

Engine Cooling System Flushing - Without Oil or Transmission Fluid Contamination

Special Tool(s) / General Equipment

Fluid Suction Gun
Hose Clamp Remover/Installer
Fluid Container

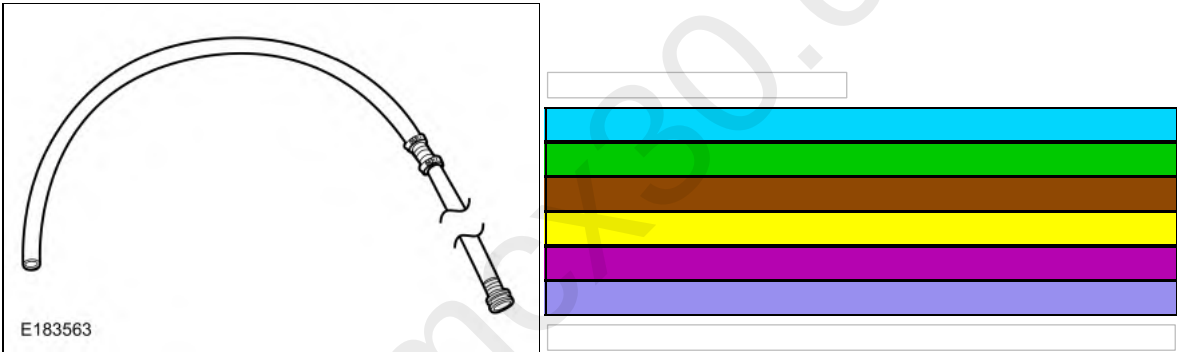
Materials

Name	Specification
Motorcraft® Engine Cooling System Iron Cleaner VC-9	-

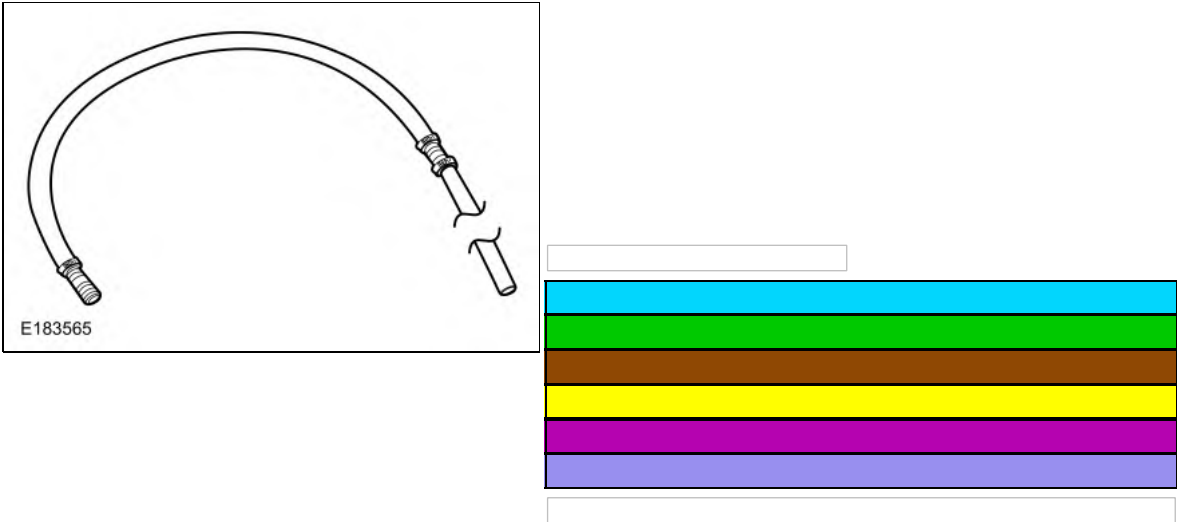
Flushing

NOTE: For the coolant flow diagram, refer to Description and Operation portion of this section.

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.
 - Fabricate a fresh water supply hose.
 - NOTE:** The heater hose will prevent kinking in tight areas of the engine compartment.
 - Cut the garden hose to length. The hose must reach from a fresh water supply faucet to the vehicle.
 - Using a coupling adapter and 2 hose clamps, attach a 61 cm (2 ft) length of heater hose to the garden hose.

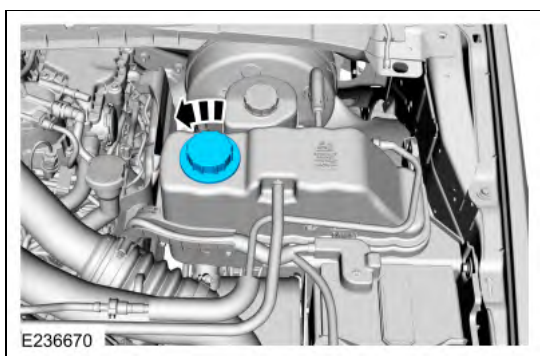


3.
 - Fabricate a drain hose.
 - NOTE:** The heater hose will prevent kinking in tight areas of the engine compartment.
- Using a coupling adapter and 2 hose clamps, attach a 61 cm (2 ft) length of heater hose to the remaining section of the garden hose to be used as a drain hose.

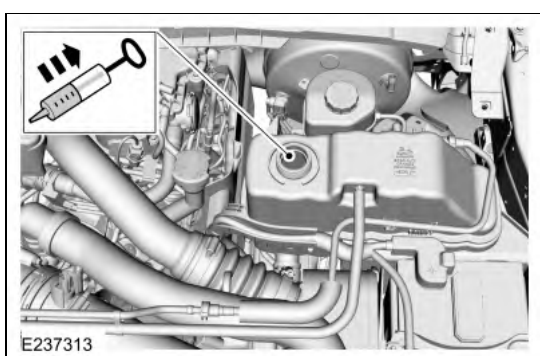


4. **WARNING:** Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

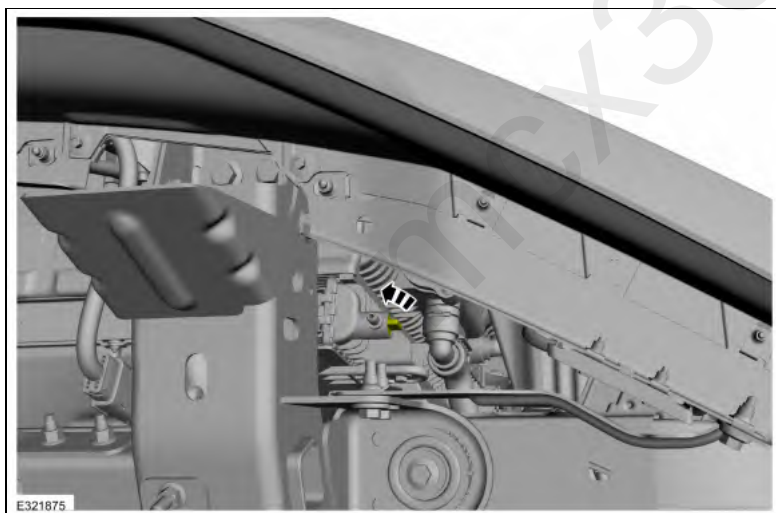
Release the pressure in the cooling system by slowly turning the pressure relief cap one-half turn counterclockwise. When the pressure is released, remove the pressure relief cap.



5. Using a suitable suction device, siphon all contents and contaminants from the degas bottle.
Use the General Equipment: Fluid Suction Gun



6. Connect a hose to drain the coolant. Open the radiator drain valve and drain the engine coolant in a suitable, clean container.
Use the General Equipment: Fluid Container



7. Remove the RH fender rear splash shield.
Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

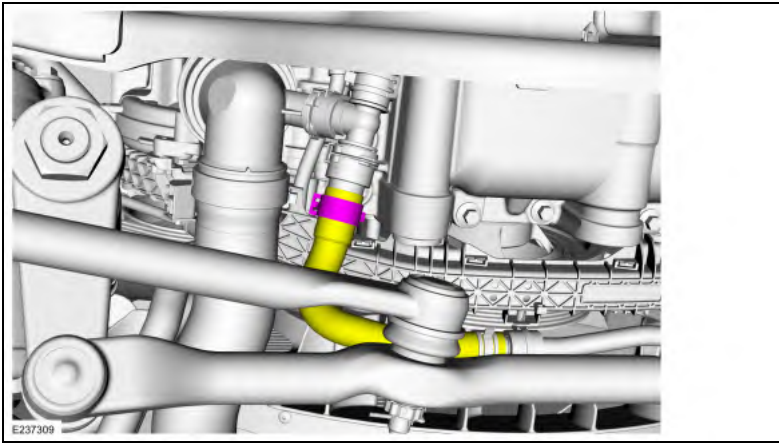
- 8.
- Pull the lower radiator hose spring clip until the end of the clip is in the detent on the quick connect coupling and disconnect the lower radiator hose, and drain all the contaminants from the lower radiator hose.
 - Connect the lower radiator hose and push the spring clip in place when finished.
 - To install, push the spring clip in place and connect the lower radiator hose quick connect coupling, making sure the coupling is secure.



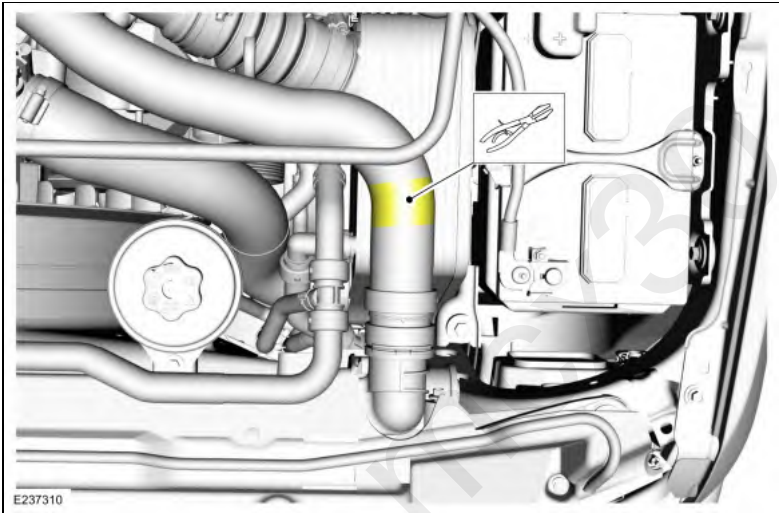
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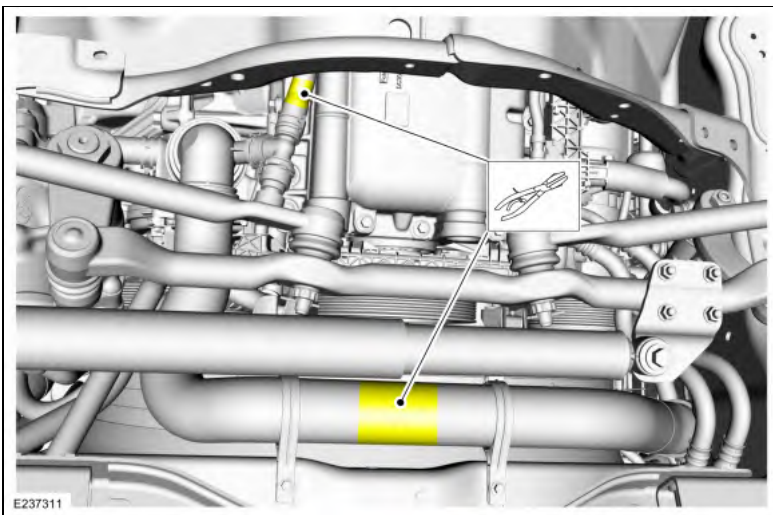
12. Release the clamp and disconnect the heater return hose.
Use the General Equipment: Hose Clamp Remover/Installer



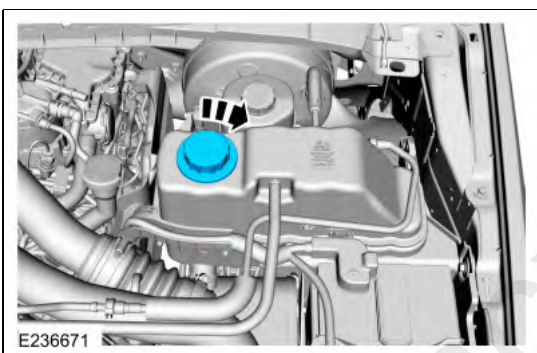
13. Using a coupling adapter and 2 hose clamps, connect the fabricated fresh water supply hose to the heater return hose.
14. Route the fabricated drain hose from under the vehicle and, using a hose clamp, connect the fabricated drain hose to the heater return hose fitting.
15. Using hose pinch pliers, clamp the upper radiator hose.



16. Using hose pinch pliers, clamp the oil cooler return hose and the lower radiator hose.



17. Install the pressure relief cap.



18. **NOTE:** Use of hot water during this procedure will improve removal of petroleum based cooling system contaminants.

Turn on the fresh water supply and allow the water to flush the cylinder block of contaminants.

19. Turn the water off when finished.

20. Remove the hose pinch pliers from the upper radiator hose.

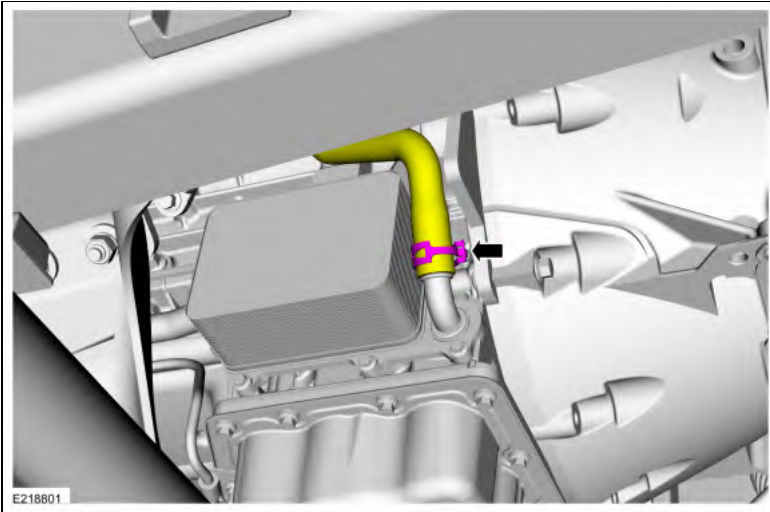
21. Turn on the fresh water supply and allow the water to flush the radiator of contaminants.

22. Turn the water off when finished.

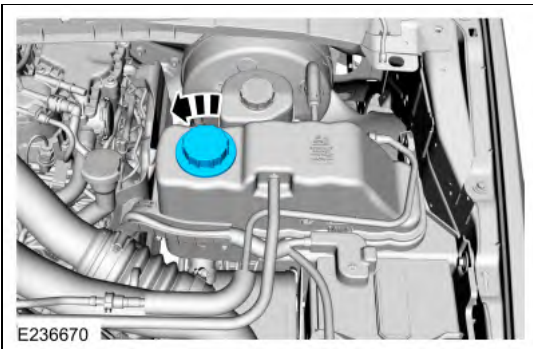
23. Remove the hose pinch pliers from the lower radiator hose and the oil cooler return hose.

24. Connect the engine-to-oil cooler hose to the oil cooler and position the clamp.

Use the General Equipment: Hose Clamp Remover/Installer

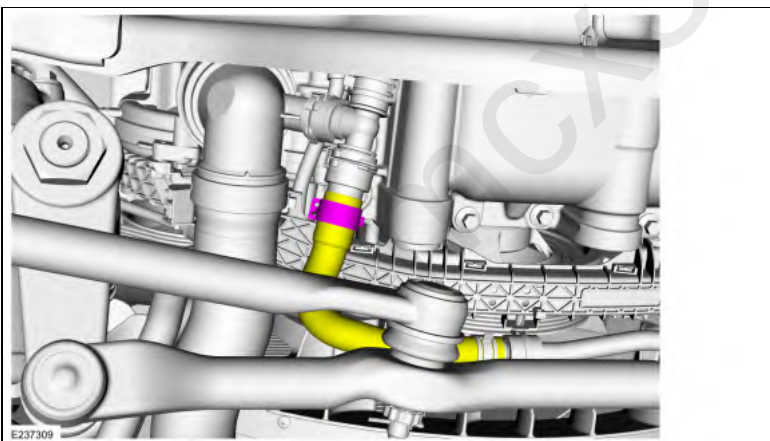


25. Remove the pressure relief cap.

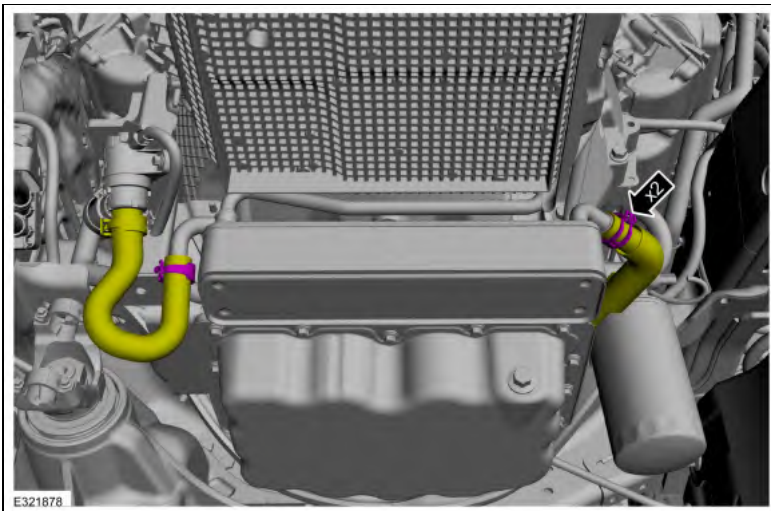


26. Disconnect the fresh water supply hose from the heater return hose and the drain hose from the lower radiator hose.

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

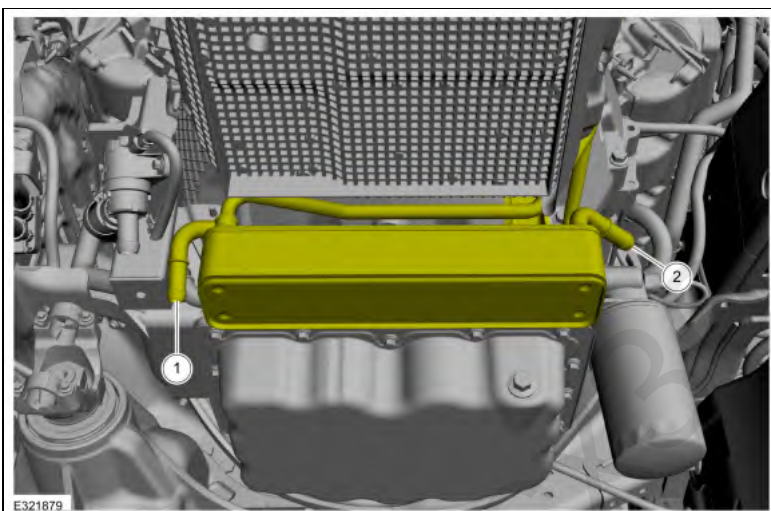


28. Release the clamps and disconnect the transmission cooler coolant tubes.
Use the General Equipment: Hose Clamp Remover/Installer



29.

1. Using a coupling adapter and 2 hose clamps, connect the fabricated fresh water supply hose to the transmission cooler outlet fitting.
2. Using a hose clamp, connect the drain hose to the transmission cooler inlet fitting.



30. Turn on the fresh water supply and allow the water to flush the transmission cooler of contaminants.

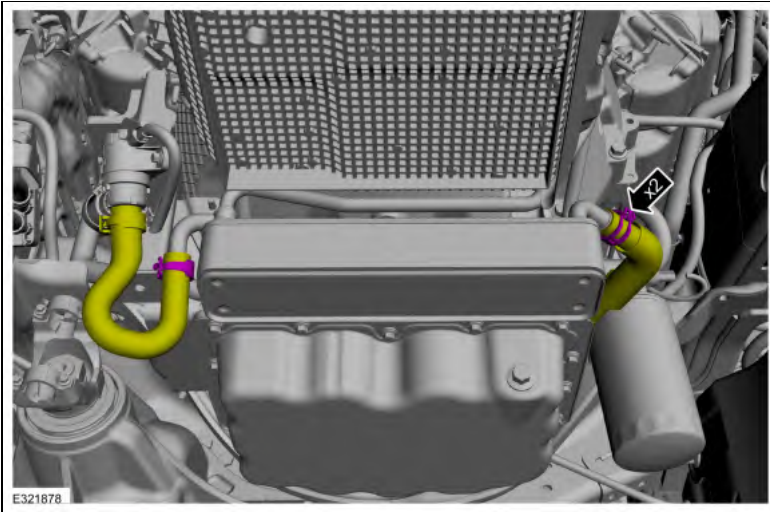
31. Turn the water off when finished.

32. Disconnect the fresh water supply hose from the transmission cooler outlet fitting.

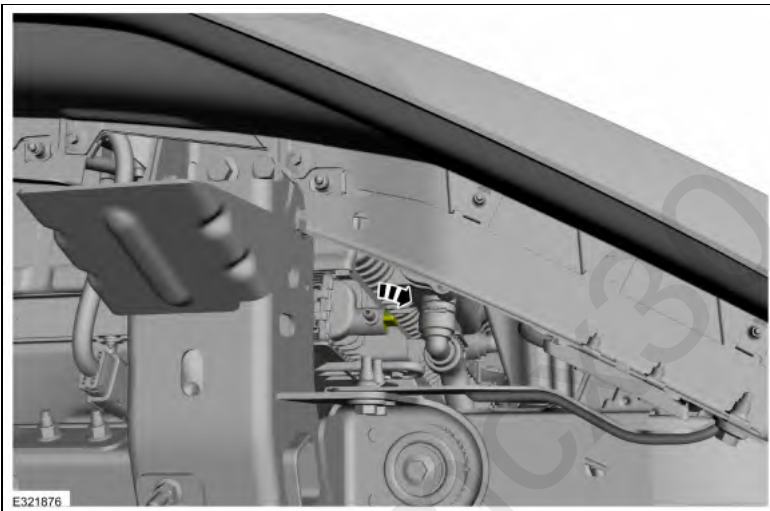
33. Disconnect the drain hose from the transmission cooler inlet fitting.

34. Connect the transmission cooler coolant tubes.

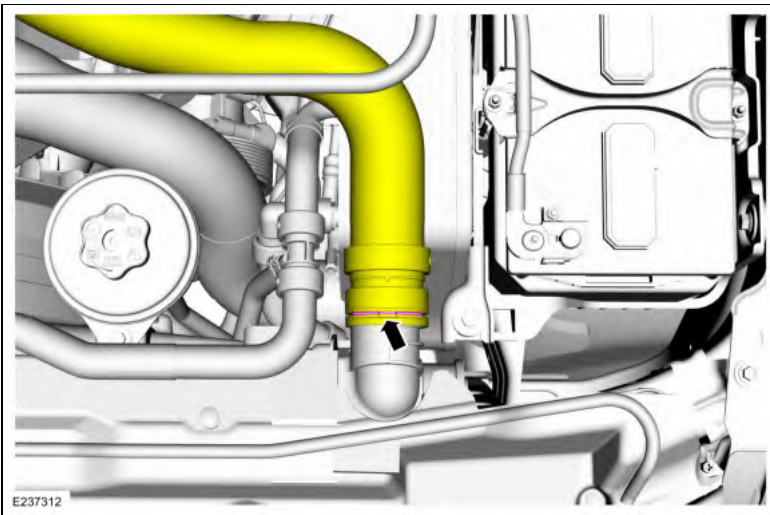
Use the General Equipment: Hose Clamp Remover/Installer



35. Close the radiator draincock.



- 36.
- Pull the upper radiator hose spring clip until the end of the clip is in the detent on the quick connect coupling and disconnect the upper radiator hose.
 - Add 1.89L (2 qt) of Motorcraft® Engine Cooling System Iron Cleaner to the engine via the coolant outlet connection opening.
Material: Motorcraft® Engine Cooling System Iron Cleaner / VC-9
 - Connect the upper radiator hose and push the spring clip in place when finished.



37.

1. Fill the cooling system with hot water:
2. Fill the degas bottle to the maximum fill line.
3. **NOTE:** *The degas bottle cap must be loose so that the cooling system does not get pressurized.*

Install the degas bottle cap until it contacts the hard stop. Back the degas bottle cap off one-half turn.

4. If the coolant level drops below the minimum fill line refill the degas bottle to the maximum fill line.
5. Run the engine at 2,000 rpm for 2 minutes.
6. Bring the engine to an idle.
7. If the coolant level drops below the minimum fill line refill the degas bottle to the maximum fill line.
8. Repeat Steps 5 through 7 until the coolant level stabilizes. Shut the engine off.
9. Fill the degas bottle to 20 mm (0.787 in) above the maximum fill line. Install the degas bottle cap.

38. Select the maximum heater temperature and blower motor speed settings.

39. Start the engine.

40. Using a scan tool, select active command and set the cooling fan to ON.

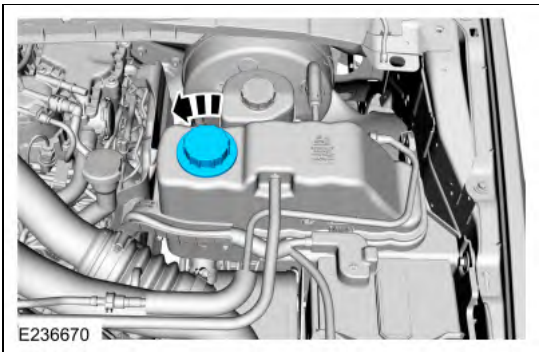
41. **NOTE:** *Failure to run the engine at 2,000 rpm for 1 hour will result in insufficient cleaning of the cooling system.*

Using a scan tool, select active command and set the engine rpm to 2,000 and run the engine for 1 hour.

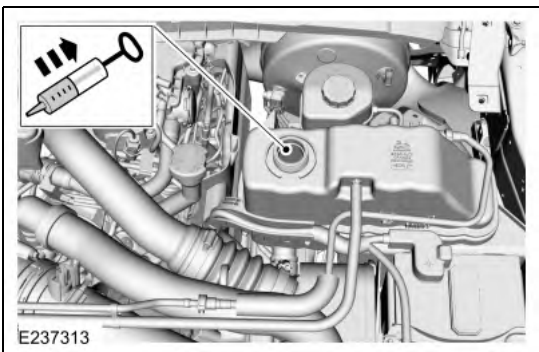
42. Return the engine to idle speed, shut the engine off and allow the engine to cool.

43. **WARNING:** *Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.*

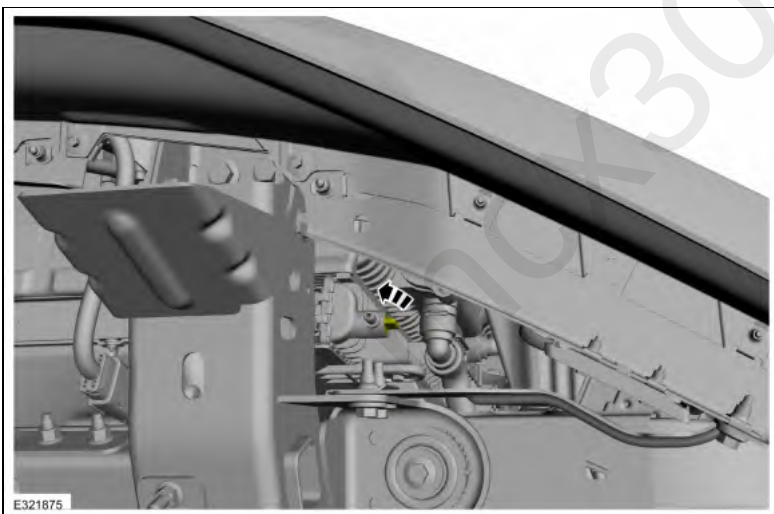
Release the pressure in the cooling system by slowly turning the pressure relief cap one-half turn counterclockwise. When the pressure is released, remove the pressure relief cap.



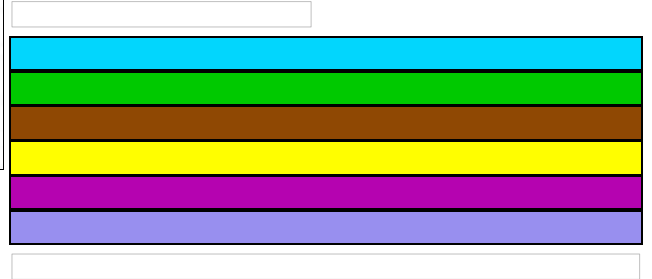
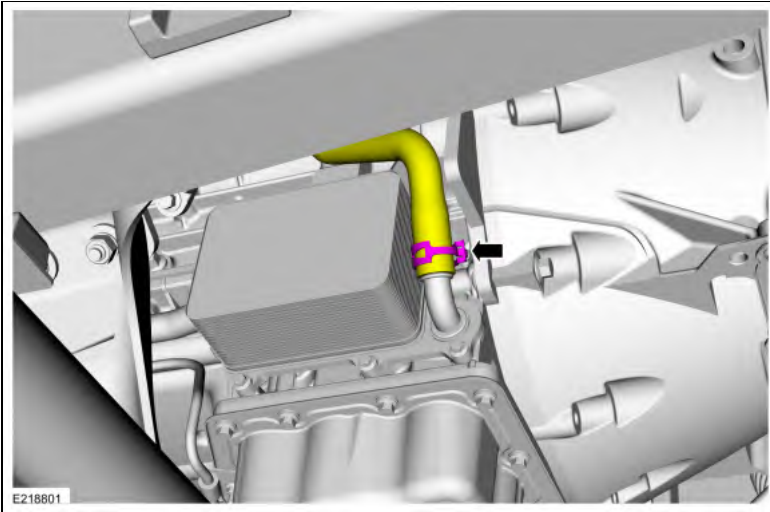
44. Using a suitable suction device, siphon all contents and contaminants from the degas bottle.



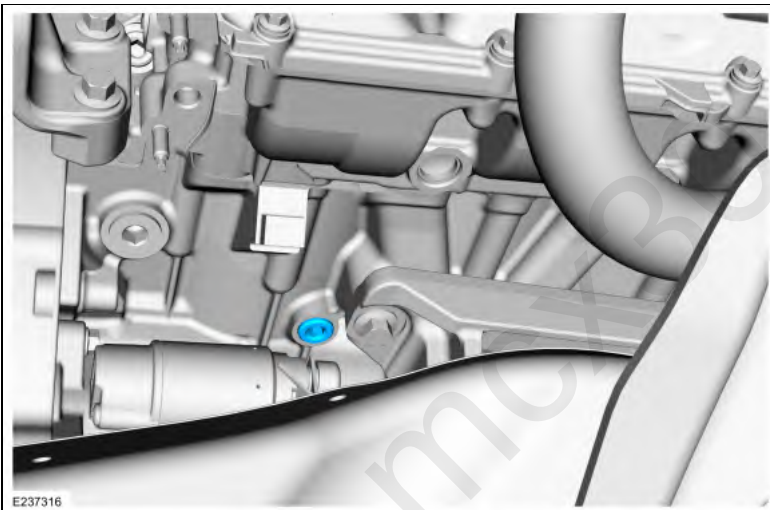
45. Open the radiator draincock and drain the cooling system. Leave the radiator draincock open.



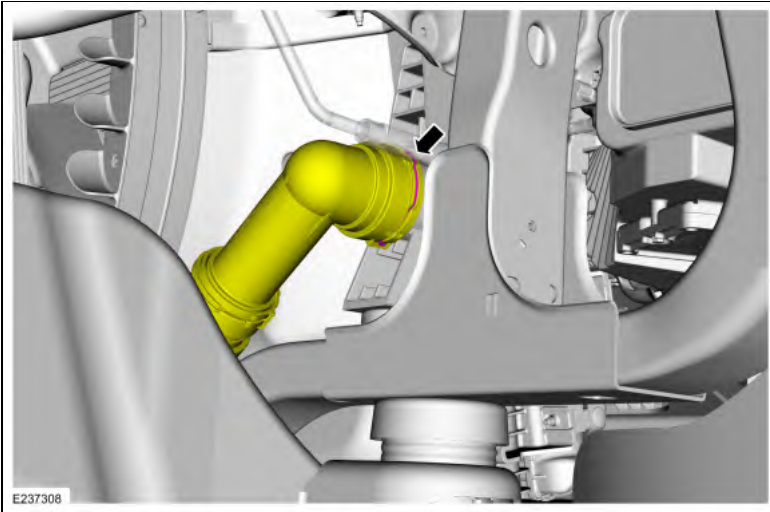
46. Release the clamp, disconnect the engine-to-oil cooler hose from the oil cooler and drain the LH side of the cylinder block.
Use the General Equipment: Hose Clamp Remover/Installer



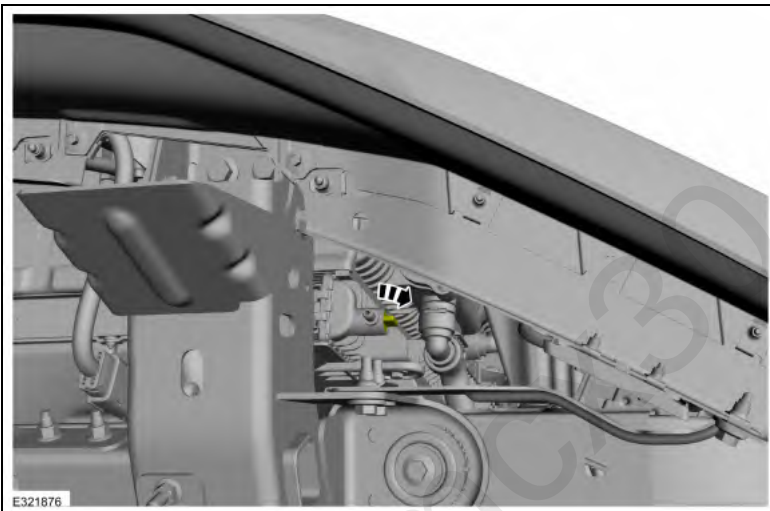
47. Disconnect the battery ground cable.
Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
48. Completely cover the starter with waterproof plastic.
49. **NOTE:** Use a 3/8" long ball hex socket driver, such as Snap-on® #FABL12E, to remove the drain plug.
Remove the RH cylinder block drain plug and drain the RH side of the cylinder block.



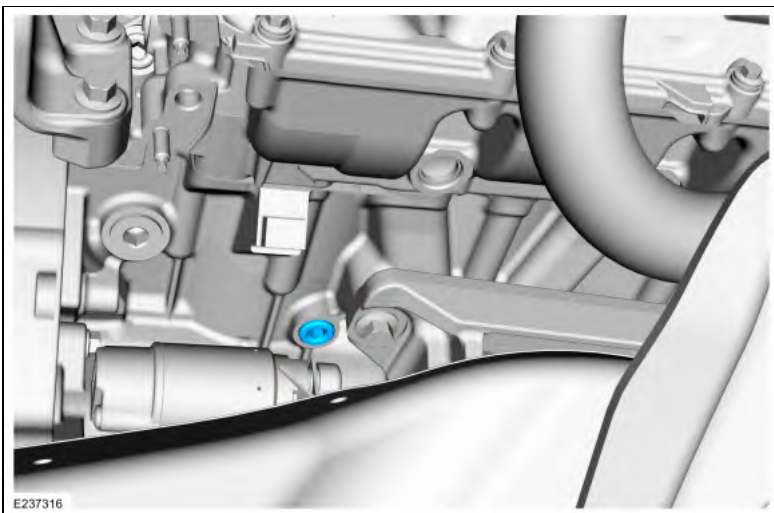
50.
 - Pull the lower radiator hose spring clip until the end of the clip is in the detent on the quick connect coupling and disconnect the lower radiator hose, and drain all the contaminants from the lower radiator hose.
 - Connect the lower radiator hose and push the spring clip in place when finished.



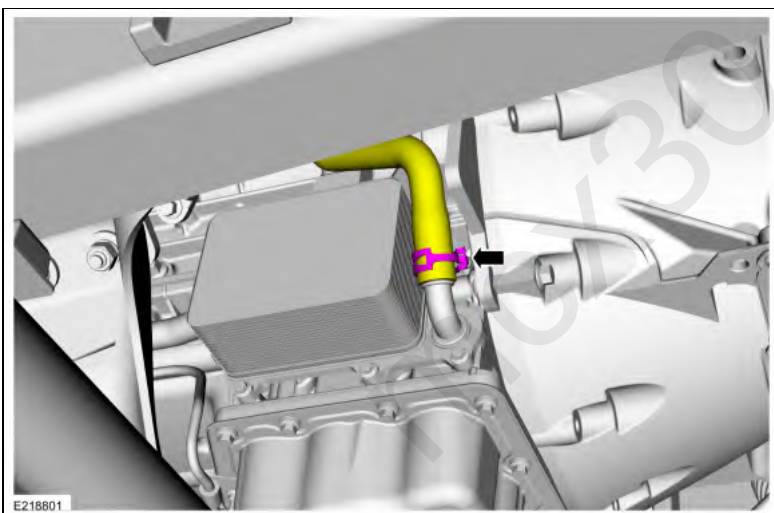
51. Close the radiator draincock.



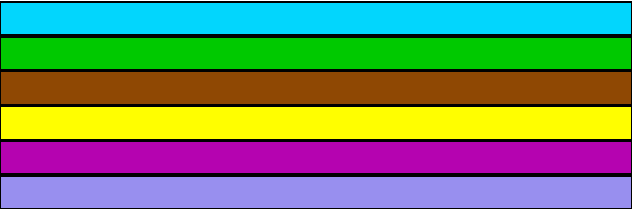
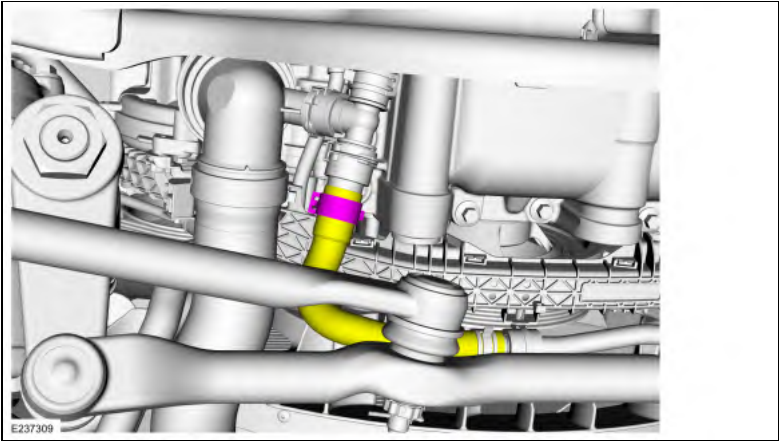
52. Install the RH cylinder block drain plug.
Torque: 44 lb.ft (60 Nm)



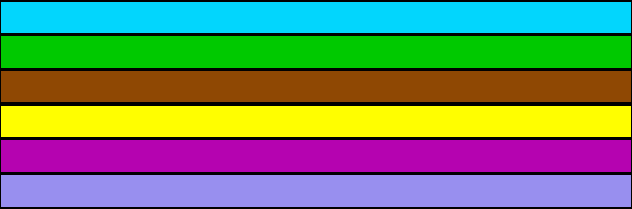
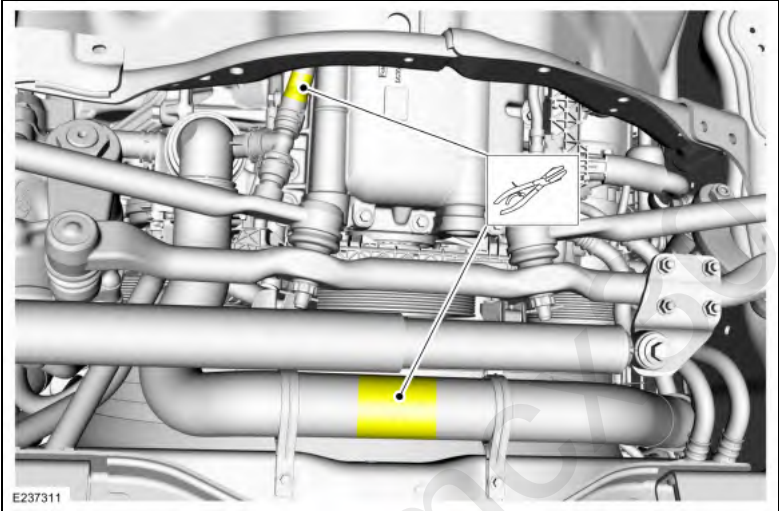
53. Connect the engine-to-engine oil cooler hose to the engine oil cooler and position the clamp. Use the General Equipment: Hose Clamp Remover/Installer



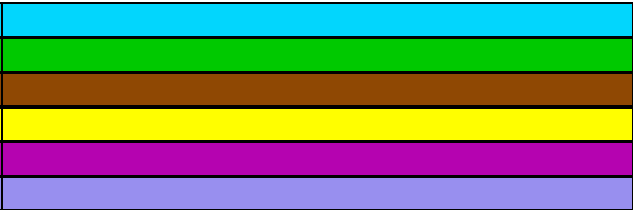
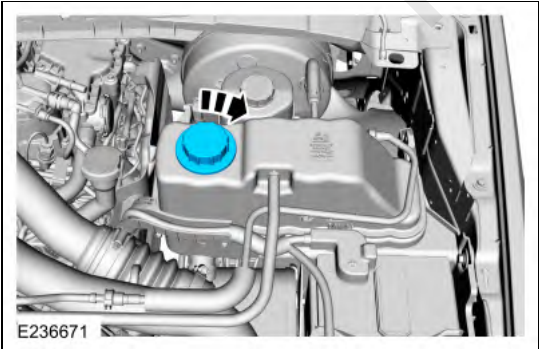
54. Release the clamp and disconnect the heater return hose.
Use the General Equipment: Hose Clamp Remover/Installer



55. Using a coupling adapter and 2 hose clamps, connect the fabricated fresh water supply hose to the heater return hose.
56. Route the fabricated drain hose from under the vehicle and, using a hose clamp, connect the fabricated drain hose to the heater return hose fitting.
57. Using hose pinch pliers, clamp the engine oil cooler return hose and the lower radiator hose.



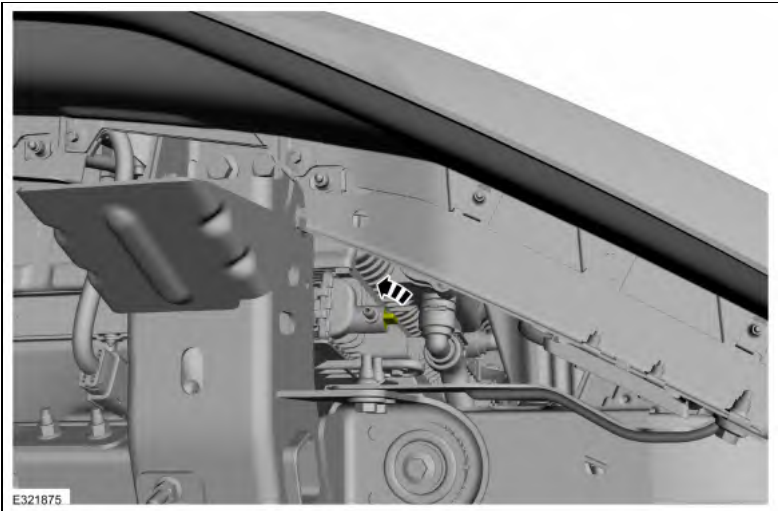
58. Install the pressure relief cap.



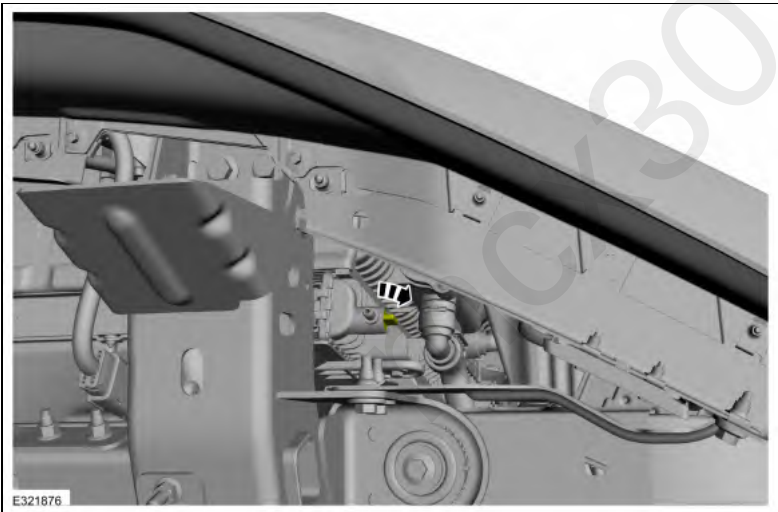
59. **NOTE:** Failure to flush all the Motorcraft® Engine Cooling System Iron Cleaner from the cooling system will result in shortened coolant protection against corrosion of the cooling system.

Turn on the fresh water supply and allow the water to flush the heater core and radiator system until the drain water is free of foam, bubbles or discoloration.

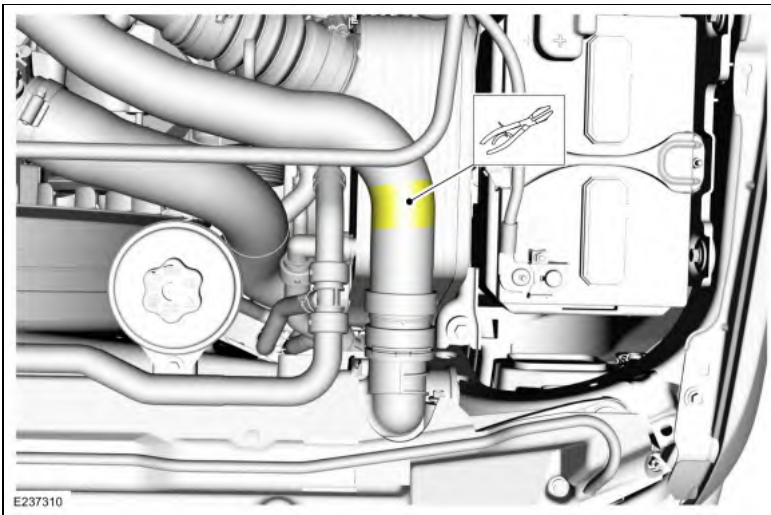
60. While the water is flushing the heater core and radiator system, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
61. If the drain water in step 60 shows signs of foam, bubbles or discoloration, continue to flush the heater core and radiator system with fresh water and repeat step 60 until the drain water is free of foam, bubbles or discoloration.
62. Turn off the fresh water supply.
63. Open the radiator draincock and drain the cooling system. Use a clear, clean, approximately 1 L (1 qt) container to verify the drain water is free of foam, bubbles or discoloration.



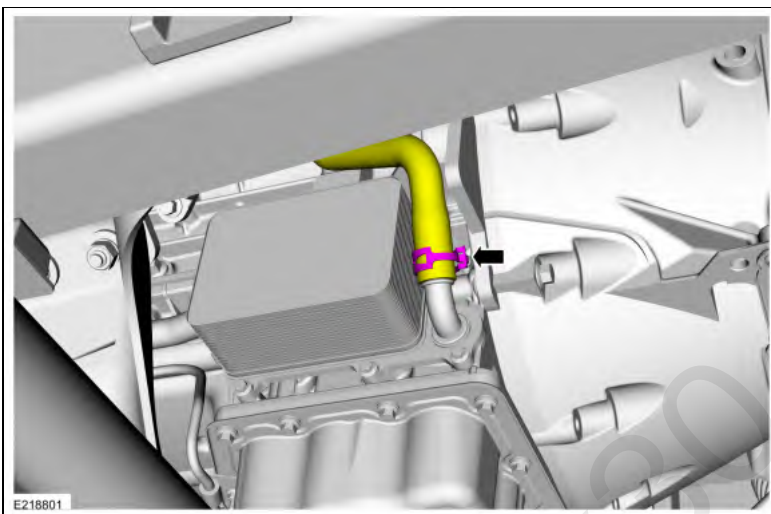
64. Close the radiator draincock.



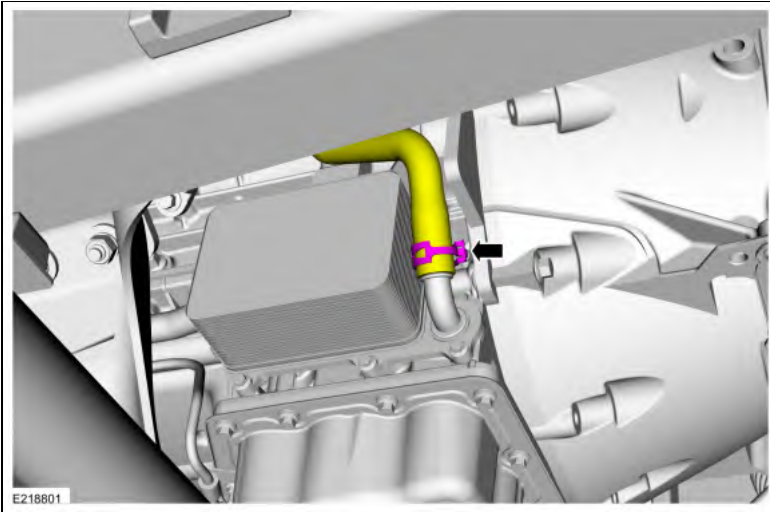
65. If any of the drain water in step 63 shows signs of foam, bubbles or discoloration, repeat steps 59 through 63.
66. Using hose pinch pliers, clamp the upper radiator hose.



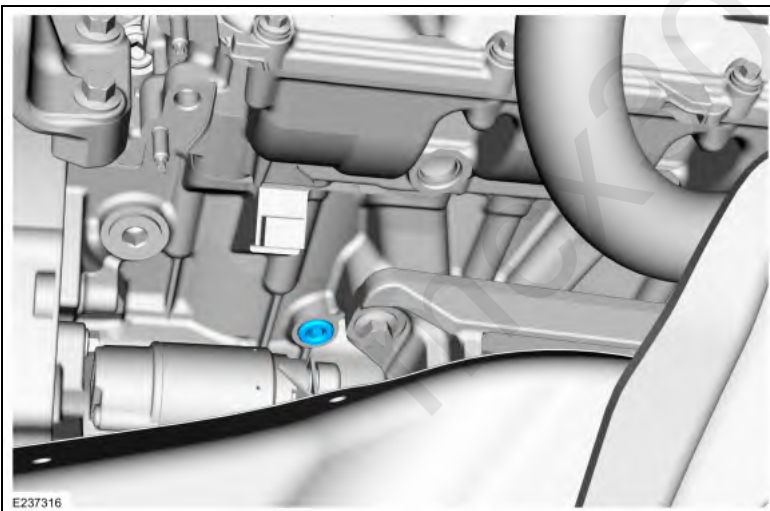
67. Release the clamp and disconnect the engine-to-engine oil cooler hose from the engine oil cooler and drain the LH side of the cylinder block.
Use the General Equipment: Hose Clamp Remover/Installer



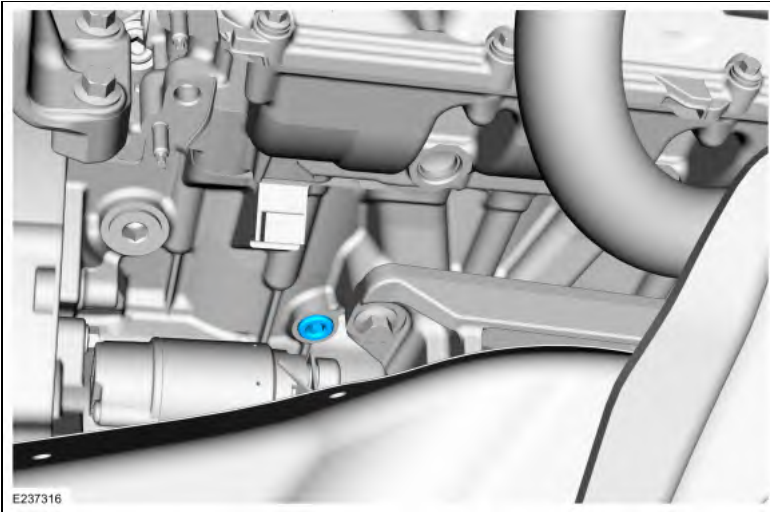
68. Turn on the fresh water supply and allow the water to flush the LH side of the cylinder block until the water is free of foam, bubbles or discoloration.
69. While the water is flushing the engine, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
70. If the drain water in step 69 shows signs of foam, bubbles or discoloration, continue to flush the engine with fresh water and repeat step 69 until the drain water is free of foam, bubbles or discoloration.
71. Turn off the fresh water supply and allow the LH side of the engine block to drain.
72. Connect the engine-to-engine oil cooler hose and position the clamp.
Use the General Equipment: Hose Clamp Remover/Installer



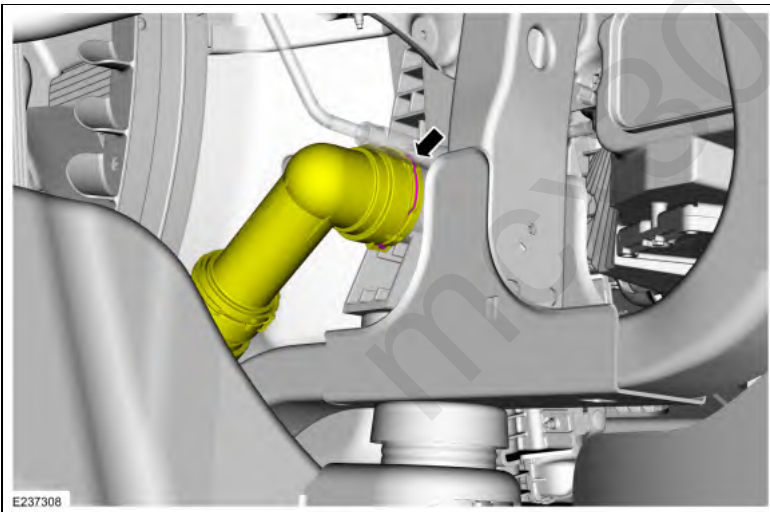
73. Remove the RH cylinder block drain plug and drain the RH side of the cylinder block.



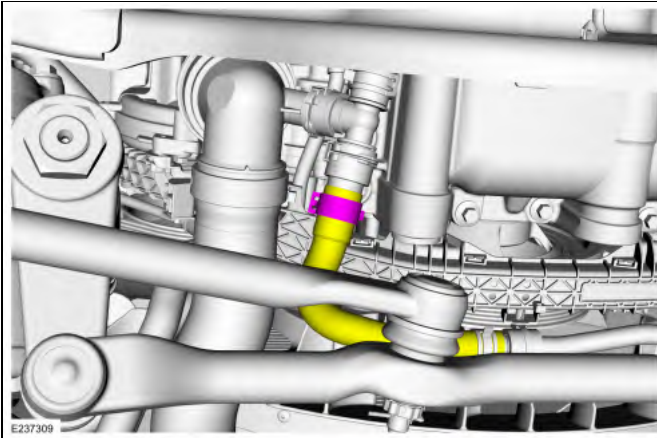
74. Turn on the fresh water supply and allow the water to flush the RH side of the cylinder block until the drain water is free of foam, bubbles or discoloration.
75. While the water is flushing the engine, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
76. If the drain water in step 75 shows signs of foam, bubbles or discoloration, continue to flush the engine with fresh water and repeat step 75 until the drain water is free of foam, bubbles or discoloration.
77. Turn off the fresh water supply and allow the RH side of the engine block to drain.
78. Install the RH cylinder block drain plug.
Torque: 44 lb.ft (60 Nm)



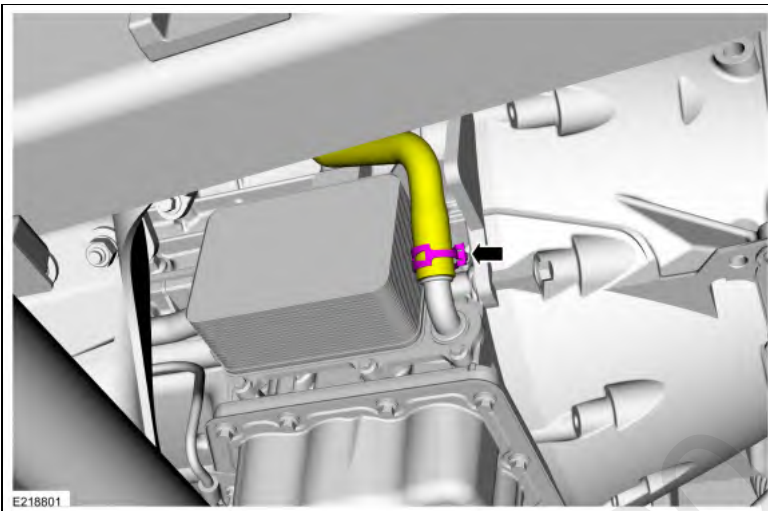
79. Remove the hose pinch pliers from the lower radiator hose and the oil cooler return hose.
80. Turn on the fresh water supply and allow the water to flush the front of the engine and coolant pump.
81. While the water is flushing the front of the engine and coolant pump, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
82. If the drain water in step 81 shows signs of foam, bubbles or discoloration, continue to flush the front of the engine and coolant pump with fresh water and repeat step 81 until the drain water is free of foam, bubbles or discoloration.
83. Turn off the fresh water supply.
84.
 - Pull the lower radiator hose spring clip until the end of the clip is in the detent on the quick connect coupling and disconnect the lower radiator hose and drain all the water from the lower radiator hose. Use a clear, clean approximately 1 L (1 qt) container to verify the drain water is free of foam, bubbles or discoloration and drain all the contaminants from the lower radiator hose.
 - Connect the lower radiator hose and push the spring clip in place when finished.



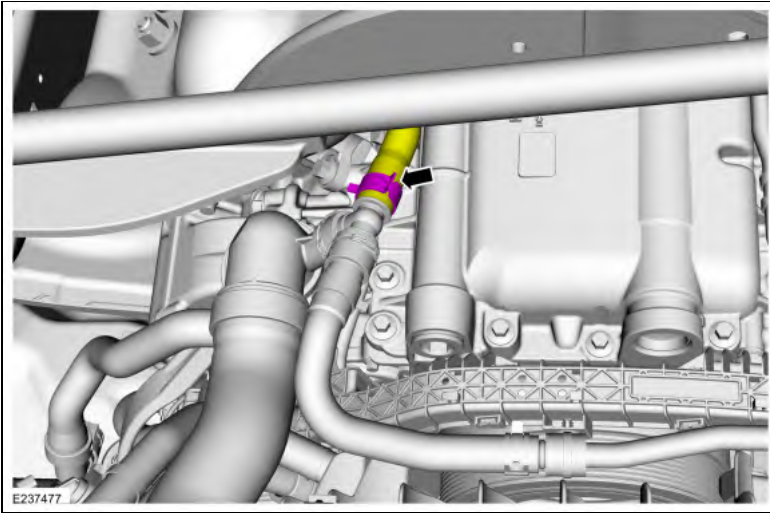
85. If any of the drain water in step 84 shows signs of foam, bubbles or discoloration, repeat steps 80 through 84.
86. Disconnect the fresh water supply and drain hoses from the heater return hose and the lower radiator hose.
87. Connect the heater return hose and position the clamp.
Use the General Equipment: Hose Clamp Remover/Installer



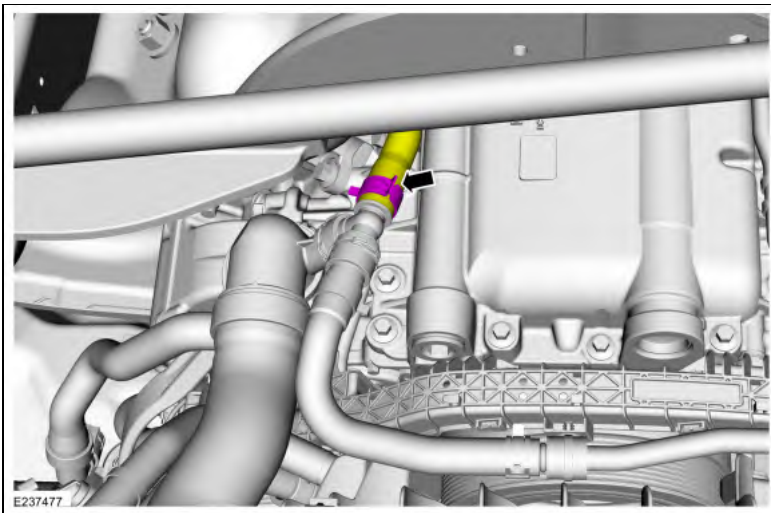
88. Release the clamp and disconnect the engine-to-engine oil cooler hose from the engine oil cooler.
Use the General Equipment: Hose Clamp Remover/Installer



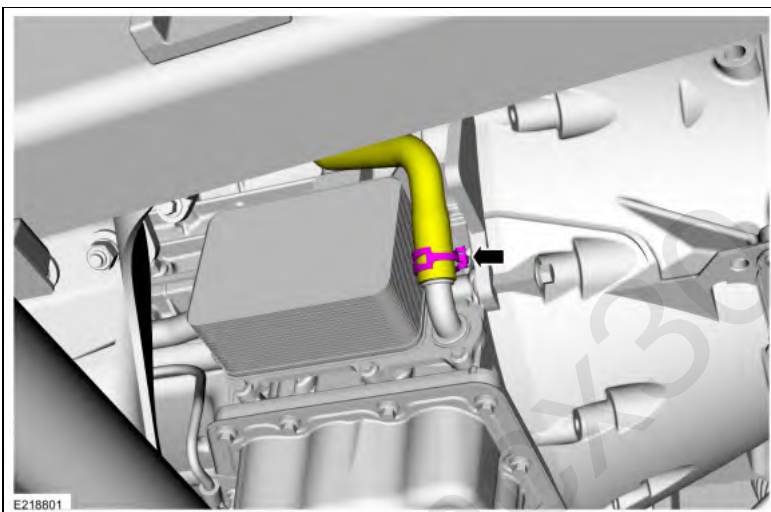
89. Release the clamp and disconnect the oil cooler return hose.
Use the General Equipment: Hose Clamp Remover/Installer



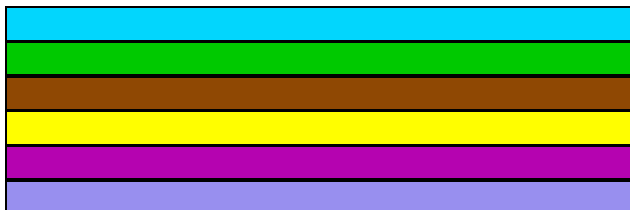
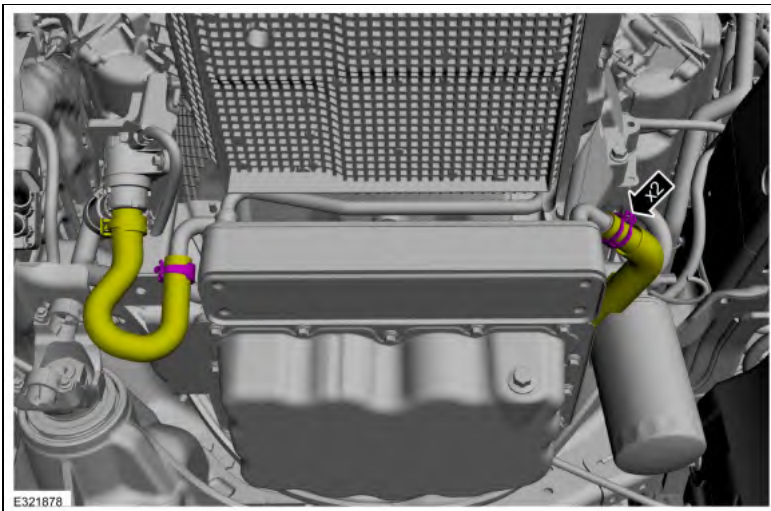
90. Using a coupling adapter and 2 hose clamps, connect the fresh water supply hose to the oil cooler return hose.
91. Using a hose clamp, connect the drain hose to the engine oil cooler feed pipe.
92. Turn on the fresh water supply and allow the water to flush the engine oil cooler until the drain water is free of foam, bubbles or discoloration.
93. While the water is flushing the oil cooler, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
94. If the drain water in step 93 shows signs of foam, bubbles or discoloration, continue to flush the oil cooler with fresh water and repeat step 94 until the drain water is free of foam, bubbles or discoloration.
95. Turn off the fresh water supply.
96. Disconnect the fresh water supply hose from the engine oil cooler return hose.
97. Disconnect the drain hose from the engine oil cooler feed pipe.
98. Connect the oil cooler return hose and position the clamp.
Use the General Equipment: Hose Clamp Remover/Installer



99. Connect the engine-to-engine oil cooler hose to the engine oil cooler and position the clamp.
Use the General Equipment: Hose Clamp Remover/Installer

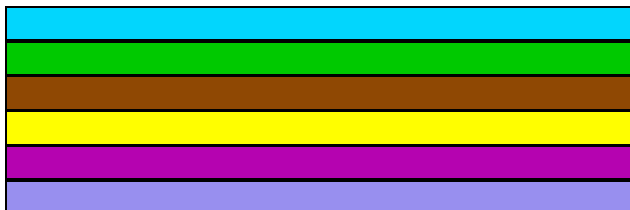
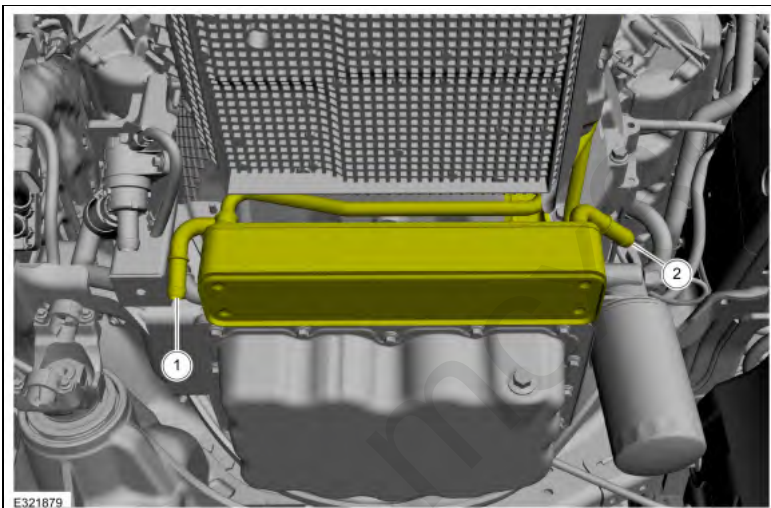


100. Remove the waterproof plastic from the starter.
101. Remove the hose pinch pliers from the upper radiator hose.
102. Release the clamps and disconnect the transmission cooler coolant tubes.
Use the General Equipment: Hose Clamp Remover/Installer

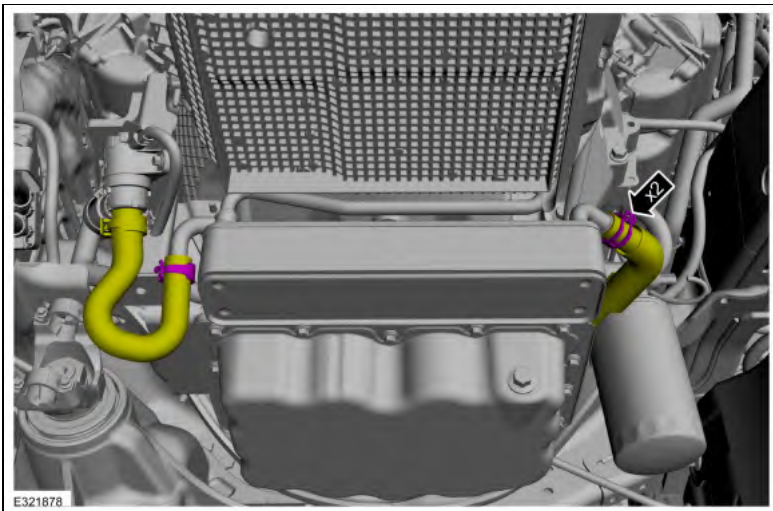


103.

1. Using a coupling adapter and 2 hose clamps, connect the fabricated fresh water supply hose to the transmission cooler outlet fitting.
2. Using a hose clamp, connect the drain hose to the transmission cooler inlet fitting.



104. Turn on the fresh water supply and allow the water to flush the transmission cooler until the drain water is free of foam, bubbles or discoloration.
105. While the water is flushing the transmission cooler, use a clear, clean approximately 1 L (1 qt) container to collect some of the drain water and verify the drain water is free of foam, bubbles or discoloration.
106. If the drain water in step 105 shows signs of foam, bubbles or discoloration, continue to flush the oil cooler with fresh water and repeat step 105 until the drain water is free of foam, bubbles or discoloration.
107. Turn off the fresh water supply.
108. Disconnect the fresh water supply hose from the transmission cooler outlet fitting.
109. Disconnect the drain hose from the transmission cooler inlet fitting.
110. Connect the transmission cooler coolant tubes.
Use the General Equipment: Hose Clamp Remover/Installer



111. Connect the battery ground cable.

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

112.

1. Fill the cooling system with low hardness, low chloride water. Tap water which is verified with Rotunda Water Test Strip 5 pack 328-00007 or equivalent is acceptable. Alternatively, use water treated by reverse osmosis, or water that is de-ionized or distilled.
2. Fill the degas bottle to the maximum fill line.

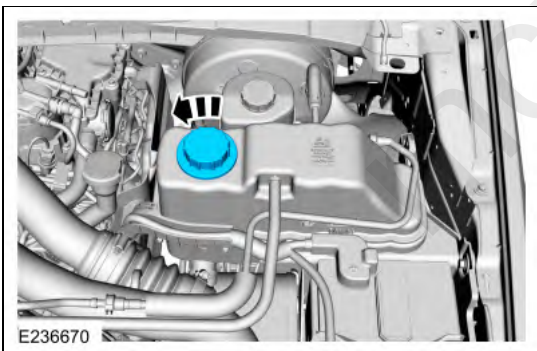
3. **NOTE:** The degas bottle cap must be loose so that the cooling system does not get pressurized.

Install the degas bottle cap until it contacts the hard stop. Back the degas bottle cap off one-half turn.

4. If the coolant level drops below the minimum fill line refill the degas bottle to the maximum fill line.
5. Run the engine at 2,000 rpm for 2 minutes.
6. Bring the engine to an idle.
7. If the coolant level drops below the minimum fill line refill the degas bottle to the maximum fill line.
8. Repeat Steps 5 through 7 until the coolant level stabilizes. Shut the engine off.
9. Fill the degas bottle to 20 mm (0.787 in) above the maximum fill line. Install the degas bottle cap.

113. **WARNING:** Always allow the engine to cool before opening the cooling system. Do not unscrew the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

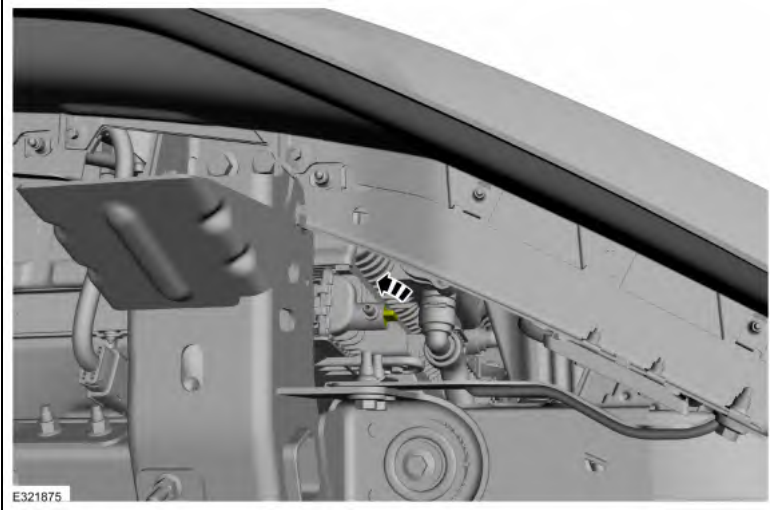
Release the pressure in the cooling system by slowly turning the pressure relief cap one-half turn counterclockwise. When the pressure is released, remove the pressure relief cap.

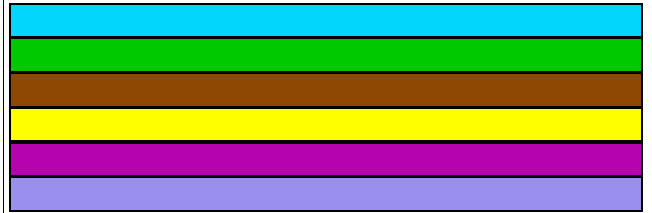


114. Disconnect the battery ground cable.

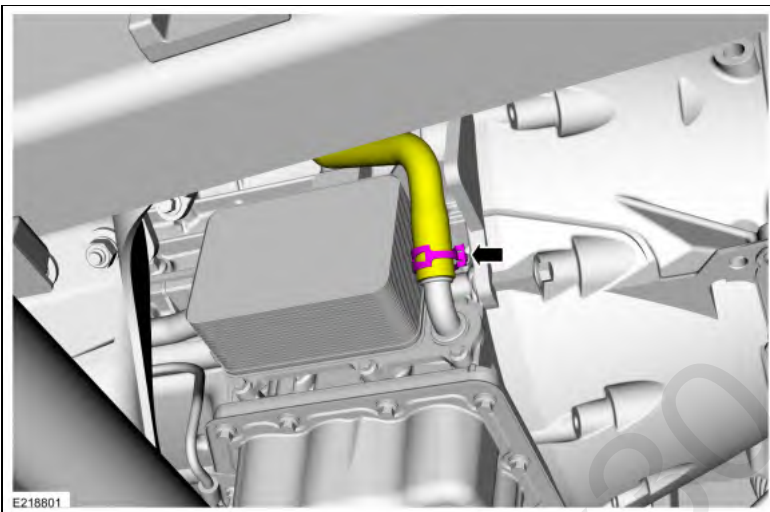
Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

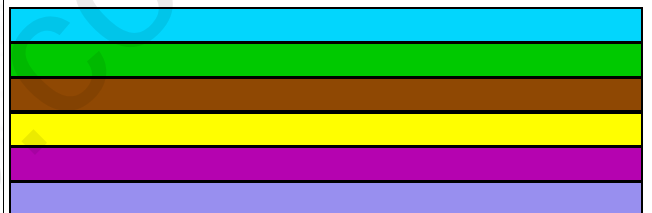
115. Open the radiator draincock and drain the cooling system. Leave the radiator draincock open.



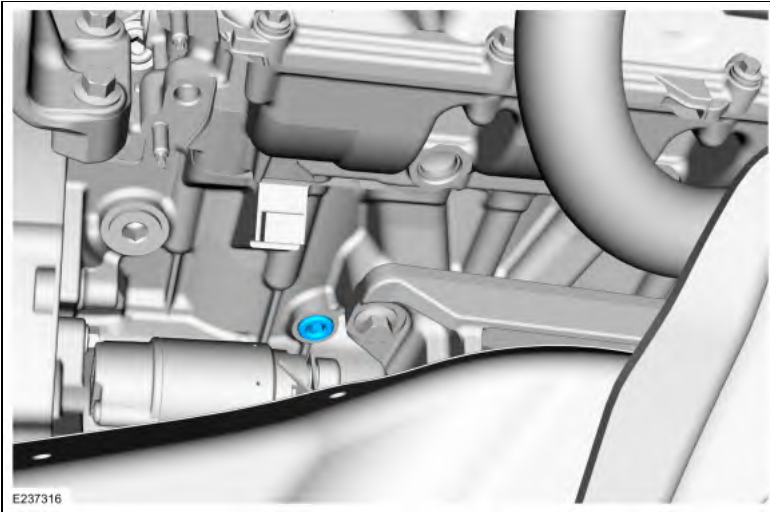


116. Release the clamp and disconnect the engine-to-engine oil cooler hose from the engine oil cooler and drain the cylinder block.
Use the General Equipment: Hose Clamp Remover/Installer



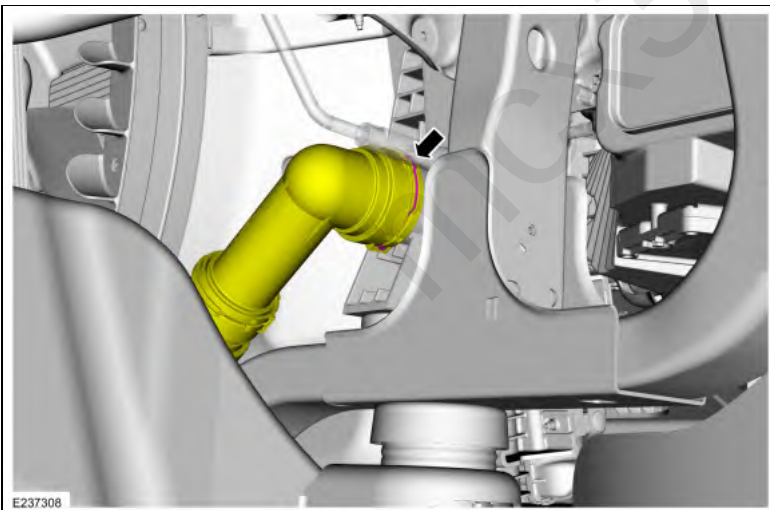


117. Completely cover the starter with waterproof plastic.
118. Remove the RH cylinder block drain plug and drain the cylinder block.

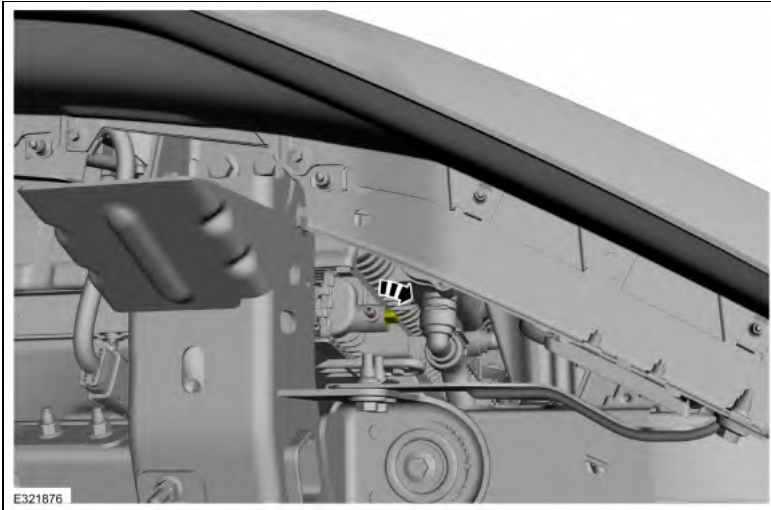


119.

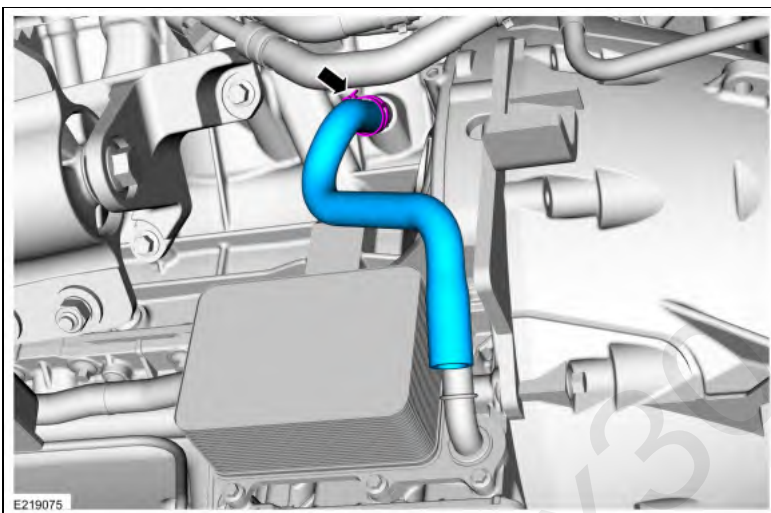
- Pull the lower radiator hose spring clip until the end of the clip is in the detent on the quick connect coupling and disconnect the lower radiator hose, and drain all the water from the lower radiator hose.
- Connect the lower radiator hose and push the spring clip in place when finished.



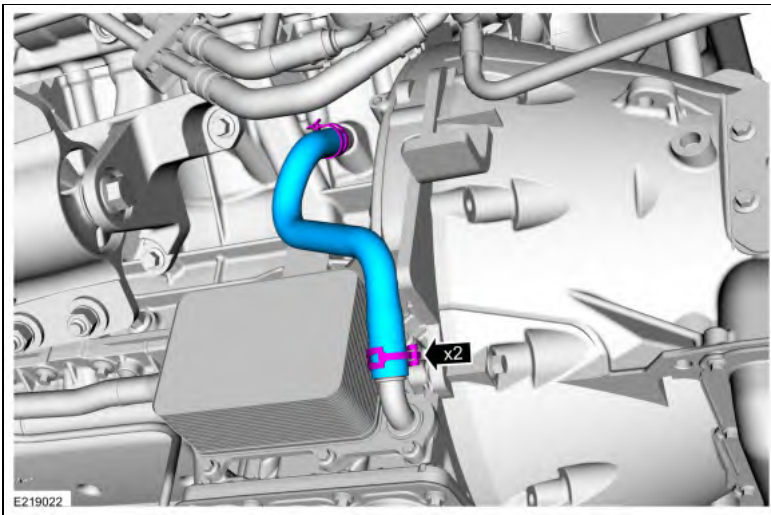
120. Close the radiator draincock.



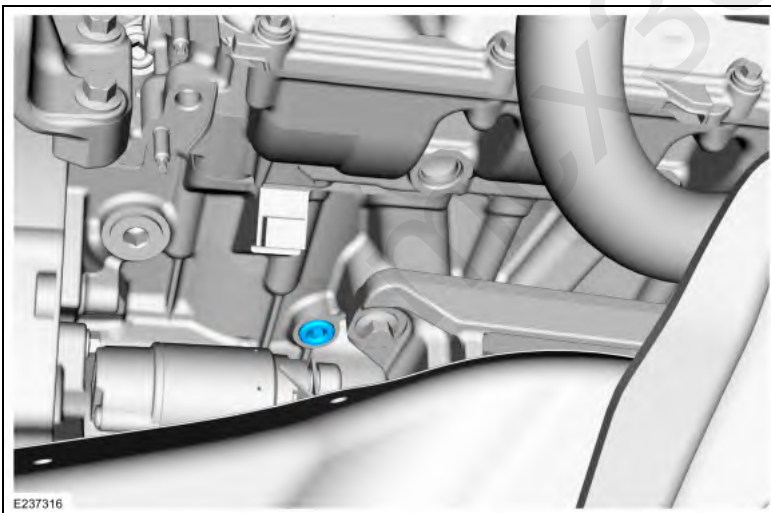
121. Release the clamp and remove the engine-to-engine oil cooler hose.
Use the General Equipment: Hose Clamp Remover/Installer



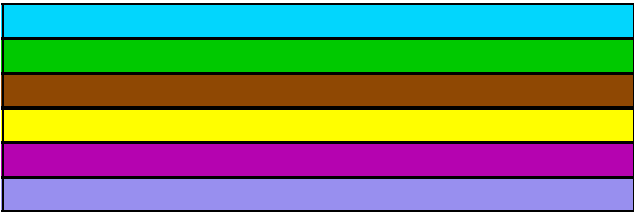
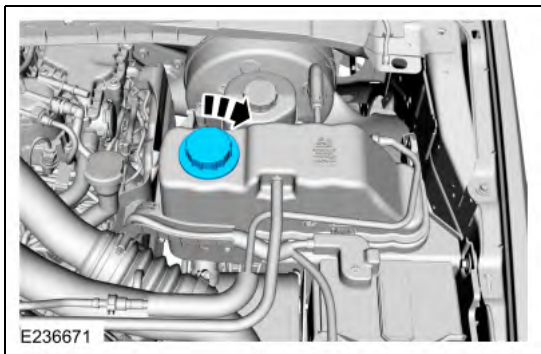
122. Install a new engine-to-engine oil cooler hose and position the clamps.
Use the General Equipment: Hose Clamp Remover/Installer



123. Install the RH cylinder block drain plug.
Torque: 44 lb.ft (60 Nm)



124. Remove the waterproof plastic from the starter.
125. Install the RH fender rear splash shield.
 Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
126. Install the RH front tire.
 Refer to: Wheel and Tire - Vehicles With: Dual Rear Wheels (204-04A Wheels and Tires, Removal and Installation).
127. Connect the battery ground cable.
 Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
128. Using a new thermostat gasket, install the thermostats.
 Refer to: Thermostat (303-03B Engine Cooling - 6.7L Power Stroke Diesel, Removal and Installation).
129. Fill and bleed the cooling system.
 Refer to: Engine Cooling System Draining, Vacuum Filling and Bleeding (303-03B Engine Cooling - 6.7L Power Stroke Diesel, General Procedures).
130. Install a new degas bottle cap until it contacts the hard stop.



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