

2018 ENGINE PERFORMANCE

Engine Controls And Fuel - 1.6L (LH7) Diesel - Diagnostic Information And Procedures (P040B - P204D) - Equinox & Terrain

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P040B, P040C, P040D, P040E, P041B, P041C, P041D, OR P041E: EXHAUST GAS RECIRCULATION (EGR) TEMPERATURE SENSOR 1-2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P040B

Exhaust Gas Recirculation (EGR) Temperature Sensor 2 Performance

DTC P040C

Exhaust Gas Recirculation (EGR) Temperature Sensor 2 Circuit Low Voltage

DTC P040D

Exhaust Gas Recirculation (EGR) Temperature Sensor 2 Circuit High Voltage

DTC P040E

Exhaust Gas Recirculation (EGR) Temperature Sensor 2 Circuit Erratic

DTC P041B

Exhaust Gas Recirculation (EGR) Temperature Sensor 1 Performance

DTC P041C

Exhaust Gas Recirculation (EGR) Temperature Sensor 1 Circuit Low Voltage

DTC P041D

Exhaust Gas Recirculation (EGR) Temperature Sensor 1 Circuit High Voltage

DTC P041E

Exhaust Gas Recirculation (EGR) Temperature Sensor 1 Circuit Erratic

Circuit/System Description

The exhaust gas recirculation (EGR) temperature sensors are variable resistors that measure the temperature of the exhaust gas at the inlet and outlet of the EGR cooler. The engine control module (ECM) supplies 5 volts to the EGR temperature sensor signal circuit and a ground for the low reference circuit. When the EGR temperature sensor is cold, the sensor resistance is high. When the EGR temperature increases, the sensor resistance decreases. With high sensor resistance, the ECM detects a higher voltage on the EGR temperature signal circuit. With lower sensor resistance, the ECM detects a lower voltage on the EGR temperature signal circuit.

Conditions for Running the DTC

P040B, P041B

- The engine is running.
- The ignition voltage is greater than 11 V.
- The engine has been OFF for greater than 8 hours.
- DTC P262B is not set.

The DTCs run continuously when the above conditions are met.

P040C, P040D, P040E, P041C, P041D, P041E

- The ignition is ON.
- The ignition voltage is greater than 11 V.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P040B, P041B

The ECM detects that the EGR temperature sensor has not changed greater than a calibrated amount for greater than a calibrated amount of time following a cold start.

P040C, P041C

The ECM detects that the EGR temperature sensor resistance is less than 147 Ω for greater than 5 s.

P040D, P041D

The ECM detects that the EGR temperature sensor resistance is greater than 885 Ω for greater than 5 s.

P040E, P041E

The ECM detects that the EGR temperature sensor resistance has changed greater than 25 Ω in 0.1 s.

Action Taken When the DTC Sets

DTCs P040B, P040C, P040D, P040E, P041B, P041C, P041D and P041E are Type B DTCs.

Conditions for Clearing the DTC

DTCs P040B, P040C, P040D, P040E, P041B, P041C, P041D and P041E are Type B DTCs.

Diagnostic Aids

- Inspect the EGR cooler temperature sensor terminals for corrosion.
- If the EGR cooler temperature sensor signal circuit is shorted to a separate 5-volt source, the DTC will set.
- If the engine has cooled for at least 8 hrs, the scan tool EGR Temperature Sensor 1, EGR Temperature Sensor 2 and the ECT Sensor values should display within 3 $^{\circ}$ C (5 $^{\circ}$ F).
- EGR cooler temperature sensors may fail while operating under extreme temperatures. Review the Freeze Frame/Failure Records to verify the failure criteria.
- With a fault present, the sensor reads a software defaulted value of 200 $^{\circ}$ C (392 $^{\circ}$ F) and does not change with a temperature increase or decrease.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

J 25070 Heat Gun 500 - 750°F

Circuit/System Verification

1. Engine running.
2. Verify the scan tool the appropriate EGR Temperature Sensor parameter is between -39°C to +999°C (-38°F to +1, 830°F) and changes with engine run time.
 - **If not between -39°C to +999°C (-38°F to +1, 830°F) or does not change**
Refer to Circuit/System Testing.
 - **Go to next step: If between -39°C to +999°C (-38°F to +1, 830°F) and changes**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify that DTC does not set.
 - **If DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate B130 Exhaust Gas Recirculation Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω, replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
4. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - **If less than infinite resistance**
Repair the short to ground on the circuit.

- **Go to next step: If infinite resistance**

5. Test for less than 2 Ω in the signal circuit end to end.

- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **Go to next step: If less than 2 Ω**

6. Ignition ON.

7. Test for less than 1 V between the signal circuit and ground.

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

8. Test or replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

9. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

10. Verify that DTC does not set.

- **If DTC sets**

Replace the K20 Engine Control Module

- **Go to next step: If DTC does not set**

11. All OK.

Component Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

NOTE: The J 25070 may be used to evaluate the sensor under high temperature conditions.

2. Verify the resistance between the signal circuit terminal 1 and the low reference circuit terminal 2 is within the range specified in the Temperature Versus Resistance (B13 Transmission Fluid Temperature Sensor) Table.

- **If not within the range specified**

Replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

- **Go to next step: If within the range specified**

3. Test for infinite resistance between each terminal and the sensor housing/case.

- **If less than infinite resistance**

Replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

- **Go to next step: If infinite resistance**

4. All OK

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Refer to Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 1
- Refer to Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 2
- Refer to Exhaust Gas Recirculation Valve Replacement
- Refer to Control Module References for engine control module replacement, programming, and setup.

DTC P0506 OR P0507: IDLE SPEED LOW/HIGH

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0506

Idle Speed Low

DTC P0507

Idle Speed High

Circuit/System Description

The engine control module (ECM) adjusts the fuel delivery in order to control crankshaft speed at idle. The ECM monitors the engine speed and will detect an out of range idle speed for the amount of fuel that is delivered.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P0171, P0172, P0300, P0301, P0302, P0303, P0304, P0400, P0401, P0402, P0403, P0405, P0406, P042E, P042F, P0462, P0463, P0489, P0490, P049D, P062D, P0502, P0503, P0722, P0723, P0806, P0807, P0808, P140B, P140C, P2227, P2228, P2229, P2230 or P2271 is not set.
- Engine is operating for at least 60 s.
- Time since gear change is at least 3 s.
- Time since torque converter clutch state change greater than 3 s.
- Engine idling for greater than 5 s.
- Ignition voltage is 11 - 32 V.
- Barometric pressure is greater than 70 kPa (10.1 psi).
- Engine coolant temperature (ECT) is between 60 to 120°C (140 - 248°F).
- Intake air temperature (IAT) is greater than -20°C (-4°F).
- Clutch pedal position is less than 12% or greater than 75%, if equipped.
- Scan tool service bay control not active.
- DTC P0506 and P0507 run continuously when the above conditions are met.

Conditions for Setting the DTC

P0506

The ECM detects the actual idle speed is below a predetermined speed for greater than 10 s.

P0507

The ECM detects the actual idle speed is above a predetermined speed for greater than 10 s.

Action Taken When the DTC Sets

DTCs P0506 and P0507 are type B DTCs.

Conditions for Clearing the DTC

DTCs P0506 and P0507 are type B DTCs.

Reference Information

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End Views

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Observe the DTC information with a scan tool. Verify there are no other DTCs set.
 - **If a DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.
 - **Go to next step: If a DTC is not set**
3. Engine idling at the normal operating temperature.
4. Compare the scan tool Desired Idle Speed parameter to the Engine Speed parameter. Both parameters should be within 200 RPM.
 - **If parameters are not within 200 RPM**

Refer to Circuit/System Testing.
 - **Go to next step: If parameters are within 200 RPM**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If a DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If a DTC does not set**
6. All OK.

Circuit/System Testing

P0506

1. Verify none of the following conditions exist.
 - A crankcase overfill can cause oil to be forced through the positive crankcase ventilation (PCV) system.
 - Restricted exhaust
 - Mechanical conditions that limits engine speed.
 - Parasitic load on the engine - For example, a transmission condition, a belt driven accessory condition.

- **If a condition is found**

Repair as necessary.

- **Go to next step: If a condition is not found**

2. All OK.

P0507

1. Verify none of the following conditions exist.

- An outside source that has allowed oil or fuel to enter the air induction system.
- Fuel in engine oil being drawn into the engine.
- An aftermarket performance kit using an external fuel source.
- **If a condition is found**

Repair as necessary.

- **Go to next step: If a condition is not found**

2. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

DTC P053A, P053B, OR P053C: POSITIVE CRANKCASE VENTILATION HEATER CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P053A

Positive Crankcase Ventilation Heater Control Circuit

DTC P053B

Positive Crankcase Ventilation Heater Control Circuit Low Voltage

DTC P053C

Positive Crankcase Ventilation Heater Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Positive Crankcase Ventilation Heater Control Circuit	P053B	P053A	P053C	-
Ignition Circuit	P053A*	P053A	-	-
* Opens circuit fuse or opens circuit.				

Typical Scan Tool Data

Positive Crankcase Ventilation Heater Control Circuit Open Test Status

Circuit	Short to Ground	Open	Short to Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, component commanded Off. Parameter Normal Range: OK/Not Run			
Positive Crankcase Ventilation Heater Control	OK/Not Run	Malfunction	OK/Not Run

Positive Crankcase Ventilation Heater Control Circuit Low Voltage Test Status

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, component commanded Off. Parameter Normal Range: OK/Not Run			
Positive Crankcase Ventilation Heater Control	Malfunction	OK/Not Run	OK/Not Run

Positive Crankcase Ventilation Heater Control Circuit High Voltage Test Status

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, component commanded On. Parameter Normal Range: OK/Not Run			
Positive Crankcase Ventilation Heater Control	OK/Not Run	OK/Not Run	Malfunction

Circuit/System Description

The positive crankcase ventilation heater is controlled by the ECM. Ignition voltage is directly supplied to the positive crankcase ventilation heater and the ECM provides a controlled ground circuit.

Conditions for Running the DTC

- Ignition ON or engine operating.
- Battery voltage is greater than 11 V.
- Engine temperature is less than 90°C (194°F).
- The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P053A

The ECM detects an open circuit on the positive crankcase ventilation heater control circuit for greater than 5 s.

P053B

The ECM detects a short to ground on the positive crankcase ventilation heater control circuit for greater than 5 s.

P053C

The ECM detects a short to voltage on the positive crankcase ventilation heater control circuit for greater than 5 s.

Action Taken When the DTC Sets

DTCs P053A, P053B and P053C are Type C DTCs.

Conditions for Clearing the DTC

DTCs P053A, P053B and P053C are Type C DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Fuel System Description

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Command the Positive Crankcase Ventilation Heater ON and OFF with a scan tool while observing the following control circuit status parameters:
 - Positive Crankcase Ventilation Heater Control Circuit Open Test Status
 - Positive Crankcase Ventilation Heater Control Circuit Low Voltage Test Status
 - Positive Crankcase Ventilation Heater Control Circuit High Voltage Test Status

Each parameter should not display Malfunction.

 - **If Malfunction**
Refer to Circuit/System Testing.
 - **Go to next step: If not Malfunction**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition OFF.
2. Disconnect the harness connector at the E45 Positive Crankcase Ventilation Heater.
3. Ignition ON.
4. Connect a test lamp between the Ignition Circuit terminal 2 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open or high resistance in the circuit.

- If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
- **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance, between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the E45 Positive Crankcase Ventilation Heater.
 - **Go to next step: If the test lamp illuminates**
- 5. Connect a test lamp between the control circuit terminal 1 and the ignition circuit terminal 2.
- 6. Verify the test lamp turns ON and OFF when commanding the Positive Crankcase Ventilation Heater from OFF to ON and back to OFF with a scan tool.
 - **If the test lamp is always OFF**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V.
 3. Ignition OFF.
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open or high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If the test lamp is always ON**
 1. Ignition OFF.
 2. Disconnect the harness connector at the K20 Engine Control Module.
 3. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp turns ON and OFF**
- 7. Replace the E45 Positive Crankcase Ventilation Heater.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- Refer to [Camshaft Housing Replacement](#) for E45 Positive Crankcase Ventilation Heater replacement.
- Refer to [Control Module References](#) for ECM replacement, setup, and programming

DTC P0545, P0546, P2032, P2033, P242C OR P242D: EXHAUST GAS TEMPERATURE SENSOR CIRCUIT VOLTAGES

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0545

Exhaust Gas Temperature Sensor 1 Circuit Low Voltage

DTC P0546

Exhaust Gas Temperature Sensor 1 Circuit High Voltage

DTC P2032

Exhaust Gas Temperature Sensor 2 Circuit Low Voltage

DTC P2033

Exhaust Gas Temperature Sensor 2 Circuit High Voltage

DTC P242C

Exhaust Gas Temperature Sensor 3 Circuit Low Voltage

DTC P242D

Exhaust Gas Temperature Sensor 3 Circuit High Voltage

Circuit/System Description

The exhaust gas temperature sensors are variable resistors that measures the temperature of the exhaust gas. The exhaust temperature sensor 1 is the first exhaust temperature sensor on the exhaust system, the following exhaust temperature sensors are counted upward from the engine outlet to the exhaust system end. The engine control module (ECM) supplies 5 V to the exhaust gas temperature signal circuit and supplies a ground to the low reference circuit. The exhaust gas temperature sensor temperature information is used by the ECM during the exhaust gas particulate filter cleaning process.

Conditions for Running the DTC

- The ignition is ON.
- The ignition voltage is greater than 11 V.

These DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

DTC P0545, P2032, P242C

The ECM detects that the exhaust gas temperature sensor is less than 158 Ω for greater than 2 s.

DTC P0546, P2033, P242D

The ECM detects that the exhaust gas temperature sensor is greater than 900 Ω for greater than 2 s.

Action Taken When the DTC Sets

DTCs P0545, P0546, P2032, P2033, P242C and P242D are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0545, P0546, P2032, P2033, P242C and P242D are Type B DTCs.

Diagnostic Aids

- After starting the engine, the exhaust gas temperature sensor temperature should rise steadily, then stabilize after the engine reaches operating temperature.
- Exhaust gas temperature sensors may fail intermittently while operating under extreme temperatures. Review the Freeze Frame/Failure Records to verify the failure criteria.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Verify that no other DTCs are set.

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.

- **Go to next step: If no other DTC are set**

2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
3. Verify DTC P0545, P0546, P2032, P2033, P242C and P242D does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If the DTC does not set**

4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B131 Exhaust Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition ON, test for 4.8 - 5.2 V between the signal circuit terminal 1 and ground.

- **If less than 4.8 V**

1. Ignition OFF.
2. Disconnect the X3 harness connector at the K20 Engine Control Module.
3. Test for infinite resistance between signal circuit and ground
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω

Replace the K20 Engine Control Module.

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Test for less than 1 V between the signal circuit and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V

Replace the K20 Engine Control Module.

- **Go to next step: If between 4.8 - 5.2 V**

4. Replace the appropriate B131 Exhaust Temperature Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Exhaust Temperature Sensor Replacement - Position 1](#)
- Refer to [Exhaust Temperature Sensor Replacement - Position 2](#)
- Refer to [Exhaust Temperature Sensor Replacement - Position 3](#)
- Refer to [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P054E OR P054F: IDLE CONTROL - FUEL QUANTITY

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P054E

Idle Control - Fuel Quantity Lower Than Expected

DTC P054F

Idle Control - Fuel Quantity Higher Than Expected

Circuit/System Description

The idle speed directly depends on the injection quantity. The monitor compares the commanded injection quantity with calculated thresholds. The commanded idle fuel needs to be between 50 percent of max and min expected fuel. The expected fuel is dependent on accessory loads, ambient temperature, BARO, engine coolant temperature and engine speed.

Conditions for Running the DTC

- Accelerator Pedal Position is less than 0.05%.
- Ambient air temperature is greater than -20°C (-4°F).
- Engine is running.
- Engine Coolant Temperature is greater than -20°C (-4°F).
- Engine speed is 546 - 1560 RPM.
- Ignition voltage is greater than 11 V.
- No gear change has occurred.
- Transmission shall be in neutral/park or in gear.
- Vehicle speed is less than 3 kph (1.86 mph).

The DTC runs continuously when the above conditions are met for 5 s.

Conditions for Setting the DTC

P054E

A fault is detected when the current fuel injection quantity is lower than the allowed limit for greater than 24 s.

P054F

A fault is detected when the current fuel injection quantity is higher than the allowed limit for greater than 24 s.

Action Taken When the DTC Sets

DTCs P054E and P054F are Type B DTCs.

Conditions for Clearing the DTC

DTCs P054E and P054F are Type B DTCs.

Diagnostic Aids

- Contaminated or improper fuel quality may cause this DTC to set.
- Clutch slippage may cause this DTC to set, if equipped.
- Excessive loads on the accessory drive or transmission due to damage may cause this DTC to set.
- When operating the vehicle within the Conditions for Running DTC P054E, turn Off all electrical loads. (HVAC fan, air conditioning, lights, seat heaters, defroster, etc.)
- When operating the vehicle within the Conditions for Running DTC P054F, turn On all electrical loads. (HVAC fan, air conditioning, lights, seat heaters, defroster, etc.)

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0071, P0072, P0073, P0074, P0101, P0102, P0103, P0111, P0112, P0113, P0114, P0117, P0118, P0119, P0171, P0172, P01CB, P01CC, P01CD, P01CE, P01CF, P01D0, P01D1, P01D2, P0201, P0202, P0203, P0204, P020A, P020B, P020C, P020D, P0216, P0261, P0262, P0263, P0264, P0265, P0266, P0267, P0268, P0269, P0270, P0271, P0272, P02CC, P02CD, P02CE, P02CF, P02D0, P02D1, P02D2, P02D3, P02EE, P02EF, P02F0, P02F1, P0335, P0336, P0502, P0503, P0697, P06A3, P111E, P1248, P1249, P124A, P124B, P2122, P2123, P2127, P2128, P2138, P2147, P2148, P2150, P2151, P268C, P268D, P268E, P268F is not set.
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If none of the DTCs are set**
3. Verify there are no aftermarket performance enhancing devices installed on the vehicle.
4. Worn or failed accessory drive components may cause this DTC to set.
5. Verify the proper fuel is used. Refer to [Fuel System Specifications](#) , and [Contaminants-in-Fuel Diagnosis](#) .
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
7. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
8. All OK.

Circuit/System Testing

NOTE: Only perform the Circuit/System Testing portion of the Fuel Injector Balance Test.

1. Verify that no cylinders have low compression and no fuel injector nozzles are clogged, stuck open, or stuck closed. Perform the Circuit/System Testing of the Fuel Injector Balance Test.

Refer to [Fuel Injector Balance Test with Scan Tool](#) .

- **If a fuel injector nozzle is clogged, stuck open, or stuck closed**

Replace the appropriate Q17 Fuel Injector.

- **If one or more of the cylinders indicate low compression**

Repair as necessary.

- **Go to next step: If all cylinders indicate normal compression and no fuel injector nozzles are clogged, stuck open, or stuck closed**

2. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Fuel Injector Replacement](#)

DTC P057B, P057C, P057D, OR P057E: BRAKE PEDAL POSITION SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P057B

Brake Pedal Position Sensor Performance

DTC P057C

Brake Pedal Position Sensor Circuit Low Voltage

DTC P057D

Brake Pedal Position Sensor Circuit High Voltage

DTC P057E

Brake Pedal Position Sensor Circuit Erratic

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P057C	P057C	P057D	P057B, P057E
5 V Reference	P057C P0651	P057C	P0651	-
Low Reference	-	P057D	P057D	-

Typical Scan Tool Data

Brake Pedal Position Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON. Normal Range: 0.25 - 4.75 V			
5 V Reference	0 V	0 V	-
Signal	0 V	0 V	5 V
Low Reference	-	5 V	-

Circuit/System Description

The brake pedal position (BPP) sensor is part of the engine brake pedal override feature. The engine control module (ECM) continuously monitors the vehicle speed and the position of the brake pedal. These two main inputs, along with other ECM inputs are used to determine if the vehicle is decelerating at the proper speed and rate with the brake pedal applied. When the engine brake pedal override system is active, the ECM reduces engine torque to assist in reducing vehicle speed.

The BPP sensor is a six wire sensor, and is part of a dual brake position sensor. One BPP Sensor is used for the stop lamps and the other BPP Sensor is used for the engine brake pedal override feature. The BPP Sensor for engine brake pedal override communicates with the ECM. The ECM supplies a 5 V reference circuit, low reference circuit, and signal circuit to the BPP sensor. The BPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage greater than 0.25 V when the brake pedal is released to a voltage less than 4.75 V when the brake pedal is fully applied.

For information on the Stop Lamps side of the BPP Sensor, refer to [Exterior Lighting Systems Description and Operation](#).

Conditions for Running the DTC

P057B

- DTCs P057C, or P057D are not set.
- Ignition voltage is greater than 10 V.
- Shift lever has been in Park at least once during key ON.
- Shift lever is not in Park.
- Vehicle speed is greater than 8 Km/h (5 mph).
- Accelerator Pedal Position is less than 5%.
- DTC runs once per key cycle when above conditions are met.

P057C, P057D, or P057E

- Ignition voltage is greater than 10 V.
- DTC runs continuously when above condition is met.

Conditions for Setting the DTC

P057B

ECM detects the BPP sensor signal is stuck in a range for greater than 1 s.

P057C

ECM detects the BPP sensor voltage is less than 0.25 V greater than 1 s.

P057D

ECM detects the BPP sensor voltage is greater than 4.75 V greater than 1 s.

P057E

ECM detects the BPP sensor value varies greater than a calibrated value.

Action Taken When the DTC Sets

- P057B, P057C, P057D and P057E are Type A DTCs.
- Brake Pedal Position Sensor parameter defaults to 0%.

Conditions for Clearing the DTC

P057B, P057C, P057D and P057E are Type A DTCs

Reference Information

Schematic Reference

- [Engine Controls Wiring Schematics 1.6L \(LH7\)](#)
- [Exterior Lights Wiring Schematics](#)

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX](#)
- [INLINE HARNESS CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: The Brake Pedal Position sensor scan tool data is located in the ECM automatic transmission data list.

1. Ignition ON.
2. Verify DTC P0641, P0651, P0697 or P06A3 is not set.
 - **If any of the DTCs are set**
Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **Go to next step: If none of the DTCs are set**
3. Transmission in Park, and service brake pedal released.
4. Verify the scan tool Brake Pedal Position Sensor parameter in the ECM displays greater than 0.25 V.
 - **If 0.25 V or less**
Refer to Circuit/System Testing.
 - **Go to next step: If greater than 0.25 V**
5. Verify the scan tool Brake Pedal Position Sensor parameter voltage changes as the brake pedal is applied and displays less than 4.75 V when the brake pedal is fully applied.
 - **If the voltage does not change, or is greater than 4.74 V**
Refer to Circuit/System Testing.
 - **Go to next step: If the voltage changes and less than 4.75 V**
6. Verify the scan tool Brake Pedal Position Sensor Learned Release Position parameter is within 0.1 V of the Brake Pedal Position Sensor parameter when the brake pedal is fully released.
 - **If difference is greater than 0.1 V**
Perform the Brake Pedal Position Sensor Calibration .
 - **Go to next step: If difference is 0.1 V or less**
7. Verify the Brake Pedal Position Sensor parameter transitions smoothly without any spikes or dropouts when slowly applying and releasing the brake pedal.
 - **If parameter does not transition smoothly or has spikes or dropouts**
Refer to Circuit/System Testing.
 - **Go to next step: If parameter transitions smoothly and there are no spikes or dropouts**
8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
9. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
10. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification first.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B22 Brake Pedal Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.

NOTE: All terminal references are for the vehicle harness brake pedal position sensor connector.

2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.
 - **If 10 Ω or greater**
 1. Disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 5 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
5. Verify the scan tool Brake Pedal Position Sensor parameter is less than 0.25 V.
 - **If 0.25 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 0.25 V between the signal circuit terminal 4 and ground.
 - If 0.25 V or greater, repair the short to voltage on the circuit.
 - If less than 0.25 V, replace the K20 Engine Control Module.
 - **Go to next step: If less than 0.25 V**
6. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the 5 V reference circuit terminal 5.
7. Verify the scan tool Brake Pedal Position Sensor parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, remove the jumper wire, and disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.

- If less than 2 Ω , replace the K20 Engine Control Module.
- **Go to next step: If greater than 4.8 V**

8. Replace the B22 Brake Pedal Position Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Brake Pedal Position Sensor Replacement](#)
- Perform the [Brake Pedal Position Sensor Calibration](#) following the replacement of the ECM or BPP sensor, or any repair that effects the BPP sensor alignment.
- Refer to [Control Module References](#) for Engine Control Module replacement, programming and setup.

DTC P0601, P0602, P0603, P0604, P0606, P062B, P062F, P0630, P16F3 OR P262B: CONTROL MODULE/VIN NOT PROGRAMMED OR MISMATCHED - ENGINE CONTROL MODULE (ECM)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each of the diagnostic category.

DTC Descriptors

DTC P0601

Control Module Read Only Memory Performance

DTC P0602

Control Module Not Programmed

DTC P0603

Control Module Long Term Memory Reset

DTC P0604

Control Module Random Access Memory Performance

DTC P0606

Control Module Processor Performance

DTC P062B

Control Module Fuel Injector Control Performance

DTC P062F

Control Module Long Term Memory Performance

DTC P0630

VIN Not Programmed or Mismatched - Engine Control Module (ECM)

DTC P16F3

Control Module Redundant Memory Performance

DTC P262B

Circuit/System Description

This diagnostic applies to internal microprocessor integrity conditions within the ECM. This diagnostic also addresses if the ECM is not programmed.

Conditions for Running the DTCs

P0601, P0602, P0630

These DTCs run continuously when the ignition is in ON.

P0603, P062F

These DTCs run once per ignition cycle.

P0604

DTC P0604 runs continuously when the ignition is ON for greater than 30 s.

P0606, P062B

These DTCs run continuously when Ignition 1 Signal voltage is greater than 11 V.

P16F3

- The engine speed is greater than 680 RPM.
- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P2227, P2228, P2229 or P2230 are not set.
- DTC P16F3 runs continuously when the above conditions are met.

P262B

DTC P262B runs during ECM power down.

Conditions for Setting the DTCs

The ECM detects an internal failure or incomplete programming for more than 10 s.

Actions Taken When the DTC Sets

- DTCs P0601, P0602, P0603, P0604, P0606, P062B, P0630 and P16F3 are Type A DTCs.
- DTC P262B is a Type B DTC.
- DTC P062F is a Type C DTC.

Conditions for Clearing the MIL/DTC

- DTCs P0601, P0602, P0603, P0604, P0606, P062B, P0630 and P16F3 are Type A DTCs.
- DTC P262B is a Type B DTC.
- DTC P062F is a Type C DTC.

Diagnostic Aids

- A disconnected Camshaft Position Sensor could set DTC P0606 and may cause a no crank condition.
- Low voltage or a momentary loss of power or ground to the ECM may cause a DTC to set. Verify the following:
 - The battery cables are clean and tight, and the battery is fully charged. Refer to **Battery Inspection/Test**.
 - The ECM ground circuits do not have an open or high resistance.
 - The ECM power circuits do not have an open, short to ground or high resistance.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.6L \(LH7\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Component View Reference

[Powertrain Component Views](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition On.
2. Verify DTC P0602 or P0630 is not set.
 - **If any of the DTCs are set**
 1. Program the K20 Engine Control Module. Refer to [Control Module References](#) .
 2. Verify DTC P0602 or P0630 is not set.
 - If any of the DTCs are set, replace the K20 Engine Control Module.
 - If none of the DTCs are set
 - 3. All OK.
 - **Go to next step: If none of the DTCs are set**
3. Verify DTC P0601, P0603, P0604, P0606, P062B, P062F, P16F3 or P262B is not set.
 - **If any of the DTCs are set**

Replace the K20 Engine Control Module.

 - **Go to next step: If none of the DTCs are set**
4. All OK.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Control Module References](#) for engine control module replacement, programming and setup.

[DTC P0627, P0628, OR P0629: FUEL PUMP ENABLE CIRCUIT](#)

[Diagnostic Instructions](#)

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P0627

Fuel Pump Enable Circuit

DTC P0628

Fuel Pump Enable Circuit Low Voltage

DTC P0629

Fuel Pump Enable Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control	P0171, P0506, P0628, P12A6	P0171, P0506, P0627, P12A6	P0629	P12A6

Circuit/System Description

The engine control module (ECM) supplies voltage to the fuel pump driver control module for 30 s when the ignition is on and continuously when the engine is running. While this voltage is being received, a serial data signal containing the desired fuel pump speed is also received from the ECM. After the voltage and data have been received the fuel pump driver control module actuates the brushless fuel pump by means of a high power three phase signal.

Conditions for Running the DTC

- The engine speed is greater than 0 RPM.
- The ignition voltage is greater than 11 V.
- The fuel pump enable circuit is commanded On.

The DTC runs continuously when the conditions above are met.

Conditions for Setting the DTC

The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match for greater than 2 s.

Action Taken When the DTC Sets

DTCs P0627, P0628 and P0629 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0627, P0628 and P0629 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the parameters listed below do not display Malfunction when commanding the Fuel Pump Enable On and Off with a scan tool.
 - Fuel Pump Enable Circuit Low Voltage Test Status
 - Fuel Pump Enable Circuit Open Test Status
 - Fuel Pump Enable Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **Go to next step: If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the K111 Fuel Pump Driver Control Module harness connector.
2. Ignition On for 10 s.
3. Verify that a test lamp does not illuminate between the control circuit terminal 18 and ground.
 - **If the test lamp illuminates**
 1. Ignition Off, remove the test lamp, disconnect the harness connector at the K20 Engine Control Module, ignition On.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp does not illuminate**
4. Remove the test lamp.
5. Verify the scan tool Fuel Pump Enable Circuit Low Voltage Test Status parameter is OK when commanding the Fuel Pump Enable On with a scan tool.
 - **If OK is not displayed**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
- **Go to next step: If OK is displayed**
6. Install a 3 A fused jumper wire between the control circuit terminal 18 and ground.
7. Verify the scan tool Fuel Pump Enable Circuit Low Voltage Test Status parameter is Malfunction when commanding the Fuel Pump Enable On with a scan tool.
 - **If Malfunction is not displayed**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If Malfunction is displayed**
8. Replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

For control module replacement, setup and programming, refer to [Control Module References](#)

DTC P062D OR P062E: CONTROL MODULE FUEL INJECTOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P062B

Control Module Fuel Injector Control Performance

DTC P062D

Control Module Fuel Injector Driver Performance

DTC P062F

Control Module Long Term Memory Performance

Circuit/System Description

These DTCs apply to internal microprocessor integrity conditions within the Engine Control Module (ECM). This diagnostic also addresses if the ECM is not programmed.

Conditions for Running the DTC

P062B, P062D and P062F

- The engine is running.
- The DTC runs continuously once the above condition is met.

Conditions for Setting the DTC

P062B

The ECM detects an internal fuel injector condition once per camshaft revolution.

P062D

The ECM detects an internal EEPROM failure.

P062F

The ECM detects an internal EEPROM failure.

Action Taken When the DTC Sets

- DTC P062B is a Type C DTC.
- DTCs P062D and P062F are Type A DTCs.

Conditions for Clearing the DTC

- DTC P062B is a Type C DTC.
- DTCs P062D and P062F are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Diagnostic Trouble Code (DTC) List - Vehicle

Scan Tool Reference

[K20 Engine Control Module: Scan Tool Information](#) for scan tool information

Circuit/System Testing

1. Ignition ON,
2. Verify with a scan tool that no other DTC is set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **Go to next step: If none of the DTCs are set**

3. Verify with a scan tool that DTC P062B is not set.

- **If DTC P062B is set**

Refer to [DTC P0601-P0604, P0606, P062B, P062F, P0630, P16F3 or P262B](#) for further diagnosis

NOTE:

Before proceeding ECM replacement it is necessary to perform the Ignition Relay Diagnosis to verify the ECM voltage supply circuit is not open or shorted.

- **Go to next step: If DTC P062B is not set**

4. Program the ECM with a scan tool, and verify that DTCs does not reset

- **If DTCs reset**

Replace the K20 Engine Control Module

- **Go to next step: If DTCs does not reset**

5. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [K20 Engine Control Module: Programming and Setup](#) for Engine Control Module replacement, programming and setup.

DTC P0641, P0651, P0697 OR P06A3: 5V REFERENCE 1-4 CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0641

5V Reference 1 Circuit

DTC P0651

5V Reference 2 Circuit

DTC P0697

5V Reference 3 Circuit

DTC P06A3

5V Reference 4 Circuit

Circuit/System Description

The engine control module (ECM) has 5 internal 5V reference circuits. Each internal reference circuit provides external 5V reference circuits for more than one sensor. A short to ground or short to voltage on one external 5V reference circuit can affect all the components connected to the same internal 5V reference circuit.

Conditions for Running the DTC

These DTCs run continuously when the ignition voltage is greater than 6.4 V.

Conditions for Setting the DTC

The ECM detects a short to ground or voltage on any of the 5V reference circuits for greater than 0.5 s.

Action Taken When the DTC Sets

DTCs P0641, P0651, P0697 and P06A3 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P0641, P0651, P0697 and P06A3 are Type A DTCs.

The 5V reference 1 circuit provides 5 V to the sensors listed below:

- Air conditioning (A/C) refrigerant pressure sensor
- Multifunction intake air sensor
- Exhaust gas recirculation valve
- Camshaft position sensor
- Engine oil pressure sensor
- Diesel particulate filter exhaust differential pressure sensor
- Multifunction switch - center console

The 5V reference 2 circuit provides 5 V to the sensors listed below:

- Manifold absolute pressure/air temperature sensor
- Crankshaft position sensor
- Throttle position sensor
- Brake pedal position sensor
- Brake booster vacuum sensor
- Turbocharger vane position sensor

The 5V reference 3 circuit provides 5 V to the accelerator pedal position sensor 2.

The 5V reference 4 circuit provides 5 V to the sensors listed below:

- Accelerator pedal position sensor 1
- Fuel rail pressure sensor

Disconnecting one component at a time from the affected 5V reference circuit while observing the scan tool 5V Reference Circuit Status parameter may help locate the fault. The scan tool parameter will change from Malfunction to OK when the source of the fault is disconnected. If all 5V reference components have been disconnected and a fault is still indicated, the fault may exist in the wiring harness.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Circuit/System Verification

1. Ignition ON.
2. Verify scan tool 5V Reference 1-5 Circuit Status parameters do not display Malfunction.
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **Go to next step: If Malfunction is not displayed**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: Additional DTCs will set when disconnecting the components.

1. Ignition OFF, disconnect the harness connector at all appropriate sensors for the applicable DTC.
Refer to [Diagnostic Aids](#).
2. Ignition ON.
3. Test for 4.8 - 5.2 V between one of the 5V reference circuits and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K20 Engine Control Module.
 2. Test for infinite resistance between the 5V reference circuit for each applicable component and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connectors at the K20 Engine Control Module.
 2. Test for less than 1 V between the 5V reference circuit for each applicable component and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**

NOTE: A short to voltage or ground on the signal circuit of certain components may cause this DTC to set.

4. Verify the appropriate scan tool 5V Reference 1, 2, 3, 4 or 5 Circuit Status parameter displays OK while connecting each component associated with the 5V reference circuit one at a time.
 - **If OK is not displayed when a component is connected**

Test the signal circuit of the component for a short to ground or voltage. If the circuit tests normal, replace the component.
 - **Go to next step: If OK is displayed after all components have been connected**
5. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Air Conditioning Cycling and Fan Control Refrigerant Pressure Sensor Replacement](#)
- Refer to [Camshaft Position Sensor Replacement - Exhaust](#)
- Refer to [Camshaft Position Sensor Replacement - Intake](#)
- Refer to [Exhaust Gas Recirculation Valve Replacement](#)
- Refer to [Intake Air Pressure and Temperature Sensor Replacement](#)
- Refer to [Engine Oil Pressure Sensor Replacement](#)
- Refer to [Crankshaft Position Sensor Replacement \(FWD\)](#), [Crankshaft Position Sensor Replacement \(AWD\)](#)
- Refer to [Brake Pedal Position Sensor Replacement](#)
- Refer to [Power Brake Booster Vacuum Pipe Replacement \(LH7\)](#)
- Refer to [Accelerator Pedal Assembly Replacement](#)
- Refer to [Throttle Body Assembly Replacement](#)
- Refer to [Fuel Injection Fuel Rail Fuel Pressure Sensor Replacement](#)
- Refer to [Intake Air Pressure and Temperature Sensor Replacement](#) for turbocharger boost/intake air temperature sensor replacement.
- Refer to [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P0650, P263A OR P263B: MALFUNCTION INDICATOR LAMP (MIL) CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P0650

Malfunction Indicator Lamp (MIL) Control Circuit

DTC P263A

Malfunction Indicator Lamp (MIL) Control Circuit Low Voltage

DTC P263B

Malfunction Indicator Lamp (MIL) Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	P0650	P0650	-	-
Control	P0650, P263A*	P0650, P263A	P263B	-
* The MIL remains ON				

Circuit/System Description

The malfunction indicator lamp (MIL) illuminates to inform the driver that an emission system fault has occurred and the powertrain control system requires service. Ignition voltage is supplied directly to the MIL. The engine control module (ECM) turns the MIL ON by grounding the MIL control circuit when the emission system fault occurs. Under normal operating conditions, the MIL should be ON only when the ignition is ON and the engine is OFF.

Conditions for Running the DTC

- The engine speed is greater than 80 RPM.
- The ignition voltage is between 11 - 32 V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

DTC P0650 or DTC P263A

The ECM detects low voltage during the MIL control circuit driver OFF state. This indicates either a shorted to ground or an open MIL control circuit.

DTC P263B

The ECM detects high voltage on the MIL control circuit during the driver ON state. This indicates a shorted to voltage MIL control circuit.

Action Taken When the DTC Sets

DTC P0650, P263A and P263B are Type B DTCs.

Conditions for Clearing the DTC

DTC P0650, P263A and P263B are Type B DTCs.

Diagnostic Aids

- If the condition is intermittent, move the related harnesses and connectors while monitoring the scan tool MIL control circuit status parameters. Perform this test with the ignition ON and the engine OFF, and with the engine running. The MIL control circuit status parameters change from OK or Not Run to Malfunction if there is a condition with a circuit or a connection.
- If the ECM detects low voltage on the MIL control circuit during the control circuit driver OFF state, DTCs P0650 and DTC P263A may set simultaneously.

Reference Information

Schematic Reference

- [Engine Controls Wiring Schematics 1.6L \(LH7\)](#)
- [Instrument Cluster Wiring Schematics](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify the parameters listed below do not display Malfunction when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
 - The MIL Control Circuit Low Voltage Test Status
 - The MIL Control Circuit Open Test Status
 - The MIL Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

 - **Go to next step: If Malfunction is not displayed**
3. Engine running.
4. Verify the parameters listed below do not display Malfunction when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
 - The MIL Control Circuit Low Voltage Test Status
 - The MIL Control Circuit Open Test Status
 - The MIL Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

 - **Go to next step: If Malfunction is not displayed**
5. Verify the malfunction indicator lamp turns ON and OFF when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
 - **If the malfunction indicator lamp does not turn ON and OFF**

Refer to Circuit/System Testing.

 - **Go to next step: If the malfunction indicator lamp turns ON and OFF**
6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If the DTC sets**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.

 - **Go to next step: If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition OFF.
2. Disconnect the X1 harness connector at the K20 Engine Control Module.
3. Ignition ON, verify the malfunction indicator lamp does not illuminate.
 - **If the malfunction indicator lamp illuminates**
 1. Test for infinite resistance between the control circuit terminal X1 18 and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the P16 Instrument Cluster.
 - **Go to next step: If the malfunction indicator lamp does not illuminate**
4. Connect a 3 A fused jumper wire between the control circuit terminal X1 18 and ground.
5. Verify the malfunction indicator lamp illuminates.
 - **If the malfunction indicator lamp illuminates**

Replace the K20 Engine Control Module.

 - **If the malfunction indicator lamp does not illuminate**
 1. Test for less than 1 V between the control circuit terminal X1 18 and ground.

- If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V
2. Ignition OFF.
 3. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω .
 6. Ignition OFF, disconnect the harness connector at the instrument cluster.
 7. Ignition ON, verify a test lamp illuminates between the ignition voltage circuit terminal 16 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ignition voltage circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - **Go to next step: If the test lamp illuminates**
 8. Replace the P16 Instrument Cluster.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Instrument Cluster Replacement \(Equinox\)](#), [Instrument Cluster Replacement \(Terrain\)](#).
- Refer to [Control Module References](#) for control module replacement, programming and setup.

DTC P0658 OR P0659: ACTUATOR HIGH CONTROL CIRCUIT GROUP 1 LOW/HIGH VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0658 00

Actuator High Control Circuit Group 1 Low Voltage

DTC P0659 00

Actuator High Control Circuit Group 1 High Voltage

Circuit/System Description

These DTC apply to internal 5 V reference voltage supply within the ECM.

Conditions for Running the DTC

- The ignition is ON.
- The DTCs run continuously once the above condition is met.

Conditions for Setting the DTC

P0658

The internal 5 V reference voltage is to low.

P0659

The internal 5 V reference voltage is to high.

Action Taken When the DTC Sets

DTC P0658 and P0659 are Type C DTCs.

Conditions for Clearing the DTC

DTC P0658 and P0659 are Type C DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Testing

1. Observe the Freeze Frame/Failure Records with a scan tool.
2. Clear the DTCs with a scan tool.
3. Ignition OFF for 30 s.
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.
5. Verify the DTCs P0658 or P0659 are not set.
 - **If the DTCs P0658 or P0659 are set**

Replace the K20 Engine Control Module
 - **Go to next step: If the DTCs P0658 or P0659 are not set**
6. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Refer to **Control Module References** for ECM replacement programming and setup.

DTC P066A, P066B, P066C, P066D, P066E, P066F, P0671, P0672, P0673, P0674, P067A OR P067B: CYLINDER 1-4 GLOW PLUG CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P066A

Cylinder 1 Glow Plug Control Circuit Low Voltage

DTC P066B

Cylinder 1 Glow Plug Control Circuit High Voltage

DTC P066C

Cylinder 2 Glow Plug Control Circuit Low Voltage

DTC P066D

Cylinder 2 Glow Plug Control Circuit High Voltage

DTC P066E

Cylinder 3 Glow Plug Control Circuit Low Voltage

DTC P066F

Cylinder 3 Glow Plug Control Circuit High Voltage

DTC P0671

Cylinder 1 Glow Plug Control Circuit

DTC P0672

Cylinder 2 Glow Plug Control Circuit

DTC P0673

Cylinder 3 Glow Plug Control Circuit

DTC P0674

Cylinder 4 Glow Plug Control Circuit

DTC P067A

Cylinder 4 Glow Plug Control Circuit Low Voltage

DTC P067B

Cylinder 4 Glow Plug Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Glow Plug Supply Voltage	P161E	P161E	-
Cylinder 1 Glow Plug Control	P1307, P066A	P1307, P0671	P1307, P066B

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Cylinder 2 Glow Plug Control	P1308, P066C	P1308, P0672	P1308, P066D
Cylinder 3 Glow Plug Control	P1309, P066E	P1309, P0673	P1309, P066F
Cylinder 4 Glow Plug Control	P130A, P067A	P130A, P0674	P130A, P067B

Circuit/System Description

The glow plug control module is integrated in the engine control module (ECM) and is a solid state device which operates the glow plugs. The temperature and the power consumption is controlled within a wide range to suit the engine pre-heating requirements. The glow plug initial ON time will vary based on the system voltage and temperature. Lower temperatures cause longer ON times.

Conditions for Running the DTC

- The ignition voltage is greater than 11 V.
- The ignition is ON.
- Engine is running.

Conditions for Setting the DTC

DTC P066A, P066C, P066E and P067A

The engine control module detects a short to ground at the Control Circuit for greater than 1 s.

DTC P066B, P066D, P066F and P067B

The engine control module detects a short to voltage at the control circuit for greater than 1 s.

DTC P0671, P0672, P0673 and P0674

The engine control module detects an open/high circuit at the control circuit for greater than 1 s.

Action Taken When the DTC Sets

DTCs P066A, P066B, P066C, P066D, P066E, P066F, P0671, P0672, P0673, P0674, P067A and P067B are Type C DTCs.

Conditions for Clearing the DTC

DTCs P066A, P066B, P066C, P066D, P066E, P066F, P0671, P0672, P0673, P0674, P067A and P067B are Type C DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Glow Plug System Description

Electrical Information Reference

- Circuit Testing
- Connector Repairs

- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On.
2. Using a scan tool perform the Glow Plug Self-Test while observing the following parameters.

Verify that all parameters display OK or Not Run.

- Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit Open Test Status
- Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit High Voltage Test Status
- Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit Low Voltage Test Status
- **If specified state is not displayed**

Refer to Circuit/System Testing.

- **Go to next step: If specified state is displayed**

3. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

- **If a DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If a DTC does not set**

4. All OK.

Circuit/System Testing

NOTE: If a glow plug is replaced and the tip is missing or burned off, the cylinder head must be removed and all debris be cleaned out of the cylinder.

1. Ignition Off, disconnect the harness connector at the appropriate E12 Glow Plug.
2. Ignition On.
3. Verify the glow plug is command Off with a scan tool.
4. Test for less than 0.2 V between the glow plug supply voltage circuit terminal 1 and ground.

- **If greater than 0.2 V**

1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Ignition On.

3. Test for less than 0.2 V between the glow plug supply voltage circuit and ground.

- If 0.2 V or greater, repair the short to voltage in the circuit.
- If less than 0.2 V replace the K20 Engine Control Module.

- **Go to next step: If less than 0.2 V**

NOTE: The glow plug supply voltage circuit will only stay On for 3 s when commanding the glow plugs On with the scan tool.

5. Test for greater than 0.2 V while commanding the appropriate glow plug On with a scan tool.

- **If less than 0.2 V**

1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the appropriate glow plug supply voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance.
3. Test for less than 2Ω in the glow plug supply voltage circuit end to end.
 - If 2Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2Ω , replace the K20 Engine Control Module.
- **Go to next step: If greater than 0.2 V**
6. Test or replace the appropriate E12 Glow Plug.

Component Testing

1. Ignition Off.
2. Disconnect the harness connector of the appropriate glow plug.
3. Test for less than 2Ω between glow plug terminal and the component's housing.
 - **If the resistance is more than 2Ω**

Replace the affected glow plug.
 - **Go to next step: If the resistance is less than 2Ω**
4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Glow Plug Replacement](#)
- Refer to [Control Module References](#) for Control Module replacement, programming and setup.

DTC P0685, P0686, P0687, P0689, P0690 OR P1682: ENGINE CONTROLS IGNITION RELAY/IGNITION 1 SWITCH CIRCUIT 2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P0685

Engine Controls Ignition Relay Control Circuit

DTC P0686

Engine Controls Ignition Relay Control Circuit Low Voltage

DTC P0687

Engine Controls Ignition Relay Control Circuit High Voltage

DTC P0689

Engine Controls Ignition Relay Feedback Circuit Low Voltage

DTC P0690

Engine Controls Ignition Relay Feedback Circuit High Voltage

Ignition 1 Switch Circuit 2

Diagnostic Fault Information

Engine Controls Ignition Relay

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Relay Coil Supply Voltage	P0689, P1682, P16A7, P16AF	P0685, P0689, P1682, P16A7, P16AF	-
Relay Control Circuit	P0686, P0690, P16B3	P0685, P0689, P1682, P16A7, P16AF	P0685, P0687, P0689, P1682, P16A7, P16AF
Relay Feedback Circuit	P0689, P1682, P16A7, P16AF	P0689, P1682, P16A7, P16AF	P0690, P16B3

Typical Scan Tool Data

Engine Controls Ignition Relay Control Circuit Low Voltage, Open and High Voltage Test Status - Component Commanded OFF

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Component commanded OFF Parameter Normal Range: The following illustrates the normal parameter state with no circuit conditions: • Component OFF - OK for Open/Low Voltage Test Status and Not Run for High Voltage Test Status • Component ON - Not Run for Open/Low Voltage Test Status and OK for High Voltage Test Status			
B+	Malfunction	Malfunction	-
Control	Malfunction	Malfunction	Not Run

Engine Controls Ignition Relay Control Circuit Low Voltage, Open and High Voltage Test Status - Component Commanded ON

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Component commanded ON Parameter Normal Range: The following illustrates the normal parameter state with no circuit conditions: • Component OFF - OK for Open/Low Voltage Test Status and Not Run for High Voltage Test Status • Component ON - Not Run for Open/Low Voltage Test Status and OK for High Voltage Test Status			
B+	Not Run	Not Run	-
Control	Not Run	Not Run	Malfunction

Circuit/System Description

There are 3 ignition voltage circuits supplied to the engine control module (ECM). Two are supplied by the engine controls ignition relay, and the other is supplied by the ignition main relay. The ECM monitors and compares the ignition voltage supplied by the 2 relays.

Conditions for Running the DTC

P0685, P0686, P0687

The DTC runs when Ignition 1 signal voltage is greater than 11 V.

P0689

- DTC P0685 is not set.
- The engine controls ignition relay is commanded ON.
- Ignition 1 signal voltage is greater than 11 V.
- The DTC runs continuously when the above conditions are met.

P0690

- DTC P0685 is not set.
- The engine controls ignition relay is commanded OFF.
- The DTC runs continuously when the above conditions are met.

P1682

- The engine controls ignition relay is commanded ON.
- Ignition voltage is greater than 5.5 V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0685

The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match for greater than 2 s.

P0686

The ECM detects a short to ground on the control circuit for greater than 2 s.

P0687

The ECM detects a short to voltage on the control circuit for greater than 2 s.

P0689

The ECM detects the engine controls ignition relay feedback circuit is less than 5 V.

P0690

The ECM detects the engine controls ignition relay feedback circuit is greater than 4 V for greater than 5 s.

P1682

The ECM detects that the voltage level difference is greater than 3 V between the 2 ignition voltage circuits for greater than 1 s.

Action Taken When the DTC Sets

- DTCs P0685, P0686, P0687, P0689 and P0690 are Type C DTCs.
- DTC P1682 is a Type A DTC.

Conditions for Clearing the DTC

- DTCs P0685, P0686, P0687, P0689 and P0690 are Type C DTCs.
- DTC P1682 is a Type A DTC.

Diagnostic Aids

The engine controls ignition relay may also be labeled the powertrain relay, the engine control module relay, or the main relay. The ignition main relay may also be labeled the run/crank relay, the ignition run relay, the ignition 1 relay or the ignition relay.

Reference Information

Schematic Reference

- [Engine Controls Wiring Schematics 1.6L \(LH7\)](#)
- Power Distribution Wiring Schematics

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Component View Reference

[Powertrain Component Views](#)

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Electrical Center Identification Views](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

NOTE:

- A short to voltage on other components may cause DTC P0690 to set. If any other DTC is set, diagnose that DTC first.
- If you were sent here from Engine Cranks But Does Not Run, proceed to Circuit/System Testing.

1. Ignition ON, observe the scan tool DTC information. Verify DTC P0685, P0686, P0687, P0689, P0690 or P1682 is not set.

- If any of the DTCs are set

Refer to Circuit/System Testing.

- Go to next step: If none of the DTCs are set

2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

- If the DTC sets

Refer to Circuit/System Testing.

- Go to next step: If the DTC does not set

3. All OK.

Circuit/System Testing

NOTE:

You must perform the Circuit/System Verification before proceeding with Circuit/System Testing unless sent here from Engine Cranks But Does Not Run.

1. Ignition OFF, disconnect the KR75 Engine Controls Ignition Relay.
2. Verify a test lamp illuminates between ground and the B+ terminals listed below:

- Terminal 1
- Terminal 3
- **If the test lamp does not illuminate**

Replace the front compartment fuse block.

- **Go to next step: If the test lamp illuminates**

NOTE:

- **High resistance in the circuit/underhood fuse block for either the KR75 Engine Controls Ignition Relay or the KR73 Ignition Main Relay can cause DTC P1682 to set.**
- **A short to voltage on any of the circuits supplied by the engine controls ignition relay can cause DTC P0690 to set.**

3. Ignition ON.

4. Verify that a test lamp does not illuminate between the ignition voltage circuit terminal 5 and ground.

- **If the test lamp illuminates**

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.

2. Ignition ON.

3. Test for less than 1 V between ground and connector terminal 1.

- If 1 V or greater, repair the short to voltage in the circuit.
- If less than 1 V, replace the K20 Engine Control Module.

- **Go to next step: If the test lamp does not illuminate**

5. Ignition OFF, connect a 20 A fused jumper wire between the B+ circuit terminal 3 and the ignition voltage circuit terminal 5.

6. Ignition ON.

7. Verify the scan tool Engine Controls Ignition Relay Feedback Signal parameter displays B+.

- **If B+ is not displayed**

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module

2. Test for less than 2 Ω in the ignition voltage circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

3. Test for infinite resistance between the ignition voltage circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20 Engine Control Module.

- **Go to next step: If B+ is displayed**

8. Ignition OFF, connect a DMM, set to the diode setting, between control circuit terminal 2 and ground.

9. Verify the DMM displays OL.

- **If OL is not displayed**

1. Disconnect the X1 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between ground and the relay control circuit.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance, replace the K20 Engine Control Module.

- **Go to next step: If OL is displayed**

10. Ignition ON.

11. Verify the DMM displays less than 1 V.

- **If 1 V or greater**

1. Ignition OFF, disconnect the X1 connector at the K20 Engine Control Module.

2. Ignition ON.

3. Test for less than 1 V on the relay control circuit.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V

4. Test for less than 2 Ω in the control circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- if less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If less than 1 V**

12. Test or replace the KR75 Engine Controls Ignition Relay.

Component Testing

Relay Test

1. Ignition OFF, disconnect the KR75 Engine Controls Ignition Relay.

2. Test for 70 - 110 Ω between terminals 1 and 2:

- **If less than 70 Ω or greater than 110 Ω**

Replace the KR75 Engine Controls Ignition Relay.

- **Go to next step: If between 70 - 110 Ω**

3. Test for infinite resistance between the terminals listed below:

- 3 and 2
- 3 and 5
- 3 and 1
- 1 and 5

- **If less than infinite resistance**

Replace the KR75 Engine Controls Ignition Relay.

- **Go to next step: If infinite resistance**

4. Install a 20 A fused jumper wire between relay terminal 1 and 12 V. Install a jumper wire between relay terminal 2 and ground.

5. Test for less than 2 Ω between terminals 3 and 5.

- **If 2 Ω or greater**

Replace the KR75 Engine Controls Ignition Relay.

- **Go to next step: If less than 2 Ω**

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Relay Replacement \(Attached to Wire Harness\)](#) [Relay Replacement \(Within an Electrical Center\)](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC C1201, P1000, P1001, P1003, P1008, P1009, P100A, P100E, P103D, P103E, P10B6-P10B9, P10BF, P10C6, P10C7, P10C8, P10F5, P1100, P1103, P117A, P11FF, P1200, P128C, P128D, P128E, P128F, P129E, P12A8, P130F, P135C, P135D, P135E, P135F, P1436, P143A, P143B, P1472, P14A0, P14B6, P14BD, P14CD, P14CE, P14D4, P14D5, P14D6, P150C, P151A, P151D, P153C, P153D, P155D, P1591, P15E2, P15F2, P15F9, P15FA, P15FB, P165C, P167F, P16E8, P16FF, P175F, P1761, P1762, P1775, P179B, P189C, P2544, P308D, P30B4, P30B5, P30BC, P30BD, P30D5, P30DE, P3168, P3169 OR P316B: MESSAGE COUNTER INCORRECT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC C1201

Transmission Range Redundant Command Message Counter Incorrect

DTC P1000

Fuel Pump Driver Control Module Reset Count Message Counter Incorrect

DTC P1001

Evaporative Emission (EVAP) System Signals Message Counter Incorrect

DTC P1003

Fuel Composition Signals Message Counter Incorrect

DTC P1008

Engine Coolant Bypass Valve Command Signal Message Counter Incorrect

DTC P1009

Fuel Pump Driver Control Module Temperature High Signal Message Counter Incorrect

DTC P100A

Turbocharger Boost Control Signal Message Counter Incorrect

DTC P100E

Accelerator Pedal Position Signal Message Counter Incorrect

DTC P103D

Engine Coolant Pump Control Signal Message Counter Incorrect

DTC P103E

Auxiliary Coolant Pump Control Signal Message Counter Incorrect

DTC P10B6

Mass Air Flow Sensor Intake Air Signals Message Counter Incorrect Bank 1

DTC P10B7

Mass Air Flow Sensor Intake Air Signals Message Counter Incorrect Bank 2

DTC P10B8

Mass Air Flow Sensor Barometric Pressure Sensor Signal Message Counter Incorrect Bank 2

DTC P10B9

Mass Air Flow Sensor Barometric Pressure Sensor Signal Message Counter Incorrect Bank 1

DTC P10BF

Engine Coolant Bypass Valve Secondary Command Signal Message Counter Incorrect

DTC P10C6

Engine Diagnostic Status Signal Message Counter Incorrect

DTC P10C7

Reductant Control System Signal Message Counter Incorrect

DTC P10C8

Reductant Temperature Signal Message Counter Incorrect

DTC P10F5

EVAP Purge Pump Status Message Counter Incorrect

DTC P1100

Fuel Level Sensor 2 Signal Message Counter Incorrect

DTC P1103

Water in Fuel Signal Message Counter Incorrect

DTC P117A

Engine Block Coolant Valve Signal Message Counter Incorrect

DTC P11FF

Fuel Pump Command Signal Message Counter Incorrect

DTC P1200

Fuel Level Sensor 1 Signal Message Counter Incorrect

DTC P128C

Fuel Rail Temperature Sensor 1 Signal Message Counter Incorrect

DTC P128D

Fuel Rail Temperature Sensor 2 Signal Message Counter Incorrect

DTC P128F

Fuel Rail Pressure Sensors 1 and 2 Signals Message Counter Incorrect

DTC P129E

Fuel Pump Driver Control Module Signal Message Counter Incorrect

DTC P12A8

Fuel Pump Control Status Signal Message Counter Incorrect

DTC P130F

Ignition On/Start Voltage Signal Message Counter Incorrect

DTC P135C

Cooling Fan 1 Status Signals Message Counter Incorrect

DTC P135D

Cooling Fan 2 Status Signals Message Counter Incorrect

DTC P135E

Cooling Fan 3 Status Signals Message Counter Incorrect

DTC P135F

Cooling Fan 4 Status Signals Message Counter Incorrect

DTC P1436

Particulate Matter Sensor Control Module Temperature Signal Message Counter Incorrect

DTC P143A

Reductant Control System Diagnostic Signal Message Counter Incorrect

DTC P143B

Reductant Control System Information Signal Message Counter Incorrect

DTC P1472

Particulate Matter Sensor Signal Message Counter Incorrect

DTC P14A0

Charge Air Cooler Coolant Pump Status Signal Message Counter Incorrect

DTC P14B6

Mass Air Flow Sensor Signal Message Counter Incorrect

DTC P14BD

Mass Air Flow Sensor Signal Message Counter Incorrect Bank 2

DTC P14CD

Fuel Pump Driver Control Module Configuration Command Signal 1 Message Counter Incorrect

DTC P14CE

Fuel Pump Driver Control Module Configuration Status Signal Message Counter Incorrect

DTC P14D4

Fuel Pump Driver Control Module Configuration Command Signal 2 Message Counter Incorrect

DTC P14D5

Fuel Pump Driver Control Module Configuration Command Signal 3 Message Counter Incorrect

DTC P14D6

Fuel Pump Driver Control Module Configuration Command Signal 5 Message Counter Incorrect

DTC P150C

Transmission Control Module Engine Speed Request Signal Message Counter Incorrect

DTC P151A

Throttle Actuator Control (TAC) Signal Message Counter Incorrect

DTC P151D

Transmission Control Module Engine Shutdown Request Signal Message Counter Incorrect

DTC P153C

Engine Speed Signal Message Counter Incorrect

DTC P153D

Driver Torque Request Signal Message Counter Incorrect

DTC P155D

Hill Descent Control Message Counter Incorrect

DTC P1591

Body Control Module Engine Speed Request Signal Message Counter Incorrect

DTC P15E2

Alternative Fuel System Request Signal Message Counter Incorrect

DTC P15F2

Engine Torque Command Signal Message Counter Incorrect

DTC P15F9

Hybrid/EV System Engine Speed Control Intervention Request Type Signal Message Counter Incorrect

DTC P15FA

Wheel Slip Status Signal Message Counter Incorrect

DTC P15FB

Brake Pedal Position Sensor Signal Message Counter Incorrect

DTC P165C

Sensor Reference Voltage Status Message Counter Incorrect

DTC P167F

Battery Voltage Signal Message Counter Incorrect

DTC P16E8

Engine Controls Ignition Relay Signal Message Counter Incorrect

DTC P16FF

Engine Controls Ignition Relay Request Signal Message Counter Incorrect

DTC P175F

Acceleration Sensor Signal Message Counter Incorrect

DTC P1761

Up and Down Shift Switch Signal Message Counter Incorrect

DTC P1762

Transmission Mode Switch Signal Message Counter Incorrect

DTC P1775

Transmission Range Request Signal Message Counter Incorrect

DTC P179B

Transmission Range State Command Signal Message Counter Incorrect

DTC P189C

Transmission Range Command Message Performance

DTC P2544

Transmission Torque Request Signal Message Counter Incorrect

DTC P30B4

NOx Sensor 1 Signal Message Counter Incorrect

DTC P30B5

NOx Sensor 2 Signal Message Counter Incorrect

DTC P30BC

Particulate Matter Sensor Control Module Status Signal Message Counter Incorrect

DTC P30BD

Engine Stall Prevention Active Signal Message Counter Incorrect

DTC P30D5

NOx Sensor 3 Signal Message Counter Incorrect

DTC P30DE

Fuel Rail Pressure Sensor 2 Signal Message Counter Incorrect

DTC P3168

Fuel Injector Set 2 Commands Signal Message Counter Incorrect

DTC P3169

Fuel Injector Control Module Commands Signal Message Counter Incorrect

DTC P316B

Secondary Fuel System Requests Signal Message Counter Incorrect

Circuit/System Description

Control modules connected to the serial data circuits monitor the communication during normal vehicle operation. Operating information and commands are exchanged among the control modules. Each

module on the serial data circuit maintains a transmit error counter and a receive error counter. The counter values increase with detected errors and decrease with error-free messages.

Conditions for Running the DTC

- Ignition = On - For greater than 3 s
- Serial Data = Enabled

Frequency the DTC runs = Continuously - After the running conditions are met

Conditions for Setting the DTC

Serial Data = Message Counter Incorrect - Control module that has set the DTC

The above condition(s) must occur 5 times.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C DTC

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify there are no DTCs set related to the following system/component: Serial Data

- **If a related DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If a related DTC is not set**

3. Clear the DTCs.
4. Operate the vehicle within the Conditions for Running the DTC.

Verify the DTC does not set.

- **If the DTC sets**

1. Ignition/Vehicle - Off
2. Replace the component: The control module that is sending the error message.
3. Operate the vehicle within the Conditions for Running the DTC.

Verify the DTC does not set.

- If the DTC sets

Replace the component: Control module that has set the DTC

- If the DTC does not set

4. All OK.

- **Go to next step: If the DTC does not set**

5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P1004, P119D, P119E, P119F, P11BE, P11BF, P11C0, P11C7, P11C8, P11D0, P11D1, P11D2, P11D5, P11D8, P11D9, P11DA, P11DC, P11FC, P11FD, P11FE, P22A0, P22A1, P22A3, P22A4, P22A5, P22A6, P22A7, P22A8, P22A9 OR P22FE: NOX SENSOR 2

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P119D

NOx Sensor 2 Signal Circuit

DTC P119E

NOx Sensor 2 Signal Circuit Low Voltage

DTC P119F

NOx Sensor 2 Signal Circuit High Voltage

DTC P11BE

O2 Reference Voltage Circuit (NOx Sensor 2)

DTC P11BF

O2 Reference Voltage Circuit Low Voltage (NOx Sensor 2)

DTC P11C0

O2 Reference Voltage Circuit High Voltage (NOx Sensor 2)

DTC P11C7

NOx Sensor 2 Heater Ground Circuit

DTC P11C8

NOx Sensor 2 Heater Ground Circuit High

DTC P11D0

O2 Signal Circuit (NOx Sensor 2)

DTC P11D1

O2 Signal Circuit Low Voltage (NOx Sensor 2)

DTC P11D2

O2 Signal Circuit High Voltage (NOx Sensor 2)

DTC P11D5

NOx Sensor 2 Exceeded Minimum Learning Limit

DTC P11D8

O2 Pump Current Control Circuit (NOx Sensor 2)

DTC P11D9

O2 Pump Current Control Circuit Low Voltage (NOx Sensor 2)

DTC P11DA

O2 Pump Current Control Circuit High Voltage (NOx Sensor 2)

DTC P11DC

NOx Sensor 2 Current Performance

DTC P11FC

O2 Low Reference Circuit (NOx Sensor 2)

DTC P11FD

O2 Low Reference Circuit Low Voltage (NOx Sensor 2)

DTC P11FE

O2 Low Reference Circuit High Voltage (NOx Sensor 2)

DTC P22A0

NOx Sensor 2 Circuit Low Voltage

DTC P22A1

NOx Sensor 2 Circuit High Voltage

DTC P22A3

NOx Sensor 2 Heater Control Circuit

DTC P22A4

NOx Sensor 2 Heater Control Circuit Low Voltage

DTC P22A5

NOx Sensor 2 Heater Control Circuit High Voltage

DTC P22A6

NOx Sensor 2 Heater Feedback Circuit

DTC P22A7

NOx Sensor 2 Heater Feedback Performance

DTC P22A8

NOx Sensor 2 Heater Feedback Circuit Low Voltage

DTC P22A9

NOx Sensor 2 Heater Feedback Circuit Low Voltage

NOx Sensor 2 Performance - Sensing Element**Circuit/System Description**

The nitrogen oxides (NOx) sensors are part of the selective catalytic reduction system, a device used to reduce Nox emission on diesel engines. There are two NOx sensors, one placed upstream of selective catalytic reduction, to measure inlet NOx concentration, and one placed downstream. They are connected with the control module via CAN and all the information is exchanged through it. Since it is a smart sensor, all the electrical monitoring is performed inside the sensor and only the results are sent to the ECM. Each NOx sensor contains a sensing cell, a pumping cell, and a heater. A sample of exhaust gas passes through a diffusion gap between the sensing cell and the pumping cell. The NOx sensor maintains a constant reference voltage across the sensing cell. An electronic circuit within the sensor controls the pump current through the pumping cell in order to maintain a constant voltage in the sensing cell. The amount of current required to maintain the reference voltage in the sensing cell is proportional to the concentration of NOx in the exhaust. The ECM varies the amount of diesel exhaust fluid (reductant) added by varying the reductant injector duty cycle in response to changes in engine exhaust NOx levels. The smart NOx sensors consist of two components, the NOx module and the NOx sensor element that are serviced as a unit. A circuit or performance condition with a NOx sensor is detected by the NOx sensor module. The smart NOx sensor module communicates the condition to the ECM over the serial data line. The ECM sets a DTC when a serial data message is received from the NOx sensor module.

Conditions for Running the DTCs

P119D, P119E, P119F, P11BE, P11BF, P11C0, P11C7, P11C8, P11D0, P11D1, P11D2, P11D8, P11D9, P11DA, P11FC, P11FD, P11FE, P22A3, P22A4, P22A5, P22A6, P22A8, P22A9

- DTC U029E is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 2 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

These DTCs run continuously when the above conditions are met

P11D5

- DTC P003A, P0046, P0087, P00AF, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0128, P122B-P122D, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E3-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P042E, P042F, P049D, P0489, P0490, P062B, P062D, P111E, P119D-P119F, P11BE, P11BF, P11C0, P11C7, P11C8, P11D0-P11D2, P11D8, P11D9, P11DA, P11DC, P11DE, P11FC-P11FE, P1248, P1249, P124A-P124F, P126A, P1402, P1407, P140F, P1424, P1425, P16D7-P16D9, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227-P2230, P228A, P220B, P228B, P229E, P229F, P22A0, P22A1, P22A3-P22A9, P22FE, U029E is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 2 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.
- The engine speed is between 550 - 3, 500 RPM.
- The intake manifold pressure lower than 300 kPa (43.5 psi).
- Time elapsed since diesel particulate filter regeneration is greater than 300 s.

These DTCs run continuously when the above conditions are met

P11DC

- DTC P119D-P119F, P11BE, P11BF, P11C0, P11C7, P11C8, P11D0-P11D2, P11D8, P11D9, P11DA, P11FC-P11FE, P220B, P229E, P22A3-P22A9, or U029E is not set.

- The engine is running.
- The ignition voltage is greater than 11 V.
- The NOx Sensor 2 Heater Operation parameter displays Allowed.
- The NOx sensor supply voltage is greater than 10.8 V.

The DTC runs continuously when the above conditions are met.

P22A0, P22A1

- DTC P11BE, P11BF, P11C0, P11C7, P11C8, P11D0, P11D1, P11D2, P11D8, P11D9, P11DA, P11DC, P11DE, P11FC, P11FD, P11FE, P119D, P119E, P119F, P220B, P229E, P22A3, P22A4, P22A5,

P22A6, P22A7, P22A8, P22A9, U029D is not set

- The engine is running.
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 2 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

These DTCs run continuously when the above conditions are met.

P22A7

- DTC U029D is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 2 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

The DTC runs continuously when the above conditions are met for greater than 180 s.

P22FE

- DTC P0070, P0071, P0E9, P0EA-P0EC, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P021A, P021B, P0234, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0299, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0405, P0406, P049D, P0502, P0503, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P118E, P1192-P1194, P119A-P119F, P11BE, P11BF, P11C0, P11C5-P11C8, P11CC, P11D0-P11D2, P11D8, P11D9, P11DA-P11DE, P11FC-P11FE, P1248, P1249, P124A-P124F, P2081, P2082, P20CB, P20CD, P20CE, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2200, P2205-P2211, P220A, P220B, P2227, P2228, P2229, P2230, P2263, P229E, P229F, P22A0, P22A1, P22A3-P22A9, P22F9, P22FA, P2670, U029D or U029E is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 1 and 2 Heater Operation parameters display Allowed
- The NOx sensor supply voltage is greater than 10.8 V.
- The engine speed is between 0 - 1, 000 RPM.

The DTC runs up to 10 times per ignition cycle when the above conditions are met.

Conditions for Setting the DTC

The NOx sensor module detects a fault in the NOx sensor circuitry or a performance fault in the NOx sensor for greater than 2 s.

Action Taken When the DTC Sets

DTCs P119E, P119F, P11BF, P11C0, P11C8, P11D1, P11D2, P11D5, P11D9, P11DA, P11DC, P11FD, P11FE, P22A0, P22A1, P22A4, P22A5, P22A7, P22A8, P22A9 and P22FE are Type B DTCs.

DTCs P119D, P11BE, P11C7, P11D0, P11D8, P11FC, P22A3 and P22A6, are Type A DTCs.

Conditions for Clearing the DTC

DTCs P119E, P119F, P11BF, P11C0, P11C8, P11D1, P11D2, P11D5, P11D9, P11DA, P11DC, P11FD, P11FE, P22A0, P22A1, P22A4, P22A5, P22A7, P22A8, P22A9 and P22FE are Type B DTCs.

DTCs P119D, P11BE, P11C7, P11D0, P11D8, P11FC, P22A3 and P22A6, are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTCs P119D, P119E, P119F, P11BE, P11BF, P11C0, P11C7, P11C8, P11D0, P11D1, P11D2, P11D5, P11D8, P11D9, P11DA, P11DC, P11FC, P11FD, P11FE, P22A0, P22A1, P22A3, P22A4, P22A5, P22A6, P22A7, P22A8, P22A9 or P22FE are not set
 - **If any of the DTCs are set**

Replace the B195B Nitrogen Oxides Sensor 2
 - **Go to next step: If none of the DTCs are set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set
 - **If the DTC sets**

Replace the B195B Nitrogen Oxides Sensor 2
 - **Go to next step: If DTC does not set**
5. All OK.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Refer to **Nitrogen Oxides Sensor Replacement - Position 2**

DTC P1005: FUEL PUMP DRIVER CONTROL MODULE ENABLE TOO MANY RESETS

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC P1005

Fuel Pump Driver Control Module Enable Too Many Resets

Circuit/System Description

The fuel pump driver control module sends a message every 100 ms to the engine control module (ECM) that indicates the amount of time elapsed since the last controller reset (power up or running reset). This message is used to detect if the fuel pump driver control module has unexpectedly reset and will eventually set a DTC if the resets continue.

Conditions for Running the DTC

- DTC U18A2 is not set.
- Ignition voltage is greater than 11 V.
- KR73 Ignition Main Relay is commanded On.

The DTC runs continuously when the conditions above are met.

Conditions for Setting the DTC

The fuel pump driver control module has exceeded 320 resets in less than 200 s

Action Taken When the DTC Sets

DTC P1005 is a Type B DTC.

Conditions for Clearing the DTC

DTC P1005 is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify DTC U18A2 is not set.
 - **If DTC U18A2 is set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle
 - **Go to next step: If DTC U18A2 is not set**
2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
3. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
4. All OK.

Circuit/System Testing

1. Ignition Off and all vehicle systems Off.
2. It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.
3. Disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
4. Test for less than 10 Ω between the ground circuit terminal 22 and ground.
 - **If 10 Ω or greater**
 1. Test for less than 2 Ω between the ground circuit terminal 22 and Terminal G402.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
5. Verify that a test lamp illuminates between the B+ circuit terminal 7 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Remove B+ fuse.
 2. Test for less than 2 Ω in the B+ circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the B+ circuit
 - If less than 2 Ω , verify the fuse is Ok and there is voltage at the fuse
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Remove B+ fuse.
 2. Test for infinite resistance between the B+ circuit terminal 7 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module
 - **Go to next step: If the test lamp illuminates**
6. Ignition On.
7. Verify a test lamp illuminates between the ignition circuit terminal 17 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Remove ignition fuse.
 2. Test for less than 2 Ω in the ignition circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the ignition circuit
- If less than 2 Ω , verify the fuse is Ok and there is voltage at the fuse
- **If the test lamp does not illuminate and the circuit fuse is open**
 1. Remove ignition fuse.
 2. Test for infinite resistance between the ignition circuit terminal 17 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module
- **Go to next step: If the test lamp illuminates**
- 8. Verify a test lamp illuminates between the voltage supply circuit terminal 16 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Remove voltage supply circuit fuse.
 2. Test for less than 2 Ω in the voltage supply circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the ignition circuit
 - If less than 2 Ω , verify the fuse is Ok and there is voltage at the fuse
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Remove voltage supply circuit fuse and all components on the same circuit.
 2. Test for infinite resistance between the voltage supply circuit terminal 16 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module
 - **Go to next step: If the test lamp illuminates**
- 9. Replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

For Control Module replacement, programming and setup, refer to [Control Module References](#)

DTC P1007 OR P129D: FUEL PUMP DRIVER CONTROL MODULE IGNITION ON/START SWITCH CIRCUIT VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P1007

Fuel Pump Driver Control Module Ignition On/Start Switch Circuit High Voltage

DTC P129D

Fuel Pump Driver Control Module Ignition On/Start Switch Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P129D	P129D	P1007	-

Circuit/System Description

The fuel pump driver control module monitors the ignition voltage circuit in order to determine if the voltage is within the normal operating range.

Conditions for Running the DTC

- Engine is cranking or running
- The powertrain sensor relay is commanded ON

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P1007

The fuel pump driver control module ignition switch circuit voltage is greater than a calibrated value for 1 s.

P129D

The fuel pump driver control module ignition switch circuit voltage is less than a calibrated value for 1 s.

Action Taken When the DTC Sets

DTC P1007 and P129D are Type B DTCs.

Conditions for Clearing the DTC

DTC P1007 and P129D are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify the engine cranks.
 - **If the engine does not crank**

Refer to [Starter Solenoid Does Not Click \(Without KL9\)](#), [Starter Solenoid Does Not Click \(KL9\)](#).

- **Go to next step: If the engine cranks**

2. Ignition ON.

3. Verify DTC P0562 or P0563 is not set.

- **If DTC P0562 or P0563 is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).

- **Go to next step: DTC P0562 or P0563 is not set**

4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

5. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If the DTC does not set**

6. All OK.

Circuit/System Testing

NOTE: Circuit/System Verification must be performed first or misdiagnosis may result.

1. Ignition OFF, all vehicle systems OFF, disconnect the harness connector at the K111 Fuel Pump Driver Control Module. It may take up to 2 min for all vehicle systems to power down.

2. Ignition ON.

3. Verify a test lamp illuminates between the ignition circuit terminal 17 and ground.

- **If the test lamp does not illuminate and the circuit fuse is good**

1. Ignition OFF, remove the test lamp.

2. Test for less than 2 Ω in the ignition circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.

- **If the test lamp does not illuminate and the circuit fuse is open**

1. Ignition OFF, remove the test lamp.

2. Test for infinite resistance between the ignition circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K111 Fuel Pump Driver Control Module.

- **Go to next step: If the test lamp illuminates**

4. Ignition OFF, and all vehicle systems OFF, it may take up to 2 minutes for all vehicle systems to power down.

5. Verify a test lamp does not illuminate between the ignition circuit terminal 17 and ground.

- **If the test lamp illuminates**

Repair the short to voltage on the circuit.

- **Go to next step: If the test lamp does not illuminate**

6. Replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

For control module replacement, programming, and setup refer to [Control Module References](#)

DTC P1015, P1016, P1017, P1018, P1019 OR P101A: REDUCTANT CONTROL MODULE SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1015

Reductant Control Module Sensor Serial Communication Circuit Low Voltage

DTC P1016

Reductant Control Module Sensor Serial Communication Circuit High Voltage

DTC P1017

Reductant Control Module Sensor Serial Communication Circuit Performance

DTC P1018

Reductant Control Module Sensor Communication Voltage Supply Circuit Low Voltage

DTC P1019

Reductant Control Module Sensor Communication Voltage Supply Circuit High Voltage

DTC P101A

Reductant Control Module Sensor Communication Ground Circuit High Voltage

Circuit/System Description

The reductant quality sensor is located in the reductant tank and uses an ultrasonic signal to measure reductant fluid quality. The reductant quality sensor includes an integrated temperature sensor to measure reductant fluid temperature. The reductant quality sensor communicates with the reductant control module using serial data.

Conditions for Running the DTC

P1015, P1016

- DTC U010E is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The reductant control module is not initializing.

The DTCs run continuously when the above conditions are met.

P1017

- DTC P1015, P1016 or U010E is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The reductant control module is not initializing.

The DTCs run continuously when the above conditions are met.

P1018, P1019, P101A

- DTC P1015, P1016, P1017 or U010E is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The reductant control module is not initializing.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P1015

The reductant control module detects a low circuit fault on the signal circuit for greater than 1 s.

P1016

The reductant control module detects a high circuit fault on the signal circuit for greater than 1 s.

P1017

The reductant control module detects a performance fault on the signal circuit for greater than 1 s.

P1018

The reductant control module detects a short to ground on the 5 V reference circuit for greater than 1 s.

P1019

The reductant control module detects a short to voltage on the 5 V reference circuit for greater than 1 s.

P101A

The reductant control module detects a short to voltage on the low reference circuit for greater than 1 s.

Action Taken When the DTC Sets

DTCs P1015, P1016, P1017, P1018, P1019 and P101A are Type A DTCs.

- The reductant quality value is replaced with the last measured value.
- The reductant quality sensor temperature value is replaced with a default value
- The Warning/Inducement strategy is activated.

Conditions for Clearing the DTC

DTCs P1015, P1016, P1017, P1018, P1019 and P101A are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTCs P1015, P1016, P1017, P1018, P1019 or P101A are not set.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing
 - **Go to next step: If none of the DTC are set**
2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
3. Verify that DTCs P1015, P1016, P1017, P1018, P1019 or P101A are not set.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing
 - **Go to next step: If no DTC Is set**
4. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the B295 Reductant Quality Sensor.
2. Ignition On.
3. Test for less than 20 Ω between low reference terminal 3 and ground.
 - **If greater than 20 Ω**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If less than 20 Ω**
4. Test for 4.8-5.2 V between 5 V reference circuit terminal 1 and ground
 - **If less than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K115 Reductant Control Module
 - **If greater than 5.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module
 - **Go to next step: If between 4.8-5.2 V**
5. Ignition ON, test for 4.2-4.8 V between signal circuit terminal 2 and ground.
 - **If less than 4.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
3. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K115 Reductant Control Module
- **If greater than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Ignition On, test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module
 - **Go to next step: If between 4.2-4.8 V**
6. Replace the B295 Reductant Quality Sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Emission Reduction Fluid Controller Replacement](#)
- Refer to [Emission Reduction Fluid Tank Replacement](#) - B295 Reductant Quality Sensor

DTC P1029, P102A, OR P102B: FUEL PUMP PHASE U-V-W CIRCUITS

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P1029

Fuel Pump Phase U-V-W Circuits Open

DTC P102A

Fuel Pump Phase U-V-W Circuits Low Voltage

DTC P102B

Fuel Pump Phase U-V-W Circuits High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Control Circuit Shorted to Control Circuit
Control - Terminal 1 @ A7 Fuel Pump and Level Sensor Assembly	P102A	P1029	P102B	-
Control - Terminal 2 @ A7 Fuel Pump and Level Sensor Assembly	P102A	P1029	P102B	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Control Circuit Shorted to Control Circuit
Control - Terminal 3 @ A7 Fuel Pump and Level Sensor Assembly	P102A	P1029	P102B	-

Typical Scan Tool Data

Fuel Pump Phase U-V-W Circuits High Voltage Test Status

Circuit	Short to Ground	Open	Short to Voltage	Control Circuit Shorted to Control Circuit
Operating Conditions: Ignition = On Parameter Normal Range: OK or Not Run				
Control - Terminal 1 @ A7 Fuel Pump and Level Sensor Assembly	-	-	Malfunction	-
Control - Terminal 2 @ A7 Fuel Pump and Level Sensor Assembly	-	-	Malfunction	-
Control - Terminal 3 @ A7 Fuel Pump and Level Sensor Assembly	-	-	Malfunction	-

Fuel Pump Phase U-V-W Circuits Low Voltage Test Status

Circuit	Short to Ground	Open	Short to Voltage	Control Circuit Shorted to Control Circuit
Operating Conditions: Ignition = On Parameter Normal Range: OK or Not Run				
Control - Terminal 1 @ A7 Fuel Pump and Level Sensor Assembly	Malfunction	-	-	-
Control - Terminal 2 @ A7 Fuel Pump and Level Sensor Assembly	Malfunction	-	-	-
Control - Terminal 3 @ A7 Fuel Pump and Level Sensor Assembly	Malfunction	-	-	-

Fuel Pump Phase U-V-W Circuits Open Test Status

Circuit	Short to Ground	Open	Short to Voltage	Control Circuit Shorted to Control Circuit
Operating Conditions: Ignition = On Parameter Normal Range: OK or Not Run				
Control - Terminal 1 @ A7 Fuel Pump and Level Sensor Assembly	-	Malfunction	-	-
Control - Terminal 2 @ A7 Fuel Pump and Level Sensor Assembly	-	Malfunction	-	-
Control - Terminal 3 @ A7 Fuel Pump and Level Sensor Assembly	-	Malfunction	-	-

Circuit/System Description

For an overview of the component/system, refer to [Fuel System Description](#)

Circuit	Description
Control	The output circuit varies between ground and 12 V.

Component	Description
G12A Fuel Pump - Primary	The component has a 3-phase motor. The control module converts the DC voltage from the battery to 3-phase AC to power the motor.
K111 Fuel Pump Driver Control Module	The control module K111 supplies the fuel pump with a 3-phase voltage in order to achieve the desired pump speed required for building fuel line pressure.

Conditions for Running the DTC

P1029

- KR73 Ignition Main Relay = On
- Fuel Pump Speed = 0 RPM

Frequency the DTC runs = Continuously - After the running conditions are met

P102A, P102B

KR73 Ignition Main Relay = On

Frequency the DTC runs = Continuously - After the running conditions are met

Conditions for Setting the DTC

P1029

Fuel Pump Phase U-V-W Circuits = Open - For greater than 1 s

P102A

Fuel Pump Phase U-V-W Circuits = Short to Ground - For greater than 1 s

P102B

Fuel Pump Phase U-V-W Circuits = Short to Voltage - For greater than 1 s

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type A DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type A DTC

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.6L \(LH7\)](#)

Connector End View Reference

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Component View Reference

Powertrain Component Views

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify DTC U18A2 is not set.
 - **If the DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **Go to next step: If the DTC is not set**
3. Verify the scan tool parameter:
 - Fuel Pump Phase U-V-W Circuits High Voltage Test Status = OK or Not Run
 - Fuel Pump Phase U-V-W Circuits Low Voltage Test Status = OK or Not Run
 - Fuel Pump Phase U-V-W Circuits Open Test Status = OK or Not Run
 - **If not the specified state**

Refer to Circuit/System Testing
 - **Go to next step: If the specified state**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing
 - **Go to next step: If the DTC is not set**
5. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: K111 Fuel Pump Driver Control Module
3. Ignition - On/Vehicle - In Service Mode
4. Test for less than 1 V between the test points:
 - Control circuit terminal 8 & Ground
 - Control circuit terminal 9 & Ground
 - Control circuit terminal 24 & Ground
 - **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

5. Ignition/Vehicle & All vehicle systems - Off

6. Test for infinite resistance between the test points:

- Control circuit terminal 8 & Ground
- Control circuit terminal 9 & Ground
- Control circuit terminal 24 & Ground
- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **Go to next step: If infinite resistance**

7. Disconnect the electrical connector: A7 Fuel Pump and Level Sensor Assembly

8. Test for less than 2 Ω between the test points:

- Control circuit terminal 8 @ Control module harness & Terminal 1 @ Component harness
- Control circuit terminal 9 @ Control module harness & Terminal 2 @ Component harness
- Control circuit terminal 24 @ Control module harness & Terminal 3 @ Component harness
- **If 2 Ω or greater**

Repair the open/high resistance in the circuit:

- **Go to next step: If less than 2 Ω**

9. Replace the component: A7 Fuel Pump Driver Control Module

10. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Replace the component: K111 Fuel Pump and Level Sensor Assembly

- **Go to next step: If the DTC does not set**

11. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- Refer to [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#), [Fuel Tank Fuel Pump Module Replacement \(AWD\)](#) - A7 Fuel Pump and Level Sensor Assembly
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P103F OR P1040: REDUCTANT PUMP DRIVER HIGH TEMPERATURE/REDUCTANT PUMP CONTROL CIRCUIT SHORTED

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P103F

Reductant Pump Driver High Temperature

DTC P1040

Circuit/System Description

The selective catalytic reduction system reduces oxides of nitrogen (NOx) emissions by injecting a metered amount of reductant into the exhaust gas stream entering the selective catalytic reduction catalyst. Within the selective catalytic reduction catalyst, the reductant reacts with the NOx to form nitrogen, carbon dioxide, and water vapor. Upstream and downstream NOx sensors provides the engine control module and the reductant control module via serial data. The engine control module (ECM) controls the reductant injector duty cycle in response to changes in engine-out NOx levels. The reductant control module supplies system voltage to the reductant pump motor. The reductant control module controls the solenoid by grounding the control circuit. The reductant control module can determine if the control circuit is open, shorted to ground, or shorted to a voltage by monitoring the feedback voltage.

Conditions for Running the DTC

- DTC U010E is not set.
- The battery voltage is greater than 11 V.
- Ignition On or engine running.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P103F

The reductant control module detects a motor pump driver high temperature

P1040

The reductant control module detects a motor pump phases shorted error

Action Taken When the DTC Sets

- DTCs P103F and P1040 are Type A DTCs.

Conditions for Clearing the DTC

- DTCs P103F and P1040 are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On
2. Verify that no other reductant system DTCs are set.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - **Go to next step: If no other DTCs are set**
3. Verify that DTC P103F or P1040 is not set.
 - **If a DTC Is set**
Refer to Circuit/System Testing.
 - **Go to next step: If no DTC is set**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify that DTC P103F or P1040 is not set.
 - **If a DTC sets**
Refer to Circuit/System Testing
 - **Go to next step: If a DTC does not set**
6. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 15 and ground.
 - **If 10 Ω or greater**
 1. Ignition Off.
 2. Test for less than 2 Ω at the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If less than 10 Ω**
3. Disconnect the X2 harness connector at the K115 Reductant Control Module.
4. Test for less than 2 Ω between the terminals listed below:
 - A38 Reductant Pump and Sensor Assembly harness connector terminal 16 and K115 Reductant Control Module harness connector terminal 1
 - A38 Reductant Pump and Sensor Assembly harness connector terminal 8 and K115 Reductant Control Module harness connector terminal 2
 - A38 Reductant Pump and Sensor Assembly harness connector terminal 7 and K115 Reductant Control Module harness connector terminal 3
 - **If greater than 2 Ω**
Repair the open/high resistance in the appropriate circuit.
 - **Go to next step: If less than 2 Ω**
5. Ignition Off, test for infinite resistance between each control circuit and ground.
 - **If less than infinite resistance**
Repair the short to ground at the appropriate circuit.
 - **Go to next step: If infinite resistance**
6. Ignition On, test for less than 1 V between each control circuit and ground.
 - **If 1 V or greater**

Repair the short to voltage on the appropriate circuit.

- **Go to next step: If less than 1 V**

7. Replace the A38 Reductant Pump and Sensor Assembly.

8. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

9. Verify the DTC does not set.

- **If the DTC sets**

Replace the K115 Reductant Control Module

- **Go to next step: If the DTC does not set**

10. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Tank Replacement](#) for reductant pump and sensor assembly replacement.
- Refer to [Emission Reduction Fluid Controller Replacement](#)

DTC P1048, P1049, P2047, P2048, OR P2049: REDUCTANT INJECTOR CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1048

Reductant Injector High Control Circuit Low Voltage

DTC P1049

Reductant Injector High Control Circuit High Voltage

DTC P2047

Reductant Injector Control Circuit

DTC P2048

Reductant Injector Control Circuit Low Voltage

DTC P2049

Reductant Injector Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Reductant Injector High Control	P1048	P2047	P1049
Reductant Injector Low Control	P2048	P2047	P2049

Circuit/System Description

The reductant injector is a component of the selective catalytic reduction system used to dose the reductant fluid to the exhaust gas and participate in the reduction reactions. The Engine Control Module (ECM) calculates the injection time of the reductant injector based on the measurement of the NO_x sensors. To activate the injector the ECM supplies a Pulse Width Modulated signal to the high control circuit and the low control circuit is always commanded ON.

Conditions for Running the DTCs

- The engine is running.
- The battery voltage is greater than 11 V.

The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

DTC P1048

The Reductant Control Module detects a short to ground in the high control circuit

DTC P1049

The Reductant Control Module detects a short to voltage in the high control circuit

DTC P2047

The Reductant Control Module detects an open in the control circuit

DTC P2048

The Reductant Control Module detects a short to ground in the low control circuit

DTC P2049

The Reductant Control Module detects a short to voltage in the low control circuit

Action Taken When the DTC Sets

DTCs P1048, P1049, P2047, P2048 and P2049 are Type A DTCs.

- The reductant injector is shut off.
- The reductant tank and line heaters are shut off.
- The selective catalytic reduction system is in stand-by mode.

Conditions for Clearing the DTC

DTCs P1048, P1049, P2047, P2048 and P2049 are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**

- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Verify the scan tool Reductant Injector Control Circuit Status parameters listed below display OK or Not Run.
 - Reductant Injector Control Circuit Open Status
 - Reductant Injector Control Circuit Low Voltage Test Status
 - **If OK or Not Run is not displayed**

Refer to Circuit/System Testing.

- **Go to next step: If OK or Not Run is displayed**
2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 3. Verify DTC P1048, P1049, P2047, P2048 or P2049 does not set.
 - **If any of the DTCs sets**

Refer to Circuit/System Testing.

- **Go to next step: If no DTC sets**
4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q61 Reductant Injector.
2. Ignition ON, test for 2 - 3 V between the reductant injector low control circuit terminal 2 and ground.
 - **If less than 2 V**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω between the test points: Terminal 1 @ Q61 Reductant injector Component harness & Terminal 1 X3 @ Control module harness
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for infinite resistance between the Q61 Reductant Injector harness terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If greater than 3 V**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
 2. Test for less than 1.0 V between Q61 Reductant Injector harness low control circuit terminal 1 and ground.
 - If greater than 1.0 V, repair the short to voltage at the circuit.
 - If less than 1.0 V, replace the K20 Engine Control Module.
 - **Go to next step: If between 2 - 3 V**
3. Connect a test lamp between the Q61 Reductant Injector low control circuit harness terminal 1 and the Q61 Reductant Injector high control circuit harness terminal 2

4. Ignition ON, verify a test lamp flashes several times while commanding the Reductant Injector on with a scan tool.

- **If the test lamp is always off**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω between Q61 Reductant Injector harness high control circuit terminal 2 to K20 Engine Control Module X3 harness connector terminal 1.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

3. Test for infinite resistance between the Q61 Reductant Injector harness reductant injector high control circuit terminal 2 and ground.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance, replace the K20 Engine Control Module.

- **If the test lamp is always ON**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Ignition ON, test for less than 1.0 V between the Q61 Reductant Injector harness high control circuit terminal 2 and ground.

- If greater than 1.0 V, repair the short to voltage at the circuit.
- If less than 1.0 V, replace the K20 Engine Control Module.

- **Go to next step: If the test lamp flashes**

5. Refer to [Component Testing](#)

Component Testing

1. Ignition OFF, disconnect the harness connector at the Q61 Reductant Injector.
2. Test for 10 - 14 Ω between the high control circuit terminal 2 and low control circuit terminal 1.

- **If not within 10 - 14 Ω**

Replace the Q61 Reductant Injector

- **Go to next step: If within 10 - 14 Ω**

3. Test for infinite resistance between each terminal and the sensor housing/case.

- **If less than infinite resistance**

Replace the Q61 Reductant Injector.

- **Go to next step: If infinite resistance**

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

Refer to [Emission Reduction Fluid Injector Replacement \(AWD\)](#), [Emission Reduction Fluid Injector Replacement \(FWD\)](#).

- Refer to [Reductant System Tamper Service Bay Test](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P1050: REDUCTANT LEVEL SENSOR INVALID RANGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.

- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1050

Reductant Level Sensor Invalid Range

Circuit/System Description

The reductant level sensor provides discrete information about the diesel exhaust fluid quantity present in the reductant tank. The sensor signal provides information to the reductant control module to determine 4 different states: FULL, OK, WARNING1 and WARNING2. The reductant control module diagnoses the sensor for open circuit, short to ground and short to voltage electrical faults. The sensor is also checked for invalid range output by determining if the float is mechanically stuck in a plausible position.

Conditions for Running the DTC

- DTC P203C, P203D or U010E is not set.
- The battery voltage is greater than 11 V.
- The ignition is On or the engine is running.

DTC P1050 runs when the above conditions have been met.

Conditions for Setting the DTC

The reductant level sensor value is outside a calibrated range.

Action Taken When the DTC Sets

DTC P1050 is a Type B DTC.

Conditions for Clearing the DTC

DTC P1050 is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify that DTC P203C or P203D is not set.
 - **If a DTC Is set**

Refer to [DTC P203C or P203D](#).
 - **Go to next step: If no DTC is set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify DTC P1050 does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing
 - **Go to next step: If no DTC sets**
5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module

NOTE: The reductant tank level must be full to ensure accurate resistance readings.

2. Verify the resistance is within the specified range between the harness connector terminals listed below:
 - Terminal 15 - 16 (3.37 - 3.43 k Ω)
 - Terminal 16 - 17 (7.2 - 7.34 k Ω)
 - **If not within the specified range**

Replace the A38 Reductant Pump and Sensor Assembly.
 - **Go to next step: If within the specified range**
3. Replace the K115 Reductant Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Controller Replacement](#)
- Refer to [Emission Reduction Fluid Supply Pump Module Replacement](#) for reductant pump and sensor assembly replacement.

DTC P1051 OR P1052: REDUCTANT HEATER 1-2 DRIVER HIGH TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1051

Reductant Heater 1 Driver High Temperature

DTC P1052

Circuit/System Description

As reductant will freeze at temperatures below -11°C (12°F), there are 2 reductant heaters. Reductant heater 1 is integral to the Emission Reduction Fluid Supply Pump Module, located in the reductant tank. Reductant heater 2 is located in the supply line to the reductant injector. The ECM monitors the reductant temperature in the tank in order to determine if the fluid is below its freeze point. If the ECM determines that the reductant may be frozen, it activates a "defrost strategy", by energizing the reductant heaters. The heaters are deactivated when the fluid temperature exceeds a calibrated value.

Conditions for Running the DTCs

- DTC P205B, P205C, P205D or U010E is not set.
- The ignition is On or the engine is running.
- The battery voltage is greater than 11 V.

Conditions for Setting the DTC

P1051

The ECM indicates the reductant tank heater temperature is over the calibrated threshold for greater than 5 s.

P1052

The ECM indicates the reductant line heater temperature is over the calibrated threshold for greater than 5 s.

Action Taken When the DTC Sets

DTCs P1051 and P1052 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P1051 and P1052 are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- Circuit Testing
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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify that no other reductant heater DTCs are set.

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **Go to next step: If no other DTCs are set**

3. Command the Reductant heater 1 and 2 On and Off with a scan tool.
4. Verify that the appropriate reductant heater parameter is between 0 - 25.5 A.

- **If not within the specified range**

Refer to Circuit/System Testing.

- **Go to next step: If within the specified range**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify DTC P1051 or P1052 does not set.

- **If a DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If no DTC sets**

7. All OK.

Circuit/System Testing

DTC P1051

1. Ignition Off and all vehicle systems Off. It may take up to 2 min for all vehicle systems to power down, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly.
2. Test for less than 10 Ω between the low reference circuit terminal 11 and ground.

- **If 10 Ω or greater**

1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
2. Test for less than 2 Ω in the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.

- **Go to next step: If less than 10 Ω**

3. Connect a test lamp between the heater control circuit terminal 9 and ground.
4. Ignition On, verify the test lamp turns On and Off while commanding the Reductant Heater 1 On and Off with a scan tool.

- **If the test lamp is always Off**

1. Ignition Off, remove the test lamp and disconnect the X2 harness connector at the K115 Reductant Control Module.
2. Test for infinite resistance between control circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.

- **If the Test lamp is always On**

1. Ignition On, test for less than 1.0 V between the control circuit and ground.
 - If 1.0 V or greater, repair the short to voltage in the circuit.
 - If less than 1.0 V, replace the K115 Reductant Control Module.

- **Go to next step: If the Test lamp turns On and Off**

5. Test or replace the E53 Reductant Tank Heater

DTC P1052

1. Ignition Off and all vehicle systems Off. It may take up to 2 minutes for all vehicle systems to power down, disconnect the harness connector at the E52 Reductant Line Heater.
2. Test for less than 10 Ω between the low reference circuit terminal 1 and ground.
 - **If 10 Ω or greater**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω in the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If less than 10 Ω**
3. Connect a test lamp between the heater control circuit terminal 2 and ground.
4. Ignition On, Verify the test lamp turns On and Off while commanding the Reductant Heater 2 On and Off with a scan tool.
 - **If the test lamp is always Off**
 1. Ignition Off, remove the test lamp and disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for infinite resistance between control circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
 3. Ignition Off.
 4. Test for less than 2 Ω in the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If the Test lamp is always On**
 1. Ignition On, test for less than 1.0 V between the control circuit and ground.
 - If 1.0 V or greater, repair the short to voltage in the circuit.
 - If less than 1.0 V, replace the K115 Reductant Control Module.
 - **Go to next step: If the Test lamp turns On and Off**
5. Test or replace the E52 Reductant Line Heater

Component Testing

Reductant Tank Heater

1. Ignition Off, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly.

NOTE: The DMM and test leads must be calibrated to 0 Ω in order to prevent misdiagnosis.

2. Test for 1 - 2 Ω between terminals 9 - 11 at the A38 Reductant Pump and Sensor Assembly.
 - **If less than 1 Ω or greater than 2 Ω**

Replace the A38 Reductant Pump and Sensor Assembly.
 - **Go to next step: If between 1 - 2 Ω**
3. Test for infinite resistance between each terminal and the A38 Reductant Pump and Sensor Assembly housing/case.
 - **If less than infinite resistance**

Replace the A38 Reductant Pump and Sensor Assembly.
 - **Go to next step: If infinite resistance**

4. All OK.

Reductant Line Heater

1. Ignition Off, disconnect the harness connector at the E52 Reductant Line Heater.

NOTE: The DMM and test leads must be calibrated to 0 Ω in order to prevent misdiagnosis.

2. Test for 1 - 2 Ω between terminals 1 - 2 at the E52 Reductant Line Heater.

- If less than 1 Ω or greater than 2 Ω

Replace the E52 Reductant Line Heater.

- Go to next step: If between 1 - 2 Ω

3. Test for infinite resistance between each terminal and the E52 Reductant Line Heater housing/case.

- If less than infinite resistance

Replace the E52 Reductant Line Heater.

- Go to next step: If infinite resistance

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Supply Pump Module Replacement](#) for reductant tank heater replacement.

Refer to [Emission Reduction Fluid Exhaust Front Pipe Injector Supply Pipe Replacement \(FWD\)](#), [Emission Reduction Fluid Exhaust Front Pipe Injector Supply Pipe Replacement \(Front AWD\)](#), [Emission Reduction Fluid Exhaust Front Pipe Injector Supply Pipe Replacement \(Rear AWD\)](#) for reductant line heater replacement.

- Refer to [Emission Reduction Fluid Controller Replacement](#)

DTC P105A: REDUCTANT PUMP LOW SPEED

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P105A

Reductant Pump Low Speed

Circuit/System Description

The reductant pump motor is controlled by the reductant control module. The engine control module (ECM) sends a command to the reductant control module via direct wire connection. This command is converted by the reductant control module into a desired pump speed. The ECM checks the state of the wire to the reductant control module for circuit continuity. The signal sent by the ECM to the reductant control module is diagnosed for open circuit, short circuit to ground, and short circuit to voltage.

Conditions for Running the DTCs

- DTC P103F, P1040, P208A, P208C, P208D, P214E or U010E is not set.
- The ignition is On or the engine is running.
- The battery voltage is greater than 11 V.
- The reductant system is not in frozen tank status.
- The Diesel Exhaust Fluid pump is being commanded to move forward or reverse.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The reductant control module detects that the reductant pump motor is stalled for greater than 5 s.

Action Taken When the DTC Sets

DTC P105A is a Type A DTC.

- The reductant injector is disabled.
- The reductant tank and line heaters are disabled.
- The reductant pump is disabled.

Conditions for Clearing the DTC

DTC P105A is a Type A DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Electrical Information Reference

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- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On, verify that no other reductant pump DTCs are set.
 - **If any other DTCs are set**
Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **Go to next step: If no other DTCs are set**
2. Verify that the status parameters listed below do not display Malfunction while commanding the Reductant Pump to 50% with a scan tool:
 - Reductant Pump Control Circuit High Voltage Test Status

- Reductant Pump Control Circuit Open Test Status
- Reductant Pump Control Circuit Low Voltage Test Status
- **If Malfunction is displayed**

Refer to Circuit/System Testing

- **Go to next step: If Malfunction is not displayed**

3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

4. Verify DTC P105A does not set.

- **If a DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If no DTC sets**

5. All OK.

Circuit/System Testing

1. Ignition Off and all vehicle systems Off. It may take up to 2 min for all vehicle systems to power down.

2. Disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly.

3. Test for less than 10 Ω between the low reference circuit terminal 15 and ground.

- **If 10 Ω or greater**

1. Ignition Off.

2. Disconnect the X2 harness connector at the K115 Reductant Control Module.

3. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 15 and K115 Reductant Control Module harness connector terminal 5.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K115 Reductant Control Module.

- **Go to next step: If less than 10 Ω**

4. Disconnect the X2 harness connector at the K115 Reductant Control Module.

5. Test for less than 2 Ω between the control terminals listed below

- A38 Reductant Pump and Sensor Assembly harness connector terminal 16 and K115 Reductant Control Module harness connector terminal 1
- A38 Reductant Pump and Sensor Assembly harness connector terminal 8 and K115 Reductant Control Module harness connector terminal 2
- A38 Reductant Pump and Sensor Assembly harness connector terminal 7 and K115 Reductant Control Module harness connector terminal 3

- **If greater than 2 Ω**

Repair the open/high resistance in the circuit.

- **Go to next step: If less than 2 Ω**

6. Test for infinite resistance between each control circuits listed above and ground.

- **If less than infinite resistance**

Repair the short to ground in the circuit.

- **Go to next step: If infinite resistance**

7. Ignition On, test for less than 1 V between each control circuits listed above and ground.

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

8. Replace the A38 Reductant Pump and Sensor Assembly.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Controller Replacement](#)
- Refer to [Emission Reduction Fluid Supply Pump Module Replacement](#) for A38 Reductant Pump and Sensor Assembly replacement.

DTC P1089: FUEL RAIL PRESSURE PERFORMANCE DURING DECELERATION FUEL CUT-OFF

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1089

Fuel Rail Pressure Performance During Deceleration Fuel Cut-Off

Circuit/System Description

The Engine Control Module (ECM) monitors for changes in fuel rail pressure when the vehicle is in a deceleration condition and the fuel injected quantity is at zero. When scan tool parameter Deceleration Fuel Cut-Off is active, the fuel rail pressure should not deviate more than 2 MPa (290 PSI) from a calculated setpoint. If the fuel rail pressure deviates more than 2. MPa (290 PSI) from the calculated setpoint for approximately 10 seconds of cumulative deceleration (this may take multiple drive cycles), the DTC will set.

Conditions for Running the DTC

- Ignition voltage is greater than 11 V.
- Engine coolant temperature is between 68 - 117Â°C (154 - 243Â°F).
- Fuel temperature is between 0 - 70Â°C (32 - 158Â°F).
- Transmission is in 4th, 5th or 6th gear.
- Deceleration Fuel Cut-Off is active for greater than 13 s.
- Engine speed is greater than 1500 RPM.
- The DTC runs continuous when the above conditions exist.

Conditions for Setting the DTC

Rail pressure deviates more than 2 MPa (290 PSI) from a calculated setpoint while in Fuel Cut-Off for greater than 10 s of cumulative deceleration.

Action Taken When the DTC Sets

DTC P1089 is a Type B DTC.

Conditions for Clearing the DTC

DTC P1089 is a Type B DTC.

Diagnostic Aids

- Aftermarket components to improve performance may cause a DTC to set.

- This Diagnostic parameter is stored in the ECM over a period of time. Time to set this DTC may take several drive cycles.
- A restricted, kinked, or damaged fuel supply line including restricted fuel filter may cause this DTC to set.
- Water or contaminated fuel may cause this DTC to intermittently set. Refer to [Contaminants-in-Fuel Diagnosis](#) .

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.6L \(LH7\)](#)

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Ignition On, observe the DTC information with a scan tool. Verify there are no other DTCs set.
 - **If a DTC is set**
 Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If a DTC is not set**
2. Verify the proper fuel is used. Refer to [Fastener Specifications](#) and [Contaminants-in-Fuel Diagnosis](#) .
3. Verify there are no aftermarket performance enhancing devices installed on the vehicle.
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify DTC P1089 does not set.
 - **If DTC P1089 is set**
 Refer to Circuit/System Testing.
 - **Go to next step: If DTC P1089 is not set**
6. All OK.

NOTE:

- **You must perform the Circuit/System Verification before proceeding with Circuit/System Testing.**

1. Verify there are no fuel system leaks. Refer to [Fuel Leak Diagnosis](#) .

- **If a fuel leak is found**

Repair as necessary.

- **Go to next step: If a fuel leak is not found**

2. Engine cranking or running, verify scan tool parameter Fuel Pressure Sensor is between 370-450 kPa (54-65 PSI).

- ***If not within 370-450 kPa (54-65 PSI)***

Refer to [Fuel System Diagnosis](#) for further diagnosis.

- ***Go to next step: If within 370-450 kPa (54-65 PSI)***

3. Verify that no fuel injector nozzles are stuck in the open position. Refer to [Fuel Injector Balance Test with Scan Tool](#) and perform the procedure under Circuit/System Testing.

- **If a fuel injector nozzle is stuck open**

Replace the appropriate Q17 Fuel Injector.

- **Go to next step: If a fuel injector nozzle is not stuck open**

4. Perform the scan tool control function: Fuel Pressure Control - Regulator 1 - Increase & Decrease

Verify the scan tool parameter: Fuel Rail Pressure Sensor 1 = The value should change with each command.

- If the value does not change

Replace the component: Q18A Fuel Pressure Regulator 1

- If the value changes

5. Perform the scan tool control function: Fuel Pressure Control - Regulator 2 - Increase & Decrease

Verify the scan tool parameter: Fuel Rail Pressure Sensor 1 = The value should change with each command.

- If the value does not change

Replace the component: Q18B Fuel Pressure Regulator 2

- If the value changes

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- For Q18A Fuel Pressure Regulator 1 replacement, refer to [Fuel Injection Pump Metering Valve Replacement](#)
- For Q18B Fuel Pressure Regulator 2 replacement refer to [Fuel Injection Fuel Rail Assembly Replacement](#)
- Refer to [Fuel Injector Replacement](#)
- For engine control module replacement, programming and setup, refer to [Control Module References](#)

DTC P10D1: REDUCTANT INJECTOR TEMPERATURE - EXHAUST GAS TEMPERATURE NOT PLAUSIBLE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P10D1

Reductant Injector Temperature - Exhaust Gas Temperature Not Plausible

Circuit/System Description

The reductant injector is a component of the selective catalytic reduction system used to dose the reductant fluid to the exhaust gas and participate in the reduction reactions. The Engine Control Module (ECM) calculates the injection time of the reductant injector based on the measurement of the NO_x sensors. To activate the injector the ECM supplies a Pulse Width Modulated signal to the high control circuit and the low control circuit is always commanded ON. The reductant injector temperature is modeled based on internal injector resistance of the injector coil and is used to monitor the temperature of the injector to prevent damage.

Conditions for Running the DTCs

- The ignition has been OFF for 8 h or greater.
- The ignition is ON or the engine is running.
- The engine is not cranking.
- The battery voltage is greater than 11 V.

The DTC runs when the above conditions are met.

Conditions for Setting the DTC

The engine control module detects that the temperature difference between the reductant injector and the exhaust is greater than a calibrated value.

Action Taken When the DTC Sets

DTC P10D1 is a Type B DTC.

Conditions for Clearing the DTC

DTC P10D1 is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Wiring Repairs](#)

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that no other DTCs are set.

- **If any other DTCs are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.

- **Go to next step: If no other DTCs are set**

2. Verify the scan tool Reductant Injector Control Circuit Status parameters listed below display OK or Not Run.

- Reductant Injector Control Circuit Open Status
- Reductant Injector Control Circuit Low Voltage Test Status
- **If OK or Not Run is not displayed**

Refer to Circuit/System Testing.

- **Go to next step: If OK or Not Run is displayed**

3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

4. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If no DTC sets**

5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q61 Reductant Injector.

2. Ignition ON, test for 2 - 3 V between the reductant injector low control circuit terminal 1 and ground.

- **If less than 2 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

Test for less than 2 Ω between Q61 Reductant Injector harness high control circuit terminal 1 to K20 Engine Control Module X3 harness connector terminal 1.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

2. Test for infinite resistance between the reductant injector low control circuit terminal 2 and ground.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance, replace the K20 Engine Control Module.

- **If greater than 3 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.

2. Test for less than 1.0 V between the low control circuit terminal 1 and ground.

- If greater than 1.0 V, repair the short to voltage in the circuit.
- If less than 1.0 V, replace the K20 Engine Control Module.

- **Go to next step: If between 2 - 3 V**
- 3. Connect a test lamp between the reductant injector low control circuit terminal 1 and the reductant injector high control circuit terminal 2
- 4. Ignition ON, verify a test lamp flashes several times while commanding the Reductant Injector on with a scan tool.
 - **If the test lamp is always off**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω between Q61 Reductant Injector harness high control circuit terminal 2 to K20 Engine Control Module X3 harness connector terminal 15.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for infinite resistance between the reductant injector high control circuit terminal 2 and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If the test lamp is always ON**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, Ignition ON.
 2. Test for less than 1.0 V between the high control circuit terminal 15 and ground.
 - If greater than 1.0 V, repair the short to voltage at the circuit.
 - If less than 1.0 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp flashes**
- 5. Refer to [Component Testing](#)

Component Testing

1. Ignition OFF, disconnect the harness connector at the Q61 Reductant Injector.
2. Test for 10 - 14 Ω between the reductant injector high control circuit terminal 1 and the reductant dosing valve low control circuit terminal 2.
 - **If not within 10 - 14 Ω**
 Replace the Q61 Reductant Injector
 - **Go to next step: If within 10 - 14 Ω**
3. Test for infinite resistance between each terminal and the sensor housing/case.
 - **If less than infinite resistance**
 Replace the Q61 Reductant Injector.
 - **Go to next step: If infinite resistance**
4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Emission Reduction Fluid Injector Replacement \(AWD\)](#), [Emission Reduction Fluid Injector Replacement \(FWD\)](#).
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P10D5: CHARGE AIR COOLER TEMPERATURE SENSOR 2 PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.

- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P10D5

Charge Air Cooler Temperature Sensor 2 Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P10D6	P10D7	P10D7*	P10D5, P026A
Low Reference	-	P10D7	10D7*	P10D5, P026A

* Internal ECM or sensor damage may occur if the circuit is shorted to B+.

Typical Scan Tool Data

Charge Air Cooler Outlet Temperature

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON or Engine Running			
Parameter Normal Range: -39 to +198Â°C (-38 to +388Â°F)			
Signal	215Â°C (419Â°F)	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)*
Low Reference	-	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)*

* Internal ECM or sensor damage may occur if the circuit is shorted to B+.

Circuit/System Description

The charge air cooler (CAC) temperature sensor 2 is a variable resistor. The sensor is located in the CAC outlet duct after the CAC assembly. Its signal is used by the ECM to measure the temperature of the intake air exiting the CAC. The engine control module (ECM) supplies 5 V to the signal circuit and a ground for the low reference circuit. The ECM monitors the sensor signal for a start-up signal that is not in correlation with the intake air temperature (IAT) sensor 3 start-up signal and fuel temperature sensor signal.

Conditions for Running the DTC

- DTC P00E9, P00EA, P00EB, P00EC, P0181, P10D6, P10D7, P10D8 or P2610 is not set.
- Ignition Off for 8 hours or greater.
- Ignition is On or the engine is operating for less than 10 s.
- Ignition voltage is greater than 11 V.
- The difference between the IAT Sensor 3 and the fuel temperature is less than 45Â°C (81Â°F).
- DTC runs when the enabling conditions are met.

Conditions for Setting the DTC

NOTE: The scan tool display range is between -40 and +215Â°C (-40 and +419Â°F).

- The ECM detects a difference of greater than 20Â°C (68Â°F) between CAC outlet temperature sensor signal and the combined average temperature of IAT 3 and the fuel temperature sensors.
- The condition exists for greater than 1 s.

Action Taken When the DTC Sets

P10D5 is a Type B DTC.

Conditions for Clearing the DTC

P10D5 is a Type B DTC.

Diagnostic Aids

An inaccurate CAC temperature sensor may cause DTC P0101 to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- To minimize the effects of residual engine heat and sensor internal heating elements, perform Steps 1 and 2 of this verification procedure only if the ignition has been OFF for 8 hours or more.
- The vehicle sitting in direct sun light or having the block heater ON will skew the results.

1. Ignition On.

2. Verify DTC P00E9, P00EA, P00EB, P00EC, P0181, P10D6, P10D7, P10D8 or P2610 is not set.

- If any of the DTCs are set

Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

- Go to next step: If none of the DTCs are set

3. Verify the following scan tool parameters are within 15Â°C (27Â°F) of each other.

- Fuel Temperature Sensor
- IAT Sensor 3
- Charge Air Cooler Outlet Temperature
- If not within 15Â°C (27Â°F)

Refer to Circuit System Testing.

- **Go to next step: If within 15Â°C (27Â°F)**

4. Engine idling.

5. Verify the scan tool Charge Air Cooler Outlet Temperature parameter is -39 to +198Â°C (-38 to +388Â°F).

- **If not between -39 to +198Â°C (-38 to +388Â°F)**

Refer to Circuit System Testing.

- **Go to next step: If between -39 to +198Â°C (-38 to +388Â°F)**

6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If the DTC does not set**

7. All OK.

Circuit/System Testing

NOTE:

- **You must perform the Circuit/System Verification before proceeding with the Circuit/System Testing.**
- **You must perform the Diagnostic Repair Verification after completing the Circuit/System Testing.**

1. Ignition OFF, and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B193B Charge Air Cooler Outlet Temperature Sensor.

2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.

- **If 5 Ω or greater**

1. Ignition OFF, disconnect the harness connector X2 at the K20 Engine Control Module.

2. Test for less than 2 Ω in the low reference circuit end to end.

- If 2 Ω or greater, repair the open or high resistance in the circuit.
- If less than 2 Ω replace the K20 Engine Control Module.

- **Go to next step: If less than 5 Ω**

3. Test for 4.8 - 5.2 V between the signal circuit terminal 1 and ground.

- **If less than 4.8 V**

1. Ignition OFF, disconnect the harness connector X2 at the K20 Engine Control Module.

2. Test for infinite resistance between the signal circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

3. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω, replace the K20 Engine Control Module.

- **If greater than 5.2 V**

NOTE: If the signal circuit is shorted to a voltage the engine control module or the sensor may be damaged.

1. Ignition OFF, disconnect the harness connector X2 at the K20 Engine Control Module.

2. Ignition ON, test for less than 1 V between the signal circuit and ground.

- If 1 V or greater, repair the short to voltage on the circuit.
- If less than 1 V, replace the K20 Engine Control Module.

- **Go to next step: If between 4.8 - 5.2 V**

4. Test or replace the B193B Charge Air Cooler Outlet Temperature Sensor.

Component Testing

- Ignition Off.
- Test the B193B Charge Air Cooler Outlet Temperature sensor by varying the sensor temperature while monitoring the air temperature with a thermometer. Compare the readings with the scan tool Charge Air Cooler Outlet Temperature parameter. The values should be within 5%.
 - **If not within the specified range**

Replace the B193B Charge Air Cooler Outlet Temperature Sensor.
 - **Go to next step: If within the specified range**
- All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Perform the [Diesel Particulate Filter \(DPF\) Service Regeneration](#) after completing the repair.
- Refer to [Charge Air Temperature Sensor Replacement \(Outlet\)](#) for B193A Charge Air Cooler Outlet Temperature Sensor replacement
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P10D6, P10D7, P10D8: CHARGE AIR COOLER TEMPERATURE SENSOR 2 CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P10D6

Charge Air Cooler Temperature Sensor 2 Circuit Low Voltage

DTC P10D7

Charge Air Cooler Temperature Sensor 2 Circuit High Voltage

DTC P10D8

Charge Air Cooler Temperature Sensor 2 Circuit Erratic

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P10D6	P10D7	P10D7	P026A, P10D5
Low Reference	-	P10D7	P10D7	P026A, P10D5
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.				

Typical Scan Tool Data

Charge Air Cooler (CAC) Temperature Sensor 2

--

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON or Engine Running Parameter Normal Range: -39 to +198Â°C (-38 to +388Â°F)			
Signal	215Â°C (419Â°F)	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)*
Low Reference	-	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)*
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.			

Circuit/System Description

The charge air cooler (CAC) temperature sensor 2 is a variable resistor. The sensor is located in the CAC outlet duct after CAC assembly. Its signal is used by the ECM to measure the temperature of the intake air leaving the CAC. The engine control module (ECM) supplies 5 V to the signal circuit and a ground for the low reference circuit. The ECM continuously monitors the sensor signal for an excessively high or low voltage, or for a start-up signal that is not in correlation with the ambient air temperature signal.

Conditions for Running the DTC

P10D6 or P10D7

- The ignition is ON or the engine is running.
- The ignition voltage is greater than 11 V.
- The DTCs run continuously when the enabling condition is met.

P10D8

- DTC P10D6 or P10D7 is not set.
- The ignition is ON or the engine is running.
- The ignition voltage is greater than 11 V.
- The DTCs run continuously when the enabling condition is met.

Conditions for Setting the DTC

NOTE: The scan tool display range is between -40 and +215Â°C (-40 and +419Â°F).

P10D6

Charge Air Cooler Outlet Temperature = Warmer than 300Â°C (572Â°F) For greater than 5 s

P10D7

Charge Air Cooler Outlet Temperature = Colder than -40Â°C (-40Â°F) For greater than 5 s

P10D8

Charge Air Cooler Outlet Temperature Signal noisy or erratic. For greater than 5 s

Action Taken When the DTC Sets

- DTCs P10D6, P10D7 and P10D8 are Type B DTCs.
- The ECM commands reduced engine power.
- The driver information center (DIC) or indicator may display reduced engine power.
- Service Emission System message is displayed on the driver information center (DIC).

Conditions for Clearing the DTC

DTCs P10D6, P10D7 and P10D8 are Type B DTCs.

Diagnostic Aids

An inaccurate CAC temperature sensor may cause DTC P0101 to set.

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: If you were sent here from DTC P026A, refer to Circuit System Testing.

1. Engine idling.
2. Verify the scan tool Charge Air Cooler Outlet Temperature parameter is between -39 to +198°C (-38 to +388°F).
 - **If not between -39 to +198°C (-38 to +388°F)**
Refer to Circuit System Testing.
 - **Go to next step: If between -39 to +198°C (-38 to +388°F)**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: You must perform the Diagnostic Repair Verification after completing the Circuit/System Testing.

1. Ignition OFF, and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B193B Charge Air Cooler Outlet Temperature sensor.
2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.

- **If 5 Ω or greater**

1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open or high resistance in the circuit.
 - If less than 2 Ω replace the K20 Engine Control Module.

- **Go to next step: If less than 5 Ω**

3. Test for 4.8 - 5.2 V between the signal circuit terminal 1 and ground.

- **If less than 4.8 V**

1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

- **If greater than 5.2 V**

NOTE: If the signal circuit is shorted to a voltage the engine control module or the sensor may be damaged.

1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Ignition ON, test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.

- **Go to next step: If between 4.8 - 5.2 V**

4. Test or replace the B193B Charge Air Cooler Outlet Temperature sensor.

Component Testing

- Test the B193B Charge Air Cooler Temperature sensor by varying the sensor temperature while monitoring the air temperature with a thermometer. Compare the readings with the scan tool CAC Temperature Sensor parameter. The values should be within 5%.
 - If not within the specified range, replace the B193B Charge Air Cooler Outlet Temperature sensor.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Perform the [Diesel Particulate Filter \(DPF\) Service Regeneration](#) after completing the repair.
- Refer to [Charge Air Temperature Sensor Replacement \(Inlet\)](#) for B193A Charge Air Cooler Inlet Temperature sensor replacement
- Refer to [Control Module References](#) for engine control module replacement, programming and setup

DTC P111E: ENGINE COOLANT TEMPERATURE SENSOR NOT PLAUSIBLE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P111E

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Signal	P0117	P0118	P0118	P0118	P0128, P111E
Low Reference	-	P0118	P0118	-	P0128

Typical Scan Tool Data**ECT Sensor Temperature**

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running			
Parameter Normal Range: -39 to +120Â°C (-38 to +248Â°F)			
ECT Sensor	150Â°C (302Â°F)	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)
Low Reference	-	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)

Circuit/System Description

The engine coolant temperature (ECT) sensor is a variable resistor that measures the temperature of the engine coolant. The engine control module (ECM) supplies 5V to the ECT sensor signal circuit and a ground for the low reference circuit.

The purpose of this diagnostic is to determine if the input from the ECT sensor is skewed warmer than normal. The internal clock of the ECM will record the amount of time the engine is OFF. If the required engine OFF time is met at start-up, the ECM will compare the temperature difference between the actual measured ECT and a calibrated ECT model. The information for this model is derived from the previous drive cycle and includes the accumulated mass air flow (MAF), the engine run time, the ambient air temperature and the ECT at the end of the drive cycle.

If the ECM detects that the temperature difference between the measured and modeled ECT is not within an acceptable operating range of each other, then the ECM will continue to run this diagnostic to determine if a block heater was active during the engine OFF time.

Conditions for Running the DTC

- DTCs P0111, P0112, P0113, P0114, P0117, P0118, P0128, P0502, P0503, P0601, P1621 or P2610 are not set.
- The vehicle has had a minimum ignition OFF time of 8 hours.
- The engine is running.
- The start-up modeled ECT is colder than 50Â°C (+122Â°F).
- The previous accumulated MAF is greater than 6, 000 grams.
- The previous engine run time is greater than 600 seconds.

OR

- The vehicle has had a minimum ignition OFF time of 8 hours.
- The engine is running.
- The previous ECT at engine shutdown is warmer than 75Â°C (+167Â°F).
- The previous accumulated MAF is greater than 6, 000 grams.
- The previous engine run time is greater than 600 seconds.
- This DTC runs once per ignition cycle within the enabling conditions.

Conditions for Setting the DTC**P111E**

The ECM detects a temperature difference at initial power-up that indicates that the actual measured ECT is 10Â°C (18Â°F) greater than the modeled ECT, and an active block heater has not been detected.

Action Taken When the DTC Sets

DTC P111E is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P111E is a Type B DTC.

Diagnostic Aids

- Engine coolant that is leaking through the sensor will create a high resistance short to ground. This condition results in less voltage on the ECT sensor signal circuit, which is interpreted by the ECM as a warmer ECT.
- The ECM memory which includes the ignition OFF timer is maintained by battery power. If the ECM or the battery are disconnected for less than 15 seconds the proper operation of the ECM memory and the timer can be disrupted. Always disconnect these components for greater than 30 seconds.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Turn OFF the ignition.
2. Inspect the cooling system surge tank for the proper engine coolant level. Refer to [Cooling System Leak Testing](#) and [Cooling System Draining and Filling \(GE 47716\) Cooling System Draining and Filling \(Static\)](#) .
3. If the ignition has been OFF for 8 hours or greater, the intake air temperature (IAT) sensor, the IAT sensor 2, and the ECT sensor should be within 9Â°C (16Â°F) of each other and also the ambient temperature. Ignition ON, observe the scan tool IAT Sensor, IAT Sensor 2 and the ECT Sensor parameters. Compare those sensor parameters to each other and also to the ambient temperature to determine if the ECT sensor is skewed warmer.
4. Engine running, observe the ECT Sensor parameter. The reading should be between -39 to +120Â°C (-38 to +248Â°F) depending on the current ambient temperature and the vehicle operating conditions.
5. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the B34 Engine Coolant Temperature Sensor harness connector at the sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5 Ω between the low reference circuit terminal 2 and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 5 Ω**
3. Ignition ON.
4. Verify the scan tool ECT Sensor parameter is colder than -39 $^{\circ}$ C (-38 $^{\circ}$ F).
 - **If warmer than -39 $^{\circ}$ C (-38 $^{\circ}$ F)**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module
 - **Go to next step: If colder than -39 $^{\circ}$ C (-38 $^{\circ}$ F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2.
6. Verify the scan tool ECT sensor parameter is warmer than 149 $^{\circ}$ C (300 $^{\circ}$ F).
 - **If warmer than 149 $^{\circ}$ C (300 $^{\circ}$ F)**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module, Ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
7. Test or replace the B34 engine coolant temperature sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B34 Engine Coolant Temperature Sensor.
2. Test the ECT sensor by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the [Temperature Versus Resistance - Engine Coolant Temperature Sensor](#) table. The resistance values should be in range of the table values.
 - **If not within the specified range**

Replace the B34 Engine Coolant Temperature Sensor.
 - **Go to next step: If within the specified range**
3. Test for infinite resistance between each terminal and the sensor housing.
 - **If less than infinite resistance**

Replace the B34 Engine Coolant Temperature Sensor.
 - **Go to next step: If infinite resistance**
4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- Refer to [Engine Coolant Temperature Sensor Replacement \(FWD\)](#), [Engine Coolant Temperature Sensor Replacement \(AWD\)](#).
- Refer to [Control Module References](#) for ECM replacement, programming and setup.

DTC P113B, P113C, OR P113D: EXHAUST GAS TEMPERATURE SENSOR 1, 2, 3

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P113B

Exhaust Gas Temperature Sensor 1 Not Plausible

DTC P113C

Exhaust Gas Temperature Sensor 2 Not Plausible

DTC P113D

Exhaust Gas Temperature Sensor 3 Not Plausible

Typical Scan Tool Data

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine Running Parameter Normal Range: -39 - 999Â°C (-38 - 1, 832Â°F)			
Exhaust Gas Temperature Sensor Signal	-40Â°C (-40Â°F)	1, 000Â°C (1, 832Â°F)	1, 000Â°C (1, 832Â°F)
Exhaust Gas Temperature Sensor Low Reference	-	1, 000Â°C (1, 832Â°F)	1, 000Â°C (1, 832Â°F)

Circuit/System Description

The exhaust gas temperature sensors are variable resistors that measure the temperature of the exhaust gas at the inlet and outlet of the diesel oxidation catalyst as well as the inlet and outlet of the Diesel Particulate Filter (DPF). The Engine Control Module (ECM) supplies a bias 5-volt signal to the exhaust gas temperature sensor signal circuit, and supplies a ground to the low reference circuit. The exhaust gas temperature information is used by the ECM during the particulate filter cleaning process.

The following table illustrates the relationship between the temperature of the exhaust gas, and the resistance and voltage of the exhaust gas temperature sensor.

Temperature	Resistance	Voltage
Low	Low	Low
High	High	High

Conditions for Running the DTC

P113B, P113C, P113DF

- DTC P0545, P0546, P2032, P2033, P242C, P242D, P2470, P2471, P2481 or P2482 is not set.
- Engine is running.
- Ignition voltage is greater than 11 V.
- The vehicle has had a minimum OFF time of 8 h.

Conditions for Setting the DTC

P113B, P113C, P113DF

The ECM detects a exhaust gas temperature value that is not plausible when ignition is switched on.

Action Taken When the DTC Sets

DTCs P113B, P113C and P113D are Type B DTCs.

Conditions for Clearing the DTC

DTCs P113B, P113C and P113D are Type B DTCs.

Diagnostic Aids

After starting the engine, the exhaust gas temperature sensor temperatures should rise steadily, then stabilize after the engine reaches operating temperature.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

J 25070 Heat Gun 500 - 750°F

Circuit/System Verification

1. Ignition ON
2. Verify DTCs P0545, P0546, P2032, P2033, P242C, P242D, P2470, P2471, P2481 or P2482 are not set.
 - **If any of the DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

- Go to next step: If none of the DTCs are set

NOTE: Determine the ambient temperature by using an accurate thermometer.

3. Ignition OFF for greater than 8 hours.
4. Observe the scan tool Exhaust Gas Temperature Sensor 1, 2 and 3 parameters and compare them to the ambient temperature. The reading for EGT 1, 2 and 3 should be within 30°C (54°F) of the ambient temperature.
 - **If not within the specified range**
Refer to Circuit/System Testing.
 - **Go to next step: If within the specified range**
5. Ignition ON
6. Observe the scan tool Exhaust Gas Temperature Sensor 1, 2, and 3 parameters. The reading should be between $-40 - 999^{\circ}\text{C}$ ($-40 - 1,830^{\circ}\text{F}$) depending on the current ambient temperature and the vehicle operating conditions.
 - **If not within the specified range**
Refer to Circuit/System Testing.
 - **Go to next step: If within the specified range**
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
8. Verify DTC P113B, P113C, P113D, P113E or P113F does not set
 - **If a DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If no DTC sets**
9. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate B131 Exhaust Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than $5\ \Omega$ between the low reference circuit terminal 2 and ground.
 - **If $10\ \Omega$ or greater**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for less than $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **Go to next step: If less than $10\ \Omega$**
3. Ignition ON.
4. Verify the appropriate scan tool Exhaust Gas Temperature Sensor parameter is warmer than 998°C (1828°F).
 - **If 998°C (1828°F) or less**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 1 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If greater than 998°C (1828°F)**

CAUTION: If the fuse in the jumper wire opens, the signal circuit may have a

short to a voltage or a short to ground and the sensor might be damaged.

5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 2.
6. Verify the scan tool Exhaust Gas Temperature parameter is colder than -35°C (-31°F).
 - **If -35°C (-31°F) or greater**
 1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF
 4. Test for less than $2\ \Omega$ in the signal circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **Go to next step: If less than -35°C (-31°F)**
7. Test or replace the appropriate B131 Exhaust Gas Temperature sensor.

Component Testing

NOTE: The J 25070 Heat Gun 500 - 750°F may be used to evaluate the sensor under high temperature conditions.

1. Ignition OFF, remove appropriate B131 Exhaust Gas Temperature sensor while leaving the harness connector connected.
2. Measure and record the resistance of the B131 Exhaust Gas Temperature sensor and compare the measurements to the [Temperature Versus Resistance - Engine Coolant Temperature Sensor](#) chart.
 - **If not within the specified range**

Replace the B131 Exhaust Gas Temperature sensor.
 - **Go to next step: If within the specified range**
3. All OK

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- Refer to [Exhaust Temperature Sensor Replacement - Position 1](#)
- Refer to [Exhaust Temperature Sensor Replacement - Position 2](#)
- Refer to [Exhaust Temperature Sensor Replacement - Position 3](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P11CC, P11D3, P11DB, P2202, P2203, P2205, P2206, P2207, P2208, P2209, P2210, OR P2211: NOX SENSOR 1

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P115E

O2 Reference Voltage Circuit (NOx Sensor 1)

DTC P115F

O2 Reference Voltage Circuit Low Voltage (NOx Sensor 1)

DTC P1160

O2 Reference Voltage Circuit High Voltage (NOx Sensor 1)

DTC P116A

O2 Signal Circuit (NOx Sensor 1)

DTC P116B

O2 Signal Circuit Low Voltage (NOx Sensor 1)

DTC P116C

O2 Signal Circuit High Voltage (NOx Sensor 1)

DTC P116D

O2 Pump Current Control Circuit (NOx Sensor 1)

DTC P116E

O2 Pump Current Control Circuit Low Voltage (NOx Sensor 1)

DTC P116F

O2 Pump Current Control Circuit High Voltage (NOx Sensor 1)

DTC P1192

O2 Low Reference Circuit (NOx Sensor 1)

DTC P1193

O2 Low Reference Circuit Low Voltage (NOx Sensor 1)

DTC P1194

O2 Low Reference Circuit High Voltage (NOx Sensor 1)

DTC P119A

NOx Sensor 1 Signal Circuit

DTC P119B

NOx Sensor 1 Signal Circuit Low Voltage

DTC P119C

NOx Sensor 1 Signal Circuit High Voltage

DTC P11C5

NOx Sensor 1 Heater Ground Circuit

DTC P11C6

NOx Sensor 1 Heater Ground Circuit High

DTC P11CC

NOx Sensor 1 Performance - Signal Low

DTC P11D3

NOx Sensor 1 Exceeded Minimum Learning Limit

DTC P11DB

NOx Sensor 1 Current Performance

DTC P2202

NOx Sensor 1 Circuit Low Voltage

DTC P2203

NOx Sensor 1 Circuit High Voltage

DTC P2205

NOx Sensor 1 Heater Control Circuit

DTC P2206

NOx Sensor 1 Heater Control Circuit Low Voltage

DTC P2207

NOx Sensor 1 Heater Control Circuit High Voltage

DTC P2208

NOx Sensor 1 Heater Feedback Circuit

DTC P2209

NOx Sensor 1 Heater Control Circuit

DTC P2210

NOx Sensor 1 Heater Feedback Circuit Low Voltage

DTC P2211

NOx Sensor 1 Heater Feedback Circuit High Voltage

Circuit/System Description

The nitrogen oxides (NOx) sensors are part of the selective catalytic reduction system, a device used to reduce NOx emission on diesel engines. There are two NOx sensors, one placed upstream of selective catalytic reduction, to measure inlet NOx concentration, and one placed downstream. They are connected with the control module via CAN and all the information is exchanged through it. Since it is a smart sensor, all the electrical monitoring is performed inside the sensor and only the results are sent to the ECM. Each NOx sensor contains a sensing cell, a pumping cell, and a heater. A sample of exhaust gas passes through a diffusion gap between the sensing cell and the pumping cell. The NOx sensor maintains a constant reference voltage across the sensing cell. An electronic circuit within sensor controls the pump current through the pumping cell in order to maintain a constant voltage in the sensing cell. The amount of current required to maintain the reference voltage in the sensing cell is proportional to the concentration of NOx in the exhaust. The ECM varies the amount of diesel exhaust fluid (reductant) added by varying the reductant injector duty cycle in response to changes in engine exhaust NOx levels. The smart NOx sensors consist of two components, the NOx module and the NOx

sensor element that are serviced as a unit. A circuit or performance condition with a NOx sensor is detected by the NOx sensor module. The smart NOx sensor module communicates the condition to the ECM over the serial data line. The ECM sets a DTC when a serial data message is received from the NOx sensor module.

Conditions for Running the DTC

P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P2205, P2206, P2207, P2208, P2210 or P2211

- DTC U029D is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 1 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

These DTCs run continuously when the above conditions are met

P11CC

- DTC P0071, P0072, P0073, P0074, P0087, P0089, P0101-P0103, P0106, P0107, P0108, P010B-P010D, P0111-P0114, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0502, P0503, P0545, P0546, P062B, P062D, P0722, P0723, P111E, P113B, P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P118E, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P11DB, P11DD, P1248, P1249, P124A-P124F, P126A, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2200, P2202, P2203, P2205, P2206, P2207, P2208, P2209, P220A, P2210, P2211, P2227, P2228, P2229, P2230, P228A, P228B, P262B or U029D is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.
- The barometric pressure is between 75 - 200 kPa (10.8 - 29 psi).
- The coolant temperature is between 70 - 128°C (158 - 262°F).
- The ambient temperature is warmer than -7°C (19.4°F).
- The manifold absolute pressure is less than 300 kPa (43.5 psi).
- The engine speed is between 800 - 2, 300 RPM.

The DTC runs continuously when the above conditions are met.

P11D3

- DTC P003A, P0046, P0070, P0071, P0072, P0073, P0074, P0087, P00AF, P00C7, P00EA, P00EB, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P122B-P122D, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E3-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P042E, P042F, P0489, P049D, P0490, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P118E, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P11CC, P11DB, P11DD, P122B-P122D, P1248, P1249, P124A-P124F, P126A, P1402, P1407, P140F, P1424, P1425, P16A0-P16A2, P16D7-P16D9, P2081, P2082, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2200, P2202, P2203, P2205, P2206, P2207, P2208, P2209, P220A, P2210, P2211, P2227, P2228, P2229, P2230, P228A, P228B, P22F9, P22FA, P2459, P245C, P262B or U029D is not set.
- The engine is running.
- The engine not in cranking phase
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.

- The NOx sensor supply voltage is greater than 10.8 V
- The engine speed is between 1, 100 - 3, 500 RPM.
- The manifold absolute pressure is less than 300 kPa (43.5 psi).

The DTC runs continuously when the above conditions are met.

P11DB

- DTC P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P11DD, P2200, P2205, P2206, P2207, P2208, P2209, P220A, P2210, P2211, or U029D is not set.
- The engine is running.
- The engine not in cranking phase
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.
- The NOx sensor supply voltage is greater than 10.8 V.

The DTC runs continuously when the above conditions are met.

P2202, P2203

- DTC P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P1192, P1193, P1194, P119A, P119B, P119C, P11C5, P11C6, P11DB, P11DD, P2200, P2205, P2206, P2207, P2208, P2209, P220A, P2210, P2211 or U029D is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.
- The NOx sensor supply voltage is greater than 10.8 V.

The DTC runs continuously when the above conditions are met.

P2209

- DTC U029D is not set
- The Engine Controls Ignition Relay Feedback Signal voltage is greater than 11 V
- The NOx Sensor 1 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

These DTCs run continuously when the above conditions are met for greater than 180 s.

P22F9

- DTC P003A, P0046, P0070-P0074, P0087, P0096-P0099, P00AF, P00C7, P00E9, P00EA-P00EC, P00F4, P00F5, P0101-P0103, P0106-P0108, P0111-P0114, P0116-P0119, P0128, P0191-P0193, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E3-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P042E, P042F, P0489, P049D, P0490, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P115E, P115F, P1160, P116A-P116F, P118E, P1192 - P1194, P119A-P119C, P11C5, P11C6, P11CC, P11DB, P11DD, P122B-P122D, P1248, P1249, P124A-P124F, P126A, P1402, P1407, P140F, P1424, P1425, P16A0-P16A2, P2081, P2082, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2200, P2202, P2203, P2205 - P2209, P220A, P2210, P2211, P2227, P2228, P2229, P2230, P228A, P228B, P22FA, P2459, P245C, P262B or U029D is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.
- The engine speed is between 600 - 3, 500 RPM.

The DTC runs continuously when the above conditions are met.

P22FA

- DTC P0087, P0096-P0099, P00C7, P00E9, P00EA-P00EC, P00F4, P00F5, P0101-P0103, P0106-P0108, P0191-P0193, P0201-P0208, P020A-P020F, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0403, P0405, P0406, P042E, P042F, P049D, P0490, P062B, P062D, P11CC, P11DB, P1248, P1249, P124A-P124F, P1402, P1407, P140F, P1424, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2202, P2203, P2227, P2228, P2229, P2230, P228A, P228B, or U029D is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The NOx Sensor 1 Heater Operation parameter displays Allowed.
- The engine speed is between 1, 500 - 3, 000 RPM.
- The manifold absolute pressure is less than 300 kPa (43.5 psi).

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The NOx sensor module detects a fault in the NOx sensor circuitry or a performance fault in the NOx sensor for greater than 2 s.

Action Taken When the DTC Sets

- DTCs P115E, P116A, P116D, P1192, P119A, P11C5, P2205, and P2208 are Type A DTCs.
- DTCs P115F, P1160, P116B, P116C, P116E, P116F, P1193, P1194, P119B, P119C, P11C6, P11CC, P11D3, P11DB, P2202, P2203, P2206, P2207, P2209, P2210 and P2211 are Type B DTCs.

Conditions for Clearing the DTC

- DTCs P115E, P116A, P116D, P1192, P119A, P11C5, P2205, and P2208 are Type A DTCs.
- DTCs P115F, P1160, P116B, P116C, P116E, P116F, P1193, P1194, P119B, P119C, P11C6, P11CC, P11D3, P11DB, P2202, P2203, P2206, P2207, P2209, P2210 and P2211 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

1. Ignition ON. Verify that no other DTCs are set.

- **If any of the DTCs are set**

Refer to: [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If none of the DTCs are set**

2. Verify none of the conditions listed below exist:

- Intake system leaks
- Exhaust system leaks
- A loose or disconnected charge air cooler hose or pipe
- Physical damage
- Soot plugged B195A Nitrogen Oxides Sensor 1
- Loose B195A Nitrogen Oxides Sensor 1 or B131 Exhaust Temperature Sensors
- Loose or missing hardware
- **If any condition is found**

Repair as necessary

- **Go to next step: If no conditions exist**

3. Verify that DTC P11CC is not set

- **If the DTC is set**

Replace the B195A Nitrogen Oxides Sensor 1.

- **Go to next step: If the DTC is not set**

4. Operate the vehicle with the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Failure Records data.

5. Verify that DTC P11CC is not set

- **If the DTC is set**

Replace the B195A Nitrogen Oxides Sensor 1.

- **Go to next step: If the DTC is not set**

All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Nitrogen Oxides Sensor Replacement - Position 1](#) - B195A Nitrogen Oxides Sensor 1

DTC P1176 OR P1177: FUEL PUMP DRIVER CONTROL MODULE 5V REFERENCE 1-2 CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1176

Fuel Pump Driver Control Module 5V Reference 1 Circuit

DTC P1177

Circuit/System Description

The Fuel Pump Driver Control Module has 2 internal 5V reference circuits. Each internal reference circuit provides external 5V reference circuits to one sensor. A short to ground or short to voltage on one external 5V reference circuit can affect the component connected to the same internal 5V reference circuit.

Conditions for Running the DTC

These DTCs run continuously when the ignition voltage is greater than 6.4 V.

Conditions for Setting the DTC

The Fuel Pump Driver Control Module detects a short to ground or voltage on any of the 5V reference circuits for greater than 0.5 s.

Action Taken When the DTC Sets

DTCs P1176, P1177 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P1176, P1177 are Type A DTCs.

Diagnostic Aids

P1176

The 5V reference 1 circuit provides 5 V circuits to the sensors listed below:

P1177

The 5V reference 2 circuit provides 5 V circuits to the sensors listed below:

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

1. Ignition ON.
2. Verify scan tool 5V Reference 1-2 Circuit Status parameters do not display Malfunction.
 - **If any of the parameters display Malfunction**

Refer to Circuit/System Testing.
 - **Go to next step: If none of the parameters display Malfunction**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

NOTE: Additional DTCs will set when disconnecting the components.

1. Ignition OFF, disconnect the harness connector at all appropriate sensors for the applicable DTC.
Refer to [Diagnostic Aids](#).
2. Ignition ON.
3. Test for 4.8 - 5.2 V between one of the 5V reference circuits and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the harness connectors at the K111 Fuel Pump Driver Control Module.
 2. Test for infinite resistance between the 5V reference circuit for each applicable component and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K111 Fuel Pump Driver Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connectors at the K111 Fuel Pump Driver Control Module.
 2. Test for less than 1 V between the 5V reference circuit for each applicable component and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K111 Fuel Pump Driver Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**

NOTE: A short to voltage or ground on the signal circuit of certain components may cause this DTC to set.

4. Verify the appropriate scan tool 5V Reference 1, 2 Circuit Status parameter displays OK while connecting each component associated with the 5V reference circuit one at a time.
 - **If the parameter does not display OK when a component is connected**

Test the signal circuit of that component for a short to ground or voltage. If the circuit tests normal, replace the component.
 - **Go to next step: If the parameter displays OK when all components are connected**
5. All OK.

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Fuel Pump Power Control Module Replacement \(AWD\)](#), [Fuel Pump Power Control Module Replacement \(FWD\)](#).
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P1178 OR P1179: FUEL PUMP DRIVER CONTROL MODULE SENSOR 1-2 INTERNAL SUPPLY CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for a overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1178

Fuel Pump Driver Control Module Sensor 1 Internal Supply Circuit

DTC P1179

Fuel Pump Driver Control Module Sensor 2 Internal Supply Circuit

Circuit/System Description

The fuel pump power control module is in constant communication with the engine control module (ECM) regarding the operating state of the fuel pump power control system. Serial data messages are sent in a continuously repeating series of rolling counts with associated password protect samples. Each count/sample is assigned a value. When the ECM determines there is an error in the fuel pump control module fuel level sensor internal supply circuit, the ECM sets DTC P1178 or P1179.

Conditions for Running the DTC

- The ignition voltage is greater than 11 V.
- The DTC runs continuously when the above condition is met.

Conditions for Setting the DTC

The ECM detects an error value for over 1 s.

Action Taken When the DTC Sets

DTC P1178 and P1179 are Type A DTCs.

Conditions for Clearing the DTC

DTC P1178 and P1179 are Type A DTCs.

Diagnostic Aids

An intermittent fault in the CAN circuits will cause the ECM to set DTC P1178 or P1179.

Reference Information

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- **DTC P1178 and P1179 are informational DTCs.**
- **Diagnose all other engine control module DTCs prior to DTC P1178 or P1179.**

1. Verify that no other DTCs are set except for DTC P1178 or P1179.

- **If any other DTCs are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle .

- **Go to next step: If only DTC P1178 or P1179 is set**

2. Replace the K111 Fuel Pump Power Control Module.

3. Verify the DTC does not set while operating the vehicle within the Conditions for Running the DTC.

- **If DTC sets**

Replace the K20 Engine Control Module.

- **Go to next step: If DTC does not set**

4. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Refer to Fuel Pump Power Control Module Replacement (AWD), Fuel Pump Power Control Module Replacement (FWD) for K111 Fuel Pump Power Control Module Replacement
- Refer to Control Module References for engine control module replacement, programming and setup.

DTC P118B: PARTICULATE MATTER SENSOR TEMPERATURE NOT PLAUSIBLE

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Refer to Diagnostic Procedure Instructions to provide an overview of each diagnostic category.

DTC Descriptors

DTC P118B

Particulate Matter Sensor Temperature Not Plausible

Circuit/System Description

The particulate matter (PM) sensor monitors the amount of the particulates (soot) in the diesel exhaust gas exiting the tailpipe. The PM sensor is similar to the heated oxygen sensor with a ceramic element, but also includes an individually calibrated sensor control unit (SCU). The sensing element includes comb-shaped interdigital electrodes (IDE), a heater and a positive temperature coefficient resistor for temperature measurement.

The operation of the PM Sensor is based on the electrical conductivity characteristic of the diesel particulate. As the exhaust gas flows over the sensing element, soot is absorbed in the combs between the electrodes, eventually creating a conductive path. When the path is formed, it generates a current based on the voltage being applied to the element. The measurement process continues until a preset current value is reached. To avoid misleading readings, the sensor performs a regeneration where the soot is cleaned off by heating up the element, before the measurement phase begins. The amount of regenerations is based on vehicle strategy; when the calibrated number of regenerations is reached, the cumulative current readings are used to determine the amount of soot concentration in the exhaust gas which in turn determines the collection efficiency of the diesel particulate filter (DPF).

Conditions for Running the DTCs

- DTC P00C7, P142C, P142D, P142E, P142F, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P262B or U02A3 is not set.
- The ignition is ON.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.
- The barometric pressure is greater than 75 kPa (10.9 psi).
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The particulate matter sensor control unit detects an internal fault of the sensor.

Action Taken When the DTC Sets

DTC P118B is a Type B DTC.

Conditions for Clearing the DTC

DTC P118B is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Exhaust Aftertreatment System Description

Electrical Information Reference

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- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Circuit/System Verification

1. Ignition On.

Verify no other DTCs are set

- **If any other DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If no other DTCs are set**

2. Verify DTC P118B is not set.

- **If the DTC sets**

Replace the B136 Exhaust Particulate Matter Sensor.

- **Go to next step: If the DTC does not set**

3. All OK.

Repair Instructions

Refer to [Exhaust Particulate Sensor Replacement](#)

DTC P118E, P118F OR P1196: EXHAUST GAS TEMPERATURE SENSOR 1, 2, 3 PERFORMANCE - ENGINE RUNNING

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P118E

Exhaust Gas Temperature Sensor 1 Performance - Engine Running

DTC P118F

Exhaust Gas Temperature Sensor 2 Performance - Engine Running

DTC P1196

Exhaust Gas Temperature Sensor 3 Performance - Engine Running

Circuit/System Description

The exhaust gas temperature sensors are variable resistors that measures the temperature of the exhaust gas. The exhaust temperature sensor 1 is the first exhaust temperature sensor on the exhaust system, the following exhaust temperature sensors are counted upward from the engine outlet to the exhaust system end. The engine control module (ECM) supplies 5 V to the exhaust gas temperature signal circuit and supplies a ground to the low reference circuit. The exhaust gas temperature sensor temperature information is used by the ECM during the exhaust gas particulate filter cleaning process.

Conditions for Running the DTC

- The engine is running.
- The ignition voltage is greater than 11 V.
- 120 s or greater has elapsed since the last diesel particulate filter (DPF) regeneration.
- The estimated exhaust gas temperature is within a calibrated value.

These DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the difference between measured exhaust gas temperature and the estimated exhaust gas temperature is greater than a calibrated amount for greater than 1 s.

Action Taken When the DTC Sets

DTCs P118E, P118F and P1196 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P118E, P118F and P1196 are Type B DTCs.

Diagnostic Aids

- After starting the engine, the exhaust gas temperature sensor temperatures should rise steadily, then stabilize after the engine reaches operating temperature.
- Inspect the exhaust gas temperature sensor terminals for corrosion.
- Inspect the exhaust gas temperature sensor wiring for pinches, cuts, and damaged insulation.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC P003A, P0070, P0071, P0072, P0073, P0074, P00C7, P00E9, P00EA, P00EB, P00EC, P0100, P0101, P0102, P0103, P010B, P010C, P010D, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P014D, P014C, P0191, P0192, P0193, P0194, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P020A, P020B, P020C, P020D, P020E, P020F, P0216, P021A, P021B, P0234, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0299, P02EE, P02EF, P02F0, P02F1, P02F2, P02F3, P02F4, P02F5, P0405, P0406, P041B, P041C, P041D, P041E, P044C, P044D, P049D, P049E, P0502, P0503, P0545, P0546, P062B, P062D, P0722, P0723, P111E, P113B, P113C, P113D, P113E, P113F, P115E, P115F, P1160, P116A, P116B, P116C, P116D, P116E, P116F, P118E, P118F, P1192, P1193, P1194, P1197, P1198, P119A, P119B, P119C, P11C5, P11C6, P11DB, P11DD, P1248, P1249, P124A, P124B, P124C, P124D, P124E, P124F, P126A, P12AF, P12B0, P12B1, P12B2, P1427, P1428, P16B0, P16B1, P16B2, P2004, P2006, P2008, P2009, P200A, P2010, P2015, P2016, P2017, P201B, P201D, P2032, P2033, P2081, P2080, P2084, P2085, P20F8, P2147, P2148, P2150, P2151, P2153,

P2154, P2156, P2157, P2200, P2205, P2206, P2207, P2208, P2209, P220A, P2210, P2211, P2227, P2228, P2229, P2230, P2263, P226B, P2297, P242B, P242C, P242D, P242E, P2452, P2453, P2454, P2455, P2456, P246F, P2470, P2471, P2472, P2481, P2482, P2483, P2484, P2564, P2565, P2627, P2628, P2A00 or U029D, is not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.

- **Go to next step: If none of the DTC are set**

2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
3. Verify that DTC P118E, P118F or P1196 does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **Go to next step: If the DTC does not set**

4. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B131 Exhaust Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω

Replace the K20 Engine Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition ON, test for 4.8 - 5.2 V between the signal circuit terminal 1 and ground.

- **If less than 4.8 V**

1. Ignition OFF.
2. Disconnect the X3 harness connector at the K20 Engine Control Module.
3. Test for infinite resistance between signal circuit and ground
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance
4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω

Replace the K20 Engine Control Module.

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.
2. Test for less than 1 V between the signal circuit and ground
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 2 Ω

Replace the K20 Engine Control Module.

- **Go to next step: If between 4.8 - 5.2 V**

4. Replace the appropriate B131 Exhaust Temperature Sensor.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Refer to **Exhaust Temperature Sensor Replacement - Position 1**
- Refer to **Exhaust Temperature Sensor Replacement - Position 2**
- Refer to **Exhaust Temperature Sensor Replacement - Position 3**
- Refer to **Control Module References** for engine control module replacement, programming and setup.

DTC P122D: INTAKE AIR FLOW VALVE POSITION SENSOR EXCEEDED LEARNING LIMIT

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptor

DTC P122D

Intake Air Flow Valve Position Sensor Exceeded Learning Limit

Circuit/System Description

A throttle plate actuator is used to achieve high exhaust gas recirculation rates. It increases the pressure difference between exhaust and intake so that the appropriate exhaust quantity can be mixed with the intake air. The ECM transmits the desired angle as a PWM signal to the throttle plate actuator. The throttle plate actuator operates the DC motor to control the throttle plate based on the PWM signal from the ECM.

The throttle body assembly contains a contactless inductive throttle position sensing element that is managed by a customized integrated circuit. The throttle position sensor is mounted within the throttle body assembly and is not serviceable. The ECM supplies the throttle body with a 5 V reference circuit, a low reference circuit, an H-bridge motor directional control circuit, and an asynchronous signal/serial data circuit. The asynchronous signal means communication is only going from the throttle body to the ECM. The throttle body cannot receive data from the ECM over the signal/serial data circuit. The throttle position sensor provides a signal voltage that changes relative to throttle blade angle. The customized integrated circuit translates the voltage based position information into serial data using the Society of Automotive Engineers (SAE) J2716 Single Edge Nibble Transmission (SENT) protocol. The throttle position sensor information is transmitted between the throttle body and the ECM on the signal/serial data circuit.

In the event that the engine control module (ECM) detects the engine speed increases beyond desired control limits. Upon detection, the engine will be shutdown by closing the intake air flow valve and disabling the fuel injectors.

Conditions for Running the DTC

- Ignition ON, engine running or engine power down
- This DTC runs once per ignition cycle when the above conditions are met.

Conditions for Setting the DTC

The ECM detects an incorrect throttle valve position.

Action Taken When the DTC Sets

- DTC P122D is a Type A DTC, with LH7.
- DTC P122D is a Type B DTC, with NE4, NCP or NCV.
- DTC P122D is a Type C DTC, all others.

Conditions for Clearing the DTC

- DTC P122D is a Type A DTC, with LH7.
- DTC P122D is a Type B DTC, with NE4, NCP, or NCV.
- DTC P122D is a Type C DTC, all others.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON
2. Verify DTC P02E0, P02E2, P02E3, P02E4, P02E5, P02EB, P0697, P122B, P122C, P1425 is not set.
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If none of the DTCs are set**
3. Clear the DTCs with a scan tool, ignition Off for 1 min.
4. Ignition On, verify DTC P122D is not set.
 - **If the DTC is set**
 1. Ignition Off.
 2. Verify the conditions listed below do not exist:
 - Intake air flow valve blade that is not in the rest position.
 - Intake air flow valve blade that is binding open or closed.
 - Intake air flow valve blade that opens or closes without spring pressure.
 - Dirt, debris or coking in the intake air flow valve.
 - Damaged intake air flow valve blade or shaft.
 - If a condition exists.
Repair or replace the component as necessary.
 - **Go to next step: If the DTC is not set**

5. Operate the vehicle within the Conditions for Running the DTCs. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify a DTC does not set.

- If any DTC sets

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- Go to next step: If no DTC sets

7. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Throttle Body Assembly Replacement](#)
- Refer to [Control Module References](#) for Engine Control Module replacement, programming and setup.

DTC P1248, P1249, P124A, OR P124B: CYLINDER 1-4 INJECTOR HIGH CONTROL CIRCUIT SHORTED TO CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1248

Cylinder 1 Injector High Control Circuit Shorted to Control Circuit

DTC P1249

Cylinder 2 Injector High Control Circuit Shorted to Control Circuit

DTC P124A

Cylinder 3 Injector High Control Circuit Shorted to Control Circuit

DTC P124B

Cylinder 4 Injector High Control Circuit Shorted to Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cylinder 1 Fuel Injector High Voltage Supply	P2147	P0201	P2148	P1248*
Cylinder 2 Fuel Injector High Voltage Supply	P2150	P0202	P2151	P1249*
Cylinder 3 Fuel Injector High Voltage Supply	P2150	P0203	P2151	P124A*
Cylinder 4 Fuel Injector High Voltage Supply	P2147	P0204	P2148	P124B*
Cylinder 1 Fuel Injector High Voltage Control	P0261	P0201	P0262, P2148	P1248*

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Cylinder 2 Fuel Injector High Voltage Control	P0264	P0202	P0265, P2151	P1249*
Cylinder 3 Fuel Injector High Voltage Control	P0267	P0203	P0268, P2151	P124A*
Cylinder 4 Fuel Injector High Voltage Control	P0270	P0204	P0271, P2148	P124B*
* Short from Supply Circuit to Control Circuit				

Circuit/System Description

The engine control module (ECM) supplies voltage to each fuel injector on the injector high voltage supply circuits. The ECM energizes each fuel injector by grounding the high voltage control circuit of the fuel injector. The ECM monitors the status of the injector high voltage supply circuits and the fuel injector high voltage control circuits. When a fuel injector circuit condition is detected by the ECM, the affected fuel injector(s) is disabled.

Conditions for Running the DTC

- The engine is running.
- The ignition voltage is greater than 11 V.
- The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

DTC P1248

The ECM detects the injector 1 high voltage supply circuit is shorted to the injector 1 high voltage control circuit for greater than 500 ms.

DTC P1249

The ECM detects the injector 2 high voltage supply circuit is shorted to the injector 2 high voltage control circuit for greater than 500 ms.

DTC P124A

The ECM detects the injector 3 high voltage supply circuit is shorted to the injector 3 high voltage control circuit for greater than 500 ms.

DTC P124B

The ECM detects the injector 4 high voltage supply circuit is shorted to the injector 4 high voltage control circuit for greater than 500 ms.

Action Taken When the DTC Sets

DTC P1248, P1249, P124A and P124B are Type A DTCs.

Conditions for Clearing the DTC

DTC P1248, P1249, P124A and P124B are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running.
2. Verify that DTC P0685 or P1682 is not set.
 - **If DTC P0685 or P1682 is set**
Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **Go to next step: If DTC P0685 or P1682 is not set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If DTC P1248, P1249, P124A or P124B sets**
Refer to Circuit/System Testing
 - **Go to next step: If DTC P1248, P1249, P124A or P124B does not set**
4. All OK.

Circuit/System Testing

1. Ignition Off and all vehicle systems Off, it may take up to 2 min for all vehicle systems to power down.
2. Disconnect the harness connector at the appropriate Q17 Fuel Injector.
3. Ignition On.
4. Test for 4.5 - 6.5 V between the high voltage supply circuit terminal 1 and ground.
 - **If less than 4.5 V**
 1. Ignition Off.
 2. Disconnect the X2 harness connector at the K20 Engine Control Module.
 3. Test for infinite resistance between the supply circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω in the supply circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.
- **If greater 6.5 V**
 1. Ignition Off.
 2. Disconnect the harness connector X2 at the K20 Engine Control Module, Ignition On.
 3. Test for less than 1 V between the high voltage supply circuit terminal 1 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If between 4.5 - 6.5 V**
- 5. Test for 0.60 - 0.80 V between the high voltage control circuit terminal 2 and ground.
 - **If less than 0.60 V**
 1. Ignition Off.
 2. Disconnect the harness connector X2 at the K20 Engine Control Module.
 3. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 0.80 V**
 1. Ignition Off.
 2. Disconnect the harness connector X2 at the K20 Engine Control Module, Ignition On.
 3. Test for less than 1 V between the control circuit terminal 2 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If between 0.60 - 0.80 V**
- 6. Test or replace the appropriate Q17 Fuel Injector.

Component Testing

Static Test

1. Ignition Off
2. Disconnect the harness connector at the appropriate Q17 Fuel Injector.

NOTE: The DMM and test leads must be calibrated to 0 Ω in order to prevent misdiagnosis.

3. Test for 0.2 - 1.5 Ω between the supply terminal 1 and the control terminal 2.
 - **If not between 0.2 - 1.5 Ω**
Replace the appropriate Q17 Fuel Injector.
 - **Go to next step: If between 0.2 - 1.5 Ω**
4. Test for infinite resistance between each terminal and the injector housing/case.
 - **If less than infinite resistance**
Replace the appropriate Q17 Fuel Injector.
 - **Go to next step: If infinite resistance**
5. All OK

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Fuel Injector Replacement](#)
- For Engine Control Module replacement, programming and setup refer to: [Control Module References](#)

DTC P1255: FUEL PUMP CONTROL MODULE DRIVER HIGH TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1255

Fuel Pump Control Module Driver High Temperature

Circuit/System Description

The engine control module (ECM) supplies voltage to the fuel pump driver control module for 30 s when the ignition is on and continuously when the engine is running. While this voltage is being received, a serial data signal containing the desired fuel pump speed is also received from the ECM. After the voltage and data have been received the fuel pump driver control module actuates the brushless fuel pump by means of a high power three phase signal.

Conditions for Running the DTC

- DTC U18A2 is not set.
- KR73 Ignition Main Relay is commanded On.

The DTC runs continuously when the conditions above are met.

Conditions for Setting the DTC

The fuel pump driver control module detects a driver temperature greater than 160Â°C (320Â°F) for less than 0.5 s.

Action Taken When the DTC Sets

DTC P1255 is a Type B DTC.

Conditions for Clearing the DTC

DTC P1255 is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify DTC U18A2 is not set.
 - **If any of the DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - **Go to next step: If none of the DTCs are set**
3. Verify that the area where the K111 Fuel Pump Driver Control Module is located is free of debris, clutter or any insulating material that would cause the fuel pump driver control module to overheat.
 - **If any debris, clutter or other material is found**
 1. Clear the area where the K111 Fuel Pump Driver Control Module is located.
 2. Clear the DTC and test drive the vehicle.
 3. Verify the DTC does not set.
 - If the DTC sets, replace the K111 Fuel Pump Driver Control Module.
 - If the DTC does not set
 4. All OK.
 - **Go to next step: If no debris, clutter or other material is found**
4. Clear the DTC and test drive the vehicle.
5. Verify the DTC does not set.
 - **If the DTC sets**
Replace the K111 Fuel Pump Driver Control Module.
 - **Go to next step: If the DTC does not set**
6. All OK.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Control Module References](#) for Control Module replacement, programming and setup

DTC P127C OR P127D: FUEL RAIL PRESSURE SENSOR 2 CIRCUIT LOW/HIGH VOLTAGE

[Diagnostic Instructions](#)

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

[DTC Descriptor](#)

DTC P127C

Fuel Rail Pressure Sensor 2 Circuit Low Voltage

DTC P127D

Fuel Rail Pressure Sensor 2 Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0193, P06A3, P127D	P0193, P127D	P0193, P06A3, P127D	-
Fuel Rail Pressure Sensor 1 - Signal	P0192	P0193	P0193	P0191
Fuel Rail Pressure Sensor 2 - Signal	P127C	P127D	P127D	P0191
Low Reference	-	P0193, P127D	P0193, P127D	P0191

Typical Scan Tool Data

Fuel Rail Pressure Sensor 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine = Running Parameter Normal Range: 0.4 to 4.5 V			
5 V Reference	5 V	5 V	5 V
Signal	0 V	5 V	5 V
Low Reference	-	5 V	-

Circuit/System Description

For an overview of the component/system, refer to [Fuel System Description](#)

Circuit	Description
5 V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5 V.
Low Reference	Grounded through the control module.

Component	Description
B47B Fuel Rail Pressure Sensor	The sensor measures the pressure in the component: Fuel Rail - The signal voltage decreases when the pressure increases.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

Conditions for Running the DTC

- Engine = Running
- Ignition Voltage = Greater than 8 V

Frequency the DTC runs = Continuously - After the running conditions are met

Conditions for Setting the DTC

P127C

Fuel Rail Pressure Sensor 2 = Less than 0.25 V - For greater than 1 s

P127D

Fuel Rail Pressure Sensor 2 = Greater than 4.75 V - For greater than 1 s

Actions Taken When the DTC Sets

DTC P127C, P127D = Type A DTC

Engine = Reduced Engine Power

Conditions for Clearing the DTC

DTC P127C, P127D = Type A DTC

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L(LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify the scan tool parameter: Fuel Rail Pressure Sensor 2 = 0.4 to 4.5 V and changes
 - **If not between 0.4 and 4.5 V or does not change**

Refer to Circuit/System Testing
 - **Go to next step: If between 0.4 and 4.5 V and changes**
3. Perform the scan tool control function: Fuel Rail Pressure - Increase & Decrease

Verify the scan tool parameter: Fuel Rail Pressure Sensor 2 = The value should change with each command.

- **If the value does not change**

Refer to Circuit/System Testing

- **Go to next step: If the value changes**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **Go to next step: If the DTC is not set**

5. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: B47B Fuel Rail Pressure Sensor
3. Test for less than 10 Ω between the test points: Low Reference circuit terminal 3 & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector: K20 Engine Control Module
 2. Test for less than 2 Ω between the test points: Low Reference circuit terminal 3 @ Component harness & Terminal 69 @ Control module harness
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component: K20 Engine Control Module
 - **Go to next step: If less than 10 Ω**
4. Ignition - On/Vehicle - In Service Mode
5. Test for 4.8 to 5.2 V between the test points: 5 V Reference circuit terminal 1 & Low Reference circuit terminal 3
 - **If less than 4.8 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector: K20 Engine Control Module
 3. Test for infinite resistance between the test points: 5 V Reference circuit terminal 1 @ Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance
 4. Test for less than 2 Ω between the test points: 5 V Reference circuit terminal 1 @ Component harness & Terminal 89 @ Control module harness
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component: K20 Engine Control Module
 - **If greater than 5.2 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector: K20 Engine Control Module
 3. Ignition - On/Vehicle - In Service Mode
 4. Test for less than 1 V between the test points: 5 V Reference circuit terminal 1 @ Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V - Replace the component: K20 Engine Control Module
 - **Go to next step: If between 4.8 and 5.2 V**
6. Verify the scan tool parameter: Fuel Rail Pressure Sensor 2 = Greater than 4.8 V
 - **If 4.8 V or less**

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 2 @ Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: K20 Engine Control Module
- **Go to next step: If greater than 4.8 V**
7. Connect a 3 A fused jumper wire between the test points: Signal circuit terminal 2 & Low Reference circuit terminal 3
8. Verify the scan tool parameter: Fuel Rail Pressure Sensor 2 = Less than 0.3 V
 - **If 0.3 V or greater**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector: K20 Engine Control Module
 3. Ignition - On/Vehicle - In Service Mode
 4. Test for less than 1 V between the test points: Signal circuit terminal 2 @ Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V
 5. Ignition/Vehicle - Off
 6. Test for less than 2 Ω between the test points: Signal circuit terminal 2 @ Component harness & Terminal 38 @ Control module harness
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component: K20 Engine Control Module
 - **Go to next step: If less than 0.3 V**
9. Test or replace the component: B47B Fuel Rail Pressure Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- Refer to [Fuel Pressure Sensor Replacement](#)
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P129F: FUEL PUMP DRIVER CONTROL MODULE FUEL PUMP SPEED SIGNAL INCORRECT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P129F

Fuel Pump Driver Control Module Fuel Pump Speed Signal Incorrect

Circuit/System Description

The fuel pump driver control module sends reports of the actual fuel pump speed to the engine control module (ECM) as serial data every 10 ms. The ECM calculates the error between the commanded fuel pump speed and the fuel pump speed that was reported from the fuel pump driver control module. A DTC will be set If the fuel pump speed is outside a calibrated threshold.

Conditions for Running the DTC

- DTC P1029, P102A, P102B, P102C, P1255, P12A6 or U18A2 is not set.

- Ignition voltage is greater than 11 V.
- KR73 Ignition Main Relay is commanded On.

Conditions for Setting the DTC

The difference between the commanded fuel pump speed and actual fuel pump speed is outside a calibrated range for greater than 7 s.

Action Taken When the DTC Sets

DTC P129F is a Type B DTC.

Conditions for Clearing the DTC

DTC P129F is a Type B DTC.

Diagnostic Aids

Any failure that exists on the fuel pump output circuit (3 phases) will be manifested in a Fuel Pump Speed and may cause this DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify DTC P1029, P102A, P102B, P102C, P1255, P12A6 or U18A2 is not set.
 - **If any of the DTCs are set**
 Refer to Diagnostic Trouble Code (DTC) List - Vehicle .
 - **Go to next step: If none of the DTCs are set**
3. Verify the scan tool parameter:

- Fuel Pump Phase U-V-W Circuits Shorted Test Status = OK/Not Run

- **If not the specified state**

Refer to Circuit/System Testing

- **Go to next step: If the specified state**

4. Engine running.

5. Verify scan tool parameters Fuel Pump Speed Command and Fuel Pump Speed are within 250 RPM of each other while operating the vehicle through varying loads.

- **If not within 250 RPM**

Refer to Circuit/System Testing

- **Go to next step: If within 250 RPM**

6. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

7. Verify DTC P129F did not set.

- **If the DTC is set**

Refer to Circuit/System Testing

- **Go to next step: If the DTC is not set**

8. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off

2. Disconnect the electrical connector: K111 Fuel Pump Driver Control Module

3. Test for less than 2 Ω between the test points:

- Control circuit terminal 8 @ Control module harness & Terminal 1 @ Component harness
- Control circuit terminal 9 @ Control module harness & Terminal 2 @ Component harness
- Control circuit terminal 24 @ Control module harness & Terminal 3 @ Component harness
- **If 2 Ω or greater**

Repair the open/high resistance in the circuit.

- **Go to next step: If less than 2 Ω**

4. Test for infinite resistance between the test points:

- Control circuit terminal 8 @ Control module harness & Control circuit terminal 9 @ Control module harness
- Control circuit terminal 8 @ Control module harness & Control circuit terminal 24 @ Control module harness
- Control circuit terminal 9 @ Control module harness & Control circuit terminal 24 @ Control module harness
- **If less than infinite resistance**

Repair the short between the circuits.

- **Go to next step: If infinite resistance**

NOTE: It may be necessary to remove engine components for the visual inspections.

5. Verify that no fuel waxing, icing, or debris is obstructing operation of the A7 Fuel Pump and Level Sensor Assembly.

- **If any obstruction is found**

Repair or replace as necessary.

- **Go to next step: If no obstruction is found**

6. Replace the component: A7 Fuel Pump and Level Sensor Assembly
7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
8. Verify the DTC does not set.

- **If the DTC sets**

Replace the component: K111 Fuel Pump Driver Control Module

- **Go to next step: If the DTC is not set**

9. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- Refer to [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#), [Fuel Tank Fuel Pump Module Replacement \(AWD\)](#).
- For control module replacement, programming and setup refer to [Control Module References](#)

DTC P12A6: FUEL PUMP DRIVER CONTROL MODULE ENABLE CIRCUIT PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P12A6

Fuel Pump Driver Control Module Enable Circuit Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control	P12A6	P12A6	-	P12A6

Circuit/System Description

After the vehicle has been powered Off for at least 2 min and the ignition is turned On, the engine control module (ECM) sends a signal via the fuel pump primary relay circuit to the fuel pump driver control module. The fuel pump driver control module enables the fuel pump for 30 s or continuously when the engine is running. The fuel pump driver control module actuates the brushless fuel pump by means of a high power three phase signal and controls the fuel pump speed according to serial data signals received from the ECM containing the desired fuel pump speed.

Conditions for Running the DTC

- DTC U18A2 is not set.
- KR73 Ignition Main Relay is commanded On.

The DTC runs continuously when the condition above is met.

Conditions for Setting the DTC

The engine control module state of the Fuel Pump Relay control circuit does not match the state of the Fuel Pump Relay control circuit sensed by the fuel pump driver control module for greater than 0.5 s.

Action Taken When the DTC Sets

DTC P12A6 is a Type A DTC.

Conditions for Clearing the DTC

DTC P12A6 is a Type A DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Fuel System Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify scan tool parameter Fuel Pump Speed is greater than 0 RPM within 30 s of turning On ignition.
 - **If Fuel Pump Speed is 0 RPM**
Refer to Circuit/System Testing.
 - **Go to next step: If Fuel Pump Speed is greater than 0 RPM**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the K111 Fuel Pump Driver Control Module.
2. Ignition On.
3. Verify that a test lamp illuminates between the control circuit terminal 18 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition Off, disconnect the harness connector X1 at the K20 Engine Control Module.
 2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit
 - If infinite resistance
 3. Test for less than 2 Ω between the control circuit end to end.
 - If greater than 2 Ω , repair the open/high resistance in the circuit
 - If less than 2 Ω , replace the K20 Engine Control Module
 - **Go to next step: If the test lamp illuminates**
4. Ignition On for greater than 30 s.
5. Verify that a test lamp does not illuminate between the control circuit terminal 18 and ground.
 - **If the test lamp illuminates**
 1. Ignition Off, remove the test lamp, disconnect the harness connector X1 at the K20 Engine Control Module.
 2. Ignition On.
 3. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp does not illuminate**
6. Replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

For Control Module replacement, programming and setup, refer to [Control Module References](#)

DTC P1307-P130A: CYLINDER 1-4 GLOW PLUG RESISTANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1307

Cylinder 1 Glow Plug Resistance

DTC P1308

Cylinder 2 Glow Plug Resistance

DTC P1309

Cylinder 3 Glow Plug Resistance

DTC P130A

Cylinder 4 Glow Plug Resistance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Glow Plug Supply Voltage	P161E	P161E	-
Cylinder 1 Glow Plug Control	P1307, P066A	P1307, P0671	P1307, P066B
Cylinder 2 Glow Plug Control	P1308, P066C	P1308, P0672	P1308, P066D
Cylinder 3 Glow Plug Control	P1309, P066E	P1309, P0673	P1309, P066F
Cylinder 4 Glow Plug Control	P130A, P067A	P130A, P0674	P130A, P067B

Circuit/System Description

The glow plug control module is integrated in the engine control module (ECM) and is a solid state device which operates the glow plugs. The temperature and the power consumption is controlled within a wide range to suit the engine pre-heating requirements. The glow plug initial ON time will vary based on the system voltage and temperature. Lower temperatures cause longer ON times.

Conditions for Running the DTC

- The engine is running.
- Ignition voltage is greater than 11 V.
- The glow plugs are commanded On.
- The DTC runs continuously when conditions above are met.

Conditions for Setting the DTC

The ECM detects the glow plug electrical resistance is outside a calibratable range for greater than 2 s.

Action Taken When the DTC Sets

DTCs P1307, P1308, P1309 and P130A are Type B DTCs.

Conditions for Clearing the DTC

DTCs P1307, P1308, P1309 and P130A are Type B DTCs.

Diagnostic Aids

If the battery is connected with the ignition On, the glow plugs could be damaged without finding any circuit fault.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Glow Plug System Description

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition On.
2. Verify DTC P037E, P037F, P066A-P066F, P0671-P0674, P067A or P067B is not set.
 - **If DTC P037E, P037F, P066A-P066F, P0671-P0674, P067A or P067B is set**
 Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If a DTC P037E, P037F, P066A-P066F, P0671-P0674, P067A or P067B is not set**
3. Ignition On.
4. Using a scan tool perform the Glow Plug Self-Test while observing the following parameters.
 Verify that all parameters display OK or Not Run.
 - Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit Open Test Status
 - Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit High Voltage Test Status
 - Cylinder 1, 2, 3 or 4 Glow Plug Control Circuit Low Voltage Test Status
 - **If specified state is not displayed**
 Refer to Circuit/System Testing.
 - **Go to next step: If specified state is displayed**
5. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not set. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If a DTC sets**
 Refer to Circuit/System Testing.
 - **Go to next step: If a DTC does not set**
6. All OK.

[Circuit/System Testing](#)

NOTE: If a glow plug is replaced and the tip is missing or burned off, the cylinder head must be removed and all debris be cleaned out of the cylinder.

1. Ignition Off, disconnect the harness connector at the appropriate E12 Glow Plug.
2. Ignition On.
3. Verify the glow plug is command Off with a scan tool.
4. Test for less than 0.2 V between the glow plug supply voltage circuit terminal 1 and ground.
 - **If greater than 0.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Ignition On.

3. Test for less than 0.2 V between the glow plug supply voltage circuit and ground.

- If 0.2 V or greater, repair the short to voltage in the circuit.
- If less than 0.2 V replace the K20 Engine Control Module.
- **Go to next step: If less than 0.2 V**

NOTE: The glow plug supply voltage circuit will only stay On for 3 s when commanding the glow plugs On with the scan tool.

5. Test for greater than 0.2 V while commanding the appropriate glow plug On with a scan tool.

- **If less than 0.2 V**

1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.

2. Test for infinite resistance between the appropriate glow plug supply voltage circuit and ground.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance.

3. Test for less than 2 Ω in the glow plug supply voltage circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If greater than 0.2 V**

6. Test or replace the appropriate E12 Glow Plug.

Component Testing

1. Ignition Off.

2. Disconnect the harness connector of the appropriate glow plug.

3. Test for less than 2 Ω between glow plug terminal and the component's housing.

- **If the resistance is more than 2 Ω**

Replace the affected glow plug.

- **Go to next step: If the resistance is less than 2 Ω**

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the diagnostic procedure.

- Refer to [Glow Plug Replacement](#)
- Refer to [Control Module References](#) for control module replacement, programming and setup.

DTC P140B OR P140C: EXHAUST GAS RECIRCULATION (EGR) SLOW RESPONSE - INCREASING/DECREASING FLOW

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P140B

Exhaust Gas Recirculation (EGR) Slow Response - Increasing Flow

DTC P140C

Exhaust Gas Recirculation (EGR) Slow Response - Decreasing Flow

Circuit/System Description

The exhaust gas recirculation (EGR) valve is an electrically controlled valve that is controlled by the engine control module (ECM). The EGR allows a specific amount of exhaust gas into the intake manifold. This exhaust gas mixes with the intake air and cools the combustion process. The recirculated exhaust gas also prevents the formation of nitrogen oxides (NO_x).

Conditions for Running the DTC

P140B

- DTC P0033-P0035, P003A, P0046, P0070-P0074, P0087, P00AF, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0243, P0245-P0250, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E2-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P041B-P041E, P042E, P042F, P049D, P0490, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P118E, P122B-P122D, P1248, P1249, P124A-P124F, P1402, P1407, P140F, P1424, P1425, P1428, P16A0-P16A2, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227, P2228, P2229, P2230, P2262, P2263, P22CF, P22D0, P22D1, P2459, P245C, or P262B is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The barometric pressure is greater than 69.6 kPa (10.1 psi).
- The outside air temperature is warmer than -7Â°C (19.4Â°F).
- The engine speed is between 750-2, 400 RPM.

The DTC runs continuously when the above conditions are met.

P140C

- DTC P0033-P0035, P003A, P0046, P0070-P0074, P0087, P00AF, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0243, P0245-P0250, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E2-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P041B-P041E, P042E, P042F, P049D, P0490, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P118E, P122B-P122D, P1248, P1249, P124A-P124F, P1402, P1407, P140F, P1424, P1425, P1428, P16A0-P16A2, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227, P2228, P2229, P2230, P2262, P2263, P22CF, P22D0, P22D1, P2459, P245C, or P262B is not set.
- The engine is running.
- The ignition voltage is greater than 11 V.
- The barometric pressure is greater than 69.6 kPa (10.1 psi).
- The outside air temperature is warmer than -7Â°C (19.4Â°F).
- The engine speed is between 1, 000-1, 900 RPM.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P140B

The ECM detects that the actual EGR flow is higher than a calibrated value for greater than 5 s.

P140C

The ECM detects that the actual EGR flow is lower than a calibrated value for greater than 5 s.

Action Taken When the DTC Sets

DTCs P140B and P140C are Type B DTCs.

Conditions for Clearing the DTC

DTCs P140B and P140C are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Ignition ON
2. Verify DTC P0033-P0035, P003A, P0046, P0070-P0074, P0087, P00AF, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0243, P0245-P0250, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02E0, P02E2-P02E5, P02E8, P02E9, P02EB, P02EE, P02EF, P02F0-P02F5, P0335, P0336, P0403, P0405, P0406, P041B-P041E, P042E, P042F, P049D, P0490, P0545, P0546, P062B, P062D, P0772, P0773, P111E, P113B, P118E, P122B-P122D, P1248, P1249, P124A-P124F, P1402, P1407, P140F, P1424, P1425, P1428, P16A0-P16A2, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227, P2228, P2229, P2230, P2262, P2263, P22CF, P22D0, P22D1, P2459, P245C or P262B is not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **Go to next step: If none of the DTCs are set**

3. Verify that none of the conditions listed below exist:

- Binding, damaged or restricted intake air flow valve
- Leaking or restricted intake system/charge air hoses
- Leaking or restricted exhaust system/turbo charger
- Wet or restricted air filter
- Loose or improperly connected hoses
- Damaged or missing components
- **If a condition is found**

Repair as necessary.

- **Go to next step: If no condition is found**

4. Verify that DTC P140B or P140C is not set.

- **If the DTC is set**

1. Clear all DTCs with a scan tool

2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

3. Verify that DTC P140B or P140C is not set.

- If a DTC is set, replace the Q14 Exhaust Gas Recirculation valve
- If no DTC is set.

4. All OK.

- **Go to next step: If no DTC is set**

5. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Exhaust Gas Recirculation Valve Replacement](#)

DTC P1424: EXHAUST GAS RECIRCULATION (EGR) MOTOR OVERTEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1424

Exhaust Gas Recirculation (EGR) Motor Overtemperature

Circuit/System Description

An EGR actuator is used to adjust the exhaust gas recirculation inside the intake manifold so that the appropriate exhaust quantity can be mixed with the intake air. The Engine Control Module transmits the desired position of EGR pintle lift as a Pulse Width Modulated signal to the EGR actuator. The EGR position is monitored by an internal position sensor.

Conditions for Running the DTC

- The ignition is ON or engine running.
- The engine is not cranking.
- The ignition voltage is greater than 11 V.

This DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects an over temperature condition on the EGR actuator driver for a time greater than 1 s.

Action Taken When the DTC Sets

DTC P1424 is a Type B DTC.

Conditions for Clearing the DTC

DTC P1424 is a Type B DTC.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.6L \(LH7\)](#)

Connector End View Reference

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[Exhaust Gas Recirculation \(EGR\) System Description](#)

Electrical Information Reference

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- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTCs P0401, P0402, P0403, P0405, P0406, P042E, P042F, P0489, P0490, P049D, P1402, P1407 or P140F are not set
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **Go to next step: If none of the DTCs are set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify DTC P1424 does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If no DTC sets**
5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the Q14 Exhaust Gas Recirculation Valve, ignition On.
2. Test for 0.1 - 0.5 V between the EGR motor control circuit terminal 2 and ground.
 - **If greater than 0.5 V**
 1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module, ignition On.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If less than 0.1 V**

1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.
2. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
3. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module
- **If between 0.1 - 0.5 V**
3. Test for 1 - 3 V between the EGR motor control circuit terminal 6 and ground.
 - **If greater than 3 V**
 - 1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module, ignition On.
 - 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If less than 1 V**
 - 1. Ignition Off, disconnect the X2 harness connector at the K20 Engine Control Module.
 - 2. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 - 3. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module
 - **If between 1 - 3 V**
4. Replace the Q14 Exhaust Gas Recirculation Valve.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Exhaust Gas Recirculation Valve Replacement](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P1428 OR P142A: EGR TEMPERATURE SENSOR 1-2 - INTAKE AIR TEMPERATURE 2 NOT PLAUSIBLE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1428

EGR Temperature Sensor 1 - Intake Air Temperature 2 Not Plausible

DTC P142A

EGR Temperature Sensor 2 - Intake Air Temperature 2 Not Plausible

Circuit/System Description

The exhaust gas recirculation (EGR) temperature sensors are variable resistors that measure the temperature of the exhaust gas at the inlet and outlet of the EGR cooler. The engine control module

(ECM) supplies 5 volts to the EGR temperature sensor signal circuit and a ground for the low reference circuit. When the EGR temperature sensor is cold, the sensor resistance is high. When the EGR temperature increases, the sensor resistance decreases. With high sensor resistance, the ECM detects a higher voltage on the EGR temperature signal circuit. With lower sensor resistance, the ECM detects a lower voltage on the EGR temperature signal circuit.

Conditions for Running the DTC

- DTCs P00E9, P010B, P0111, P0114, P0116, P0117, P0118, P0119, P0128, P017B, P017C, P017D, P111E, P117B, P117C, P117D, P117E, P117F or P262B are not set.
- The ignition has been OFF for 8 h or greater.
- The ignition is in run or crank.

These DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the EGR cooler temperature sensor 1 or 2 is greater than 20Â°C (36Â°F) different from intake air temperature (IAT) sensor 2.

Action Taken When the DTC Sets

DTCs P1428 and P142A are Type B DTCs.

Conditions for Clearing the DTC

DTCs P1428 and P142A are Type B DTCs.

Diagnostic Aids

- Inspect the EGR cooler temperature sensor 1 and 2 terminals for corrosion.
- Inspect the EGR cooler temperature sensor 1 and 2 wiring for pinches, cuts and damaged insulation.
- EGR cooler temperature sensors may fail while operating under extreme temperatures. Review the Freeze Frame/Failure Records to verify the failure criteria.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Special Tools

Circuit/System Verification

1. Ignition ON
2. Verify DTCs P0096, P0097, P0098, P0099, P00E9, P010B, P0111, P0114, P0116, P0117, P0118, P0119, P0128, P017B, P017C, P017D, P111E, P117B, P117C, P117D, P117E, P117F or P262B are not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **Go to next step: If none of the DTCs are set**

NOTE: Determine the ambient temperature by using an accurate thermometer.

3. Ignition OFF for greater than 8 hours.
4. Observe the scan tool EGR Cooler Temperature Sensor 1 and 2 parameters and compare them to the ambient temperature. The reading for EGR Cooler Temperature Sensor 1 and 2 should be within 30Å°C (54Å°F) of the ambient temperature.

- **If not within the specified range**

Refer to Circuit/System Testing.

- **Go to next step: If within the specified range**

5. Engine running.
6. Verify the scan tool EGR Temperature Sensor 1 and EGR Temperature Sensor 2 parameters are between -39Å° to +999Å°C (-38Å° to +1, 830Å°F) and changes with engine run time.

- **If not between -39Å° to +999Å°C (-38Å° to +1, 830Å°F) or does not change**

Refer to Circuit/System Testing.

- **Go to next step: If between -39Å° to +999Å°C (-38Å° to +1, 830Å°F) and changes**

7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate B130 Exhaust Gas Recirculation Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 10 Å between the low reference circuit terminal 2 and ground.

- **If 10 Å or greater**

1. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

2. Test for less than 2 Å in the low reference circuit end to end.

- If 2 Å or greater, repair the open/high resistance in the circuit.
- If less than 2 Å, replace the K20 Engine Control Module.

- **Go to next step: If less than 10 Å**

3. Ignition OFF, disconnect the X3 harness connector at the K20 Engine Control Module.

4. Test for infinite resistance between the signal circuit terminal 1 and ground.

- **If less than infinite resistance**

Repair the short to ground on the circuit.

- **Go to next step: If infinite resistance**

5. Test for less than 2 Å in the signal circuit end to end.

- **If 2 Å or greater**

Repair the open/high resistance in the circuit.

- **Go to next step: If less than 2 Ω**

6. Ignition ON.

7. Test for less than 1 V between the signal circuit and ground.

- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**

8. Test or replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

9. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

10. Verify that DTC does not set.

- **If DTC sets**

Replace the K20 Engine Control Module

- **Go to next step: If DTC does not set**

11. All OK.

Component Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

NOTE: The J 25070 may be used to evaluate the sensor under high temperature conditions.

2. Verify the resistance between the signal circuit terminal 1 and the low reference circuit terminal 2 is within the range specified in the [Temperature Versus Resistance - Engine Coolant Temperature Sensor](#) Table.

- **If not within the range specified**

Replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

- **Go to next step: If within the range specified**

3. Test for infinite resistance between each terminal and the sensor housing/case.

- **If less than infinite resistance**

Replace the appropriate B130 Exhaust Gas Recirculation Temperature Sensor.

- **Go to next step: If infinite resistance**

4. All OK

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 1](#)
- Refer to [Exhaust Gas Recirculation Cooler Temperature Sensor Replacement - Position 2](#)
- Refer to [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P142B, P142C, P142D, P142E, P142F, OR P1435: PARTICULATE MATTER SENSOR CONTROL MODULE TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.

- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P142B

Particulate Matter Sensor Control Module High Temperature

DTC P142C

Particulate Matter Sensor Control Module Temperature Sensor 1 Low Voltage

DTC P142D

Particulate Matter Sensor Control Module Temperature Sensor 1 High Voltage

DTC P142E

Particulate Matter Sensor Control Module Temperature Sensor 2 Low Voltage

DTC P142F

Particulate Matter Sensor Control Module Temperature Sensor 2 High Voltage

DTC P1435

Particulate Matter Sensor Control Module Temperature Sensors 1-2 Not Plausible

DTC P1436

Particulate Matter Sensor Control Module Temperature Signal Message Counter Incorrect

Circuit/System Description

The particulate matter (PM) sensor monitors the amount of the particulates (soot) in the diesel exhaust gas exiting the tailpipe. The PM sensor is similar to the heated oxygen sensor with a ceramic element, but also includes an individually calibrated sensor control unit (SCU). The sensing element includes comb-shaped interdigital electrodes (IDE), a heater and a positive temperature coefficient resistor for temperature measurement.

The operation of the PM Sensor is based on the electrical conductivity characteristic of the diesel particulate. As the exhaust gas flows over the sensing element, soot is absorbed in the combs between the electrodes, eventually creating a conductive path. When the path is formed, it generates a current based on the voltage being applied to the element. The measurement process continues until a preset current value is reached. To avoid misleading readings, the sensor performs a regeneration where the soot is cleaned off by heating up the element, before the measurement phase begins. The amount of regenerations is based on vehicle strategy; when the calibrated number of regenerations is reached, the cumulative current readings are used to determine the amount of soot concentration in the exhaust gas which in turn determines the collection efficiency of the diesel particulate filter (DPF).

Conditions for Running the DTCs

P142B, P1435

- DTC P142C, P142D, P142E, P142F, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0 or U02A3 is not set.
- The ignition is ON and the engine is not cranking.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

The DTCs run continuously when the above conditions are met.

P142C, P142D, P142E, P142F, P1436

- DTC P16D7, P16D8, P16D9, P24D0 or U02A3 is not set.
- The ignition is ON and the engine is not cranking.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The particulate matter sensor control unit detects an internal electrical fault or an over temperature condition on one of the internal temperature sensors.

Action Taken When the DTC Sets

DTCs P142B, P142C, P142D, P142E, P142F, P1435 and P1436 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P142B, P142C, P142D, P142E, P142F, P1435 and P1436 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition On.

Verify DTC P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0 or U02A3 is not set

- **If any of the DTCs are set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle

- **Go to next step: If none of the DTCs are set**

2. Verify DTC P142B, P142C, P142D, P142E, P142F, P1435 or P1436 is not set.

- **If the DTC sets**

Replace the B136 Exhaust Particulate Matter Sensor.

- **Go to next step: If the DTC does not set**

3. All OK.

Repair Instructions

- Refer to [Exhaust Particulate Sensor Replacement](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P142B, P142C, P142D, P142E, P142F, P1435 OR P1436: PARTICULATE MATTER SENSOR CONTROL MODULE TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P142B

Particulate Matter Sensor Control Module High Temperature

DTC P142C

Particulate Matter Sensor Control Module Temperature Sensor 1 Low Voltage

DTC P142D

Particulate Matter Sensor Control Module Temperature Sensor 1 High Voltage

DTC P142E

Particulate Matter Sensor Control Module Temperature Sensor 2 Low Voltage

DTC P142F

Particulate Matter Sensor Control Module Temperature Sensor 2 High Voltage

DTC P1435

Particulate Matter Sensor Control Module Temperature Sensors 1-2 Not Plausible

DTC P1436

Particulate Matter Sensor Control Module Temperature Signal Message Counter Incorrect

Circuit/System Description

The particulate matter (PM) sensor monitors the amount of the particulates (soot) in the diesel exhaust gas exiting the tailpipe. The PM sensor is similar to the heated oxygen sensor with a ceramic element, but also includes an individually calibrated sensor control unit (SCU). The sensing element includes comb-shaped interdigital electrodes (IDE), a heater and a positive temperature coefficient resistor for temperature measurement.

The operation of the PM Sensor is based on the electrical conductivity characteristic of the diesel particulate. As the exhaust gas flows over the sensing element, soot is absorbed in the combs between

the electrodes, eventually creating a conductive path. When the path is formed, it generates a current based on the voltage being applied to the element. The measurement process continues until a preset current value is reached. To avoid misleading readings, the sensor performs a regeneration where the soot is cleaned off by heating up the element, before the measurement phase begins. The amount of regenerations is based on vehicle strategy; when the calibrated number of regenerations is reached, the cumulative current readings are used to determine the amount of soot concentration in the exhaust gas which in turn determines the collection efficiency of the diesel particulate filter (DPF).

Conditions for Running the DTCs

P142B, P1435

- DTC P142C, P142D, P142E, P142F, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0 or U02A3 is not set.
- The ignition is ON and the engine is not cranking.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

The DTCs run continuously when the above conditions are met.

P142C, P142D, P142E, P142F, P1436

- DTC P16D7, P16D8, P16D9, P24D0 or U02A3 is not set.
- The ignition is ON and the engine is not cranking.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The particulate matter sensor control unit detects an internal electrical fault or an over temperature condition on one of the internal temperature sensors.

Action Taken When the DTC Sets

DTCs P142B, P142C, P142D, P142E, P142F, P1435 and P1436 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P142B, P142C, P142D, P142E, P142F, P1435 and P1436 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information.

[Circuit/System Verification](#)

1. Ignition On.

Verify DTC P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0 or U02A3 is not set

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If none of the DTCs are set**

2. Verify DTC P142B, P142C, P142D, P142E, P142F, P1435 or P1436 is not set.

- **If the DTC sets**

Replace the B136 Exhaust Particulate Matter Sensor.

- **Go to next step: If the DTC does not set**

3. All OK.

[Repair Instructions](#)

- Refer to [Exhaust Particulate Sensor Replacement](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P1436: PARTICULATE MATTER SENSOR CONTROL MODULE TEMPERATURE SIGNAL MESSAGE COUNTER INCORRECT

[Diagnostic Instructions](#)

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

[DTC Descriptor](#)

DTC P1436

Particulate Matter Sensor Control Module Temperature Signal Message Counter Incorrect

[Circuit/System Description](#)

Control modules connected to the serial data circuits monitor the communication during normal vehicle operation. Operating information and commands are exchanged among the control modules. Each module on the serial data circuit maintains a transmit error counter and a receive error counter. The counter values increase with detected errors and decrease with error-free messages.

[Conditions for Running the DTC](#)

Ignition Voltage = Greater than 11 V

DTC runs continuously when the above condition is met for greater than 3 s.

Conditions for Setting the DTC

Serial Data = Message Counter Incorrect - Between the following control modules:

- K181 Exhaust Particulate Matter Sensor Control Module
- K20 Engine Control Module

Actions Taken When the DTC Sets

DTC P1009 = Type B DTC

Conditions for Clearing the DTC

DTC P1009 = Type B DTC

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify there are no DTCs set related to the following system/component: Serial Data
 - **If other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **If no other DTCs are set**
 1. Ignition/Vehicle - Off
 2. Replace the component: K181 Exhaust Particulate Matter Sensor Control Module
 3. Operate the vehicle within the Conditions for Running the DTC.
 4. Verify the DTC does not set.
 - If the DTC sets - Replace the component: K20 Engine Control Module
 - If the DTC is not set
 5. All OK.
 - **Go to next step: If no DTC is set**
3. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P144E OR P144F: CLOSED LOOP DIESEL PARTICULATE FILTER (DPF) REGENERATION CONTROL AT LIMIT - STAGE 2 LOW/HIGH TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.

- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P144E

Closed Loop Diesel Particulate Filter (DPF) Regeneration Control At Limit - Stage 2 Low Temperature

DTC P114F

Closed Loop Diesel Particulate Filter (DPF) Regeneration Control At Limit - Stage 2 High Temperature

Circuit/System Description

The main function of the close coupled diesel oxidation catalyst (CCDOC) is to control emissions of non methane hydrocarbons and carbon monoxide (CO). Its secondary function is to assist with the diesel particulate filter (DPF) regeneration, by obtaining and sustaining the temperature necessary for regeneration. In order to generate the high exhaust temperatures needed for regeneration, the aftertreatment system increases exhaust temperatures by injecting diesel fuel into the exhaust system via post-injection. The injected fuel is converted into heat by the DOC to incinerate soot accumulated in the DPF. The engine control module (ECM) monitors the exhaust gas temperature sensor 1 and 2 to determine if catalyst downstream temperatures are achieved during a DPF regeneration.

Conditions for Running the DTCs

P144E and P144F

- DTC P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0405, P0406, P049D, P062B, P062D, P0772, P0773, P111E, P113C, P118F, P1248, P1249, P124A-P124F, P126A, P2032, P2033, P2084, P2085, P2147, P2148, P2150, P2151, P2153, P2154, P2156 or P2157 is not set,
- Ignition voltage is greater than 11 V.
- Vehicle speed is greater than 0 km/h (0 mph).
- The ECM is commanding a DPF regeneration.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P144E and P144F

The ECM detects insufficient exhaust temperature downstream of the first diesel oxidation catalyst during a DPF regeneration.

Action Taken When the DTC Sets

DTCs P144E is a Type B DTC.

DTCs P144F is a Type A DTC.

Conditions for Clearing the DTC

DTCs P144E is a Type B DTC.

DTCs P144F is a Type A DTC.

Reference Information

Schematic Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify DTC P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0405, P0406, P049D, P062B, P062D, P0772, P0773, P111E, P113C, P118F, P1248, P1249, P124A-P124F, P126A, P2032, P2033, P2084, P2085, P2147, P2148, P2150, P2151, P2153, P2154, P2156 or P2157 is not set,
 - **If a DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **Go to next step: If a DTC is not set**
3. Verify that the resistance of B131 Exhaust Gas Temperature Sensor 1 and 2 is within the value specified in **Temperature Versus Resistance**
 - **If not within the specified range**

Replace the appropriate B131 Exhaust Gas Temperature Sensor
 - **Go to next step: If within the specified range**
4. Verify the following conditions do not exist:
 - Exhaust system leaks - Refer to **Exhaust Leakage** .
 - A loose or disconnected charge air cooler hose or pipe
 - Loose or missing induction or exhaust system components
 - **If a condition is found**

Repair as necessary.
 - **Go to next step: If no condition is found**
5. Perform the Diesel Particulate Filter Service Regeneration

6. Verify that EGT Sensor 2 reads at least 100Â°C (180Â°F) warmer than EGT Sensor 1 during regeneration.

- **If EGT Sensor 2 is less than 100Â°C (180Â°F) warmer than EGT Sensor 1**

Replace the diesel oxidation catalyst

- **Go to next step: If EGT Sensor 2 is at least 100Â°C (180Â°F) warmer than EGT Sensor 1**

7. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

8. Verify the DTC does not set.

- **If the DTC sets**

Replace the diesel oxidation catalyst.

- **Go to next step: If the DTC does not set**

9. All OK.

Repair Instructions

- Refer to [Oxidation Catalytic Converter Replacement \(LH7\)](#). Perform the scan tool Catalyst 1 Reset after replacing the oxidation catalytic converter.
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P1474, P1475, P1476, P1477, P1478, P1479, P147B OR P1488: PARTICULATE MATTER SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P1474

Particulate Matter Sensor Electrode Supply Circuit

DTC P1475

Particulate Matter Sensor Electrode Supply Circuit Low Voltage

DTC P1476

Particulate Matter Sensor Electrode Supply Circuit High Voltage

DTC P1477

Particulate Matter Sensor Temperature Circuit Low Voltage

DTC P1478

Particulate Matter Sensor Temperature Circuit High Voltage

DTC P1479

Particulate Matter Sensor Sensitivity Factor Performance

DTC P147B

Particulate Matter Sensor Shunt Circuit High Current

Particulate Matter Sensor Protection Tube Performance**Circuit/System Description**

The particulate matter (PM) sensor monitors the amount of the particulates (soot) in the diesel exhaust gas exiting the tailpipe. The PM sensor is similar to the heated oxygen sensor with a ceramic element, but also includes an individually calibrated sensor control unit (SCU). The sensing element includes comb-shaped interdigital electrodes (IDE), a heater and a positive temperature coefficient resistor for temperature measurement.

The operation of the PM Sensor is based on the electrical conductivity characteristic of the diesel particulate. As the exhaust gas flows over the sensing element, soot is absorbed in the combs between the electrodes, eventually creating a conductive path. When the path is formed, it generates a current based on the voltage being applied to the element. The measurement process continues until a preset current value is reached. To avoid misleading readings, the sensor performs a regeneration where the soot is cleaned off by heating up the element, before the measurement phase begins. The amount of regenerations is based on vehicle strategy; when the calibrated number of regenerations is reached, the cumulative current readings are used to determine the amount of soot concentration in the exhaust gas which in turn determines the collection efficiency of the diesel particulate filter (DPF).

Conditions for Running the DTCs**P1474, P1475, P1476, P1477, P1478**

- DTC P16D7, P16D8, P16D9, P24D0 or U02A3 is not set.
- The ignition is ON and the engine is not cranking.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

These DTCs run continuously when the above conditions are met.

P1479, P147B

- DTC P142D, P142C, P142F, P142E, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0 or U02A3 is not set.
- The ignition is ON.
- The ignition voltage is greater than 11 V.
- The reductant control module relay 2 is commanded ON.

These DTCs run continuously when the above conditions are met.

P1488

- DTC P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0119, P0128, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0405, P0406, P049D, P062B, P062D, P0772, P0773, P111E, P113F, P1198, P1248, P1249, P124A-P124F, P126A, P142D, P142C, P142F, P142E, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P2032, P2033, P2084, P2085, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227, P2228, P2229, P2230, P2481, P2482, P2483, P2484, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0, P262B or U02A3 is not set.
- The ignition has been Off for greater than 8 h.
- The ignition is ON.
- The ignition voltage is greater than 11 V.
- The particulate matter sensor temperature is between 0-300Â°C (32-572Â°F).
- The reductant control module relay 2 is commanded ON.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The particulate matter sensor control unit detects a fault in the particulate matter sensor circuitry.

Action Taken When the DTC Sets

DTCs P1474, P1475 P1476, P1477, P1478, P1479, P147B and P1488 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P1474, P1475 P1476, P1477, P1478, P1479, P147B and P1488 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Description and Operation

Exhaust Aftertreatment System Description

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition On.

Verify no other DTCs are set

- **If any other DTCs are set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**

- **Go to next step: If no other DTCs are set**

2. Verify DTC P1474, P1475, P1476, P1477, P1478, P1479, P147B or P1488 is not set.

- **If the DTC sets**

Replace the B136 Exhaust Particulate Matter Sensor.

- **Go to next step: If the DTC does not set**

3. All OK.

Repair Instructions

- Refer to [Exhaust Particulate Sensor Replacement](#)
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P157A: SENSOR SUPPLY VOLTAGE RELAY FEEDBACK CIRCUIT HIGH VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category

DTC Descriptor

DTC P157A

Sensor Supply Voltage Relay Feedback Circuit High Voltage

Circuit/System Description

The reductant control module relay 1 & 2 supply ignition voltage to the Reductant Control Module. The Reductant Control Module Relay 2 also supplies ignition voltage to Nitrogen Oxide Sensor 1 & 2 and the Exhaust Particulate Matter Sensor. Both Reductant Control Module Relay 1 & 2 are controlled by a low side driver in the ECM.

Conditions for Running the DTC

- The DTC runs when Ignition OFF.

Conditions for Setting the DTC

The ECM detects the reductant control module relay 2 feedback circuit is shorted to voltage.

Action Taken when the DTC Sets

DTC P157A is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P157A is a Type B DTC.

Reference Information

Schematic Reference

Power Moding Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

[Control Module References](#) for scan tool information

Special Tools

EL 43244 Relay Puller Pliers

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

Circuit/System Verification

1. Ignition ON.
2. Verify with a scan tool that no other DTC is set.
 - **If any other DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
 - **Go to next step: If no other DTC is set**
3. Operate the vehicle within the Conditions for Running the DTC. It may be helpful to operate the vehicle within the conditions identified from the Freeze Frame/Failure Records data
4. Verify DTC P157A is not set.
 - **If the DTC P157A is set.**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC P157A is not set.**
5. All OK.

Circuit/System Testing

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

1. Ignition Off and all vehicle systems Off.
2. Disconnect the KR121A Reductant Control Module Relay 1.
3. Test for less than 1 V between the ignition circuit terminal 30 & Ground.

NOTE: It may take up to 2 min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

- **If 1 V or greater**
4. Repair the short to voltage in the circuit.
 - **Go to next step: If less than 1 V**
 5. Test or replace KR121A Reductant Control Module Relay 1.

Component Testing

Relay Test

1. Ignition OFF, disconnect the KR121A Reductant Control Module Relay 1.
2. Test for 70 - 110 Ω between terminals 85 and 86 of the relay.
 - **If not within 70 - 100 Ω**

Replace the relay.
 - **Go to next step: If within 70 - 100 Ω**

3. Test for infinite resistance between the following terminals listed below:

- 30 and 86
- 30 and 87
- 30 and 85
- 85 and 87
- **If less than infinite resistance**

Replace the relay.

- **Go to next step: If infinite resistance**

4. Install a 20 A fused jumper wire between relay terminal 85 and B+. Install a jumper wire between relay terminal 86 and ground.

5. Test for less than 2 Ω between terminals 30 and 87.

- **If 2 Ω or greater**

Replace the relay.

- **Go to next step: If less than 2 Ω**

6. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- Refer to [Relay Replacement \(Attached to Wire Harness\)](#), [Relay Replacement \(Within an Electrical Center\)](#).
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P161E: GLOW PLUG SUPPLY VOLTAGE CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P161E

Glow Plug Supply Voltage Circuit

Circuit/System Description

The glow plug control module is integrated in the engine control module (ECM) and is a solid state device which operates the glow plugs. The temperature and the power consumption is controlled within a wide range to suit the engine pre-heating requirements. The glow plug initial ON time will vary based on the system voltage and temperature. Lower temperatures cause longer ON times.

Conditions for Running the DTC

- Ignition ON, or engine running.
- The ignition voltage is greater than 11 V.
- The DTC runs once per ignition cycle when the above conditions are met.

Conditions for Setting the DTC

The ECM detects the internal glow plug module is not powered up for greater than 1 s.

Action Taken When the DTC Sets

DTC P161E is a Type C DTC.

Conditions for Clearing the DTC

DTC P161E is a Type C DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON
2. Verify with a scan tool that no other DTCs are set.
 - **If any other DTCs are set**
Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **Go to next step: If no other DTC is set**
3. Verify that DTC P161E is not set.
 - **If the DTC P161E is set**
Refer to Circuit/System Testing.
 - **Go to next step: If the DTC P161E is not set**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed in the Freeze Frame/Failure Records data.
5. Verify the DTC not reset.
 - **If the DTC P161E resets**
Refer to Circuit/System Testing
 - **Go to next step: If DTC P161E does not reset**
6. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the K20 Engine Control Module. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.

- **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω at the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **Go to next step: If less than 10 Ω**
- 3. Ignition ON, verify a test lamp illuminates between the Voltage circuit terminal 5 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the voltage circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is OK and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF.
 2. Test for infinite resistance between the voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp illuminates**
- 4. Ignition OFF, reconnect the harness connector at the K20 Engine Control Module.
- 5. Verify with a scan tool that the DTC does not reset
 - **If DTC resets**

Replace the K20 Engine Control Module
 - **Go to next step: If the DTC does not reset**
- 6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Control Module References](#) for Engine Control Module replacement, programming and setup.

DTC P163A: CONTROL MODULE FUEL PRESSURE REGULATOR 1 CONTROL SYSTEM CIRCUITRY PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P163A

Control Module Fuel Pressure Regulator 1 Control System Circuitry Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Control	P0091	P0091	-	-
Low Control	P0091	P0090	P0092	P163A

Circuit/System Description

The fuel pressure regulator 1 is used to control the fuel pressure at the high pressure pump. The engine control module (ECM) supplies the voltage directly to fuel pressure regulator 1. The ECM controls the solenoid by grounding the control circuit with a solid state device called a driver.

Conditions for Running the DTC

- DTC P0090, P0091 or P0092 is not set.
- The ignition voltage is greater than 11 V.
- The Fuel rail pressure is being controlled by fuel pressure regulator 1.
- The DTC runs continuously once the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the commanded current flowing through Fuel Pressure Regulator 1 is out of range for greater than 1 s.

Action Taken When the DTC Sets

DTC P163A is a type B DTC.

Conditions for Clearing the DTC

DTC P163A is a type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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Powertrain Component Views

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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify with a scan tool that DTC P0090, P0091, P0092, P0689, P0690 or P1682, is not set.
 - If DTC P0090, P0091, P0092, P0689, P0690 or P1682 is set

- **Go to next step: If DTC P0090, P0091, P0092, P0689, P0690 or P1682 is not set**
- 3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed in the Freeze Frame/Failure Records data.
- 4. Verify the DTC does not set.
 - **If DTC P163A is set**

Refer to Circuit/System Testing

- **Go to next step: If DTC P163A is not set**
- 5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the Q18A Fuel Pressure Regulator 1, Ignition On.
2. Verify a test lamp illuminates between the high control circuit terminal 1 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition Off, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the high control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the high control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp illuminates**
3. Ignition Off.
4. Verify the test lamp is not illuminated
 - **If the test lamp illuminates**
 1. Disconnect the X1 harness connector at the K20 Engine Control Module, ignition On.
 2. Test for less than 1 V between the high control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp is not illuminated**
5. Connect a test lamp between the low control circuit terminal 2 and the high control circuit terminal 1.
6. Ignition On, verify the test lamp turns On and Off when Commanding Fuel Pressure Regulator 1 On and Off with a scan tool.
 - **If the test lamp is always Off**
 1. Ignition Off, disconnect the X1 harness connector at the K20 Engine Control Module, Ignition On.
 2. Test for less than 1 V between the low control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 - 3. Ignition Off.
 - 4. Test for less than 2 Ω in the low control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If the test lamp is always On**
 1. Ignition Off, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the low control circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp turns On and Off**
7. Replace the Q18A Fuel Pressure Regulator 1.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- For Q18A Fuel Pressure Regulator 1 replacement, refer to [Fuel Injection Pump Metering Valve Replacement](#)
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P163B: CONTROL MODULE FUEL PRESSURE REGULATOR 2 CONTROL SYSTEM CIRCUITRY PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P163B

Control Module Fuel Pressure Regulator 2 Control System Circuitry Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2295	P2295	P0690, P16B3	-
Low Control	P2295	P2294	P0690, P16B3, P2296	-

Circuit/System Description

Fuel pressure regulator 2 is used to control the fuel pressure at the fuel rail. The engine control module (ECM) supplies the voltage directly to fuel pressure regulator 2. The ECM controls the solenoid by grounding the control circuit with a solid state device called a driver.

Conditions for Running the DTC

- DTC P2294, P2295 or P2296 is not set.
- The ignition voltage is greater than 11 V.
- The Fuel rail pressure is being controlled by fuel pressure regulator 2.
- The DTC runs continuously once the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the current flowing through Fuel Pressure Regulator 2 value is out of range for greater than 1 s.

Action Taken When the DTC Sets

DTC P163B is a type B DTC.

Conditions for Clearing the DTC

DTC P163B is a type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify with a scan tool that DTC P0689, P0690, P1682, P2294, P2295 or P2296 is not set.
 - **If DTC P0689, P0690, P1682, P2294, P2295 or P2296 is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If DTC P0689, P0690, P1682, P2294, P2295 or P2296 is not set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed in the Freeze Frame/Failure Records data.
4. Verify the DTC does not set.
 - **If DTC P163B is set**

Refer to Circuit/System Testing
 - **Go to next step: If DTC P163B is not set**
5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q18B Fuel Pressure Regulator 2, Ignition ON.
2. Verify a test lamp illuminates between the high control circuit terminal 1 and ground.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the high control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.

- If infinite resistance
3. Test for less than 2 Ω in the high control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp illuminates**
 3. Ignition Off.
 4. Verify the test lamp is not illuminated
 - **If the test lamp illuminates**
 1. Disconnect the X2 harness connector at the K20 Engine Control Module, ignition On.
 2. Test for less than 1 V between the high control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp is not illuminated**
 5. Connect a test lamp between the low control circuit terminal 2 and the high control circuit terminal 1.
 6. Ignition ON, verify the test lamp turns ON and OFF when Commanding Fuel Pressure Regulator 2 ON and OFF with a scan tool.
 - **If the test lamp is always Off**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 1 V between the low control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 Ω in the low control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If the test lamp is always On**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the low control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp turns On and Off**
 7. Replace the Q18B Fuel Pressure Regulator 2.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- For Q18B Fuel Pressure Regulator 2 replacement, refer to [Fuel Injection Fuel Rail Assembly Replacement](#)
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P02E8, P02E9, P16A0, P16A1, OR P16A2: SENSOR COMMUNICATION CIRCUIT 1/INTAKE AIR FLOW VALVE POSITION SENSOR CIRCUIT VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P16A0

DTC P16A1

Sensor Communication Circuit 1 High Voltage

DTC P16A2

Sensor Communication Circuit 1 Performance

DTC P02E8

Intake Air Flow Valve Position Sensor Circuit Low Voltage

DTC P02E9

Intake Air Flow Valve Position Sensor Circuit High Voltage

Circuit/System Description

The throttle body assembly contains a contactless inductive throttle position sensing element that is managed by a customized integrated circuit. The throttle position sensor is mounted within the throttle body assembly and is not serviceable. The ECM supplies the throttle body with a 5 V reference circuit, a low reference circuit, an H-bridge motor directional control circuit, and an asynchronous signal/serial data circuit. The asynchronous signal means communication is only going from the throttle body to the ECM. The throttle body cannot receive data from the ECM over the signal/serial data circuit. The throttle position sensor provides a signal voltage that changes relative to throttle blade angle. The customized integrated circuit translates the voltage based position information into serial data using the Society of Automotive Engineers (SAE) J2716 Single Edge Nibble Transmission (SENT) protocol. The throttle position sensor information is transmitted between the throttle body and the ECM on the signal/serial data circuit. The ECM decodes the serial data signal and is used as voltages for throttle position sensor 1 and 2.

Conditions for Running the DTC

P02E8 and P02E9

- Ignition is On or engine is running.
- DTC P0651 is not set
- The DTCs run continuously when the conditions above are met.

P16A0, P16A1 or P16A2

- Ignition is On or engine is running.
- The DTCs run continuously when the conditions above are met.

Conditions for Setting the DTC

P16A0

The ECM detects a low voltage circuit condition on the throttle position sensor signal circuit for greater than 0.5 s.

P16A1

The ECM detects a high voltage circuit condition on the throttle position sensor signal circuit for greater than 0.5 s.

P16A2

The ECM detects an incorrect message was received over the throttle position sensor signal circuit for greater than 0.5 s.

P02E8

The ECM detects that the throttle valve position sensor voltage is less than a calibrated threshold for 0.5 s.

P02E9

The ECM detects that the throttle valve position sensor voltage is greater than a calibrated threshold for 0.5 s.

Action Taken When the DTC Sets

- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type A DTCs, with LH7.
- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type B DTCs, with NE4, NCP or NCV.
- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type C DTCs, all others.

Conditions for Clearing the DTC

- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type A DTCs, with LH7
- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type B DTCs, with NE4, NCP or NCV
- DTCs P16A0, P16A1, P16A2, P02E8 and P02E9 are Type C DTCs, all others

Diagnostic Aids

- A high resistance condition on the throttle position or throttle actuator control circuits could cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify DTC P02E0, P02E2, P02E3, P02EB, P0651, P122B or P122C is not set.
 - **If a DTC is set.**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)

- **Go to next step: If none of the DTCs are set**
3. Verify DTC P02E8, P02E9, P16A0, P16A1 or P16A2 is not set.
 - **If P02E8 or P02E9 are the only DTCs set**

Test or replace the Q38 Throttle Body Assembly

- **If DTC P16A0, P16A1 or P16A2 is set with any of the DTCs**

Refer to Circuit/System Testing.

- **Go to next step: If none of the DTCs are set**

4. Ignition On, verify the scan tool Intake Air Flow Valve Position parameter is between 0 - 100% and changes when commanding the Intake Air Flow Valve Position between 0 - 100%.

- **If not within the specified range or does not change**

Refer to Circuit/System Testing

- **Go to next step: If within the specified range and changes**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

- **If a DTC sets**

Refer to Circuit/System Testing

- **Go to next step: If DTC does not set**

6. All OK.

Circuit/System Testing

NOTE: Disconnecting the throttle body harness connector may cause additional DTCs to set.

1. Ignition Off, and all vehicle systems Off, disconnect the harness connector at Q38 Throttle Body Assembly. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 10 Ω between the low reference circuit terminal 4 and ground.

- **If 10 Ω or greater**

1. Ignition Off, disconnect the harness connector X2 at the K20 Engine Control Module.

2. Test for less than 2 Ω in the low reference circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If less than 10 Ω**

3. Ignition On.

4. Test for greater than 4.8 V between the 5 V reference circuit terminal 5 and ground.

- **If less than 4.8 V**

1. Test for less than 2 Ω in the 5 V reference circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- **Go to next step: If greater than 4.8 V**

5. Ignition On.

6. Test for 4.6 - 5.2 V between the signal circuit terminal 3 and ground.

- **If less than 4.8 V**

1. Ignition Off, disconnect the harness connector X2 at the K20 Engine Control Module.

2. Test for infinite resistance between the signal circuit and ground.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance

3. Test for less than 2 Ω in the signal circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- If greater than 5.2 V

1. Ignition Off, disconnect the harness connector X2 at the K20 Engine Control Module, ignition On.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.

- **Go to next step: If between 4.8 - 5.2 V**

7. Replace the Q38 Throttle Body Assembly.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

- Refer to **Throttle Body Assembly Replacement**
- Refer to **Control Module References** for Engine Control Module replacement, programming and setup.

DTC P16A7, P16AF OR P16B3: ENGINE CONTROLS IGNITION RELAY FEEDBACK CIRCUIT 2

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- Refer to **Diagnostic Procedure Instructions** to provide an overview of each diagnostic category.

DTC Descriptors

DTC P16A7

Engine Controls Ignition Relay Feedback Circuit 2

DTC P16AF

Engine Controls Ignition Relay Feedback Circuit 2 Low Voltage

DTC P16B3

Engine Controls Ignition Relay Feedback Circuit 2 High Voltage

Diagnostic Fault Information

Engine Controls Ignition Relay

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Relay Coil Supply Voltage	P0689, P1682, P16A7, P16AF	P0685, P0689, P1682, P16A7, P16AF	-
Relay Control Circuit	P0686, P0690, P16B3	P0685, P0689, P1682, P16A7, P16AF	P0685, P0687, P0689, P1682, P16A7, P16AF
Relay Feedback Circuit	P0689, P1682, P16A7, P16AF	P0689, P1682, P16A7, P16AF	P0690, P16B3

Typical Scan Tool Data

Engine Controls Ignition Relay Control Circuit Low Voltage, Open and High Voltage Test Status - Component Commanded OFF

Circuit	Short to Ground	Open	Short to Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Component commanded OFF Parameter Normal Range: The following illustrates the normal parameter state with no circuit conditions: • Component OFF - OK for Open/Low Voltage Test Status and Not Run for High Voltage Test Status • Component ON - Not Run for Open/Low Voltage Test Status and OK for High Voltage Test Status			
B+	Malfunction	Malfunction	-
Control	Malfunction	Malfunction	Not Run

Engine Controls Ignition Relay Control Circuit Low Voltage, Open and High Voltage Test Status - Component Commanded ON

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Component commanded ON Parameter Normal Range: The following illustrates the normal parameter state with no circuit conditions: • Component OFF - OK for Open/Low Voltage Test Status and Not Run for High Voltage Test Status • Component ON - Not Run for Open/Low Voltage Test Status and OK for High Voltage Test Status			
B+	Not Run	Not Run	-
Control	Not Run	Not Run	Malfunction

Circuit/System Description

There are 3 ignition voltage circuits supplied to the engine control module (ECM). Two are supplied by the engine controls ignition relay, and the other is supplied by the ignition main relay. The ECM monitors and compares the ignition voltage supplied by the 2 relays.

Conditions for Running the DTC

P16A7

- The engine controls ignition relay is commanded ON.
- Ignition voltage is greater than 5.5 V.
- The DTC runs continuously when the above conditions are met.

P16AF

- The engine controls ignition relay is commanded ON.
- Ignition 1 signal voltage is greater than 11 V.
- The DTC runs continuously when the above conditions are met.

P16B3

The DTC runs when the engine controls ignition relay is commanded OFF.

Conditions for Setting the DTC

P16A7

The ECM detects that the voltage level difference is greater than 3 V between the 2 ignition voltage circuits for greater than 1 s.

P16AF

The ECM detects the engine controls ignition relay feedback circuit 2 is less than 5 V.

P16B3

The ECM detects the engine controls ignition relay feedback circuit 2 is greater than 4 V for greater than 5 s.

Action Taken When the DTC Sets

- DTC P16A7 is a Type A DTC.
- DTCs P16AF and P16B3 are Type C DTCs.

Conditions for Clearing the DTC

- DTC P16A7 is a Type A DTC.
- DTCs P16AF and P16B3 are Type C DTCs.

Diagnostic Aids

The engine controls ignition relay may also be labeled the powertrain relay, the engine control module relay, or the main relay. The ignition main relay may also be labeled the run/crank relay, the ignition run relay, the ignition 1 relay, or the ignition relay.

Reference Information

Schematic Reference

- [Engine Controls Wiring Schematics 1.6L \(LH7\)](#)
- Power Distribution Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Electrical Center Identification Views](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- A short to voltage on other components may cause DTC P16B3 to set. If any other DTC is set, diagnose that DTC first.
- If you were sent here from Engine Cranks But Does Not Run, proceed to Circuit/System Testing.

1. Ignition ON, observe the scan tool DTC information. Verify DTC P16A7, P16AF or P16B3 is not set.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing.
 - **Go to next step: If none of the DTCs are set**
2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
3. All OK.

Circuit/System Testing

NOTE: You must perform the Circuit/System Verification before proceeding with Circuit/System Testing unless sent here from Engine Cranks But Does Not Run.

1. Ignition OFF, disconnect the KR75 Engine Controls Ignition Relay.
2. Verify a test lamp illuminates between ground and the B+ terminals listed below:
 - Terminal 85
 - Terminal 30
 - **If the test lamp does not illuminate**

Replace the front compartment fuse block.

- **Go to next step: If the test lamp illuminates**

NOTE:

- High resistance in the circuit/underhood fuse block for either the KR75 Engine Controls Ignition Relay or the KR73 Ignition Main Relay can cause DTC P16A7 to set.
- A short to voltage on any of the circuits supplied by the engine controls ignition relay can cause DTC P16B3 to set.

3. Ignition ON.
4. Verify that a test lamp does not illuminate between the ignition voltage circuit terminal 87 and ground.
 - **If the test lamp illuminates**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Ignition ON.
 3. Test for less than 1 V between ground and connector terminal 73.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **Go to next step: If the test lamp does not illuminate**
5. Ignition OFF, connect a 20 A fused jumper wire between the B+ circuit terminal 30 and the ignition voltage circuit terminal 87.
6. Ignition ON.
7. Verify the scan tool Engine Controls Ignition Relay Feedback Signal parameter displays B+.
 - **If B+ is not displayed**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module
 2. Test for less than 2 Ω in the relay switch ignition voltage circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
3. Test for infinite resistance between the relay switch ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If B+ is displayed**
8. Ignition OFF, connect a DMM, set to the diode setting, between control circuit terminal 86 and ground.
 9. Verify the DMM displays OL.
 - **If OL is not displayed**
 1. Disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between ground and the relay control circuit.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If OL is displayed**
 10. Ignition ON.
 11. Verify the DMM displays less than 1 V.
 - **If 1 V or greater**
 1. Ignition OFF, disconnect the X1 connector at the K20 Engine Control Module.
 2. Ignition ON.
 3. Test for less than 1 V on the relay control circuit.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - if less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 1 V**
 12. Test or replace the KR75 Engine Controls Ignition Relay.

Component Testing

Relay Test

1. Ignition OFF, disconnect the KR75 Engine Controls Ignition Relay.
2. Test for 70 - 110 Ω between terminals 85 and 86:
 - **If less than 70 Ω or greater than 110 Ω**
 Replace the KR75 Engine Controls Ignition Relay.
 - **Go to next step: If between 70 - 110 Ω**
3. Test for infinite resistance between the terminals listed below:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - **If less than infinite resistance**
 Replace the KR75 Engine Controls Ignition Relay.
 - **Go to next step: If infinite resistance**
4. Install a 20 A fused jumper wire between relay terminal 85 and 12 V. Install a jumper wire between relay terminal 86 and ground.
5. Test for less than 2 Ω between terminals 30 and 87.

- If 2 Ω or greater

Replace the KR75 Engine Controls Ignition Relay.

- Go to next step: If less than 2 Ω

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Battery Distribution Engine Compartment Fuse Block Replacement](#) .
- Refer to [Relay Replacement \(Attached to Wire Harness\)](#), [Relay Replacement \(Within an Electrical Center\)](#).
- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P16D7, P16D8, OR P16D9: SENSOR SUPPLY VOLTAGE RELAY CONTROL CIRCUIT

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P16D7

Sensor Supply Voltage Relay Control Circuit

DTC P16D8

Sensor Supply Voltage Relay Control Circuit Low Voltage

DTC P16D9

Sensor Supply Voltage Relay Control Circuit High Voltage

Circuit/System Description

The reductant control module relay 1 & 2 supply ignition voltage to the Reductant Control Module. The Reductant Control Module Relay 2 also supplies ignition voltage to Nitrogen Oxide Sensor 1 & 2 and the Exhaust Particulate Matter Sensor. Both Reductant Control Module Relay 1 & 2 are controlled by a low side driver in the ECM.

Conditions for Running the DTC

P16D7, P16D8

- The DTC runs when Ignition OFF.

P16D9

- The DTC runs when Ignition ON.

Conditions for Setting the DTC

The ECM detects an open circuit, short to voltage or short to ground on the reductant control module relay control circuit.

Action Taken When the DTC Sets

DTC P16D7, P16D8 are Type A DTCs.

DTC P16D9 is Type B DTC.

Conditions for Clearing the DTC

DTC P16D7, P16D8 are Type A DTCs.

DTC P16D9 is Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, observe the scan tool DTC information. Verify DTC P16D7, P16D8, P16D9 is not set.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing.
 - **Go to next step: If none of the DTCs are set**
2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC does not set**
3. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the K115 Reductant Control Module Relay 1 & K115 Reductant Control Module Relay 2.
2. connect a DMM, set to the diode setting, between control circuit terminal 86 of K115 Reductant Control Module Relay 2 and ground.
3. Verify the DMM displays OL.
 - **If OL is not displayed**
 1. Disconnect the X3 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between ground and the relay control circuit.

- If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If OL is displayed**
4. Ignition ON.
 5. Verify the DMM displays less than 1 V.
 - **If 1 V or greater**
 1. Ignition OFF, disconnect the X3 connector at the K20 Engine Control Module.
 2. Ignition ON.
 3. Test for less than 1 V on the relay control circuit.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - if less than 2 Ω , replace the K20 Engine Control Module.
 - If less than 2 Ω
 5. Disconnect the DMM from terminal 86 of K115 Reductant Control Module Relay 2.
 6. Connect the DMM to control circuit terminal 85 of K115 Reductant Control Module Relay 1 and ground.
 7. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - if less than 2 Ω , replace the K20 Engine Control Module.
 - **Go to next step: If less than 1 V**
 6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Control Module References](#) for engine control module replacement, programming and setup.

DTC P2002: DIESEL PARTICULATE FILTER (DPF) LOW EFFICIENCY

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P2002

Diesel Particulate Filter (DPF) Low Efficiency

Circuit/System Description

The diesel exhaust aftertreatment system consists of an under hood pre-catalyst and an underbody catalyst. The underbody catalyst also consists of the main diesel oxidation catalyst and the coated Diesel Particulate Filter (DPF). One of the main purposes of the DPF is to collect particulates from the engine exhaust in order to minimize discharge of soot to the atmosphere. The soot particles accumulate in the channels of the DPF and are burned off at regular intervals through a process called regeneration. This prevents the DPF from clogging. The ECM commands the DPF regeneration after calculating various vehicle conditions such as DPF pressure difference, exhaust gas temperature, engine oil quality, engine speed, etc. Excessive accumulation of the soot in the DPF can cause a drop in the engine performance. During regeneration, additional fuel is injected via multiple post injections in order to increase the

exhaust gas temperature. During this period, the DPF temperature is raised to approximately 600Â°C (1,112Â°F) and the accumulated soot is oxidized or burned off into carbon dioxide (CO₂).

Conditions for Running the DTC

- DTC P0071, P0072, P0073, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P140C, P140D, P0191, P0192, P0193, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0405, P0406, P049D, P0545, P0546, P062B, P062D, P0722, P0723, P111E, P113B, P115E, P115F, P1160, P116A-P116F, P118E, P1192-P1194, P119A-P119C, P11C5, P11C6, P1248, P1249, P124A-P124F, P126A, P142C, P142D, P142E, P142F, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P2032, P2033, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2205-P2211, P2227, P2228, P2229, P2230, P2297, P2452-P2456, P2481, P2482, P2483, P2484, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0, P24D1, P2627, P2628, P262B, P2A00 or U029D is not set.
- The engine is cranking or running.
- The ignition voltage is greater than 11 V.
- The ambient temperature is warmer than -7Â°C (19.4Â°F).
- The particulate matter sensor is operating.
- The NOx Sensor 1 Heater Operation parameter displays Allowed
- The NOx sensor supply voltage is greater than 10.8 V.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the particulate filter has degraded beyond a calibrated threshold.

Action Taken When the DTC Sets

DTC P2002 is a type B DTC.

Conditions for Clearing the DTC

DTC P2002 is a type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

1. Ignition ON.
2. Verify that DTC P0071, P0072, P0073, P00C7, P00E9, P00EA-P00EC, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P140C, P140D, P0191, P0192, P0193, P0201-P0208, P020A-P020F, P0216, P021A, P021B, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P02EE, P02EF, P02F0-P02F5, P0405, P0406, P049D, P0545, P0546, P062B, P062D, P0722, P0723, P111E, P113B, P115E, P115F, P1160, P116A-P116F, P118E, P1192-P1194, P119A-P119C, P11C5, P11C6, P1248, P1249, P124A-P124F, P126A, P142C, P142D, P142E, P142F, P1474, P1475, P1476, P1477, P1478, P16D7, P16D8, P16D9, P2032, P2033, P2080, P2081, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2205-P2211, P2227, P2228, P2229, P2230, P2297, P2452-P2456, P2481, P2482, P2483, P2484, P24B0, P24B1, P24B3, P24B5, P24B6, P24D0, P24D1, P2627, P2628, P262B, P2A00 or U029D is not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.

- **Go to next step: If none of the DTCs are set**

3. Verify DTC P2002 is not set.

- **If the DTC is set**

Replace the diesel particulate filter.

- **Go to next step: If no DTC is set**

4. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Refer to [Oxidation Catalytic Converter Replacement \(LH7\)](#). Perform the scan tool DPF/Catalyst 2 Reset after replacing the exhaust particulate filter.

DTC P2006 OR P200A: INTAKE MANIFOLD RUNNER CONTROL VALVE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P2006

Intake Manifold Runner Control Valve Stuck Closed

DTC P200A

Intake Manifold Runner Control Valve Performance

Circuit/System Description

The position of the intake manifold swirl flaps is controlled by the engine control module (ECM). The ECM controls the intake manifold runner control valve actuator to create a swirl in the combustion chamber to get a homogeneous diesel air mixture.

Ignition voltage is supplied directly to the intake manifold tuning valve actuator. The engine control module (ECM) controls the valve actuator motor by grounding the control circuit with a solid state device called a driver. The driver is equipped with a feedback circuit that is pulled up to a voltage. The ECM can determine if the control circuit is open, shorted to ground, or shorted to a voltage by monitoring the feedback voltage signal.

The runner control valve actuator contains a position sensor, which outputs a pulse width modulated (PWM) signal, to detect the actual position of the actuator in relation to its commanded position. Variations in the duty cycle of the PWM signal enables the ECM to detect a physically broken, restricted or stuck actuator.

Conditions for Running the DTC

P2006

- DTC P0071, P0072, P0073, P0074, P0117, P0118, P0119, P200A, P2008, P2009, P2010, P2015, P2016, P2017 or P20F8 is not set.
- The engine is running.
- The battery voltage is greater than 11 V.
- The ambient air temperature is warmer than -7°C (19°F).
- The engine coolant temperature (ECT) is warmer than 60°C (140°F).
- The actuator is commanded On for greater than 30 s.
- The actuator command is steady at less than 50% for greater than 50 s.
- The DTC runs continuously when the above conditions are met.

P200A

- DTC P0117, P0118, P0119, P2008, P2009, P2010, P2015, P2016 or P2017 is not set.
- The battery voltage is greater than 11 V.
- The engine coolant temperature (ECT) is warmer than 60°C (140°F).
- The actuator is commanded On for greater than 30 s.
- The DTC runs once per trip when the ignition is switched Off.

Conditions for Setting the DTC

P2006

The ECM detects that the intake manifold runner control valve is stuck closed for greater than 25 ms

P200A Condition 1

The ECM detects that the runner control valve position is not within 80 - 93% when commanded closed, or the time to achieve the desired position is greater than 5 s.

Condition 2

The ECM detects that the runner control valve position is not within 25 - 40% when commanded open, or the time to achieve the desired position is greater than 5 s.

Condition 3

The ECM detects that the total time for the intake manifold runner control valve to open and close is greater than 10 s.

Action Taken When the DTC Sets

- DTC P2006 is a Type A DTC.
- DTC P200A is a Type B DTC.

Conditions for Clearing the DTC

- DTC P2006 is a Type A DTC.
- DTC P200A is a Type B DTC.

Reference Information

Schematic Reference

Connector End View Reference

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- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

Scan Tool Reference

[Control Module References](#) for scan tool information

[Circuit/System Verification](#)

1. Ignition ON
2. Verify that DTC P2008, P2009, P2010, P2015, P2016 or P2017 is not set.
 - **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If none of the DTCs are set**
3. Command the Intake Manifold Runner Control Valve between 30 and 80%.
4. Verify the scan tool the Intake Manifold Runner Control Valve Feedback Signal parameter increases and decreases as commanded.
 - **If the Intake Manifold Runner Control Valve Feedback Signal does not increase and decrease**
 1. Ignition Off.
 2. Verify that the Intake Manifold Runner Valve is not stuck - refer to [Intake Manifold Cleaning and Inspection](#)
 - If a condition exists, repair or replace as necessary.
 - **Go to next step: If the Intake Manifold Runner Control Valve Feedback Signal does increase and decrease**
5. Operate the vehicle within the Conditions for Running the DTCs. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to [Intake Manifold Cleaning and Inspection](#) .

- **Go to next step: If the DTC does not set**

6. All OK.

[Repair Instructions](#)

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Intake Manifold Replacement](#) - M98 Intake Manifold Runner Valve Actuator replacement.

- Refer to [Control Module References](#) for Engine Control Module replacement, programming and setup.

DTC P2008, P2009, OR P2010: INTAKE MANIFOLD RUNNER CONTROL VALVE CONTROL CIRCUIT

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: [Diagnostic System Check - Vehicle](#)
- Review the description of Strategy Based Diagnosis: [Strategy Based Diagnosis](#)
- An overview of each diagnostic category can be found here: [Diagnostic Procedure Instructions](#)

DTC Descriptor

DTC P2008

Intake Manifold Runner Control Valve Control Circuit

DTC P2009

Intake Manifold Runner Control Valve Control Circuit Low Voltage

DTC P2010

Intake Manifold Runner Control Valve Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2009, P201B	P2009, P2017	-	P201D, P20F8
Control	P2009	P2008	P2010	P201D, P20F8

Typical Scan Tool Data

Intake Manifold Runner Control Valve Feedback Signal

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine - Idling - At normal operating temperature			
Parameter Normal Range: 32%			
Ignition	0%	100%	100%
Control	0%	29%	29%

Circuit/System Description

Circuit	Description
Ignition	Supplied from a fuse.
Control	The output is PWM controlled.

Component	Description
K20 Engine Control Module	The control module contains a microprocessor used to process input data to control outputs. The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

Component	Description
M98 Intake Manifold Runner Valve Actuator	The intake manifold runner control solenoid valve is actuated by a DC motor. The control valve is spring loaded to the closed position. The motor overcomes the spring pressure to open the control valve. An increase in current flow through the motor increases the opening of the control valve.

Conditions for Running the DTC

- Ignition = On or Engine = Running
- Ignition Voltage = Greater than 11 V
- Frequency the DTC runs = Continuously - After the running conditions are met

Conditions for Setting the DTC

Control Circuit = Commanded state does not match the actual state - For greater than 1 s

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type B DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type B DTC

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Perform the scan tool control function: Intake Manifold Runner Control Valve - Increase & Decrease

Verify the scan tool parameter:

- Intake Manifold Runner Control Valve Control Circuit High Voltage Test Status = OK or Not Run
- Intake Manifold Runner Control Valve Control Circuit Open Test Status = OK or Not Run
- Intake Manifold Runner Control Valve Control Circuit Low Voltage Test Status = OK or Not Run
- **If not the specified state**

Refer to Circuit/System Testing

- **Go to next step: If the specified state**

3. Perform the scan tool control function: Intake Manifold Runner Control Valve - Increase

Verify the scan tool parameter: Intake Manifold Runner Control Valve Feedback Signal = The value should not spike or drop out.

- Perform the action while monitoring the parameter:
 - Wiggle the harness and connector: K20 Engine Control Module
 - Wiggle the harness and connector: M98 Intake Manifold Runner Valve Actuator
- **If the value spikes or drops out**

Refer to: Circuit/System Testing

- **Go to next step: If the value does not spike or drop out**

4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **Go to next step: If the DTC is not set**

5. All OK.

Circuit/System Testing

1. Ignition/Vehicle & All vehicle systems - Off
2. Disconnect the electrical connector: M98 Intake Manifold Runner Valve Actuator
3. Ignition - On/Vehicle - In Service Mode
4. Verify a test lamp turns On between the test points: Ignition circuit terminal 6 & Ground
 - **If the test lamp does not turn On and the circuit fuse is OK**
 1. Ignition/Vehicle - Off & Remove - Test lamp
 2. Test for less than 2 Ω between the test points: Ignition circuit terminal 6 & Output terminal @ F3UA Fuse
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Verify the fuse is OK and there is voltage at the fuse.
 - **If the test lamp does not turn On and the circuit fuse is open**
 1. Connect the electrical connector: M98 Intake Manifold Runner Valve Actuator
 2. Replace the component: F3UA Fuse
 3. Verify the fuse does not open.
 - If the fuse opens and there are components connected to the circuit - Disconnect a component listed below and repeat step 4.2
 - E45 Positive Crankcase Ventilation Heater
 - M98 Intake Manifold Runner Valve Actuator

- If the fuse opens with all components disconnected from the circuit - Repair the short to ground on the circuit.
- If the fuse does not open after disconnecting a component from the circuit - Replace the component disconnected last.
- If the fuse does not open with all components connected.

4. Ignition - On/Vehicle - In Service Mode

NOTE: It may be necessary to use a scan tool control function to operate a component.

5. Operate the component: Each component on the circuit - One at a time

Verify the fuse does not open when any of the components are activated.

- If the fuse opens - Replace the component that caused the fuse to open when activated.
- If the fuse does not open

6. All OK.

- **Go to next step: If the test lamp turns On**

5. Verify a test lamp does not turn On between the test points: Control circuit terminal 1 & B+

- **If the test lamp turns On**

1. Ignition/Vehicle - Off & Remove - Test lamp
2. Disconnect the electrical connector: X2 @ K20 Engine Control Module
3. Test for infinite resistance between the test points: Control circuit terminal 1 @ Component harness & Ground
 - If less than infinite resistance - Repair the short to ground on the circuit.
 - If infinite resistance - Replace the component: K20 Engine Control Module

- **Go to next step: If the test lamp does not turn On**

6. Remove - Test Lamp

7. Verify the scan tool parameter: Intake Manifold Runner Control Valve Control Circuit High Voltage Test Status = OK

- **If not the specified state**

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector: X2 @ K20 Engine Control Module
3. Ignition - On/Vehicle - In Service Mode
4. Test for less than 1 V between the test points: Control circuit terminal 1 @ Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 1 V - Replace the component: K20 Engine Control Module

- **Go to next step: If the specified state**

8. Connect a 3 A fused jumper wire between the test points: Control circuit terminal 1 & Ignition circuit terminal 6

9. Perform the scan tool control function: Intake Manifold Runner Control Valve - Increase

Verify the scan tool parameter: Intake Manifold Runner Control Valve Control Circuit High Voltage Test Status = Malfunction

- **If not the specified state**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
2. Disconnect the electrical connector: X2 @ K20 Engine Control Module
3. Test for less than 2 Ω between the test points: Control circuit terminal 1 @ Component harness & Terminal 54 @ Control module harness
 - If 2 Ω or greater - Repair the open/high resistance in the circuit.
 - If less than 2 Ω - Replace the component: K20 Engine Control Module

- Go to next step: If the specified state

10. Test or replace the component: M98 Intake Manifold Runner Valve Actuator

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: [Diagnostic Repair Verification](#)

- Refer to [Intake Manifold Replacement](#) - M98 Intake Manifold Runner Valve Actuator
- For control module replacement, programming and setup, refer to [Control Module References](#)

DTC P200C: DIESEL PARTICULATE FILTER (DPF) HIGH TEMPERATURE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P200C

Diesel Particulate Filter (DPF) High Temperature

Circuit/System Description

The diesel exhaust aftertreatment system consists of a diesel oxidation catalyst and a Diesel Particulate Filter (DPF). One of the main purposes of the DPF is to collect particulates from the engine exhaust in order to minimize discharge of soot to the atmosphere. The soot particles accumulate in the channels of the DPF and are burned off at regular intervals through a process called regeneration. This prevents the DPF from clogging. The ECM commands the DPF regeneration after calculating various vehicle conditions such as DPF pressure difference, exhaust gas temperature, engine oil quality, engine speed, etc. Excessive accumulation of the soot in the DPF can cause a drop in the engine performance. During regeneration, additional fuel is injected in order to increase the exhaust gas temperature. During this period, the DPF temperature is raised to approximately 600°C (1, 112°F) and the accumulated soot is oxidized or burned off into carbon dioxide (CO₂).

The following table illustrates the difference between temperature, resistance, and voltage:

Exhaust Gas Temperature	Exhaust Gas Temperature Resistance	Exhaust Gas Temperature Signal Voltage
Cold	Low	Low
Warm	High	High

Conditions for Running the DTC

- DTC P113C, P113D, P118F, P1196, P2032, P2033, P2084, P2085, P242B, P242C, P242D or P242E is not set.
- The engine is running.
- The battery voltage is greater than 11 V.

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the exhaust gas temperature at exhaust gas temperature sensor 2 is greater than 800°C (1, 472°F) or greater than 850°C (1, 562°F) during regeneration for greater than 20 s.

Action Taken When the DTC Sets

- DTC P200C is a Type A DTC.
- DPF regeneration is inhibited

- The cooling fans are activated
- Engine power is reduced
- The engine is shut down when exhaust gas temperature is above a calibrated threshold and the vehicle is stationary

Conditions for Clearing the DTC

DTC P200C is a Type A DTC.

Diagnostic Aids

- After starting the engine, the exhaust gas temperature sensor temperature should rise steadily, then stabilize after the engine reaches operating temperature.
- If the vehicle has set overnight, the exhaust gas temperature sensor and the intake air temperature (IAT) sensor values should display within 3Å°C (5Å°F).

The following conditions can also cause the DTC to set:

- Faulty or plugged exhaust system, such as plugged diesel particulate filter
- Damaged turbocharger
- Inefficient diesel oxidation catalyst
- Engine misfire with excessive oil consumption
- Leaking fuel injectors
- Incorrect fuel rail pressure
- Leaks in the intake system and charge air system

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify that DTCs P0071, P0072, P0073, P0074, P00C7, P00E9, P00EA, P00EB, P00EC, P0100, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P014C, P014D, P0201, P0202, P0203, P0204, P020A, P020B, P020C, P020D, P0216, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P02EE, P02EF, P02F0, P02F1, P0405, P0406, P049D, P0502, P0503, P062B, P062D, P0722, P0723, P111E, P113C, P113D, P118B, P118F, P1196, P1248, P1249, P124A, P124B, P126A, P142B, P142C, P142D, P142E, P142F, P1435, P1436, P1474, P1475, P1476, P1477, P1478, P1479, P147B, P1488,

P2147, P2148, P2002, P2032, P2033, P2084, P2085, P2150, P2151, P2227, P2228, P2229, P2230, P2297, P242B, P242C, P242D, P242E, P2452, P2453, P2454, P2455, P2456, P2463, P24A4, P24B0, P24B1, P24B3, P24B4, P24B5, P24B6, P24C7, P24D0, P24D1 P2627, P2628, P2A00 or U029D are not set.

- **If any of the DTCs are set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.

- **Go to next step: If no other DTC is set**

3. Verify none of the conditions listed below exist:

- Leaking fuel injectors. Refer to [Fuel Injector Balance Test with Scan Tool](#) .
- Engine oil consumption. Refer to [Oil Consumption Diagnosis](#) .
- Incorrect fuel rail pressure. Refer to [Fuel System Diagnosis - High Pressure Side](#)
- Damaged, missing, or improperly installed exhaust system components.
- Restrictions in the exhaust pressure differential sensor ports
- Damaged, bent, restricted, or kinked exhaust pressure differential sensor lines
- Leaks in the Induction system or charge air system
- Missing or disconnected charge air system components
- Presence of additional washers under fuel injectors
- Turbocharger underboost
- **If any condition is found**

Repair as necessary

- **Go to next step: If no condition is found**

4. Perform the Diesel Particulate Filter Service Regeneration.

5. Verify the regeneration completed.

- **If the regeneration did not complete**

Replace the diesel particulate filter.

- **Go to next step: If the regeneration completed**

6. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Exhaust Muffler Replacement \(LH7\)](#) for diesel particulate filter replacement.
- Refer to [Control Module References](#) for ECM replacement, programming and setup.

DTC P2015, P2016, OR P2017: INTAKE MANIFOLD RUNNER CONTROL VALVE POSITION SENSOR

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P2015

Intake Manifold Runner Control Valve Position Sensor Performance

DTC P2016

Intake Manifold Runner Control Valve Position Sensor Circuit Low Voltage

DTC P2017

Intake Manifold Runner Control Valve Position Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2009, P2017	P2009, P2017	-	P201D, P2015, P20F8
Signal	P2016	P2017	P2017	P201D, P2015, P20F8
Ground	-	P2017	-	P201D, P2015, P20F8

Circuit/System Description

The position of the swirl flaps is controlled by the engine control module (ECM). The ECM controls the intake manifold runner control solenoid valve to create a swirl in the combustion chamber to get a homogeneous diesel air mixture. The ECM will vary the intake manifold runner control solenoid valve referring to inputs such as manifold absolute pressure and mass air flow. The ECM uses a pulse width modulation on the control circuit to control the intake manifold runner valve actuator.

Conditions for Running the DTC

- The ignition voltage is greater than 11 V.
- The starter motor is not engaged.
- The intake runner control valve is being commanded to greater than 0 and less than 100% for greater than 30 s.
- The DTC runs continuously when the condition above are met.

Conditions for Setting the DTC

The ECM detects that the commanded and actual runner control valve positions do not match for greater than 1 s.

Action Taken When the DTC Sets

DTC P2015, P2016 and P2017 are Type B DTCs.

Conditions for Clearing the DTC

DTC P2015, P2016 and P2017 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On/Vehicle in Service Mode.
2. Verify DTC P2009 is not set.
 - **If the DTC is set**

Refer to DTC P2008-P2010.
 - **Go to next step: If the DTC is not set**
3. Verify the Intake Manifold Runner Control Valve Feedback Signal parameter changes when commanding the Intake Manifold Runner Control Valve between 30 - 80% with a scan tool.
 - **If the parameter does not change**

Refer to Circuit/System Testing
 - **Go to next step: If the parameter changes**
4. Operate the vehicle within the Conditions for Running the DTCs. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Verify the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **Go to next step: If none of the DTCs set**
5. All OK.

Circuit/System Testing

1. Ignition Off and all vehicle systems Off, disconnect the harness connector at the M98 Intake Manifold Runner Valve Actuator. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 5 Ω between the ground circuit terminal 2 and ground.
 - **If 5 Ω or greater**
 1. Ignition Off.
 2. Test for less than 2 Ω in the circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the high resistance in the ground connection.
 - **Go to next step: If less than 5 Ω**
3. Ignition On.
4. Verify there is between 9 - 11 V between the signal circuit terminal 5 and ground.
 - **If 9 V or less**
 1. Ignition Off, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit and ground
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If 11 V or greater**

1. Ignition Off, disconnect the harness connector at the K20 Engine Control Module, ignition On.
2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
- **Go to next step: If between 9 - 11 V**
5. Replace the M98 Intake Manifold Runner Valve Actuator.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

- Refer to [Intake Manifold Replacement](#) for M98 Intake Manifold Runner Valve Actuator replacement.
- Refer to [Control Module References](#) for Engine Control Module replacement, programming and setup.

DTC P203C OR P203D: REDUCTANT LEVEL SENSOR CIRCUIT LOW/HIGH VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptors

DTC P203C

Reductant Level Sensor Circuit Low Voltage

DTC P203D

Reductant Level Sensor Circuit High Voltage

Circuit/System Description

The reductant level sensor provides discrete information about the diesel exhaust fluid quantity present in the Reductant tank. The sensor signal provides information to the reductant control module to determine 4 different states: FULL, OK, WARNING1, and WARNING2. The reductant control module diagnoses the sensor for open circuit, short to ground and short to voltage electrical faults. The sensor is also checked for invalid range output by determining if the float is mechanically stuck in a plausible position.

Conditions for Running the DTC

- DTC U010E is not set.
- The ignition is On or the engine is running.
- The battery voltage is greater than 11 V.

DTC P203C and P203D run when the above conditions have been met.

Conditions for Setting the DTC

P203D

The reductant level sensor signal is less than a calibrated threshold for greater than 5 s.

P203C

The reductant level sensor signal is greater than a calibrated threshold for greater than 5 s.

Action Taken When the DTC Sets

DTC P203C is a Type A DTC.

DTC P203D is a Type B DTC.

Conditions for Clearing the DTC

DTC P203C is a Type A DTC.

DTC P203D is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information

Circuit/System Verification

1. Ignition On.
2. Verify that DTC P203C or P203D is not set.
 - **If a DTC Is set**

Refer to Circuit/System Testing.
 - **Go to next step: If no DTC is set**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify DTC P203C or P203D does not set.
 - **If a DTC sets**

Refer to Circuit/System Testing
 - **Go to next step: If no DTC sets**
5. All OK.

Circuit/System Testing

1. Ignition Off, and all vehicle systems Off, it may take up to 2 minutes for all vehicle systems to power down, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly.
2. Test for less than 5 Ω between the low reference circuit terminal 6 and ground.
 - **If 5 Ω or greater**

1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
2. Test for less than 2 Ω in the low reference circuit end to end.
 - If greater than 2 Ω , repair the open or high resistance in the circuit.
 - If 2 Ω or less replace the K115 Reductant Control Module.
- **Go to next step: If less than 5 Ω**
3. Ignition On.
4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 13 and ground.
 - **If less than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If greater than 5.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module, ignition On.
 2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
5. Test for 4.4 - 4.8 V between the signal circuit terminal 14 and ground.
 - **If less than 4.4 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If greater than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module, ignition On.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If between 4.4 - 4.8 V**
6. Replace the A38 Reductant Pump and Sensor Assembly.
7. Verify that DTC P203C or P203D is not set.
 - **If a DTC sets**

Replace the K115 Reductant Control Module.
 - **Go to next step: If no DTC sets**
8. All OK.

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Controller Replacement](#)
- Refer to [Emission Reduction Fluid Tank Replacement](#) for reductant pump and sensor assembly replacement,

DTC P204B: REDUCTANT PRESSURE SENSOR PERFORMANCE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P204B

Reductant Pressure Sensor Performance

Circuit/System Description

The reductant pressure sensor, located in the Reductant Pump and Sensor Assembly, responds to pressure changes in the reductant system. The Reductant Control Module supplies 5 V to the reductant pressure sensor on the 5 V reference circuit and provides a ground on the low reference circuit. The reductant pressure sensor provides a signal to the Reductant Control Module on the sensor signal circuit relative to the pressure changes in the reductant system. The engine control module (ECM) is connected to the Reductant Control Module via the controller area network (CAN) bus.

Conditions for Running the DTC

- DTCs related to the following system/component = Not Set
 - B214 Reductant Temperature Sensor
 - G33 Reductant Pump
 - Q61 Reductant Injector
- The ignition is Off and the ECM is powering down.
- The reductant temperature is warmer than -7°C (19°F).

The DTCs runs when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the DEF pressure sensor signal is outside a calibrated threshold.

Action Taken When the DTC Sets

- DTC P204B is Type A DTC.
- The reductant injector is disabled.
- The reductant tank and line heaters are disabled.
- The reductant pump is disabled.

Conditions for Clearing the DTC

DTCs P204B, P204C and P204D are Type A DTCs.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.6L \(LH7\)](#)

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

[Control Module References](#) for scan tool information.

Circuit/System Verification

1. Ignition - On/Vehicle - In Service Mode
2. Verify there are no DTCs set related to the following system/component:
 - B214 Reductant Temperature Sensor
 - G33 Reductant Pump
 - Q61 Reductant Injector
 - **If a related DTC is set**

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.
 - **Go to next step: If a related DTC is not set**
3. Verify DTC P204B is not set.
 - **If DTC P204B is set**
 1. Perform the scan tool control function: Reductant Pump - ON - For 20 s
 2. Wait for greater than 10 s. - After the pump was turned off.
 3. Verify the scan tool parameter: Reductant Pressure = -7 to 7 kPa (-1 to 1 PSI)
 - If not in the specified range

Refer to Circuit/System Testing.
 - If in the specified range
 - **Go to next step: If DTC P204B is not set**
4. Operate the vehicle within the Conditions for Running the DTCs. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify that no DTC listed in the DTC Descriptor Category is set.
 - **If any of the DTCs are set**

Refer to Circuit/System Testing.
 - **Go to next step: If none of the DTCs are set**
6. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly.
2. Ignition On.
3. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.
 - **If 10 Ω or greater**

1. Ignition Off.
2. Disconnect the harness connector at the K115 Reductant Control Module.
3. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 14 and K115 Reductant Control Module X2 harness connector terminal 3.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If less than 10 Ω**
4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 5 and ground.
 - **If less than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 5 and K115 Reductant Control Module X2 harness connector terminal 12.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If greater than 5.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module, ignition On.
 2. Test for less than 1 V between the A38 Reductant Pump and Sensor Assembly harness connector terminal 5 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
5. Verify with a scan tool that the Pressure Sensor voltage parameter is 0 V.
 - **If greater than 0 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 1 V between the A38 Reductant Pump and Sensor Assembly harness connector terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If 0 V**
6. Install a 3 A fused jumper wire between the between the A38 Reductant Pump and Sensor Assembly harness connector signal circuit terminal 4 and 5 V reference circuit terminal 5. Verify with a scan tool that the Pressure Sensor voltage parameter is greater than 4.5 V
 - **If 4.5 V or less**
 1. Ignition Off, remove the jumper wire, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for infinite resistance between the A38 Reductant Pump and Sensor Assembly signal circuit harness connector terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground at the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 4 and K115 Reductant Control Module X2 harness connector terminal 13.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If greater than 4.5 V**
7. Replace the A38 Reductant Pump and Sensor Assembly

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Controller Replacement](#)
- Refer to [Emission Reduction Fluid Tank Replacement](#) for Reductant Pump and Sensor Assembly replacement.

DTC P204C OR P204D: REDUCTANT PRESSURE SENSOR CIRCUIT LOW/HIGH VOLTAGE

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- Refer to [Diagnostic Procedure Instructions](#) to provide an overview of each diagnostic category.

DTC Descriptor

DTC P204C

Reductant Pressure Sensor Circuit Low Voltage

DTC P204D

Reductant Pressure Sensor Circuit High Voltage

Circuit/System Description

The reductant pressure sensor, located in the Reductant Pump and Sensor Assembly, responds to pressure changes in the reductant system. The Reductant Control Module supplies 5 V to the reductant pressure sensor on the 5 V reference circuit and provides a ground on the low reference circuit. The reductant pressure sensor provides a signal to the Reductant Control Module on the sensor signal circuit relative to the pressure changes in the reductant system. The engine control module (ECM) is connected to the Reductant Control Module via the controller area network (CAN) bus.

Conditions for Running the DTC

- The ignition is On.
- The battery voltage is greater than 11 V.
- The engine is not cranking.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

DTC P204C

The ECM detects that the reductant pressure sensor signal is open or shorted to ground.

DTC P204D

The ECM detects that the reductant pressure sensor signal is shorted to voltage.

Action Taken When the DTC Sets

- DTCs P204C, and P204D are Type A DTCs.
- The reductant injector is disabled.
- The reductant tank and line heaters are disabled.
- The reductant pump is disabled.

Conditions for Clearing the DTC

DTCs P204C and P204D are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.6L (LH7)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition On, verify that DTC P205B, P205C or P205D is not set.
 - **If any of the DTCs are set**
Refer to DTC P205B-P205D
 - **Go to next step: If none of the DTCs are set**
2. Verify that DTC P204C or P204D is not set
 - **If any of the DTCs are set**
Refer to Circuit/System Testing.
 - **Go to next step: If none of the DTCs are set**
3. Operate the vehicle within the Conditions for Running the DTCs. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
4. Verify that DTC P204C or P204D does not set.
 - **If a DTC sets**
Refer to Circuit/System Testing.
 - **Go to next step: If no DTCs set**
5. All OK.

Circuit/System Testing

1. Ignition Off, and all vehicle systems Off, disconnect the harness connector at the A38 Reductant Pump and Sensor Assembly. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 3 and ground.
 - **If 10 Ω or greater**
 1. Disconnect the harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 14 and K115 Reductant Control Module X2 harness connector terminal 3.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **Go to next step: If less than 10 Ω**
3. Ignition On, test for 4.8 - 5.2 V between the 5 V reference circuit terminal 5 and ground.
- **If less than 4.8 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 5 and K115 Reductant Control Module X2 harness connector terminal 12.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If greater than 5.2 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module, ignition On.
 2. Test for less than 1 V between the A38 Reductant Pump and Sensor Assembly harness connector terminal 5 and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If between 4.8 - 5.2 V**
4. Verify with a scan tool that the Pressure Sensor voltage parameter is 0 V.
- **If greater than 0 V**
 1. Ignition Off, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for less than 1 V between the A38 Reductant Pump and Sensor Assembly harness connector terminal 4 and ground.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K115 Reductant Control Module.
 - **Go to next step: If 0 V**
5. Install a 3 A fused jumper wire between the between the A38 Reductant Pump and Sensor Assembly harness connector signal circuit terminal 4 and 5 V reference circuit terminal 5. Verify with a scan tool that the Pressure Sensor voltage parameter is greater than 4.5 V
- **If 4.5 V or less**
 1. Ignition Off, remove the jumper wire, disconnect the X2 harness connector at the K115 Reductant Control Module.
 2. Test for infinite resistance between the A38 Reductant Pump and Sensor Assembly signal circuit harness connector terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground at the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω between A38 Reductant Pump and Sensor Assembly harness connector terminal 4 and K115 Reductant Control Module X2 harness connector terminal 13.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K115 Reductant Control Module.
 - **If greater than 4.5 V**
6. Replace the A38 Reductant Pump and Sensor Assembly

Repair Instructions

Perform the [Diagnostic Repair Verification](#) after completing the repair.

Perform the [Reductant System Tamper Service Bay Test](#) after completing the repair to clear the Service Emission System or Service Exhaust Fluid System warning message, if displayed.

- Refer to [Emission Reduction Fluid Controller Replacement](#)

- Refer to [Emission Reduction Fluid Tank Replacement](#) for Reductant Pump and Sensor Assembly replacement.
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