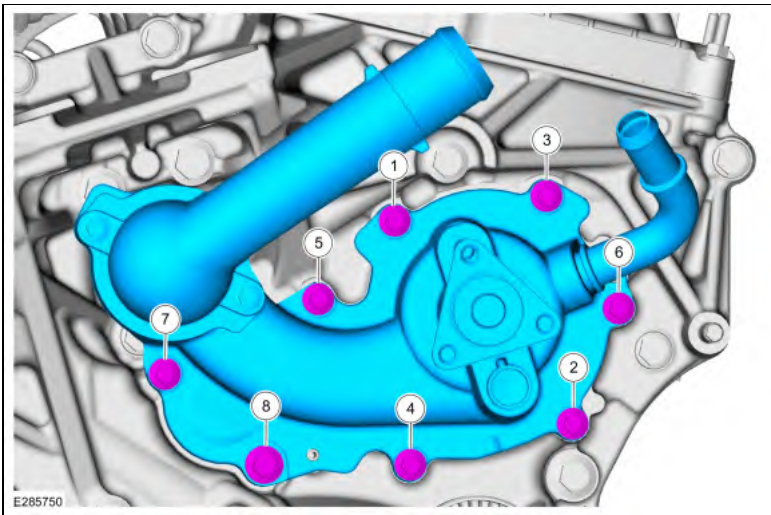
- Lubricate the inside and the outside diameter of the grommet with clean engine coolant.
- Install the grommet so it is flush with the rear of the coolant pump housing.



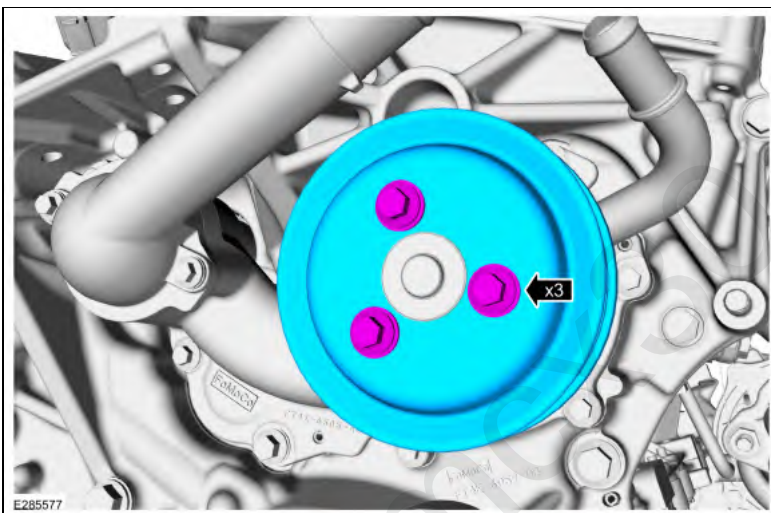
A horizontal bar chart with six bars of equal length, each a different color. From top to bottom, the colors are light blue, green, brown, yellow, purple, and light purple. The bars are separated by thin white gaps.

38. **NOTE:** Verify the front cover dowel pins are aligned to the coolant pump and that the coolant pump is fully seated prior to installing the fasteners.

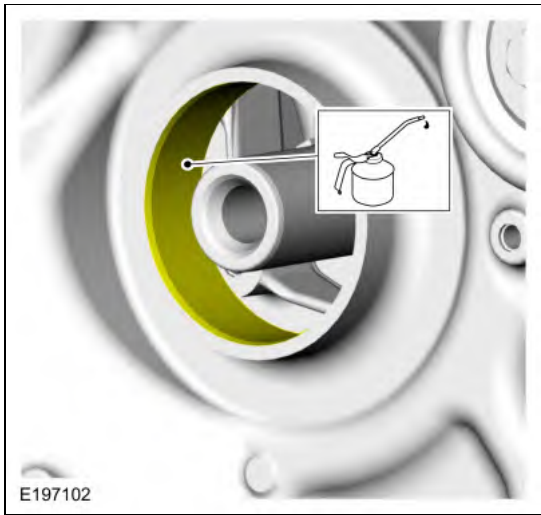
- Using a new gasket, install the coolant pump and the fasteners.
Torque:
Fasteners 1-7:
Stage 1: 89 lb.in (10 Nm)
Stage 2: 45Å°
Torque:
Fastener 8: 18 lb.ft (24 Nm)



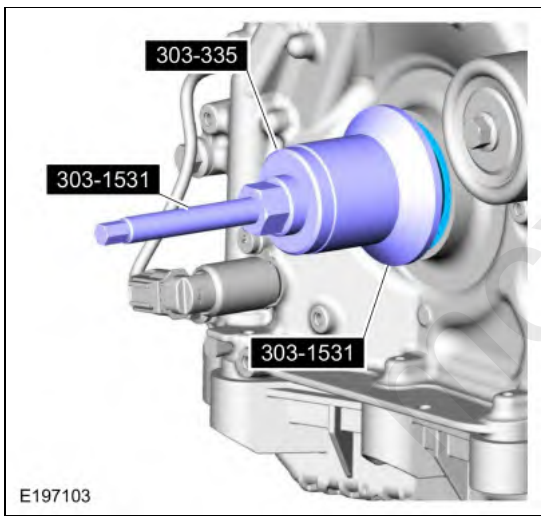
39. Install the coolant pump pulley and the bolts.
Torque: 89 lb.in (10 Nm)



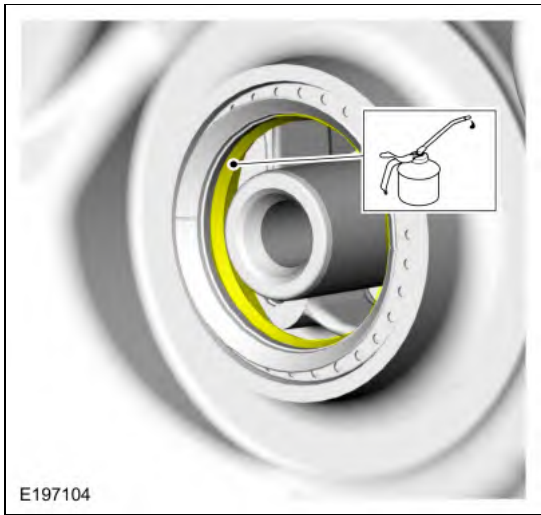
40. Lubricate the engine front cover bore with clean engine oil.



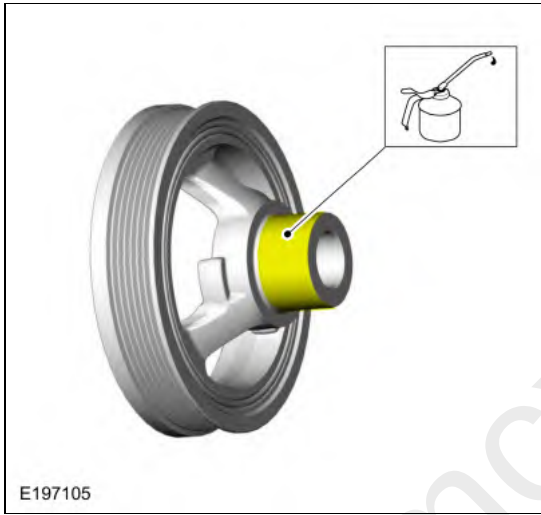
41. Using the special tools, install the new crankshaft front oil seal.
Use Special Service Tool: 303-335 (T88T-6701-A) Installer, Front Cover Oil Seal , 303-1531 Installer, Front Crank Seal and Damper.



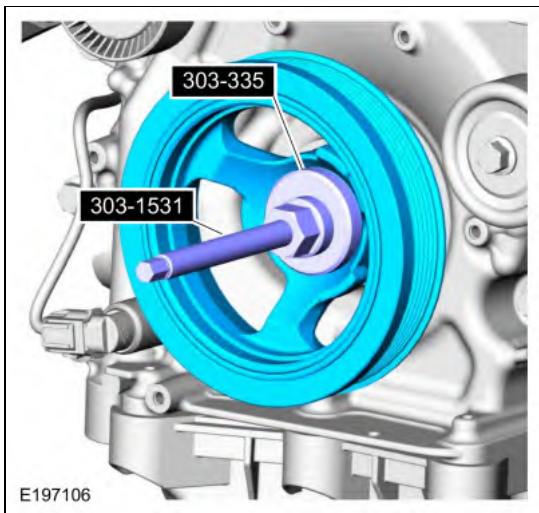
42. Lubricate the crankshaft front seal inner lip with clean engine oil.



43. Lubricate the crankshaft pulley sealing surface with clean engine oil prior to installation.



44. 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.



45. **NOTE:** Use a universal pulley holder (such as an OTC 4754, or equivalent).

Using a universal pulley holder, install and tighten a new crankshaft pulley bolt.

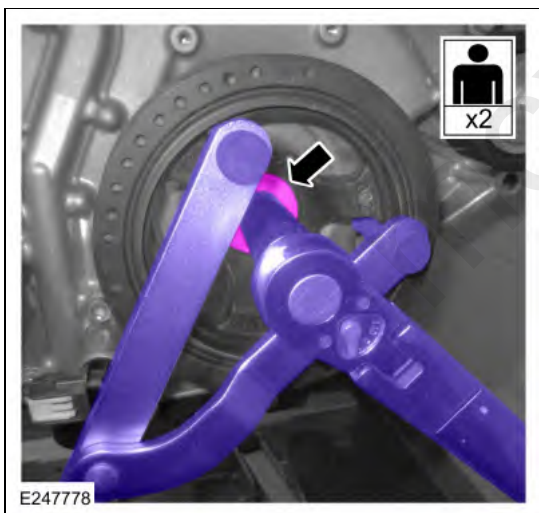
Torque:

Stage 1: 166 lb.ft (225 Nm)

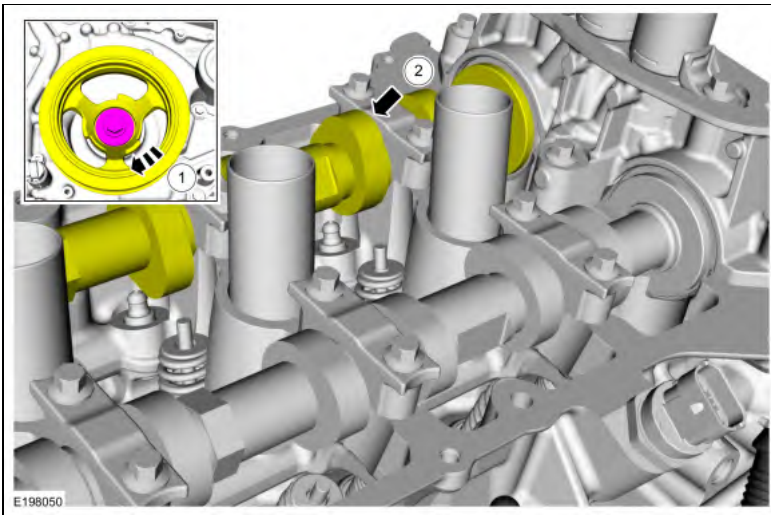
Stage 2: Loosen: 360°

Stage 3: 26 lb.ft (35 Nm)

Stage 4: 270°

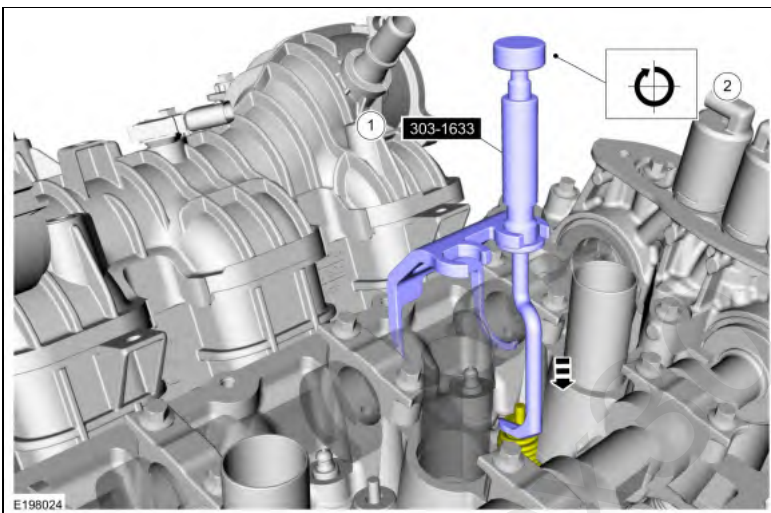


46. Rotate the crankshaft pulley bolt clockwise to position the camshaft lobe upward for the camshaft roller follower to be installed.



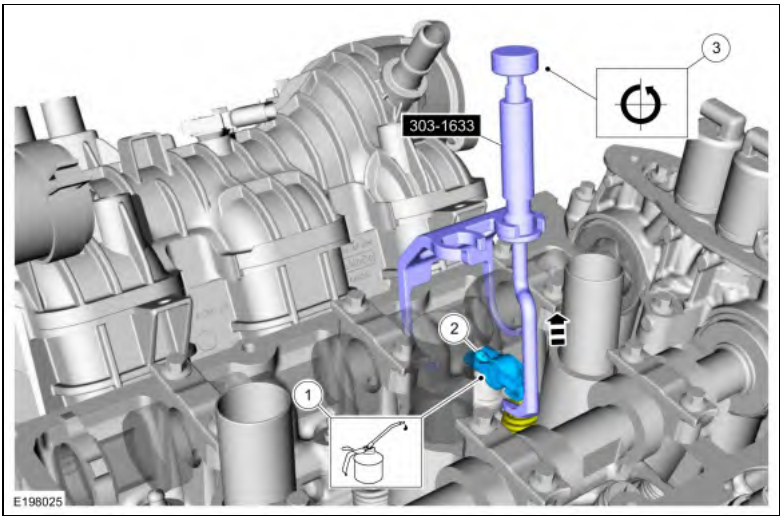
47.

1. Install Special Service Tool: 303-1633 Remover, Roller Rocker Follower.
2. Turn the knob on the special tool clockwise to depress the valve and spring.

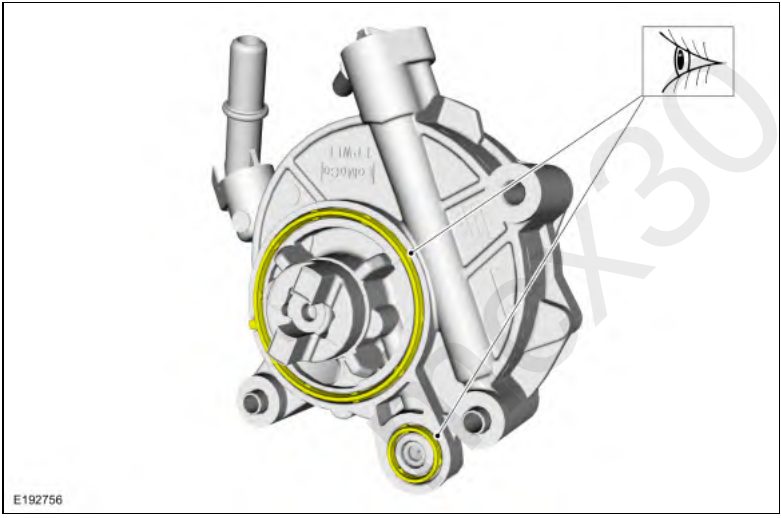


48.

1. Lubricate the camshaft roller follower with clean engine oil.
2. Install the camshaft roller follower.
3. Turn the knob on the special tool counterclockwise to raise the valve and spring. Remove Special Service Tool: 303-1633 Remover, Roller Rocker Follower.
- Repeat steps for the remaining camshaft roller followers.

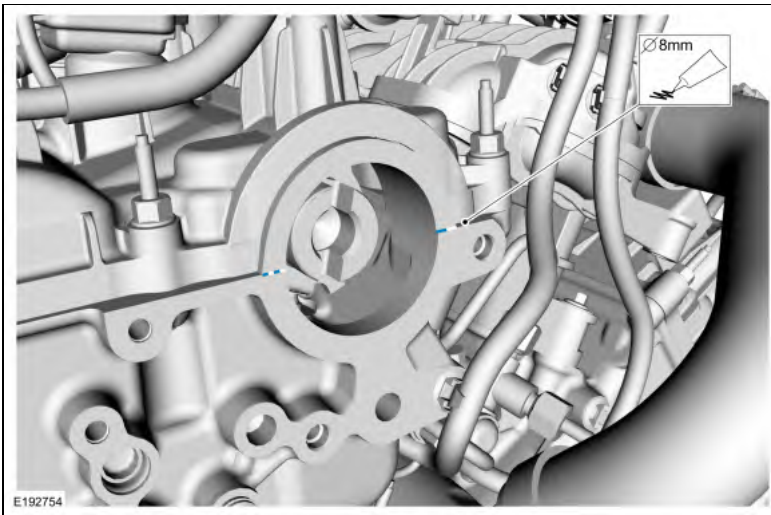


49. Inspect the gaskets and replace if damaged.

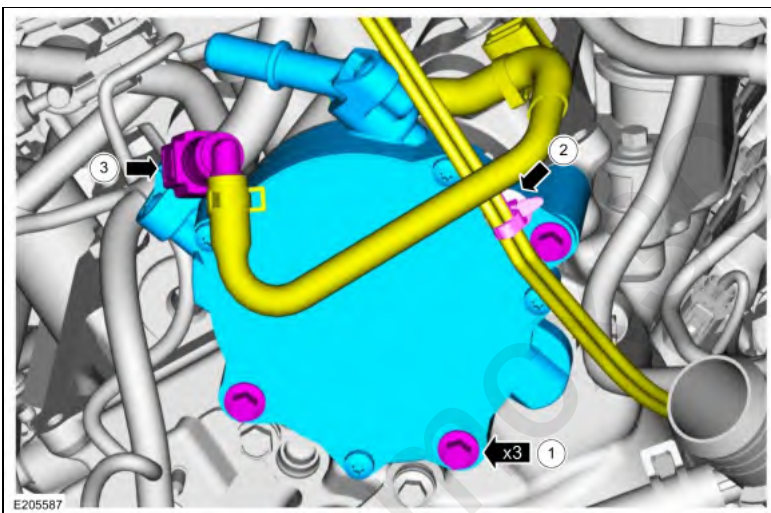


50. **NOTE:** If the brake vacuum pump is not secured within 10 minutes of sealant application, the sealant must be removed and the sealing area cleaned with metal surface prep. Failure to follow this procedure can cause future oil leakage.

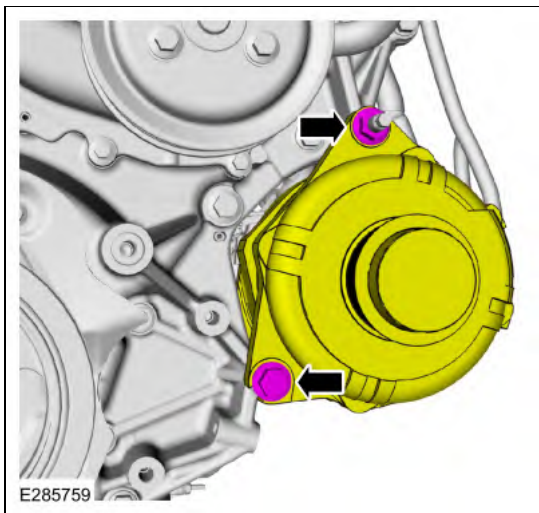
Apply 8 mm (0.14 in) beads of Motorcraft® High Performance Engine RTV Silicone as shown.



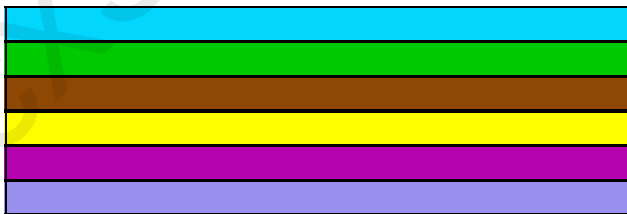
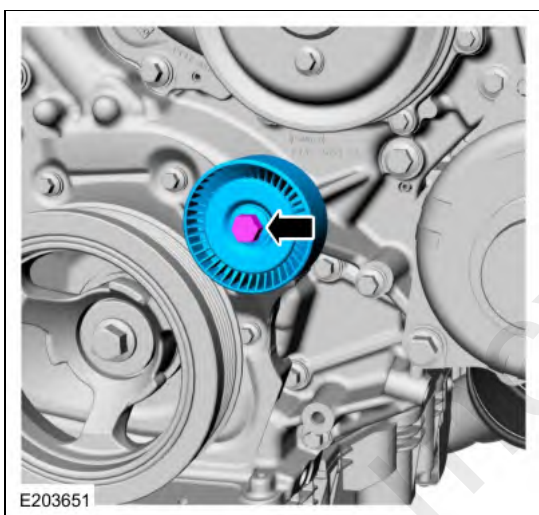
- 51.
1. Install the brake vacuum pump and the bolts.
Torque: 89 lb.in (10 Nm)
 2. Attach the wiring harness retainer.
 3. Connect the vacuum tube.



52. Position the generator and install the bolt and nut.
Torque: 35 lb.ft (47 Nm)



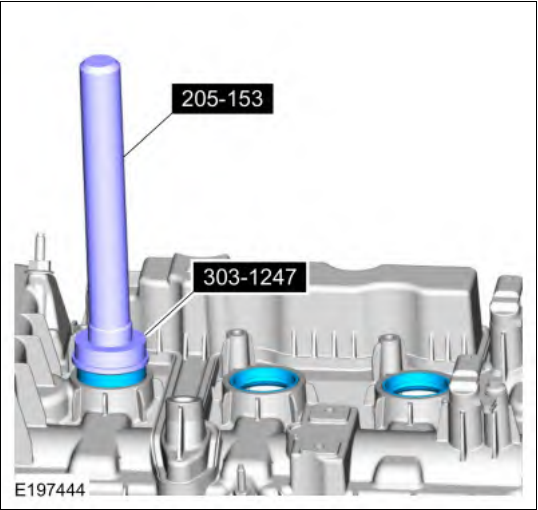
53. Install the idler pulley and the bolt.
Torque: 35 lb.ft (48 Nm)



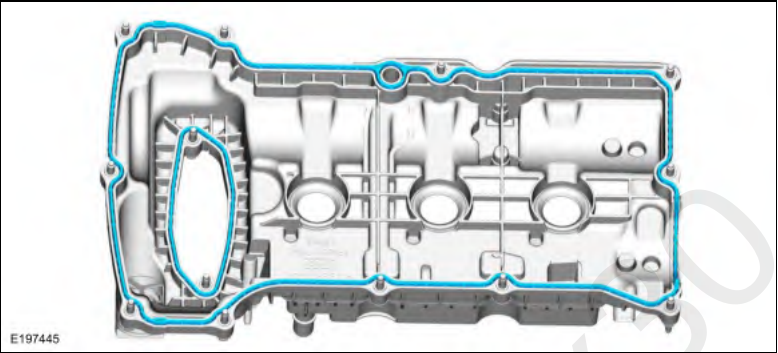
54. **NOTE:** Installation of new seals is only required if damaged seals were removed.

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

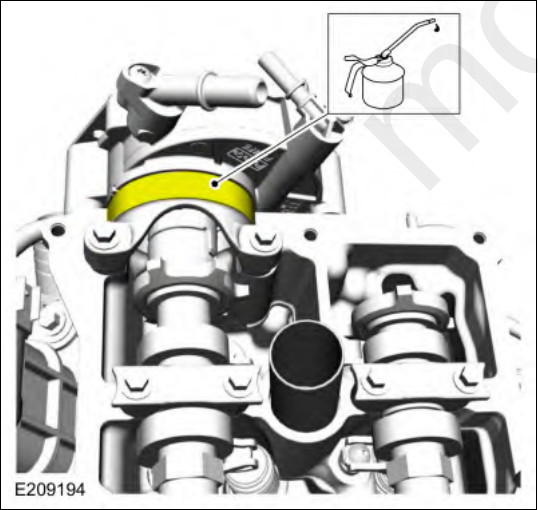
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 303-1247 VCT Spark Plug Tube Seal Remover and Installer.



55. Install a new gasket.

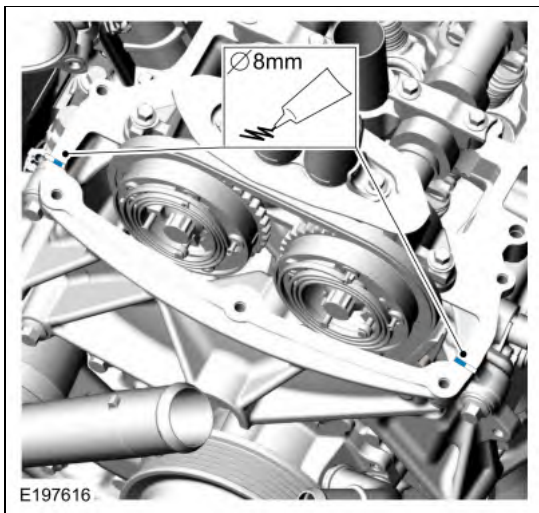


56. Apply clean engine oil to the surface.

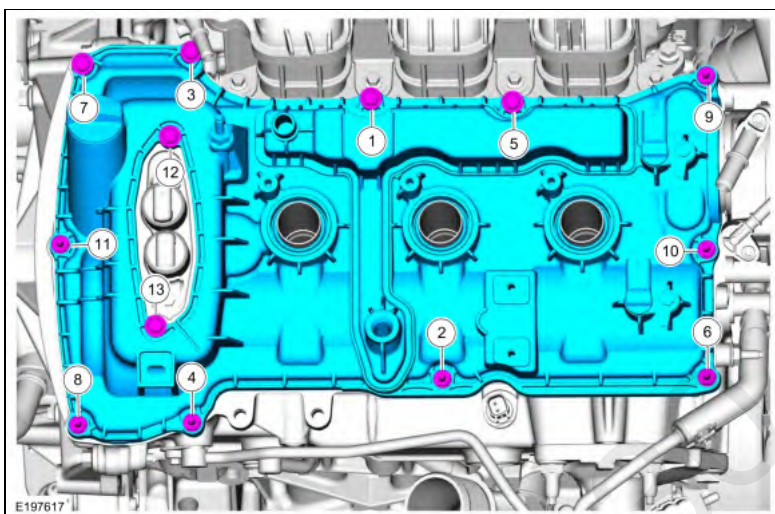


57. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 10 minutes, the sealant must be removed and the sealing area cleaned.

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)



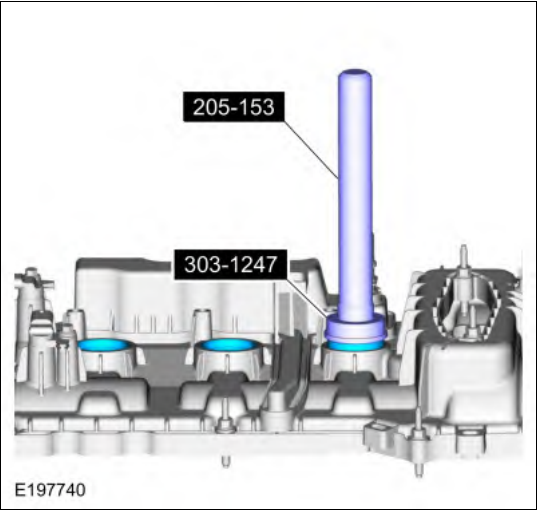
58. Install the valve cover and tighten the bolts.
Torque: 89 lb.in (10 Nm)



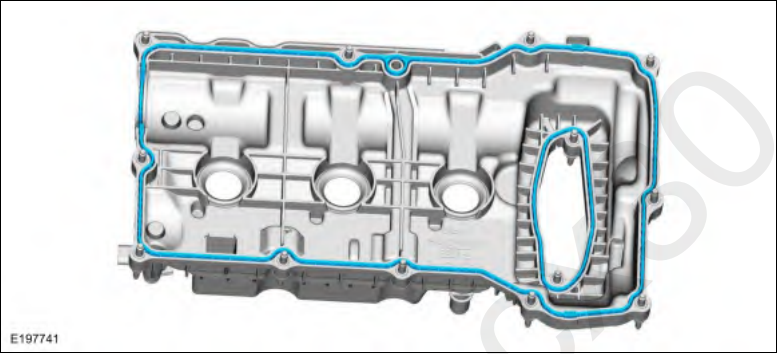
59. **NOTE:** Installation of new seals is only required if damaged seals were removed.

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

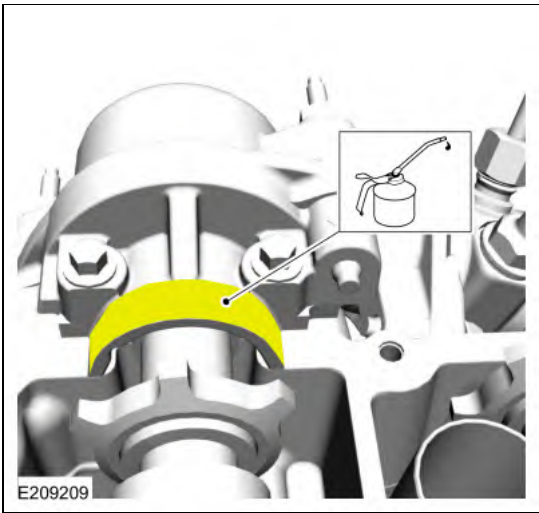
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 303-1247 VCT Spark Plug Tube Seal Remover and Installer.



60. Install a new gasket.

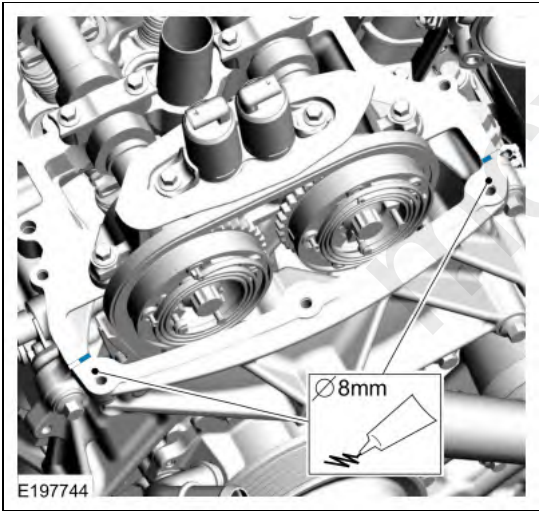


61. Apply clean engine oil to the surface.

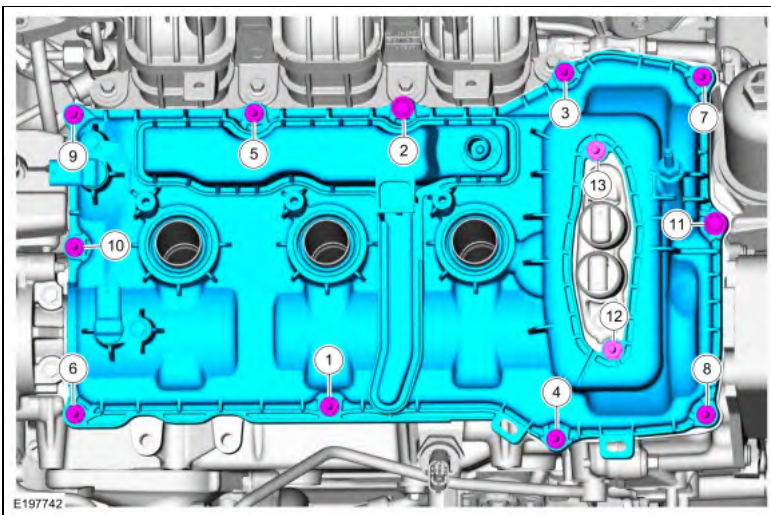


62. **NOTICE:** If the valve cover is not installed and the fasteners tightened within 10 minutes, the sealant must be removed and the sealing area cleaned.

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)



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

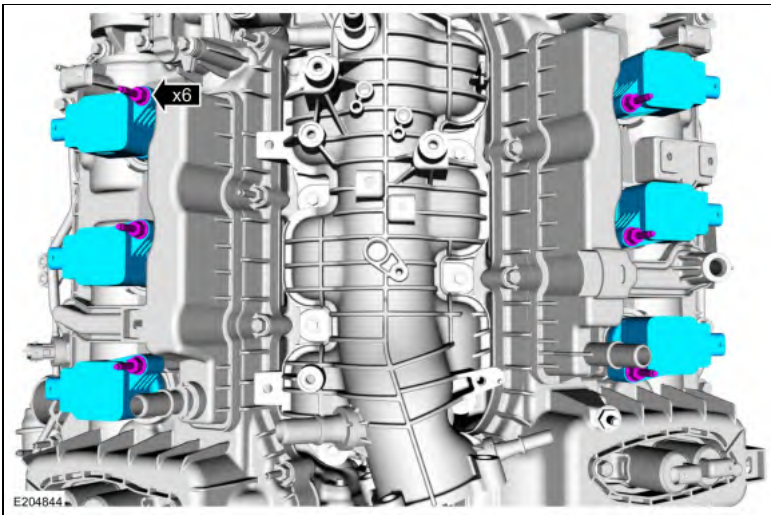


A horizontal bar chart consisting of six stacked rectangular segments of equal width. From top to bottom, the segments are colored cyan, green, brown, yellow, purple, and light blue. Each segment is outlined in black. The chart is positioned on a white background with a light gray grid line visible to its left.

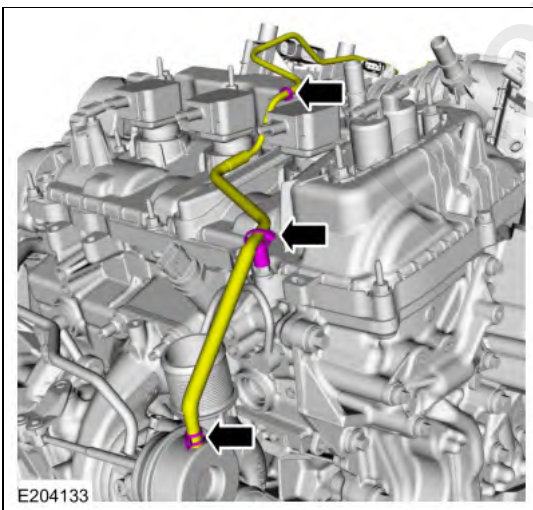
64. Inspect the ignition coil-on-plug assembly for cracks, rips or tears. Replace any damaged coil-on-plug assembly's.



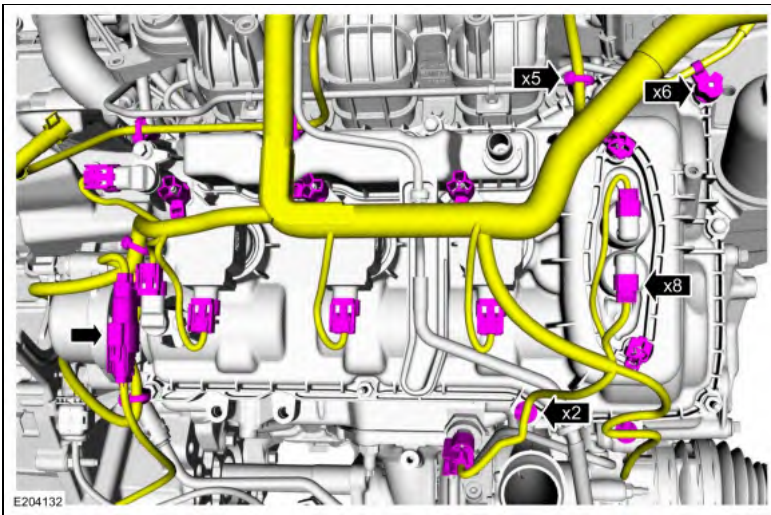
65. Install the coil-on-plug assemblies.
Torque: 53 lb.in (6 Nm)



- 66.
- Connect the TC vacuum supply tube.
Use the General Equipment: Hose Clamp Remover/Installer
 - Attach the vacuum tube retainers.

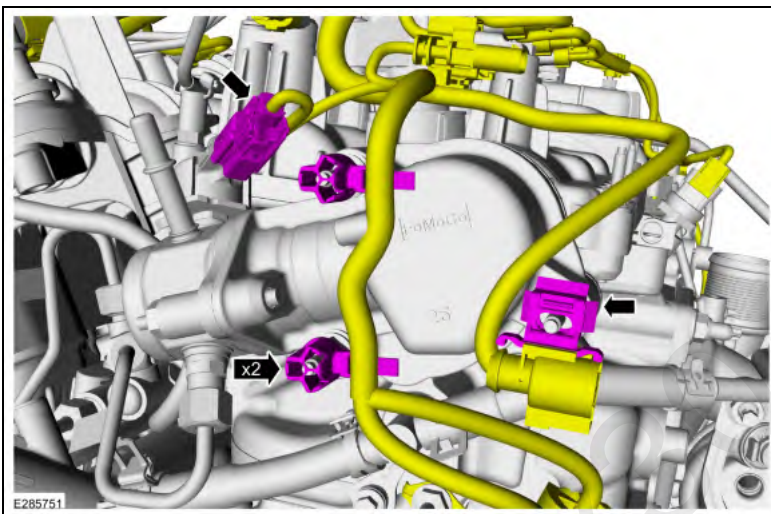


- 67.
- Attach the vacuum tube and coolant tube retainers.
 - Connect the engine wiring harness electrical connector and retainers.

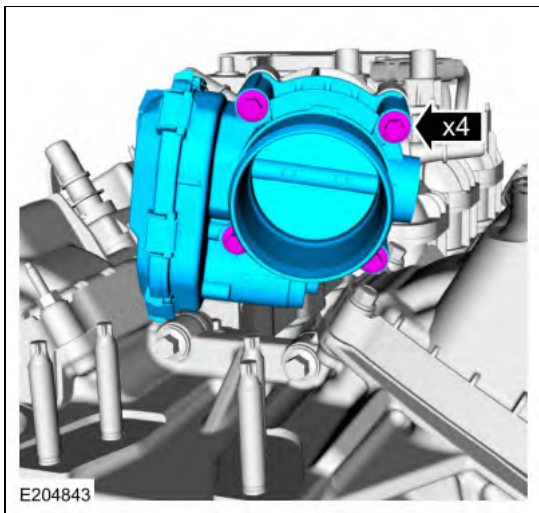


68.

- Connect the high pressure fuel pump electrical connector.
- Attach the wiring harness retainers.

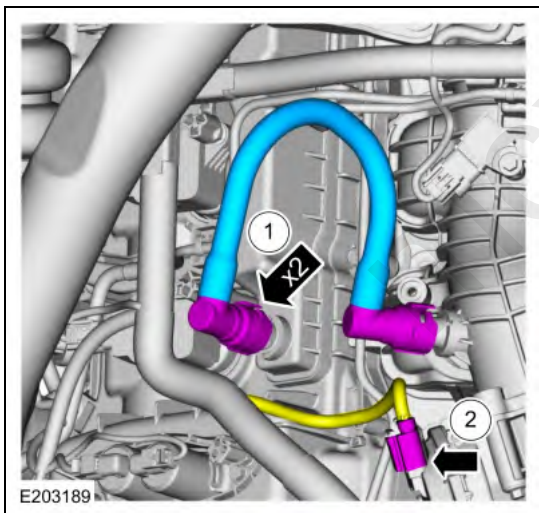


69. Install the throttle body and the bolts.
Torque: 89 lb.in (10 Nm)

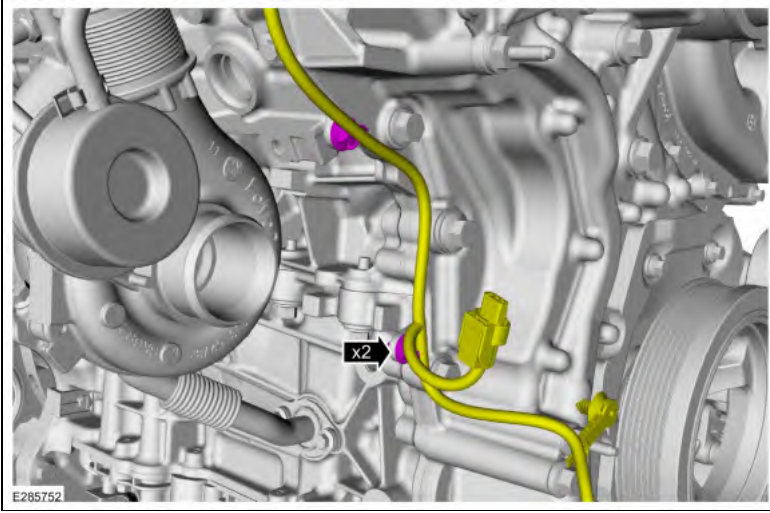


70.

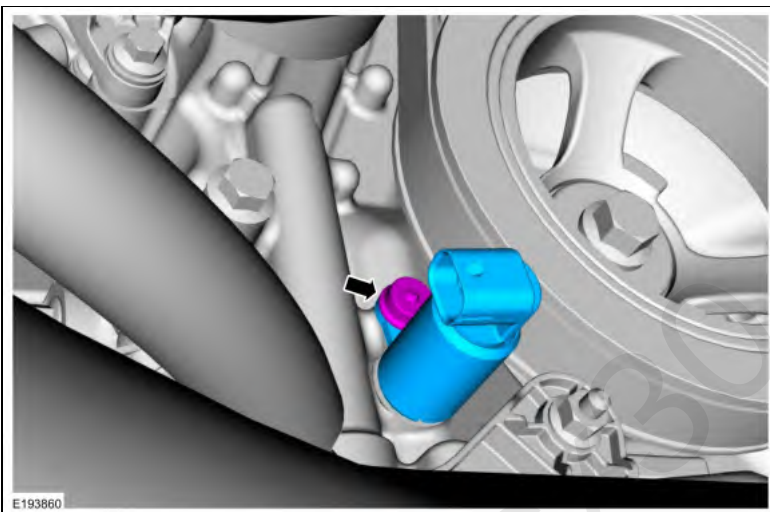
1. Position the PCV tube and connect the quick release couplings.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
2. Connect the throttle body electrical connector.



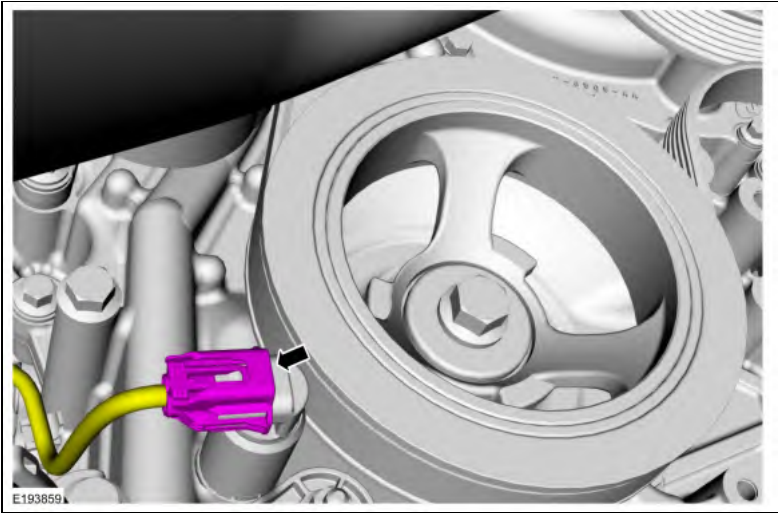
71. Attach the wiring harness retainers.



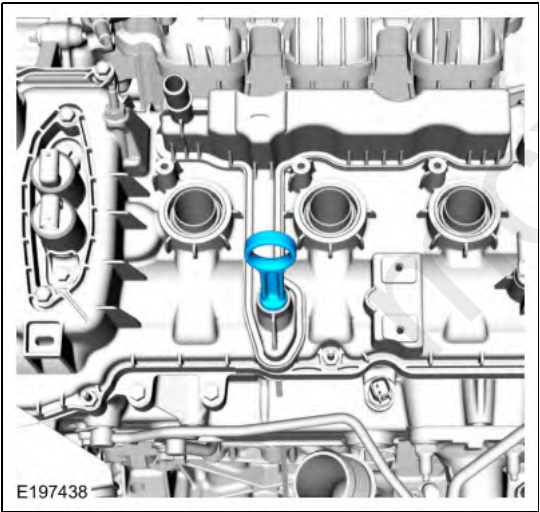
72. Install the oil pressure control solenoid and the retainer.
Torque: 97 lb.in (11 Nm)



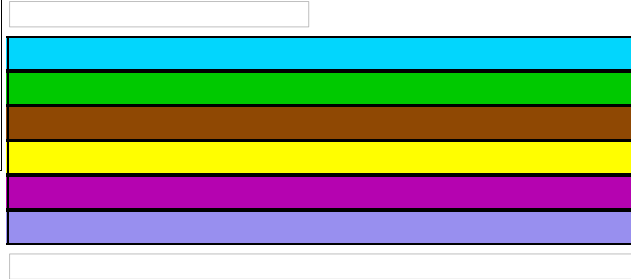
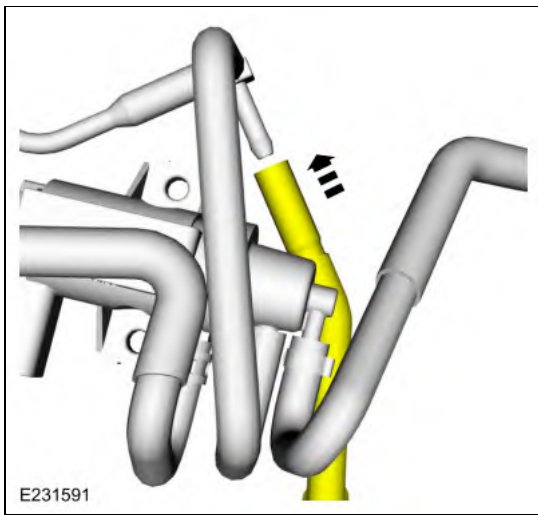
73. Connect the oil pressure control solenoid electrical connector.



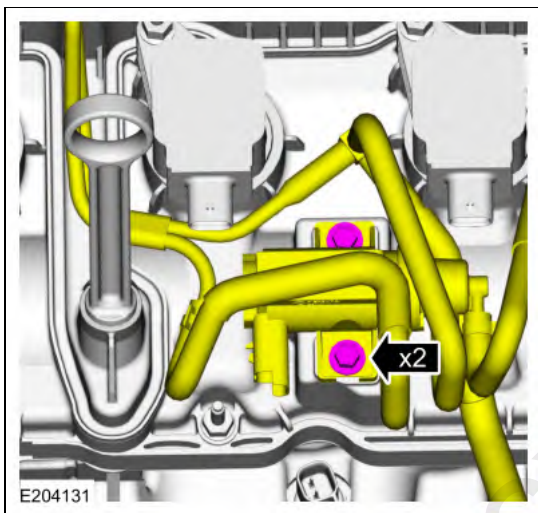
74. Install the oil level indicator.



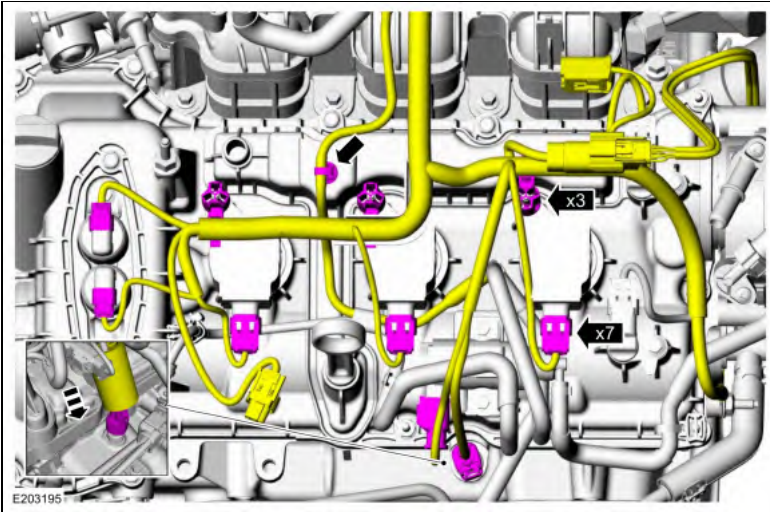
75. Connect the TC vacuum supply hose.



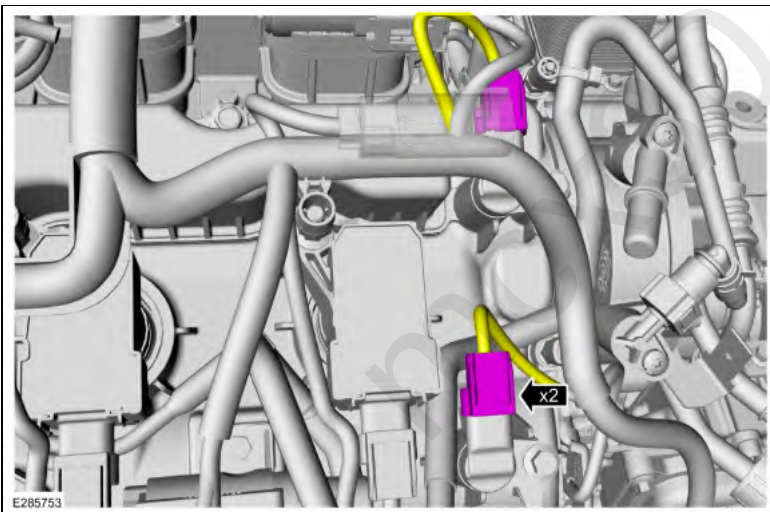
76. Install the TC boost solenoid and the bolts.
Torque: 62 lb.in (7 Nm)



- 77.
- Connect the engine wiring harness electrical connectors and attach the harness and vacuum hose retainers.
 - Slide the insulator down onto the CHT electrical connector.

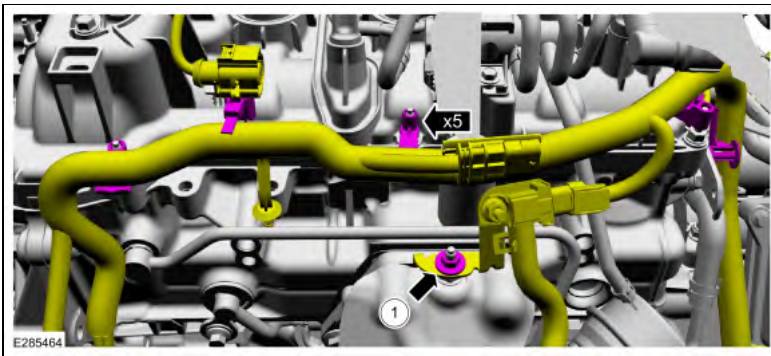


78. Connect theCMP electrical connectors.



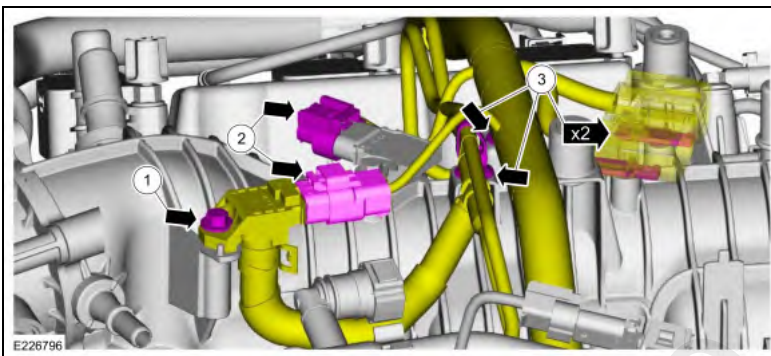
79.

1. If equipped, position the transducer and install the nut.
Torque: 80 lb.in (9 Nm)
- Attach the retainers and position the battery cable aside.

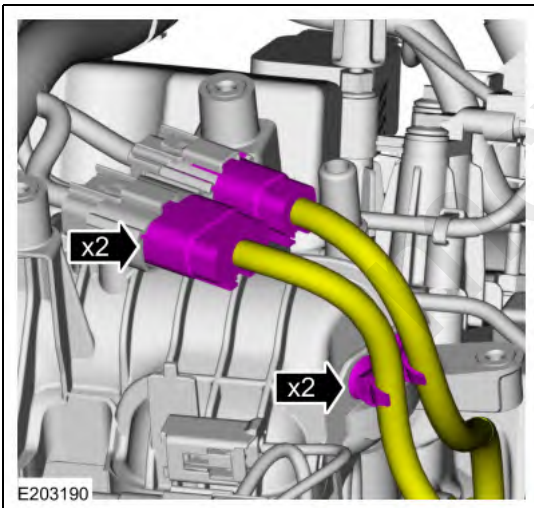


80.

1. Position the vacuum harness pressure sensor and install the bolt.
Torque: 62 lb.in (7 Nm)
2. Connect the wiring harness electrical connectors.
3. Attach the wiring harness and vacuum harness retainers.

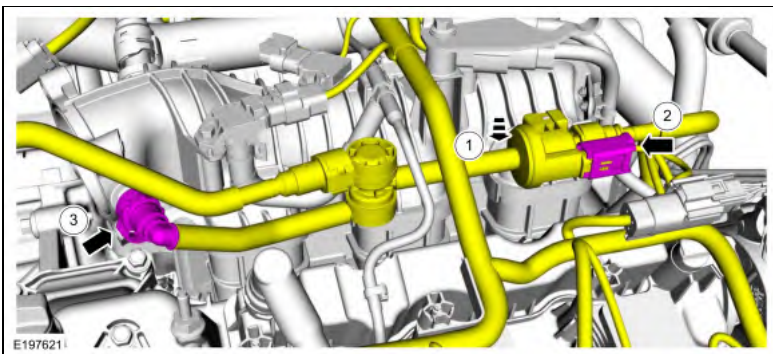


81. Connect the engine wiring harness electrical connectors and retainers.



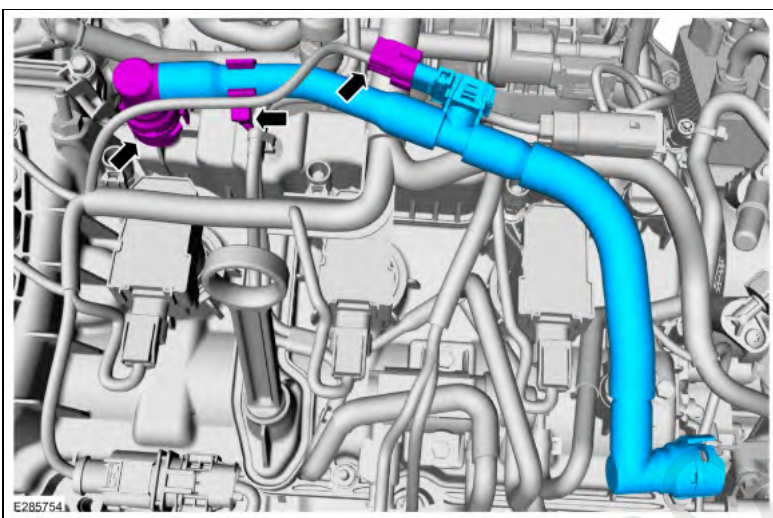
82.

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 (310-00 Fuel System - General Information) .



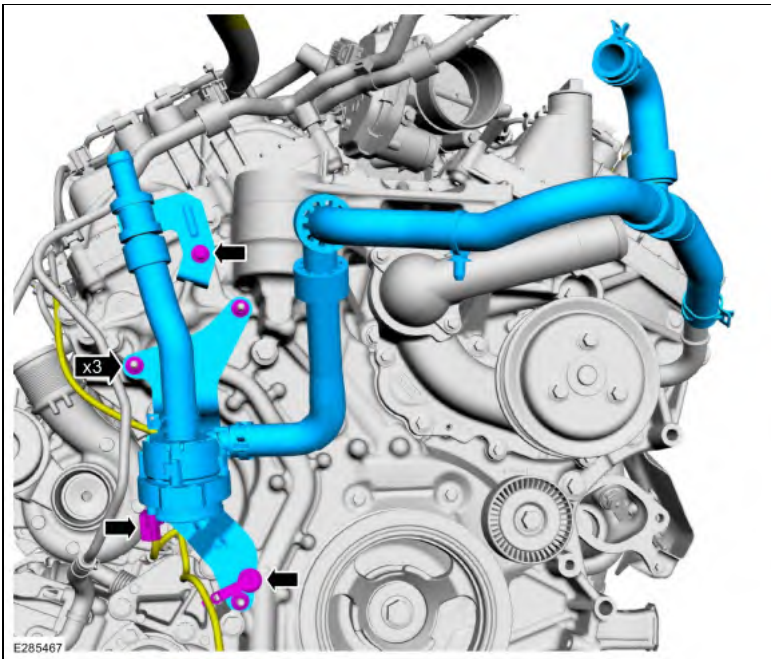
83.

- Position the PCV tube and connect the quick release coupling.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
- Attach the PCV tube retainer.
- Connect the crankcase pressure sensor electrical connector.

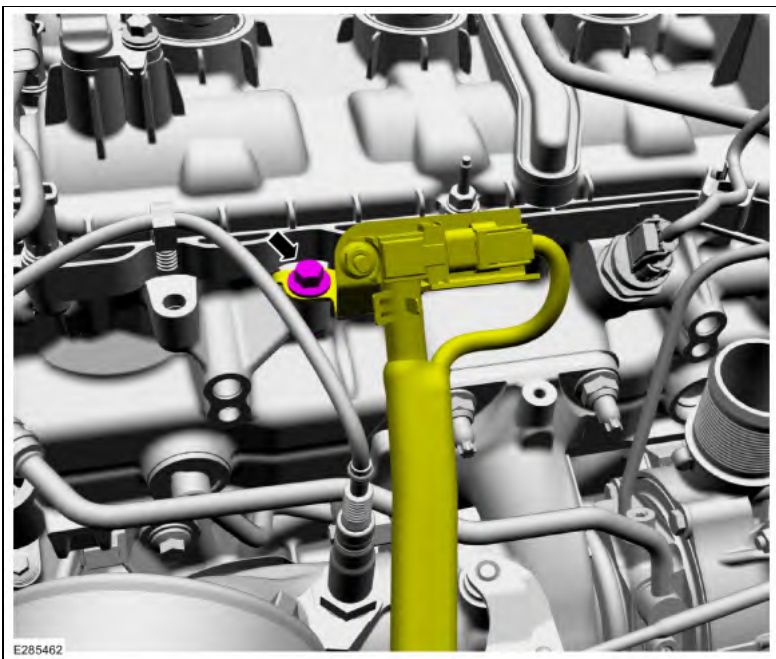


84.

- Install the coolant pump and hose assembly, the nuts and the bolt.
Torque: 80 lb.in (9 Nm)
- Attach the wiring harness retainer.
- Connect the coolant pump electrical connector.

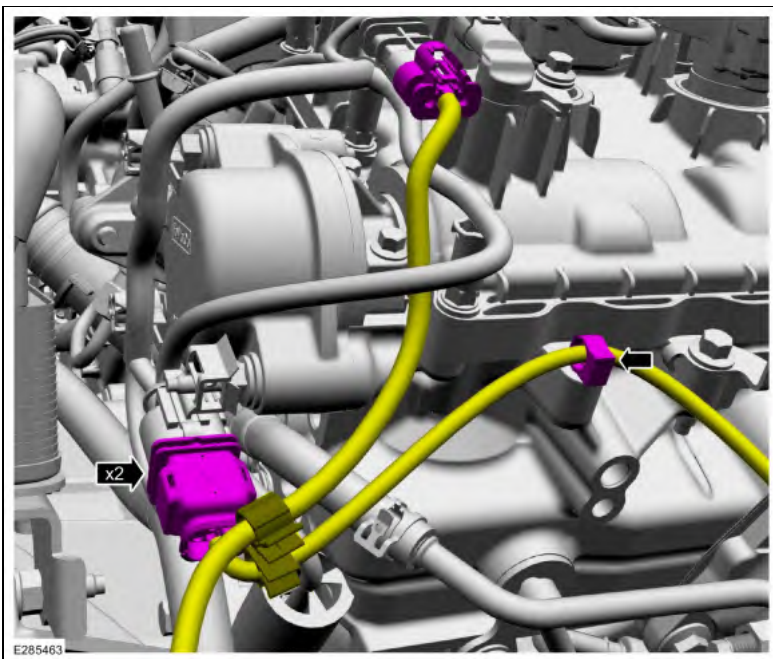


85. If equipped, position the transducer and install the bolt.
Torque: 97 lb.in (11 Nm)



86.

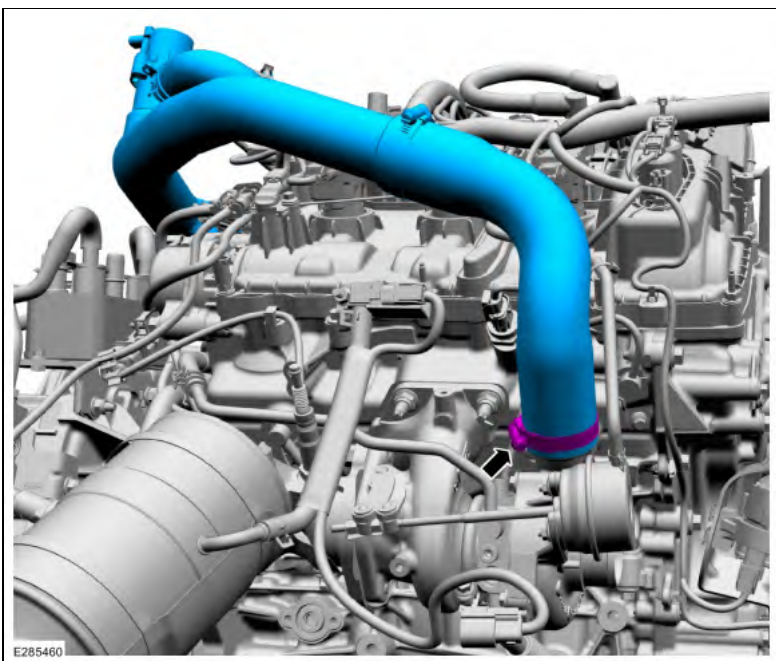
- Connect the HO2S and the catalyst monitor sensor electrical connectors.
- Attach the wiring harness retainer.



87. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

1. Uncover, clean and inspect all open ports.
2. Install the turbocharger outlet pipe and clamp.

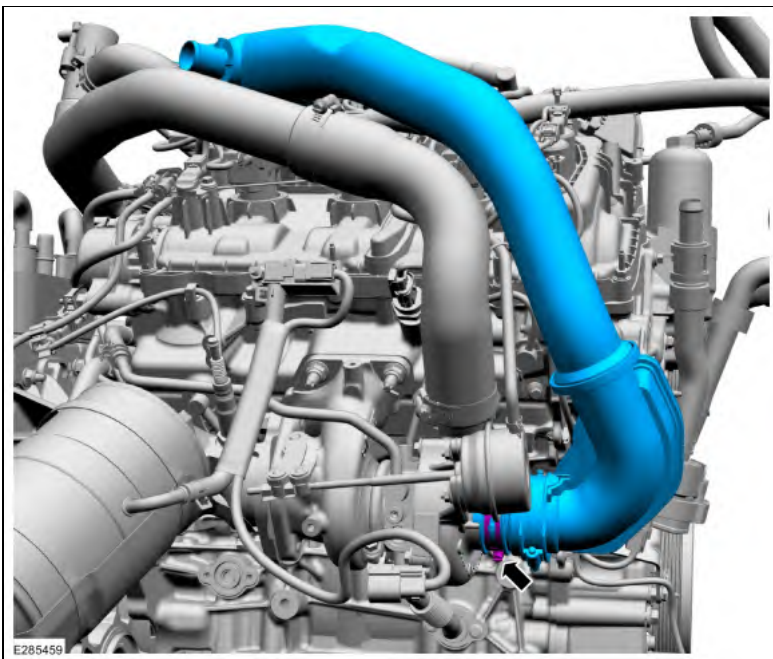
Torque: 44 lb.in (5 Nm)



88. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

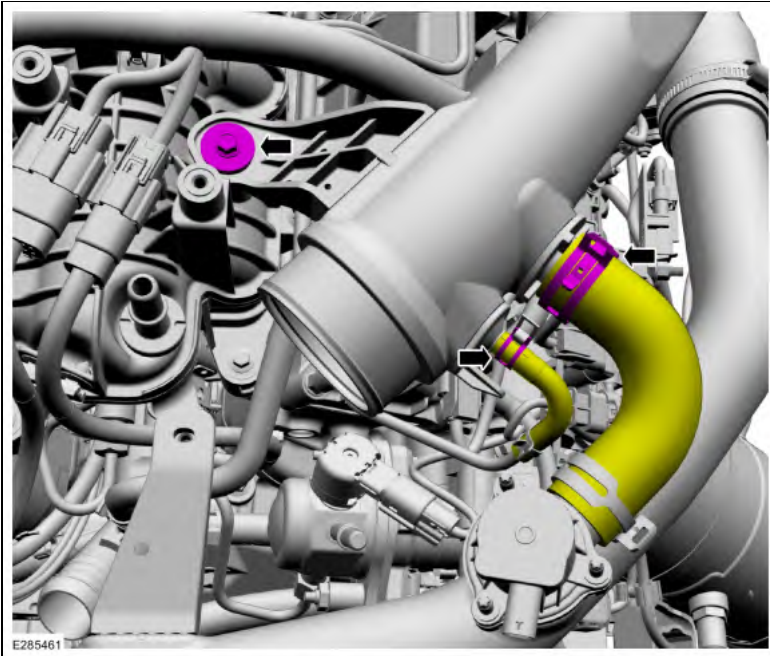
1. Uncover, clean and inspect all open ports.
2. Install the turbocharger intake pipe and clamp.

Torque: 44 lb.in (5 Nm)

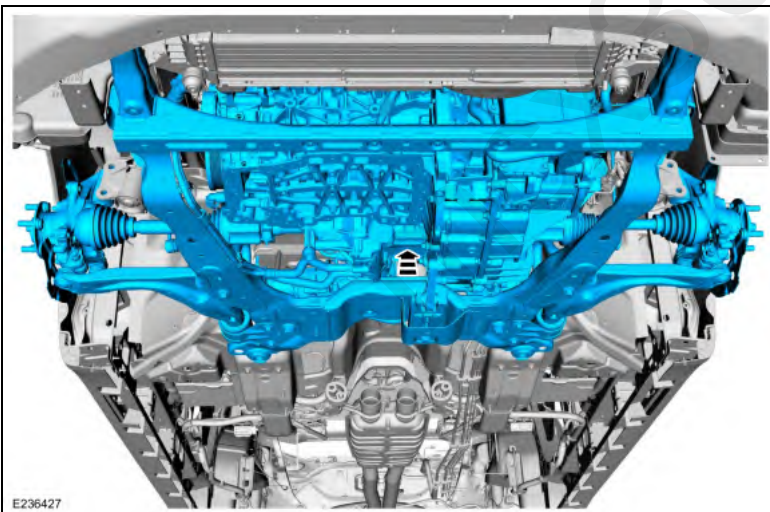


89. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

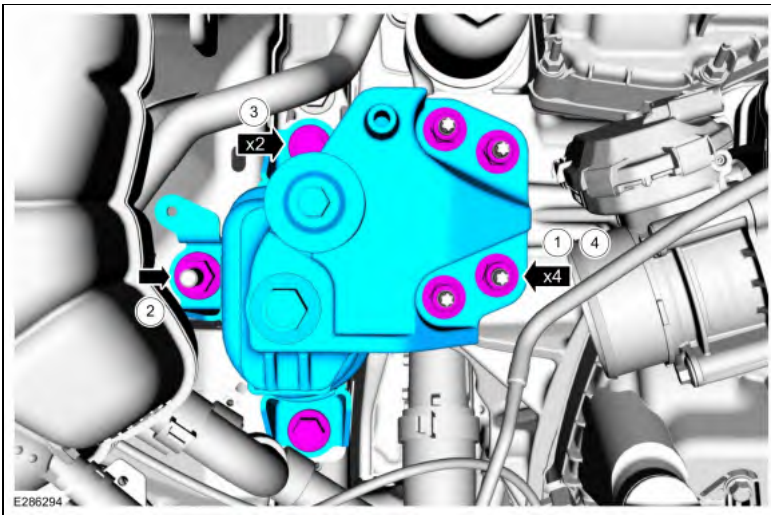
1. Uncover, clean and inspect all open ports.
2. Install the bolt.
Torque: 71 lb.in (8 Nm)
3. Install the hoses and the clamps.
Use the General Equipment: Hose Clamp Remover/Installer



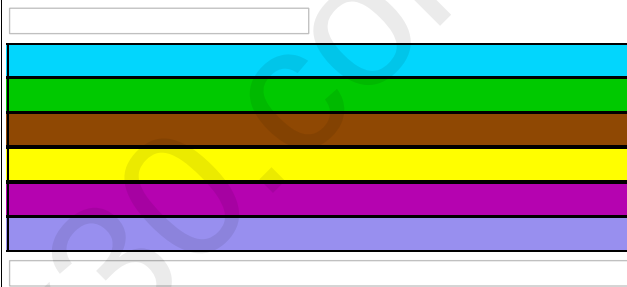
90. Using the powertrain jack, raise the powertrain and subframe assembly into the engine compartment.
Use the General Equipment: Powertrain Jack



91. Install the engine mount and bracket assembly.
1. Install the new engine mount bracket-to-engine nuts finger tight.
 2. Install the new engine mount-to-frame nut finger tight.
 3. Install the new engine mount-to-frame bolts finger tight.
 4. Tighten the engine mount bracket-to-engine nuts.
- Torque: 59 lb.ft (80 Nm)*



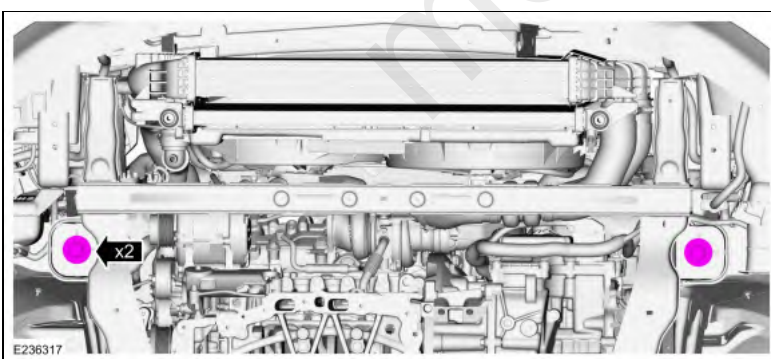
92. Install the new transmission mount bolts.
Torque: 66 lb.ft (90 Nm)



93. **NOTE:** Align the reference marks made during removal.

NOTE: Only tighten the bolts finger tight at this stage.

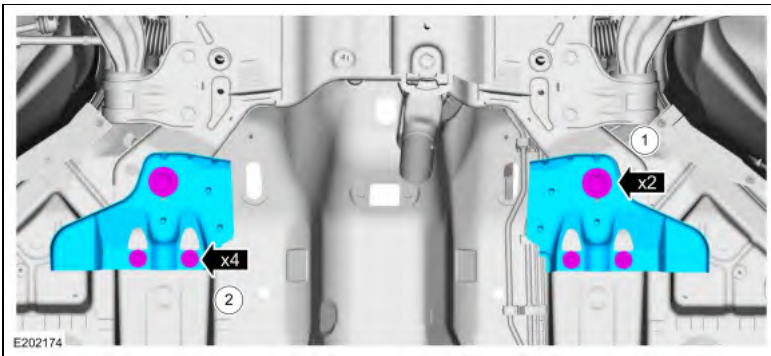
Install the new subframe bolts.



94. **NOTE:** Align the reference marks made during removal.

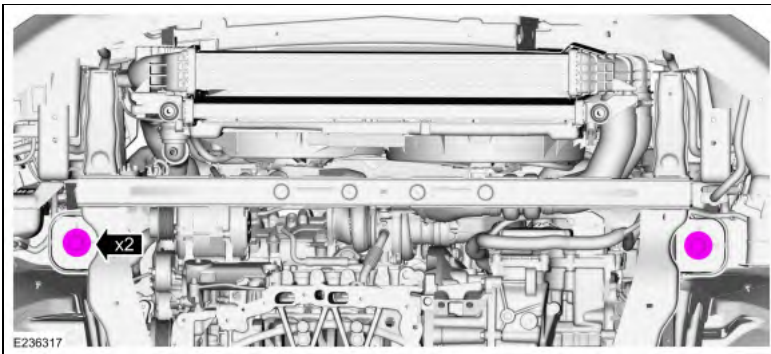
NOTE: Only tighten the bolts finger tight at this stage.

1. Install the subframe brackets and the new subframe bolts.
2. Install the subframe bracket bolts.



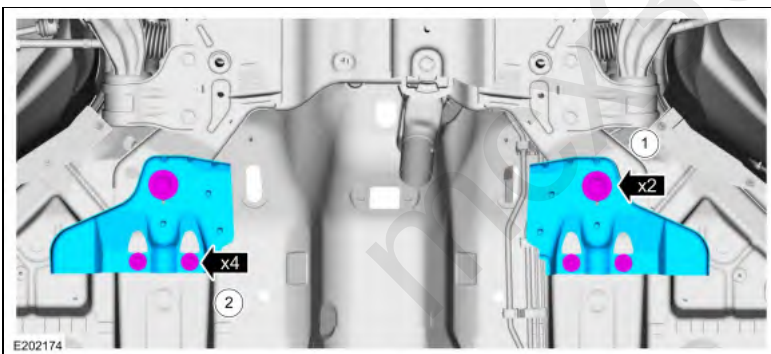
95. **NOTE:** While tightening the subframe bolts, make sure the front subframe does not move.

Tighten the subframe bolts.
Torque: 173 lb.ft (235 Nm)

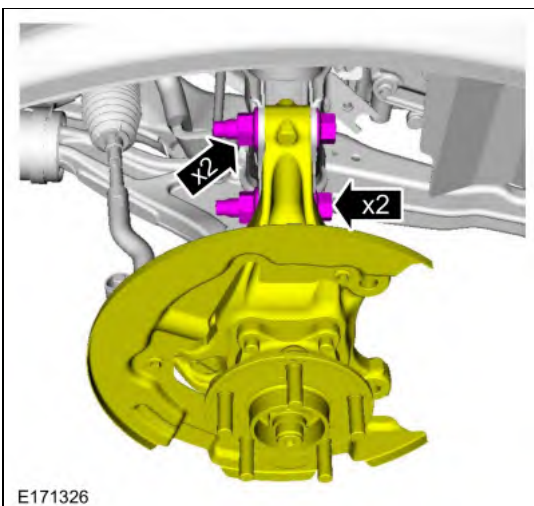


96.

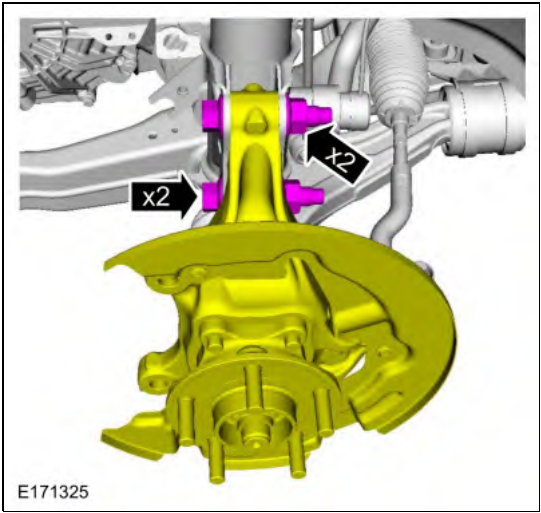
1. Tighten.
Torque:
Stage 1: 76 lb.ft (103 Nm)
Stage 2: 270°
2. Tighten.
Torque: 35 lb.ft (48 Nm)



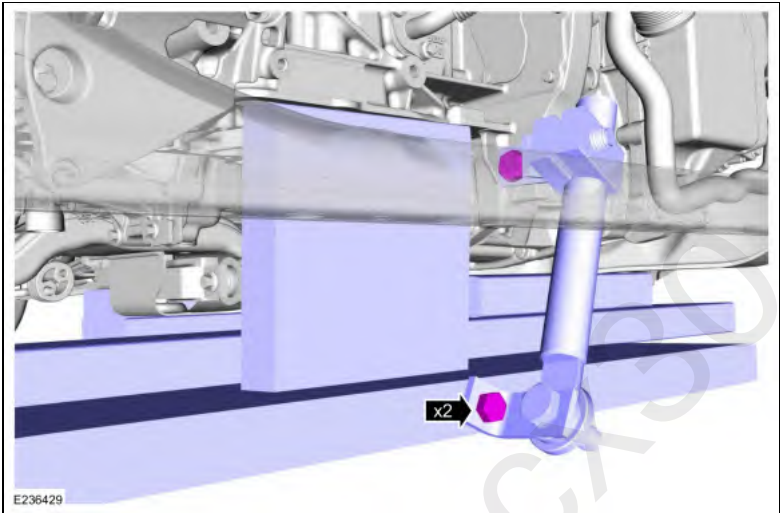
97. Install new bolts and nuts.
Torque: 173 lb.ft (235 Nm)



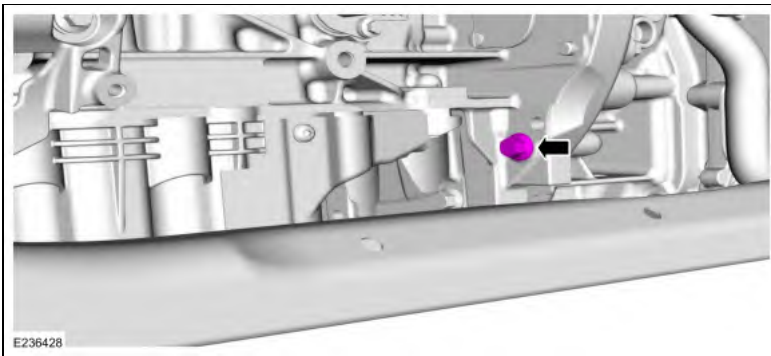
98. Install new bolts and nuts.
Torque: 173 lb.ft (235 Nm)



99. Remove.
Use the General Equipment: Powertrain Jack
Use the General Equipment: Wooden Block
Use the General Equipment: Adjustable Mounting Arm

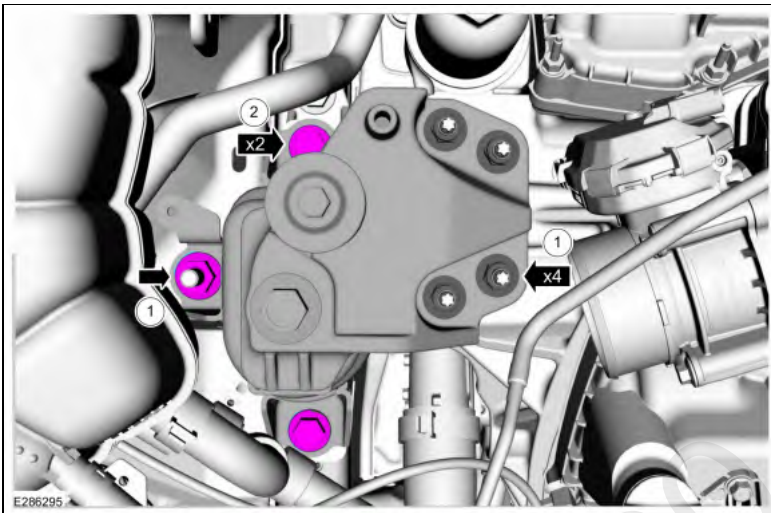


100. Install the engine-to-transmission bolt.
Torque: 35 lb.ft (48 Nm)

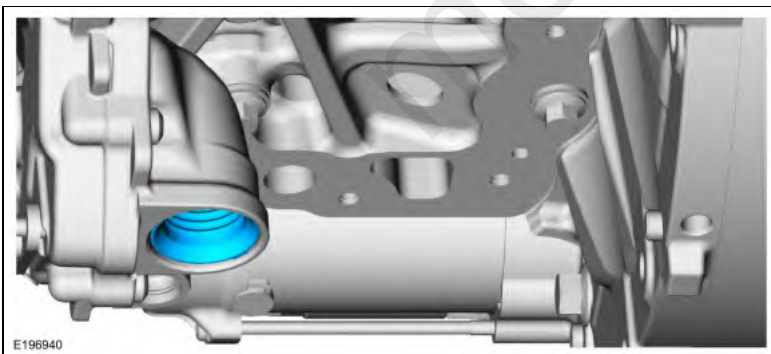


101.

1. Tighten the engine mount-to-frame nut.
Torque: 66 lb.ft (90 Nm)
2. Tighten the engine mount-to-frame bolts.
Torque: 81 lb.ft (110 Nm)



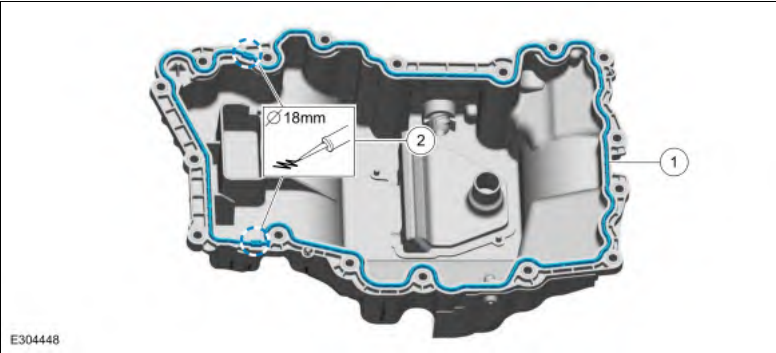
102. Install a new oil pump seal.



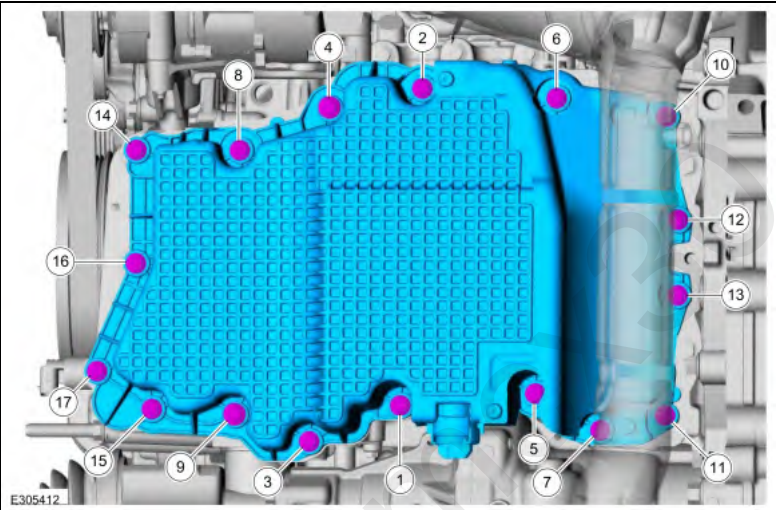
103. **NOTICE:** Failure to use Motorcraft® High Performance Engine RTV Silicone may cause the engine oil to foam excessively and result in serious engine damage.

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 minutes 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. Install a new oil pan press-in-place gasket.
2. Apply a 18 mm (0.708 in) bead of Motorcraft® High Performance Engine RTV Silicone to the engine front cover-to-cylinder block joint areas on the oil pan.
Material: Motorcraft® High Performance Engine RTV Silicone / TA-357 (WSE-M4G323-A6)

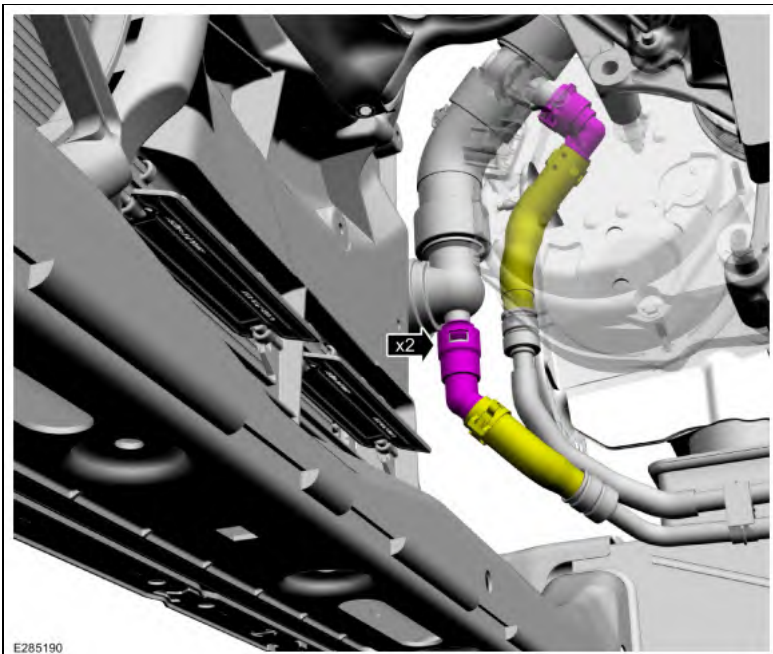


104. Install the oil pan and the bolts.
Torque:
Stage 1: 31 lb.in (3.5 Nm)
Stage 2: 89 lb.in (10 Nm)



LHD AWD

105. Connect the transfer case coolant hose quick connect couplings.



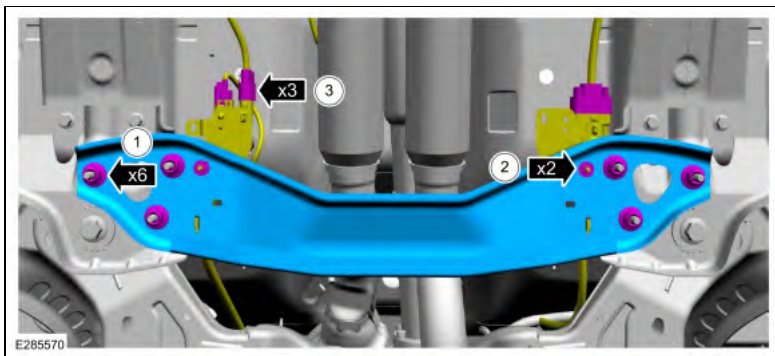
E285190



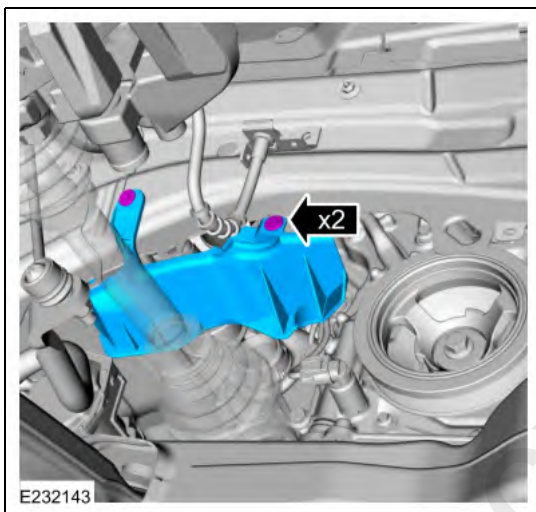
106. Install the driveshaft.
Refer to: Rear Driveshaft - 2.0L EcoBoost (177kW/240PS) & MI4 (205-01 Driveshaft, Removal and Installation).

LHD AWD/LHD FWD

107. Install the following items:
 1. LH catalytic convertor.
Refer to: Catalytic Converter LH (309-00B Exhaust System - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 2. Exhaust flexible pipes.
Refer to: Exhaust Flexible Pipe (309-00B Exhaust System - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
108.
 1. Install the subframe support bracket and the nuts.
Torque: 30 lb.ft (40 Nm)
 2. If equipped, install the wiring harness support bracket(s) and the nut(s).
Torque: 80 lb.in (9 Nm)
 3. If equipped, connect the wiring harness electrical connectors.



109. Install the shield and the retainers.



110. **NOTICE:** Do not allow the brake caliper and anchor plate assembly to hang from the brake hose or damage to the hose can occur.

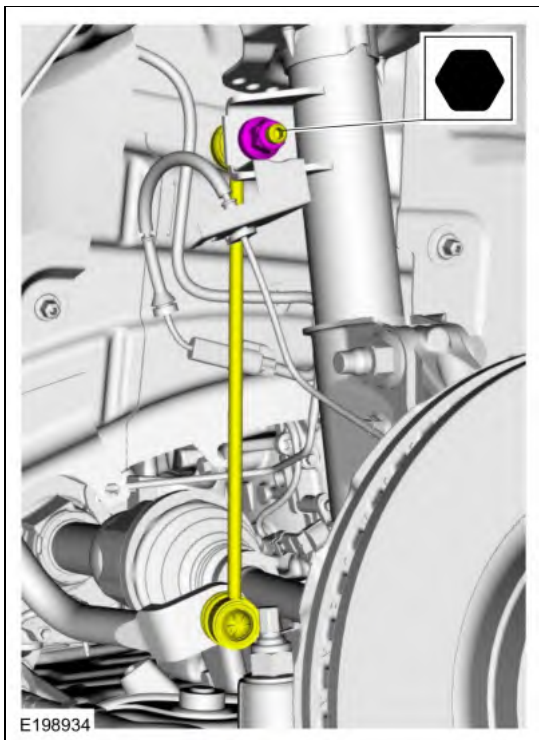
Install the front brake discs.

Refer to: Brake Disc (206-03 Front Disc Brake, Removal and Installation).

111. **NOTICE:** Use the internal or external hex-holding feature to prevent the ball and stud from turning while removing or installing the stabilizer bar link nuts. The link boot seal must not be allowed to twist while tightening the link nuts or damage to the boot seal will occur.

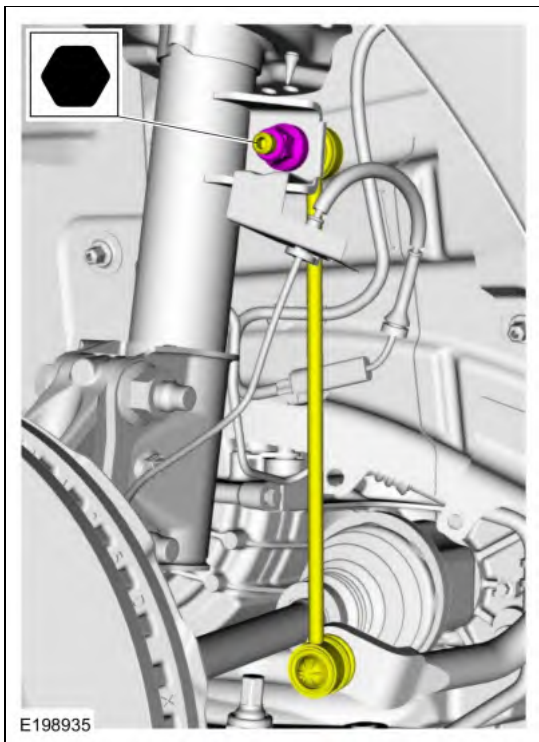
Position the RH sway bar link and install the new nut.

Torque: 85 lb.ft (115 Nm)



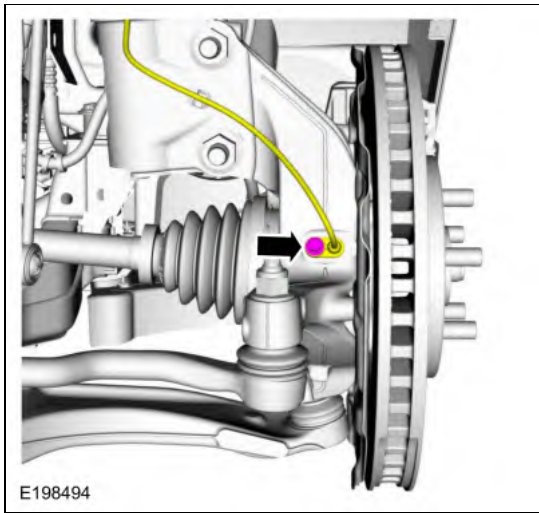
112. **NOTICE:** Use the internal or external hex-holding feature to prevent the ball and stud from turning while removing or installing the stabilizer bar link nuts. The link boot seal must not be allowed to twist while tightening the link nuts or damage to the boot seal will occur.

Position the LH sway bar link and install the new nut.
Torque: 85 lb.ft (115 Nm)



113. **NOTICE:** Before installing a new sensor, inspect the sensor housing to make sure the sensor cavity is clean and free of foreign material or damage to the sensor may occur. Clean and inspect the sensor housing cavity.

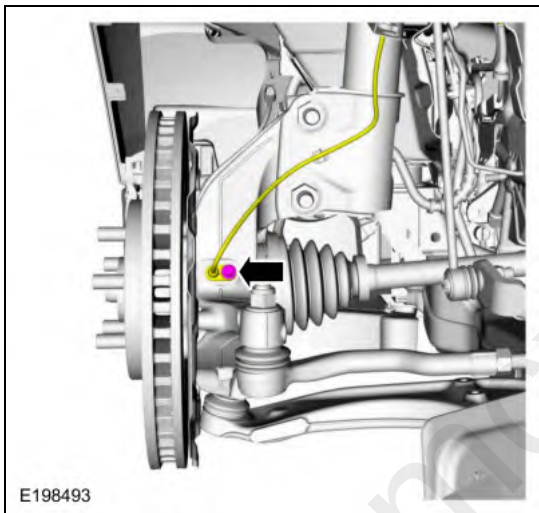
Install the RH anti-lock sensor and the bolt.
Torque: 80 lb.in (9 Nm)



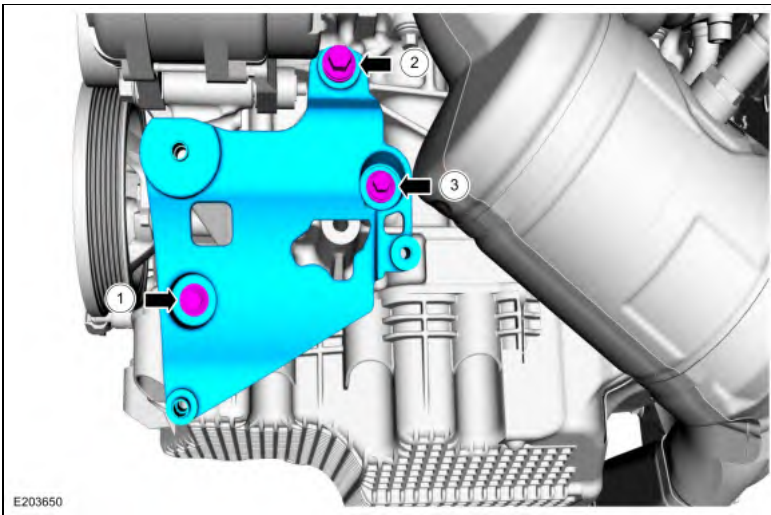
114. **NOTICE:** Before installing a new sensor, inspect the sensor housing to make sure the sensor cavity is clean and free of foreign material or damage to the sensor may occur. Clean and inspect the sensor housing cavity.

Install the LH anti-lock sensor and the bolt.

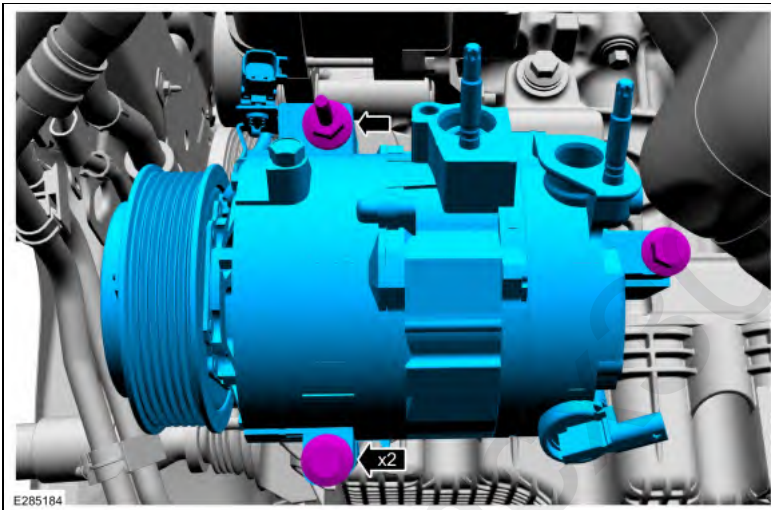
Torque: 80 lb.in (9 Nm)



- 115.
1. Install the A/C compressor mounting bracket and the M8 x 50 mm bolt.
Torque: 18 lb.ft (25 Nm)
 2. Install the M10 x 43 mm bolt.
Torque: 35 lb.ft (47 Nm)
 3. Install the M8 x 30 mm bolt.
Torque: 18 lb.ft (25 Nm)

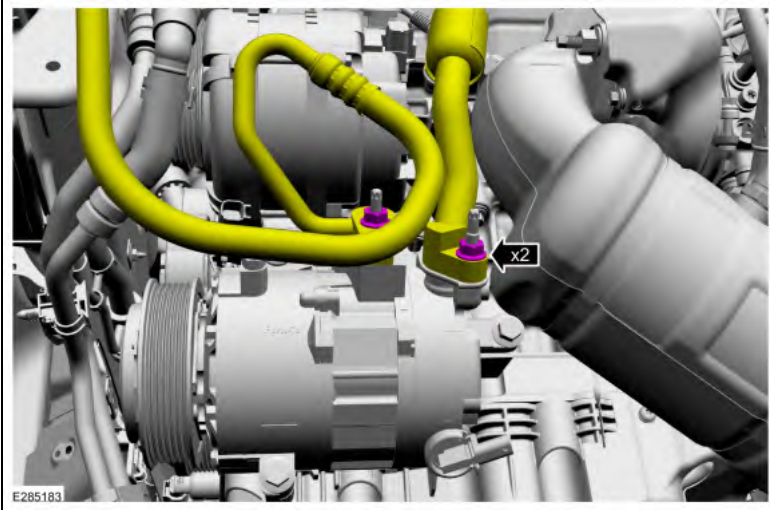


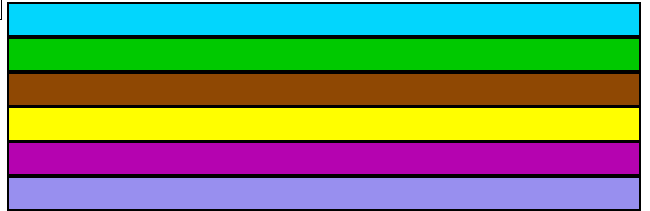
116. Install the A/C compressor, the bolts and the stud bolt.
Torque: 18 lb.ft (25 Nm)



117. **NOTICE:** During the removal of components, cap, tape or otherwise appropriately protect all openings to prevent the ingress of dirt or other contamination. Remove protective materials prior to installation.

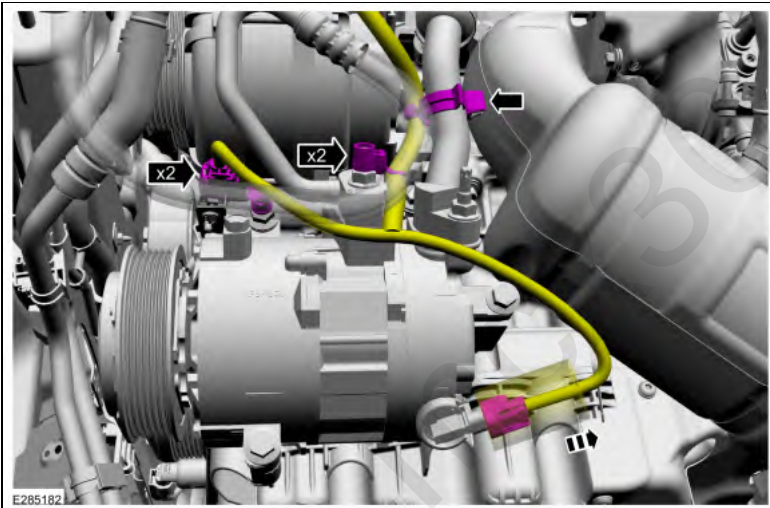
1. Make sure to uncover any open ports.
2. Install new the O-ring seals and gasket seals.
3. Connect the A/C compressor inlet and outlet line fittings and install the nuts.
Torque: 159 lb.in (18 Nm)





118.

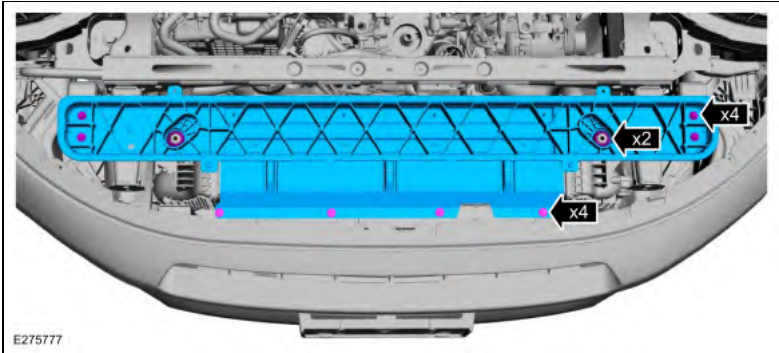
- Connect the A/C compressor electrical connectors.
- Slide the insulator over the A/C compressor electrical connector.
- Attach the wiring harness retainers.



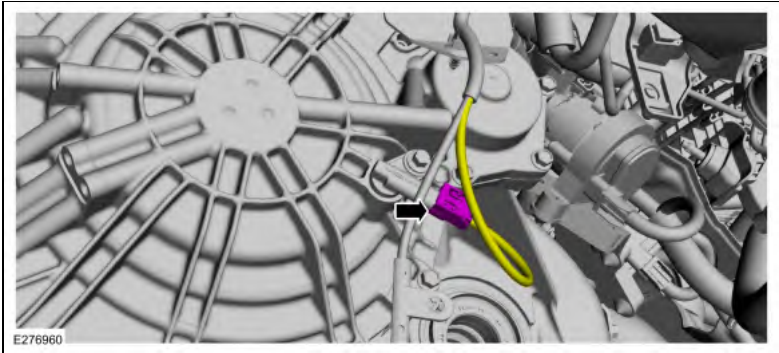


119.

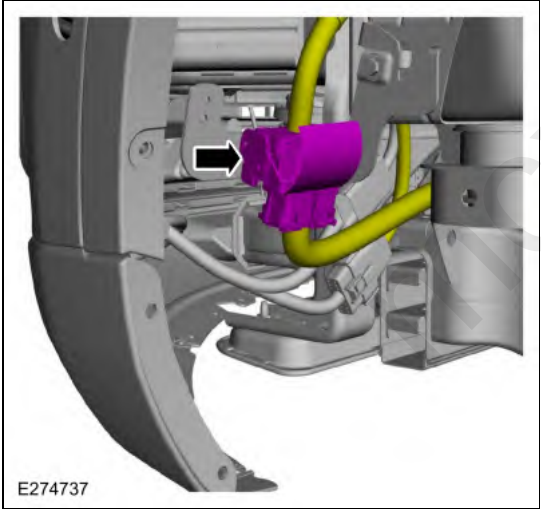
- Install the cooling module support panel and the bolts.
Torque: 18 lb.ft (24 Nm)
- Install the pin-type retainers.



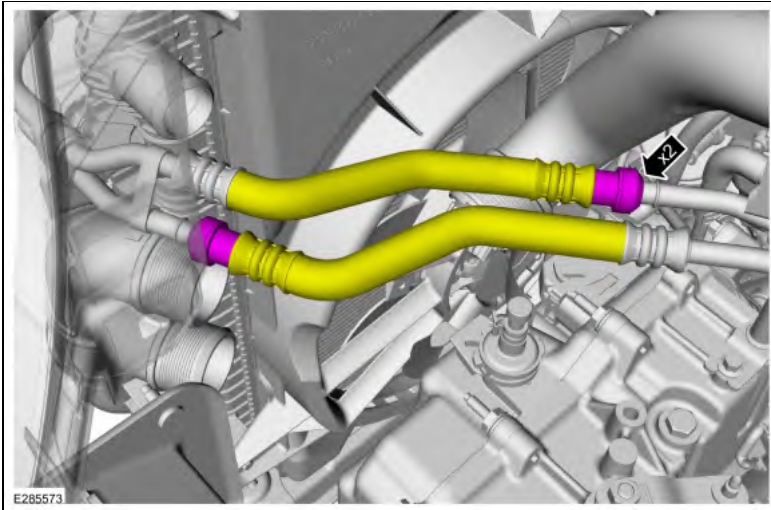
120. Connect the TSS sensor.



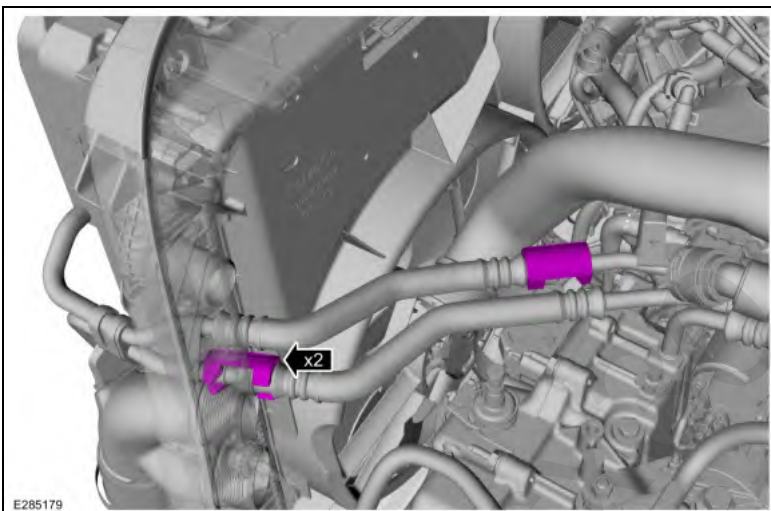
121. Connect and attach the engine harness electrical connector.



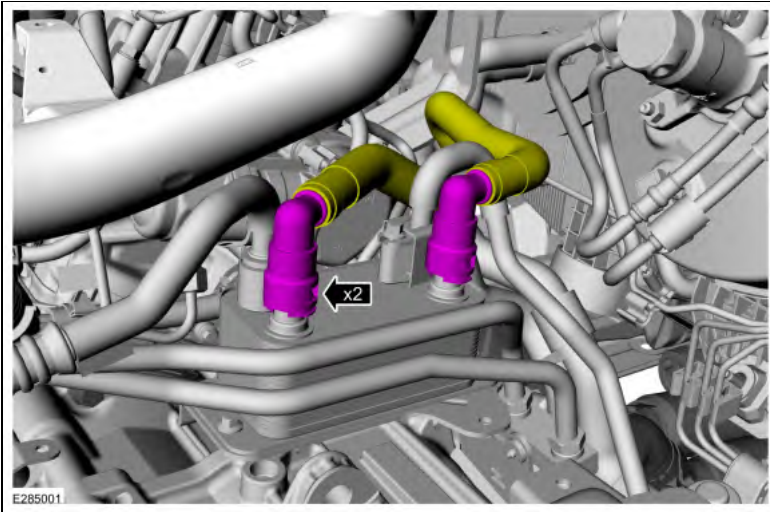
122. Connect the transmission fluid cooler tubes.



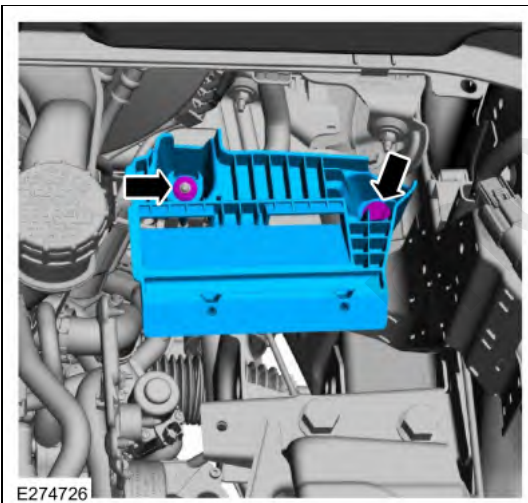
123. Install the transmission fluid cooler tube secondary latches.



124. Connect the coolant tube couplings.

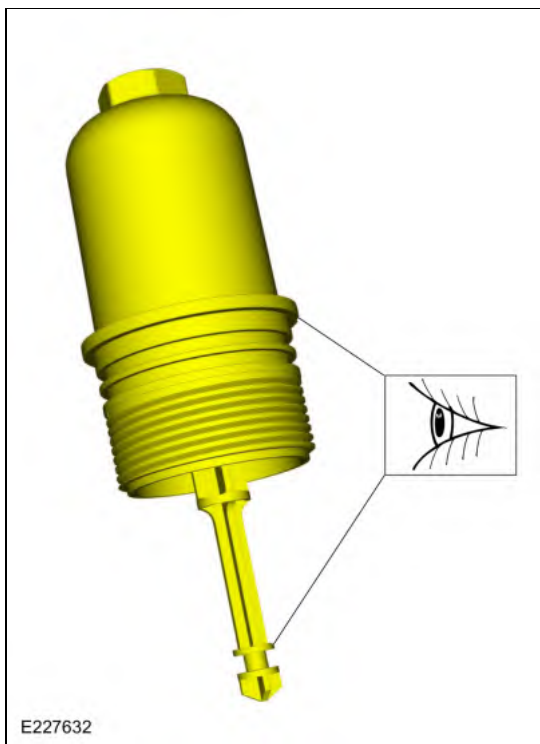


125. Install the battery tray support bracket and the nut and bolt.
Torque: 18 lb.ft (24 Nm)



126. **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.



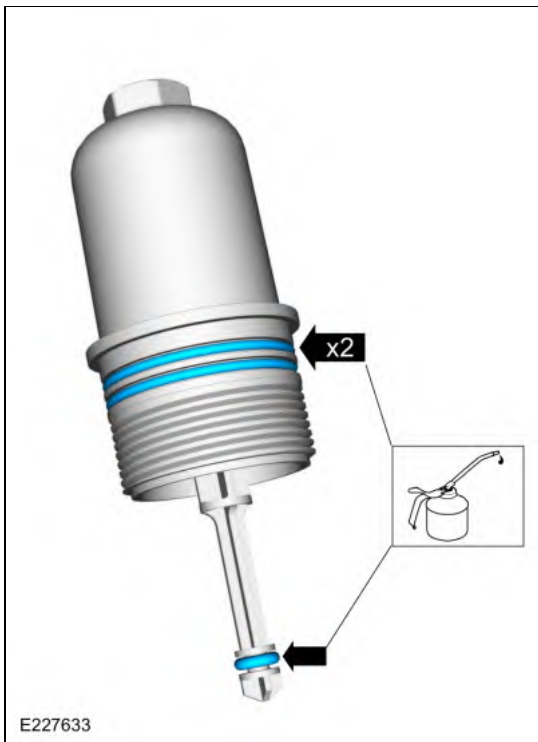
127.

- **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.

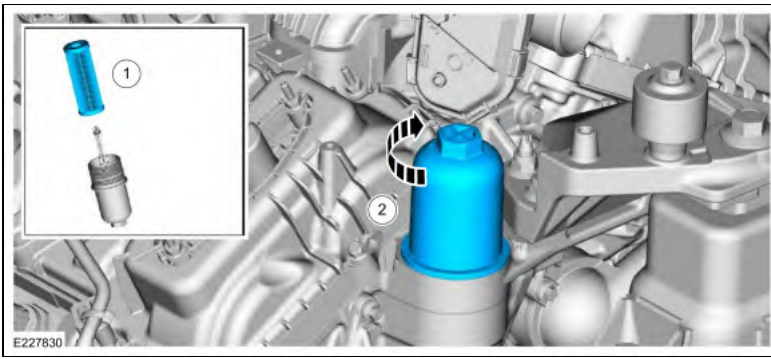
- **NOTE:** Failure to install a new oil filter housing stem-to-oil reservoir drain port seal will result with the oil flowing through the reservoir drain port and a *loss* of engine oil pressure.

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

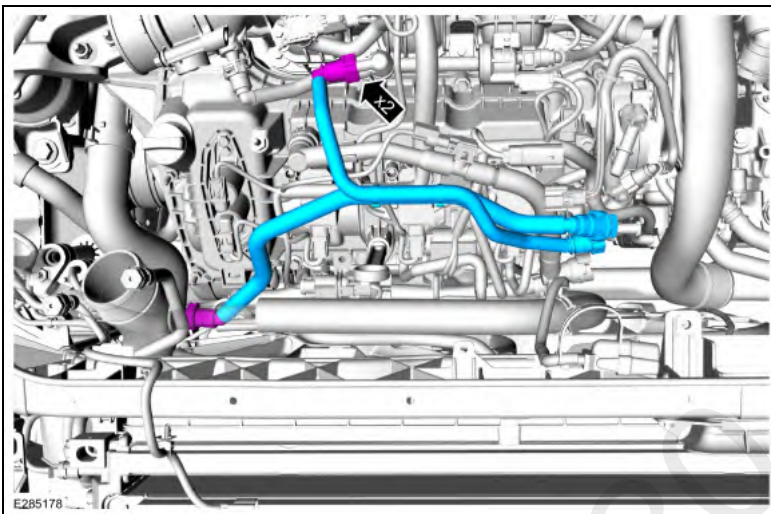


128.

1. Install a new oil filter element.
2. Install the oil filter housing.
Torque: 18 lb.ft (24 Nm)

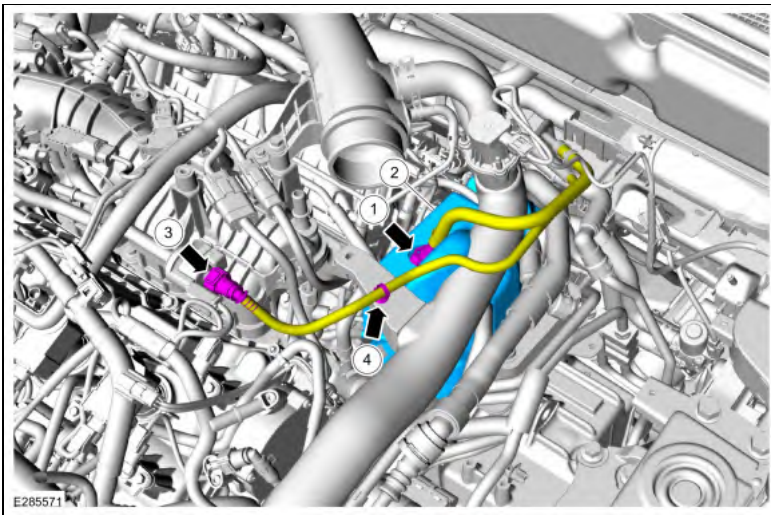


129. Install and connect the EVAP tube.



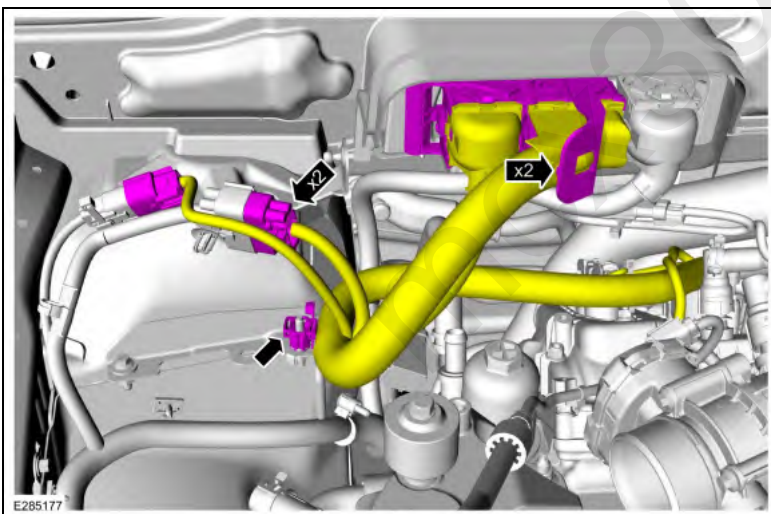
130.

1. Connect the high-pressure fuel pump fuel supply tube quick release coupling.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
2. Install the high-pressure fuel pump insulator.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
3. Connect the EVAP tube quick release coupling.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .
4. Attach the EVAP tube retainer.



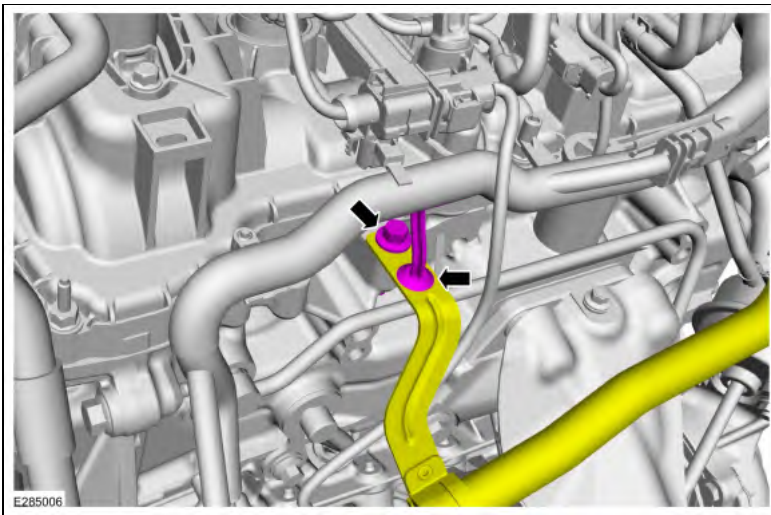
131.

- Connect the engine harness electrical connectors and attach the retainer.
- Connect the PCM electrical connectors.



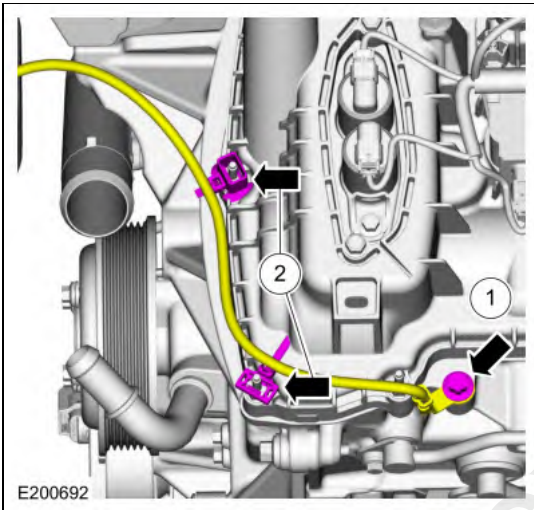
132.

- Position the bracket and install the bolt.
Torque: 159 lb.in (18 Nm)
- Attach the wiring harness retainer.



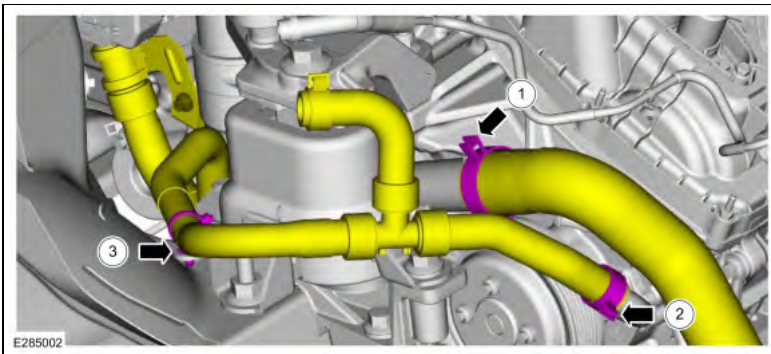
133.

1. Install the ground wire and the bolt.
Torque: 159 lb.in (18 Nm)
2. Attach the wiring harness retainers.

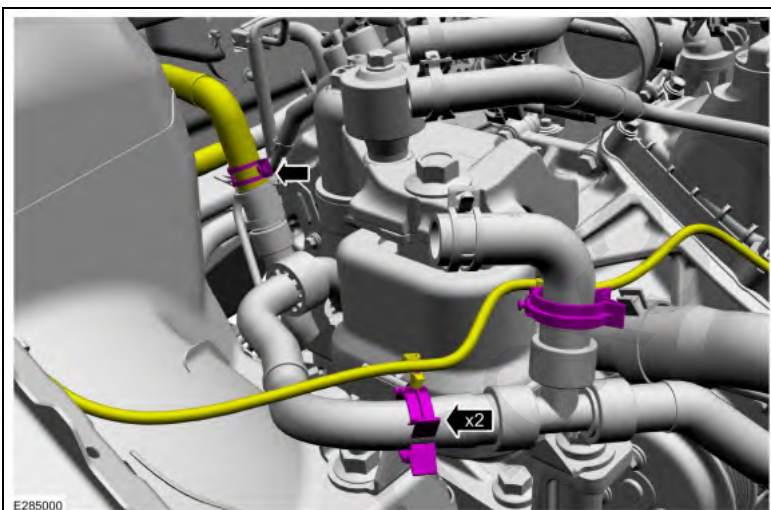


134.

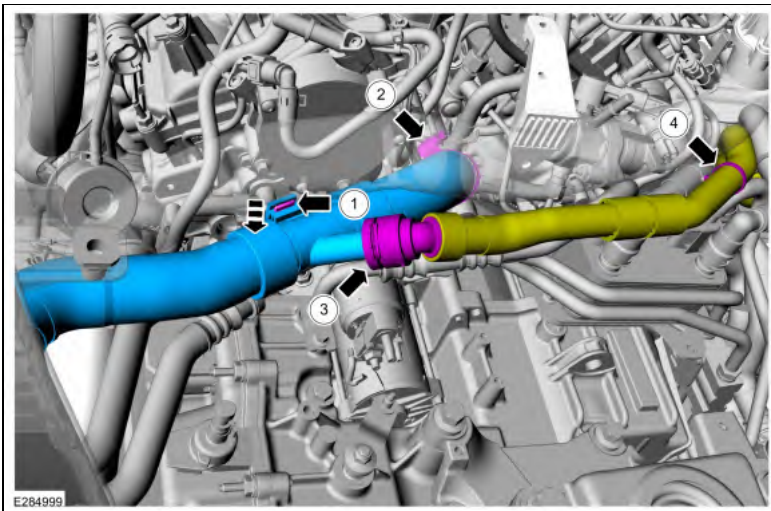
1. Install the lower radiator hose and clamp.
Use the General Equipment: Hose Clamp Remover/Installer
2. Install the heater hose and clamp.
3. Attach the heater hose retainer.



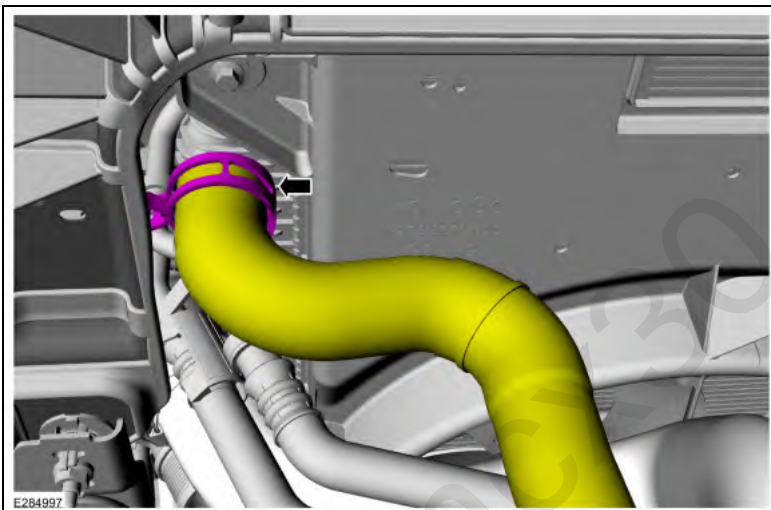
- 135.
1. Install the heater hose and clamp.
Use the General Equipment: Hose Clamp Remover/Installer
 2. Attach the wiring harness retainers.



- 136.
1. Install the radiator hose onto the engine and retaining tab.
 2. Tighten the radiator hose clamp.
Torque: 48 lb.in (5.4 Nm)
 3. Connect the heater hose coupling.
 4. Attach the heater hose retainer.

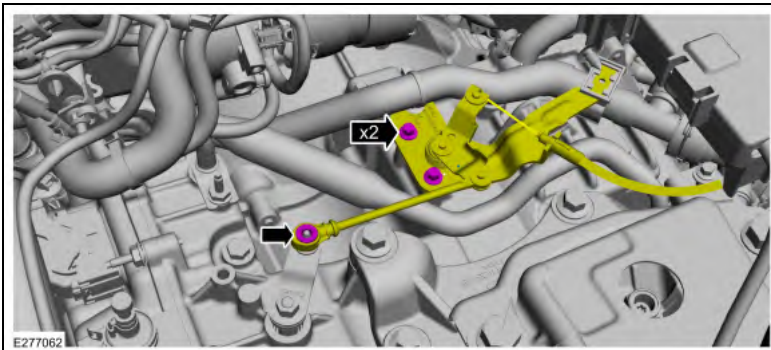


137. Install the upper radiator hose and clamp.
Use the General Equipment: Hose Clamp Remover/Installer

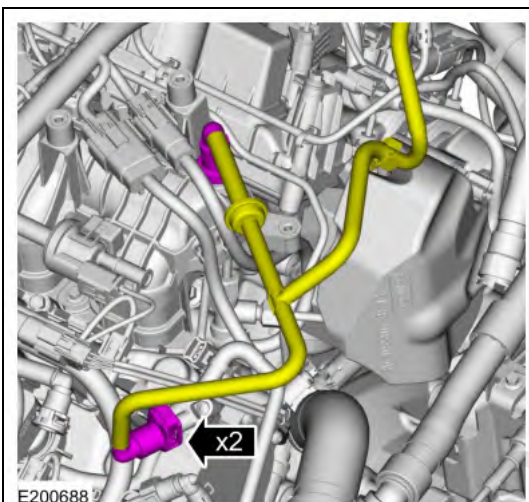


A horizontal bar chart with six colored bars: cyan, green, brown, yellow, purple, and light blue. Above the bars is a small grey diamond icon and a text input field.

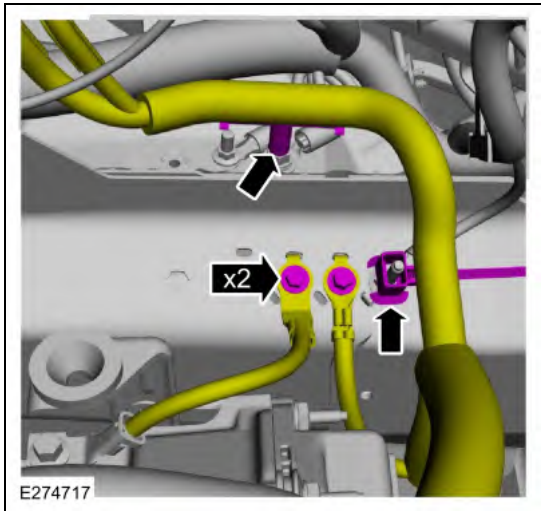
138.
 1. Position the cable and install the bolts.
Torque: 62 lb.in (7 Nm)
 2. Attach the cable to the manual control lever.



139. Connect the vacuum tube quick release couplings.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information) .

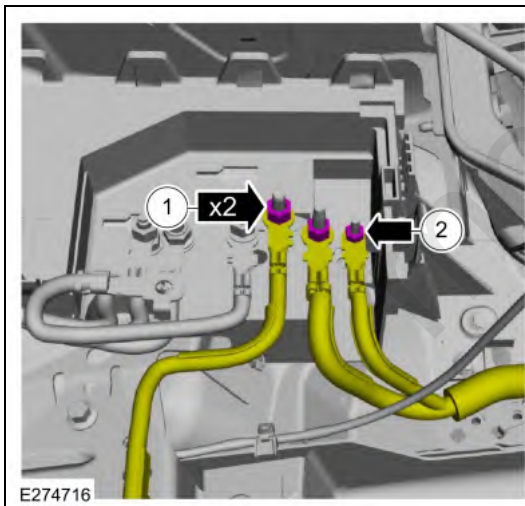


140. Install the bolts and attach the wiring harness retainers.
Torque: 106 lb.in (12 Nm)

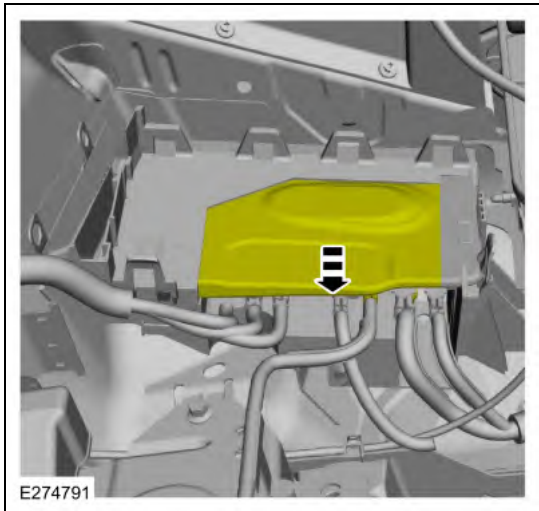


141.

1. Install the electrical wiring harness and the nuts.
Torque: 106 lb.in (12 Nm)
2. Install the electrical wiring harness and the nut.
Torque: 71 lb.in (8 Nm)

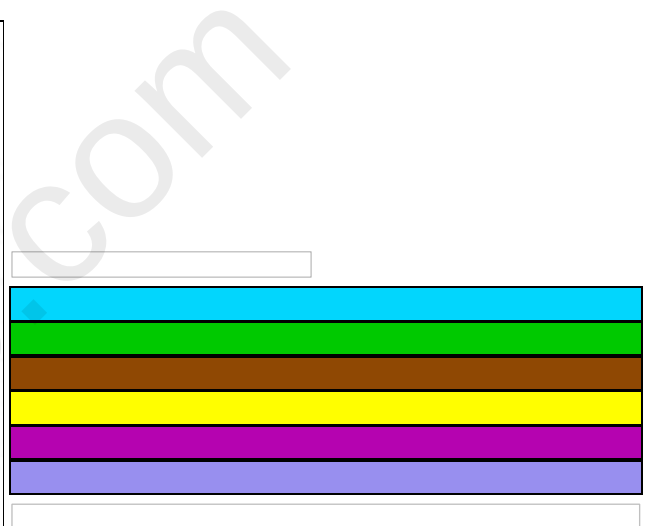
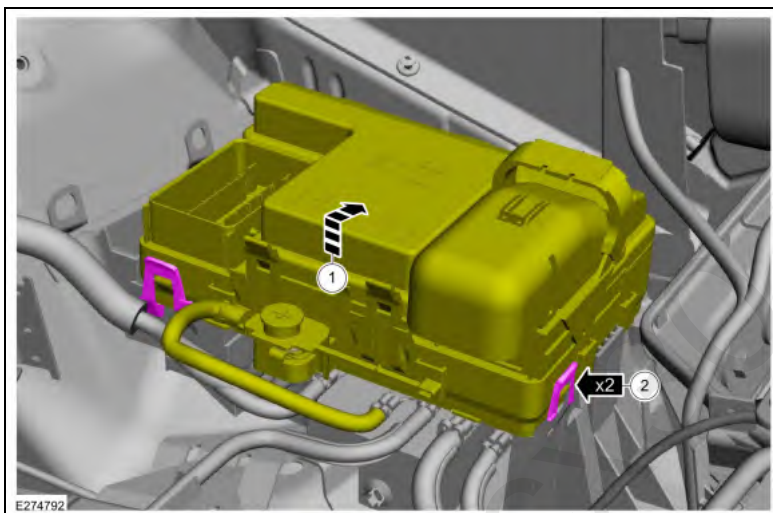


142. Close the cover.

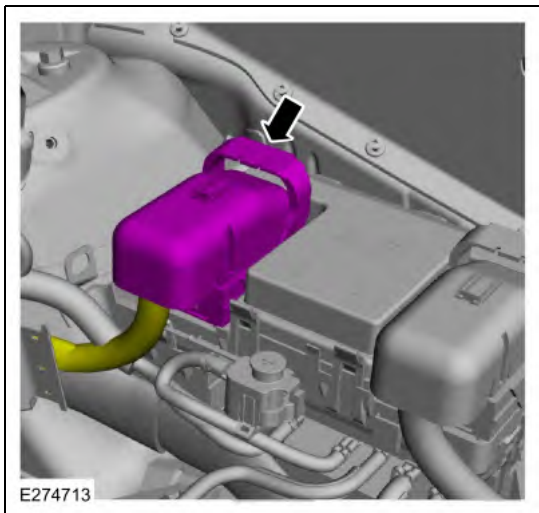


143.

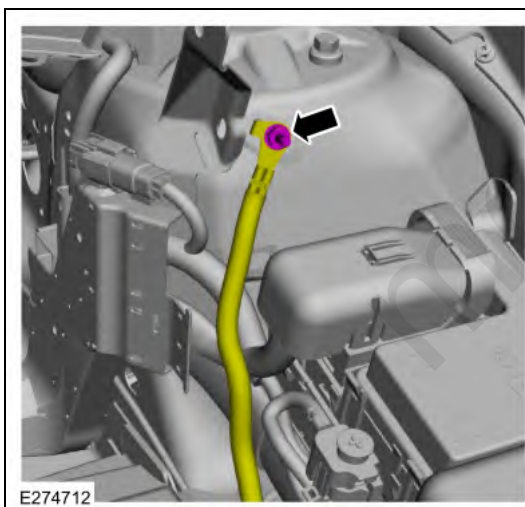
- Position the top part of junction box.
- Latch the tabs.



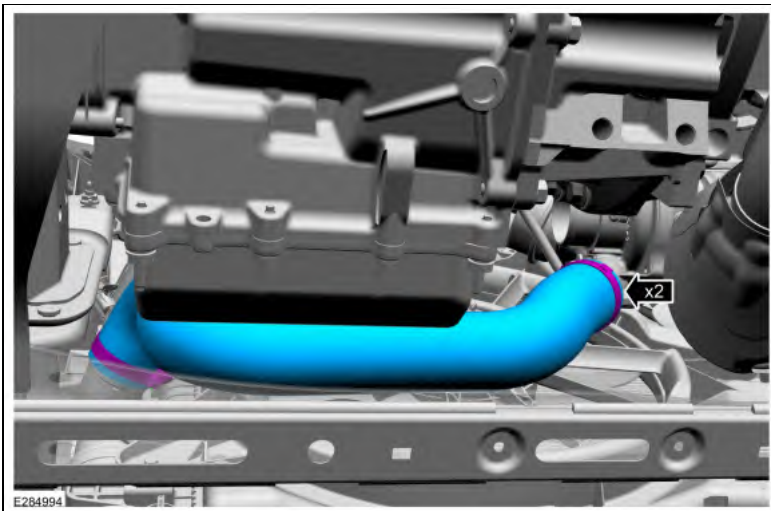
144. Connect the junction box electrical connector.



145. Install the ground cable and stud bolt.
Torque: 106 lb.in (12 Nm)

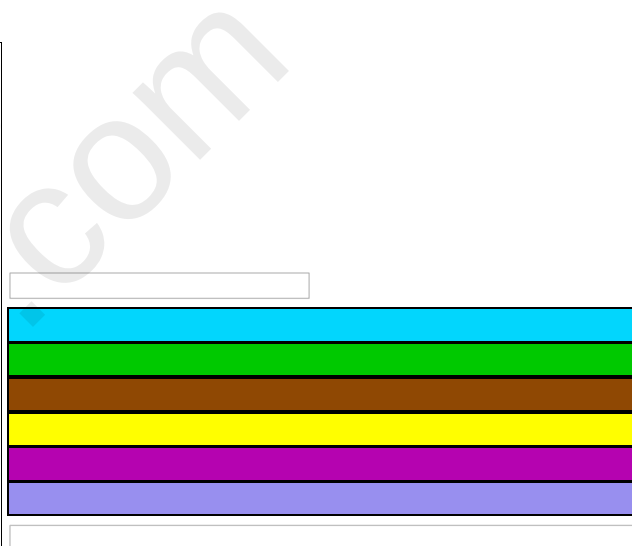
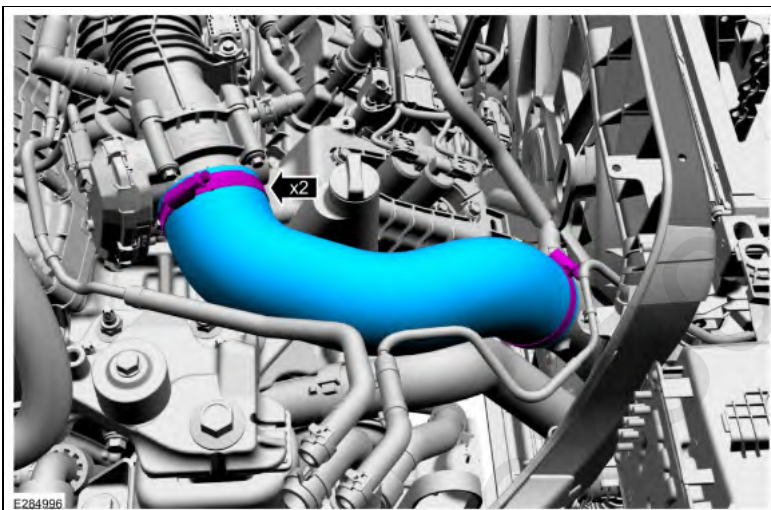


146. Install the following items:
1. Battery tray.
Refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
 2. Accessory drive belt tensioner.
Refer to: Accessory Drive Belt Tensioner (303-05B Accessory Drive - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
147. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.
1. Uncover, clean and inspect all open ports.
 2. Install the CAC inlet pipe and tighten the clamps.
Torque: 44 lb.in (5 Nm)

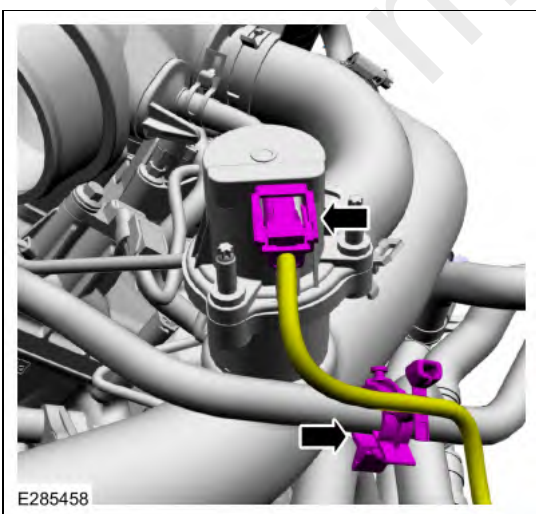


148. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.

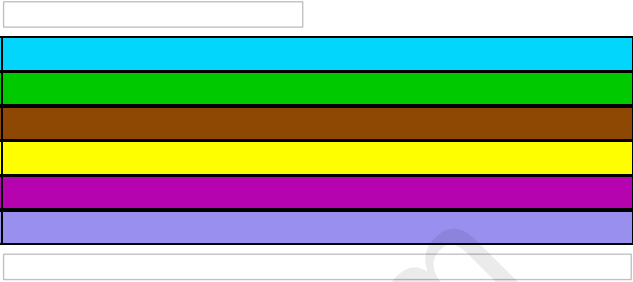
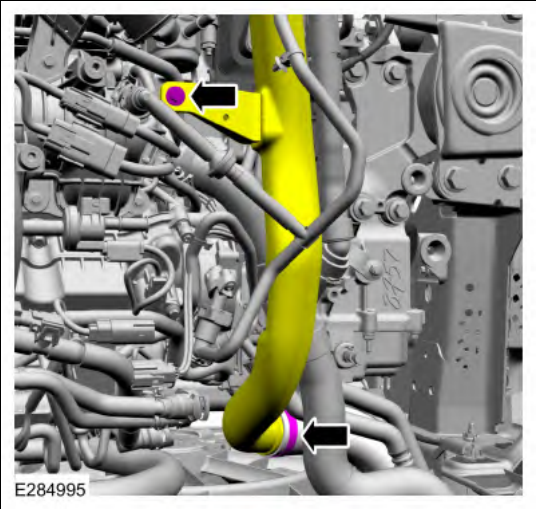
1. Uncover, clean and inspect all open ports.
2. Install the CAC outlet pipe and tighten the clamps.
Torque: 44 lb.in (5 Nm)



149. Connect the wiring harness electrical connector and attach the retainer.



150. **NOTICE:** When removing any turbocharger air intake system components, make sure to cover any open ports to prevent debris from entering the system. The turbocharger compressor vanes can be damaged by even the smallest particles. All components need to be inspected and cleaned prior to installation or reassembly.
- 1. Uncover, clean and inspect all open ports.
 - 2. Connect the CAC inlet pipe and tighten the clamps.
Torque: 44 lb.in (5 Nm)
 - 3. Install the bolt.
Torque: 71 lb.in (8 Nm)

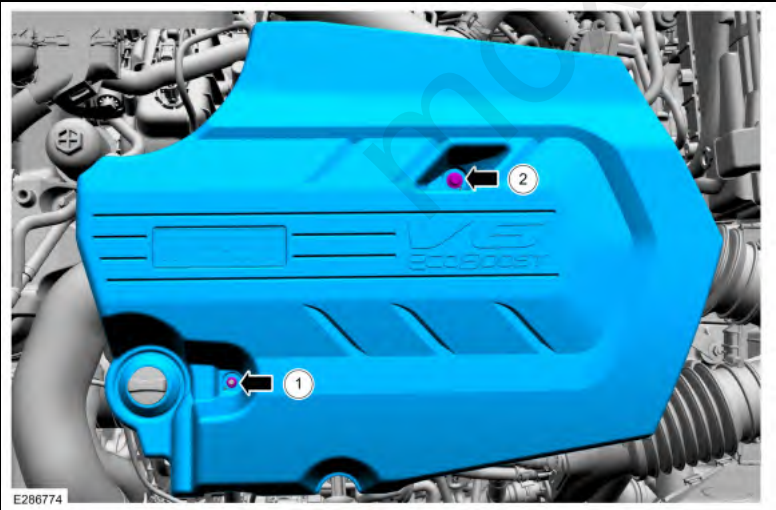


151. Install the following items:
- 1. Upper RH air cleaner outlet pipe.

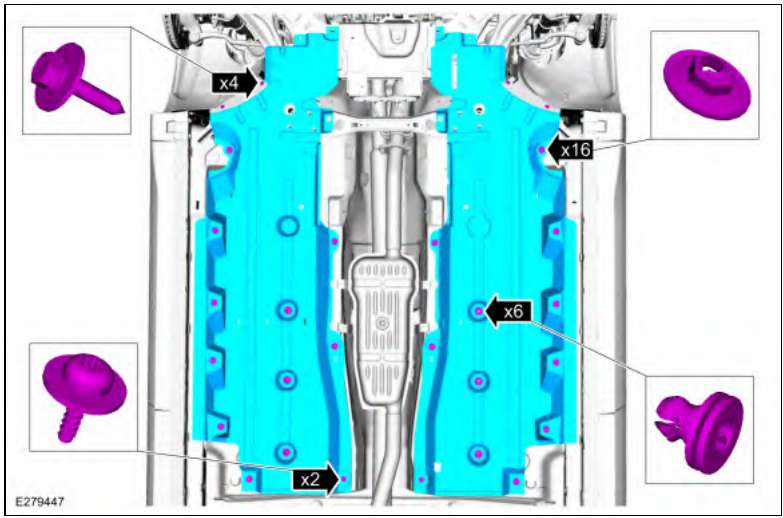
Refer to: Air Cleaner Outlet Pipe RH (303-12B Intake Air Distribution and Filtering - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 - 2. LH air cleaner outlet pipe.

Refer to: Air Cleaner Outlet Pipe LH (303-12B Intake Air Distribution and Filtering - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
 - 3. Degas bottle.

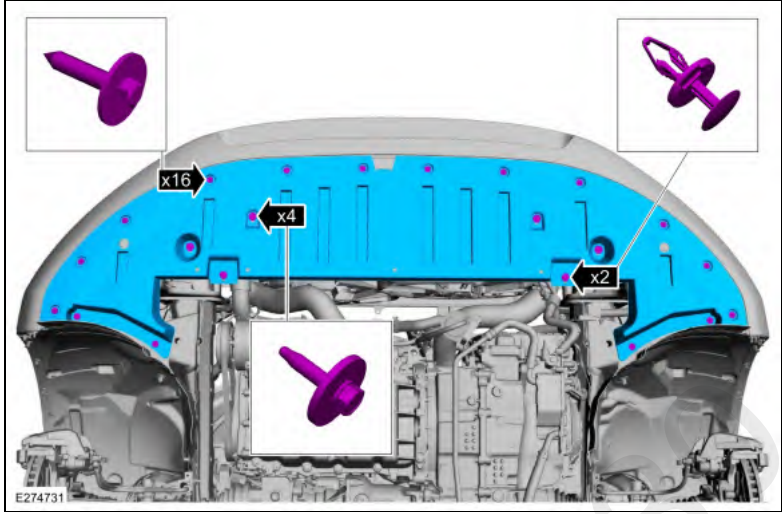
Refer to: Degas Bottle (303-03B Engine Cooling - 2.7L EcoBoost (238kW/324PS), Removal and Installation).
- 152.
- 1. Install the engine appearance cover and the nut.
Torque: 42 lb.in (4.8 Nm)
 - 2. Install the bolt.
Torque: 93 lb.in (10.5 Nm)



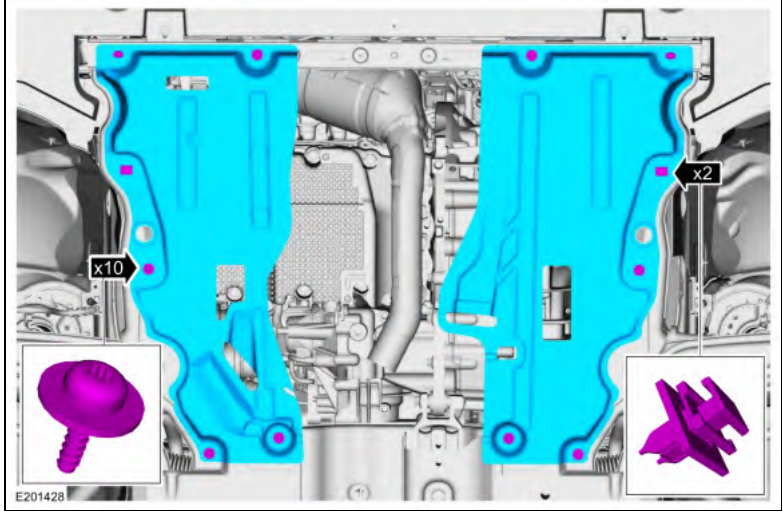
153. Install the underbody shields and the retainers.



154. Install the front underbody shield and the retainers.



155. Install the underbody shields and the retainers.



156. Install the following items:
1. Front headlamp leveling sensor.

Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

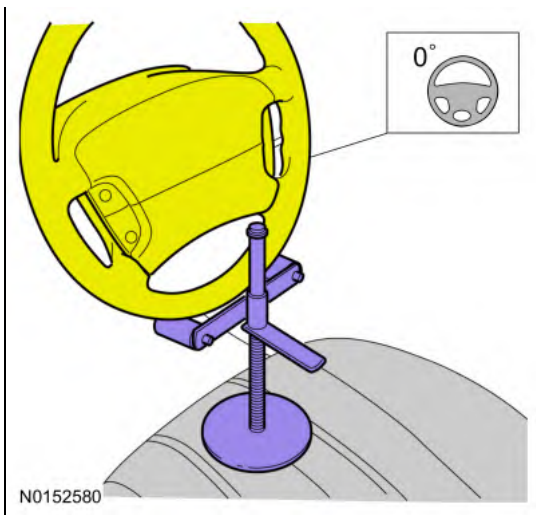
1. Remove the cable ties or mechanics wire.
2. Install the upper cooling module support brackets.



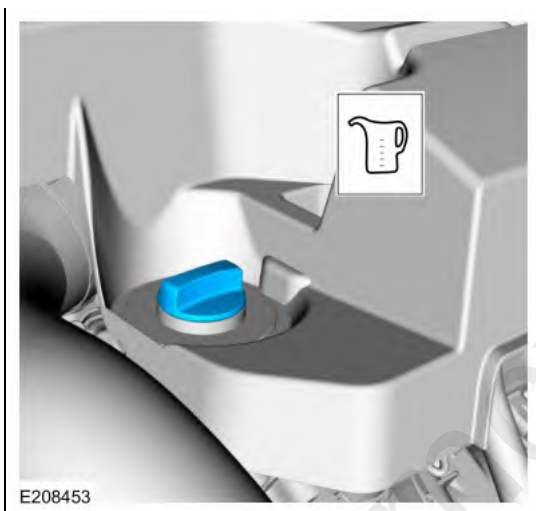
E280209



160. Remove the holding device.



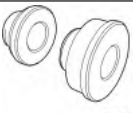
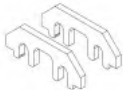
161. Fill the engine with clean engine oil.
 Refer to: Specifications (303-01B Engine - 2.7L EcoBoost (238kW/324PS), Specifications).



162. Pressurize the fuel system
 Refer to: Fuel System Pressure Release (310-00B Fuel System - General Information - 2.7L EcoBoost (238kW/324PS), General Procedures).
163. Fill and bleed the engine cooling system
 Refer to: Engine Cooling System Draining, Vacuum Filling and Bleeding (303-03B Engine Cooling - 2.7L EcoBoost (238kW/324PS), General Procedures).
164. Charge the A/C system
 Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - Vehicles With: R134A Refrigerant (412-00 Climate Control System - General Information, General Procedures).
165. Start and check the exhaust system for leaks.
166. Check and top off the transmission fluid.
 Refer to: Transmission Fluid Level Check (307-01A Automatic Transmission - 8-Speed Automatic Transmission - 8F35/8F40, General Procedures).
167. Use the Powertrain Control Module (PCM) Misfire Monitor Profile Correction routine in the diagnostic scan tool.

Camshaft RH

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
 E216421	303-1248 Camshaft holding tools TKIT-2006UF-FLM TKIT-2006UF-ROW
 E216458	303-1531 Installer, Front Crank Seal and Damper
 E188624	303-1633 Remover, Roller Rocker Follower TKIT-2014D-ROW3 TKIT-2014D-FL_ROW
 E222985	303-335 (T88T-6701-A) Installer, Front Cover Oil Seal TKIT-1988-FLM TKIT-1988-F
 E134603	303-409 (T92C-6700-CH) Remover, Crankshaft Seal TKIT-1992-FH/FMH/FLMH TKIT-1993-LMH/MH
 E158906	307-569 Disconnect Tool TOC Line (1/2) TKIT-2006U-F/FM TKIT-2006U-FLM/LM TKIT-2006U-ROW1 TKIT-2006U-ROW2
Three Leg Puller	
Adjustable Mounting Arm	
Plastic Scraper	
Oil Drain Equipment	
Cable Ties	
Hose Clamp Remover/Installer	
Flat-Bladed Screwdriver	
Powertrain Jack	
Wooden Block	
Vise	
Vise Jaw Protectors	

Materials

Name	Specification
Motorcraft® High Performance Engine RTV Silicone TA-357	WSE-M4G323-A6

Flange Sealant CU7Z-19B508-A	WSS-M2G348-A11
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Removal

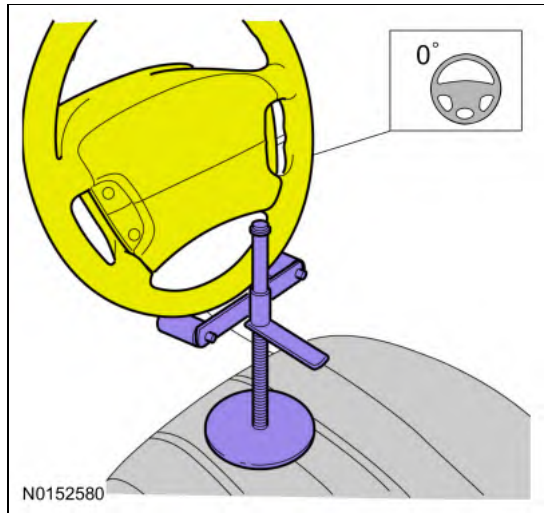
NOTICE: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces, that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

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

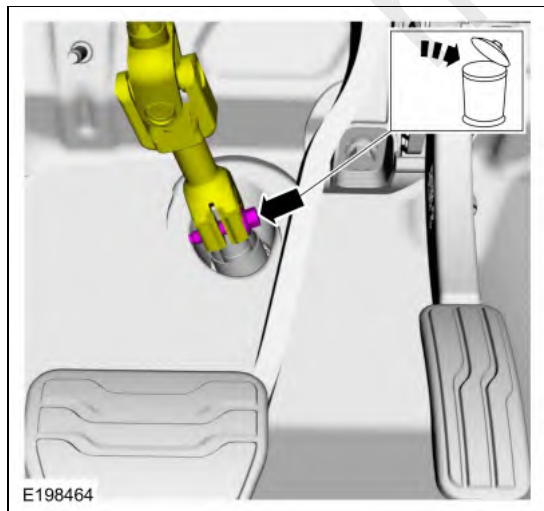
LHD AWD/LHD FWD

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. Evacuate the A/C system.
Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging - Vehicles With: R134A Refrigerant (412-00 Climate Control System - General Information, General Procedures).
3. Release the fuel pressure.
Refer to: Fuel System Pressure Release (310-00B Fuel System - General Information - 2.7L EcoBoost (238kW/324PS), General Procedures).
4. **NOTE:** Use a steering wheel holding device (such as Hunter[®] 28-75-1 or equivalent).

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



5. **NOTICE:** Do not allow the intermediate shaft to rotate while it is disconnected from the gear or damage to the clockspring can occur. If there is evidence that the intermediate shaft has rotated, the clockspring must be removed and recentered. Refer to Section 501-20B.
 - Remove and discard the steering intermediate shaft bolt.
 - Separate the steering intermediate shaft from the steering gear.



6. Remove the retainers and the upper air deflector.