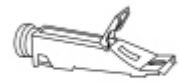
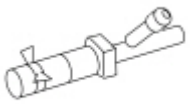
Engine Cooling

Materials

Name	Specification
Motorcraft® Orange Prediluted Antifreeze/Coolant VC-3DIL-B	WSS-M97B44-D2
Motorcraft® Yellow Concentrated Antifreeze/Coolant VC-13-G	WSS-M97B57-A1
Motorcraft® Yellow Prediluted Antifreeze/Coolant VC-13DL-G	WSS-M97B57-A2
Motorcraft® Orange Concentrated Antifreeze/Coolant VC-3-B	WSS-M97B44-D

Special Tool(s)

 E144764	3-Way HD Antifreeze Coolant Test Kit 328-2050-62291 or equivalent
 E144765	Coolant/Battery Refractometer ROB75240 or equivalent
 E144767	D-Gas Adapter 300-OTC014-R1068 or equivalent
 E144766	Radiator Tester 014-R1072 or equivalent
	UView® Combustion Leak Tester UVU560000-R

NOTICE: The cooling system is filled with Motorcraft® Orange Antifreeze/Coolant or Motorcraft® Yellow Antifreeze/Coolant. Use the same type of coolant that was originally used to fill the cooling system. Do not mix coolant types. Mixing coolant types may degrade the coolant corrosion protection and may damage the engine or cooling system.

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

Material: Motorcraft® Yellow Concentrated Antifreeze/Coolant / VC-13-G (WSS-M97B57-A1)
Material: Motorcraft® Yellow Prediluted Antifreeze/Coolant / VC-13DL-G (WSS-M97B57-A2)

DTC Chart

WARNING: Before beginning any service procedure in this section, refer to Safety Warnings in section 100-00 General Information. Failure to follow this instruction may result in serious personal injury.

REFER to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

PCM DTC Chart

DTC	Description	Action
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	GO to Pinpoint Test C
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	GO to Pinpoint Test C
P0217	Engine Coolant Overtemperature Condition	GO to Pinpoint Test B

P0480	Fan 1 Control Circuit	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1285	Cylinder Head Overtemperature Condition	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1299	Cylinder Head Overtemperature Protection Active	GO to Pinpoint Test B
P2681	Engine Coolant Bypass Valve "A" Control Circuit/Open	REFER to: Transmission Cooling (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
P2683	Engine Coolant Bypass Valve "A" Control Circuit High	REFER to: Transmission Cooling (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
All Other PCM Diagnostic Trouble Codes (DTCs)	—	REFER to: Transmission Cooling (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).

Inspection and Verification

NOTICE: The engine cooling system is filled with Motorcraft® Orange Antifreeze/Coolant or Motorcraft® Yellow Antifreeze/Coolant. Always fill the cooling system with the manufacturer's specified coolant. Chemically flush the cooling system if a non-specified coolant has been used. Failure to follow these instructions may damage the engine or cooling system.

NOTE: *During normal vehicle operation, Motorcraft Orange Antifreeze/Coolant may change color from orange to pink or light red. As long as the engine coolant is clear and uncontaminated, this color change does not indicate the engine coolant has degraded nor does it require the engine coolant to be drained, the system to be flushed, or the engine coolant to be replaced.*

1. Verify the customer concern.
2. Visually check the engine coolant level at the degas bottle when the system is cold.
3. Make sure the pressure relief cap is installed correctly.
4. Record any cooling system Diagnostic Trouble Codes (DTCs) retrieved. Refer to the PCM DTC chart in this section for DTC descriptions.
5. **NOTE:** *Take note of any coolant odor or steam coming from cooling system components.*

   If the system coolant is filled correctly and no Diagnostic Trouble Codes (DTCs) associated with fail-safe cooling are retrieved, verify the customer concern by operating the engine to duplicate the condition.
6. Visually inspect for obvious signs of any mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical

• Leaks or weeps at:
  • Hoses
  • Tubes
  • Clamp joints
  • Gaskets
  • O-rings
  • Thermostat housing (part of coolant pump adapter)
  • Radiator
  • Pressure relief cap
  • Coolant pump
  • Cabin heater coolant pump
  • Heater core (wet floor or coolant odor in vehicle)
  • Coolant inlet connector
  • Coolant outlet connector
  • Coolant pump adapter
  • Oil cooler (may leak internally or externally)
  • Transmission fluid cooler (may leak internally or externally)
  • EGR cooler (may leak internally or externally)
  • Transmission fluid cooler coolant control valve
  • Degas bottle
  • Cylinder block core plugs
  • Cylinder head core plugs
  • Block heater (if equipped)
  • Turbocharger
• Cracked or damaged:
  • Hoses
  • Tubes
  • Hose clamps
  • Thermostat housing (part of coolant pump adapter)
  • Coolant inlet connector
  • Coolant outlet connector
  • Coolant pump adapter
  • Oil cooler
  • Transmission fluid cooler
  • EGR cooler
  • Transmission fluid cooler coolant control valve
  • Radiator
  • Pressure relief cap
  • Cooling fan
  • Coolant pump
  • Cabin heater coolant pump
  • Degas bottle
  • Cylinder block core plugs
  • Cylinder head core plugs
  • Block heater (if equipped)
  • Turbocharger
• Restricted airflow through the A/C condenser/radiator
• Drive belt loose, worn or installed incorrectly
• Broken or weak drive belt tensioner
• Excessive white or light gray exhaust smoke (may have burnt coolant odor)
	• Inoperative or damaged:
	  • Electronically actuated fan clutch
	  • Electronically actuated fan clutch controller
	  • Wiring, connectors, relays or modules
	  • ECT sensor
	  • CHT sensor
	  • Temperature gauge

• Coolant in engine oil • Coolant in transmission fluid • Engine oil in coolant • Transmission fluid in coolant	

7. If the inspection reveals an obvious concern that can be readily identified, repair it as necessary.

8. Inspect the coolant condition.
    1. Inspect the coolant color.
        - Change in color of coolant may indicate that incorrect coolant may have been added to the system. Use of incorrect coolant degrades the corrosion protection. The addition of Motorcraft® Premium Antifreeze/Coolant or Motorcraft® Specialty Green Engine Coolant to the Motorcraft® Yellow Antifreeze/Coolant may cause the color to appear light green. Addition of Motorcraft® Orange Antifreeze/Coolant may cause the color to appear light orange. The addition of Motorcraft® Premium Antifreeze/Coolant or Motorcraft® Specialty Green Engine Coolant to the Motorcraft® Orange Antifreeze/Coolant may cause the color to appear light green to murky green-brown. The addition of Motorcraft® Gold Antifreeze/Coolant, however, may not change the color or appearance of the orange colored or yellow colored coolants. Detection of contamination with Motorcraft® Gold Antifreeze/Coolant is determined by the presence of nitrite. If contamination with Motorcraft® Gold Antifreeze/Coolant is suspected, test the coolant with the 3-Way HD Antifreeze Coolant Test Kit. Follow the nitrite testing directions in the kit to determine if nitrite is present in the system. If nitrite is present, flush the system and refill with the correct mixture of distilled water and the relevant Motorcraft® Concentrated Antifreeze/Coolant.
          REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

        - A darker orange with the presence of debris could indicate a commercially available stop leak may have been used and could result in loss of coolant flow to critical parts of the engine. If sediment is present, flush the system and refill with the correct mixture of distilled water and the relevant Motorcraft® Concentrated Antifreeze/Coolant.
          REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

        - A light or reddish brown color indicates that rust may be present in the cooling system. Flush the system and refill with the correct mixture of distilled water the relevant Motorcraft® Concentrated Antifreeze/Coolant.
          REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

        - An iridescent sheen on top of the coolant could indicate a trace of oil is entering the system. For engine diagnosis,
          REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
          Flush the system and refill with the correct mixture of distilled water and the relevant Motorcraft® Concentrated Antifreeze/Coolant. REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

        - A milky brown color may indicate that engine oil is entering the cooling system. Pressure test the cooling system. Refer to component tests in this section. If engine oil is suspected, the cause of the leak may be internal to the engine. For engine diagnosis, REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
          Flush the system and refill with the correct mixture of distilled water and the relevant Motorcraft® Concentrated Antifreeze/Coolant. REFER to: Cooling System Flushing

(303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

2. If the engine coolant appearance is acceptable, test the engine coolant freezing point range with the Coolant/Battery Refractometer. Maintain the coolant concentration within 48% to 50%, which equates to a freeze point between -34˚C and -37˚C (-30˚F and -34˚F). If the vehicle is driven in cold climates less than -37°C (-34°F), it may be necessary to increase the coolant concentration to get adequate freeze protection. Recommended coolant concentration is 48/52 to 50/50 (freeze protection -34°C to -37°C [-30°F to -34°F]) engine coolant to distilled water.
   - Maximum coolant concentration is 60/40 for cold weather areas.
   - Minimum coolant concentration is 40/60 for warm weather areas.
3. **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.**

   Adjust coolant range and level if necessary:
   - If coolant is low, add specified coolant mixture only.
   - If the engine coolant tests too weak, remove some of the engine coolant and add the relevant Motorcraft® Concentrated Antifreeze/Coolant until the readings are within acceptable levels. Start the engine and allow to idle for 4 minutes to mix the coolant.
   - If the engine coolant tests strong, remove some of the engine coolant and add distilled water until the readings are within acceptable levels. Start the engine and allow to idle for 4 minutes to mix the coolant.

9. If an obvious cause for an observed or reported concern is found, correct the cause and test the system for normal operation before proceeding to the next step.

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices. REFER to: Diagnostic Methods (100-00 General Information, Description and Operation).

Condition	Possible Sources	Actions
Loss of coolant	Refer to the Pinpoint Test	GO to Pinpoint Test A
The engine overheats.	Refer to the Pinpoint Test	GO to Pinpoint Test B
The engine does not reach normal operating temperature.	Refer to the Pinpoint Test	GO to Pinpoint Test C
The block heater does not operate correctly.	• Block heater power cable • Block heater	• CHECK continuity in all 3 power cable circuits. If any circuit measures more than 5 ohms, INSTALL a new power cable. • CHECK the resistance of the block heater. If the resistance does not measure between 30 and 40 ohms, INSTALL a new block heater. REFER to: Block Heater (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation).

The electronically controlled fan clutch is inoperative in one or more speeds or does not operate correctly.	• Wiring • Electric fan clutch	Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Pinpoint Tests

Loss of Coolant

Normal operation and Fault Conditions

The engine cooling system is a closed system providing for coolant expansion and contraction as well as changes in pressure as coolant warms and cools with engine operation. Various gaskets, seals, hoses and clamps contain coolant within the cooling system and keep other fluids and contaminants from entering the cooling system.

Possible Sources

- Coolant hoses or tubes
- Hose clamps
- Thermostat O-ring seal or gasket
- Coolant pump O-ring seal or gasket
- Thermostat housing (part of coolant pump adapter)
- Oil cooler (may leak internally or externally)
- Transmission fluid cooler (may leak internally or externally)
- EGR cooler (may leak internally or externally)
- Transmission fluid cooler coolant control valve
- Pressure relief cap
- Coolant pump leaking from weep hole
- Cabin heater coolant pump
- Heater core
- Coolant inlet connector O-ring seal or gasket
- Coolant outlet connector O-ring seal or gasket
- Coolant pump adapter O-ring seal or gasket
- Engine gaskets (may leak internally or externally)
- Degas bottle
- Cylinder block core plugs
- Cylinder head core plugs
- Block heater (if equipped)
- Turbocharger

PINPOINT TEST A : PINPOINT TEST

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.

A1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out Inspection and Verification.

Are any concerns present?

Yes	REPAIR as needed.
No	GO to A2

A2 CHECK THE ENGINE COOLANT LEVEL AND PRESSURE TEST THE ENGINE COOLING SYSTEM

NOTE: *Allow the engine to cool before checking the engine coolant level.*

- Ignition OFF
- Visually inspect the engine coolant level at the degas bottle and adjust as necessary. Pressure test the engine cooling system. Refer to Component Tests, Cooling System Pressure Test in this section.

Does the engine cooling system leak externally?

Yes	REPAIR or INSTALL new components.
No	GO to A3

A3 CHECK THE ENGINE COOLANT FOR AN INTERNAL LEAK

- Inspect the engine coolant in the degas bottle for signs of engine oil.

Is engine oil evident in the engine coolant?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	GO to A4

A4 CHECK THE ENGINE OIL FOR COOLANT

- Remove the oil level indicator from the engine.

Is coolant evident in the oil?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	GO to A5

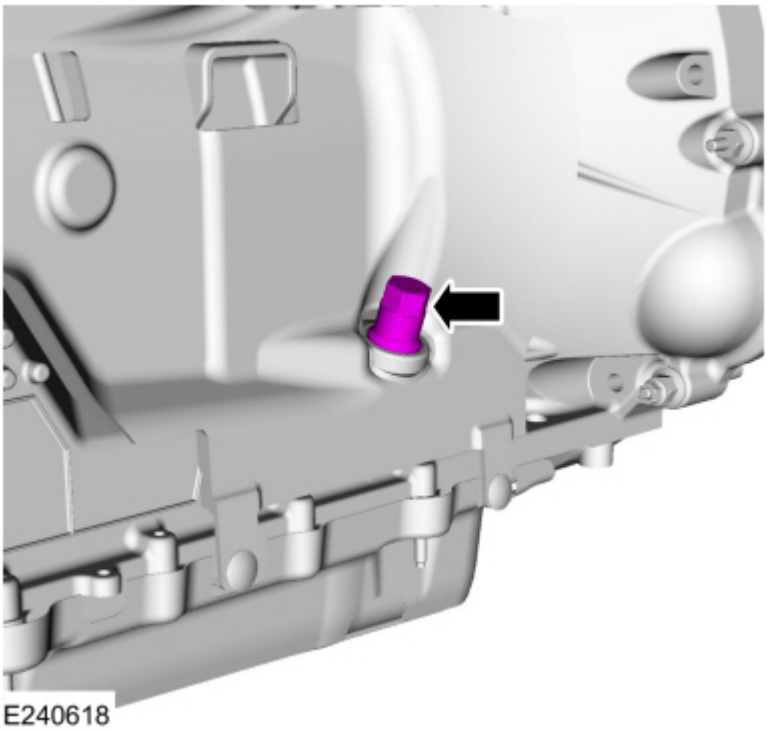
A5 CHECK THE ENGINE COOLANT FOR TRANSMISSION FLUID

Is transmission fluid evident in the engine coolant?

Yes	INSTALL a new transmission fluid cooler. REFER to: Transmission Fluid Cooler (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Removal and Installation). REPAIR the transmission as necessary. FLUSH the engine cooling system. REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures). REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing). TEST the system for normal operation.
No	GO to A6

A6 CHECK THE TRANSMISSION FLUID FOR ENGINE COOLANT

- Remove the transmission oil leveling plug.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- Check the transmission fluid for engine coolant.

Is engine coolant evident in the transmission fluid?

Yes	INSTALL a new transmission fluid cooler. REFER to: Transmission Fluid Cooler (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Removal and Installation). REPAIR the transmission as necessary. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing). TEST the system for normal operation. FLUSH the engine cooling system. REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost

	(201kW/273PS), General Procedures).
No	GO to A7

A7 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE: *Use UView® Combustion Leak Tester part number UVU560000-R or equivalent.*

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.

Are combustion gases present?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	The cooling system is operational.

The Engine Overheats

Normal operation and Fault Conditions

The engine cooling system maintains the engine temperature during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. Coolant is sent from the coolant pump through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core and turbochargers with coolant. The coolant pump circulates the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant flows through the radiator circuit to transfer engine-generated heat to the outside air.

Engine overheating generally occurs when there is a disruption in the ability to control either coolant flow at the correct rate, the inability to transfer heat from the engine through the coolant (including low coolant) or an inability to transfer engine-generated heat to the outside air through the radiator.

Possible Sources

- Low coolant level
- External engine coolant leak
- Airlock in system
- Pressure relief cap
- Restricted airflow through A/C condenser/radiator
- Internal engine coolant leak
- Turbocharger
- Coolant condition/concentration
- Accessory drive components

- Non-OEM engine enhancement components
- Cooling fan
- Electronically actuated cooling fan clutch
- CHT sensor
- ECT sensor
- Radiator
- Thermostat
- Coolant pump
- Coolant flow restriction
- Engine oil in engine coolant
- Transmission fluid in engine coolant

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0217	Engine Coolant Overtemperature Condition	Sets in the PCM when an engine overheat condition was sensed by the ECT sensor.
P1299	Cylinder Head Overtemperature Protection Active	Sets in the PCM when an engine overheat condition was sensed by the CHT sensor or ECT sensor.

PINPOINT TEST B : PINPOINT TEST

B1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the Inspection and Verification procedure in this section.

Are any concerns present?

Yes	REPAIR as needed.
No	GO to B2

B2 CHECK FOR NON-OEM ENGINE ENHANCEMENT COMPONENTS

- Check the engine for any non-OEM components.

Are there any non-OEM components on the engine?

Yes	ADVISE the customer the engine modifications may be causing the engine to overheat.
No	GO to B3

B3 CHECK FOR PCM (POWERTRAIN CONTROL MODULE) DTCS

- Ignition ON.
- Using a scan tool, perform PCM self-test.

Is DTC P0217 and/or P1299 present?

Yes	GO to B4
No	Actual engine overheating has not been verified. CHECK the engine coolant temperature gauge operation. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). If any other PCM DTCs are retrieved, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).

B4 CHECK FOR AN AIRFLOW OBSTRUCTION AND MISSING AIR DEFLECTORS

NOTE: *Verify no vehicle front end damage is present.*

- Check the radiator or A/C condenser for an external obstruction such as leaves or cardboard and verify all air deflectors are present.

Is an airflow obstruction present or air deflectors missing?

Yes	REPAIR as necessary.
No	GO to B5

B5 CHECK THE COOLING FAN CLUTCH OPERATION

- Ignition OFF.
- Check the cooling fan clutch operation. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Is the cooling fan clutch operation OK?

Yes	GO to B6
No	REFER to: Cooling Fan (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation).

B6 CHECK THE ENGINE COOLANT LEVEL AND PRESSURE TEST THE COOLING SYSTEM

- Ignition OFF.
- Visually check the engine coolant level in the coolant expansion tank and adjust as necessary. Pressure test the cooling system.

Does the engine cooling system leak externally?

Yes	REPAIR or INSTALL new components.
No	GO to B7

- Inspect the engine coolant in the coolant expansion tank for signs of engine oil.

Is engine oil evident in the coolant?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	GO to B8

B8 CHECK THE ENGINE OIL FOR COOLANT

- Remove the oil level indicator from the engine.

Is coolant evident in the oil?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	GO to B9

B9 CHECK THE ENGINE COOLANT FOR TRANSMISSION FLUID

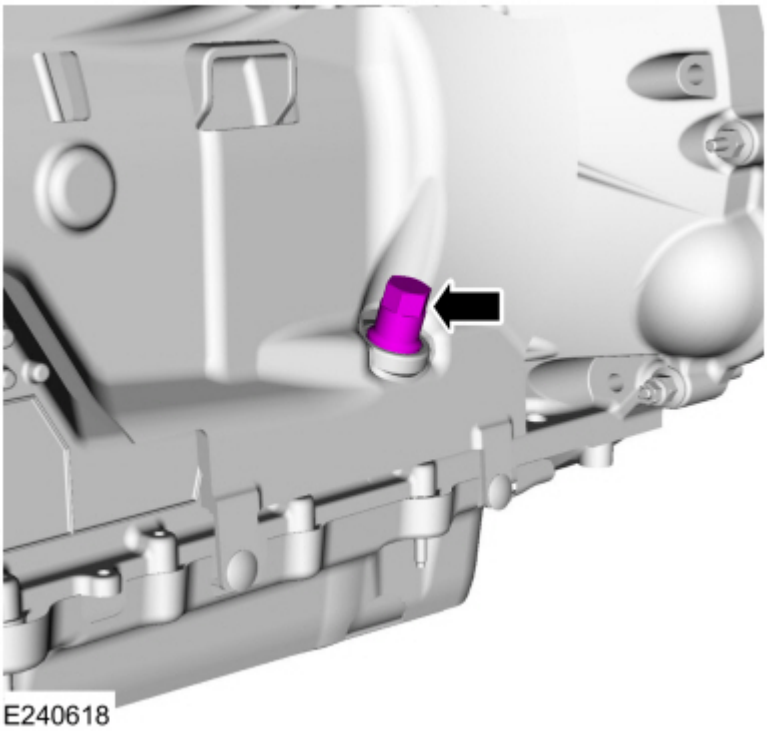
- Check the engine coolant in the degas bottle for signs of transmission fluid.

Is transmission fluid evident in the engine coolant?

Yes	INSTALL a new transmission fluid cooler. REFER to: Transmission Fluid Cooler (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Removal and Installation). REPAIR the transmission as necessary. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing). TEST the system for normal operation.
No	GO to B10

B10 CHECK THE TRANSMISSION FLUID FOR ENGINE COOLANT

- Remove the transmission oil leveling plug.



- Check the transmission fluid for engine coolant.

Is engine coolant evident in the transmission fluid?

Yes	INSTALL a new transmission fluid cooler. REFER to: Transmission Fluid Cooler (307-02 Transmission Cooling - 10-Speed Automatic Transmission - 10R80, Removal and Installation). REPAIR the transmission as necessary. REFER to: Diagnosis By Symptom (307-01 Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing). TEST the system for normal operation.
No	GO to B11

B11 CHECK THE COOLING SYSTEM FOR COMBUSTION GASES

NOTE: *Use UView® Combustion Leak Tester part number UVU560000-R or equivalent.*

- Using a cooling system combustion gas leak tester, following the instructions supplied with the tester, check the coolant for combustion gases.

Are combustion gases present?

Yes	REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).
No	GO to B12

- Check the coolant for dirt, rust or contamination and check the coolant concentration.

Is the coolant condition OK?

Yes	GO to B13
No	FLUSH the engine cooling system. REFER to: Cooling System Flushing (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), General Procedures).

B13 CHECK THE COOLANT PUMP OPERATION

- Start the engine.
- Allow the engine to run for 30 minutes. Place the climate control function selector in the MAX HEAT position. Feel the heater outlet hose.

Is the heater outlet hose hot?

Yes	GO to B14
No	INSTALL a new coolant pump. REFER to: Coolant Pump (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation).

B14 CHECK THE THERMOSTAT OPERATION

NOTE: *This cooling system uses a cold side thermostat. The coolant in the radiator must reach full operating temperature for the thermostat to remain in an open state.*

- Start the engine.
- Allow the engine to run for 30 minutes. Place the climate control function selector in the MAX HEAT position. Feel the lower radiator hose.

Is the lower radiator hose hot?

Yes	CHECK the temperature gauge operation. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing).
No	GO to B15

B15 VISUALLY INSPECT THE THERMOSTAT

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.

- Carry out the Thermostat Visual Inspection in the Component Tests portion of this section.

Is the thermostat damaged?

Yes	INSTALL a new thermostat. REFER to: Thermostat (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation).
No	INSTALL a new thermostat. REFER to: Thermostat (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation). If the engine still overheats, INSTALL a new radiator. REFER to: Radiator (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation).

The Engine Does Not Reach Normal Operating Temperature

Normal operation and Fault Conditions

The engine cooling system maintains engine temperature during operation. Correct coolant flow through the engine, radiator and remainder of cooling system passages and components is essential to maintaining a correct engine temperature.

Engine coolant flows primarily from the engine to the radiator circuit and back to the coolant pump. Coolant is sent from the coolant pump through the engine block and cylinder heads. A separate circuit from the engine also feeds the heater core and turbochargers with coolant. The coolant pump circulates the coolant. The coolant thermostat is a control valve actuated by coolant temperature. When the thermostat is closed, coolant flow bypasses the radiator circuit and returns to the coolant pump. When the thermostat is opened, coolant flows through the radiator circuit in order to transfer engine generated heat to the outside air.

Concerns of engine inability to reach normal operating temperature typically occur when the rate of coolant flow through some coolant circuits (radiator, heater core) is more than expected given the conditions. Heat is not allowed to build in the engine because a heat exchanger is removing too much heat, including the radiator, heater core and oil cooler. In addition, perceived concerns that the engine does not reach normal operating temperature can be related to a low coolant level or trapped air which does not allow for hot coolant to be available at the heater core, an inoperative climate control system, or for concerns perceived or related to an incorrect engine temperature gauge indication.

Possible Sources

- Low coolant level
- Thermostat
- Temperature gauge
- CHT sensor
- ECT sensor

Diagnostic Trouble Code (DTC) Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0125	Insufficient Coolant Temp for Closed Loop Fuel Control	Sets in the PCM when the CHT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting the

		engine.
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	Sets in the PCM when the thermostat monitor has not achieved the required engine operating temperature within a specified amount of time after starting the engine.

PINPOINT TEST C : PINPOINT TEST

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.

C1 CARRY OUT INSPECTION AND VERIFICATION

- Carry out the Inspection and Verification procedure in this section.

Were any concerns found?

Yes	REPAIR as needed.
No	GO to C2

C2 CHECK FOR DTC P0125 OR P0128

- Using a scan tool, perform the PCM self-test.

Is DTC P0125 or P0128 present?

Yes	GO to C3
No	The cooling system is operational. If an inoperative temperature gauge is suspected, CHECK the temperature gauge operation. REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes, Diagnosis and Testing). If an inoperative climate control system is suspected, CHECK the climate control system operation. For Dual Automatic Temperature Control (DATC), REFER to: Climate Control System - Vehicles With: Dual Automatic Temperature Control (DATC) (412-00 Climate Control System - General Information, Diagnosis and Testing). For Electronic Manual Temperature control (EMTC), REFER to: Climate Control System - Vehicles With: Electronic Manual Temperature Control (EMTC) (412-00 Climate Control System - General Information, Diagnosis and Testing). If any other Diagnostic Trouble Codes (DTCs) are retrieved, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).

C3 CHECK THE COOLANT LEVEL

NOTE: *Allow the engine to cool before checking the coolant expansion tank.*

- Visually check the engine coolant level in the coolant expansion tank

Is the engine coolant level within specification?

Yes	INSTALL a new thermostat. REFER to: Thermostat (303-03 Engine Cooling - 2.3L EcoBoost (201kW/273PS), Removal and Installation). CLEAR Diagnostic Trouble Codes (DTCs). If the DTC returns check for correct CHT sensor and ECT operation.
No	GO to Pinpoint Test A

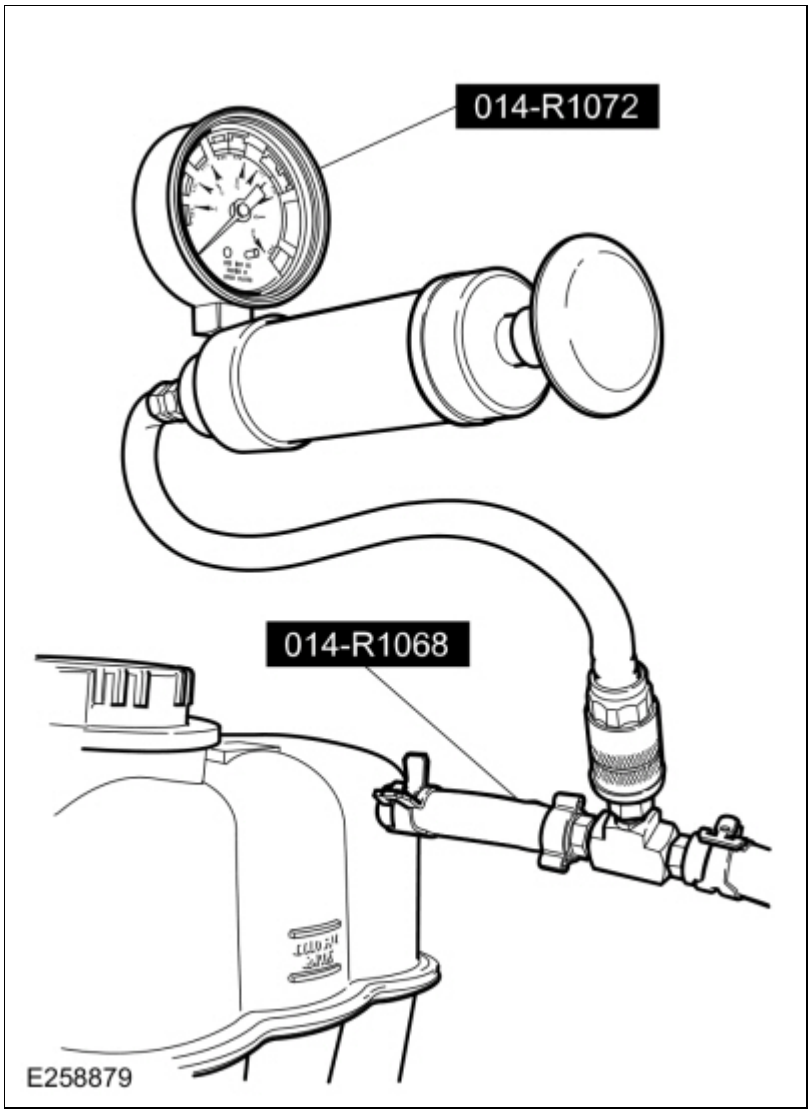
Component Tests

Cooling System Pressure Test

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.

NOTE: *Vehicles have a pressure relief cap on the degas bottle and no radiator cap.*

1. Turn the engine OFF.
2. Check the engine coolant level and adjust as necessary.
3. Attach the Pressure Tester to the degas bottle nipple and overflow hose. Install a pressure test pump to the quick connect fitting of the test adapter.



4. **NOTICE: Do not pressurize the cooling system beyond the maximum pressure listed in the Specifications table in this section or cooling system components may be damaged.**

   NOTE: *If the plunger of the pressure tester is pressed too fast, an erroneous pressure reading results.*

   Slowly press the plunger of the pressure test pump until the pressure gauge reading stops increasing and note the highest pressure reading obtained. If the pressure reading exceeds the maximum cap pressure listed in the Specifications table, install a new pressure relief cap.

5. If the system does not hold pressure, remove the pressure relief cap and wash in clean water to dislodge all the foreign material from the gasket. Check the sealing surface in the filler neck of the degas bottle for nicks or cuts. Install the pressure relief cap.

6. Pressurize the engine cooling system as described in Step 4 above. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.

7. If no leaks are found after a new pressure relief cap is installed, and the pressure drops, the leak may

be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant. REFER to: Engine (303-01 Engine - 2.3L EcoBoost (201kW/273PS), Diagnosis and Testing).

8. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

Thermostat

Install a new thermostat only after at least one of the following tests and checks have been carried out:

- Pinpoint Test B or C
- Thermostat Visual Inspection

Thermostat Visual Inspection

1. Remove the thermostat.

2. Examine the thermostat for signs of damage including:

- Valve not fully seated (light visible through the valve)
- Foreign material lodged in the main valve
- Bent or broken frame or flange
- Bent or broken spring
- Wax leaking from wax reservoir or a bulge in the reservoir
- Any other damage or distortion

3. **NOTE:** *If no damage is found during the inspection, do not attempt to open the thermostat using hot water or other heat sources. This method is not an accurate means to test the function of the thermostat and may damage the thermostat.*

   If damage is found during the inspection, remove any foreign material or broken pieces and install a new thermostat.

Radiator Leak Test, Removed From Vehicle

NOTICE: Never leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the cleaning tank and they will damage aluminum radiators.

NOTE: *Clean the radiator before leak testing to avoid contamination of tank.*

1. Leak test the radiator in clean water with air pressurized to the maximum pressure listed in the Specifications table.