







Engine

Special Tool(s) / General Equipment


 E234304	205-142 (T80T-4000-J) Installer, Differential Bearing Cone
 E133913	205-153 (T80T-4000-W) Handle
 E175042	303-1247 VCT Spark Plug Tube Seal Remover and Installer TKIT-2006UF-FLM TKIT-2006UF-ROW
 E134603	303-409 (T92C-6700-CH) Remover, Crankshaft Seal TKIT-1992-FH/FMH/FLMH TKIT-1993-LMH/MH
	303-448 (T93P-6303-A) Holding Tool, Crankshaft TKIT-1993-FLM TKIT-1993-LM
	303-F047 Lifting Bracket, Engine
Floor Crane	
Three Leg Puller	
Mounting Stand	

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

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

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

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

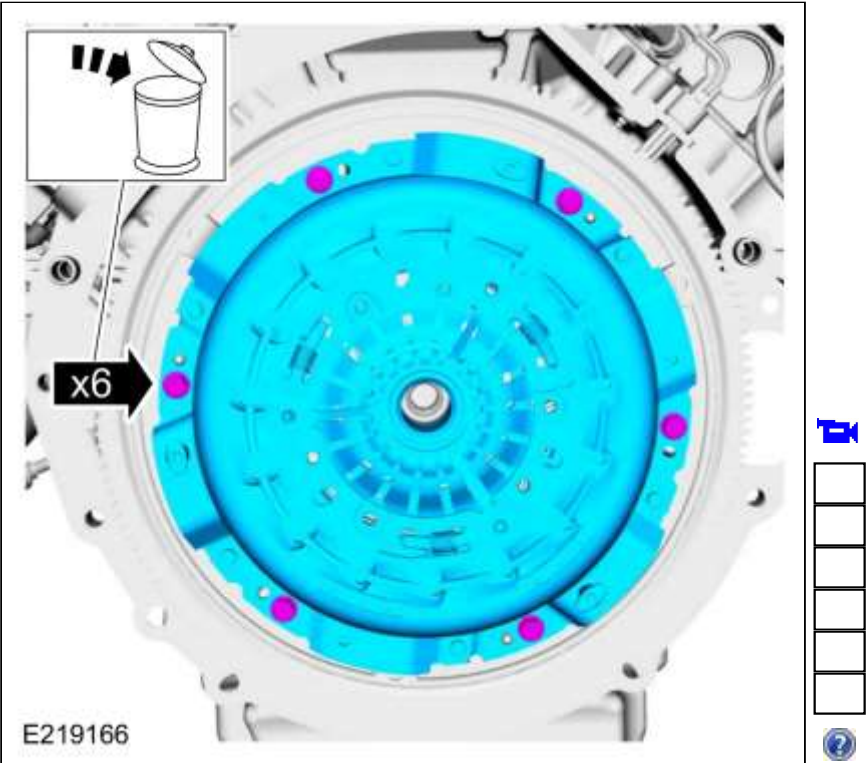
1.  **WARNING:** Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

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

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

Remove and discard the pressure plate bolts.

- Remove the pressure plate and the clutch disc.

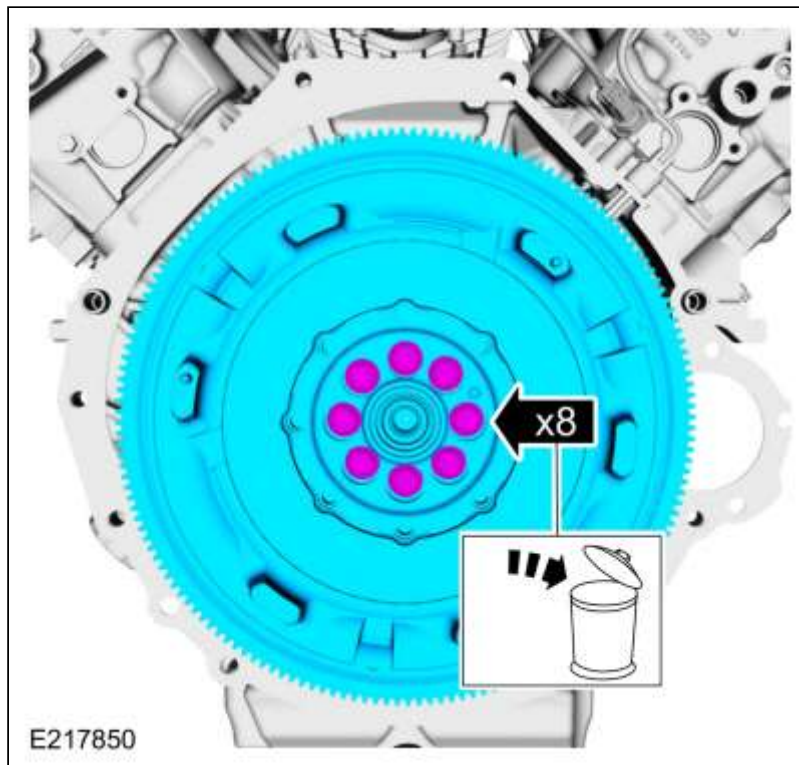


2. **NOTE:** The flywheel bolts are torque-to-yield design and are not reusable

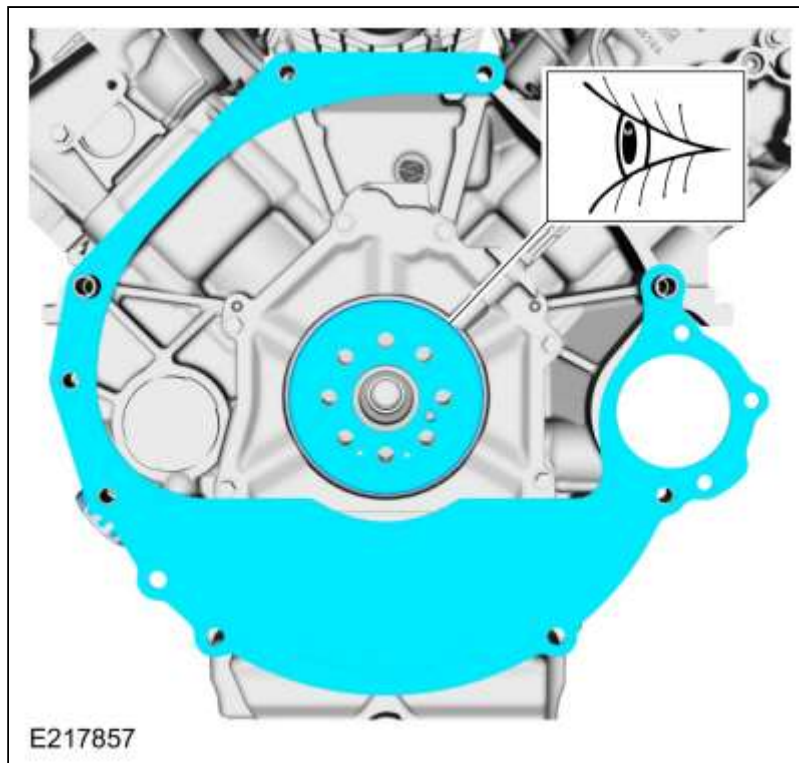
Remove and discard the flywheel bolts.

- Remove the flywheel.



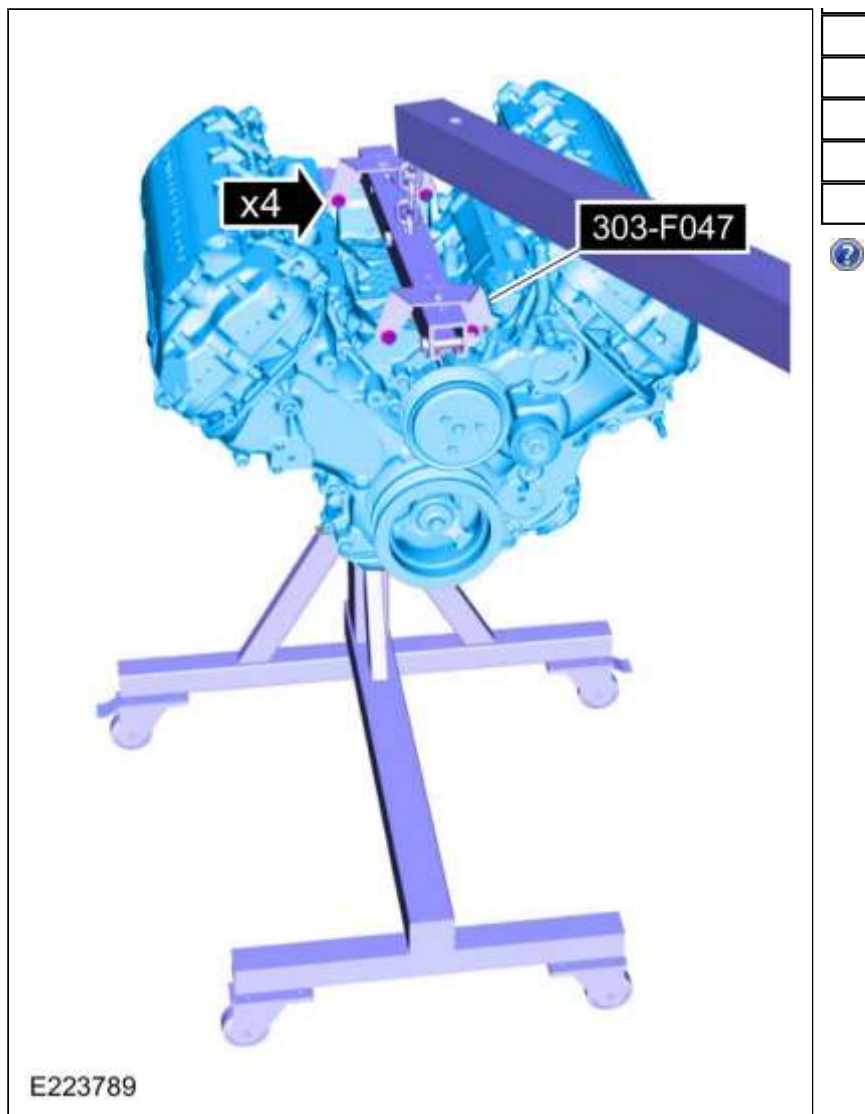


3.
 - Remove the crankshaft sensor ring and the engine-to-transmission spacer plate.
 - Inspect the crankshaft sensor ring for damage. If the crankshaft sensor ring has been dropped or has any visual damage, it must be discarded.

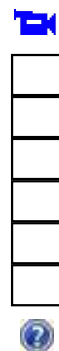


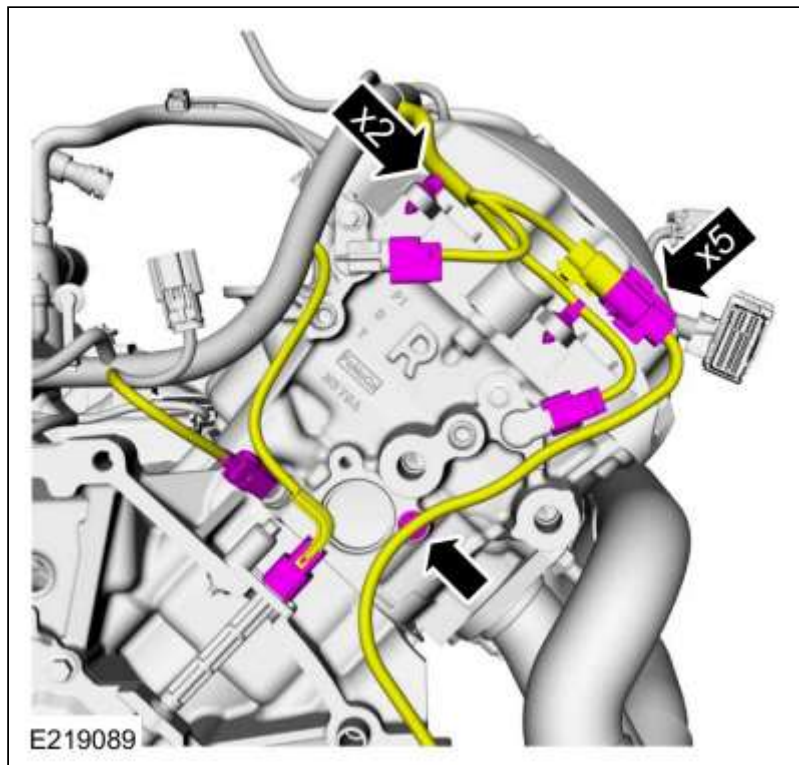
4. Using a floor crane, install the engine on a mounting stand and remove the special tool.
 Remove Special Service Tool: [303-F047 Lifting Bracket, Engine](#).
 Use the General Equipment: Floor Crane
 Use the General Equipment: Mounting Stand



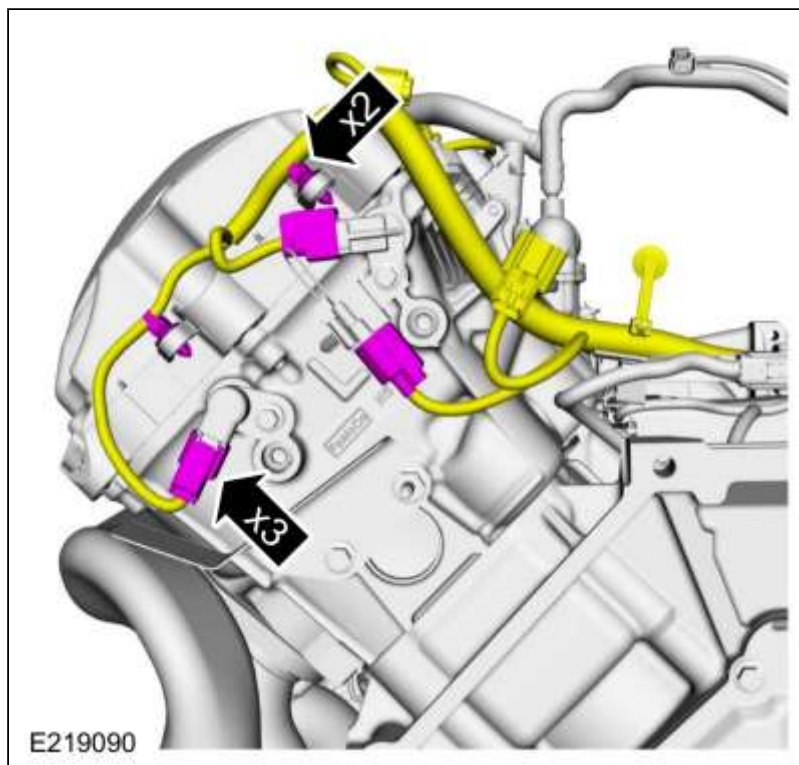


5.
 - Disconnect the engine wiring harness electrical connectors.
 - Detach the engine wiring harness retainers and position the harness aside.





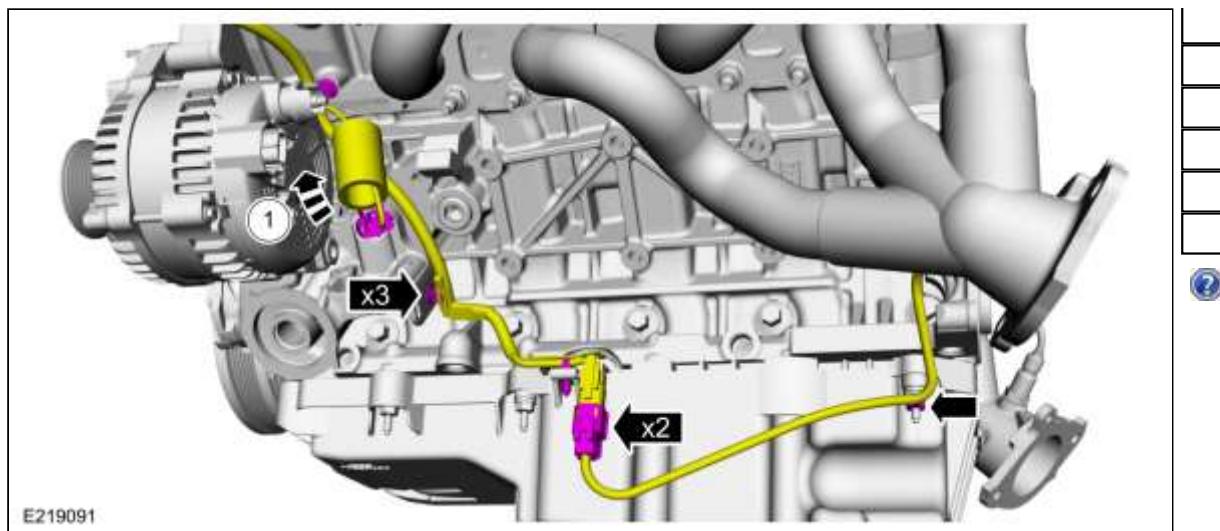
6.
 - Disconnect the engine wiring harness electrical connectors.
 - Detach the engine wiring harness retainers and position the harness aside.



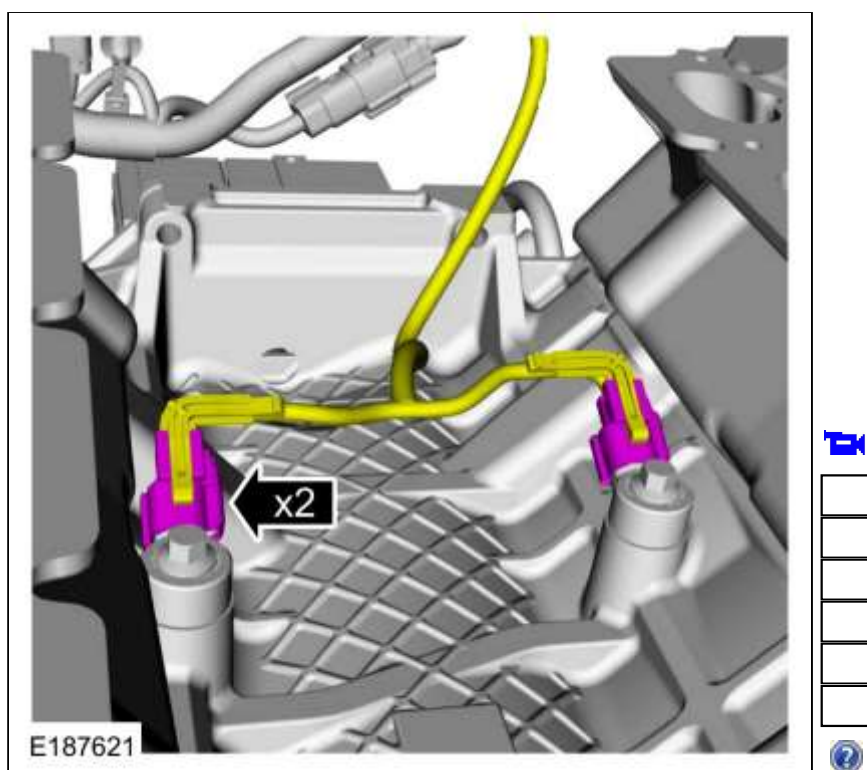
7.
 1. **NOTE:** Early build engine shown, late build engine similar.

Slide up the engine wiring harness insulator to access the electrical connector.

 - Disconnect the engine wiring harness electrical connectors.
 - Detach the engine wiring harness retainers and position the harness aside.

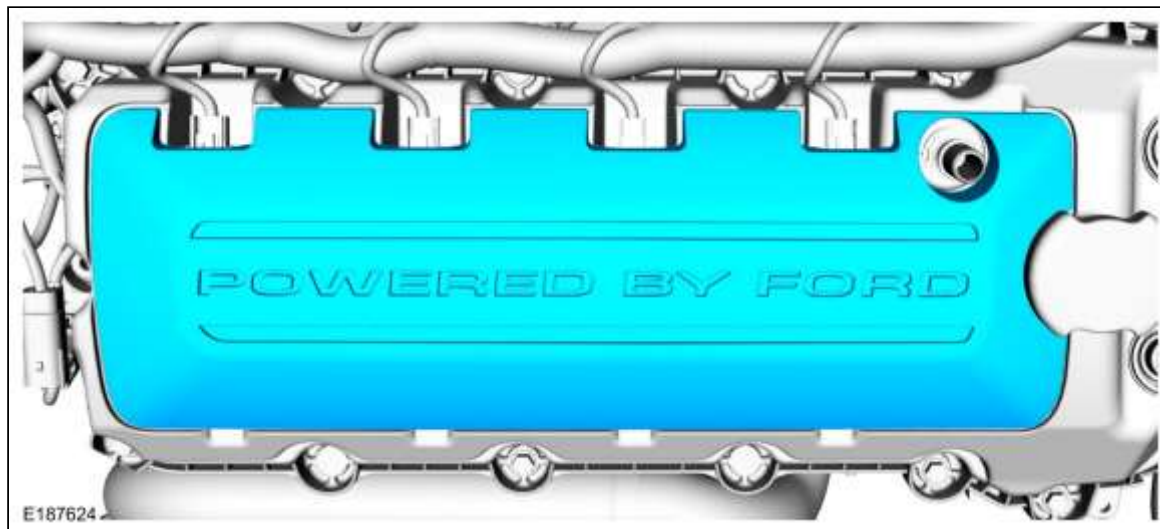


8. Disconnect the engine wiring harness electrical connectors.

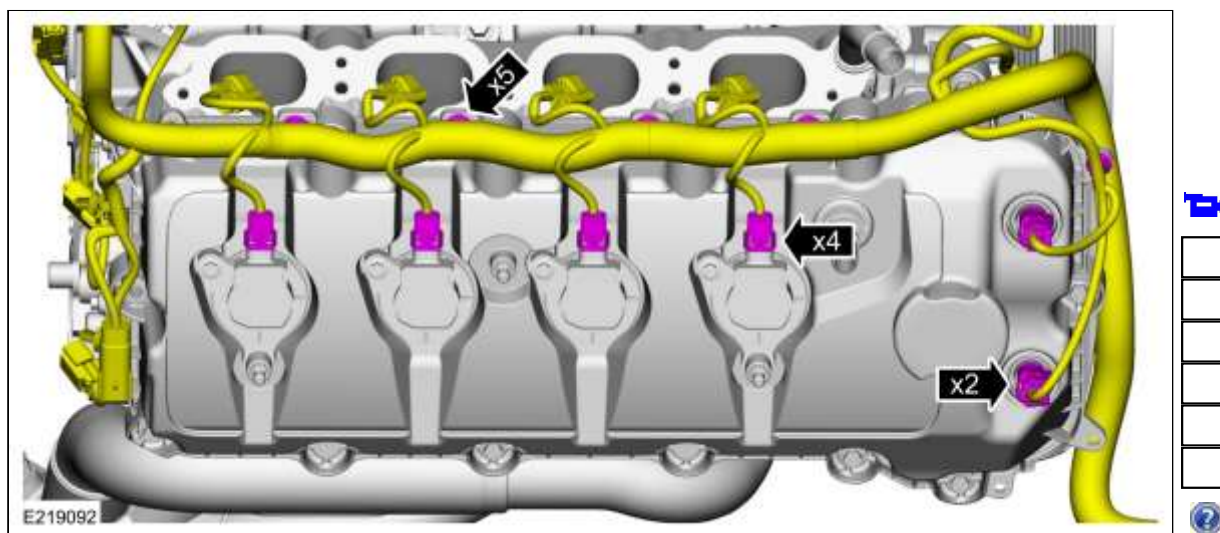


9. Remove the RH spark plug cover.

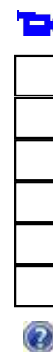


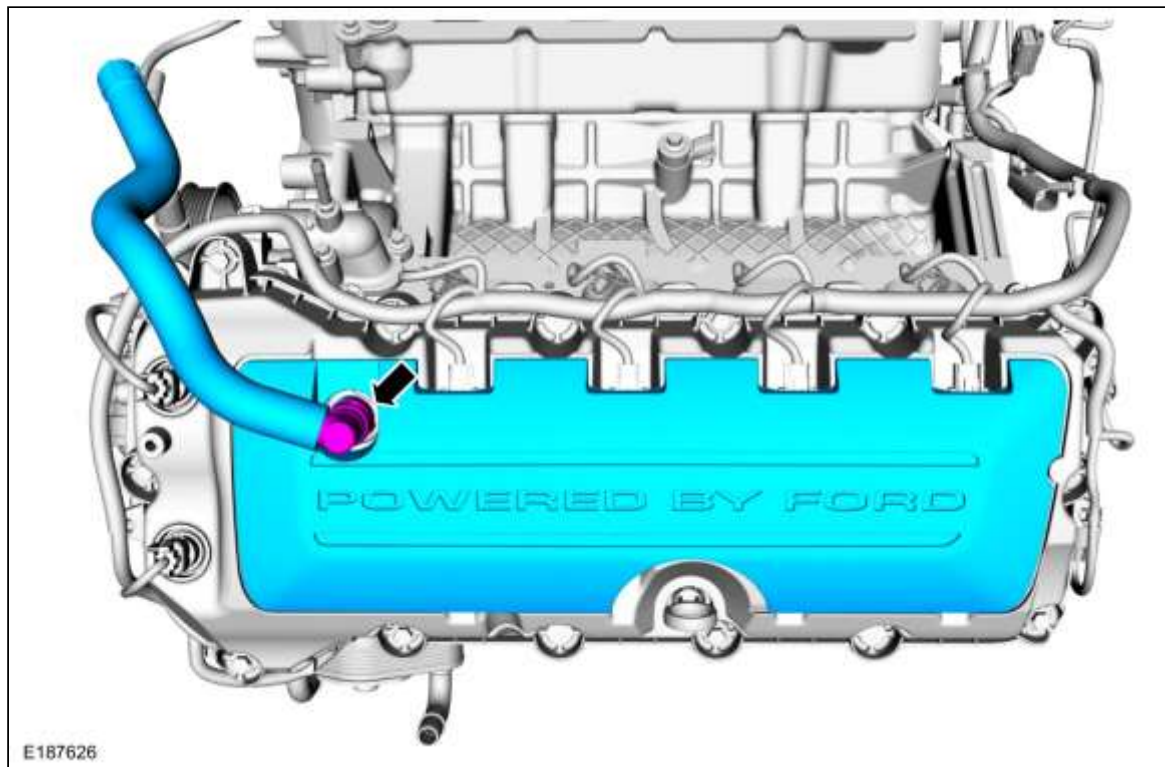


10.
 - Disconnect the engine wiring harness electrical connectors.
 - Detach the engine wiring harness retainers and position the harness aside.

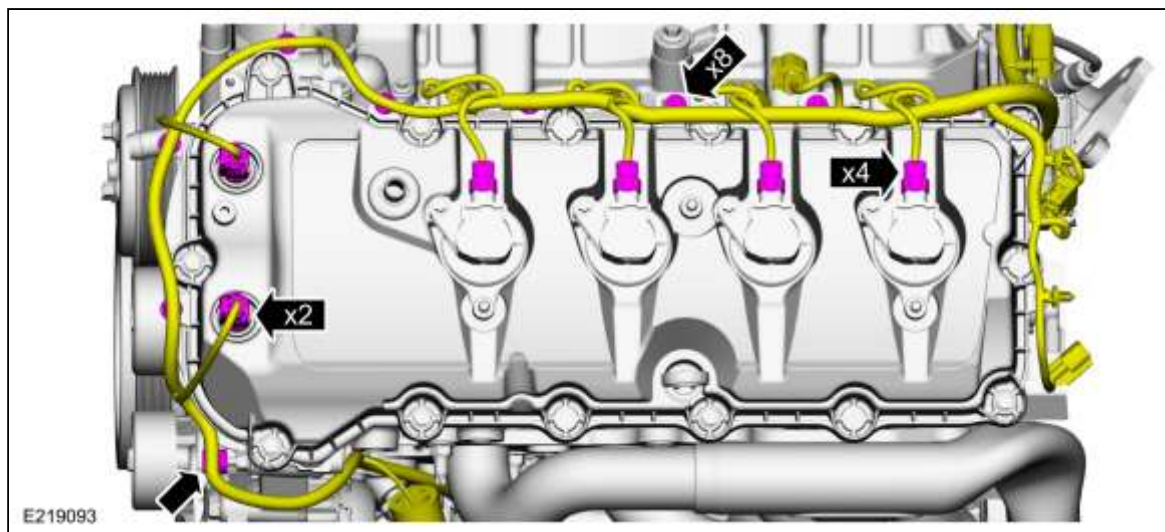


11.
 - Remove the crankcase ventilation tube.
Refer to: [Quick Release Coupling](#) (310-00D Fuel System - General Information - 5.2L 32V Ti-VCT, General Procedures).
 - Remove the LH spark plug cover.

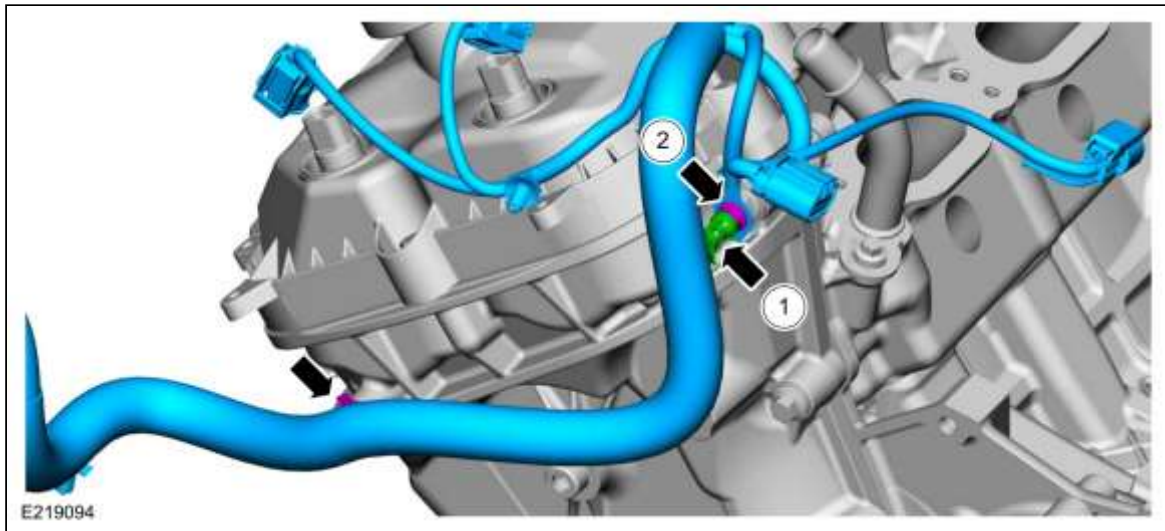




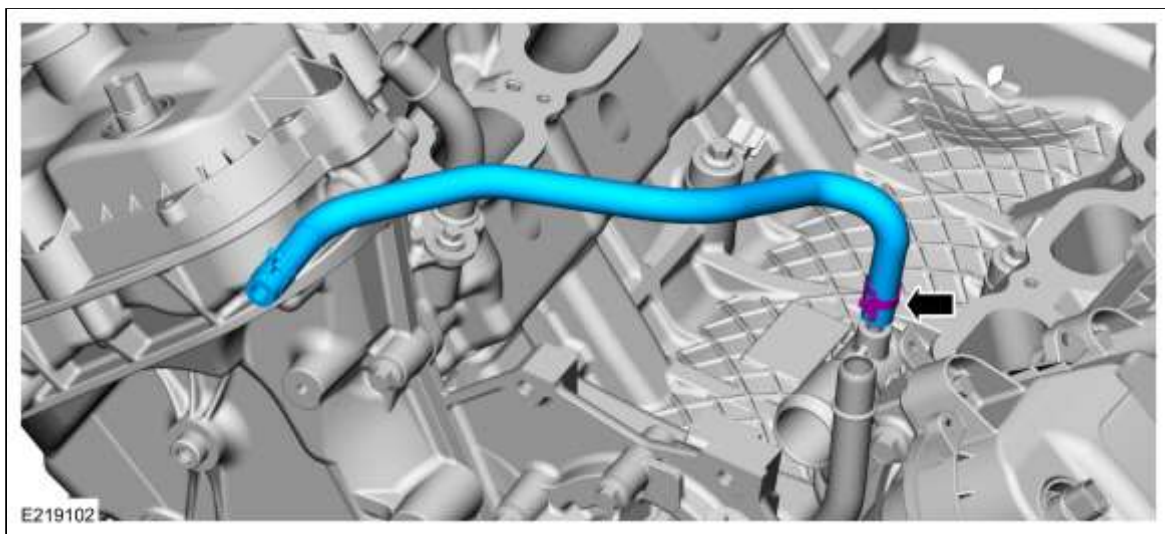
- 12.
- Disconnect the engine wiring harness electrical connectors.
 - Detach the engine wiring harness retainers and position the harness aside.



- 13.
1. Detach the wiring harness retainer from the engine front cover stud bolt.
 2. Remove the nut and the ground wire.
- Detach the wiring harness retainer and remove the wiring harness from the engine.

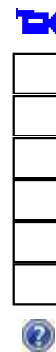


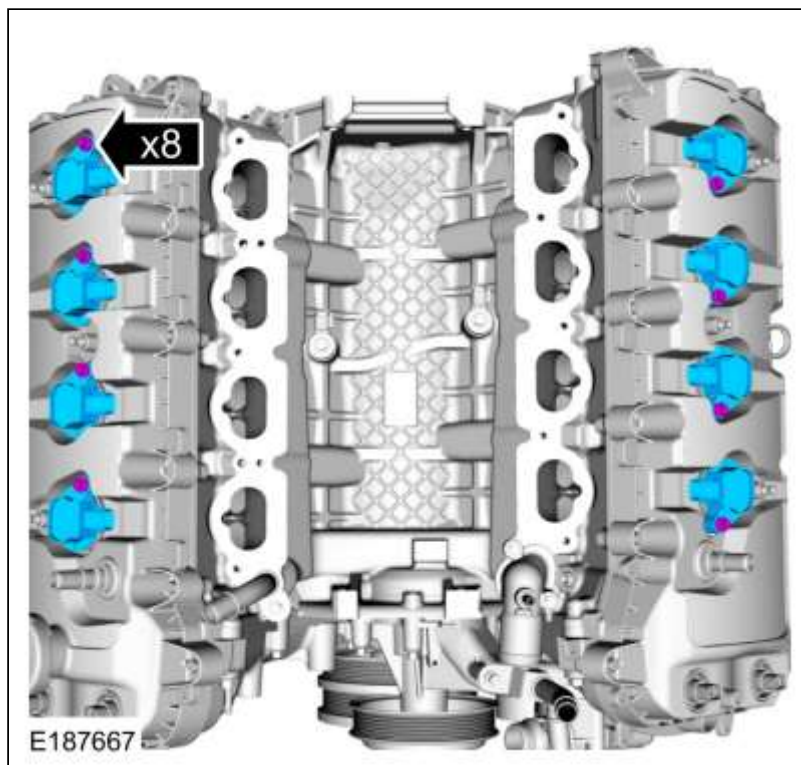
14. Remove the coolant hose.



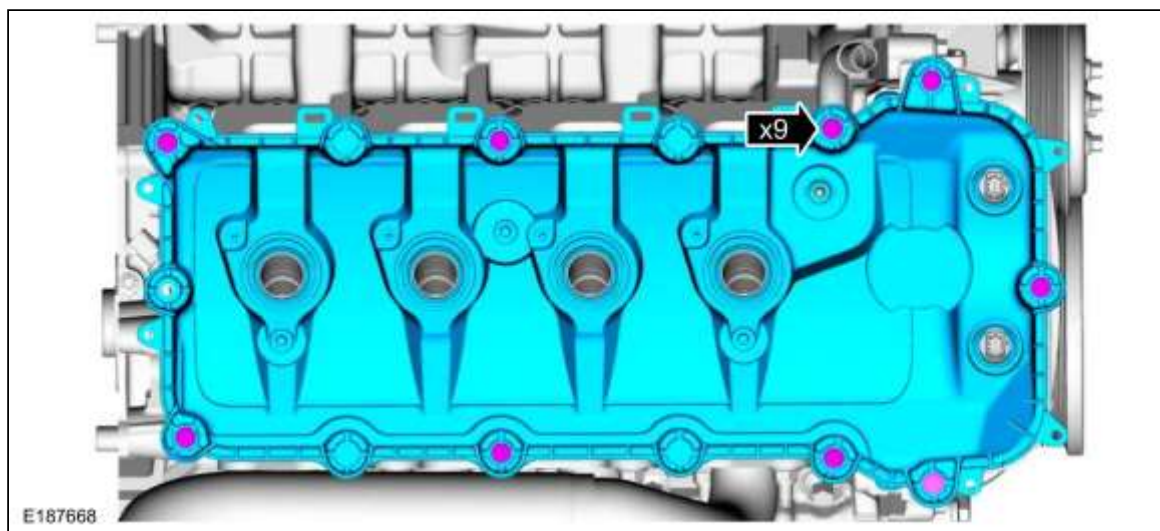
15. **NOTE:** When removing the ignition coils, a slight twisting motion will break the seal and ease removal.

Remove the bolts and the ignition coils.

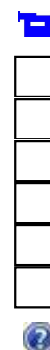


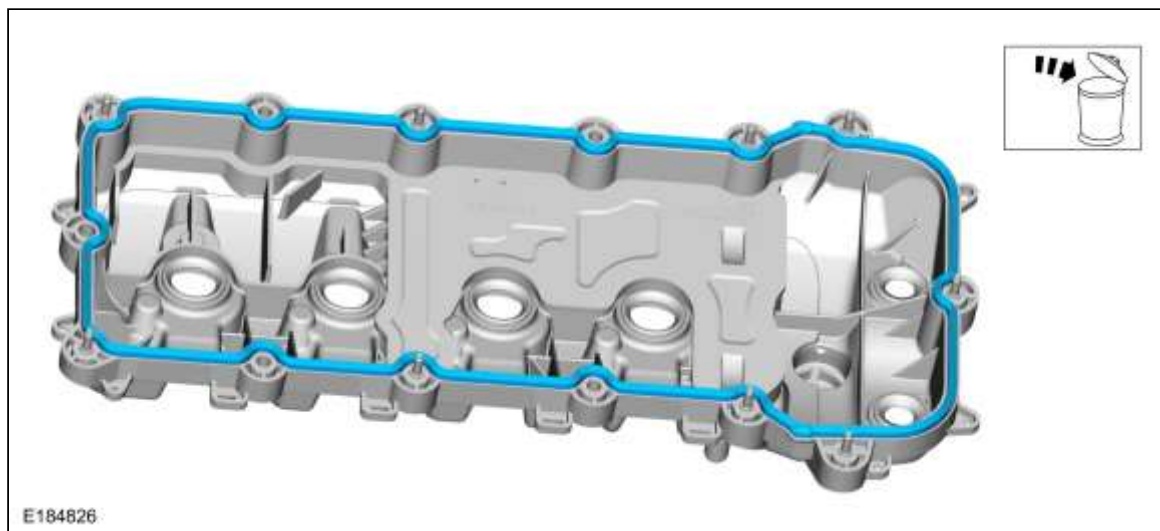


16. Loosen the bolts and remove the RH valve cover.

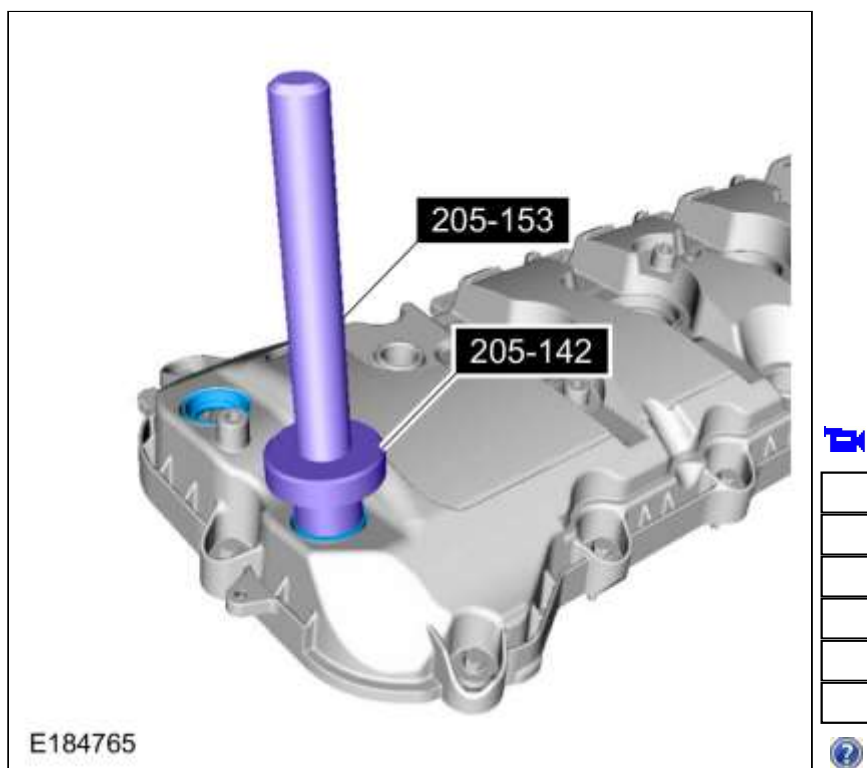


17. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.
Remove and discard the gasket.



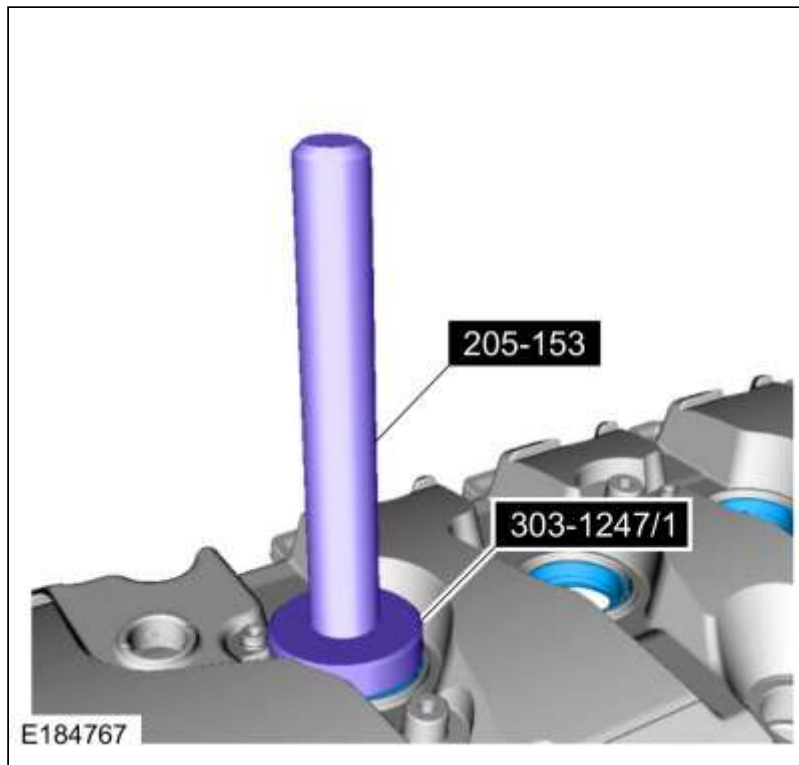


18. Inspect the VCT variable force solenoid seals. Remove any damaged seals using the special tools.
 Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing Cone.](#)



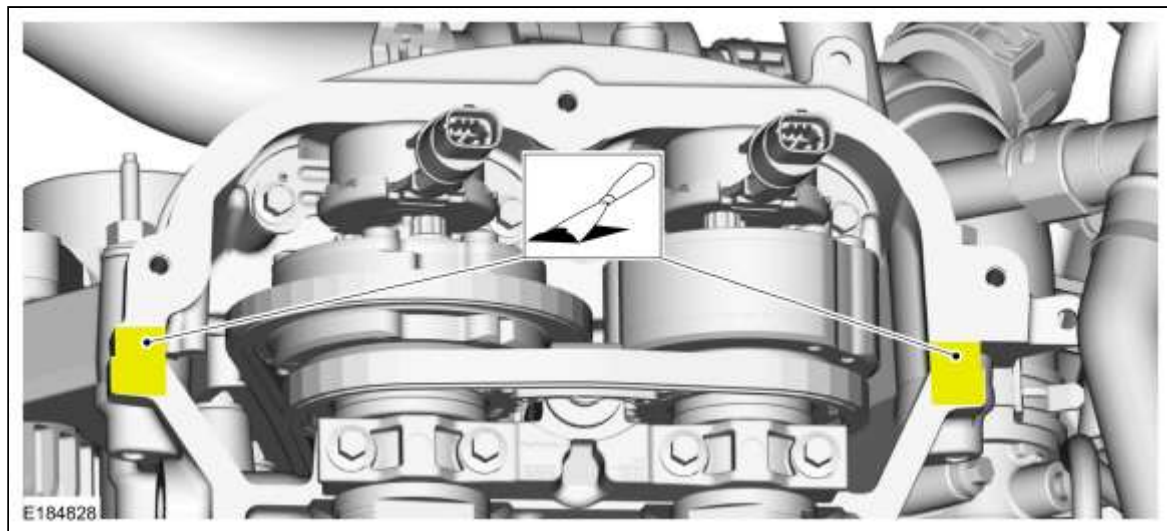
19. Inspect the spark plug seals. Remove any damaged seals using the special tools.
 Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [303-1247 VCT Spark Plug Tube Seal Remover and Installer.](#)



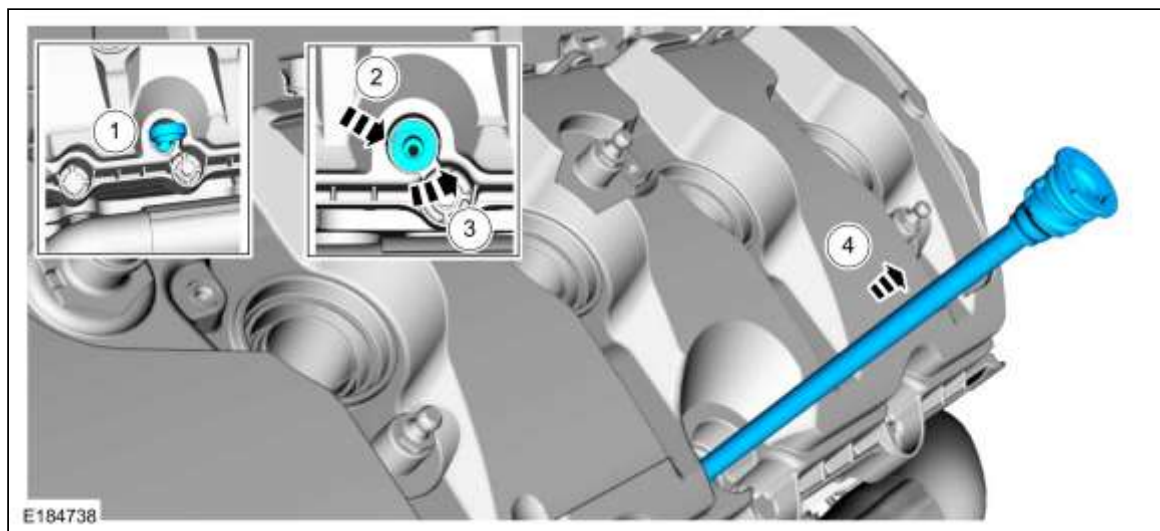


20. Clean and prepare the RTV sealing surface.

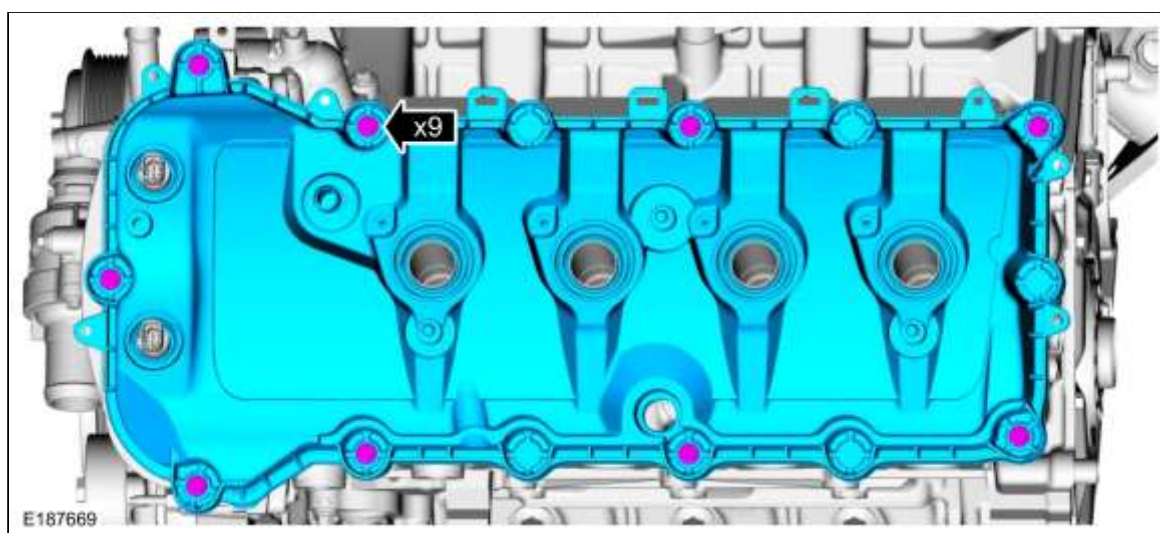
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).



21.
 1. Remove the oil level indicator.
 2. Depress the tab.
 3. Rotate the oil level indicator tube counterclockwise.
 4. Pull the oil level indicator tube from the engine.

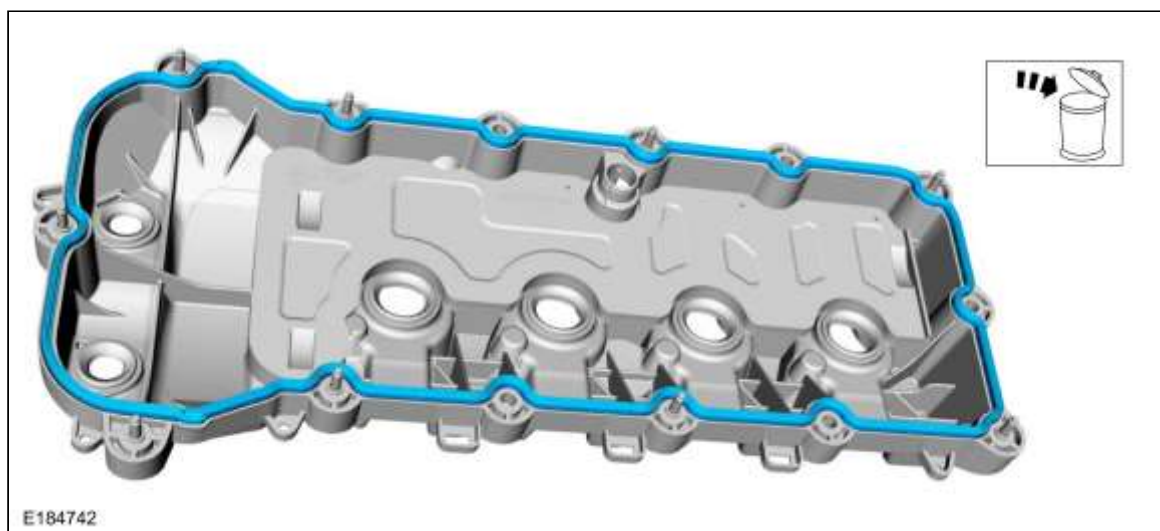


22. Loosen the bolts and remove the LH valve cover.



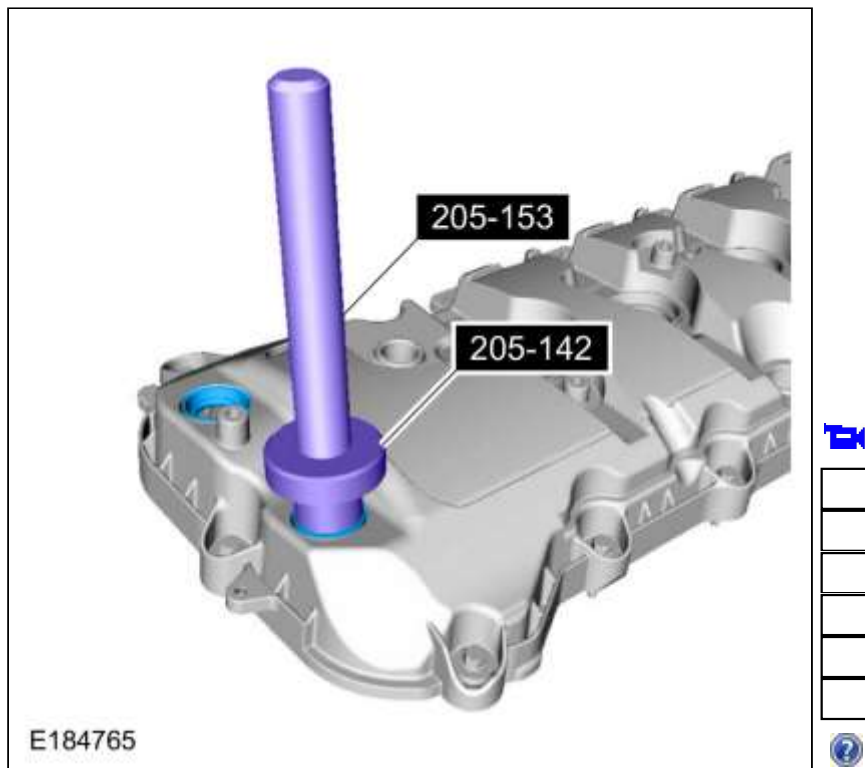
23. **NOTE:** Clean the valve cover gasket groove with soap and water or a suitable solvent.

Remove and discard the gasket.

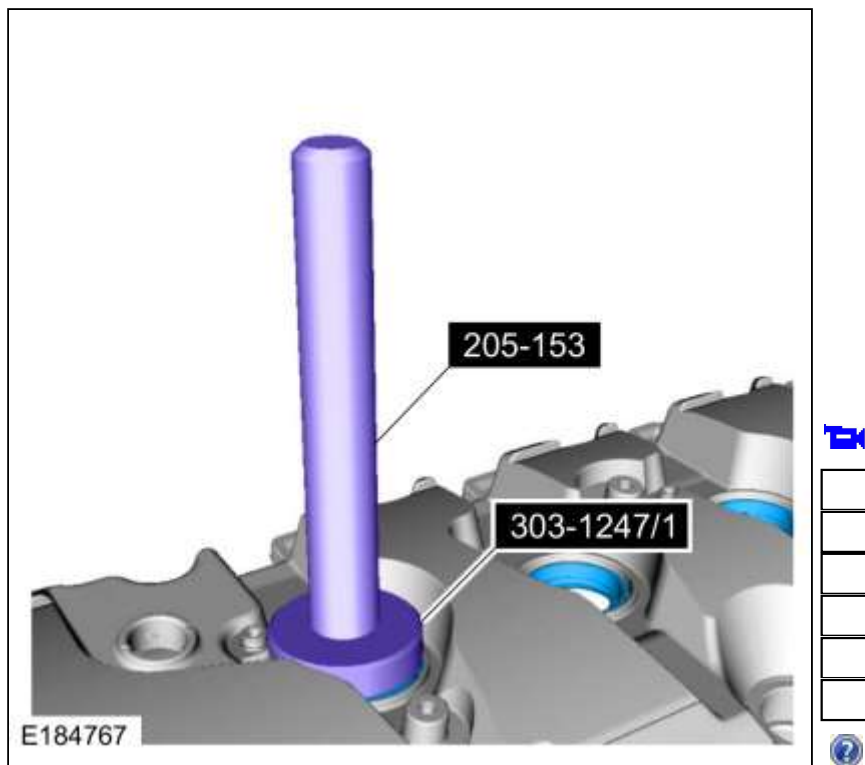


24. Inspect the VCT variable force solenoid seals. Remove any damaged seals using the special tools.
Use Special Service Tool: [205-153 \(T80T-4000-W\) Handle.](#) , [205-142 \(T80T-4000-J\) Installer, Differential Bearing](#)

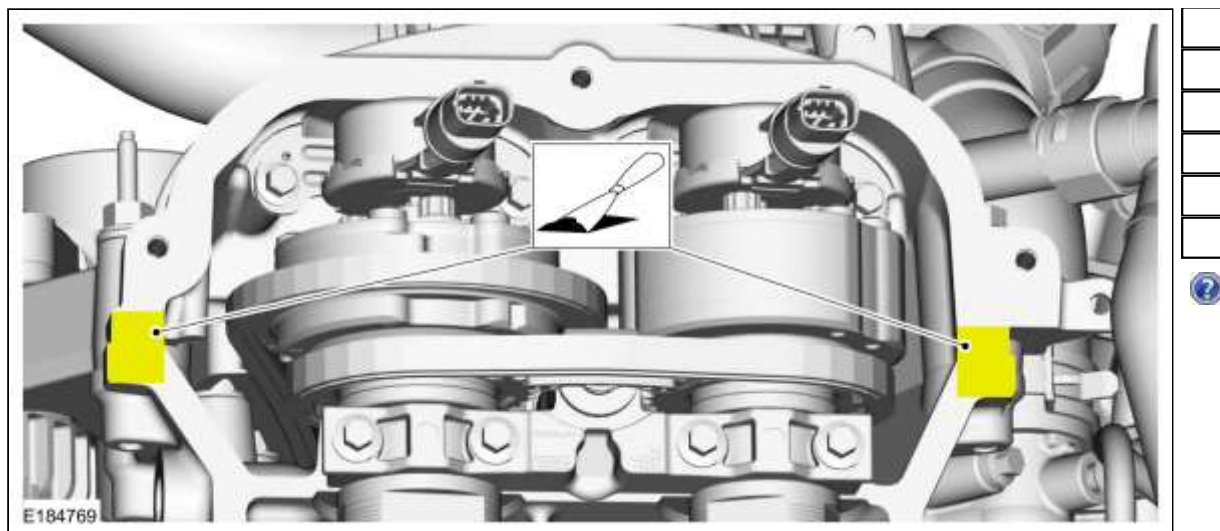
Cone.



25. 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.](#)



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

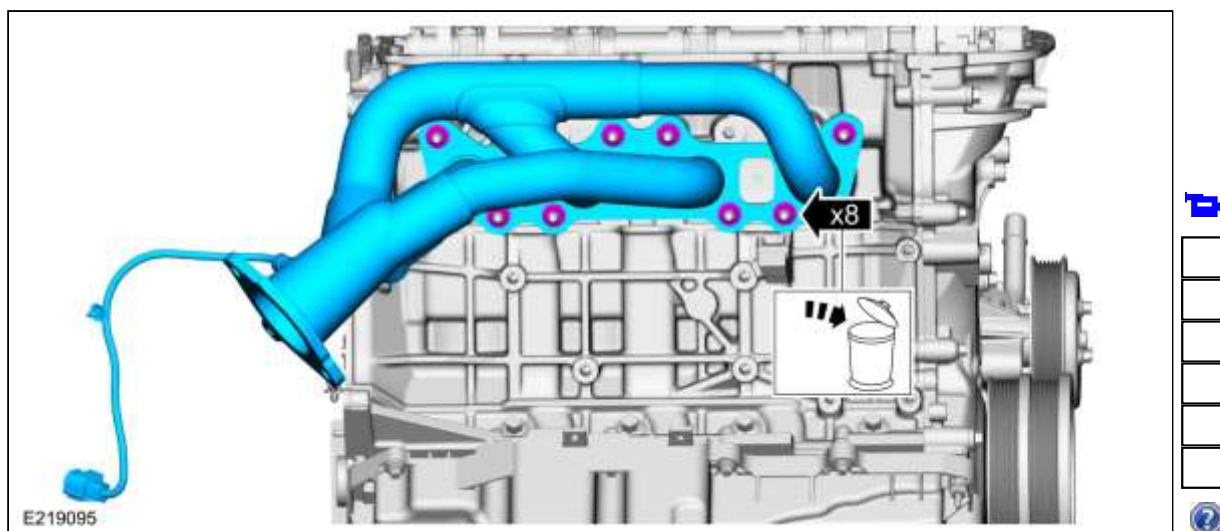


27.

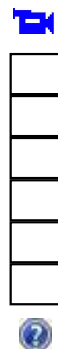
Remove and discard the nuts.

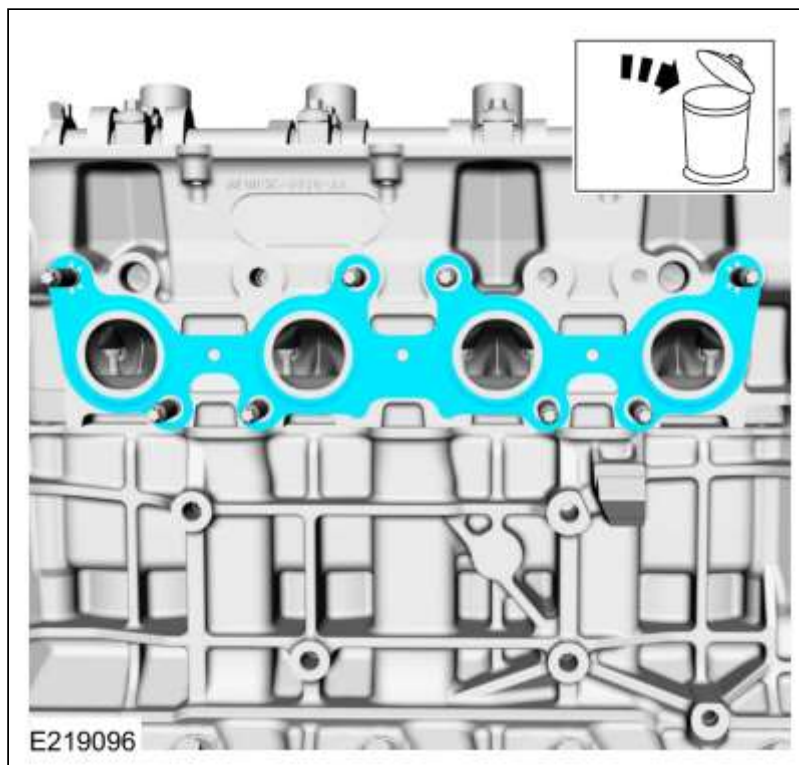
- Remove the exhaust manifold.
- Clean and inspect the exhaust manifold.

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

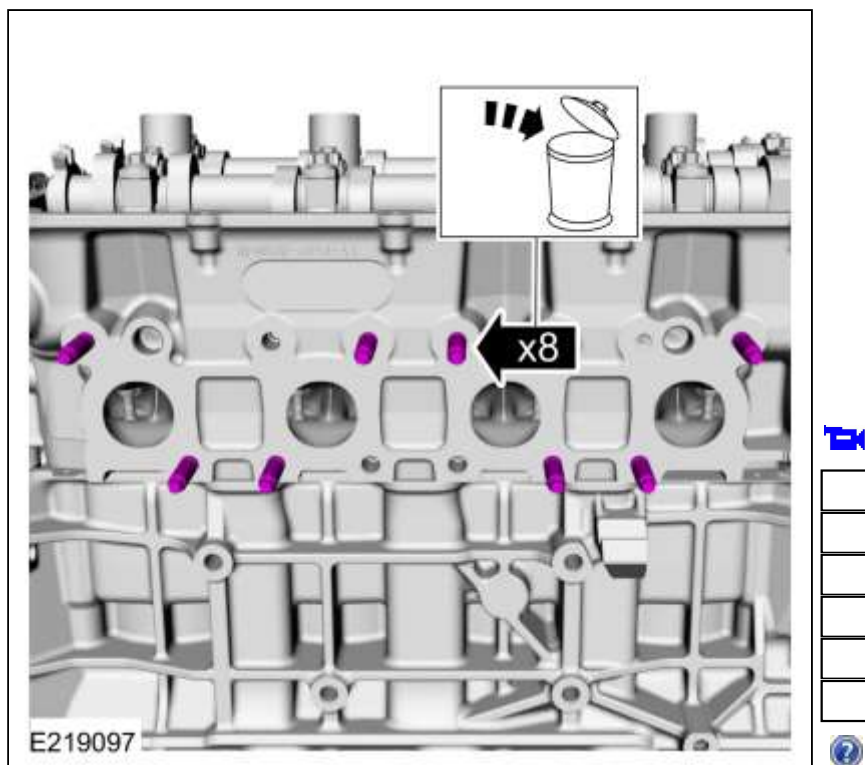


28. Remove and discard the gasket.





29. Remove and discard the studs.



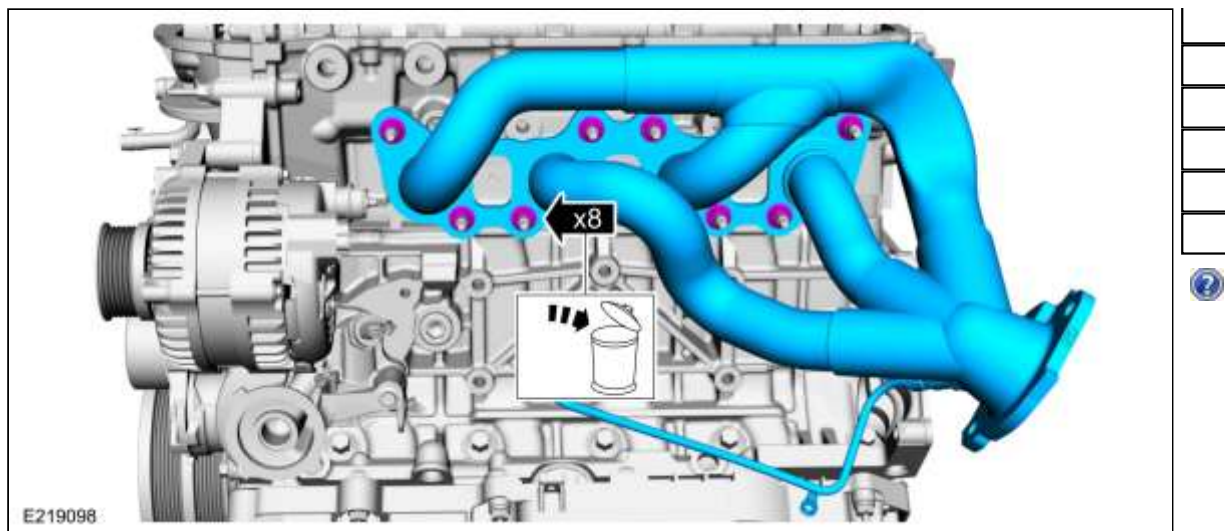
30.

Remove and discard the nuts.

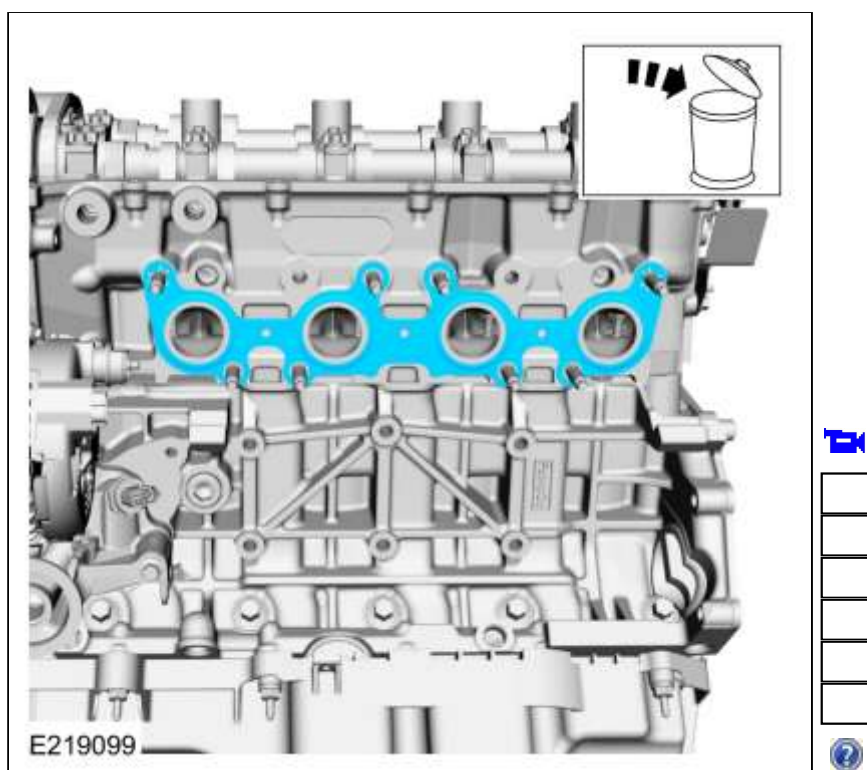
- Remove the exhaust manifold.
- Clean and inspect the exhaust manifold.

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

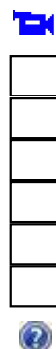


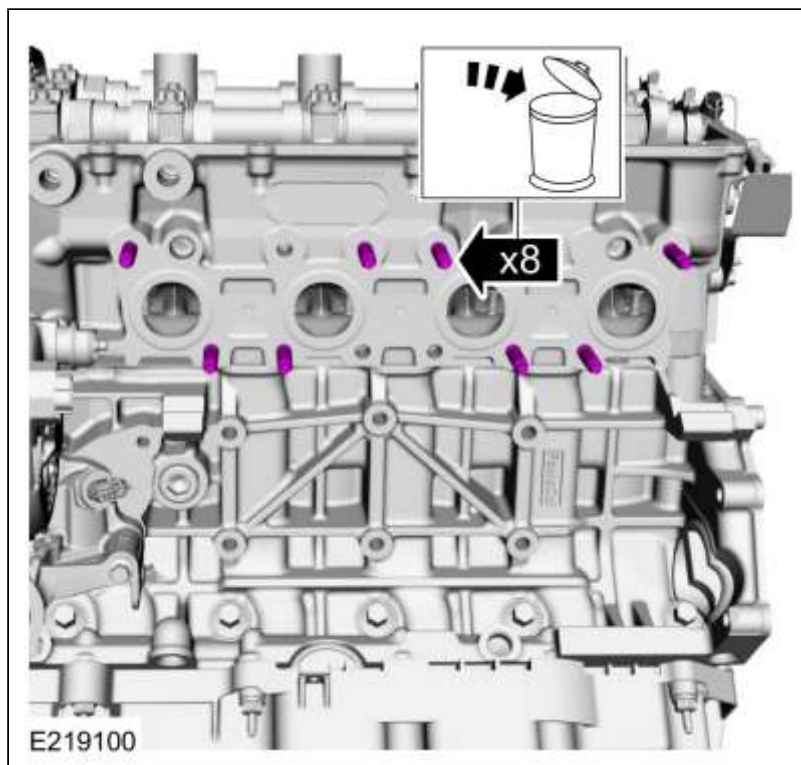


31. Remove and discard the gasket.

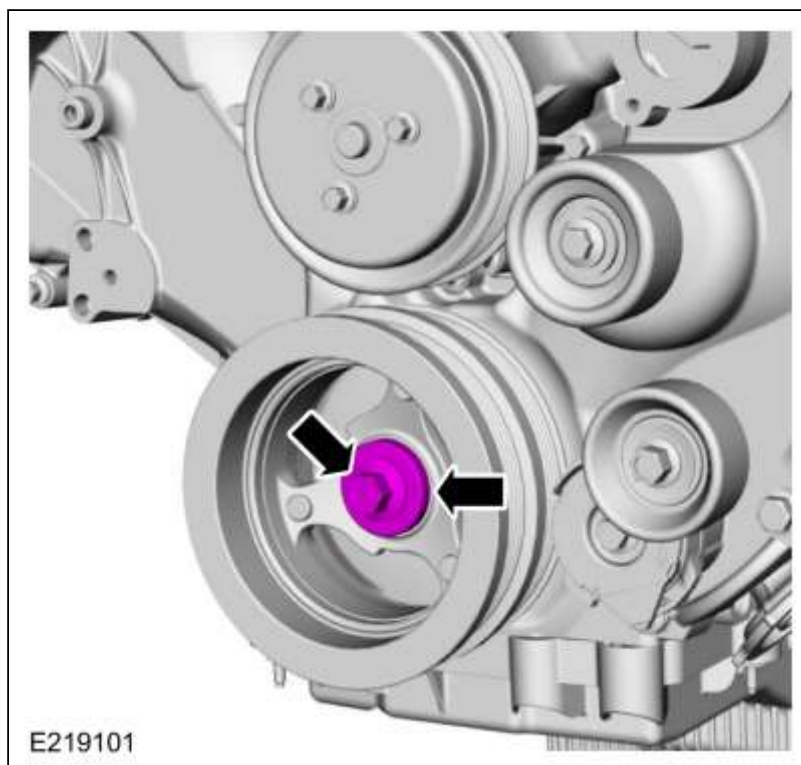


32. Remove and discard the studs.





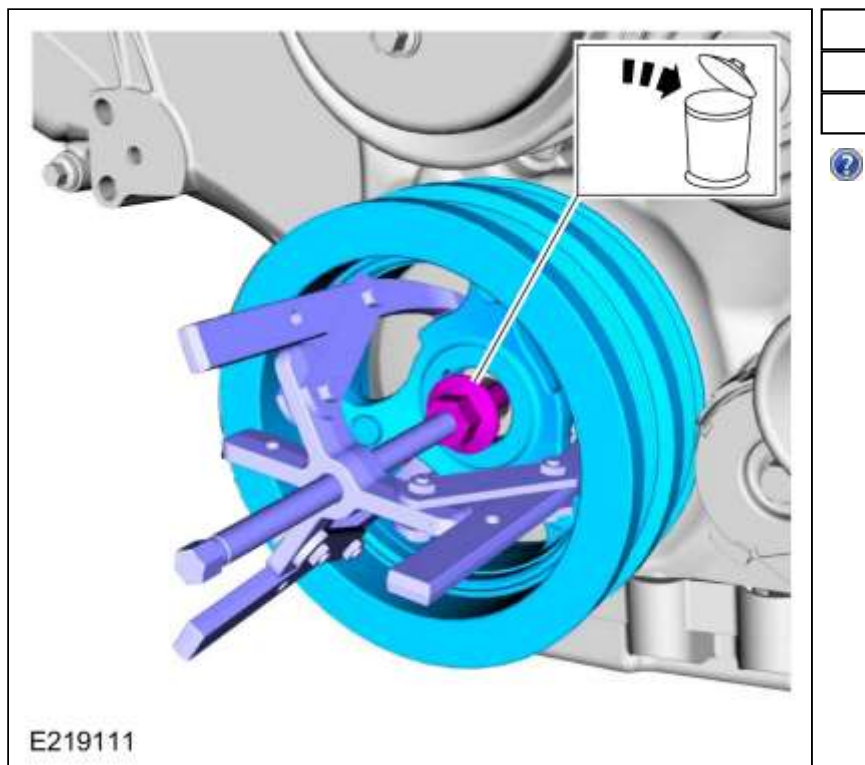
33. Remove the crankshaft pulley bolt and washer.





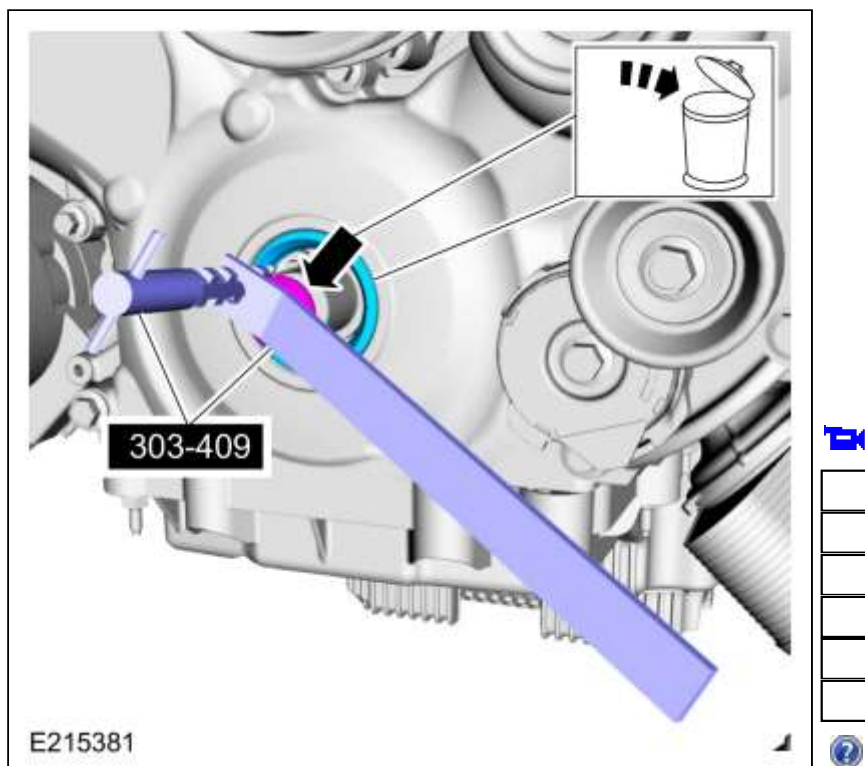
- 34.
- Using the 3 Leg Puller and the crankshaft pulley bolt, remove the crankshaft pulley. Use the General Equipment: Three Leg Puller
 - Discard the crankshaft pulley bolt.



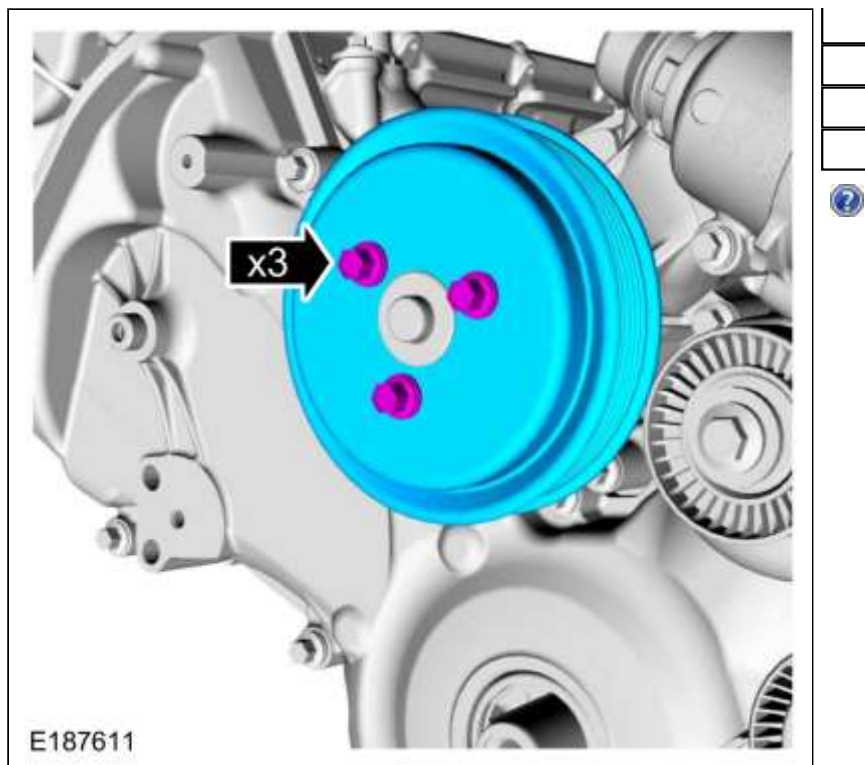


35. **NOTICE:** Use care not to damage the engine front cover or the crankshaft when removing the seal.

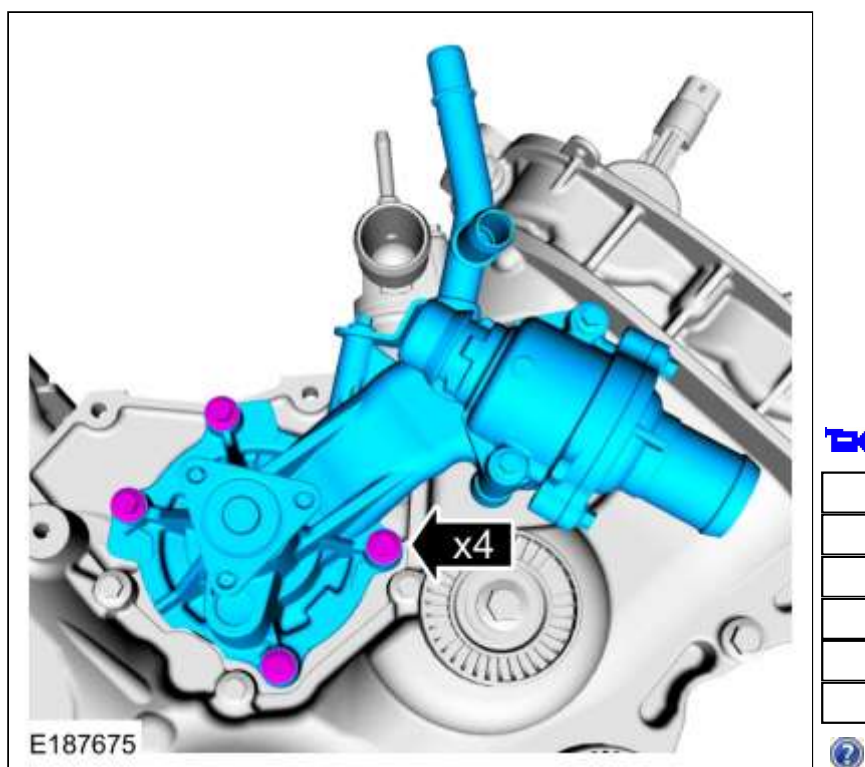
Using the special tool, remove and discard the crankshaft front oil seal.
 Use Special Service Tool: [303-409 \(T92C-6700-CH\) Remover, Crankshaft Seal.](#)



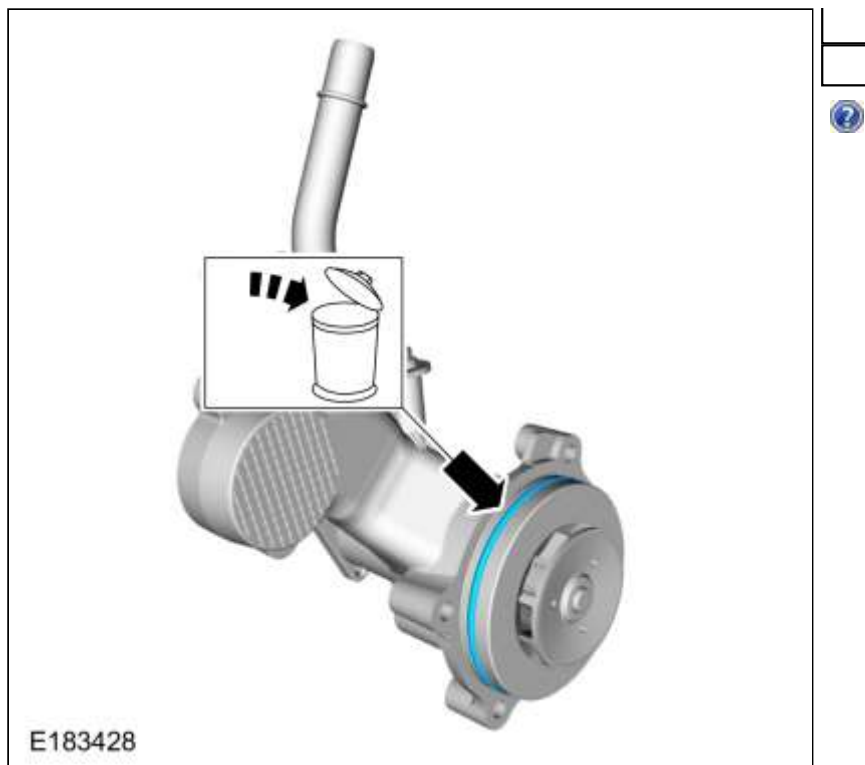
36. Remove the bolts and the coolant pump pulley.



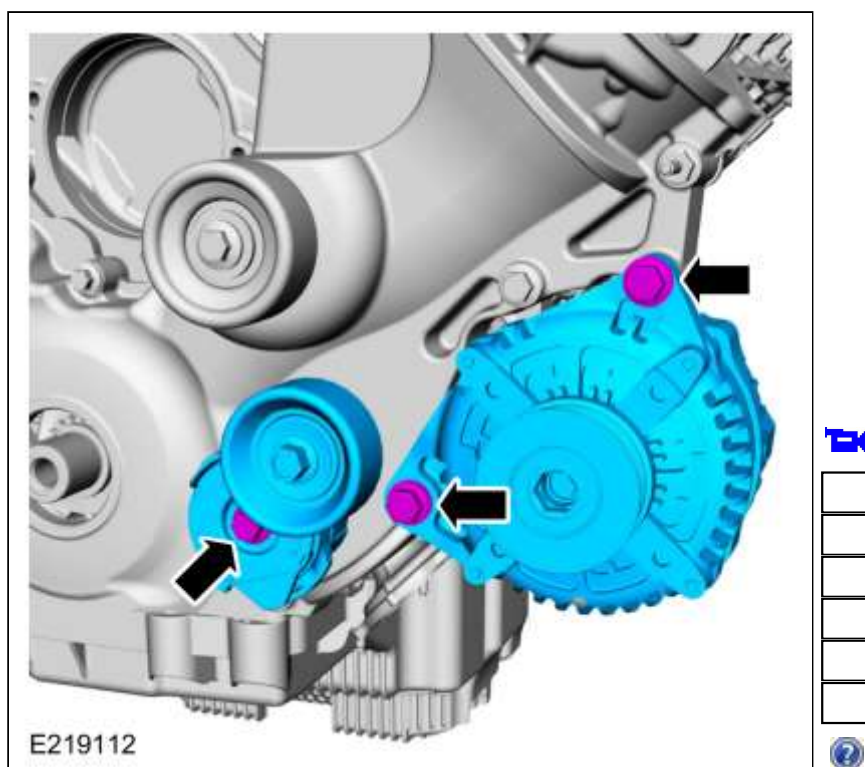
37. Remove the bolts and the coolant pump.



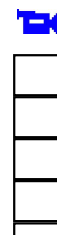
38. Remove and discard the coolant pump O-ring seal.

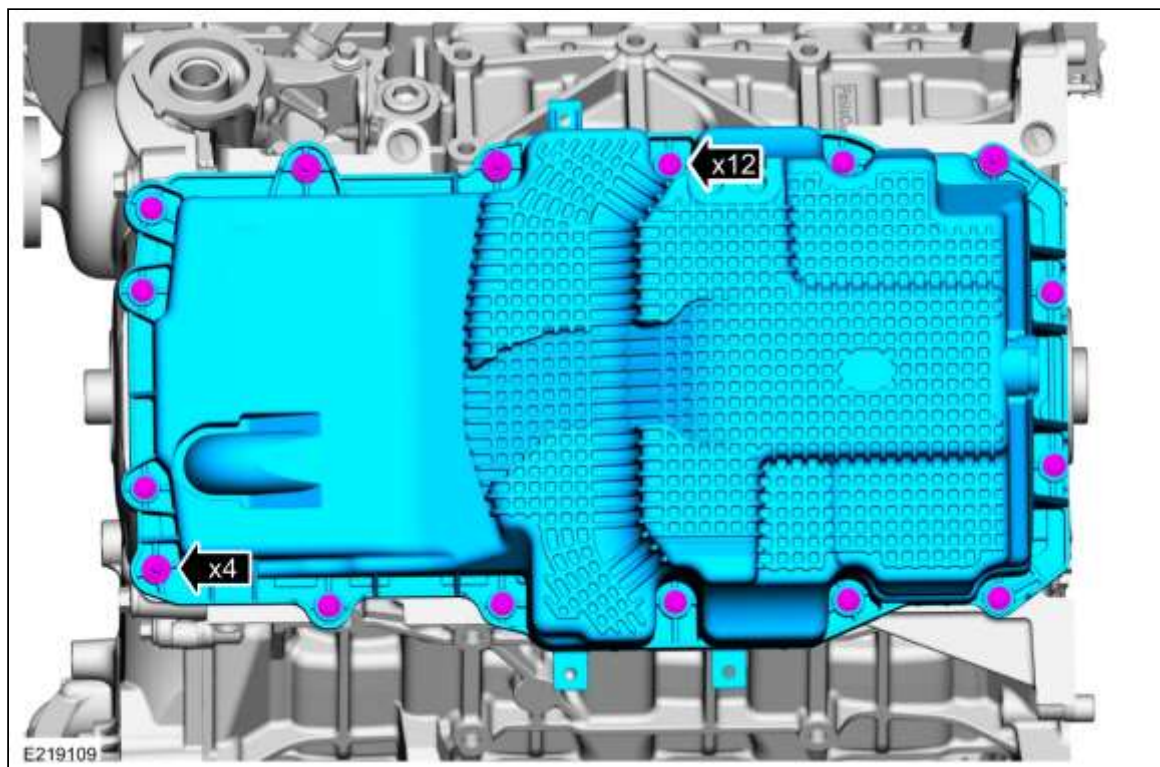


39. Remove the nut, the bolt and the generator.

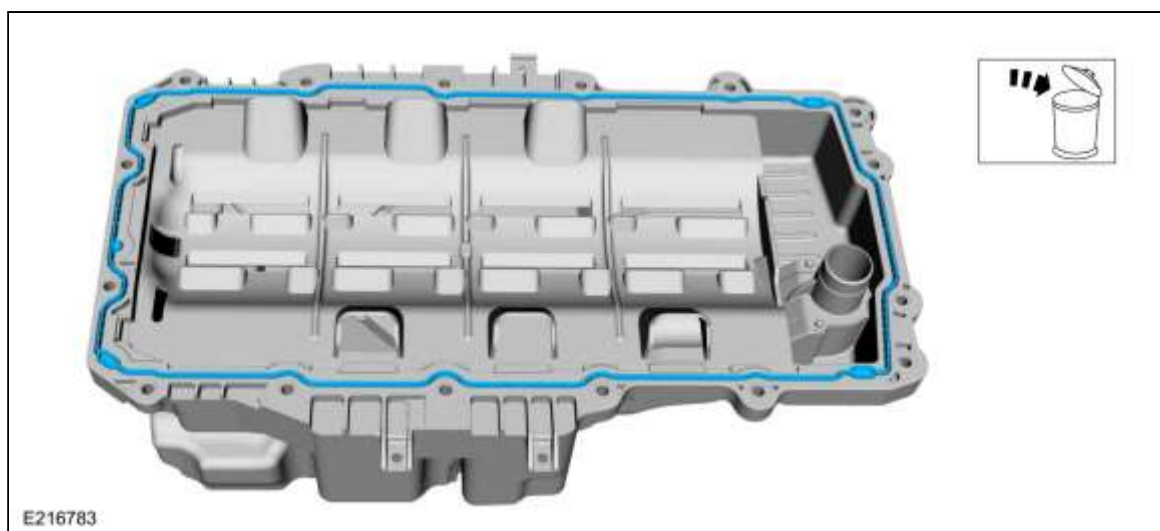


40. Remove the plug.



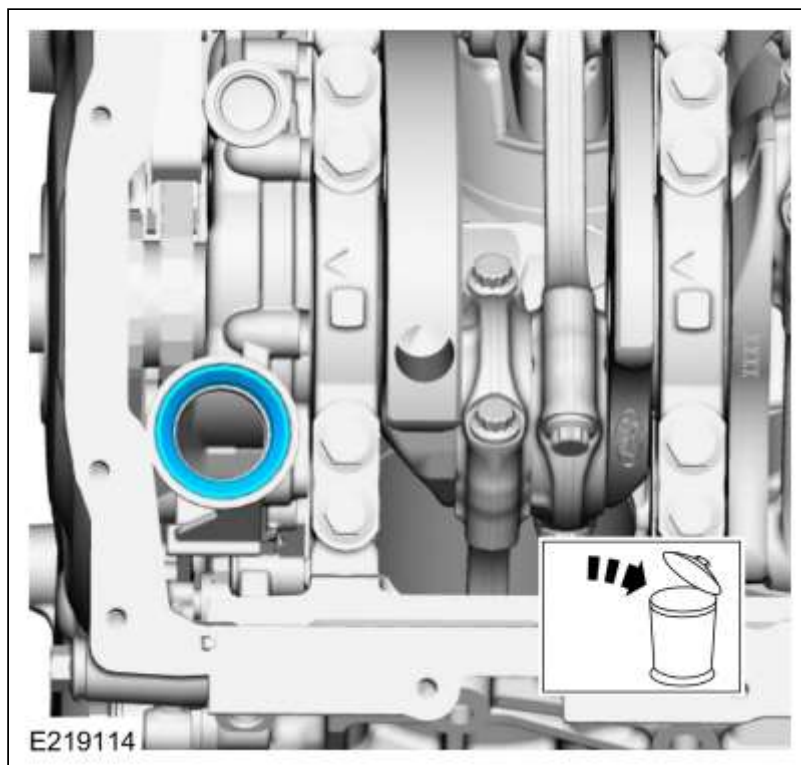


43. Remove and discard the oil pan gasket.



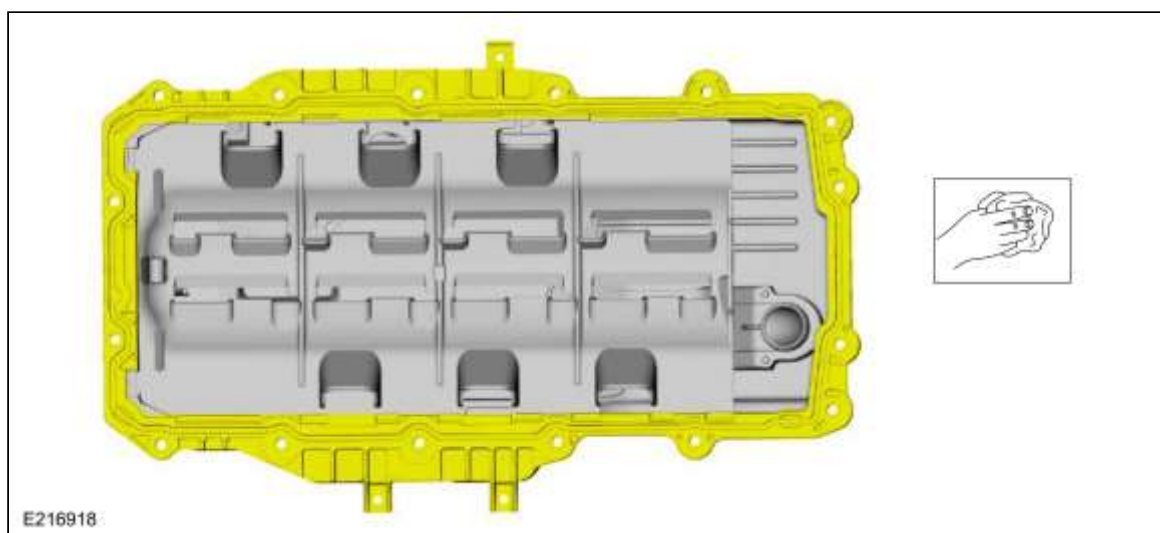
44. Remove and discard the oil pump pickup seal.





45. **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.

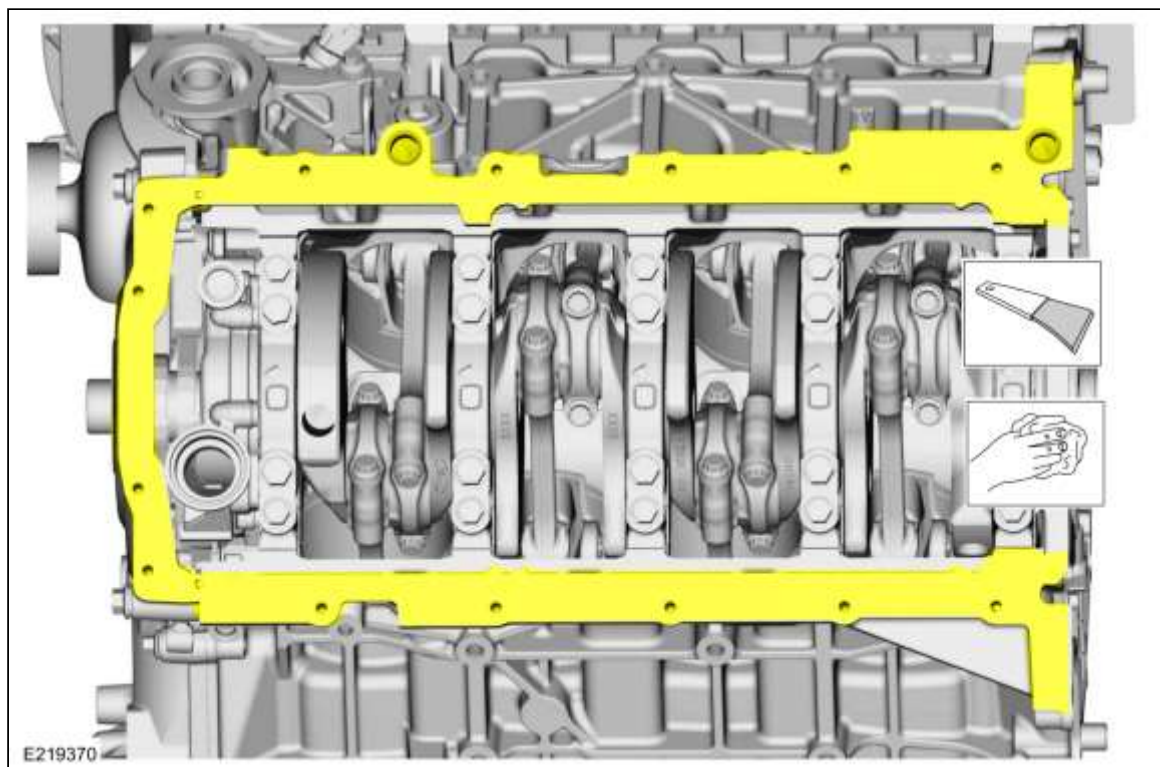
Make sure that the mating faces are clean and free of foreign material.



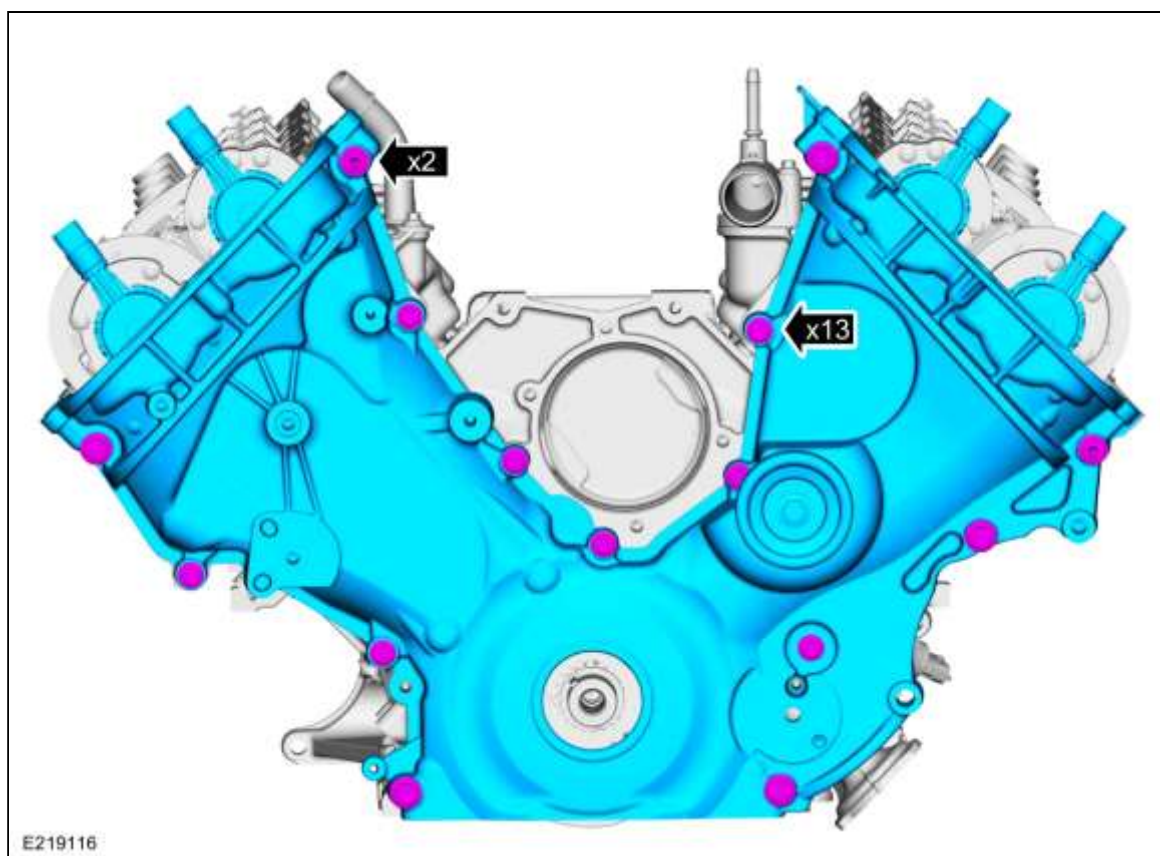
46. Clean and prepare the RTV sealing surface.
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).



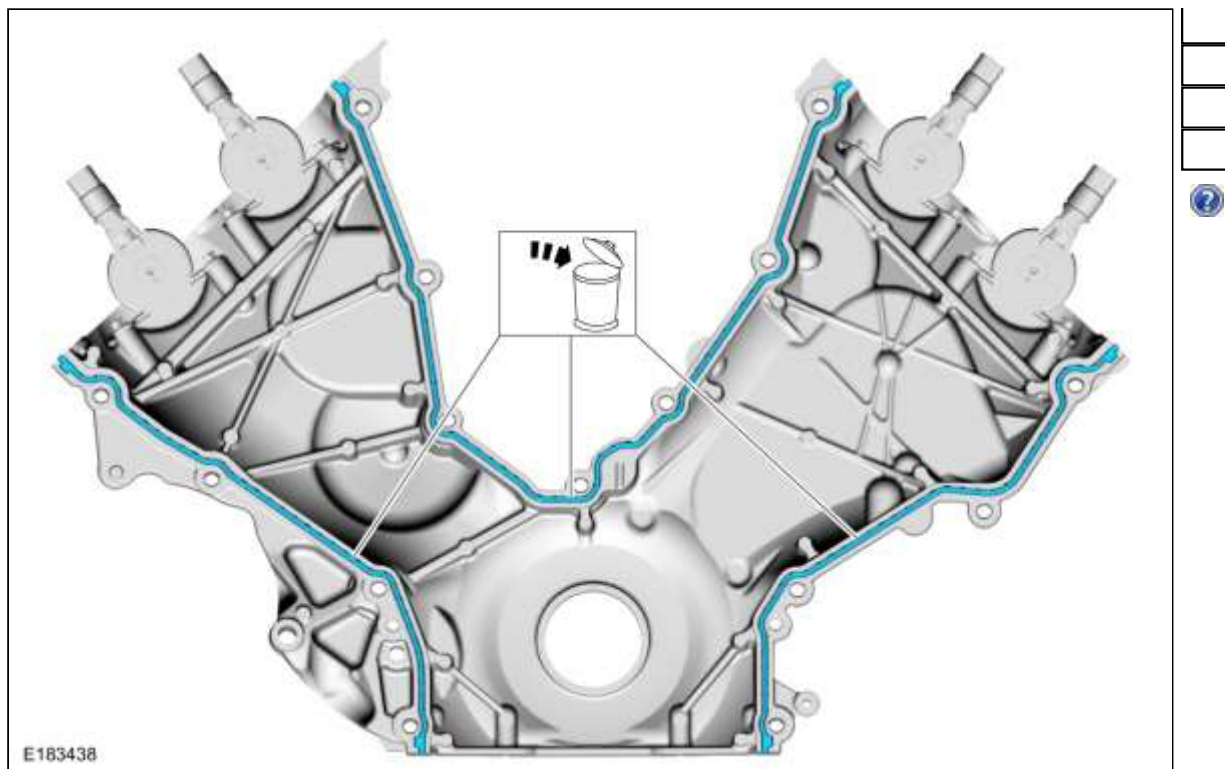




47. Remove the fasteners and the engine front cover.

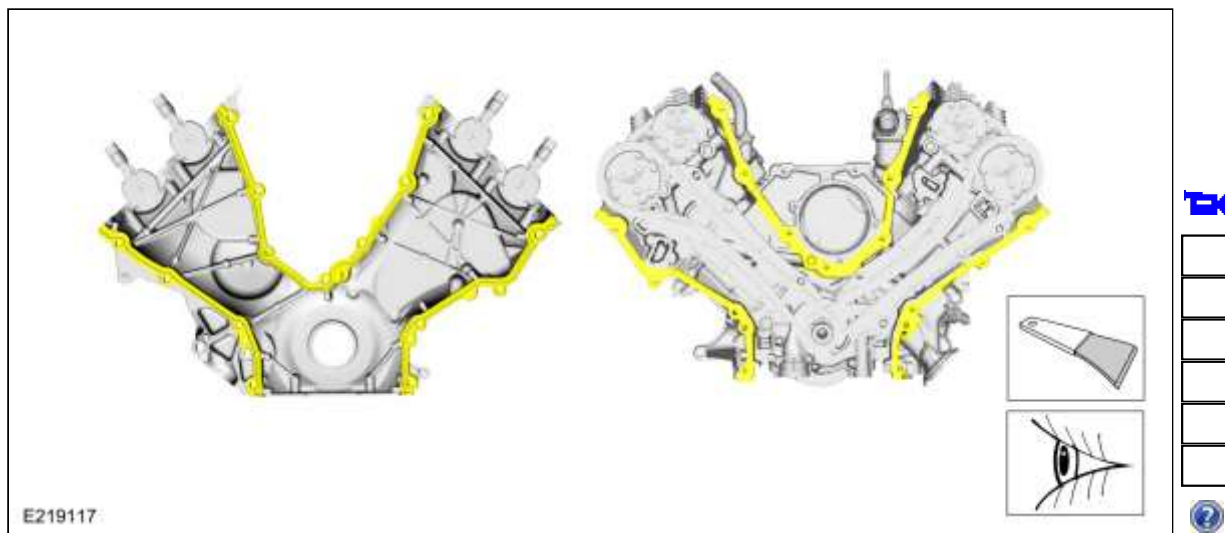


48. Remove and discard the gaskets.



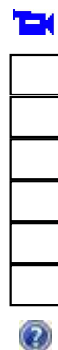
49. Clean and prepare the RTV sealing surface.

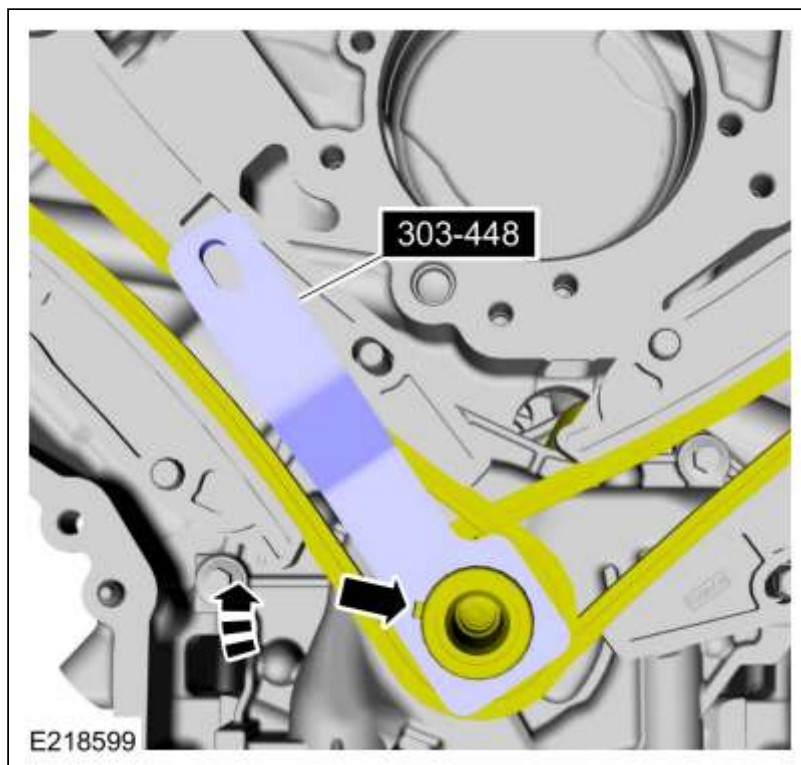
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).



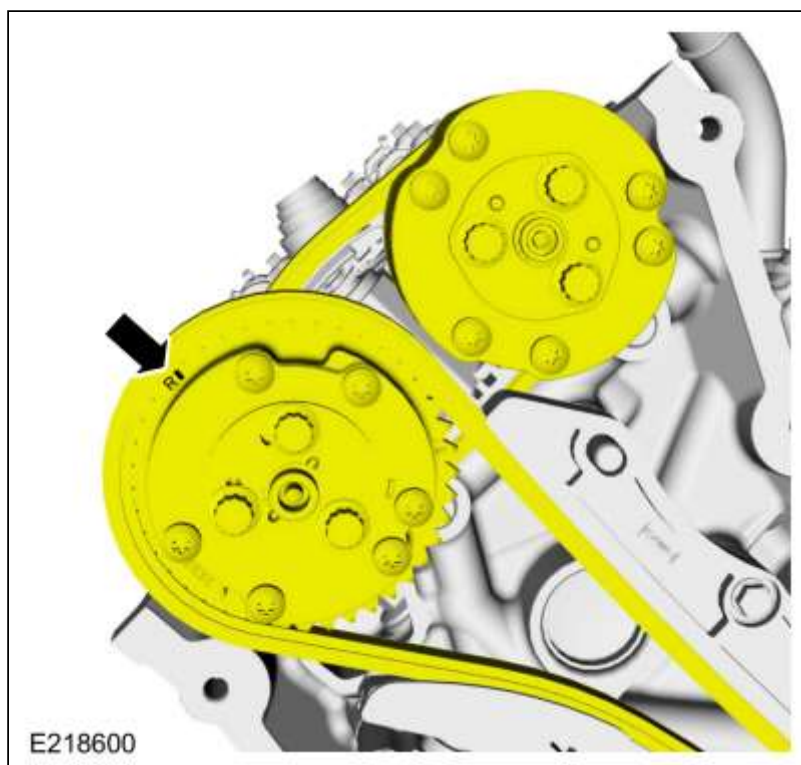
50. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 9:30 position.

Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).

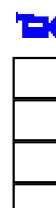


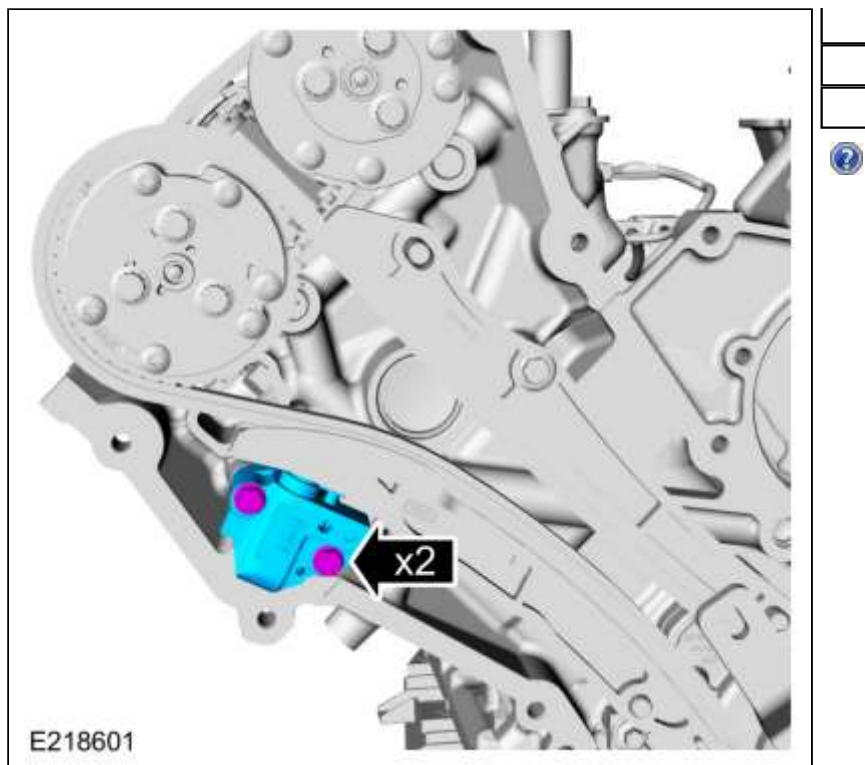


51. Verify the timing mark on the RH VCT unit is on top, if not, rotate the crankshaft clockwise one complete revolution so the keyway is at the 9:30 position.



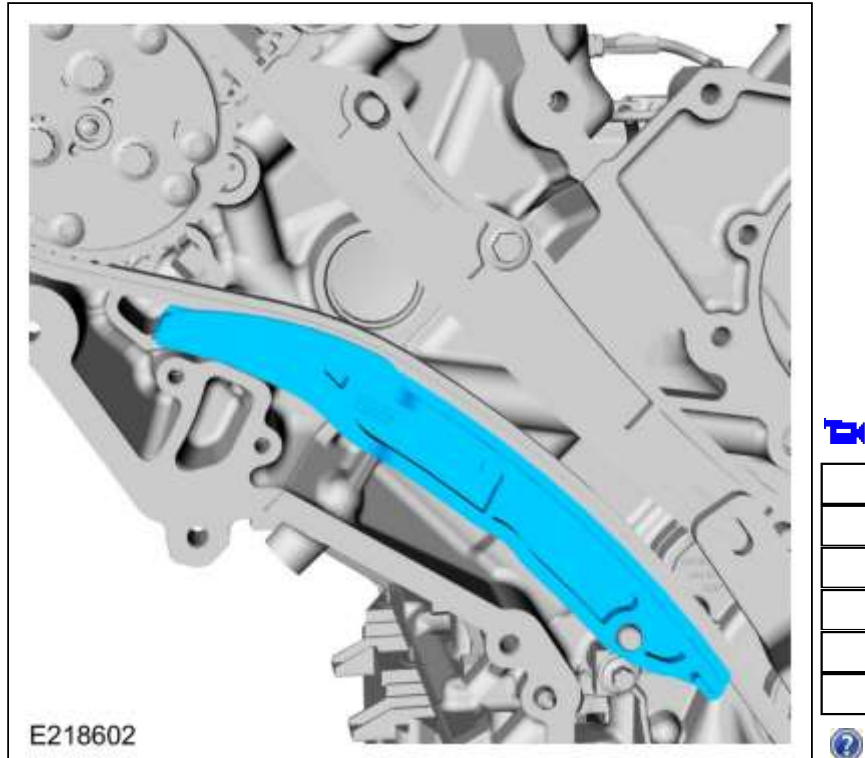
52. Remove the bolts and the RH primary timing chain tensioner.





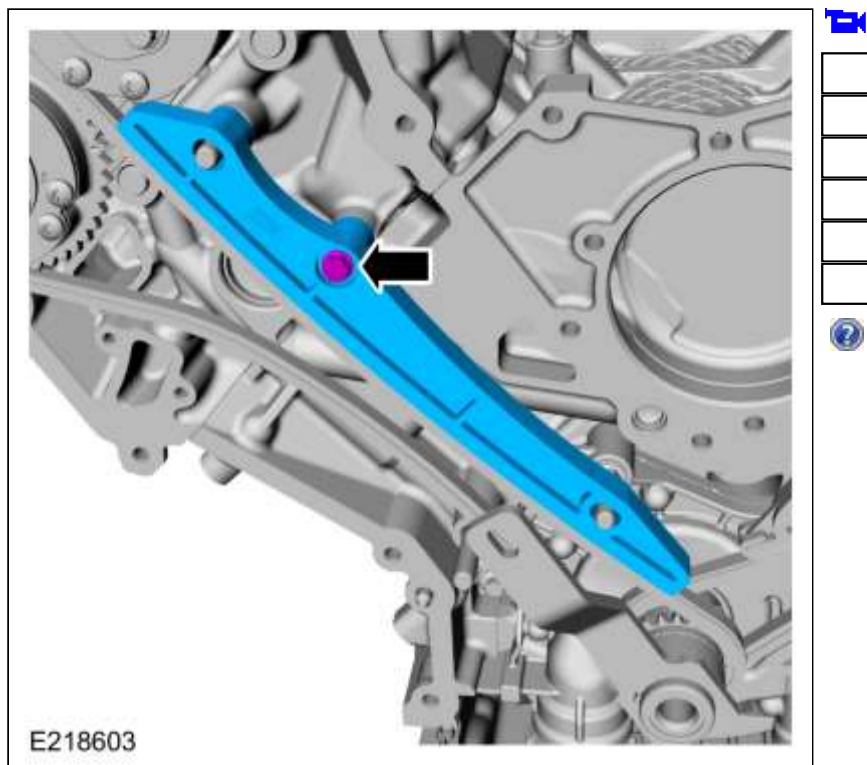
53. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain tensioner arm. Return the crankshaft keyway to the 9:30 position after removing the RH timing chain tensioner arm.

Remove the RH timing chain tensioner arm.

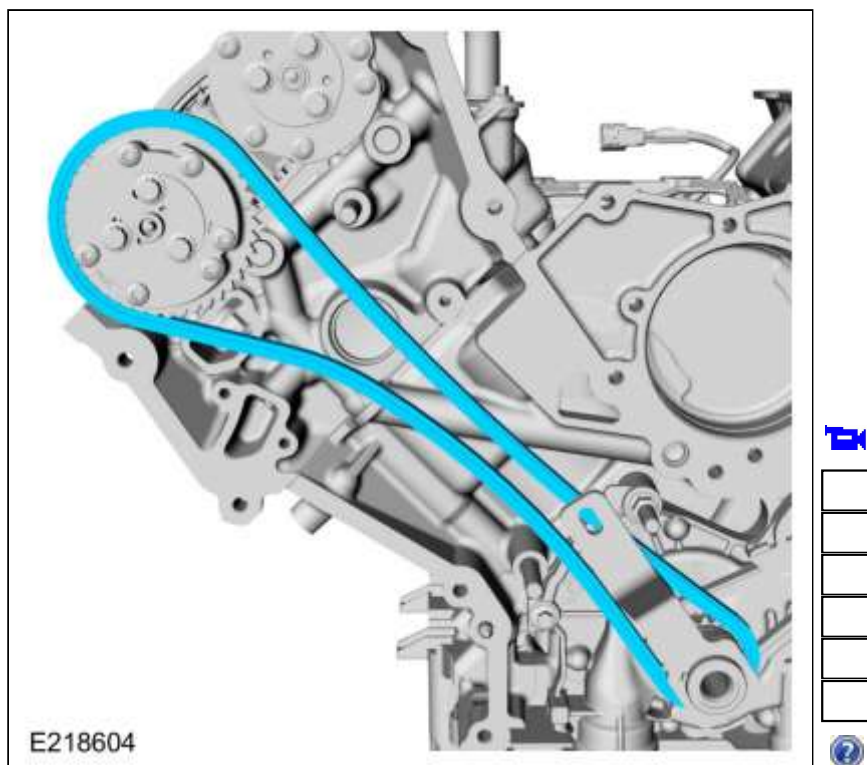


54. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the RH timing chain guide. Return the crankshaft keyway to the 9:30 position after removing the RH timing chain guide.

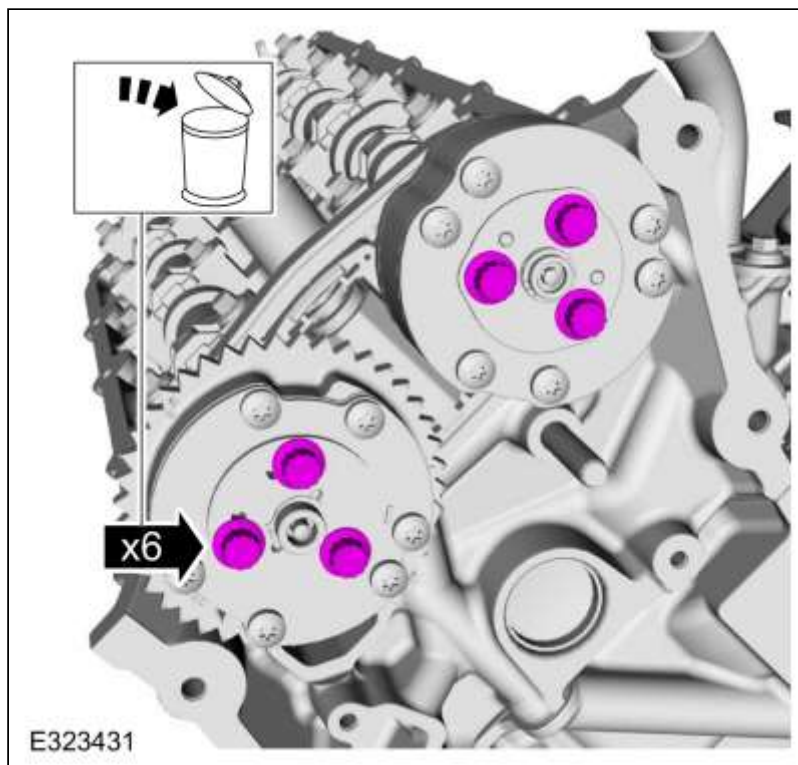
Remove the bolt and the RH timing chain guide.



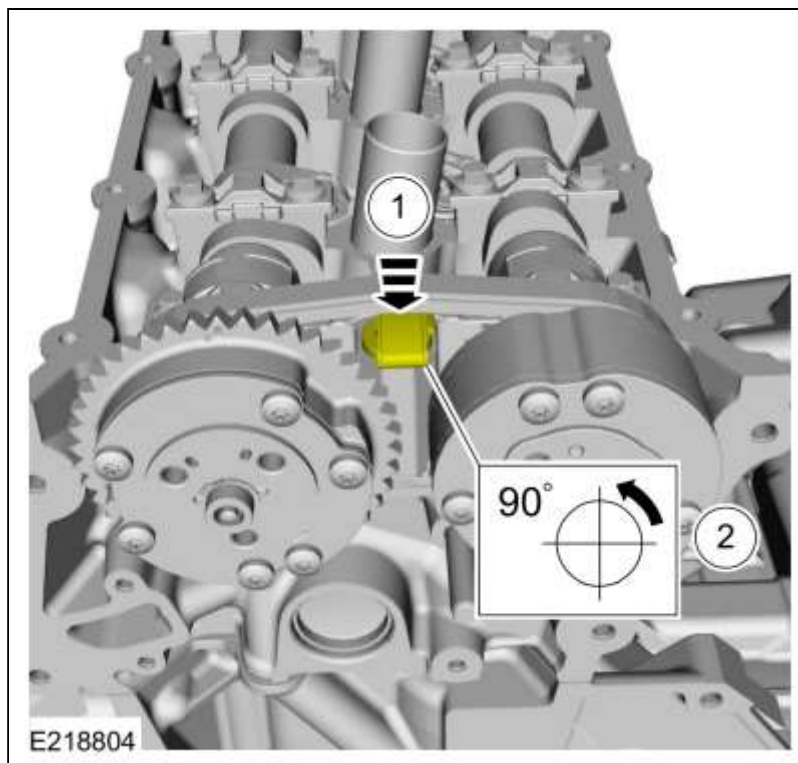
55. Remove the RH timing chain.



56. Remove and discard the intake and exhaust VCT assembly bolts.

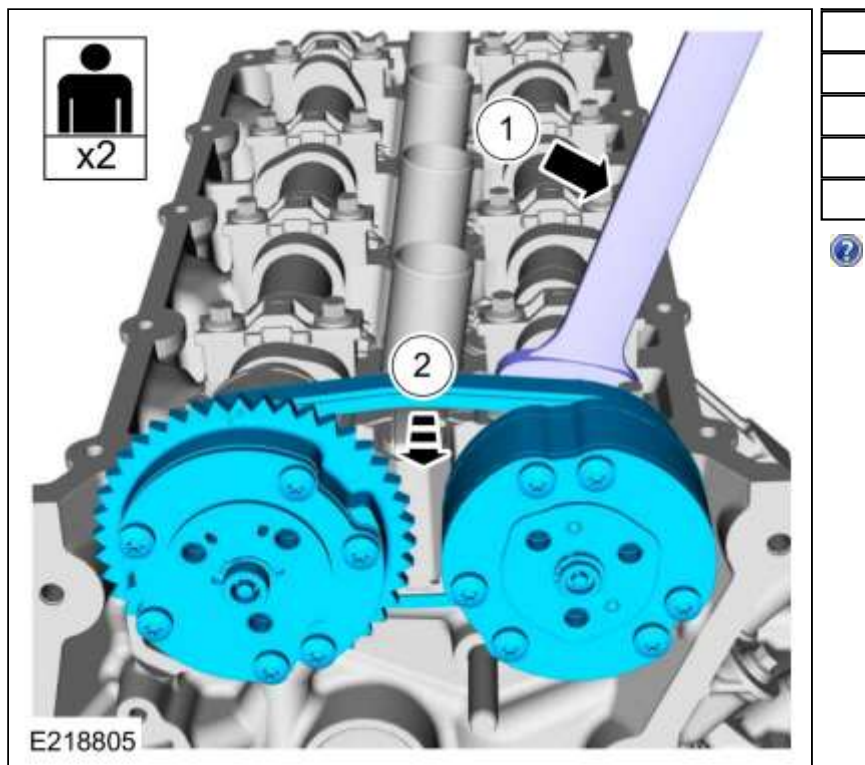


57. 1. Depress the secondary timing chain tensioner.
2. Turn the tensioner counterclockwise 90 degrees.

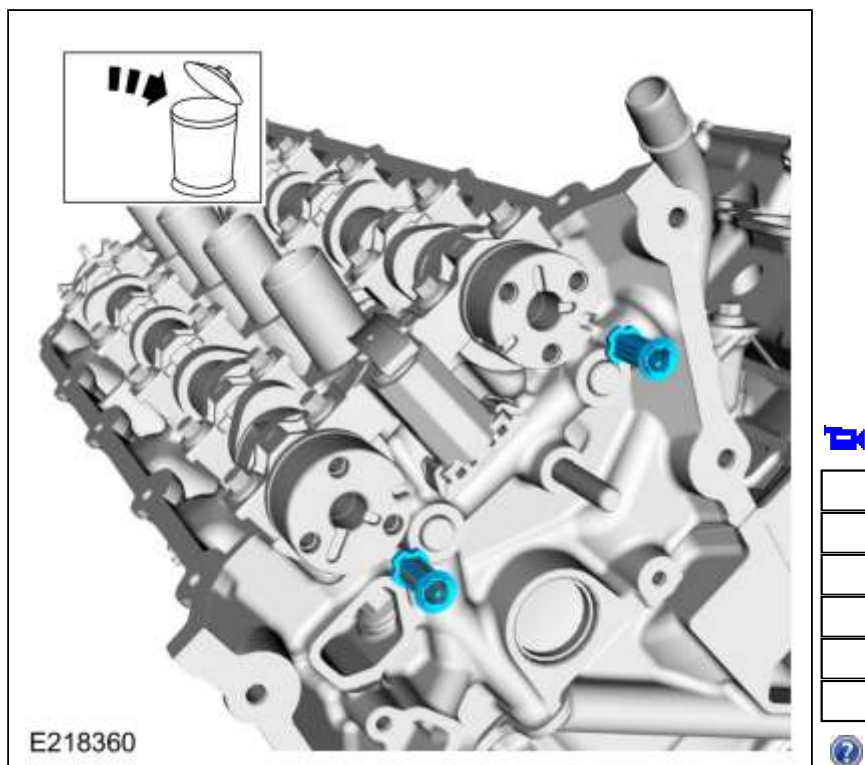


58. **NOTE:** Valve spring pressure will rotate the intake camshaft clockwise after the VCT units are removed.

1. Using a wrench on the flats of the camshaft, have an assistant hold the intake camshaft in position to prevent valve spring pressure from binding the locating pin of the VCT in the end of the camshaft.
2. Slide the VCT units and secondary timing chain off of the camshafts as an assembly.



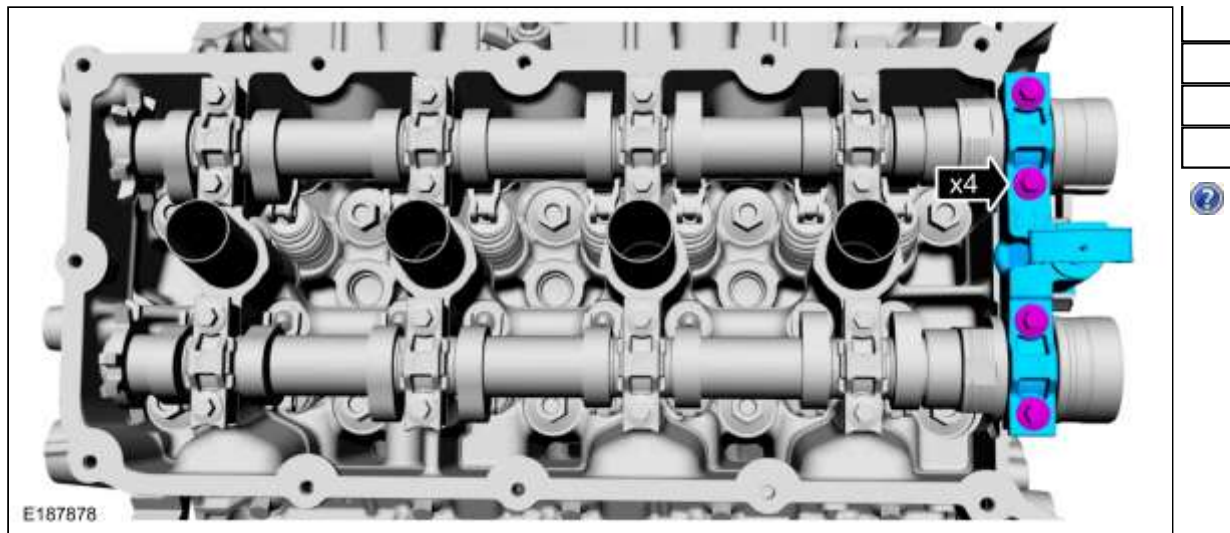
59. Remove the VCT system oil filters from the camshafts.



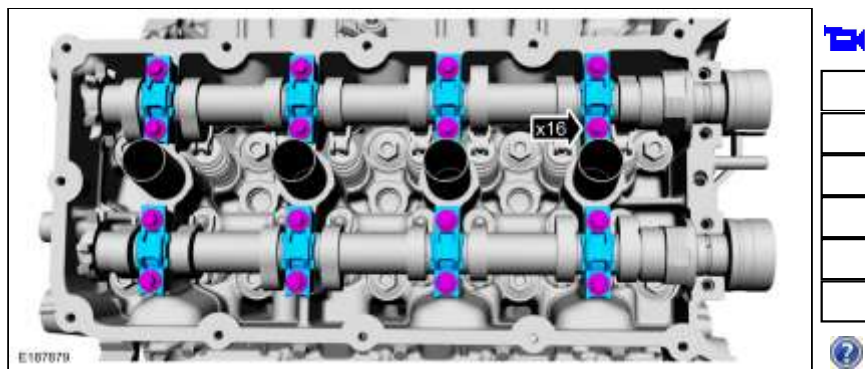
60. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

Remove the bolts and the front camshaft bearing mega cap.

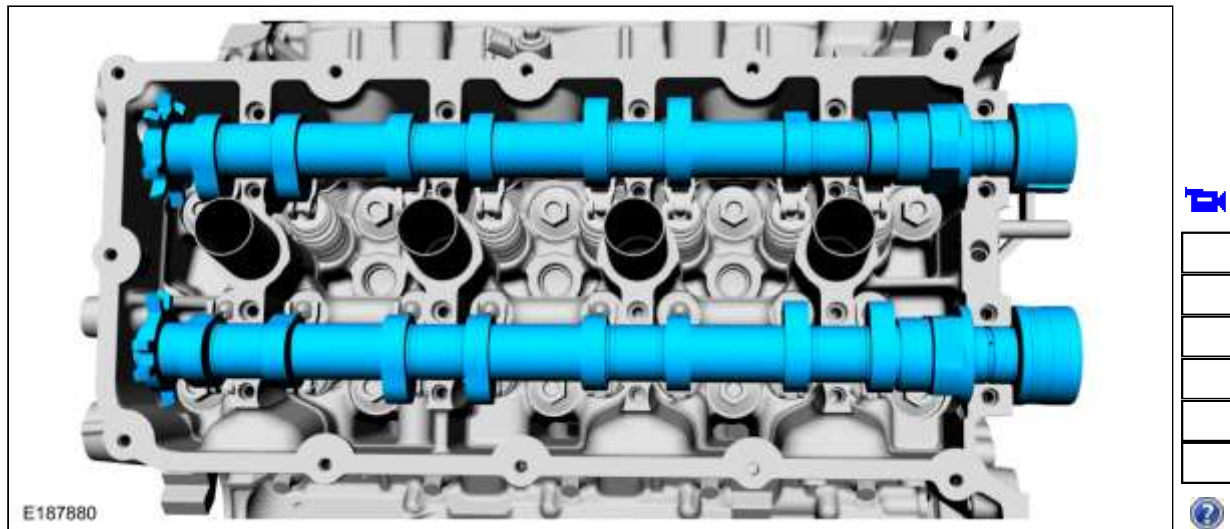




61. Remove the bolts and the camshaft bearing caps.

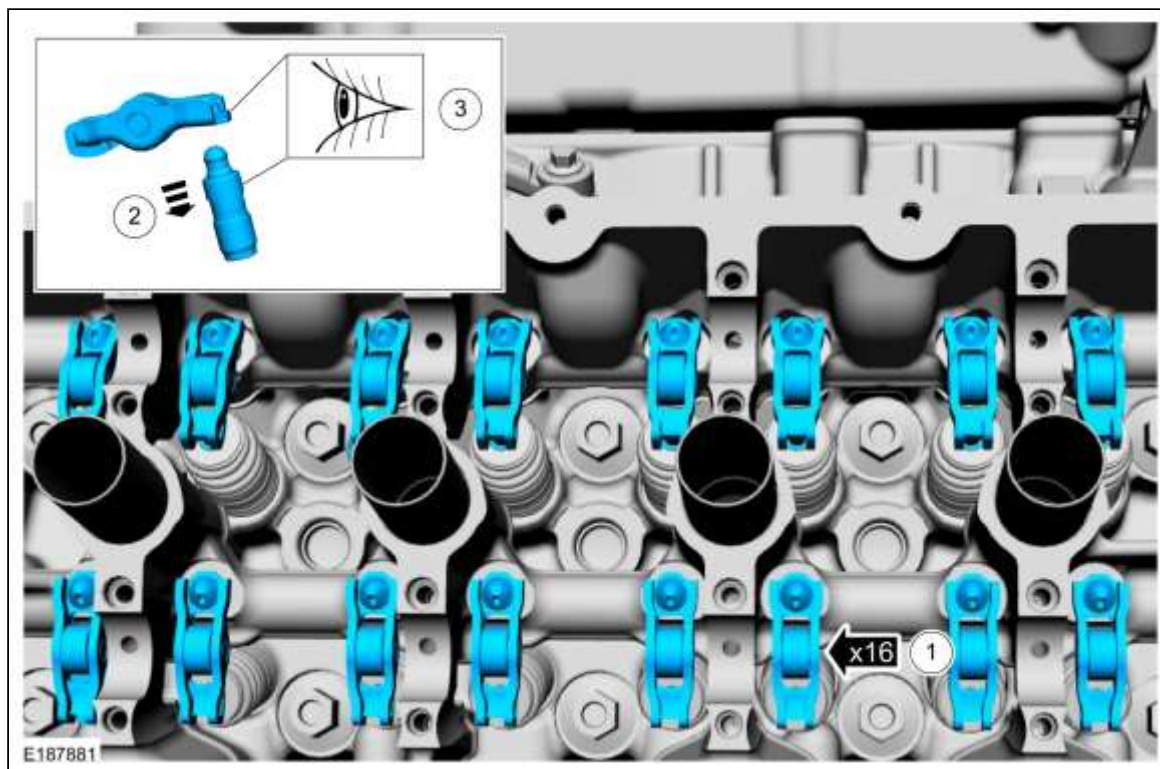


62. Remove the intake and exhaust camshafts.

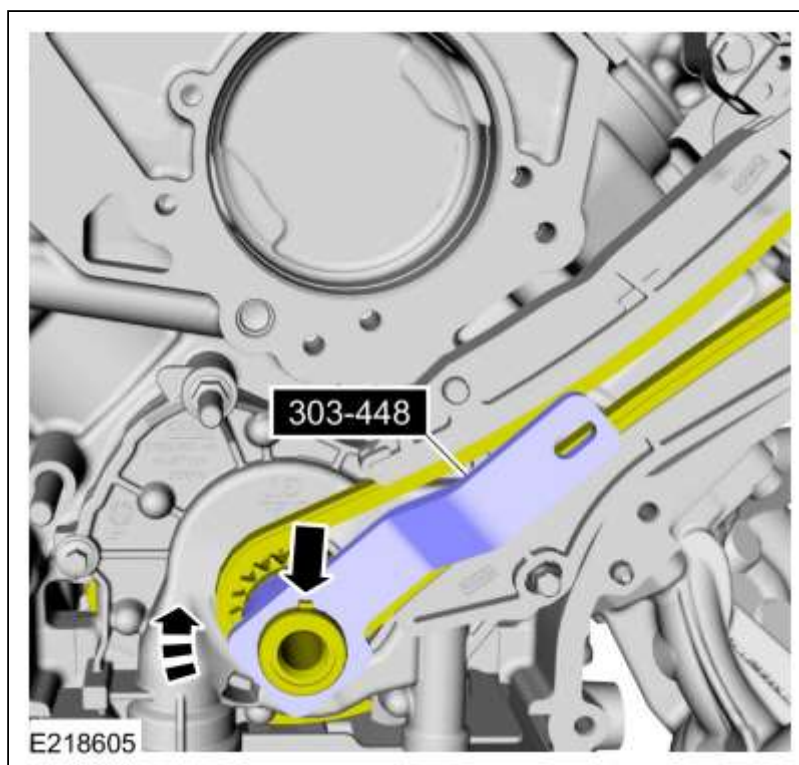


63. 1. Remove the camshaft roller follower and hydraulic lash adjusters.
2. **NOTE:** Early build date engines are not equipped with spring clips on the camshaft roller followers.
- Separate the hydraulic lash adjusters from the spring clips on the camshaft roller followers.
3. Inspect the hydraulic lash adjusters and roller followers for damage. If any damage is found, inspect the camshaft lobes and valves for damage. Replace damaged components as necessary.

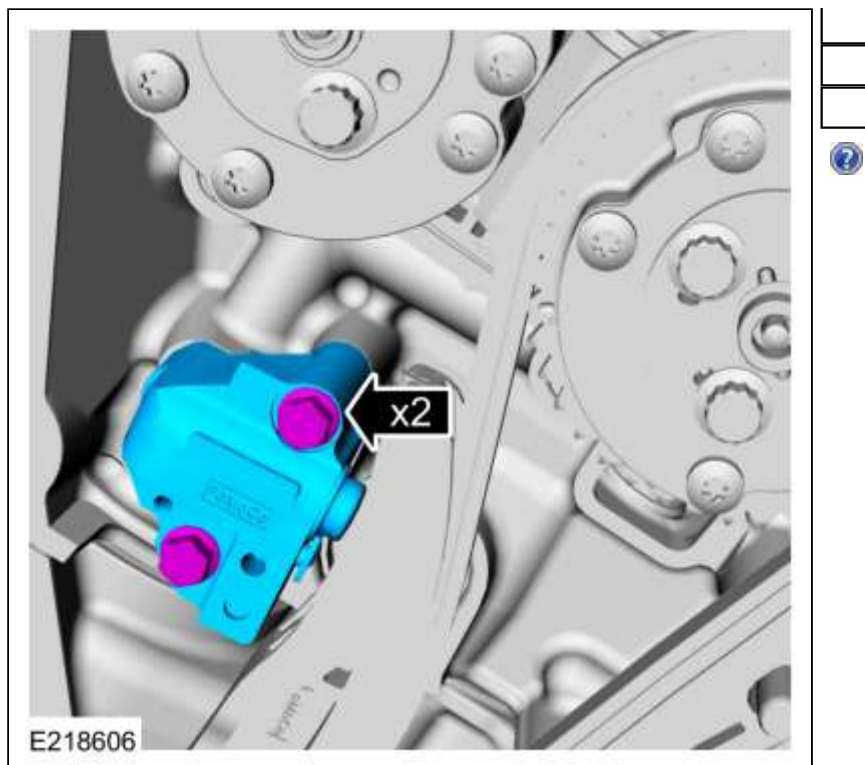




64. Using the special tool, rotate the crankshaft clockwise until the keyway is at the 12:30 position.
Use Special Service Tool: [303-448 \(T93P-6303-A\) Holding Tool, Crankshaft](#).

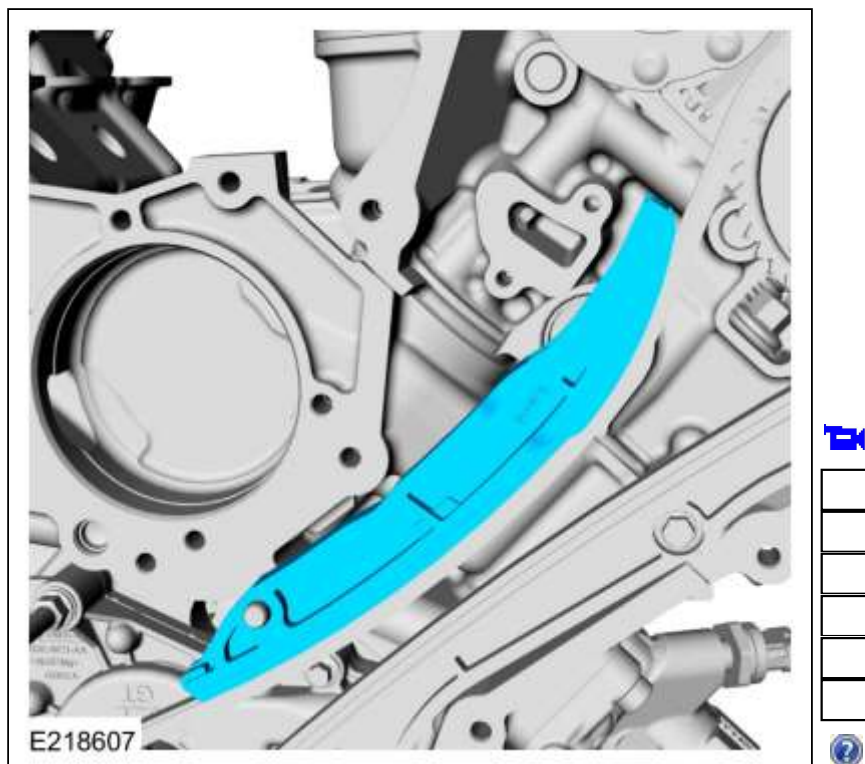


65. Remove the bolts and the LH primary timing chain tensioner.



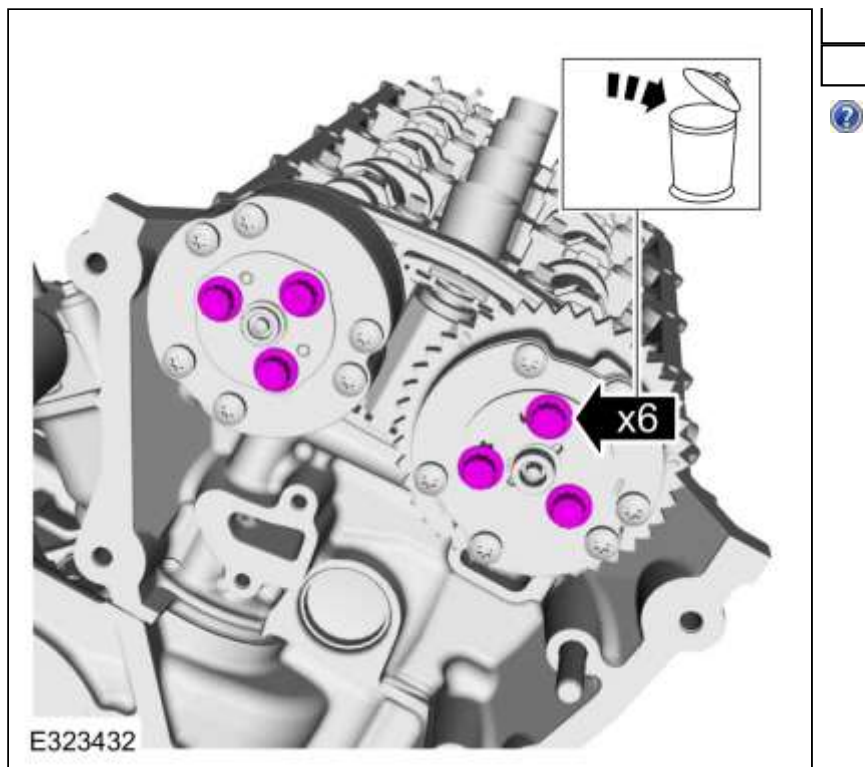
66. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain tensioner arm. Return the crankshaft keyway to the 12:30 position after removing the LH timing chain tensioner arm.

Remove the LH timing chain tensioner arm.

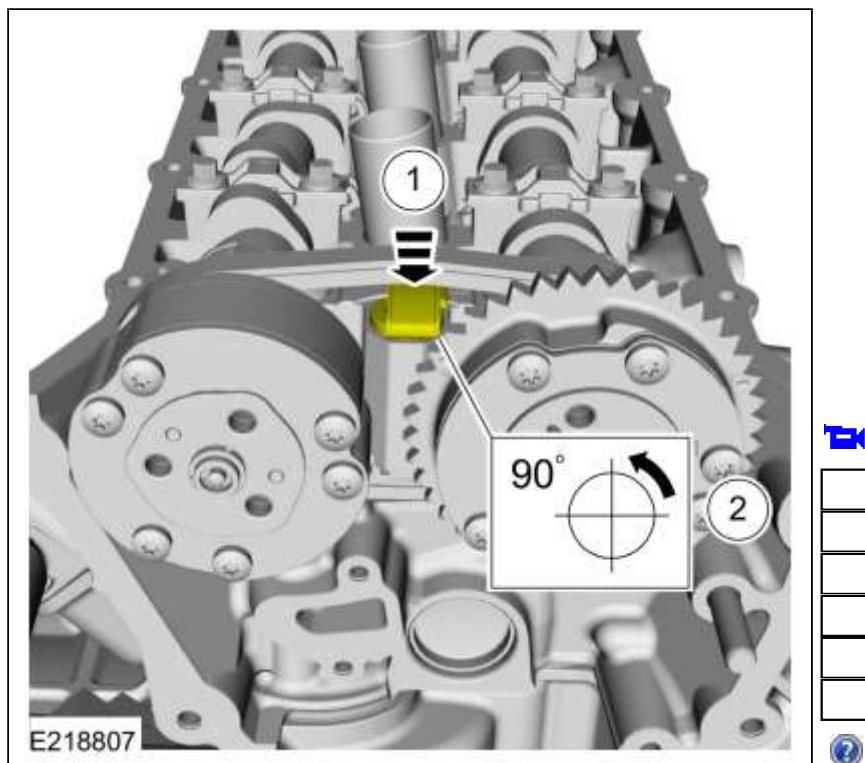


67. **NOTE:** It may be necessary to rotate the crankshaft slightly to provide enough slack in the chain to remove the LH timing chain guide. Return the crankshaft keyway to the 12:30 position after removing the LH timing chain guide.

Remove the bolt and the LH timing chain guide.

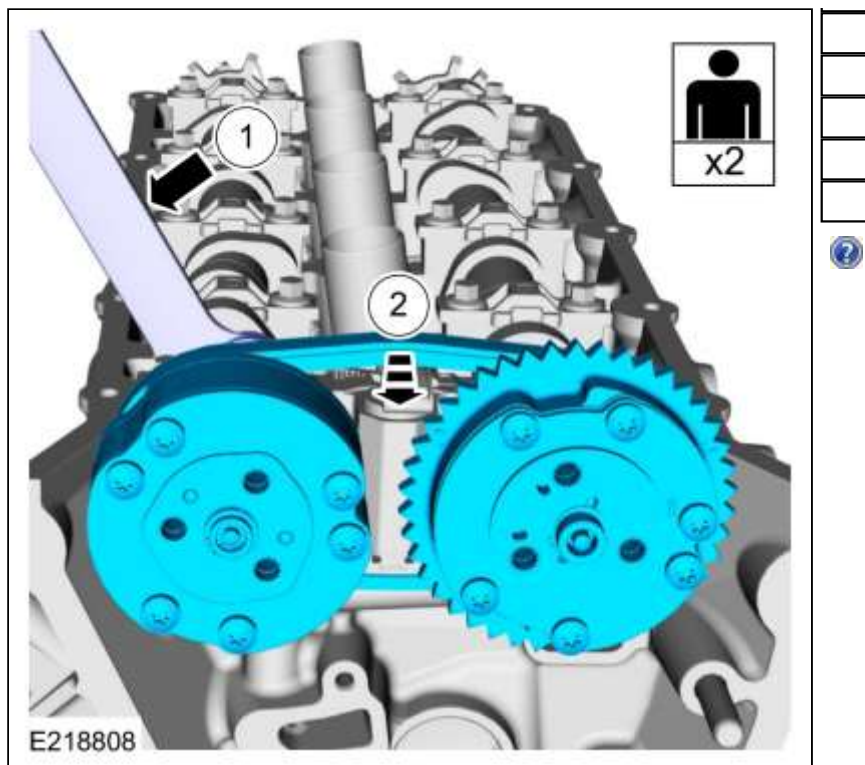


70. 1. Depress the secondary timing chain tensioner.
2. Turn the tensioner counterclockwise 90 degrees.

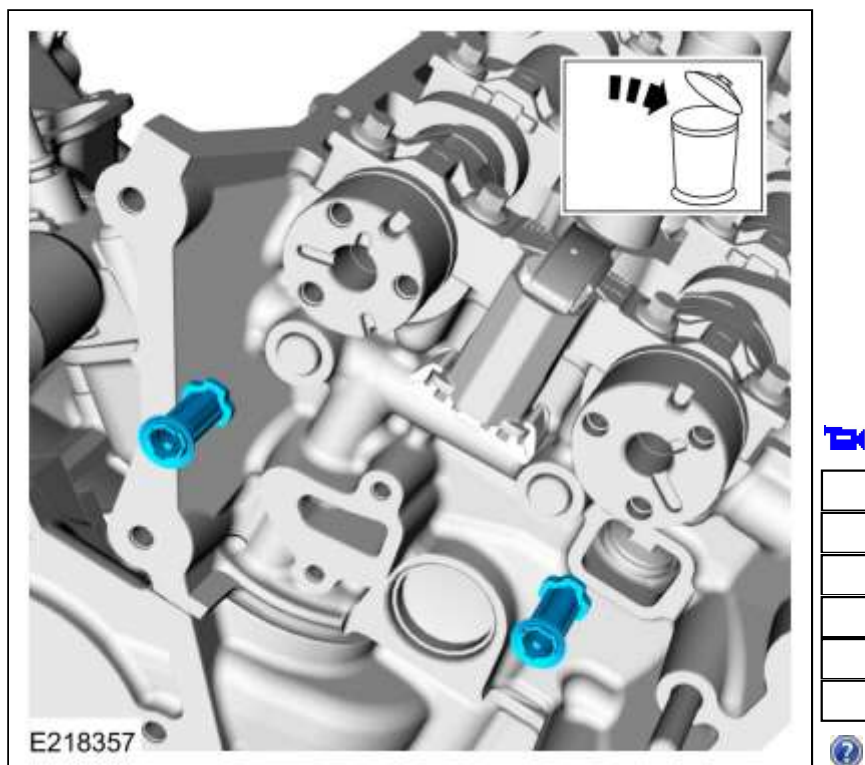


71. **NOTE:** Valve spring pressure will rotate the intake camshaft clockwise after the VCT units are removed.

1. Using a wrench on the flats of the camshaft, have an assistant hold the intake camshaft in position to prevent valve spring pressure from binding the locating pin of the VCT in the end of the camshaft.
2. Slide the VCT units and secondary timing chain off of the camshafts as an assembly.



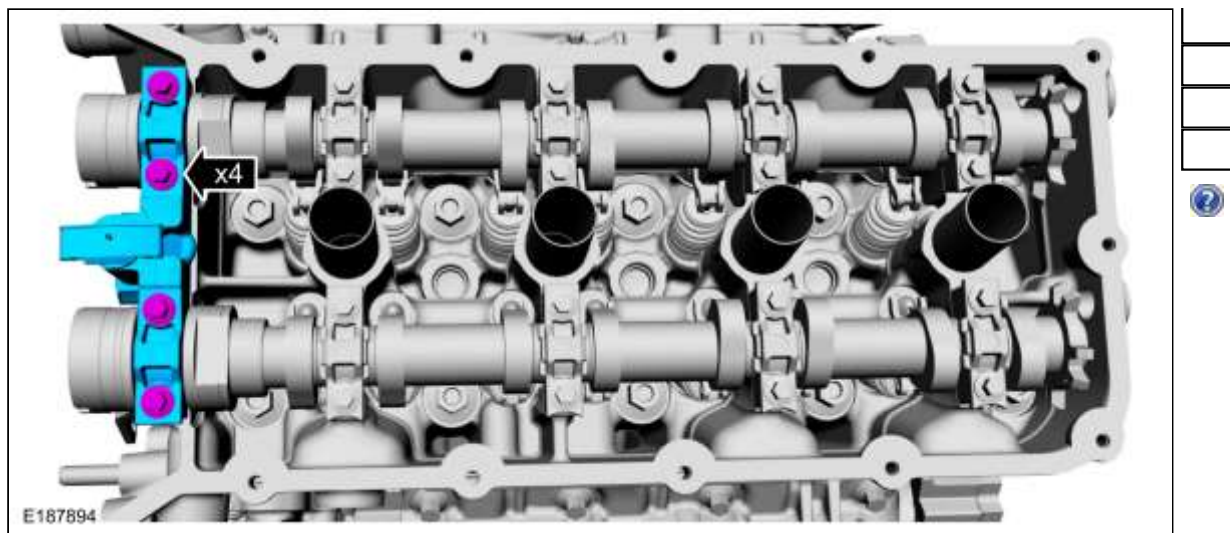
72. Remove and discard the VCT system oil filters.



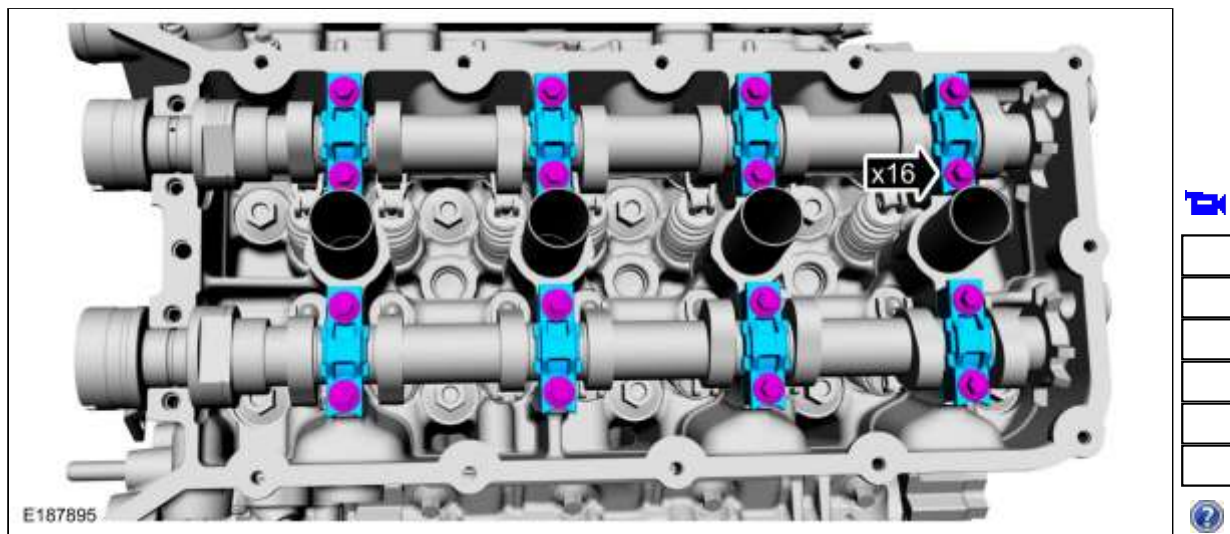
73. **NOTICE:** The front camshaft bearing mega cap must be removed first and then the remaining camshaft bearing caps. Failure to follow this direction may result in damage to the engine.

Remove the bolts and the front camshaft bearing mega cap.

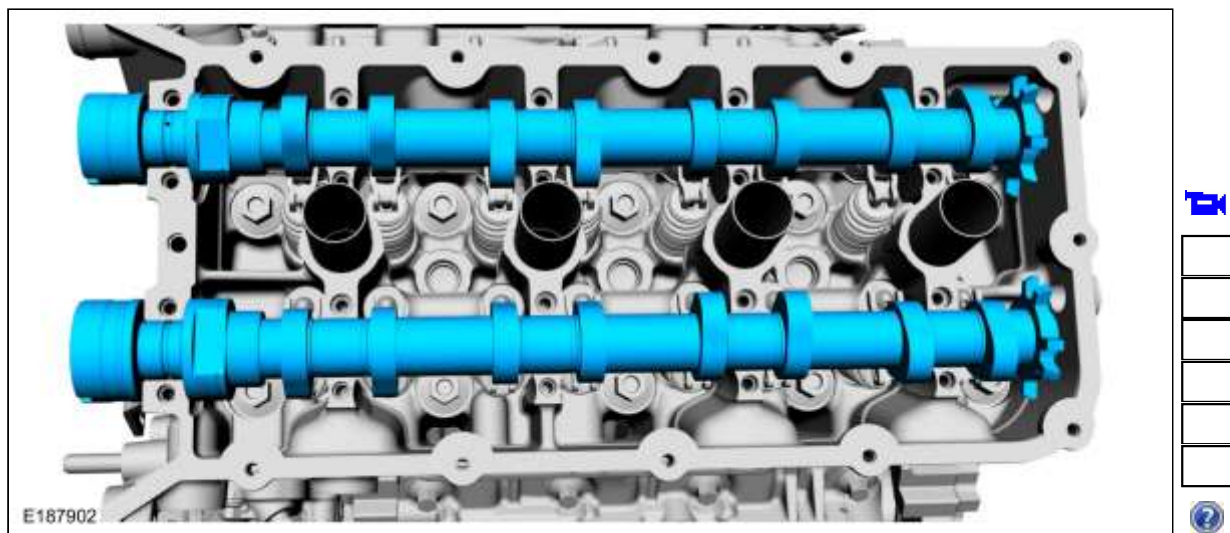




74. Remove the bolts and the camshaft bearing caps.

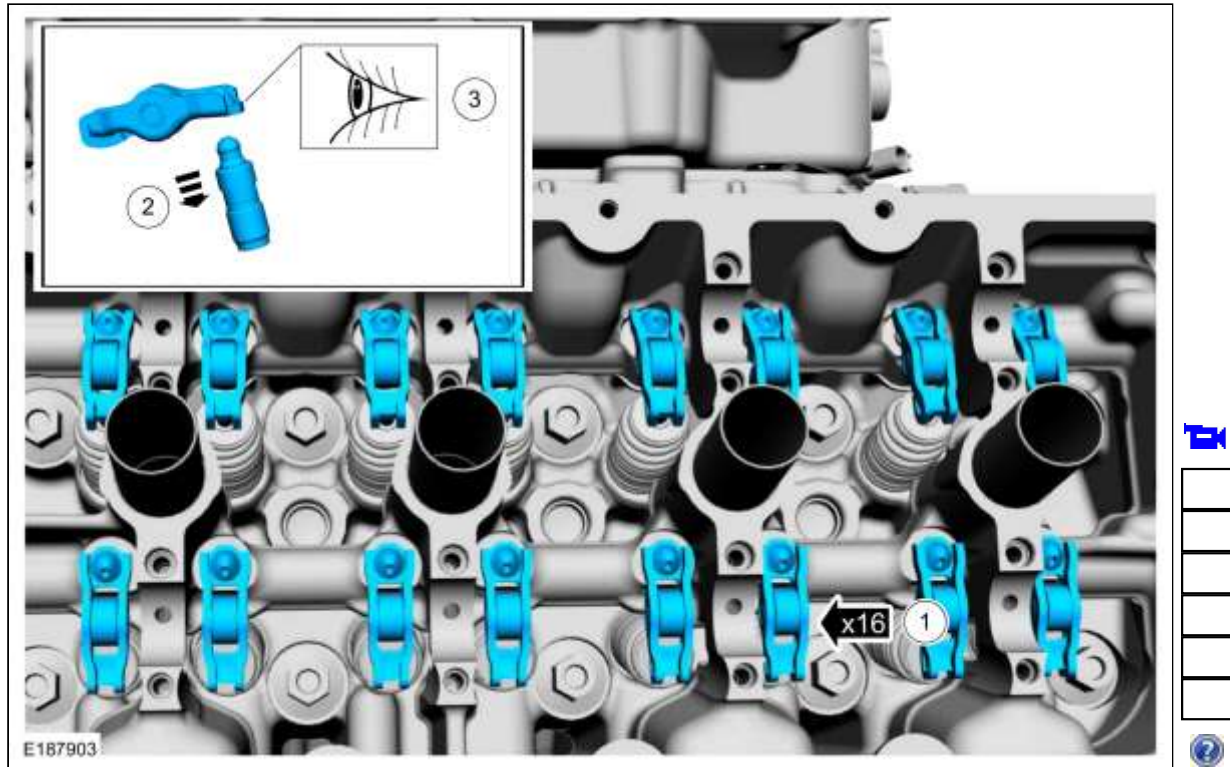


75. Remove the intake and exhaust camshafts.



76. 1. Remove the camshaft roller follower and hydraulic lash adjusters.
2. **NOTE:** Early build date engines are not equipped with spring clips on the camshaft roller followers.

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



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

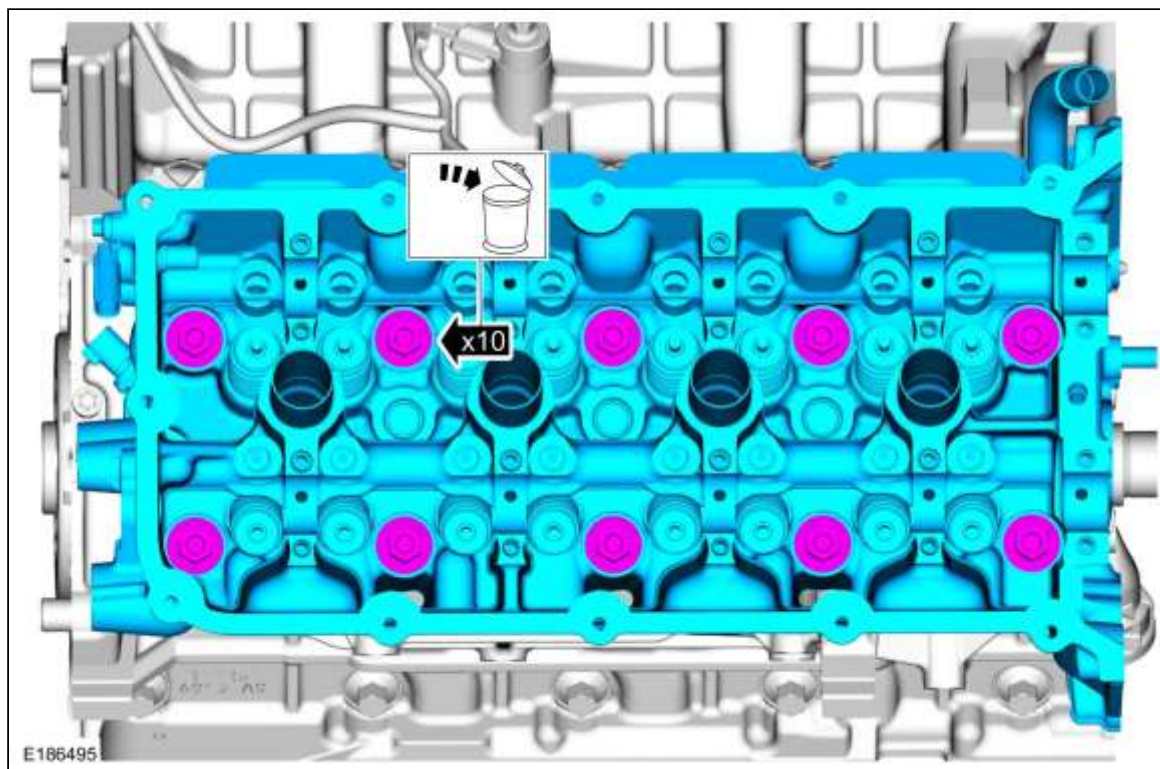
NOTICE: Place clean shop towels over exposed engine cavities. Carefully remove the towels so foreign material is not dropped into the engine.

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

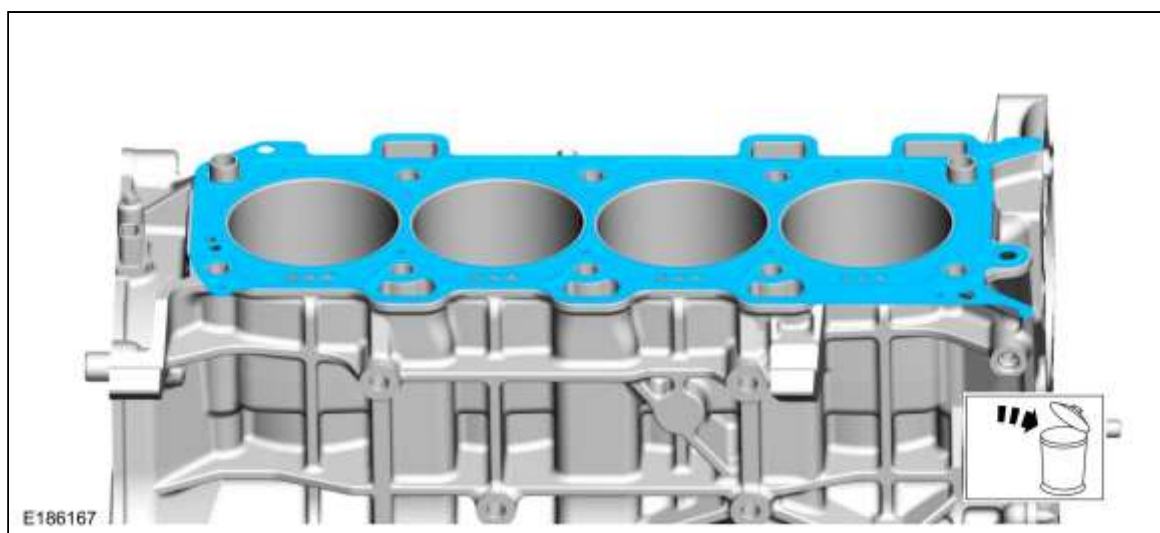
NOTICE: The cylinder head bolts must be discarded and new bolts must be installed. They are a tighten-to-yield design and cannot be reused.

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



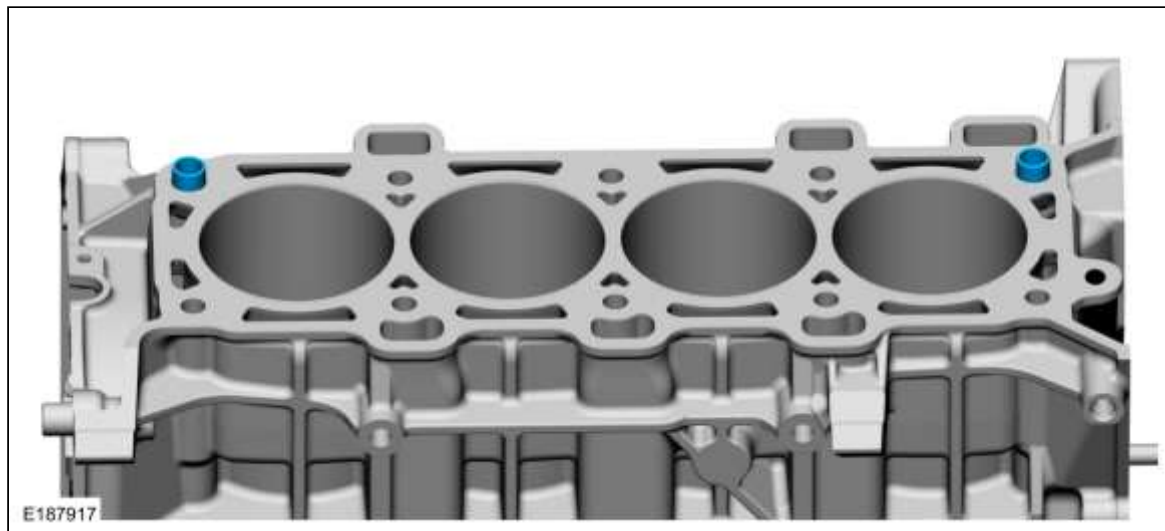


78. Remove and discard the cylinder head gasket.



79. Remove the dowels.

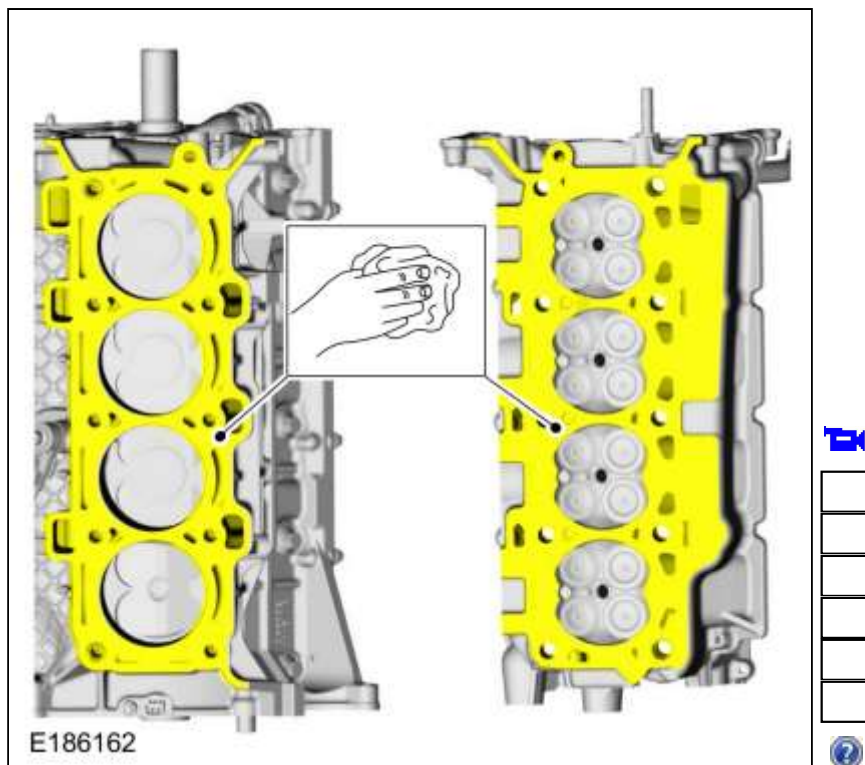




80. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

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

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



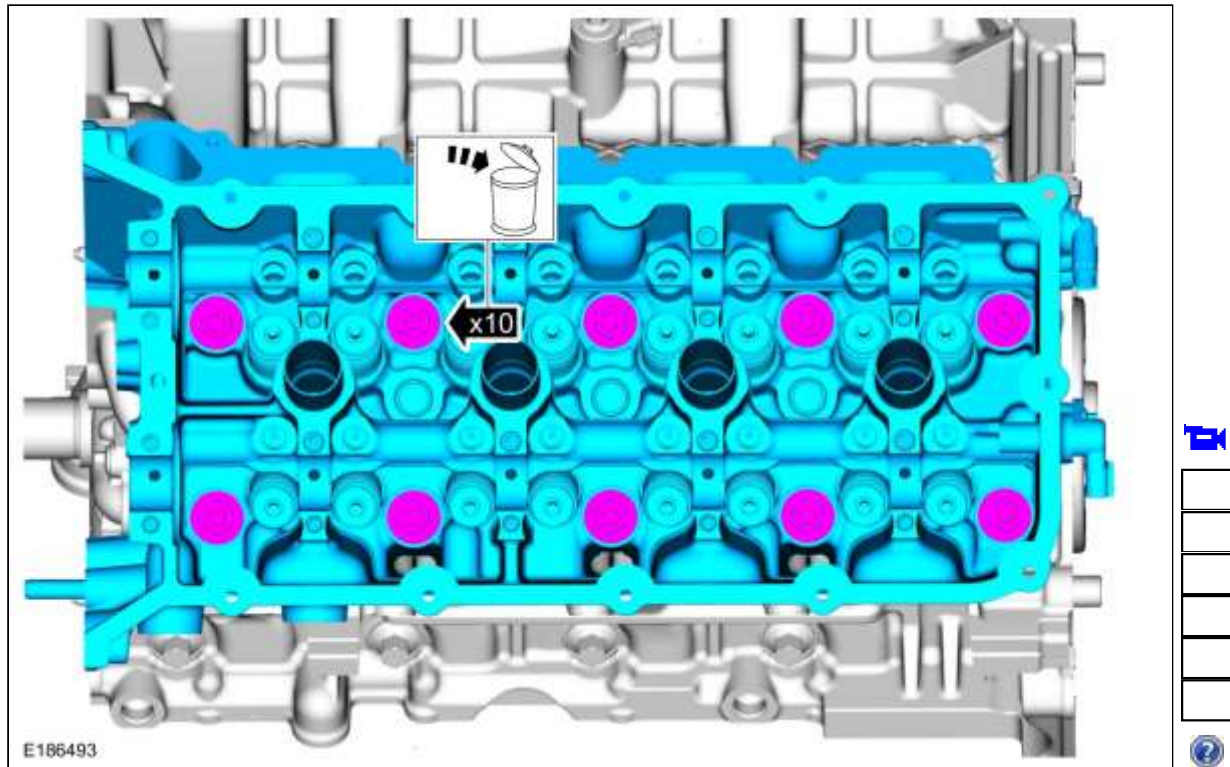
81. **NOTICE:** The cylinder head must be cool before removing it from the engine. Cylinder head warpage can result if a warm or hot cylinder head is removed.

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

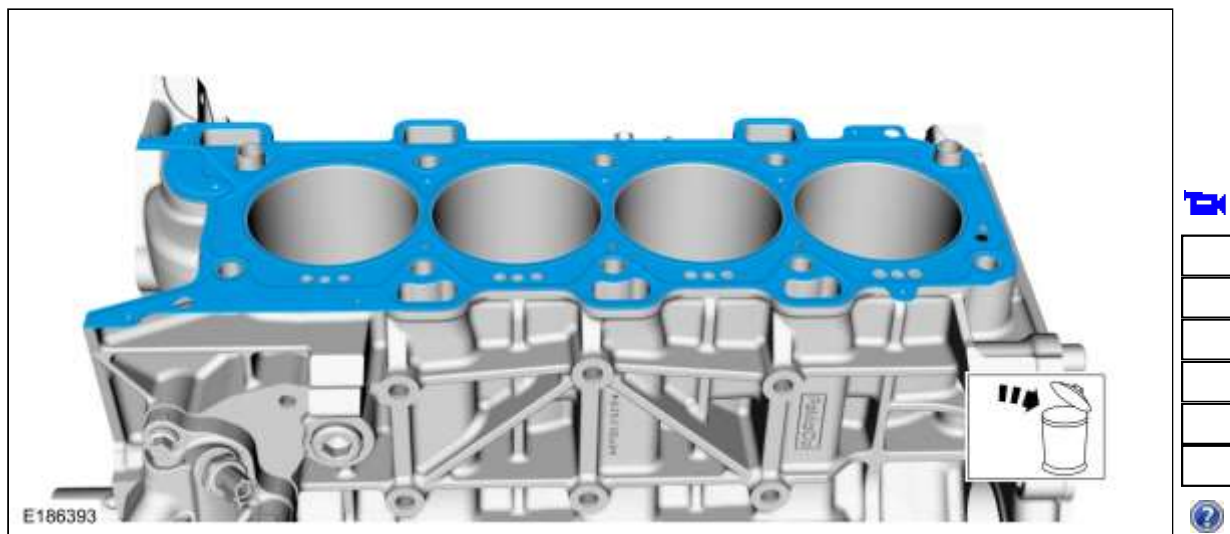
NOTICE: Aluminum surfaces are soft and can be scratched easily. Never place the cylinder head gasket surface, unprotected, on a bench surface.

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

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

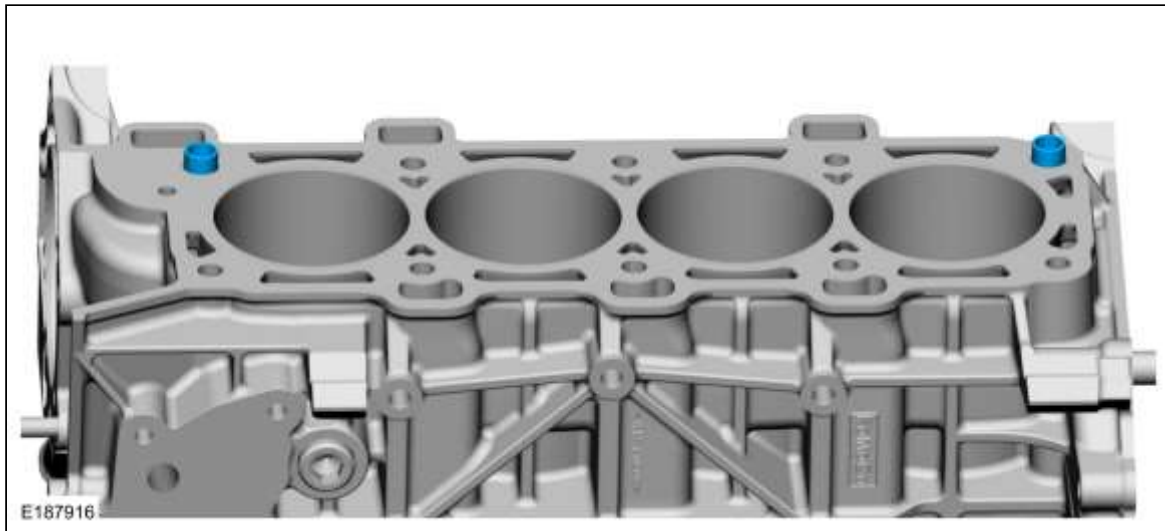


82. Discard the cylinder head gasket.



83. Remove the dowels.

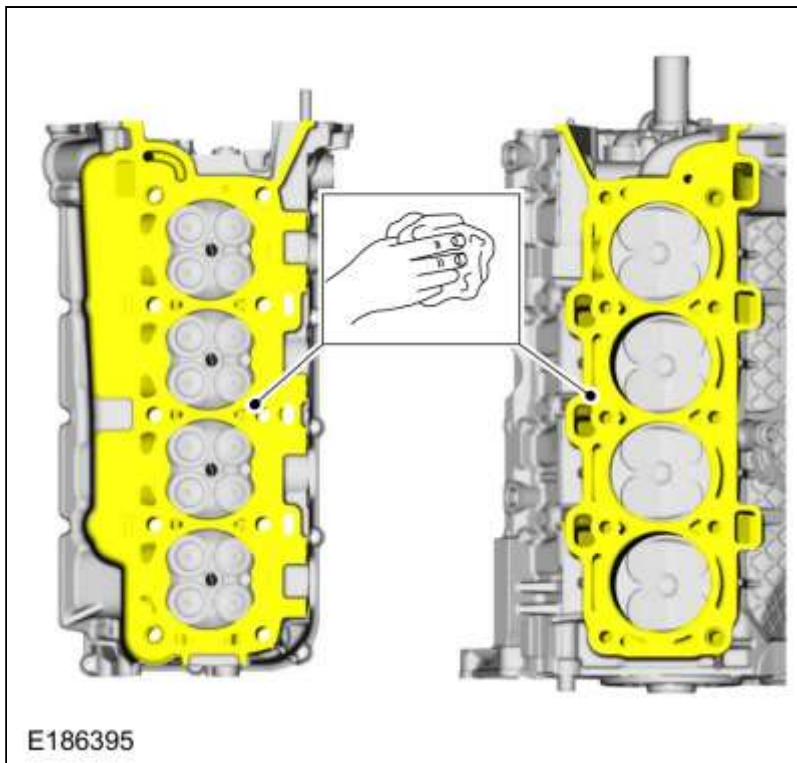




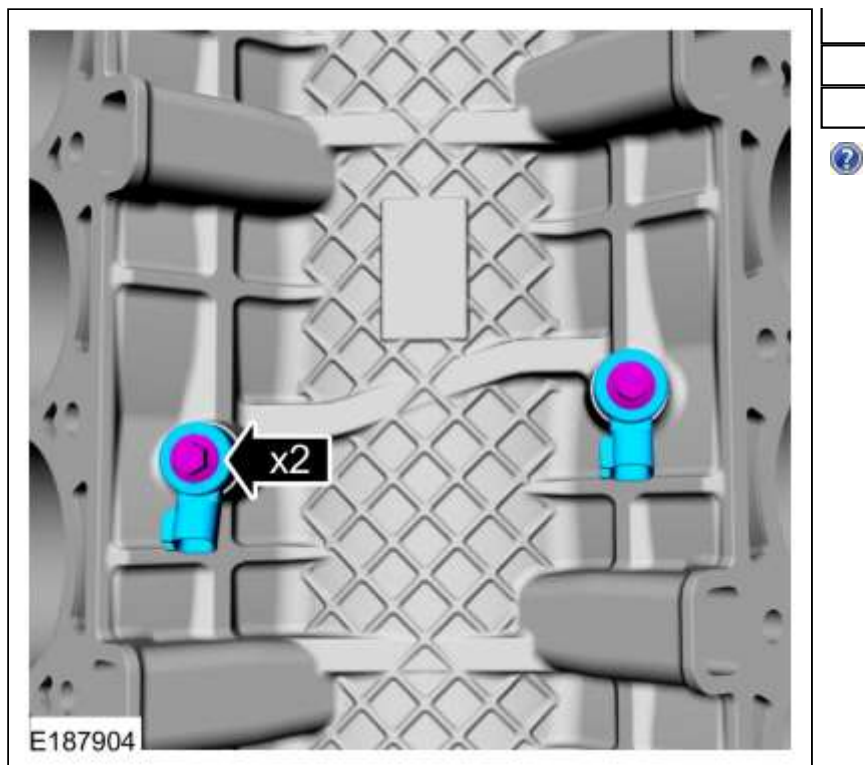
84. **NOTICE:** Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These tools cause scratches and gouges which make leak paths.

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

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

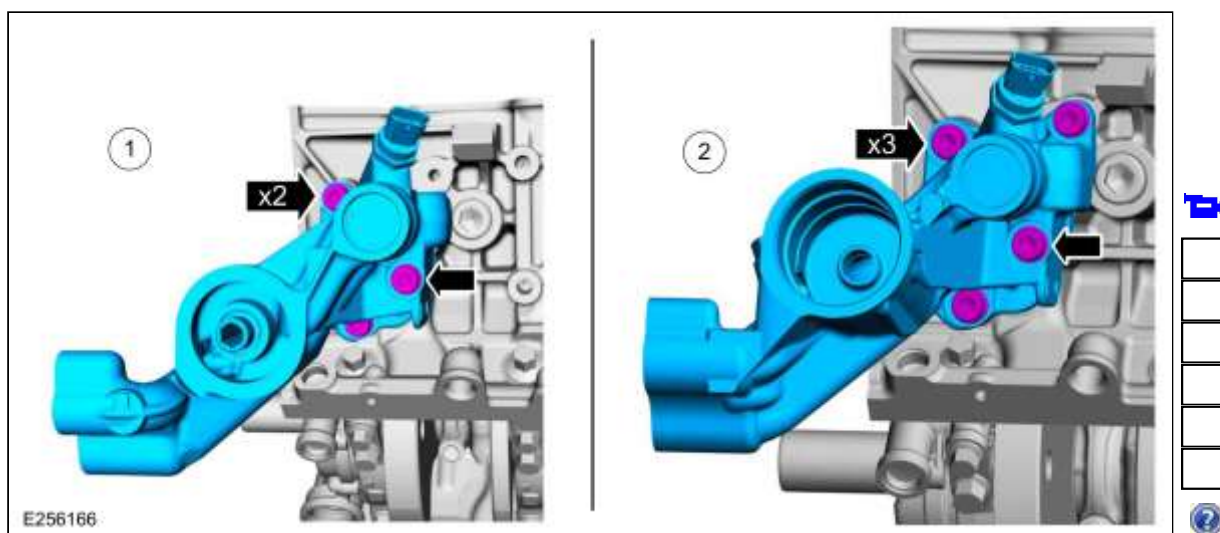


85. Remove the bolts and the KSs.



86. **NOTE:** Early build engines have an oil filter adapter (1) designed for a spin-on oil filter, late build engines have an oil filter adapter (2) designed for a cartridge oil filter.

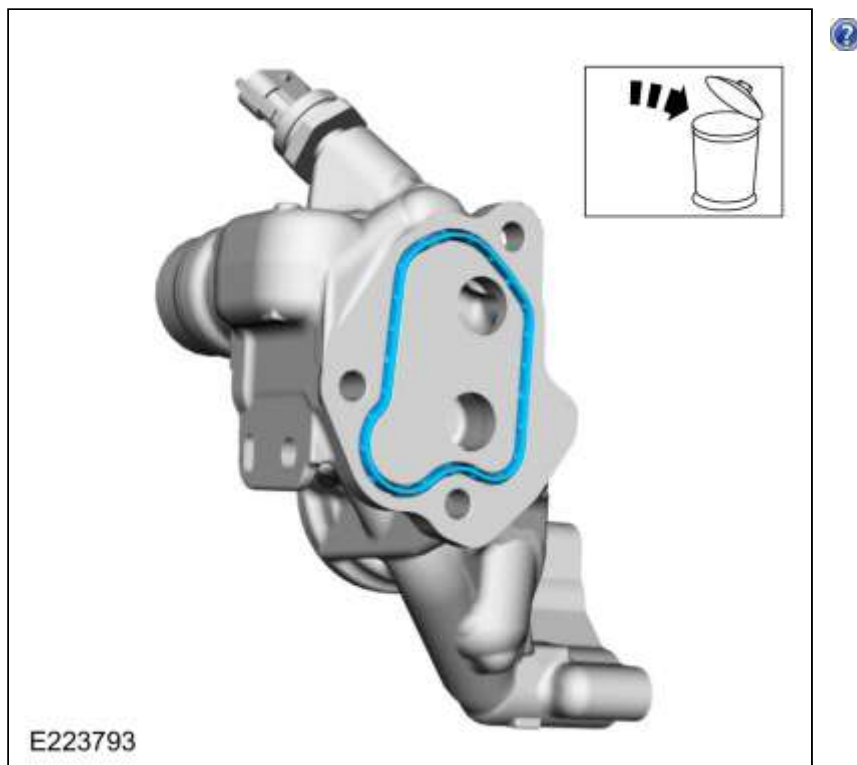
Remove the bolts and the oil filter adapter.



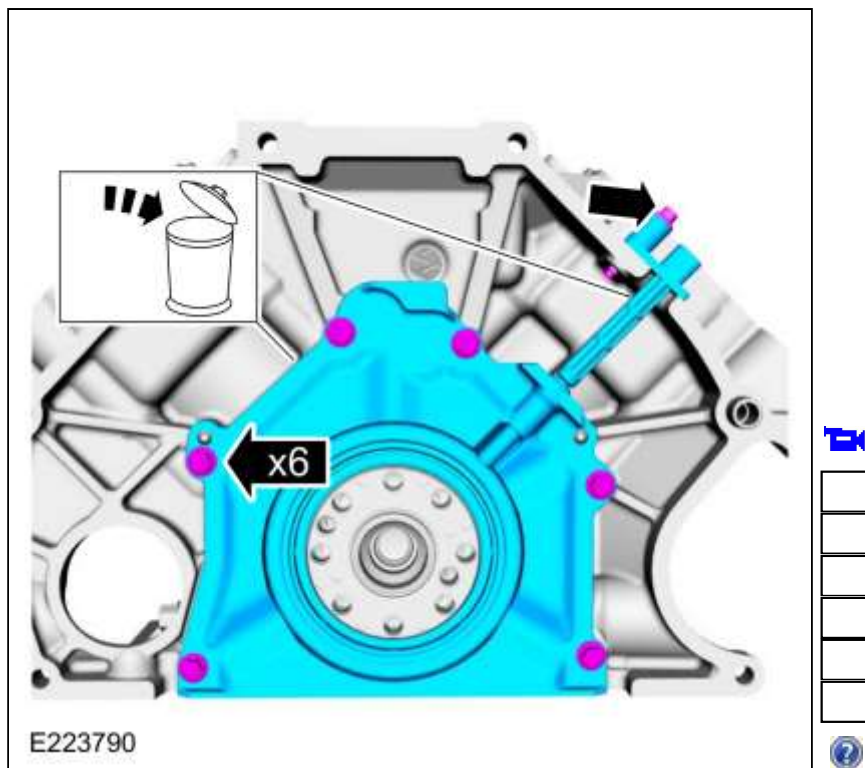
87. **NOTE:** Early build engine shown, late build engine similar.

Remove and discard the gasket.



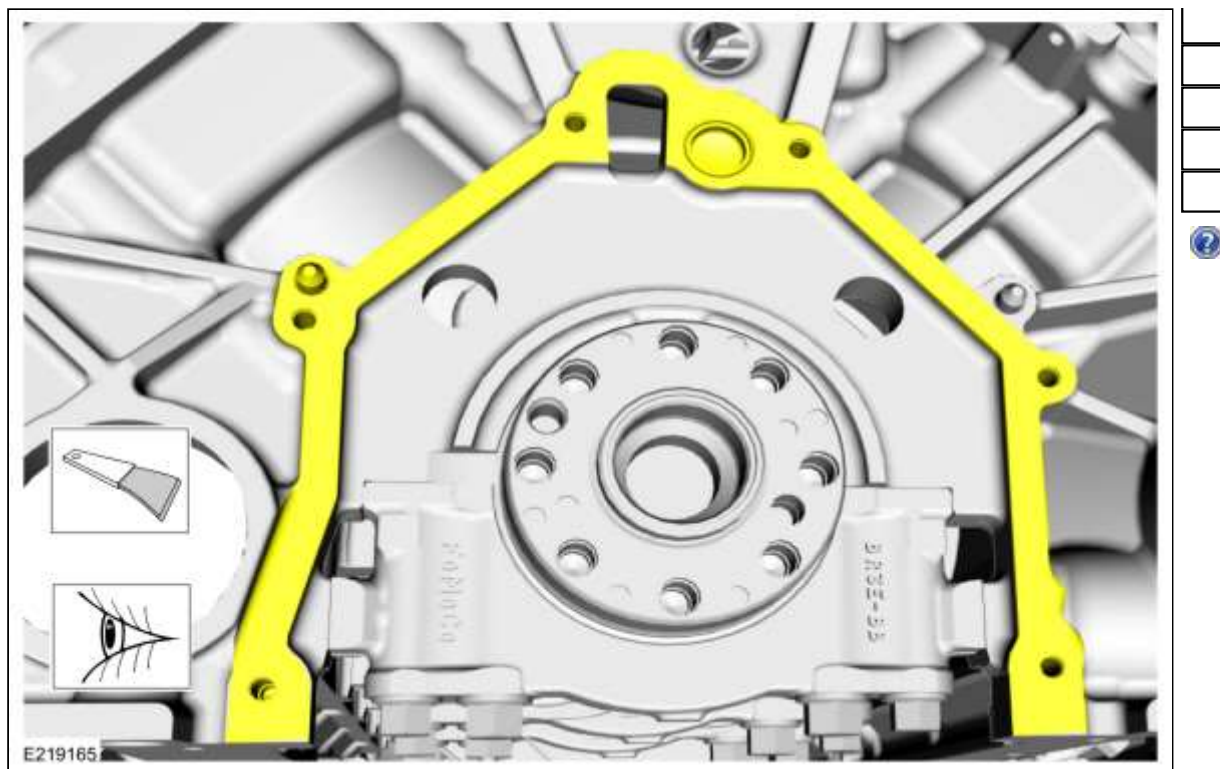


- 88.
- Loosen the CKP sensor bolt.
 - Remove the rear seal retainer plate bolts.
 - Remove and discard the rear seal retainer plate and CKP sensor.

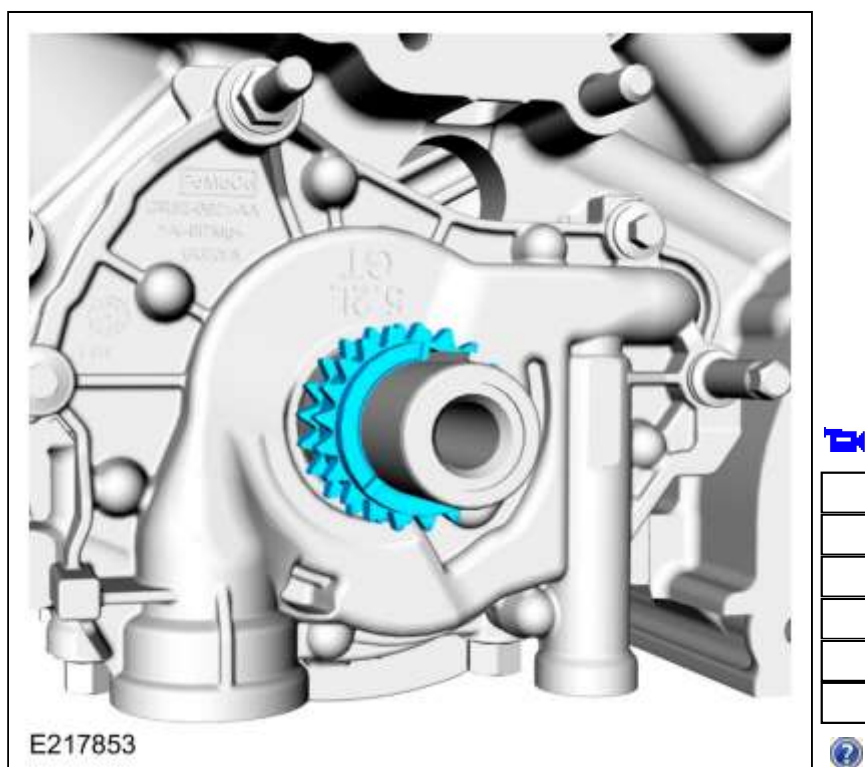


89. Clean and prepare the RTV sealing surface.
Refer to: [RTV Sealing Surface Cleaning and Preparation](#) (303-00 Engine System - General Information, General Procedures).

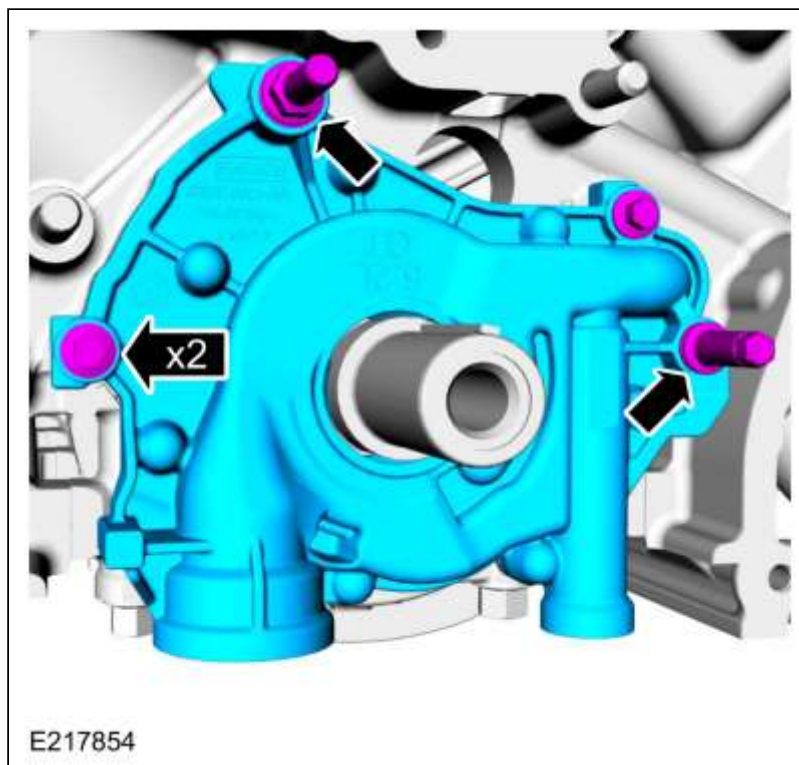




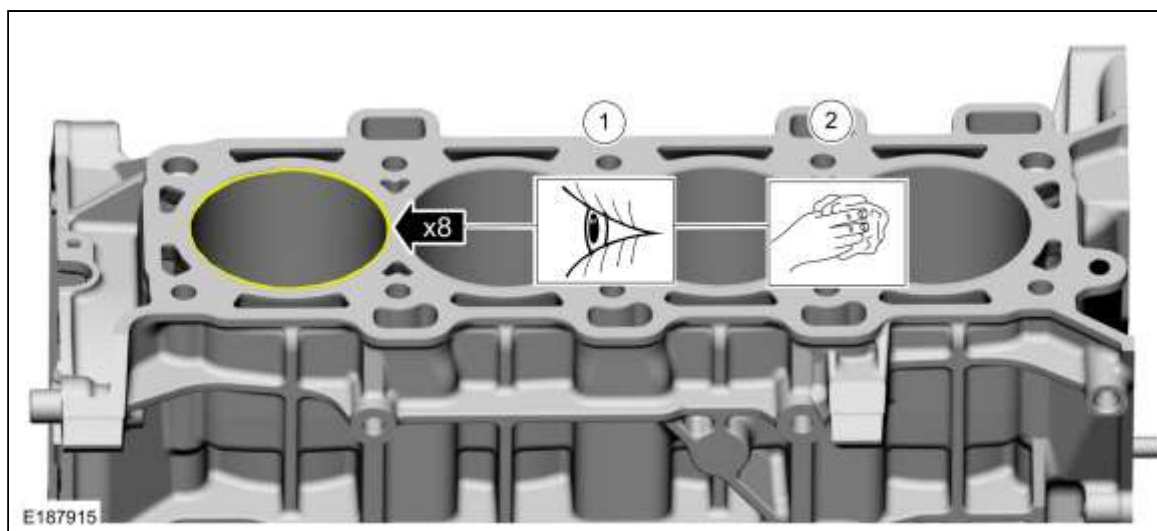
90. Remove the crankshaft sprocket.



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

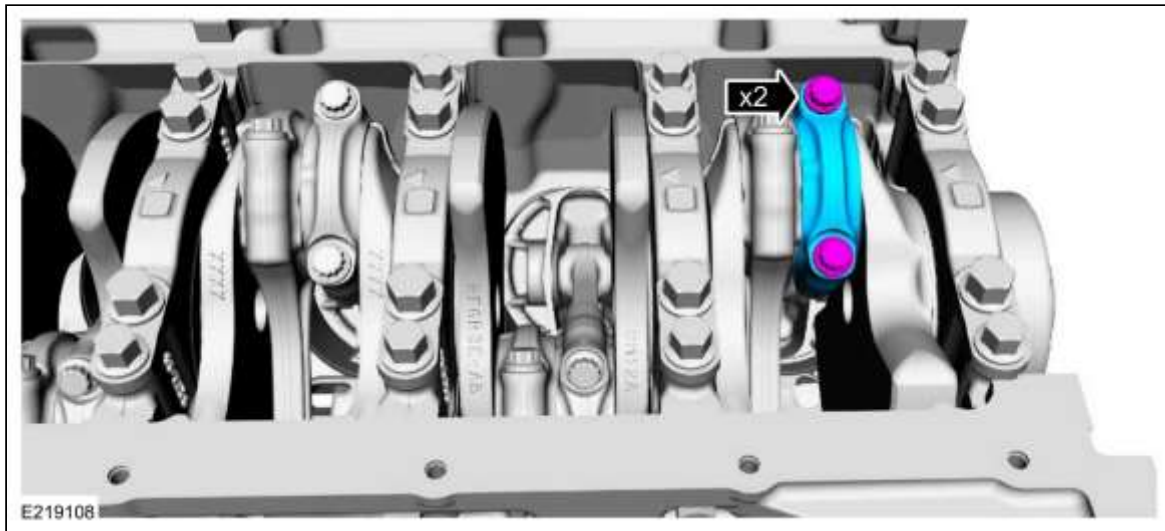


- 92.
- Before removing the pistons, inspect the top of the cylinder bores.
 - If necessary, remove the ridge or carbon deposits from each cylinder using an abrasive pad.



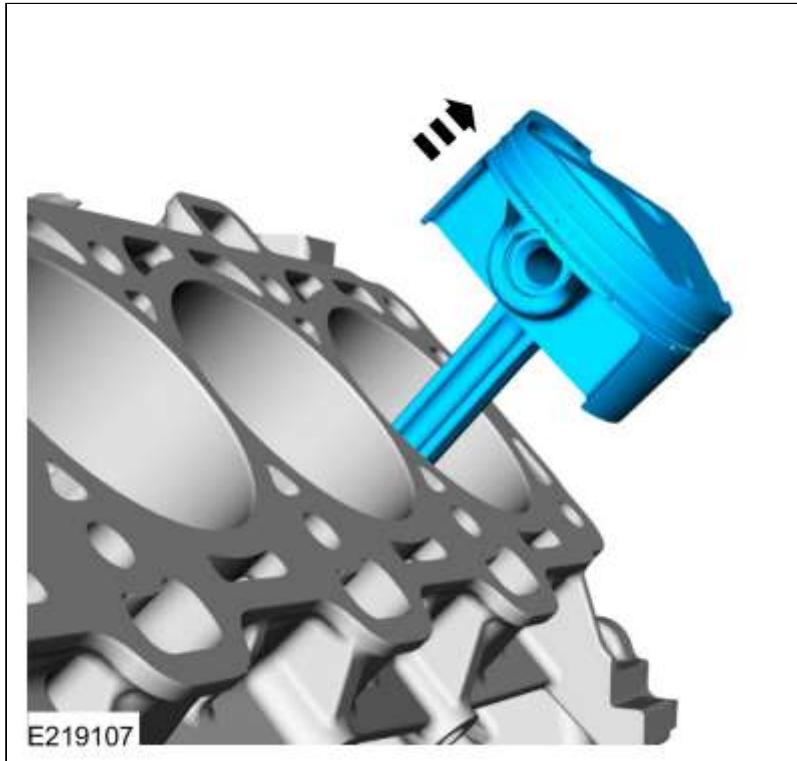
93. **NOTICE:** Verify that the connecting rod and rod cap have orientation numbers cast into them. If not, number the connecting rod and rod cap for correct orientation. Failure to do so can result in engine damage.

Remove the bolts and the connecting rod cap.



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

Remove the piston through the top of the cylinder block.

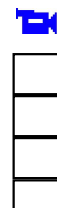


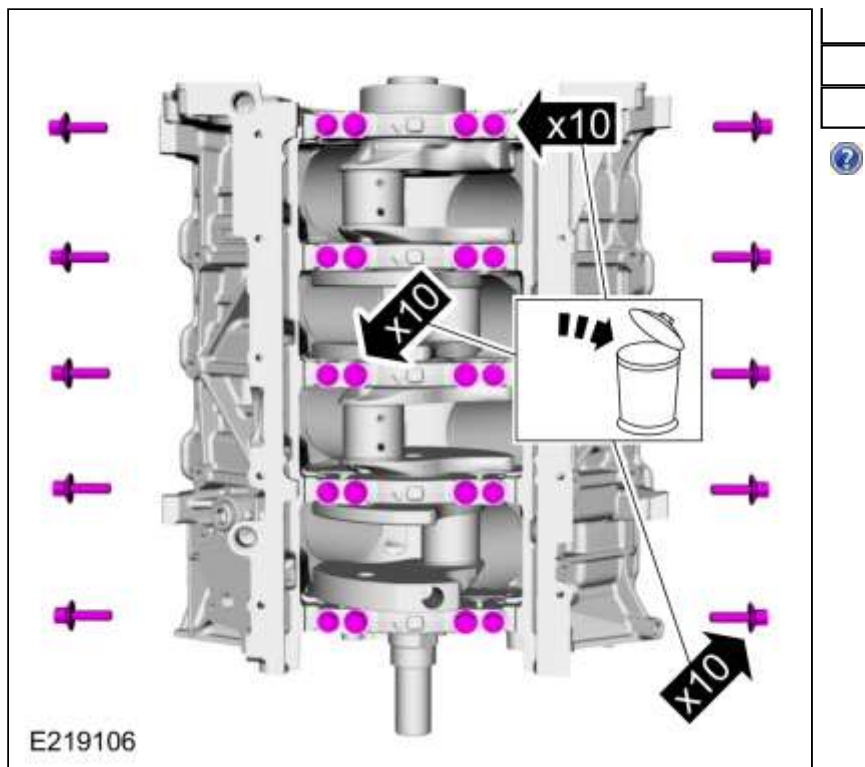
95. Repeat the previous 2 steps for each of the remaining pistons.

96. Disassemble the 8 pistons.

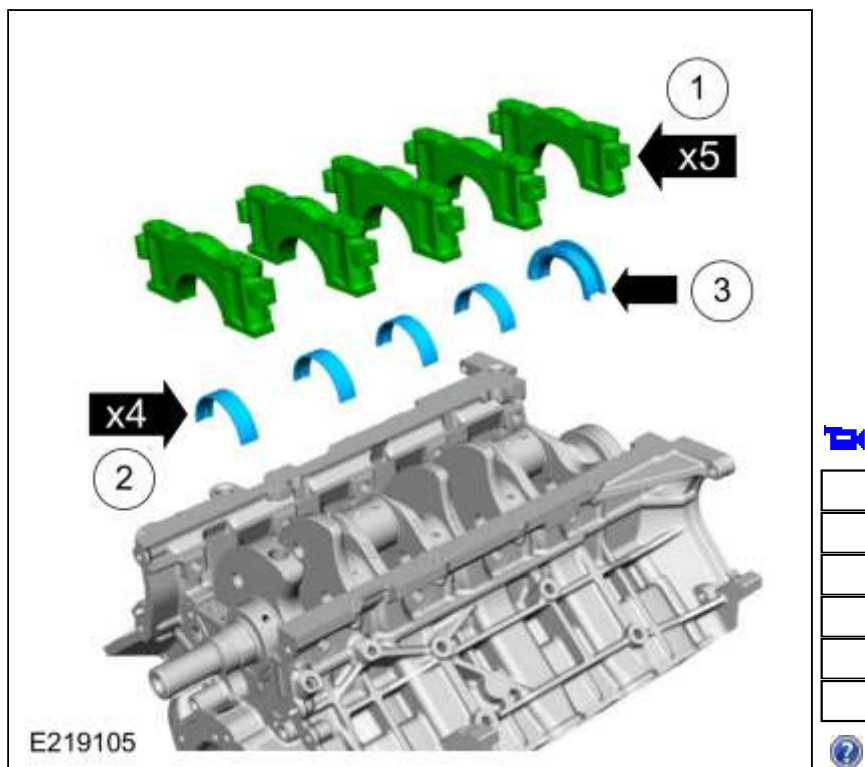
Refer to: [Piston](#) (303-01D Engine - 5.2L 32V Ti-VCT, Disassembly and Assembly of Subassemblies).

97. 1. Remove and discard the cross-mounted main cap bolts.
2. Remove and discard the main bearing cap bolts.

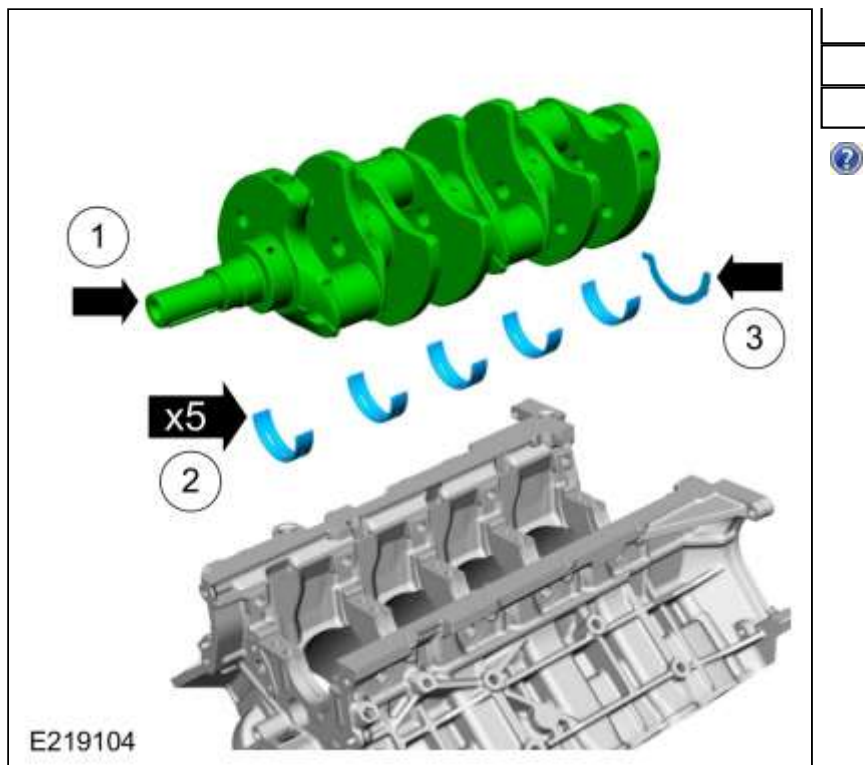




98. Remove the main bearing caps (1), the lower crankshaft main bearings (2) and the lower thrust bearing (3).



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



100. Remove the piston cooling jets from the cylinder block.

