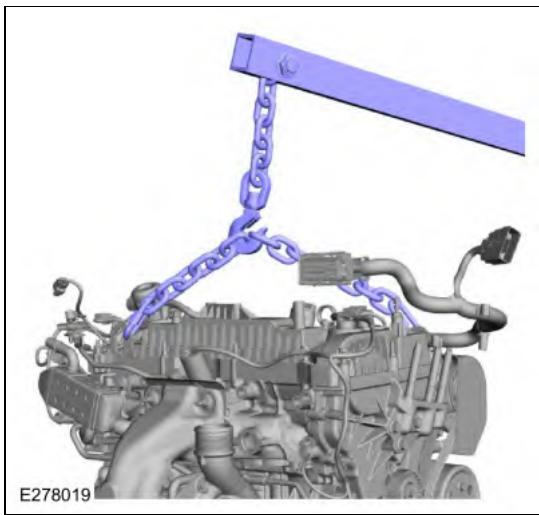
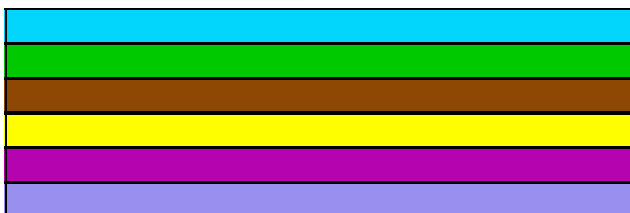
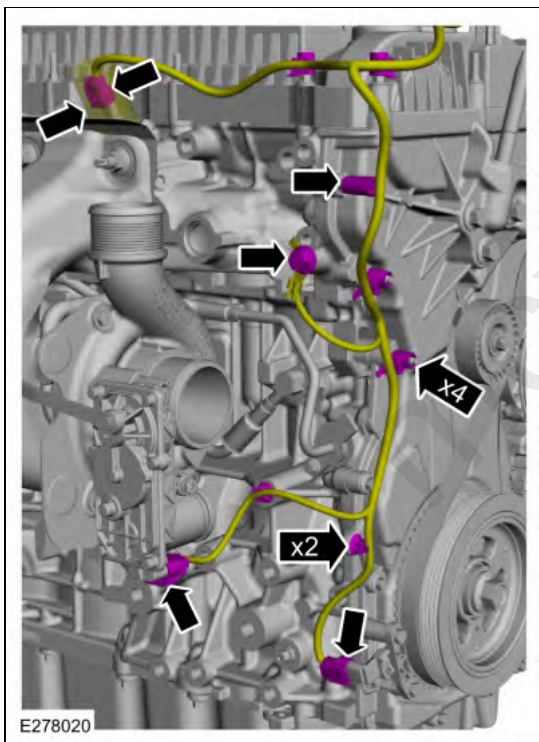
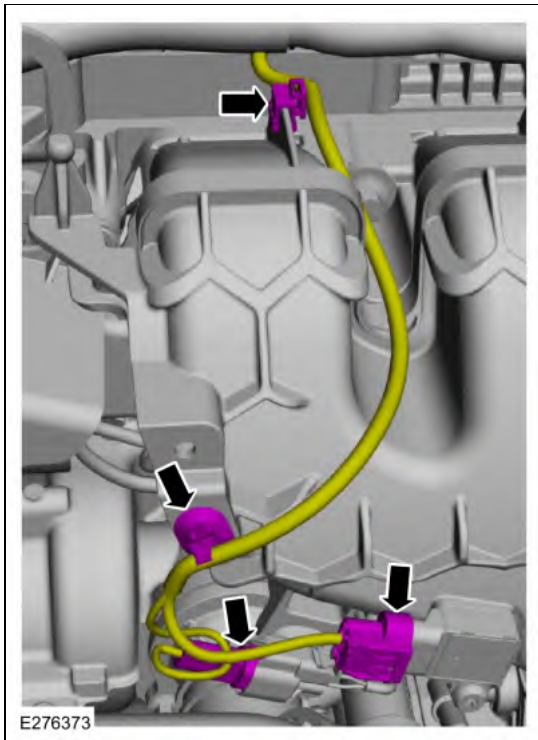




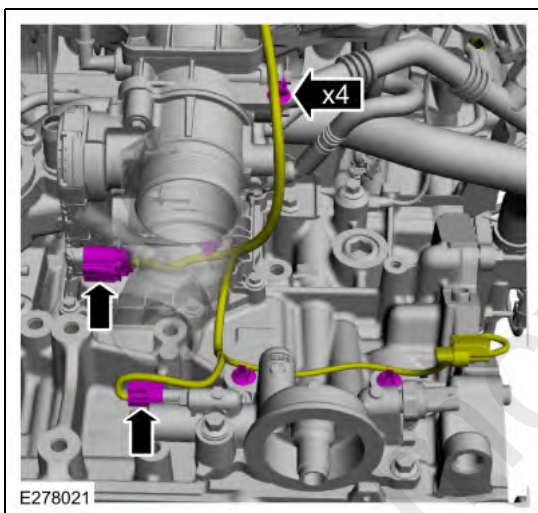
- 4.
- Remove the ground bolt.
 - Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.



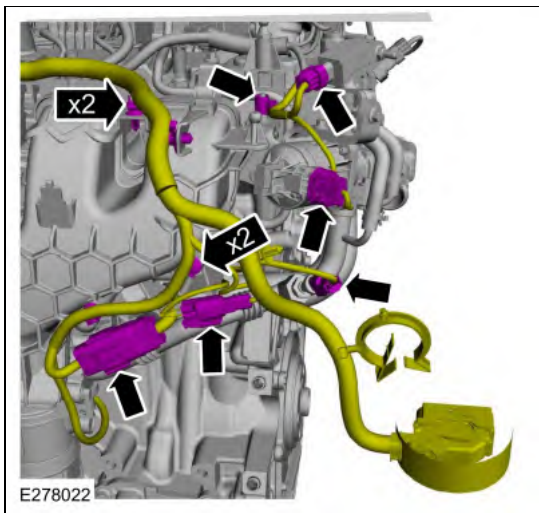
- 5.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.



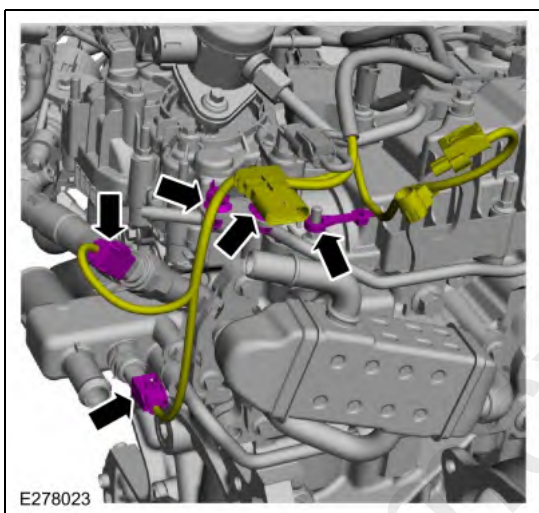
- 6.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.



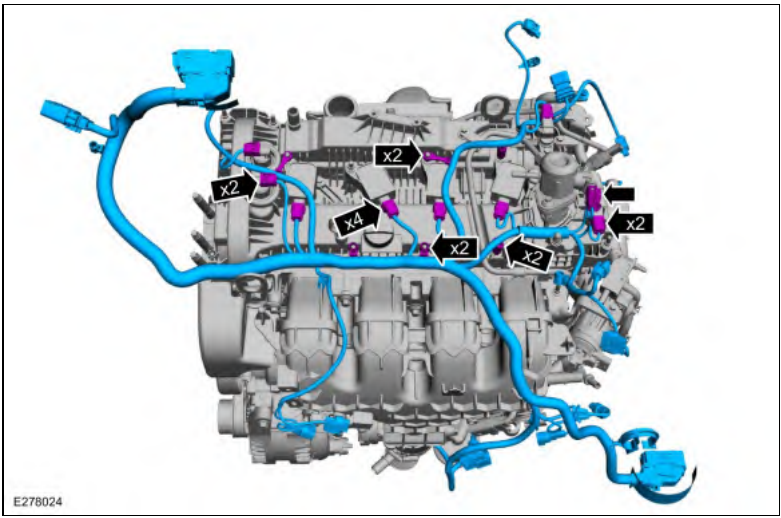
- 7.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.



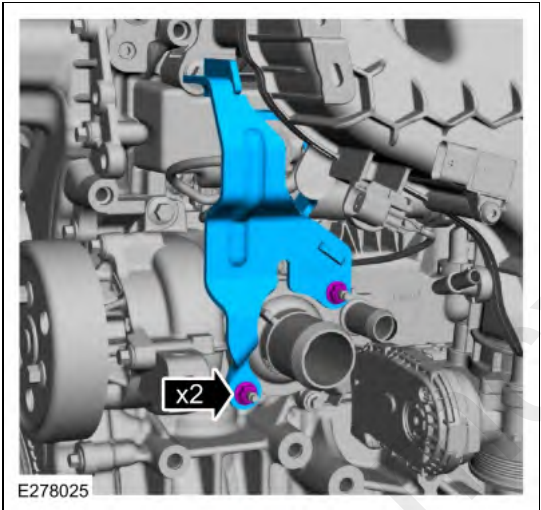
- 8.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers.



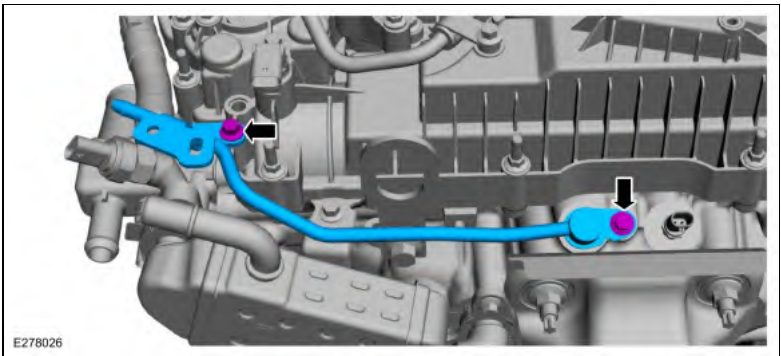
- 9.
- Disconnect the wiring harness electrical connectors.
 - Detach the wiring harness retainers and remove the engine wiring harness.



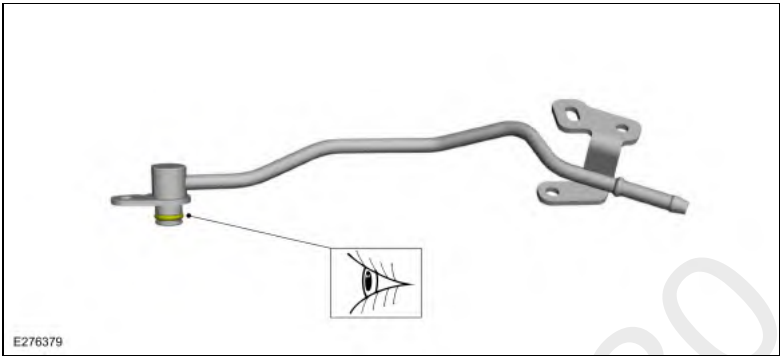
10. Remove the nuts and the crash bracket.



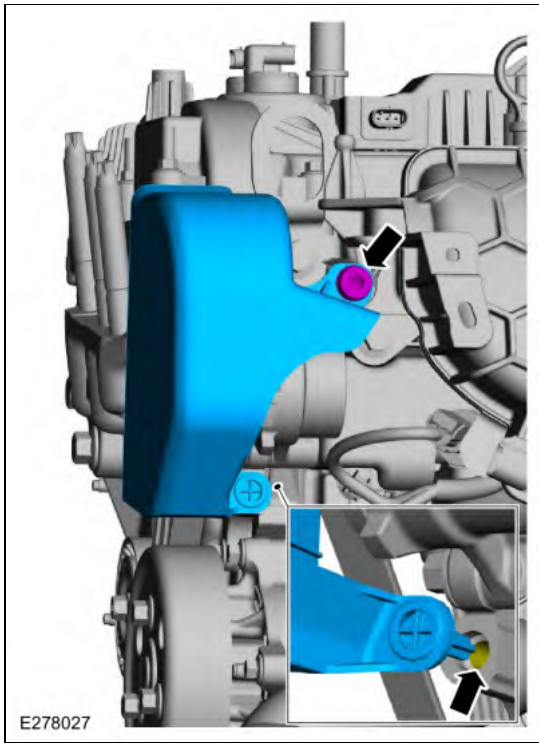
11. Remove the bolts and the coolant tube.



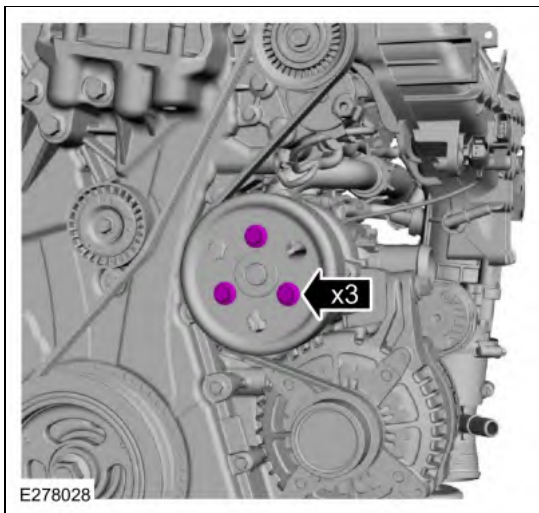
12. Inspect the coolant tube O-ring seal and replace if damaged.



13. Remove the bolt (Enhanced Hexalobular or TORX PLUS Â® Acument Intellectual Properties, LLC as the owner) and the shield.

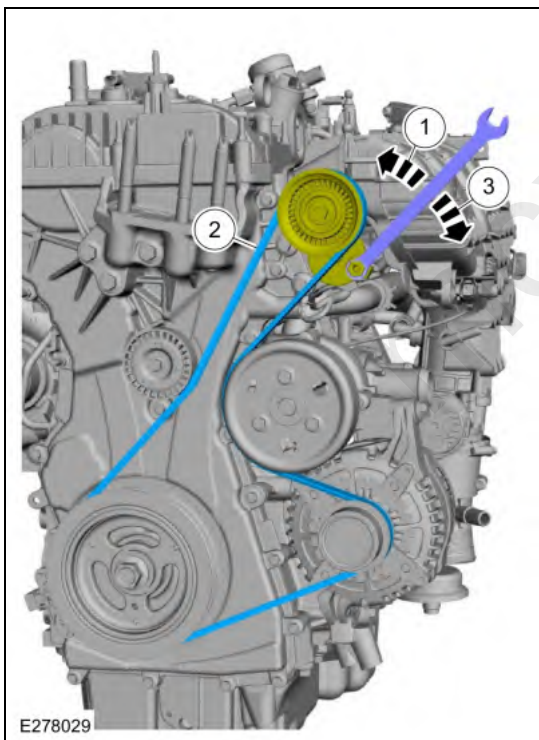


14. Loosen the coolant pump pulley bolts.

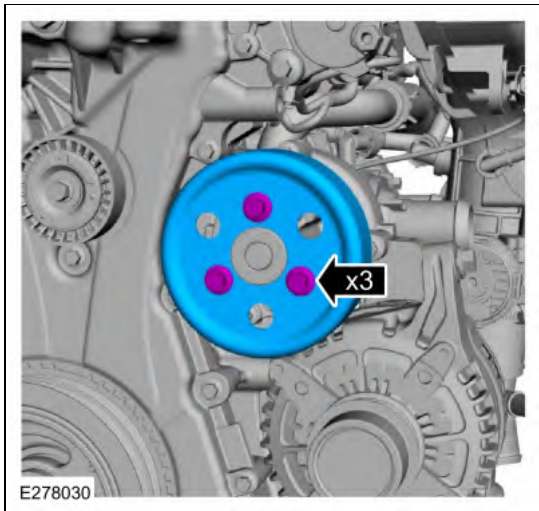


15.

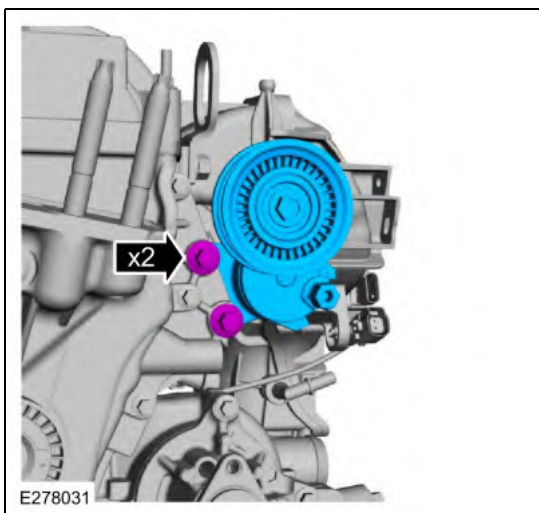
1. Install the tool and release the tension on the accessory drive belt tensioner.
2. Remove the accessory drive belt.
3. Release the tension and remove the tool.



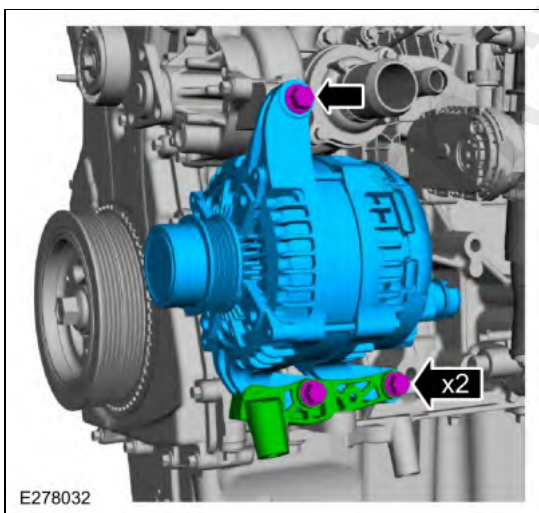
16. Remove the bolts and the coolant pump pulley.



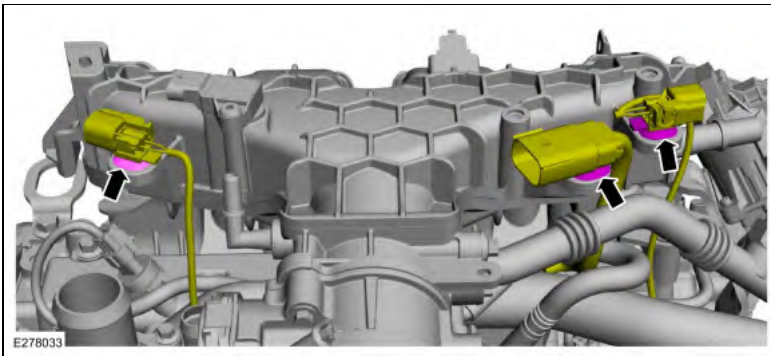
17. Remove the bolts and the accessory drive belt tensioner.



18. Remove the bolts, oil pan bracket and the generator.

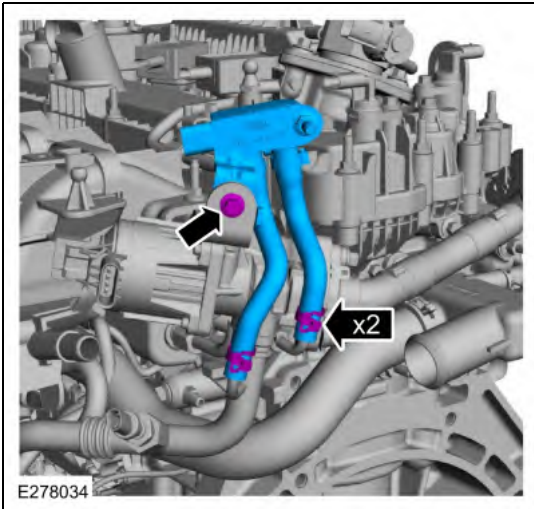


19. Detach the wiring connector retainers from the intake manifold.

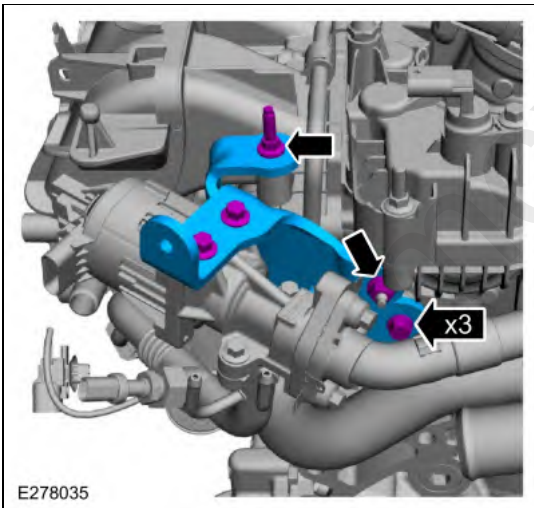


20.

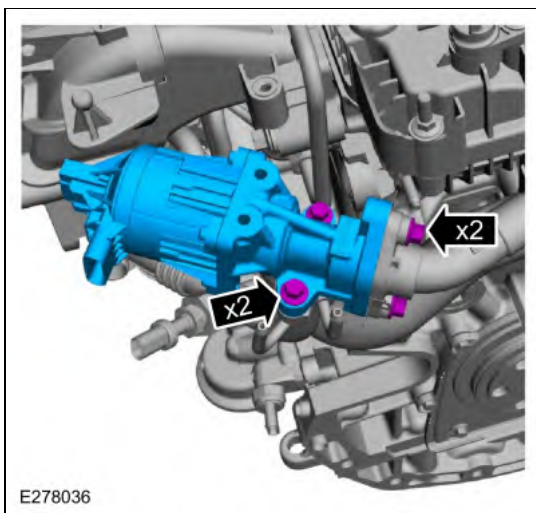
- Loosen the clamps and remove the EGR transducer hoses.
- Remove the bolt and the EGR transducer assembly.



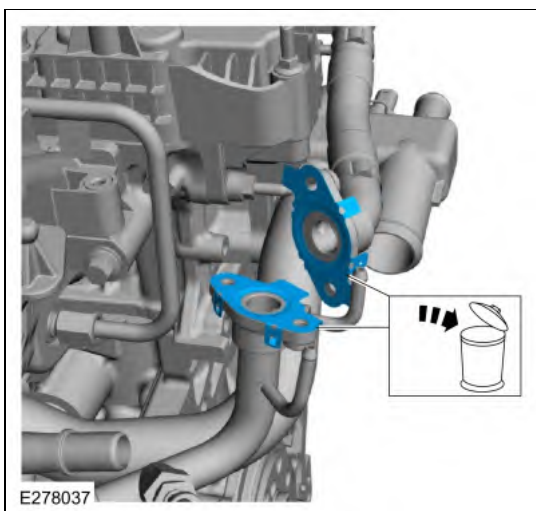
21. Remove the stud bolt, nut, bolts and the EGR bracket.



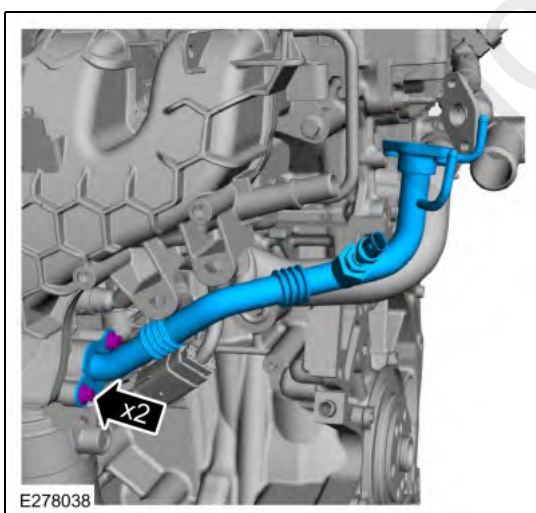
22. Remove the bolts and the EGR valve.



23. Remove and discard EGR valve gaskets.



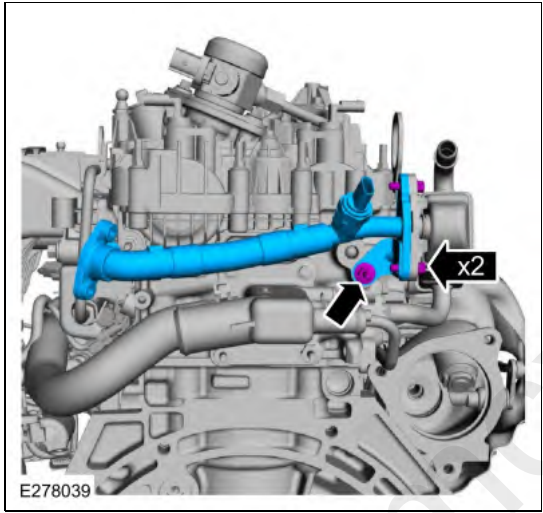
24. Remove the bolts and the EGR outlet tube assembly.



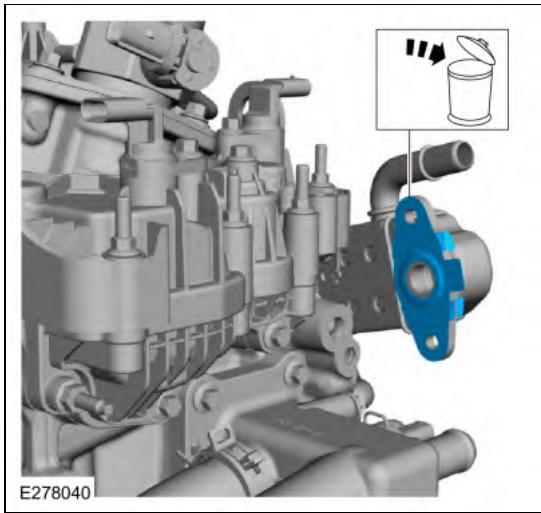
25. Remove and discard the EGR outlet tube assembly O-ring seal.



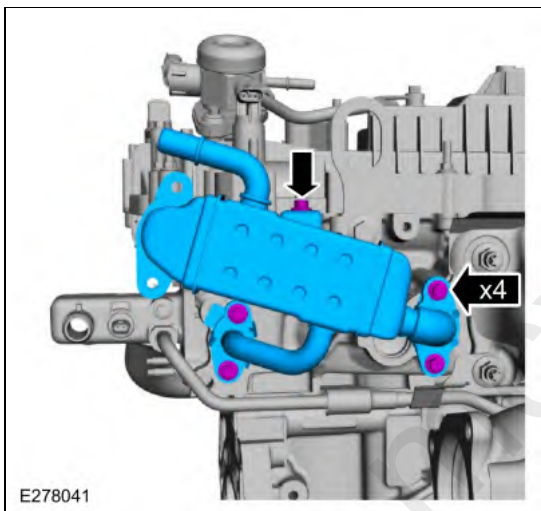
26. Remove the bolts, stud bolt and the EGR inlet tube assembly.



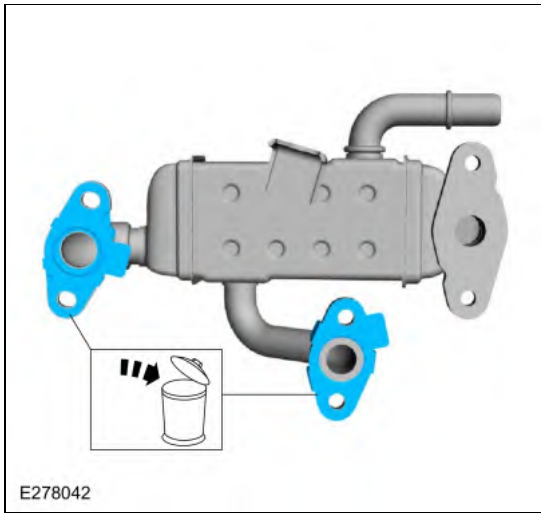
27. Remove and discard the EGR inlet tube gasket.



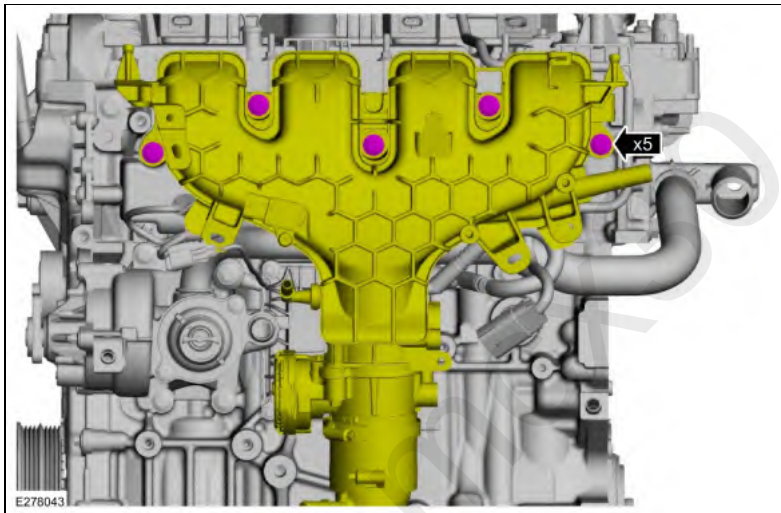
28. Remove the bolts and the EGR cooler.



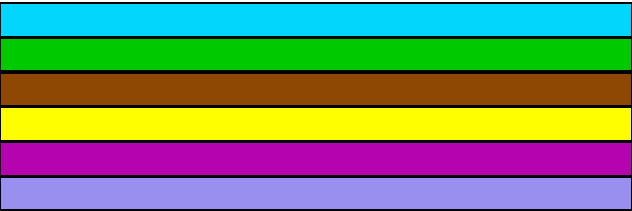
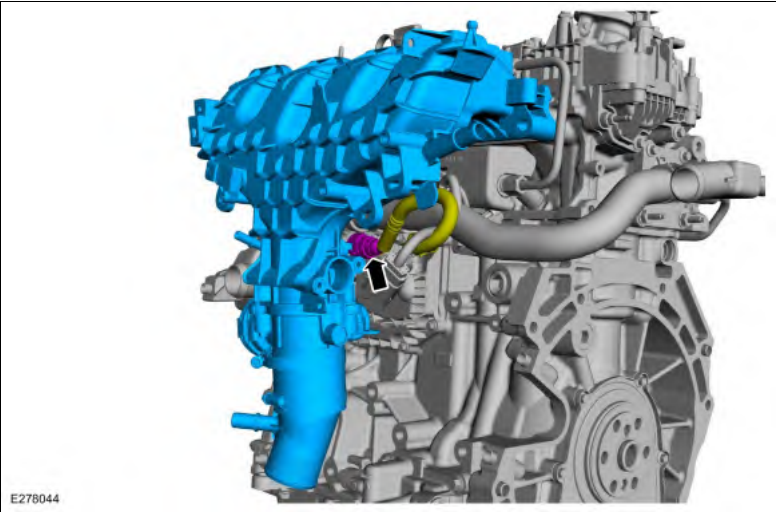
29. Remove and discard EGR cooler gaskets.



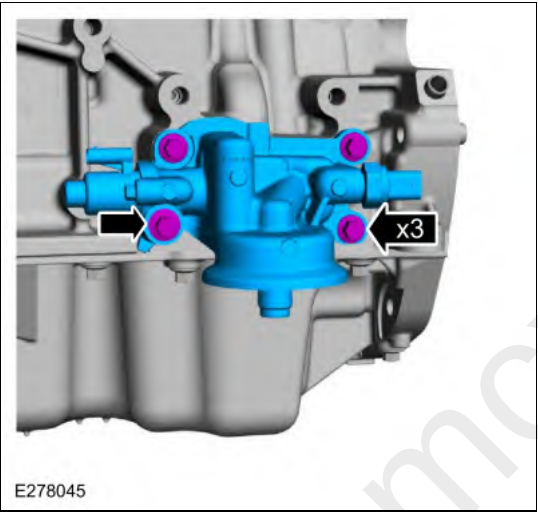
30. Remove the bolts and position the intake manifold forward.



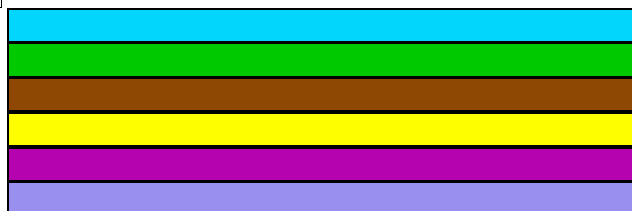
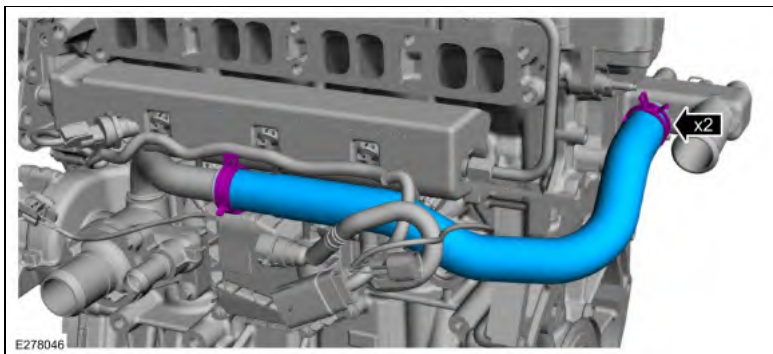
31. Disconnect the crankcase vent oil separator tube and remove the intake manifold.
 Refer to: Quick Release Coupling (310-00 Fuel System - General Information - 2.0L EcoBoost (184kW/250PS) & MI4) .



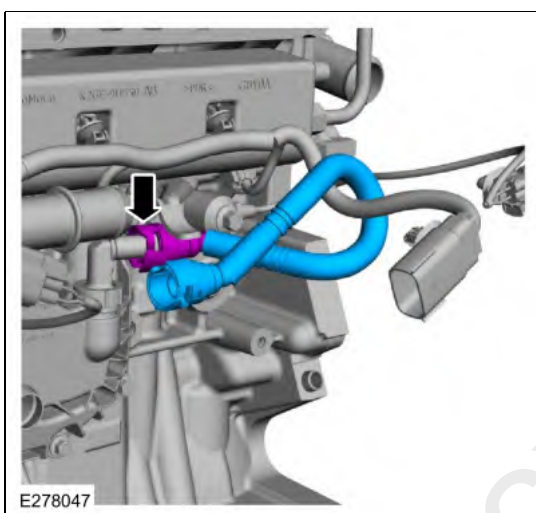
32. Remove the bolts and the oil filter adapter.



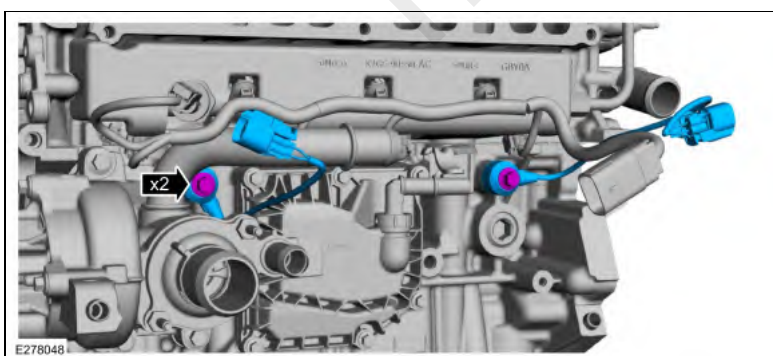
33. Release the clamps and remove the coolant hose.
Use the General Equipment: Hose Clamp Remover/Installer



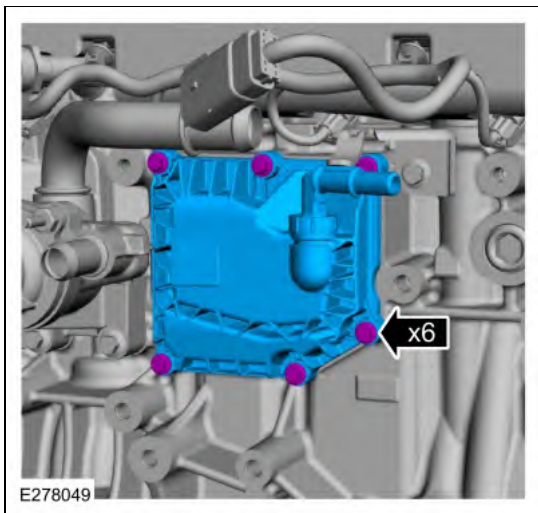
34. Disconnect the crankcase vent oil separator tube and remove.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information - 2.0L EcoBoost (184kW/250PS) â€“ MI4) .



35. **NOTE:** Note the position of the KS before removing.
Remove the bolts and the KS.

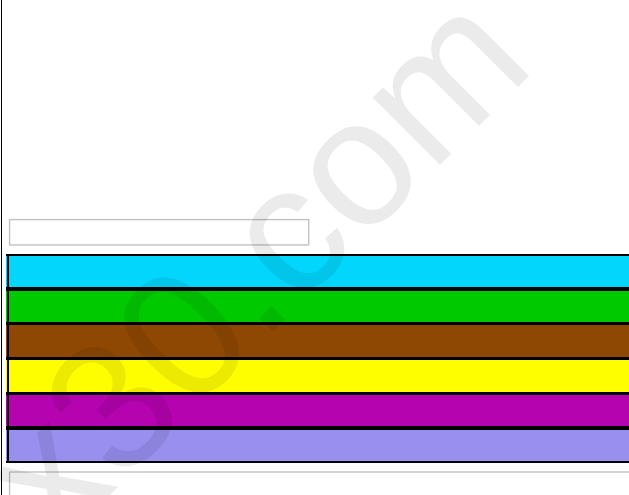
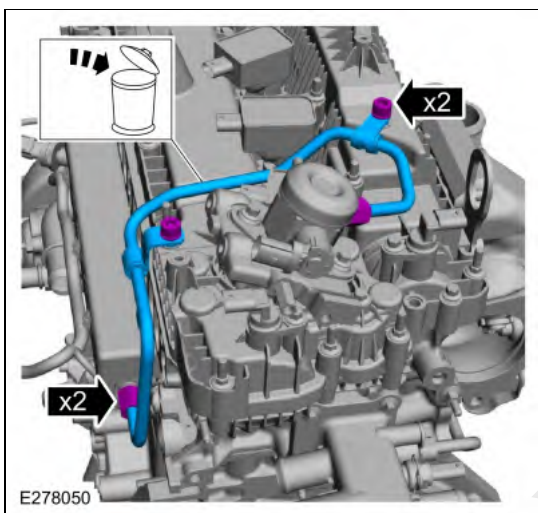


36. Remove the bolts and the crankcase vent separator.

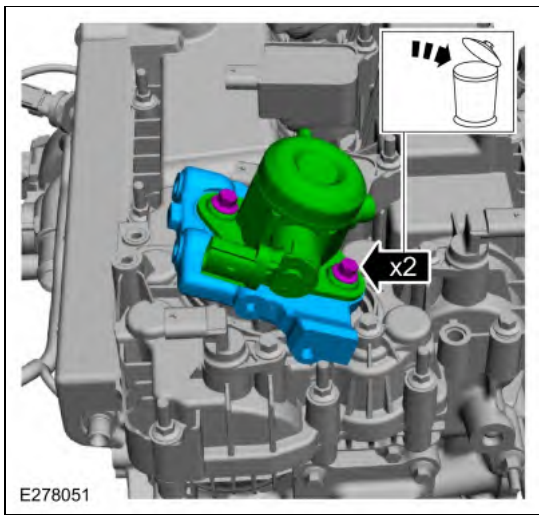


37. **NOTE:** To release the fuel pressure in the high pressure fuel tube, wrap the fuel injection pump flare nut with a shop towel to absorb any residual fuel pressure during the loosening of the fuel injection pump flare nut.

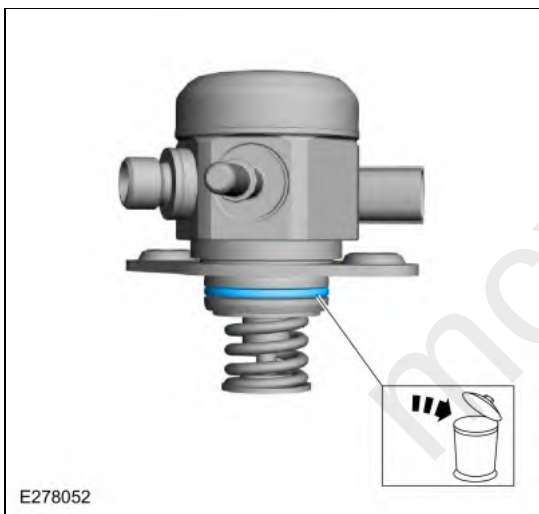
- Remove the high-pressure fuel tube bolts.
- Loosen the flare nuts, remove and discard the high-pressure fuel tube.



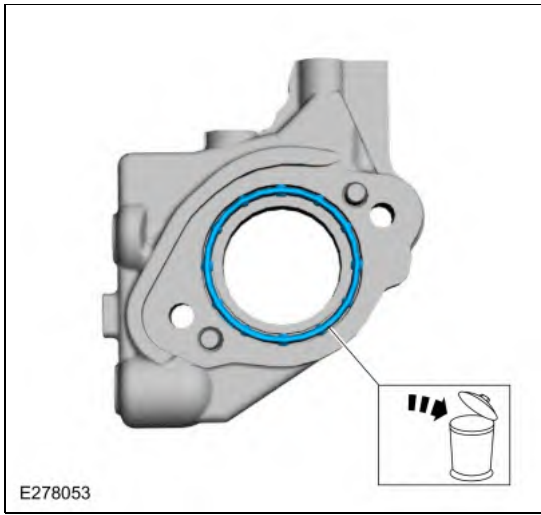
- 38.
- Remove the bolts and discard.
 - Remove the high-pressure fuel pump and mounting plate.



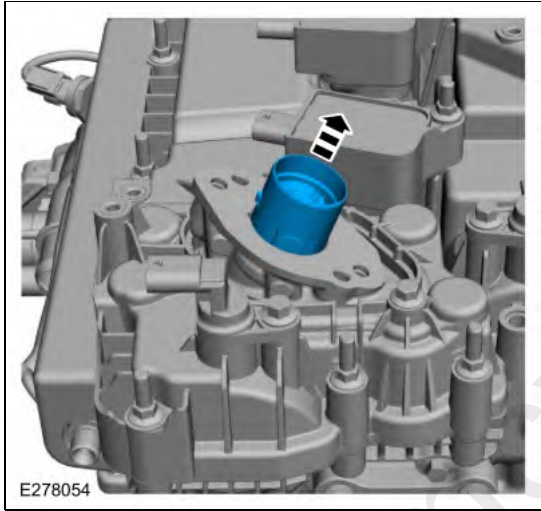
39. Remove and discard the high-pressure fuel pump O-ring seal.



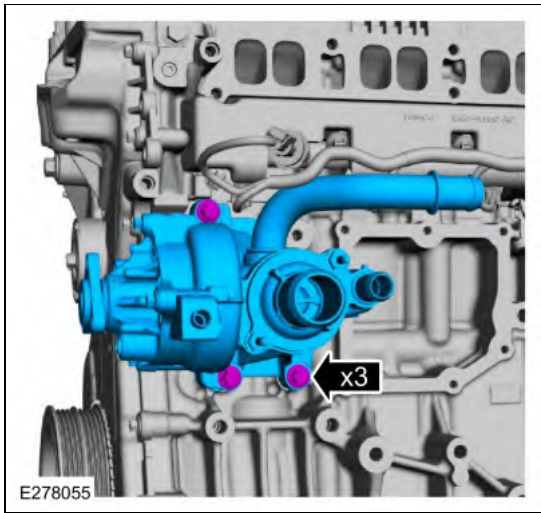
40. Remove and discard the fuel pump mounting plate O-ring seal.



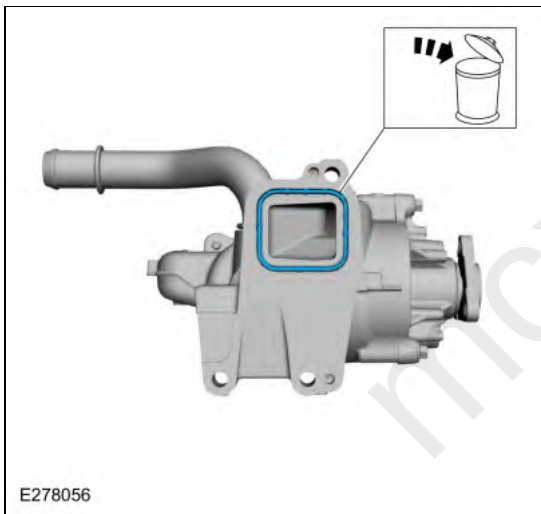
41. Remove the high-pressure fuel pump tappet.



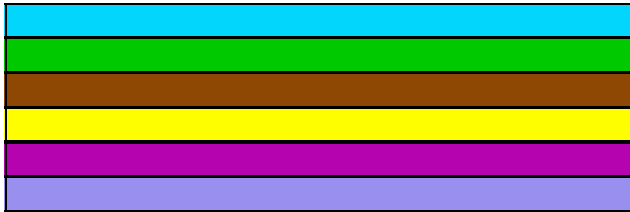
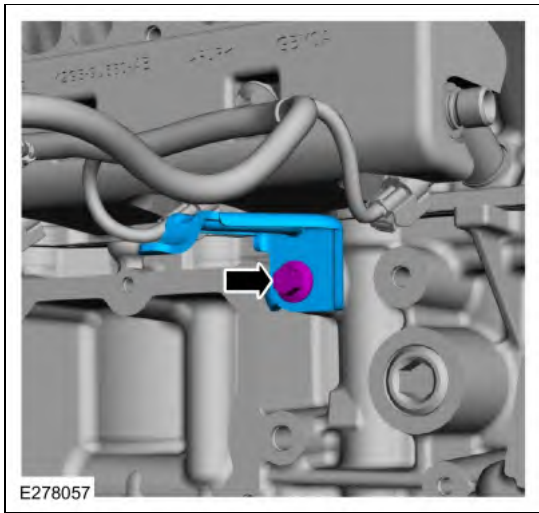
42. Remove the bolts and the coolant pump adapter assembly.



43. Remove and discard the coolant pump adapter assembly gasket.

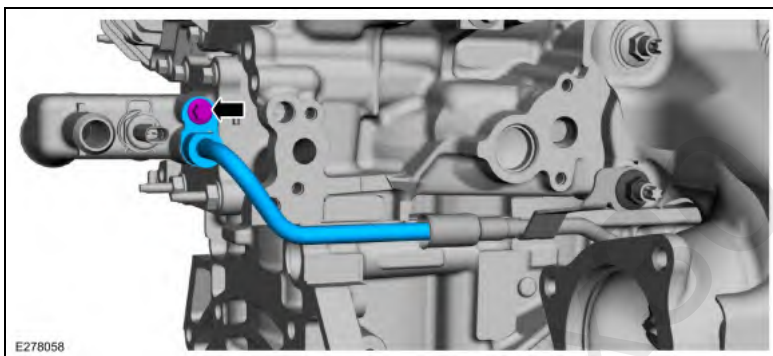


44. Remove the bolt coolant hose bracket.

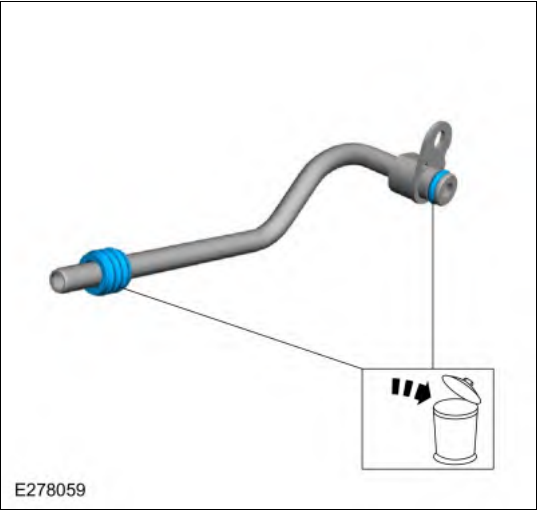


45.

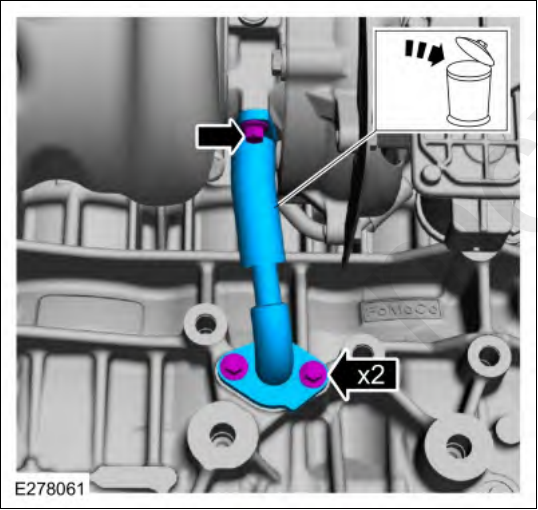
- Remove the turbocharger coolant inlet tube nut and bolt.
- Remove the turbocharger coolant inlet tube.



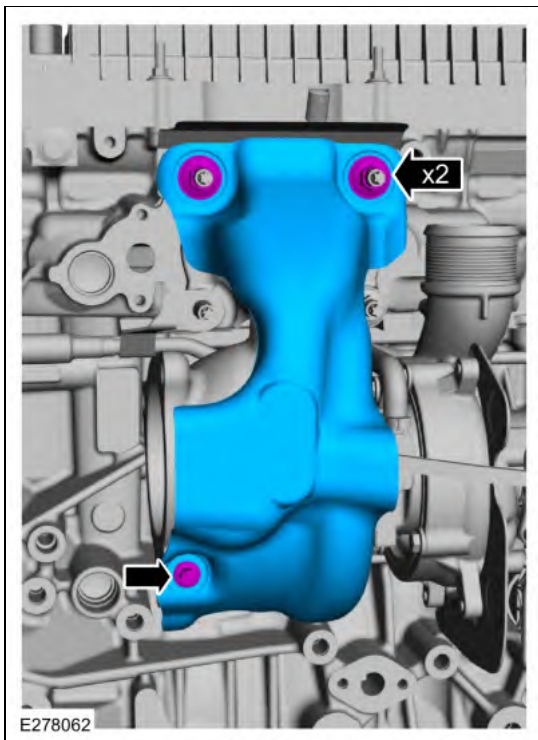
46. Remove and discard the turbocharger coolant inlet tube seals.



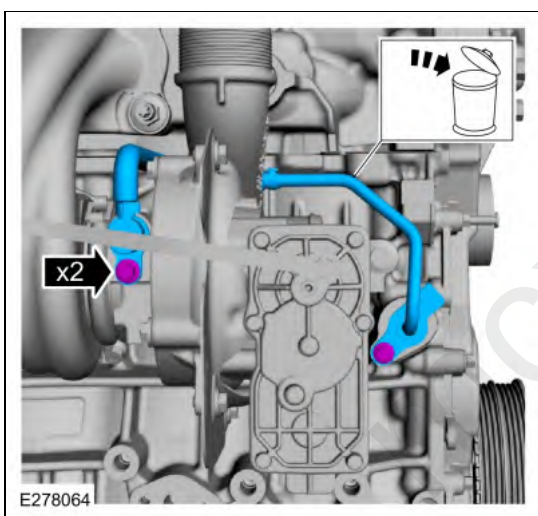
47. Remove the bolts and discard the turbocharger-to-cylinder block oil return pipe.



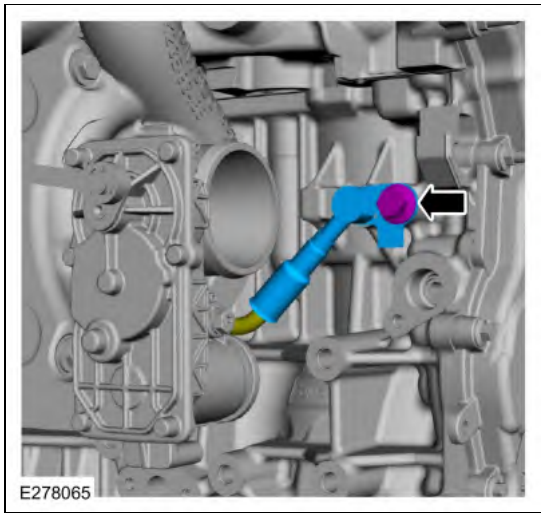
48. Remove the nuts, bolt and the heat shield.



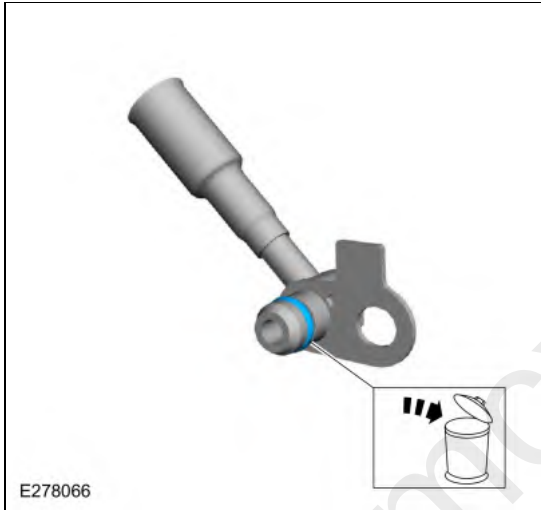
49. Remove the bolts and discard the cylinder block-to-turbocharger oil supply pipe.



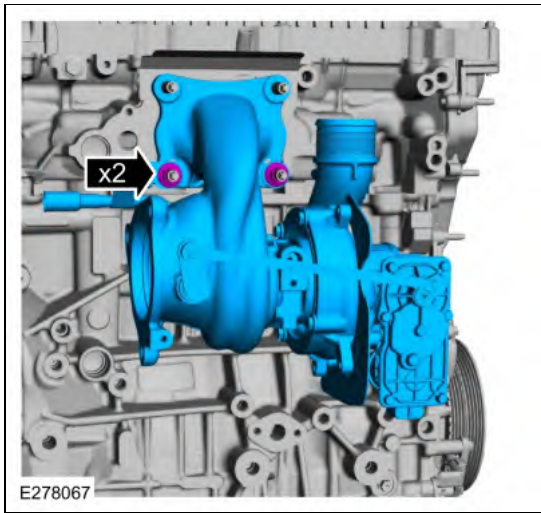
50. Remove the bolt and the coolant outlet tube.



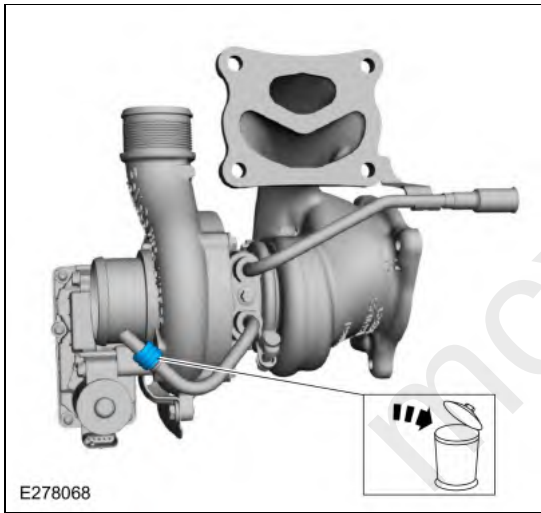
51. Remove and discard coolant outlet tube O-ring seal.



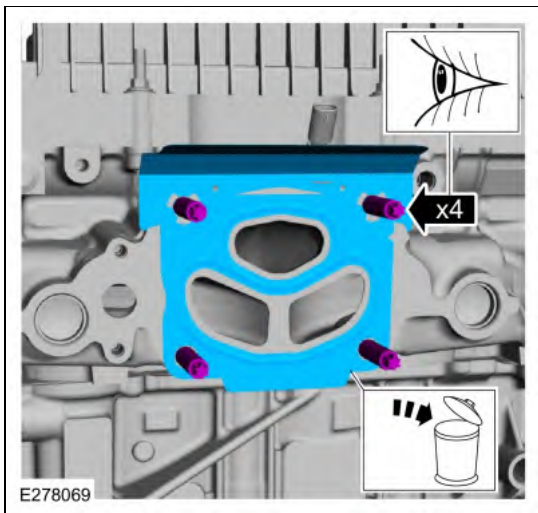
52. Remove the nut and the turbocharger.



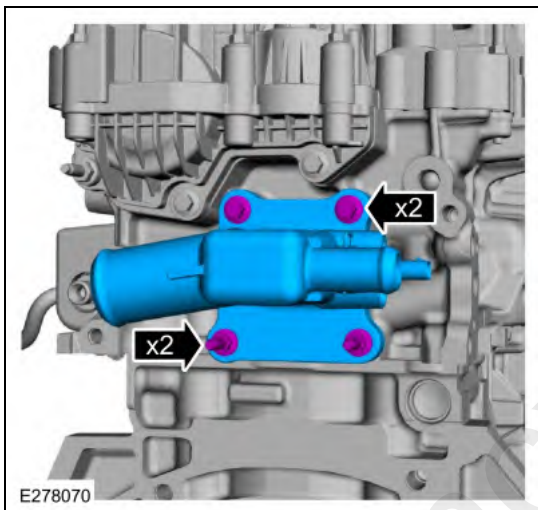
53. Remove and discard coolant outlet tube seal.



- 54.
- Remove and discard the gasket.
 - Inspect and replace the studs if damaged.



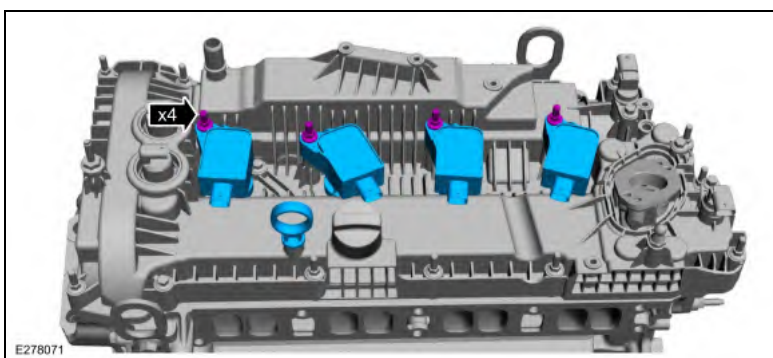
55. Remove the stud bolts, bolts and the coolant outlet.



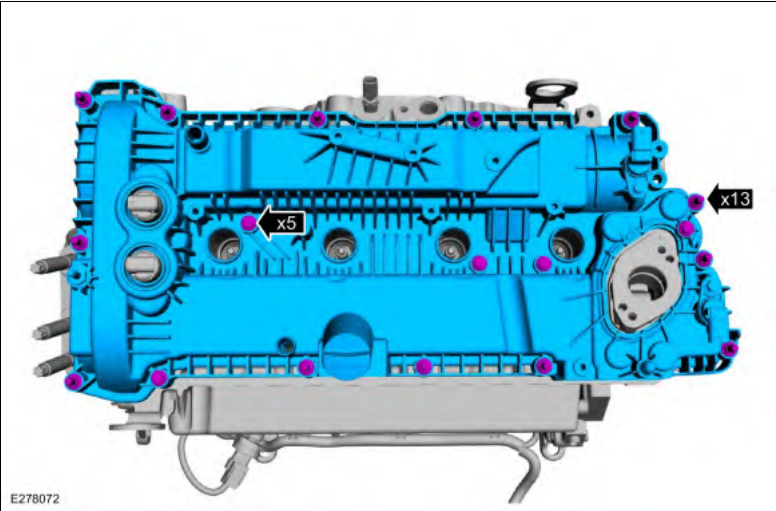
56. **NOTE:** Use compressed air to remove any foreign material from the ignition coil-on-plugs and surrounding area before removing the ignition coil-on-plugs.

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

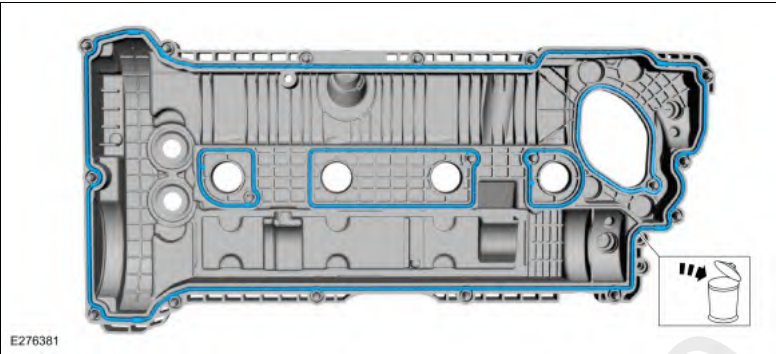
- Remove the stud bolts and the ignition coil-on-plugs.
- Remove the oil level indicator.



57. Loosen the fasteners and remove the valve cover.

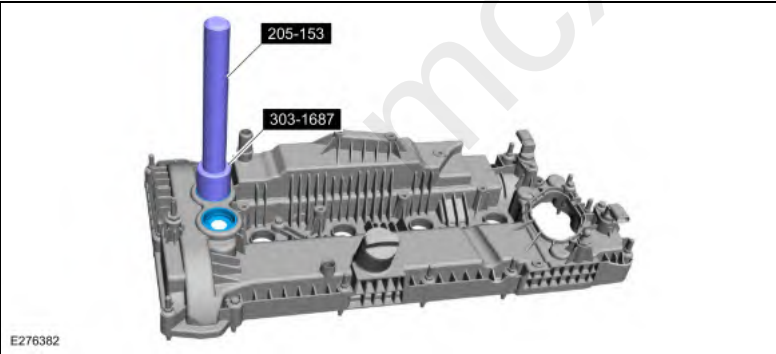


58. Discard the valve cover gaskets.



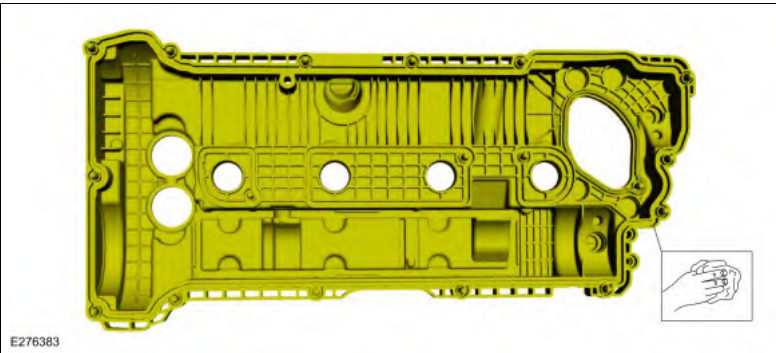
59.

- **NOTE:** The VCT solenoid seals should only be replaced if they are damaged upon inspection.
Inspect the VCT seals for damage.
- If damaged, using the special tools, remove and discard the VCT oil control solenoid seals.
Use Special Service Tool: 303-1687 Installer, VCT Solenoid Seal , 205-153 (T80T-4000-W) Handle.



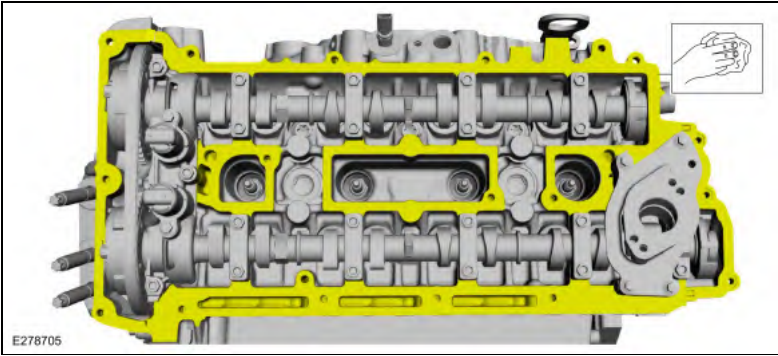
60. **NOTE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

Clean the valve cover.

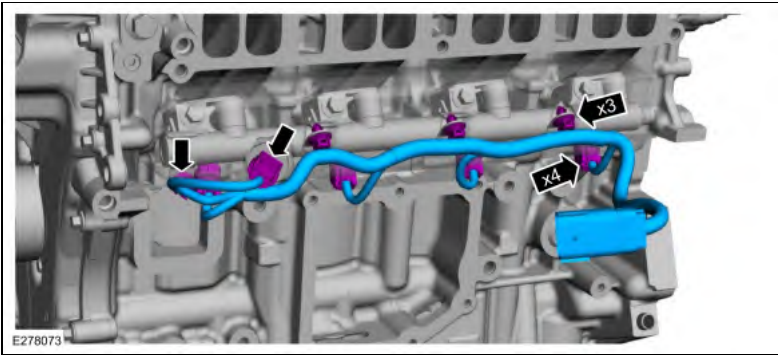


61. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

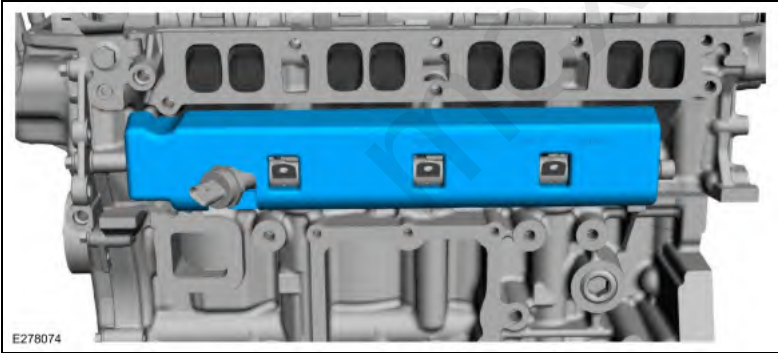
Make sure that the mating faces are clean and free of foreign material.



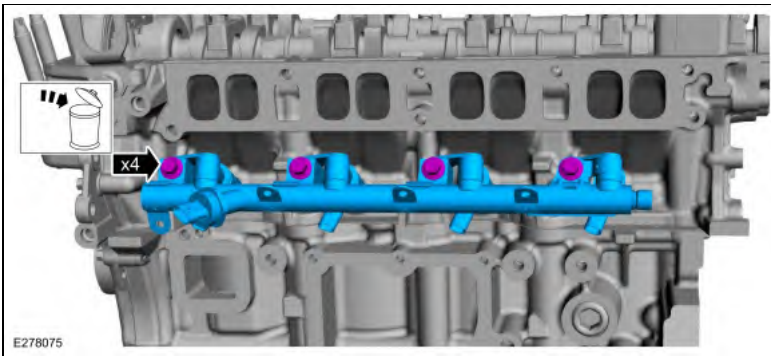
- 62.
- Disconnect the fuel rail wiring harness electrical connectors.
 - Detach the fuel rail wiring harness retainers and remove harness.



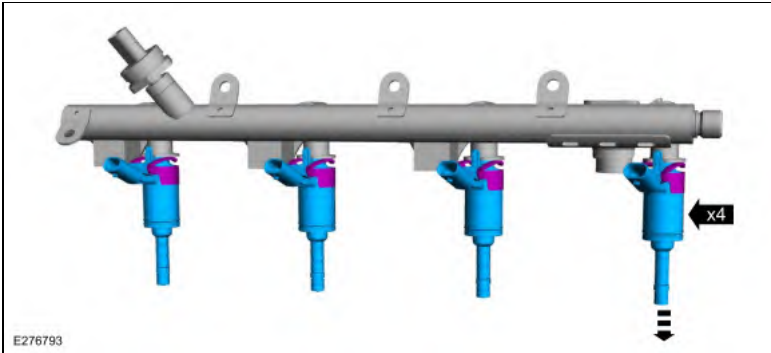
63. Remove the fuel rail insulator.



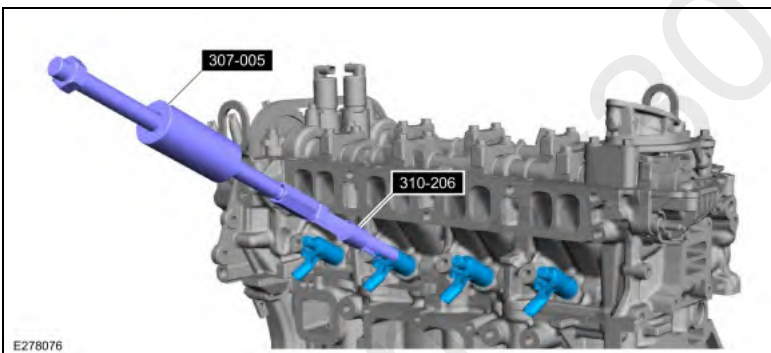
64. **NOTICE:** Pull out the fuel rails in the direction of the fuel injector axis or damage may occur to the fuel injectors.
- NOTE:** Use compressed air and remove any dirt or foreign material from the cylinder head, block and general surrounding area of the fuel rail and injectors.
- NOTE:** When removing the fuel rails, the fuel injectors may remain in the fuel rails but normally remain in the cylinder head and require the use of a Fuel Injector Remover tool to extract.
- Remove and discard the bolts. Remove the fuel rail.



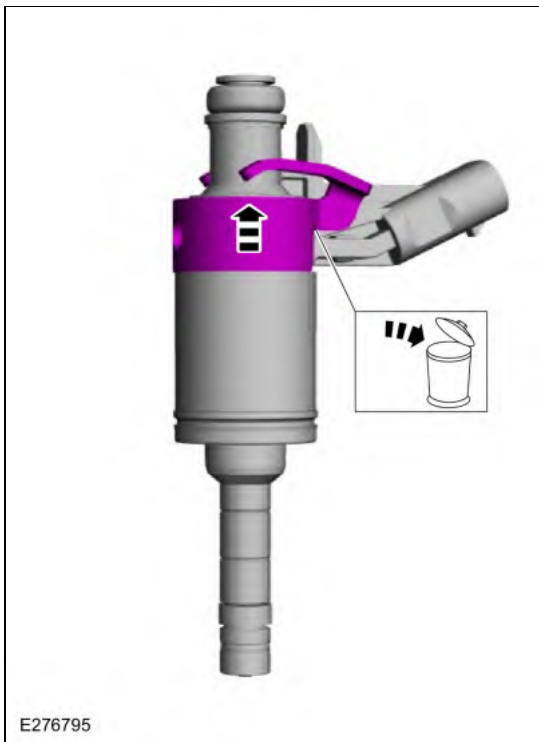
65. Remove any of the fuel injectors that remained in the fuel rail.



66. Remove any of the fuel injectors that remained in the cylinder head.
Use Special Service Tool: 307-005 (T59L-100-B) Slide Hammer. , 310-206 Remover, Fuel Injector.



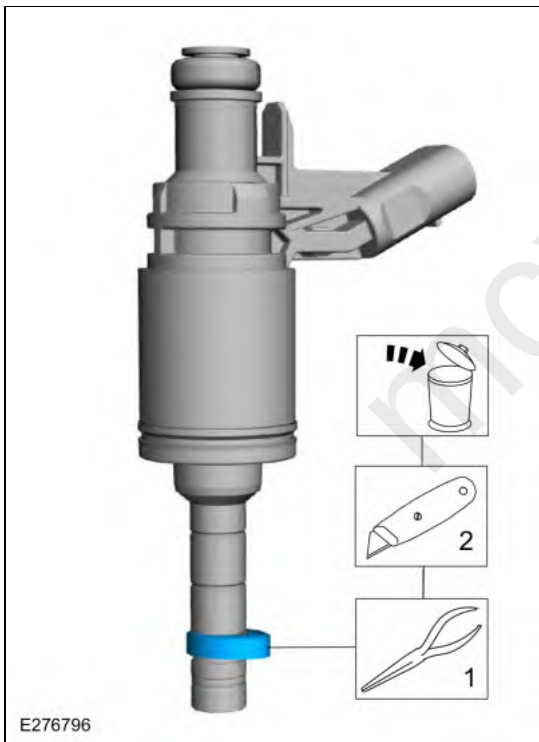
67. Remove and discard the fuel injector clip.



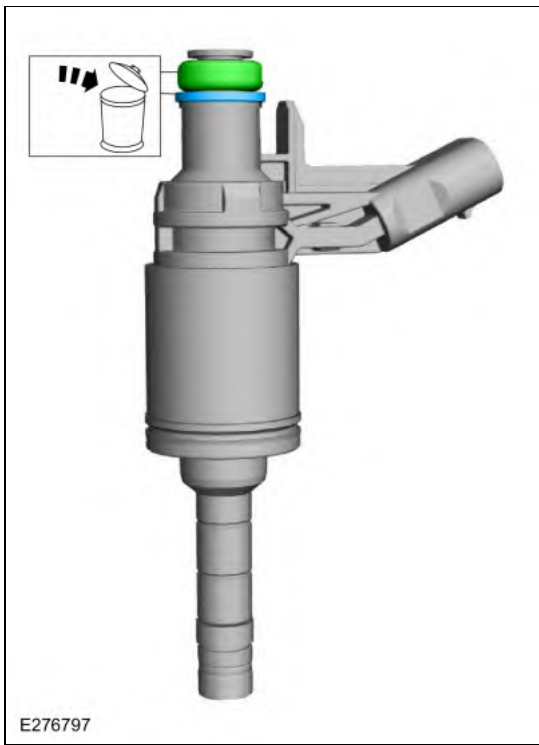
68. **NOTICE:** Do not attempt to cut the lower Teflon® seal without first pulling it away from the fuel injector or damage to the injector may occur.

NOTE: Be very careful when removing the lower Teflon® seals, not to scratch, nick or gouge the fuel injectors.

1. Pull the lower Teflon® seal away from the injector.
2. Carefully cut and discard the lower fuel injector Teflon® seals.

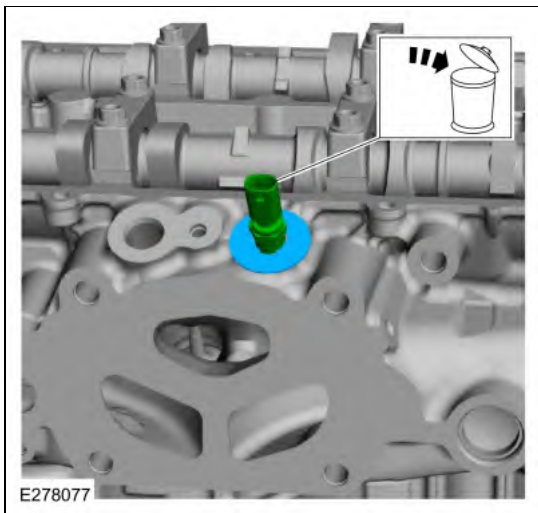


69. Remove and discard the fuel injector seal and O-ring seal.

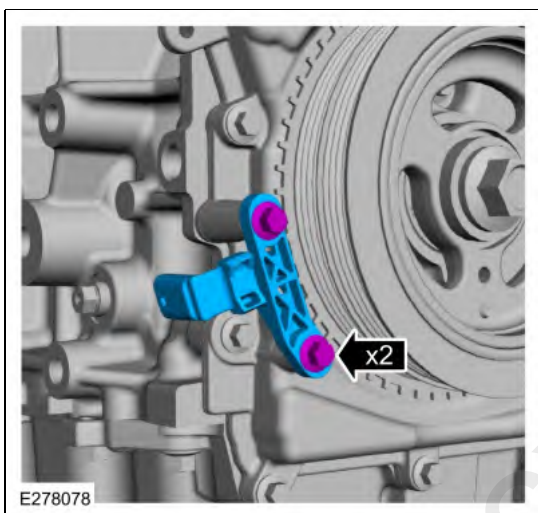


70.

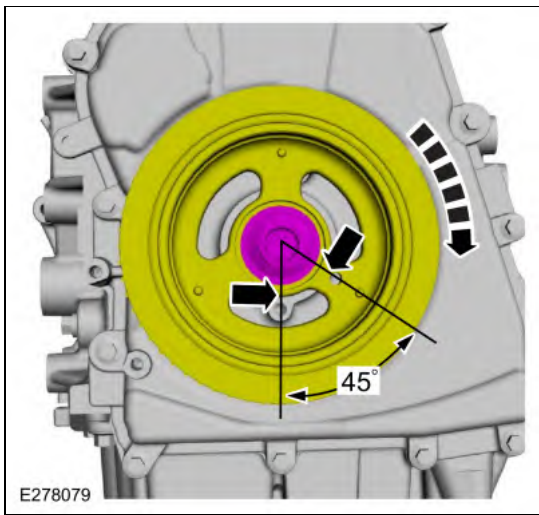
- Remove the CHT sensor and the heat shield.
- Discard the CHT sensor.



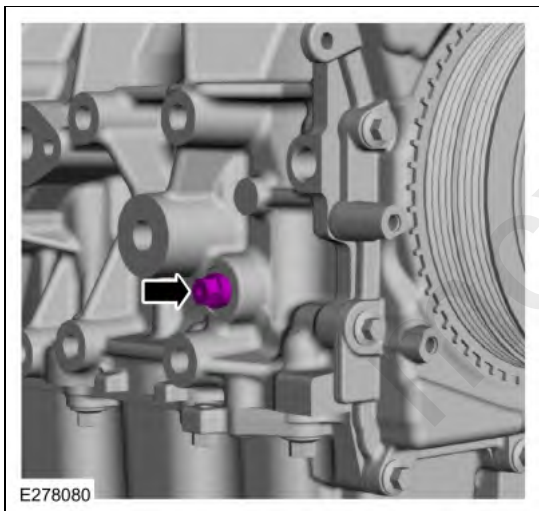
71. Remove the bolts and the CKP sensor.



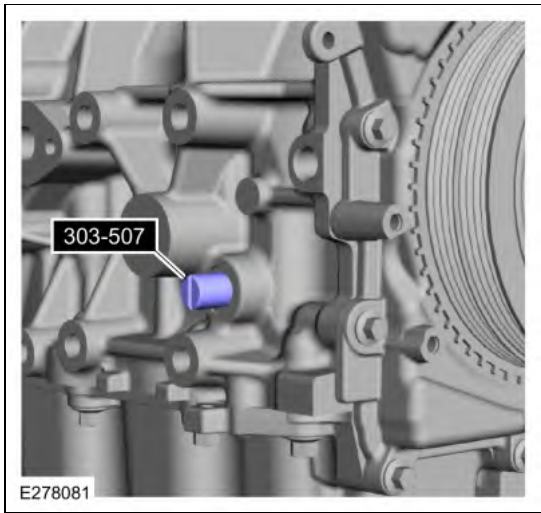
72. Turn the crankshaft clockwise until the No.1 piston is 45 degrees BTDC using the guide holes on the engine front cover and the crankshaft pulley.



73. Remove the engine plug bolt.



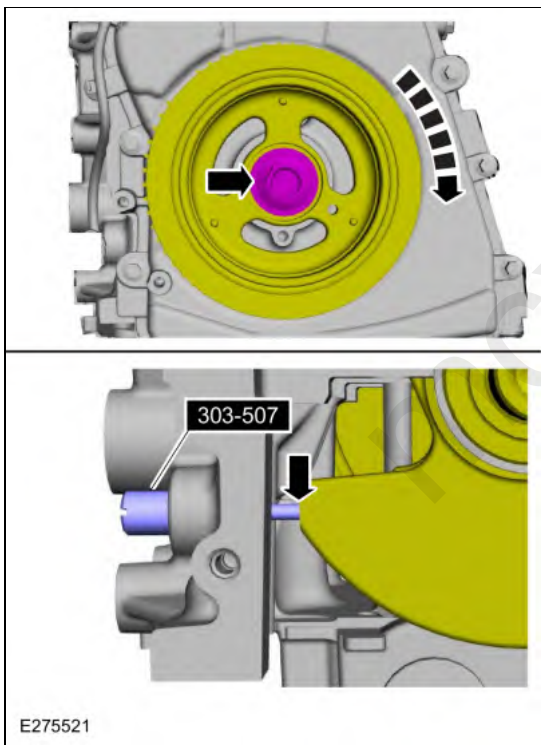
74. Install Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



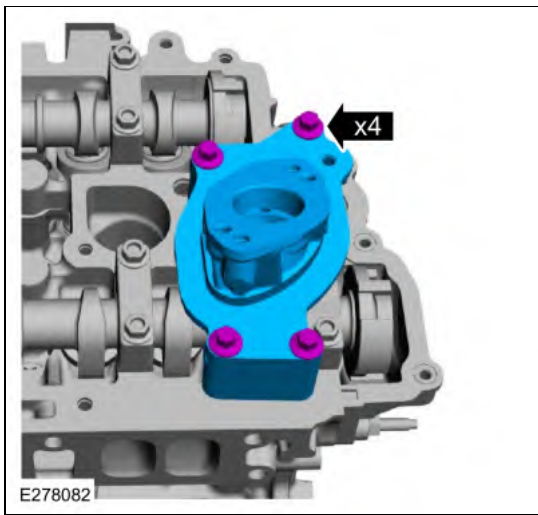
75. **NOTE:** The special tool will contact the crankshaft and prevent it from turning past TDC. However, the crankshaft can still be rotated in the counterclockwise direction. The crankshaft must remain at the TDC position during the crankshaft pulley removal and installation.

NOTE: The engine front cover is removed from graphic for clarity.

Rotate the crankshaft clockwise until it contacts the special tool.
Use Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



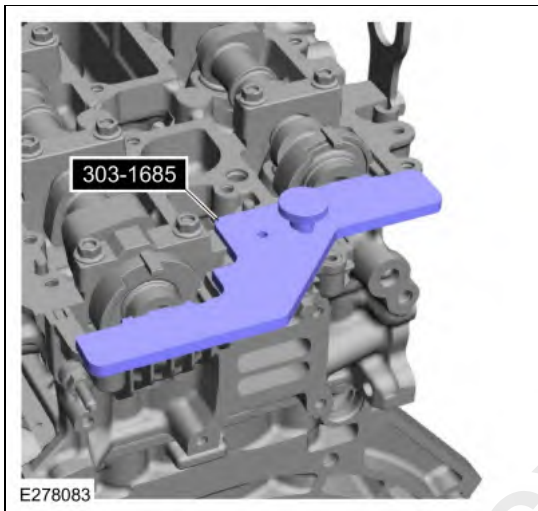
76. Remove the bolts and the high-pressure fuel pump drive unit.



77. **NOTICE:** The Camshaft Alignment Tool is for camshaft alignment only. Using this tool to prevent engine rotation can result in engine damage.

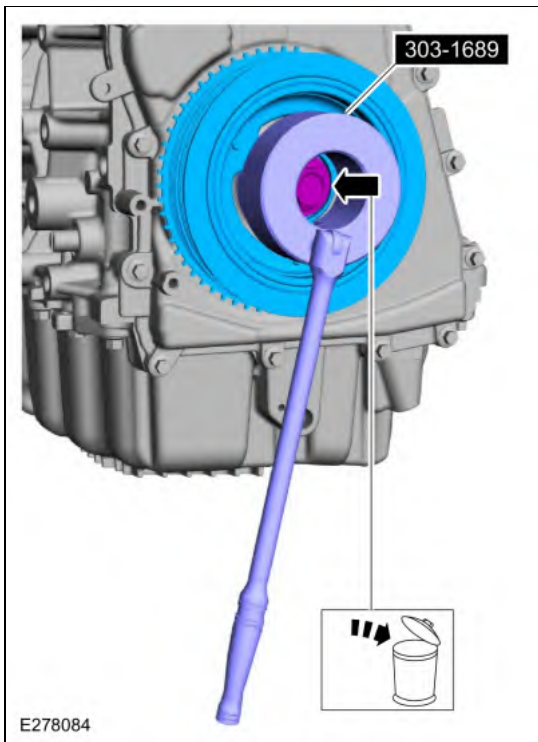
NOTE: The camshaft timing slots are offset. If the Camshaft Alignment Tool cannot be installed, remove the TDC Timing Peg and rotate the crankshaft three-fourths of a revolution clockwise and repeat the previous 2 steps of this procedure.

Install Special Service Tool: 303-1685 Alignment Tool, Camshaft.

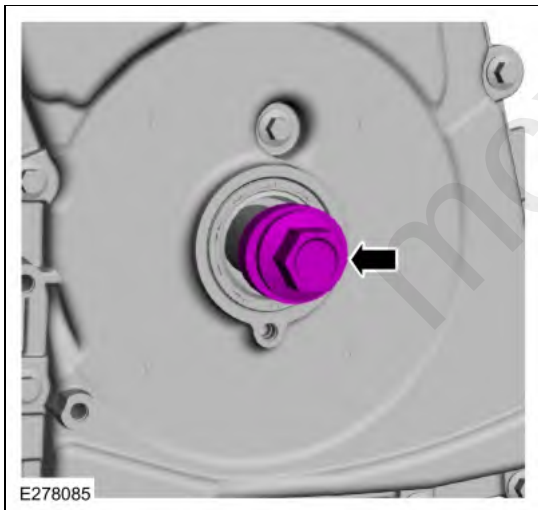


78. **NOTICE:** The crankshaft must remain in the TDC position during removal of the pulley bolt or damage to the engine can occur. Therefore, the crankshaft pulley must be held in place with the special tool and the bolt should be removed using an air impact wrench (1/2-in drive minimum).

- Using the special tools, remove the bolt and the crankshaft pulley.
Use Special Service Tool: 303-1689 Holding Tool, Crank Damper.
- Discard the bolt.

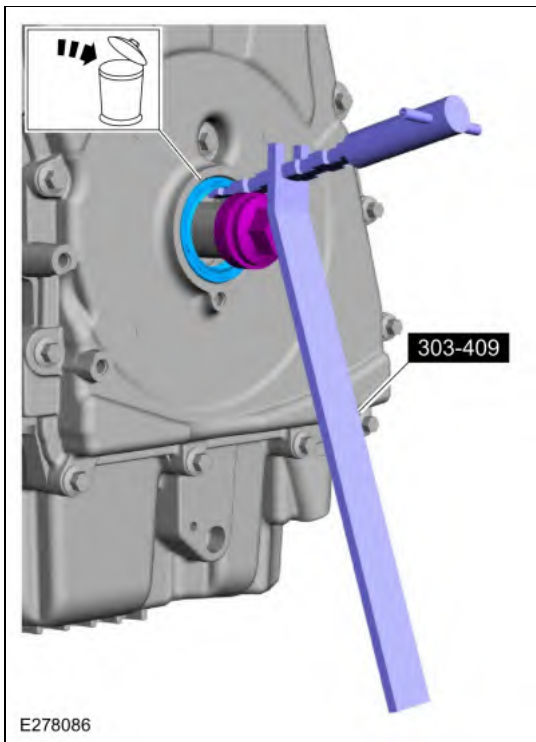


79. Install the original crankshaft pulley bolt and washer.

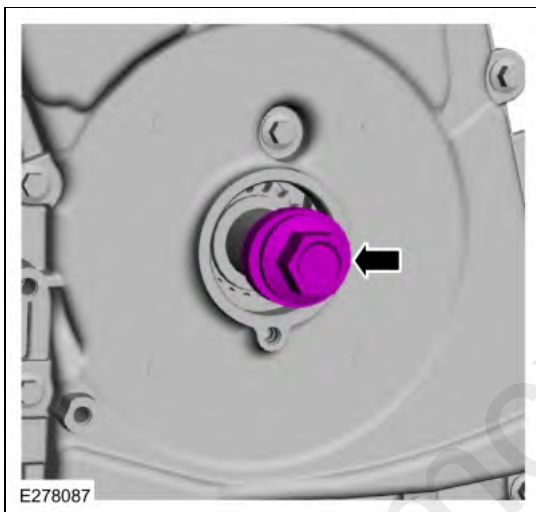


80. **NOTICE:** Use care not to damage the engine front cover or the crankshaft when removing the seal.

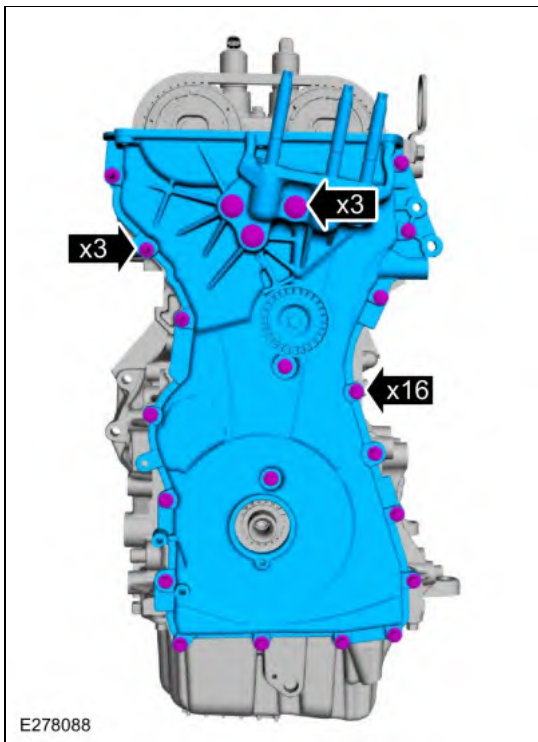
Using the crankshaft seal remover, remove the crankshaft front seal and discard.
Use Special Service Tool: 303-409 (T92C-6700-CH) Remover, Crankshaft Seal.



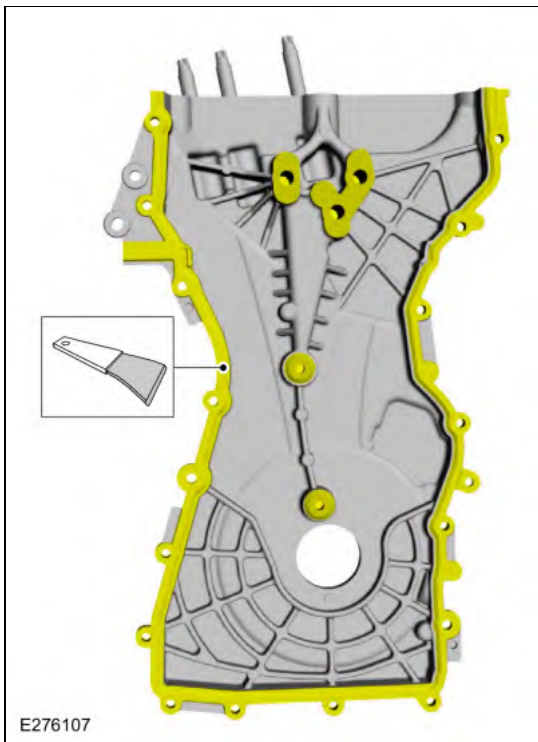
81. Remove the original crankshaft pulley bolt and washer.



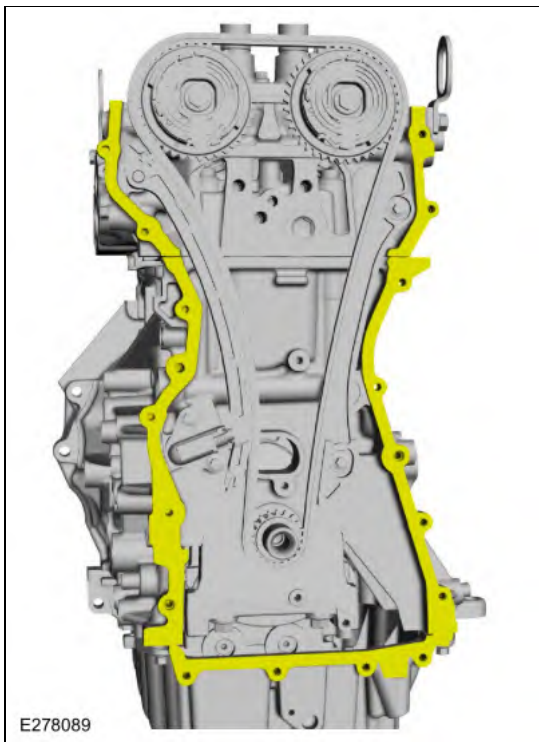
82. Remove the bolts and the engine front cover.



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

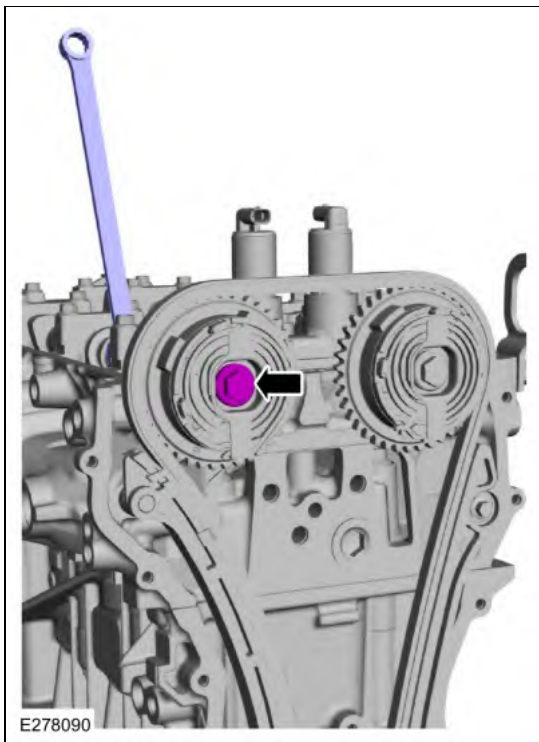


84. Clean and prepare the RTV sealing surface.
 Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).



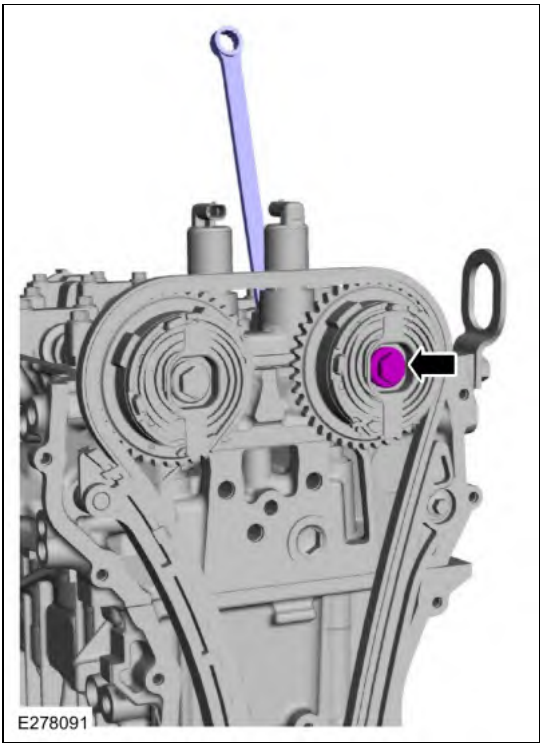
85. **NOTICE:** Use an open-ended wrench on the flats of the camshaft to prevent the component from turning.

Loosen the exhaust VCT bolt.

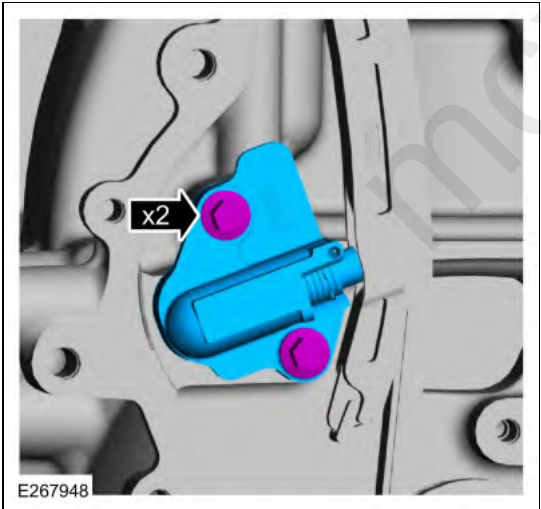


86. **NOTICE:** Use an open-ended wrench on the flats of the camshaft to prevent the component from turning.

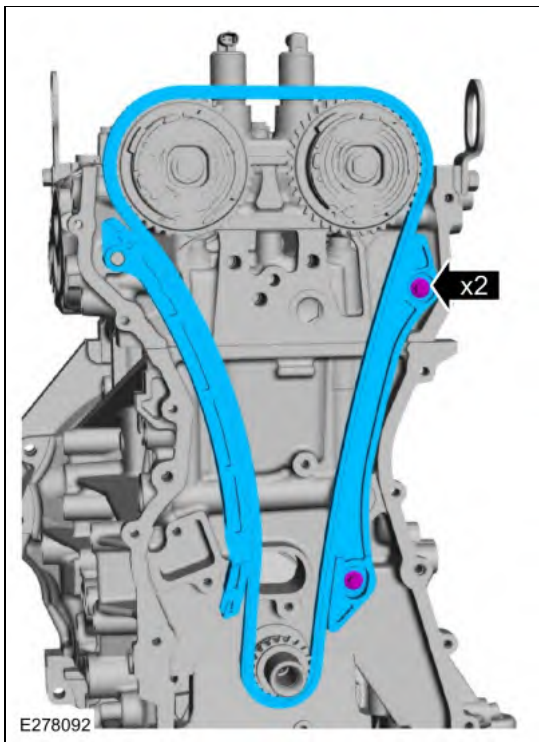
Loosen the intake VCT bolt.



87. Remove the bolts and the timing chain tensioner.

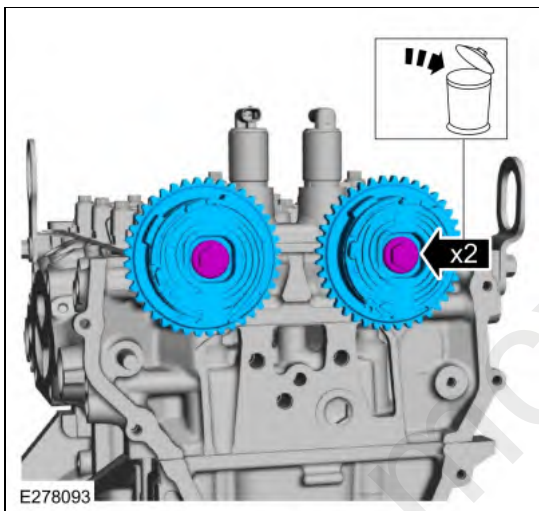


88. Remove the bolts and the timing chain guide, timing chain and tensioner arm.

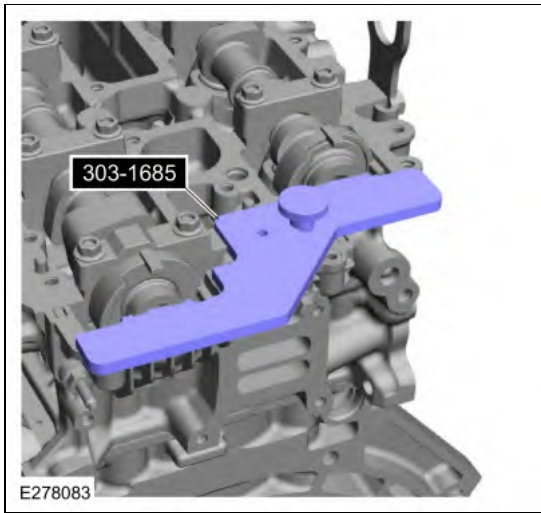


89.

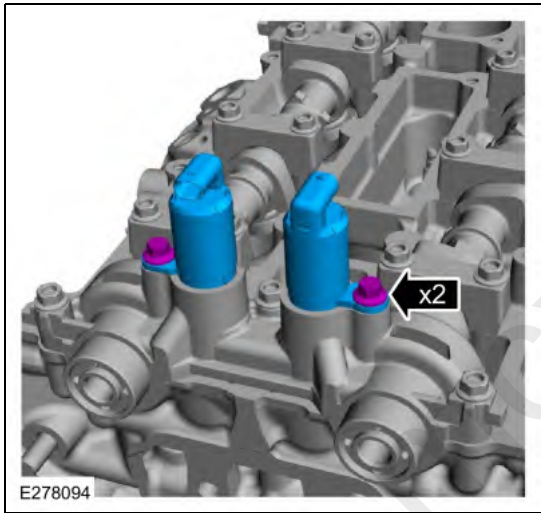
- Remove the bolts and the VCT units.
- Discard the bolts.



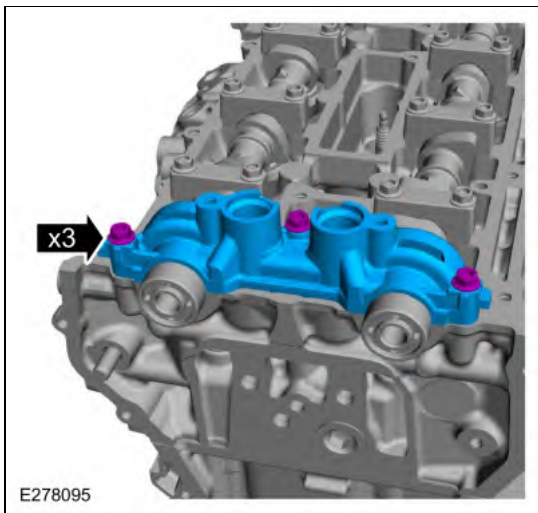
90. Remove Special Service Tool: 303-1685 Alignment Tool, Camshaft.



91. Remove the bolts and the VCT oil control solenoids.



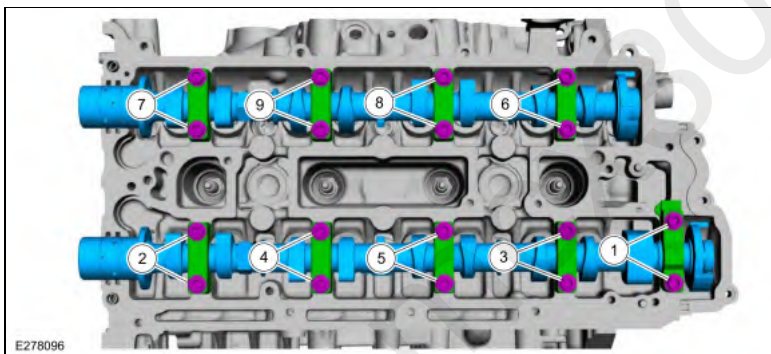
92. Remove bolts and front camshaft bearing cap.



93. **NOTICE:** Failure to follow the camshaft loosening procedure can result in damage to the camshafts.

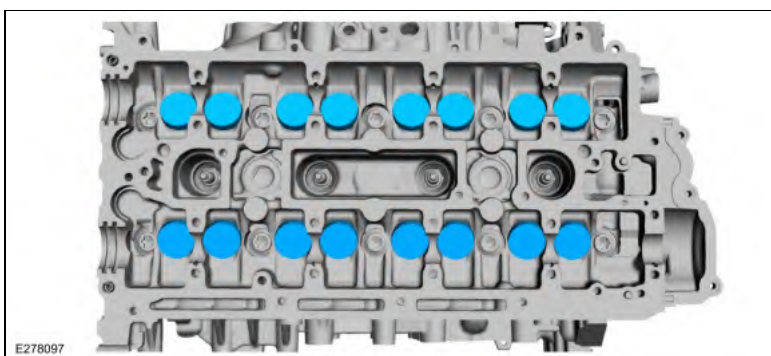
NOTE: Note the location and orientation of each camshaft bearing cap and the position of the camshaft lobes on the No. 1 cylinder for installation reference.

- Loosen the camshaft bearing caps in sequence 2 turns at a time until all tension is released from the camshaft bearing caps and remove the camshaft bearing caps and camshafts.
- Inspect the camshaft bores for any scratches that can be felt by hand.



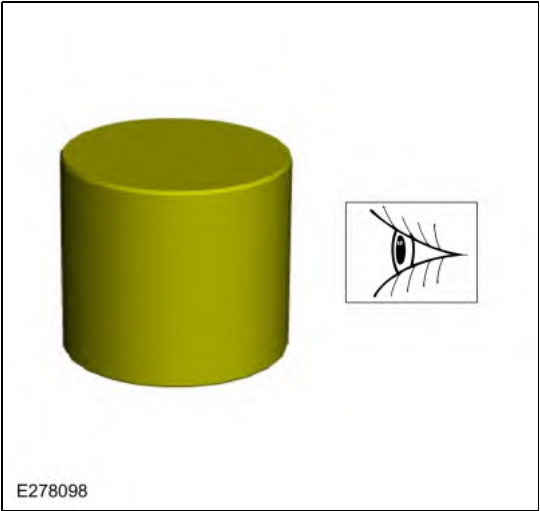
94. **NOTE:** If the camshafts and valve tappets are to be reused, mark the location of the valve tappets to make sure they are assembled in their original positions.

Remove the valve tappets.

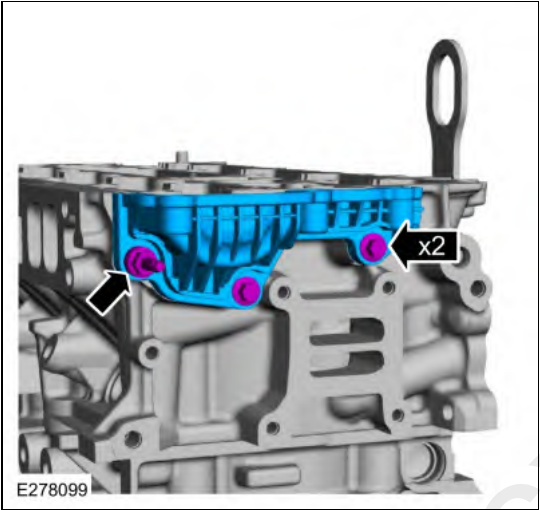


95. **NOTE:** The number on the valve tappets only reflects the digits that follow the decimal. For example, a tappet with the number 0.650 has the thickness of 3.650 mm.

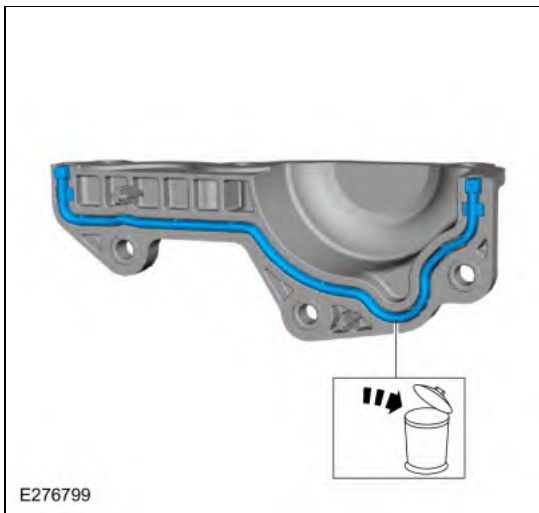
Inspect the valve tappets.



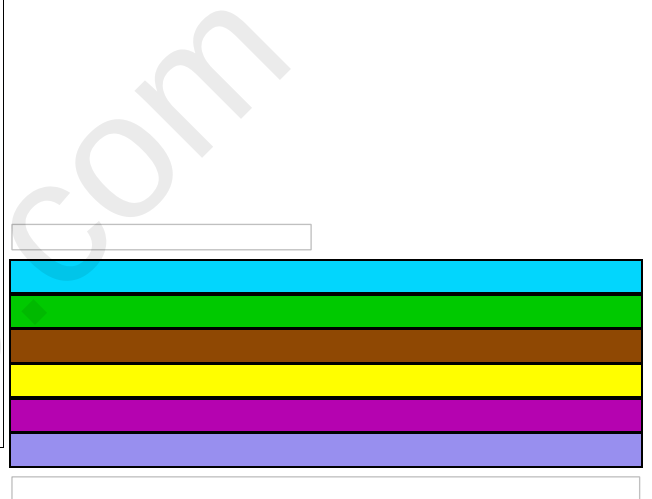
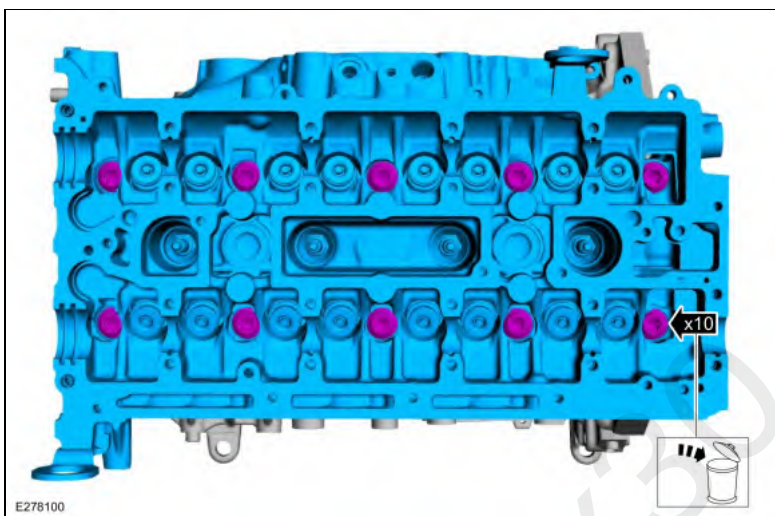
96. Remove the bolts, stud bolt and the cylinder head cover assembly.



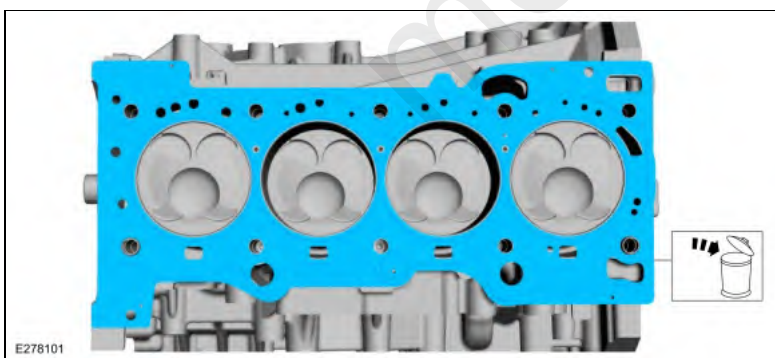
97. Remove and discard the cylinder head cover gasket.



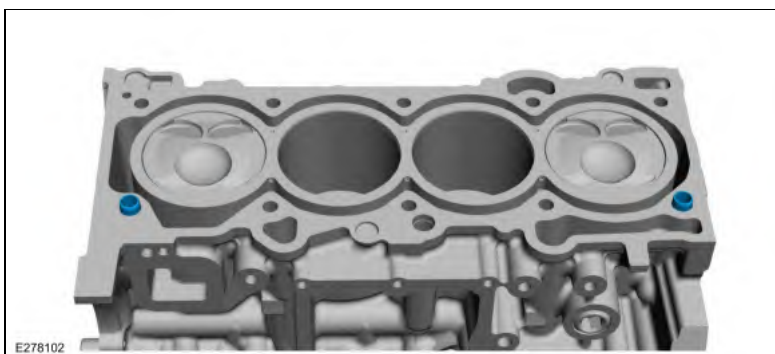
- 98.
- Remove the bolts and the cylinder head.
 - Discard the bolts.



99. Remove and discard the cylinder head gasket.

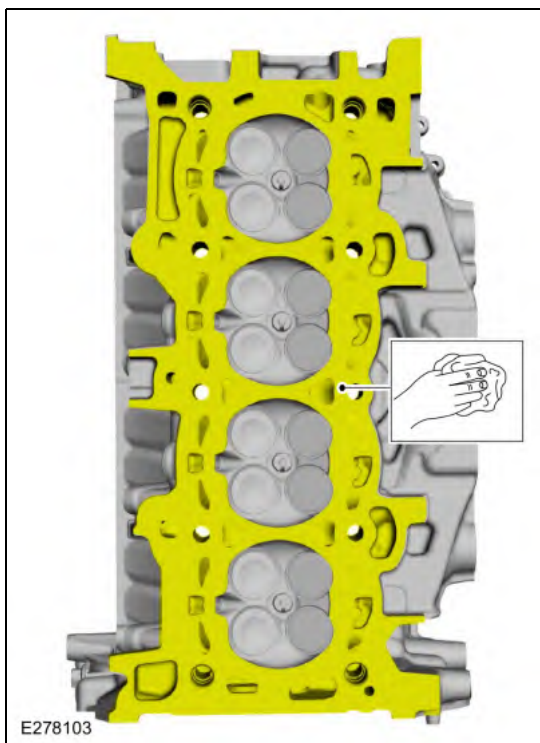


100. Remove the cylinder block bushings.



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

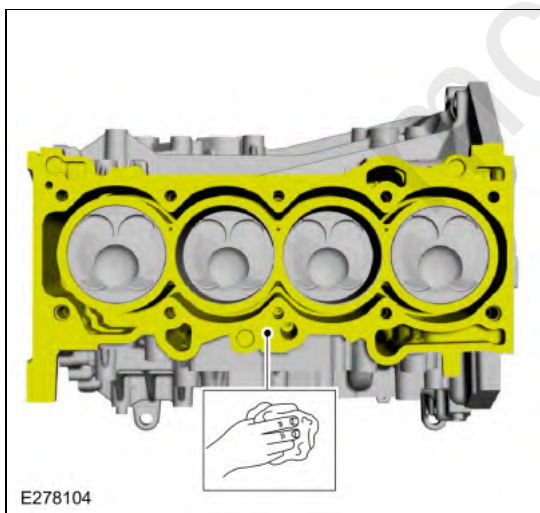
Clean the cylinder head sealing surfaces.



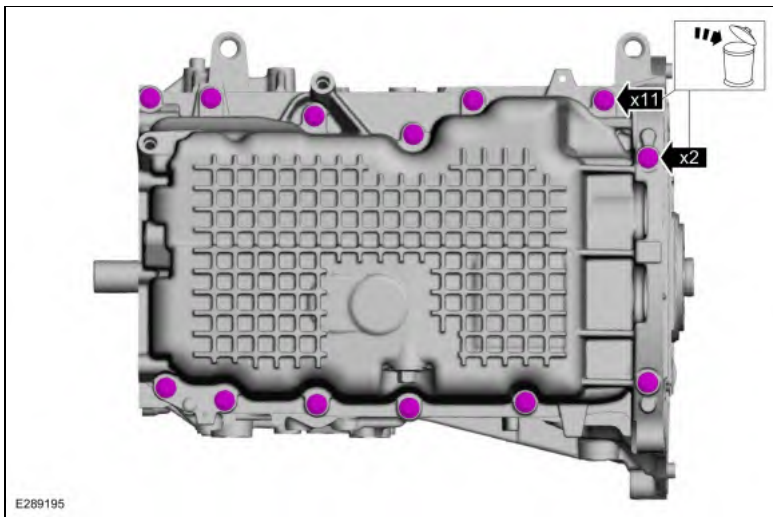
102. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges that make leak paths. Use a plastic scraping tool to remove all traces of the head gasket.

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

Clean the cylinder block sealing surfaces.

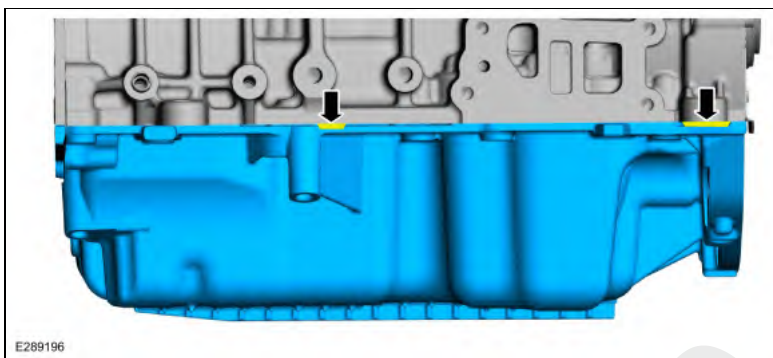


- 103.
- Check the cylinder block distortion.
Refer to: Cylinder Block Distortion (303-00 Engine System - General Information, General Procedures).
 - Check the cylinder head distortion.
Refer to: Cylinder Head Distortion (303-00 Engine System - General Information, General Procedures).
104. Remove and discard the oil pan bolts.

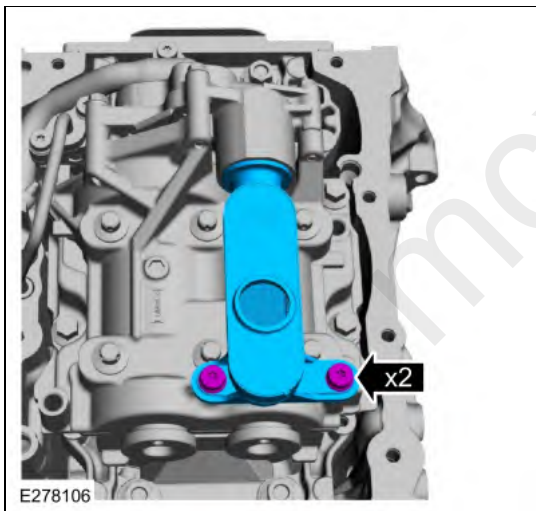


105. **NOTICE:** Do not strike the oil pan sideways to remove, the oil pan is doweled and will damage the oil pan and block.

Using the pry pads, remove the oil pan.



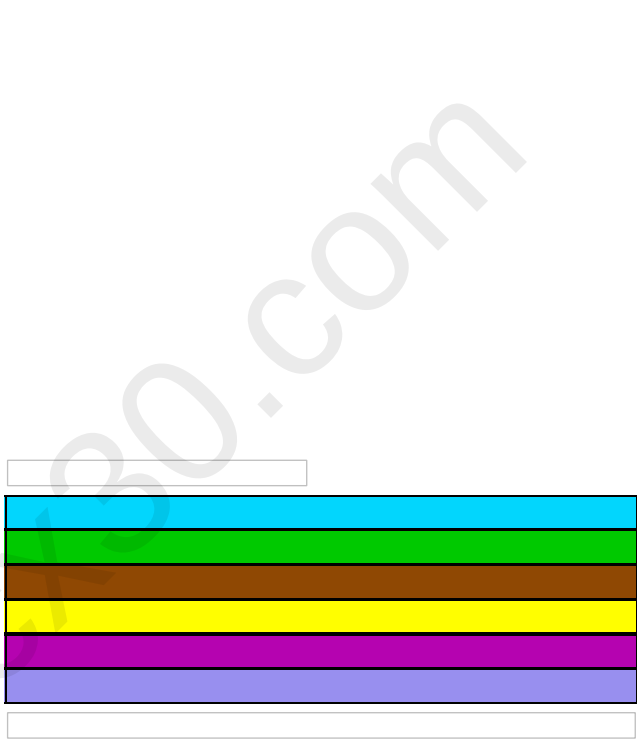
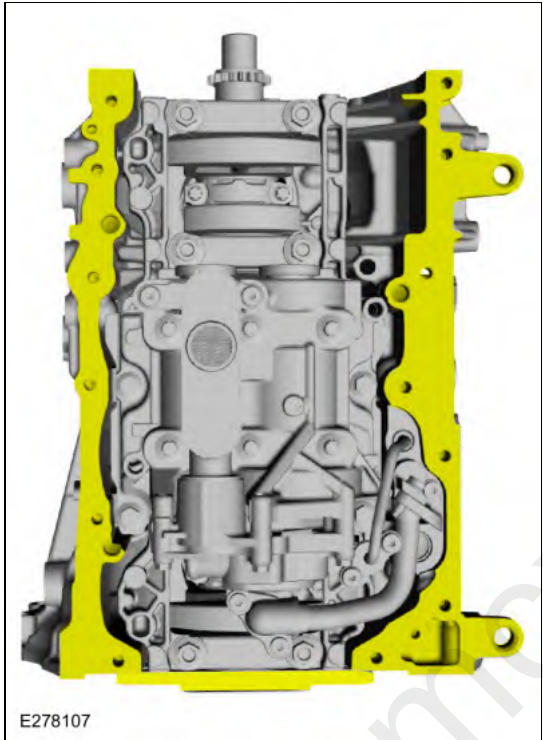
106. Remove the bolts and the oil pickup and screen.



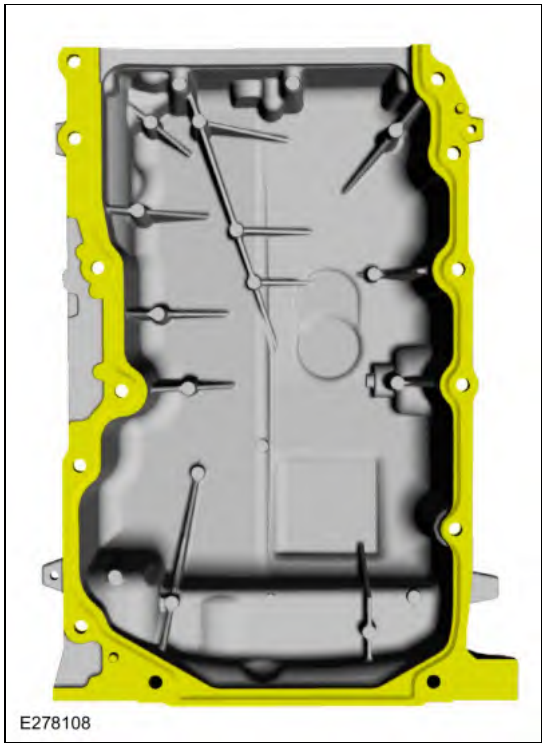
107. Discard the oil pickup and screen O-ring seal.



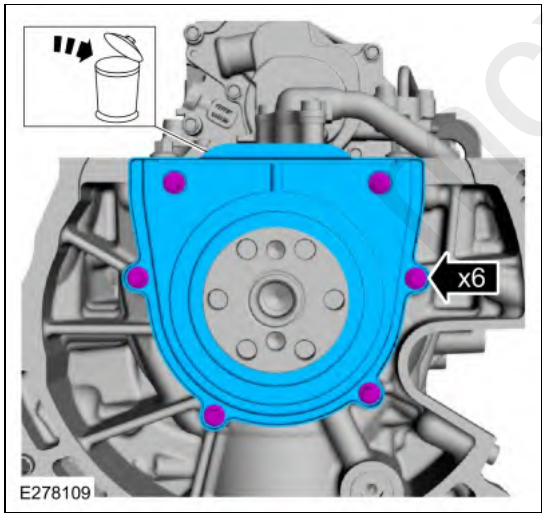
108. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).



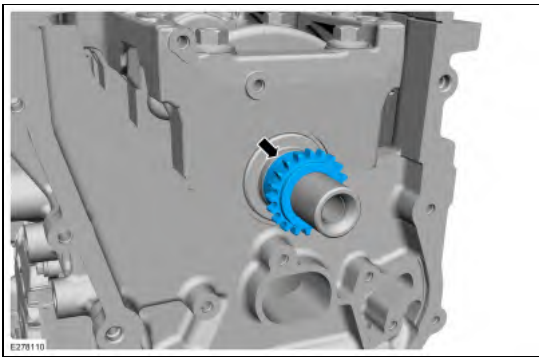
109. Clean and prepare the RTV sealing surface.
Refer to: RTV Sealing Surface Cleaning and Preparation (303-00 Engine System - General Information, General Procedures).



- 110.
- Remove the bolts and the crankshaft rear seal.
 - Discard the crankshaft rear seal.

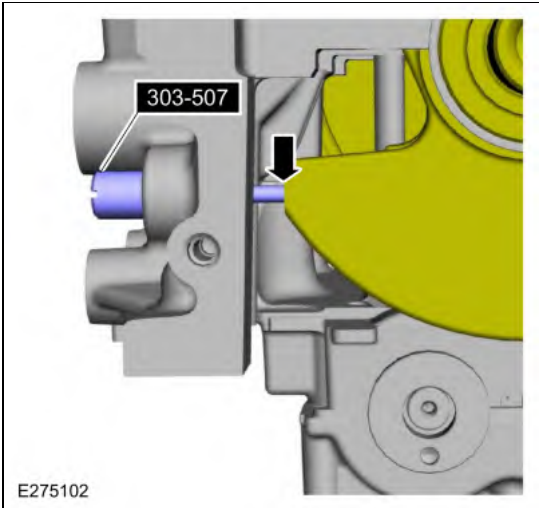


111. Remove the crankshaft sprocket.



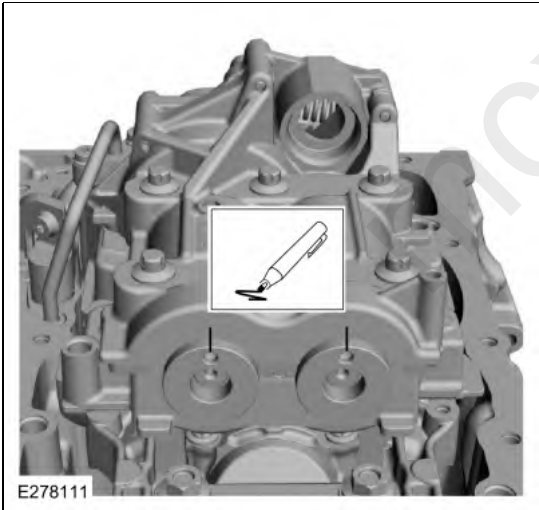
112. **NOTE:** Make sure the Crankshaft TDC Timing Peg is still installed and the engine is still at TDC.

Rotate the crankshaft until it contacts the special tool.

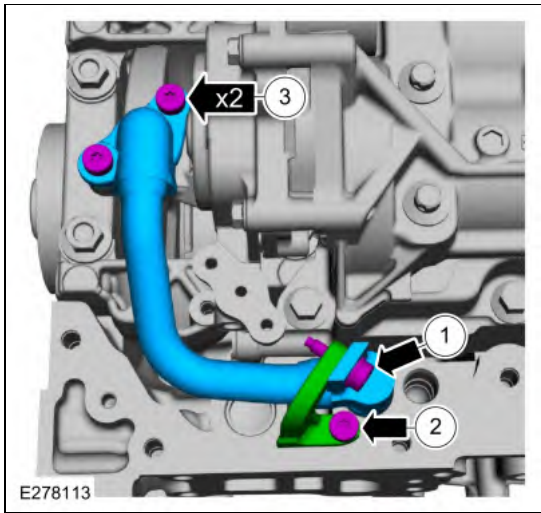


113. **NOTE:** Mark the balance shaft assembly front shafts on the top for reference that the balance shaft assembly is at TDC.

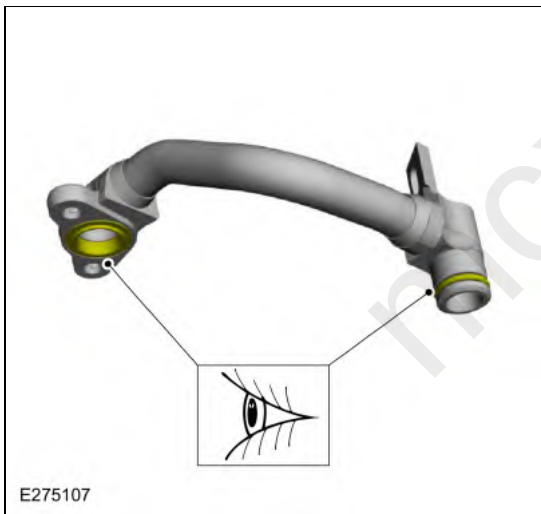
Index-mark the balance shaft assembly.



114. Remove the bolts and the oil outlet tube.

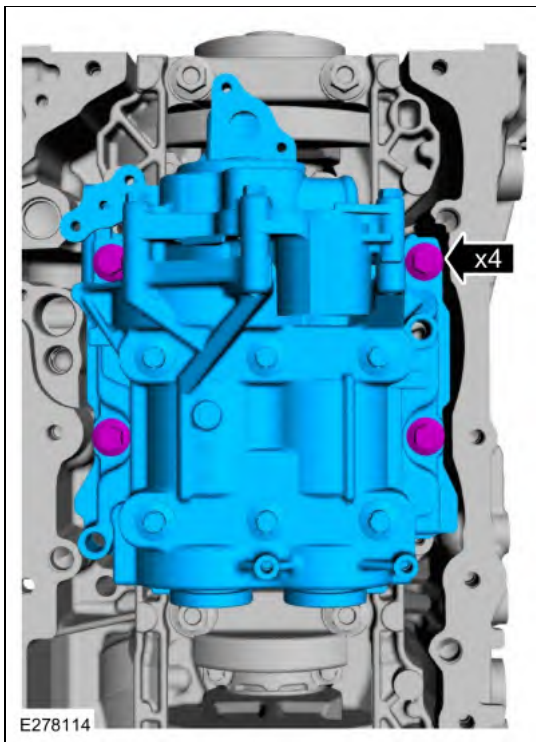


117. Inspect the oil inlet tube O-ring seals and replace if damaged.

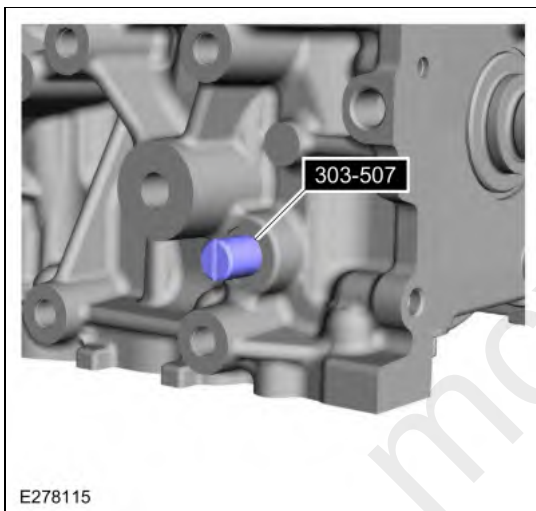


118. **NOTE:** Due to the precision interior construction of the balance shaft assembly, it should not be disassembled.

Remove the bolts and the balance shaft assembly.

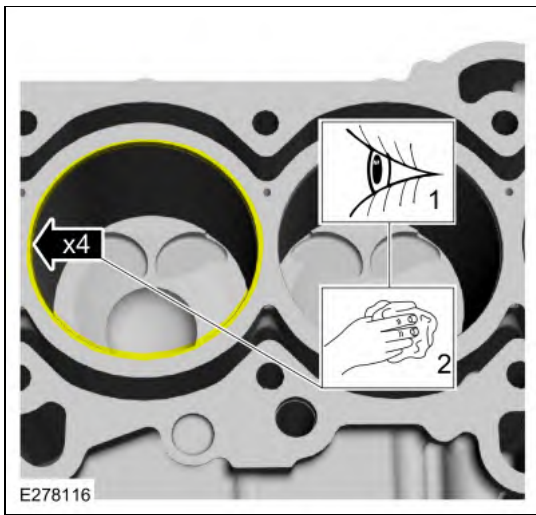


119. Remove Special Service Tool: 303-507 Timing Peg, Crankshaft TDC.



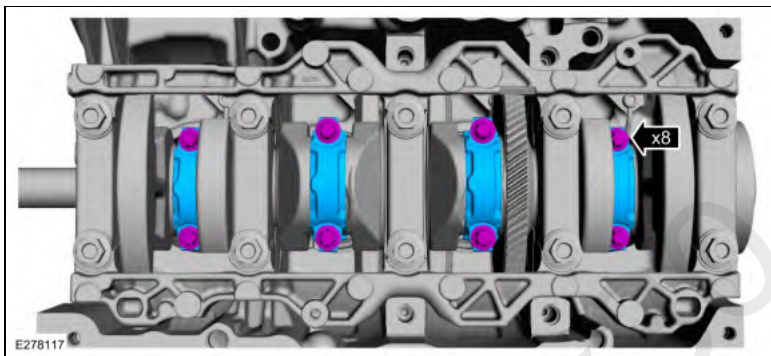
120.

1. Inspect ridge.
2. **NOTE:** Remove the carbon buildup, do not scratch the cylinder wall. Remove all debris from the cylinder.
Clean with abrasive pad.



121. **NOTE:** Clearly mark the connecting rods, connecting rod caps and connecting rod bearings in numerical order for correct orientation for reassembly.

Remove the bolts and the connecting rod caps.



122. **NOTICE:** Do not scratch the cylinder walls or crankshaft journals with the connecting rod.

Remove the pistons.



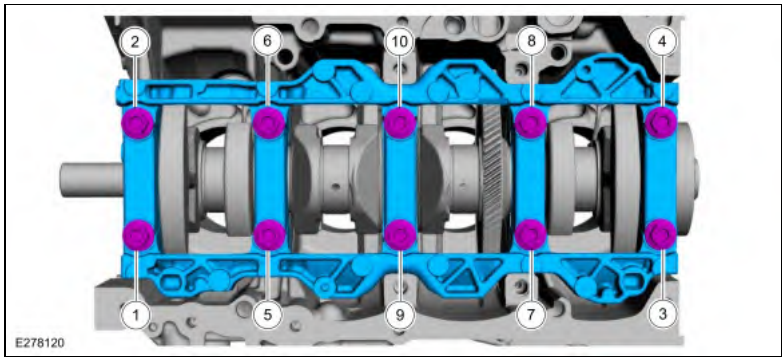
123. **NOTE:** Mark the position of the parts, so they can be installed in their original positions.

Remove the connecting rod bearings.

Refer to: Piston Inspection (303-00 Engine System - General Information, General Procedures).



124. Remove the bolts and the main bearing beam.

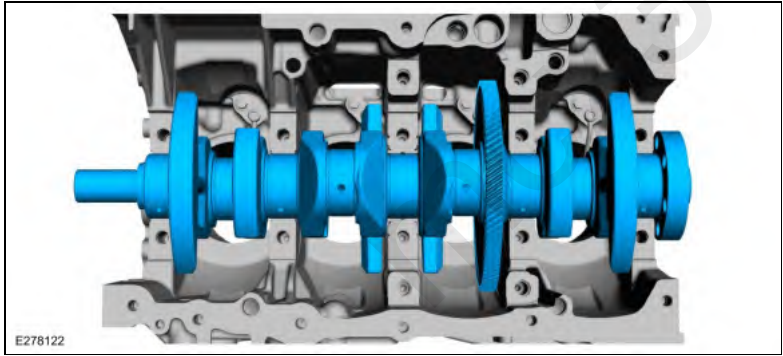


125. **NOTE:** If the main bearings are being reused, mark them in order for correct orientation and reassembly.

Remove the main bearing beam bearings.



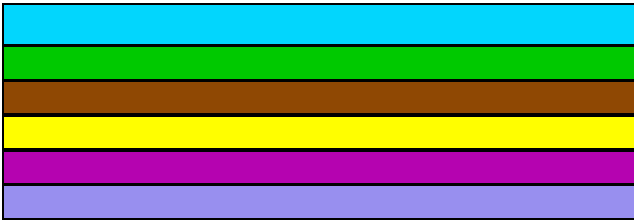
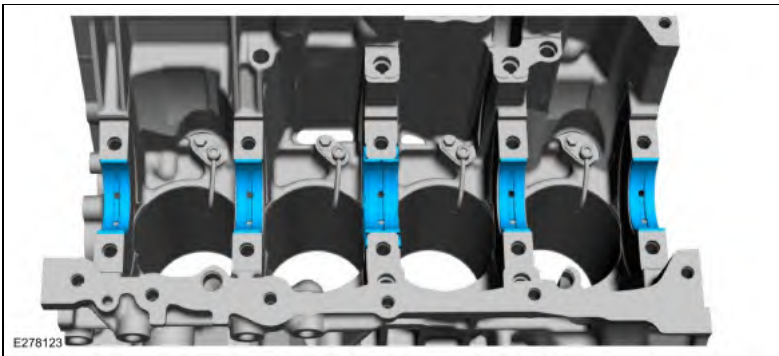
126. Remove the crankshaft.



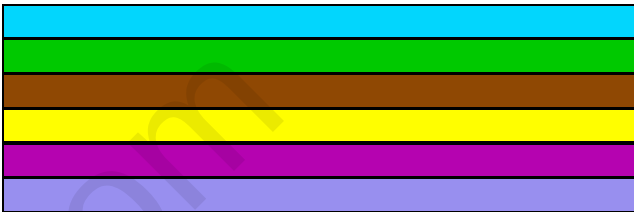
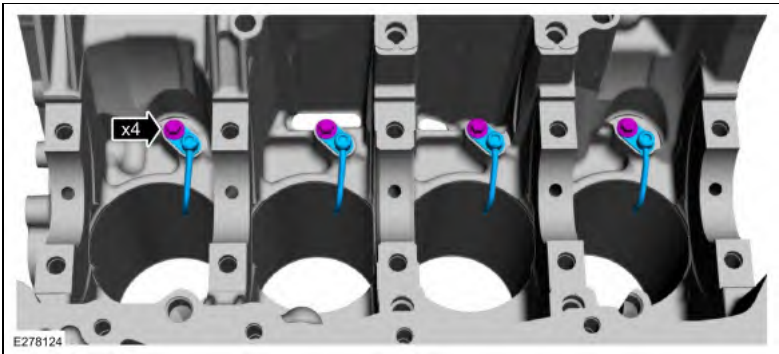
127. **NOTE:** If the main bearings are being reused, mark them in order for correct orientation and reassembly.

NOTE: The center bulkhead has the thrust bearing.

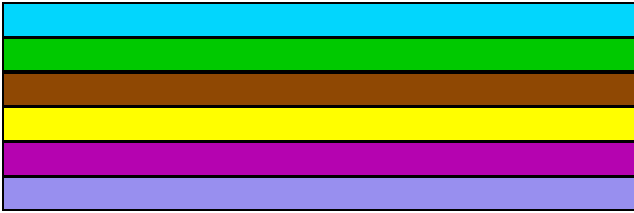
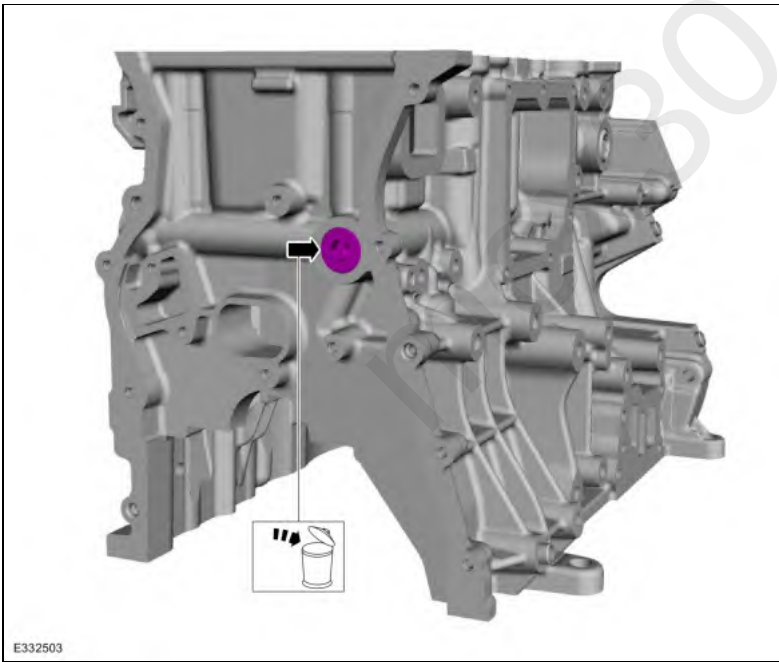
Remove the crankshaft main bearings.



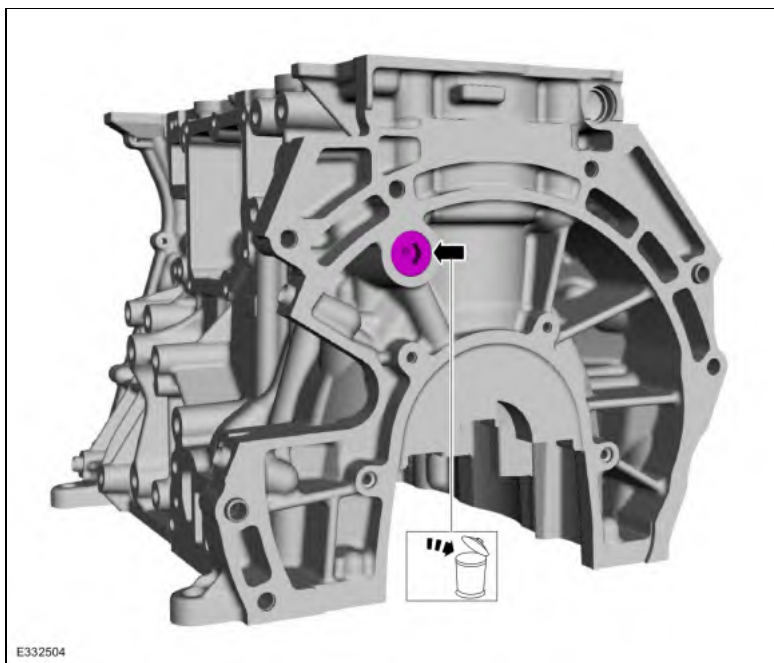
128. Remove the bolts and the engine piston oil cooler valves.



129. If necessary, remove and discard the front cylinder block plug.



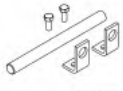
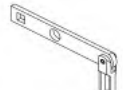
130. If necessary, remove and discard the rear cylinder block plug.



Disassembly and Assembly of Subassemblies

Cylinder Head

Special Tool(s) / General Equipment

 E223048	303-1249 Valve Spring Compressor TKIT-2006UF-FLM TKIT-2006UF-ROW
 E222987	303-1567 Sizer, Teflon Seal TKIT-2010C-FLM
 E134677	303-300 (T87C-6565-A) Set, Valve Spring Compressor TKIT-1988-FESTIVA T88C-1000-ST TKIT-1988-TRACER TKIT-2009TC-F
 E134678	303-350 (T89P-6565-A) Compressor, Valve Spring TKIT-1990-LMH TKIT-1989-F TKIT-1989-FM TKIT-1989-FLM
 E134679	303-472 (T94P-6565-AH) Adapter, Valve Spring Compressor TKIT-1994-LMH/MH2 TKIT-1994-FH/FMH/FLMH
 E222982	307-005 (T59L-100-B) Slide Hammer
 E223046	310-205 Fuel Injector Brush
 E168032	310-206 Remover, Fuel Injector TKIT-2009A-FLM
 E223047	310-207 Installer, Fuel Injector Seal Assembly TKIT-2009A-FLM
Knife	
Long Nose Pliers	

Materials

Name	Specification
Motorcraft® Multi-Purpose Grease Spray XL-5-A	ESB-M1C93-B

DISASSEMBLY

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

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

NOTE: If the components are to be reinstalled, mark the location of the components removed, they must be installed in the same location.