

2018 ENGINE PERFORMANCE

Engine Controls And Fuel - 1.5L (LYX) - Diagnostic Information And Procedures - Equinox & Terrain

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0351, P0352, P0353, P0354, P2300, P2301, P2303, P2304, P2306, P2307, P2309, OR P2310: IGNITION COIL 1-4 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0351

Ignition Coil 1 Control Circuit

DTC P0352

Ignition Coil 2 Control Circuit

DTC P0353

Ignition Coil 3 Control Circuit

DTC P0354

Ignition Coil 4 Control Circuit

DTC P2300

Ignition Coil 1 Control Circuit Low Voltage

DTC P2301

Ignition Coil 1 Control Circuit High Voltage

DTC P2303

Ignition Coil 2 Control Circuit Low Voltage

DTC P2304

Ignition Coil 2 Control Circuit High Voltage

DTC P2306

Ignition Coil 3 Control Circuit Low Voltage

DTC P2307

Ignition Coil 3 Control Circuit High Voltage

DTC P2309

Ignition Coil 4 Control Circuit Low Voltage

Ignition Coil 4 Control Circuit High Voltage**Diagnostic Fault Information**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Coil 1 Control	P0300, P2300	P0300, P0351	P0300, P2301	P0300, P0351
Ignition Coil 2 Control	P0300, P2303	P0300, P0352	P0300, P2304	P0300, P0352
Ignition Coil 3 Control	P0300, P2306	P0300, P0353	P0300, P2307	P0300, P0353
Ignition Coil 4 Control	P0300, P2309	P0300, P0354	P0300, P2310	P0300, P0354
Ground - Terminal 1/A@T8A Ignition Coil 1	-	P0300, P0351	-	P0300
Ground - Terminal 1/A@T8B Ignition Coil 2	-	P0300, P0352	-	P0300
Ground - Terminal 1/A@T8C Ignition Coil 3	-	P0300, P0353	-	P0300
Ground - Terminal 1/A@T8D Ignition Coil 4	-	P0300, P0354	-	P0300

Circuit/System Description

The ignition system on this engine uses an individual coil for each cylinder. The engine control module (ECM) controls the spark event for each cylinder through a dedicated ignition control circuit to each coil. When the ECM commands the ignition control circuit ON, electrical current will flow through the primary winding of the ignition coil, creating a magnetic field. When a spark event is requested, the ECM will command the ignition control circuit OFF, interrupting current flow through the primary winding. The magnetic field created by the primary winding will collapse across the secondary coil windings, producing a high voltage across the spark plug electrodes. The ECM uses information from the crankshaft position sensor, and the camshaft position sensor for sequencing and timing of the spark events. The ECM monitors each ignition control circuit for improper voltage levels.

Conditions for Running the DTC

- The engine is cranking or running.
- Ignition voltage greater than 11 V.

The DTCs run continuously when the above conditions 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.

Action Taken When the DTC Sets

DTCs P0351, P0352, P0353, P0354, P2300, P2301, P2303, P2304, P2306, P2307, P2309, and P2310 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P0351, P0352, P0353, P0354, P2300, P2301, P2303, P2304, P2306, P2307, P2309, and P2310 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L(LYX)

Connector End View Reference

Description and Operation

Electronic Ignition 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

Special Tools

EL 26792 HEI Spark Tester

For equivalent regional tools, refer to **Special Tools (Diagnostic Tools)** **Special Tools (Mechanical Tools)**.

Circuit/System Verification

1. Engine Running.
2. Verify the scan tool parameters listed below do not display Malfunction:
 - Ignition Coil 1 - 4 Control Circuit High Voltage Test Status
 - Ignition Coil 1 - 4 Control Circuit Low Voltage Test Status
 - Ignition Coil 1 - 4 Control Circuit Open 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 DTCs. 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: 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 appropriate electrical connector: T8 Ignition Coil
3. Test for less than 10 ohms between the test points: Ground circuit terminal 1/A & Ground
 - **If 10 ohms or greater**

1. Disconnect the ground connection: Ground terminal
2. Test for less than 2 ohms between the test points: Ground circuit terminal 1/A@Component harness & The other end of the circuit
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Repair the open/high resistance in the ground connection.
- **Go to next step: If less than 10 ohms**
4. Engine - Running
5. Verify the appropriate scan tool Ignition Coil Control Circuit Low Voltage Test Status does not display Malfunction.
 - **If Malfunction is 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 control circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **Go to next step: If Malfunction is not displayed**
6. Verify the appropriate scan tool Ignition Coil Control Circuit High Voltage Test Status does not display Malfunction.
 - **If Malfunction is displayed**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 1 V between the control circuit and ground.
 - 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 Malfunction is not displayed**
7. Ignition OFF, install a 10 A fused jumper wire between the control circuit terminal 3 or C and ground, engine Running.
8. Verify the appropriate scan tool Ignition Coil Control Circuit Low Voltage Test Status displays Malfunction.
 - **If Malfunction is not displayed**
 1. Ignition OFF, remove the fused jumper, and 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**
9. Test or replace the T8 Ignition Coil.

Component Test

NOTE: You must perform the Circuit/System Testing before proceeding with Component Testing.

1. Ignition OFF, connect the **EL 26792** HEI spark tester to the appropriate T8 Ignition Coil.
2. Engine Running.
3. Verify the spark output of the T8 Ignition Coil.
 - **If no output or the output is weak**

Replace the T8 Ignition Coil.
 - **Go to next step: If the output is normal**
4. All OK.

Repair Instructions

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

- [Ignition Coil Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup

DTC P0420: CATALYST SYSTEM 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0420

Catalyst System Low Efficiency

Circuit/System Description

A 3-way catalyst controls emissions of hydrocarbons, carbon monoxide (CO) and nitrogen oxide (NOx). The catalyst within the converter promotes a chemical reaction, which oxidizes the hydrocarbons and the CO that are present in the exhaust gas. This process converts the hydrocarbons and the CO into water vapor and carbon dioxide (CO₂), and reduces the NOx, converting the NOx into nitrogen. The catalyst also stores oxygen. The engine control module (ECM) monitors this process by using heated oxygen sensors (HO₂S) that are in the exhaust stream before and after the 3- way catalyst. The HO₂S produces an output signal that the ECM uses to calculate the oxygen storage capacity of the catalyst. This indicates the ability of the catalyst to convert the exhaust emissions efficiently. The ECM monitors the efficiency of the catalyst by monitoring the HO₂S during an off-idle, decel fuel cut off (DFCO) event. When the catalyst is functioning properly, the post catalyst HO₂S response to the fuel conditions during the DFCO event is slow compared to the response of the pre catalyst HO₂S. When the post HO₂S response is near that of the pre HO₂S, the oxygen storage capability and efficiency of the catalyst may be degraded below an acceptable threshold.

Conditions for Running the DTC

- DTC P0030, P0031, P0032, P0036, P0037, P0038, P0053, P0054, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P0131, P0132, P0133, P0135, P0137, P0138, P0141, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P16F3, P2101, P2135, P2270, or P2271 is not set.
- Ignition voltage is between 10 - 32 V.
- HO₂S heater resistance is learned.
- Accelerator pedal position is no more than 3%.
- Mass air flow (MAF) is between 2 - 20 g/s.
- Fuel level is greater than 10%.
- Fuel system is in closed loop.
- Evaporative emissions (EVAP) diagnostics are not in control of purge.
- Predicted catalyst temperature is between 550 - 910Â°C (1, 022 - 1, 670Â°F).
- HO₂S heater is commanded On for greater than 60 s.
- Engine speed is between 1, 900 - 3, 500 RPM to initially enable the test.
- Engine speed is between 1, 850 - 3, 650 RPM to keep the test enabled.
- Vehicle speed is between 66 - 125 km/h (41 - 78 mph) to initially enable the test.
- Vehicle speed is between 58 - 128 km/h (36 - 80 mph) to keep the test enabled.
- Engine is operating in decel fuel cut off (DFCO).

This diagnostic attempts one test during each valid decel fuel cut off period once the above conditions have been met. This diagnostic attempts up to 3 tests during each drive cycle.

Conditions for Setting the DTC

The ECM has detected that the catalyst efficiency has degraded below a calibrated threshold.

Action Taken When The DTC Sets

DTC P0420 is a Type A DTC.

Conditions for Clearing the MIL/DTC

DTC P0420 is a Type A DTC.

Diagnostic Aids

Inspect for the conditions listed below, which may cause a catalyst to degrade:

- Engine misfire
- High engine oil or high coolant consumption
- Retarded spark timing
- Weak or poor spark
- Lean fuel mixture
- Rich fuel mixture
- Damaged oxygen sensor or wiring harness

Reference Information

Electrical Information Reference

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

DTC Types 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 there are no other DTCs set.
 - **If other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **Go to next step: If no other DTCs are set**
3. Operate the vehicle within the Conditions for Running the DTC.
4. Verify the scan tool Catalyst Monitor Not At Idle Test Conditions Met parameter changes to Yes.
 - **If Yes is not displayed**
Refer to step 3.
 - **Go to next step: If Yes is displayed**
5. When the conditions are safe, stop and idle the vehicle in gear if equipped with automatic transmission or neutral if equipped with manual transmission.
6. Verify the Catalyst Monitor Test Result parameter displays Passed when performing the steps listed below:

1. Apply the service brake.
2. Monitor the scan tool Catalyst Monitor Test State parameter. When the parameter indicates Active, the Catalyst Monitor Test is running.

NOTE: When the test has completed, the Catalyst Monitor Test Counter parameter will increment by one and the Catalyst Monitor Test Result parameter will indicate Passed, Failed or No Result.

3. Continue to monitor the parameter. When the parameter indicates Inactive, the Catalyst Monitor Test has completed.

- **If No Result is displayed**

Repeat steps 3 - 6 until the Test Result parameter indicates Passed or Failed

- **If Failed is displayed**

Refer to Circuit /System Testing

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

7. All OK.

Circuit/System Testing

1. Verify the conditions listed below do not exist with the catalytic converter:

- Dents
- Severe discoloration caused by excessive temperatures
- Road damage
- Internal rattles caused by damaged catalyst substrate
- Restrictions

- **If a condition is found**

Replace the catalytic converter.

- **Go to next step: If no condition is found**

2. Verify the conditions listed below do not exist with the exhaust system:

- Leaks
- Physical damage
- Loose or missing hardware

- **If a condition is found**

Repair or replace the component as necessary.

- **Go to next step: If no condition is found**

3. Verify the conditions listed below do not exist with the B52B Heated Oxygen Sensor 2:

- Incorrect torque
- Damage

- **If a condition is found**

Replace the B52B Heated Oxygen Sensor 2 or repair the condition as necessary.

- **Go to next step: If no condition is found**

4. Replace the catalytic converter.

Repair Instructions

- [Warm Up Three-Way Catalytic Converter Replacement \(LYX\)](#), [Warm Up Three-Way Catalytic Converter Replacement \(LTG\)](#)

- [Exhaust Leakage](#)
- [Heated Oxygen Sensor Replacement - Sensor 2](#)
- [Restricted Exhaust](#)

Repair Verification

1. Install any components that have been removed or replaced during diagnosis.
2. Perform any adjustments, programming or setup procedures that are required when a component is removed or replaced.
3. Clear the DTCs with a scan tool.
4. Turn Off the ignition for 60 s
5. Operate the vehicle within the Conditions for Running the DTC.
6. Verify the scan tool Catalyst Monitor Not At Idle Test Conditions Met parameter changes to Yes.
 - **If Yes is not displayed**

Refer to step 5.

- **Go to next step: If Yes is displayed**
7. When the conditions are safe, stop and idle the vehicle in gear if equipped with automatic transmission or neutral if equipped with manual transmission.
 8. Verify the Catalyst Monitor Test Result parameter displays Passed when performing the steps listed below:
 1. Apply the service brake.
 2. Monitor the scan tool Catalyst Monitor Test State parameter. When the parameter indicates Active, the Catalyst Monitor Test is running.

NOTE:

When the test has completed, the Catalyst Monitor Test Counter parameter will increment by one and the Catalyst Monitor Test Result parameter will indicate Passed, Failed or No Result.

3. Continue to monitor the parameter. When the parameter indicates Inactive, the Catalyst Monitor Test has completed.
 - **If No Result is displayed**

Repeat steps 5 - 8 until the Test Result parameter indicates Passed or Failed

 - **If Failed is displayed**

Refer to Circuit /System Testing

 - **Go to next step: If Passed is displayed**
9. All OK.

DTC P0442: EVAPORATIVE EMISSION (EVAP) SYSTEM SMALL LEAK DETECTED

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

DTC Descriptor

DTC P0442

Evaporative Emission (EVAP) System Small Leak Detected

Circuit/System Description

The engine off natural vacuum (EONV) test is the small leak detection diagnostic for the evaporative emission (EVAP) system. This diagnostic tests the EVAP system for a small leak when the key is turned OFF and the correct conditions are met. Heat from the exhaust system is transferred into the fuel tank while the vehicle is operating. When the vehicle is turned OFF and the EVAP system is sealed a change in the fuel tank vapor temperature occurs which results in a corresponding pressure change in the fuel tank vapor space. This change is monitored by the engine control module (ECM) using the fuel tank pressure sensor input. With a leak in the system, the amount of pressure change will be less than that of a sealed system.

Conditions for Running the DTC

- DTCs P010B, P012B, P012C, P012D, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P012B, P012C, P012D, P0222, P0223, P0236, P0237, P0238, P0443, P0446, P0449, P0452, P0453, P0455, P0458, P0459, P0461, P0462, P0463, P0496, P0498, P0499, P0502, P0503, P0722, P0723, P111E, P117D, P017C, P017D, P017B, P117B, P117F, P117E, P117C, P2066, P2067, P2068, P1221, P222B, P222C, P222D, P222E, P262B. are not set.
- The barometric pressure (BARO) is greater than 70 kPa.
- The engine coolant sensor (ECT) is greater than 63Â°C (145Â°F)
- The fuel level is between 10 - 90%.
- The start-up engine coolant temperature (ECT) and the start-up intake air temperature (IAT) are within 8Â°C (14Â°F).
- The engine run time before shut-off was greater than 10 min.
- The drive distance before engine shut-off was greater than 5 km (3 mi).
- The ambient air temperature at the end of the drive cycle is between 0 - 34Â°C (32 - 93Â°F).
- DTC P0442 runs once per drive cycle during the hot soak period after the ignition is turned OFF and may require up to 40 min to complete. The control module will not make more than 2 test attempts per day. The time since the last completed engine off natural vacuum test must be at least 17 h if passed or 10 h if failed.

Conditions for Setting the DTC

- The ECM detects a leak in the EVAP system that is greater than a calibrated amount.
- The ECM must complete several engine off natural vacuum tests before the diagnostic can turn the MIL ON or OFF.

Action Taken When the DTC Sets

DTC P0442 is a Type A DTC.

Conditions for Clearing the DTC

DTC P0442 is a Type A DTC.

Diagnostic Aids

- The EVAP system can be filled with smoke more quickly and completely by opening the system opposite the end where the smoke is injected. When injecting smoke at the service port tool temporarily leave the EVAP Vent Solenoid Valve open until smoke is observed then close the system and continue testing.
- To help locate intermittent leaks using the **GE-41413-A** , move all EVAP components while observing smoke with the **GE-41413-SPT** .
- Individual components can be isolated and tested using adapters in the **GE-41413-300** .
- When servicing the EVAP system, test pressure must not exceed 13 in H2O (0.5 PSI) as pressure in excess of this could cause system components to perform inaccurately.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. This type of leak may be detected by using the scan tool Purge/Seal function to create a vacuum in the EVAP system and then observe the Fuel Tank Pressure Sensor parameter for vacuum decay.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.5L \(LYX\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Powertrain Component View

[Powertrain Component Views](#)

Description and Operation

[Evaporative Emission Control 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

Special Tools

- **CH-48096** EVAP Service Port Access Tool
- **GE-41413 - A** Evaporative Emissions System Tester
- **GE-41413 - SPT** High Intensity White Light
- **GE-41413 - 300** EVAP Cap and Plug Kit

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#) .

[Circuit/System Testing](#)

NOTE:

- Refer to the **GE-41413-A** operation manual for detailed instructions in [Evaporative Emission Control System Diagnosis](#).
- Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize or produce smoke from a leak.
- Ensure that the underbody temperature of the vehicle and the tester are similar.

1. Disconnect the purge tube at the quick connector on the EVAP canister side of the Q12 Evaporative Emission Canister Purge Solenoid Valve and install the **CH-48096** .
2. Connect the **GE-41413-A** to the **CH-48096** .
3. Command the EVAP Purge/Seal function to Not Venting or System Seal with a scan tool to seal the EVAP system.
4. Use the flow meter on the **GE-41413-A** calibrated to 0.51 mm (0.020 in) to determine if there is a leak.
 - If a leak is detected

1. Use the **GE-41413-A** to apply smoke to the EVAP system at the purge tube service port until the leak is located using the **GE-41413-SPT** .

- If leak is detected, repair or replace the affected component as necessary.
- **Go to next step: If no leak is detected**

5. All OK.

Repair Instructions

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

DTC P0443, P0458, OR P0459: EVAPORATIVE EMISSION (EVAP) PURGE SOLENOID VALVE 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.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P0443

Evaporative Emission (EVAP) Purge Solenoid Valve Control Circuit

DTC P0458

Evaporative Emission (EVAP) Purge Solenoid Valve Control Circuit Low Voltage

DTC P0459

Evaporative Emission (EVAP) Purge Solenoid Valve Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P0443, P0458	P0443	P0690	-
Control	P0443, P0458	P0443, P0458	P0459, P0690	-

Circuit/System Description

The evaporative emission (EVAP) purge solenoid valve is used to purge fuel vapor from the EVAP canister to the intake manifold. The EVAP purge solenoid valve is pulse width modulated (PWM). Ignition voltage is supplied directly to the EVAP purge solenoid valve. The engine control module (ECM) controls the solenoid valve 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. A scan tool will display the amount of ON time as a percentage.

Conditions for Running the DTC

- The ignition voltage is greater than 11 V.
- The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

P0443

The ECM detects the EVAP Purge Solenoid Valve control circuit is open within 0.25 s.

P0458

The ECM detects the EVAP Purge Solenoid Valve control circuit is shorted to ground within 0.25 s.

P0459

The ECM detects the EVAP Purge Solenoid Valve control circuit is shorted to voltage within 0.25 s.

Action Taken When the DTC Sets

DTC P0443, P0458 and P0459 are Type B DTCs.

Conditions for Clearing the DTC

DTC P0443, P0458 and P0459 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Powertrain Component View

Powertrain Component Views

Description and Operation

Evaporative Emission Control 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

NOTE: The audible clicking intensity will vary depending on mounting locations and interference with the fuel injectors clicking. You may also feel a change in the frequency of clicking.

1. Ignition ON, verify DTC P0690 is not set.

- **If the DTC is set**

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

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

2. Verify the EVAP Purge Solenoid Valve control circuit status parameters do not display Malfunction while commanding the solenoid from 0% to 50% and back to 0% with a scan tool:

- EVAP Purge Solenoid Valve Control Circuit Open Test Status
- EVAP Purge Solenoid Valve Control Circuit Low Voltage Test Status

- EVAP Purge Solenoid Valve 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. Verify the EVAP Purge Solenoid Valve control circuit status parameters above do not display Malfunction when moving the related harnesses and connectors of the Q12 Evaporative Emission Purge Solenoid Valve.

- **If Malfunction is displayed**

Refer to Circuit/System Testing

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

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 does not set**

5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the Q12 Evaporative Emission Purge Solenoid Valve, ignition ON,

2. Verify that a test lamp illuminates between the ignition voltage circuit terminal 1/A 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, test all components connected to the ignition voltage circuit for a short and replace as necessary.

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

3. Verify that a test lamp does not illuminate between the ignition circuit terminal 1/A and the control circuit terminal 2/B.

- **If the test lamp illuminates**

1. Ignition OFF, remove the test lamp, disconnect the appropriate 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 the test lamp does not illuminate**

4. Remove the test lamp.

5. Verify the scan tool EVAP Purge Solenoid Valve Control Circuit High Voltage Test Status parameter is OK when commanding the EVAP Purge Solenoid Valve to 50% with a scan tool.

- **If OK is not displayed**

1. Ignition OFF, disconnect the appropriate 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 OK is displayed**
6. Install a 3 A fused jumper wire between the control circuit terminal 2/B and the ignition circuit terminal 1/A.
7. Verify the scan tool EVAP Purge Solenoid Valve Control Circuit High Voltage Test Status parameter is Malfunction when commanding the EVAP Purge Solenoid Valve to 50% 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. Test or replace the Q12 Evaporative Emission Purge Solenoid Valve.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the Q12 Evaporative Emission Purge Solenoid Valve.
2. Test for 10-30 Ω between the control terminal 2/B and the ignition circuit terminal 1/A.
 - **If not between 10-30 Ω**

Replace the Q12 Evaporative Emission Purge Solenoid Valve.
 - **Go to next step: If between 10-30 Ω**
3. All OK.

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the Q12 Evaporative Emission Purge Solenoid Valve.
2. Install a 3 A fused jumper wire between the ignition terminal 1/A and 12 V. Install a jumper wire between the control terminal 2/B and ground.
3. Verify the Evaporative Emission Purge Solenoid Valve turns on & off/clicks and flows vacuum.
 - **If it does not turn on & off/click or flow vacuum**

Replace the Q12 Evaporative Emission Purge Solenoid Valve.
 - **Go to next step: If it does turn on & off/clicks and flows vacuum**
4. All OK

Repair Instructions

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

- [Evaporative Emission Canister Purge Solenoid Valve Replacement](#)
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0446: EVAPORATIVE EMISSION (EVAP) VENT SYSTEM 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P0446

Evaporative Emission (EVAP) Vent System Performance

Typical Scan Tool Data

Fuel Tank Pressure Sensor Signal Voltage	Fuel Tank Pressure
1.5 V	Atmospheric Pressure / BARO
Less than 1.5 V	Positive Pressure
More than 1.5 V	Negative Pressure / Vacuum

Circuit/System Description

This DTC tests the evaporative emission (EVAP) system for a restricted or blocked EVAP vent path that would cause excess amounts of vacuum to be developed in the EVAP system. The engine control module (ECM) uses the fuel tank pressure sensor to monitor EVAP system vacuum. With the purge valve and vent valve open, if the EVAP system vacuum goes above a calibrated threshold, P0446 will set.

The following table illustrates the relationship between the ON and OFF states, and the OPEN or CLOSED states of the EVAP purge and vent solenoid valves.

ECM Command	EVAP Purge Solenoid Valve	EVAP Vent Solenoid Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P0068, P00C8, P00C9, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0121, P0122, P0123, P0128, P0191, P0192, P0193, P0222, P0223, P0443, P0601, P0604, P0606, P16A0, P16A1, P16A2, P16F3, P2101, P2135, P2176, are not set.
- The ignition voltage is between 11 - 32 V.
- The barometric pressure (BARO) is more than 70 kPa.
- The fuel level is between 10 - 90%.
- The startup engine coolant temperature (ECT) is less than 35Â°C (95Â°F).
- The startup intake air temperature (IAT) is between 4 - 30Â°C (39 - 86Â°F).
- DTC P0446 runs once per cold start, for up to 17 min, when the above conditions are met.

Conditions for Setting the DTC

NOTE: There are two stages to setting this DTC. Stage one, prep test, then stage two test.

- If fuel tank pressure sensor reading is greater than 2.5 in H₂O of pressure or less than - 5 in H₂O of vacuum for 60 s.

OR

- If fuel tank pressure sensor reading is less than -12 in H₂O of vacuum for 5 s before 10 L (2.6 gal) of purge volume.
- After setting the DTC for the first time, 2 L (0.5 gal) of fuel must be consumed before setting the DTC for the second time.

Action Taken When the DTC Sets

DTC P0446 is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P0446 is a Type B DTC.

Diagnostic Aids

- An intermittent condition could be caused by a damaged EVAP vent housing, a temporary blockage at the EVAP vent solenoid valve inlet, or a pinched vent hose. A blockage in the vent system may also cause a poor fuel fill condition.
- An EVAP canister filter that is restricted can cause this DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

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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

Special Tools

- **CH-41415-30** Fuel Tank Cap Adapter
- **GE-41413-A** Evaporative Emissions System Tester

For equivalent regional tools, refer to **Special Tools (Diagnostic Tools)**, **Special Tools (Mechanical Tools)**.

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0443 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. Ignition OFF, remove the fuel tank filler cap. Ignition ON.
4. Verify the scan tool Fuel Tank Pressure Sensor parameter is between 1.3 - 1.7 V.

- **If not between the 1.3 - 1.7 V**

Refer to P0452, P0453 within [DTC P0451-P0454](#).

- **Go to next step: If between the 1.3 - 1.7 V**

5. Install the fuel tank filler cap. Engine idling at operating temperature for 5 min.
6. Verify the scan tool Fuel Tank Pressure Sensor parameter does not increase to greater than 2.5 V when commanding the EVAP Purge Solenoid Valve to 50%.

- **If greater than 2.5 V**

Refer to Circuit/System Testing.

- **Go to next step: If 2.5 V or less**

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.

- **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: Perform the Circuit/System Verification before proceeding with the Circuit/System Testing.

1. Test for a blockage or restrictions in the EVAP system components listed below and repair as necessary.
 - Evaporative Emission Vent System Hoses
 - Evaporative Emission Canister
 - Q13 Evaporative Emission Vent Solenoid Valve
 - Evaporative Emission Vent Filter
2. Reconnect all previously disconnected EVAP hardware.

NOTE: Refer to the GE-41413-A operation manual for detailed instructions in [Evaporative Emission Control System Diagnosis](#).

3. Remove the fuel fill cap and connect the CH-41415-30 to the fuel tank filler neck. Connect the GE-41413-A to the CH-41415-30.
4. Command the EVAP Purge/Seal function to System Seal with a scan tool to seal the EVAP system.
5. Turn the nitrogen/smoke valve on the GE-41413-A to nitrogen.

NOTE: DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.

6. Use the remote switch to activate the GE-41413-A and pressurize the fuel tank to 5.0 in H₂O.
7. Verify the scan tool Fuel Tank Pressure Sensor parameter is 0 in H₂O when commanding the EVAP Vent Solenoid Valve to OFF.

- **If not 0 in H₂O**

Test for a blockage or a restriction in the EVAP vent hose or inlet. If the inlet or hose test normal, replace the Q13 Evaporative Emission Vent Solenoid Valve.

- **Go to next step: If 0 in H₂O**

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.

- **If the DTC sets**

Refer to step 1 above.

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

9. All OK.

Repair Instructions

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

- [Evaporative Emission Canister Replacement \(FWD\)](#), [Evaporative Emission Canister Replacement \(AWD\)](#)
- [Evaporative Emission Canister Vent Solenoid Valve Replacement](#)
- [Fuel Tank Pressure Sensor Replacement \(FWD\)](#), [Fuel Tank Pressure Sensor Replacement \(AWD\)](#)

DTC P0449, P0498, OR P0499: EVAPORATIVE EMISSION (EVAP) VENT SOLENOID VALVE 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0449

Evaporative Emission (EVAP) Vent Solenoid Valve Control Circuit

DTC P0498

Evaporative Emission (EVAP) Vent Solenoid Valve Control Circuit Low Voltage

DTC P0499

Evaporative Emission (EVAP) Vent Solenoid Valve Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
B+	P0449, P0498	P0449	-
Control	P0449, P0498	P0449	P0499

Circuit/System Description

The evaporative emission (EVAP) vent solenoid valve is a normally open valve. Battery voltage is supplied to the EVAP vent solenoid valve through a fuse. The engine control module (ECM) grounds the EVAP vent solenoid valve control circuit through an internal switch called a driver. The evaporative emission (EVAP) vent solenoid valve is a normally open valve. Battery voltage is supplied to the EVAP vent solenoid valve through a fuse. A scan tool will display the commanded state of the EVAP vent solenoid valve as ON (Not Venting) or OFF (Venting).

Conditions for Running the DTC

The DTCs run continuously.

Conditions for Setting the DTC

P0449

The ECM detects the EVAP Vent Solenoid Valve control circuit is open within 0.25 s.

P0498

The ECM detects the EVAP Vent Solenoid Valve control circuit is shorted to ground within 0.25 s.

P0499

The ECM detects the EVAP Vent Solenoid Valve control circuit is shorted to voltage within 0.25 s.

Action Taken When the DTC Sets

DTC P0449, P0498 and P0499 are Type B DTCs.

Conditions for Clearing the DTC

DTC P0449, P0498 and P0499 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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

NOTE: An audible click may be heard when performing step 2 below.

1. Ignition ON.
2. Verify the EVAP Vent Solenoid Valve control circuit status parameters do not display Malfunction while commanding the solenoid to ON (Not Venting) and OFF (Venting) with a scan tool:
 - EVAP Vent Solenoid Valve Control Circuit Open Test Status
 - EVAP Vent Solenoid Valve Control Circuit Low Voltage Test Status
 - EVAP Vent Solenoid Valve 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. Verify the EVAP Vent Solenoid Valve control circuit status parameters above do not display Malfunction when moving the related harnesses and connectors of the Q13 Evaporative Emission Vent Solenoid Valve.

- **If Malfunction is displayed**

Refer to Circuit/System Testing

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

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

1. Ignition OFF, disconnect the harness connector at the Q13 Evaporative Emission Vent Solenoid Valve, ignition ON.
2. Verify that a test lamp illuminates between the B+ circuit terminal A or 2 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 B+ 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 B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, test all components connected to the B+ circuit for a short and replace as necessary.
 - **Go to next step: If the test lamp illuminates**
3. Verify that a test lamp does not illuminate between the B+ circuit terminal A or 2 and the control circuit terminal B or 1.
 - **If the test lamp illuminates**
 1. Ignition OFF, remove the test lamp, 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 the test lamp does not illuminate**
4. Remove the test lamp.
5. Verify the scan tool EVAP Vent Solenoid Valve Control Circuit High Voltage Test Status parameter is OK when commanding the EVAP Vent Solenoid Valve to ON (Not Venting) with a scan tool.
 - **If OK is not displayed**

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, 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 B or 1 and the B+ circuit terminal A or 2.
7. Verify the scan tool EVAP Vent Solenoid Valve Control Circuit High Voltage Test Status parameter is Malfunction when commanding the EVAP Vent Solenoid Valve to ON (Not Venting) 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. Test or replace the Q13 Evaporative Emission Vent Solenoid Valve.

Component Testing

1. Ignition OFF, disconnect the harness connector at the Q13 Evaporative Emission Vent Solenoid Valve.
2. Test for 10-30 Ω between the control terminal B or 1 and the B+ circuit terminal A or 2.
 - **If not between 10-30 Ω**

Replace the Q13 Evaporative Emission Vent Solenoid Valve.
 - **Go to next step: If between 10-30 Ω**
3. All OK.

Repair Instructions

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

- [Evaporative Emission Canister Vent Solenoid Valve Replacement](#)
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0451, P0452, P0453, OR P0454: FUEL TANK 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0451

Fuel Tank Pressure Sensor Performance

DTC P0452

Fuel Tank Pressure Sensor Circuit Low Voltage

DTC P0453

DTC P0454

Fuel Tank Pressure Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5 V Reference	P0452, *	P0451	P0452, *	P0453, *	-
Signal	P0452	P0451	P0452	P0453	P0451, P0454
Low Reference	-	P0446, P0451	P0453, *	-	P0451
* Additional DTCs may set					

Typical Scan Tool Data**Fuel Tank Pressure Sensor Voltage**

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, Engine OFF Parameter Normal Range: 1.3 - 1.7 V			
5 V Reference	0 V	0 V	4.2 - 5 V
Signal	0 V	0 V	5 V
Low Reference	-	4.5 V	-

Circuit/System Description

The fuel tank pressure sensor measures vapor pressure or vacuum in the evaporative emission (EVAP) system. The engine control module (ECM) supplies a 5 V reference and a low reference circuit to the fuel tank pressure sensor. The fuel tank pressure sensor signal voltage varies depending on EVAP system pressure or vacuum. The controller also uses this fuel tank pressure signal to determine atmospheric pressure for use in the engine-off small leak test, DTC P0442. Before using this signal as an atmospheric reference it must first be re-zeroed.

Conditions for Running the DTC**P0451**

- DTC P0451 runs only when the engine-off natural vacuum small leak test, P0442, executes.
- The number of times this test runs can range from 0 - 2 per engine-off period. The length of the test can be up to 10 min.

P0452 and P0453

DTC P0452 and P0453 run continuously when the ignition is ON.

P0454

- DTC P0454 runs only when the engine-off natural vacuum small leak test, P0442, executes.
- This test can run once per engine-off period. The length of the test can be up to 10 min.
- A refueling event is not detected. A refueling event is confirmed if the fuel level has a persistent change of 10% for 30 s during a 10 min refueling rationality test.

Conditions for Setting the DTC**P0451**

This DTC will set if the controller is unable to re-zero the fuel tank pressure sensor voltage within a calibrated range during the engine-off small leak test, P0442.

P0452

The fuel tank pressure sensor voltage is less than 0.15 V for greater than 10 s.

P0453

The fuel tank pressure sensor voltage is greater than 4.9 V for greater than 10 s.

P0454

If, during the engine-off natural vacuum small leak test, P0442, the ECM detects an abrupt fuel tank pressure signal change, other than a refueling event, this DTC will set. An abrupt change is defined as a change of greater than 0.45 in H₂O (0.11 kPa) in the span of 1 s but less than 1 in H₂O (0.25 kPa) in 12.5 ms. This test must fail twice to set this DTC.

Action Taken When the DTC Sets

- DTCs P0451 and P0454 are Type A DTCs.
- DTCs P0452 and P0453 are Type B DTCs.

Conditions for Clearing the MIL/DTC

- DTCs P0451 and P0454 are Type A DTCs.
- DTCs P0452 and P0453 are Type B DTCs.

Diagnostic Aids

P0451 and P0454

- A restriction in the EVAP canister or vent lines could prevent fuel vapor pressure from bleeding off fast enough. If the vent system cannot bleed off pressure fast enough, the re-zero procedure may not complete successfully, which could cause this DTC to set.
- Ensure that the reference port on the fuel tank pressure sensor is unobstructed.
- A fuel tank pressure sensor that is skewed or does not have a linear transition from low to high may cause this DTC to set. Scan tool control functions, snapshot, and plot functions can help detect erratic sensor response. To test the sensor signal under vacuum conditions, use the Quick Snapshot and the Purge/Seal functions to capture data while commanding purge to 20%, then plot the data to look for erratic sensor operation. A similar test can be done for the pressure side of the sensor operation by applying pressure with the **GE-41413-A** while taking a snapshot.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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

Special Tools

- **GE-41413-A** Evaporative Emission System Tester
- **GE-41415-60** Engine Induction System Leak Test Adapter/Capless Fuel Fill Adapter

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify DTC P0641, P0651, P0697, P06A3, or P06D2 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. Remove the fuel cap or install **GE-41415-60** for capless fuel fill, if equipped.
4. Ignition ON, engine OFF.
5. Verify the scan tool Fuel Tank Pressure sensor parameter is between 1.3 and 1.7 V.
 - **If not between 1.3 - 1.7 V**
Refer to Circuit/System Testing.
 - **Go to next step: If between 1.3 - 1.7 V**
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](#)

1. Ignition OFF, all vehicle systems OFF, this may take up to 2 min, for all vehicle systems to power down. Disconnect the harness connector at the B150 Fuel Tank Pressure Sensor.
2. Test for less than 5 Ω of resistance 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. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 3 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 Fuel Tank Pressure parameter is less than 0.2 V.
 - **If 0.2 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 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 less than 0.2 V**
- 6. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the 5 V reference circuit terminal 3.
- 7. Verify the scan tool Fuel Tank Pressure sensor parameter is greater than 4.7 V.
 - **If 4.7 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 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 greater than 4.7 V**
- 8. Test or replace the B150 Fuel Tank Pressure Sensor.

Repair Instructions

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

- [Fuel Tank Pressure Sensor Replacement \(FWD\)](#), [Fuel Tank Pressure Sensor Replacement \(AWD\)](#).
- [Control Module References](#) for control module replacement, programming and setup

DTC P0455: EVAPORATIVE EMISSION (EVAP) SYSTEM LARGE LEAK DETECTED

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

DTC P0455**Evaporative Emission (EVAP) System Large Leak Detected****Circuit/System Description**

The engine control module (ECM) tests the evaporative emission (EVAP) system for a large leak or restrictions to the purge path in the EVAP system. When the enabling criteria has been met, the ECM commands the EVAP vent solenoid valve and purge solenoid valve ON, allowing vacuum into the EVAP system. The ECM monitors the fuel tank pressure sensor voltage to verify that the system is able to reach a predetermined level of vacuum within a set amount of time.

Conditions for Running the DTC

- DTCs P00C8, P00C9, P010C, P010D, P16A0, P16A1, P16A2, P160E, P160D, P16F3, P0068, P0101, P0102, P0103, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0122, P0123, P0125, P0128, P0191, P0192, P0193, P0222, P0223, P0443, P0449, P0452, P0453, P0454, P0502, P0503, P0601, P0604, P0606, P0722, P0723, P1104, P1682, P2100, P2101, P2102, P2103, P2135, P2176, P2227, P2228, P2229, P2230 are not set.
- The ignition voltage is between 11 - 32 V.
- The barometric pressure (BARO) is greater than 70 kPa.
- The fuel level is between 10 - 90%.
- The cold startup engine coolant temperature (ECT) and the startup intake air temperature (IAT) are within 8Â°C (14Â°F).
- The startup engine coolant temperature (ECT) is less than 35Â°C (95Â°F).
- The startup intake air temperature (IAT) is between 4 - 34Â°C (39 - 93Â°F).
- DTC P0455 runs once per cold start, shortly after purge is enabled followed by vent system performance test P0446.

Conditions for Setting the DTC

- The EVAP system is not able to achieve or maintain a calibrated level of vacuum before a calibrated amount of purge volume has passed through the system.
- After setting the DTC for the first time, 2 L (0.5 gal) of fuel must be consumed before setting the DTC for the second time.
- With a DTC P0455 detected a weak vacuum follow-up test (fuel cap replacement test) will run and pass if tank vacuum is greater than 2.74 kPa (11 in H₂O). This test will run for a maximum of 21 min. This test runs until it passes.

Action Taken When the DTC Sets

DTC P0455 is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P0455 is a Type B DTC.

Diagnostic Aids

- Inspect for a loose, missing, damaged, or incorrect fuel fill cap.
- Inspect for a damaged fuel filler neck seal surface.
- A blockage or restriction in the EVAP purge solenoid valve, purge pipe, EVAP canister, or vapor pipe, can cause this DTC to set.
- The EVAP system can be filled with smoke more quickly and completely by opening the system opposite the end where the smoke is injected. For example, when injecting smoke at the service port remove the fuel fill cap, or temporarily leave the vent open, until smoke is observed, then close the system and continue testing. If using a fuel cap adapter at the filler neck, use the **J-41413-VLV** at the service port to allow the system to fill faster.

- To help locate intermittent leaks using the **GE-41413-A** move all EVAP components while observing smoke with the **GE-41413-SPT** .
- Individual components can be isolated and tested using adapters in the **J-41413-300** .
- When servicing the EVAP system, test pressure must not exceed 13 in H2O (0.5 PSI) as pressure in excess of this could cause system components to perform inaccurately.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. This type of leak may be detected by using the scan tool Purge/Seal function to create a vacuum in the EVAP system and then observe the fuel tank pressure sensor parameter for vacuum decay.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

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Powertrain Component Views

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Evaporative Emission Control System Description

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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

Special Tools

- **CH-48096** EVAP Service Access Port Tool
- **GE-41413-A** Evaporative Emissions System Tester
- **GE-41413-SPT** High Intensity White Light
- **GE-41415-30** Fuel Tank Cap Adapter
- **GE-41415-60** Engine Induction System Leak Test Adapter/Capless Fuel Fill Adapter
- **J-41413-300** EVAP Cap and Plug Kit
- **J-41413-311** EVAP Plug (Brass Nozzle)
- **J-41413-VLV** EVAP Service Port Vent Fitting

For equivalent regional tools, refer to **Special Tools (Diagnostic Tools)** **Special Tools (Mechanical Tools)**.

Circuit/System Testing

NOTE:

- **Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize or**

produce smoke from a leak.

- Refer to the GE-41413-A operation manual for detailed instructions in [Evaporative Emission Control System Diagnosis](#).

1. Disconnect the purge tube at the quick connector on the EVAP canister side of the purge solenoid valve and install the **CH-48096**.
2. Connect the **GE-41413-A** to the vehicle EVAP service port adapter.
3. Ignition ON, command the EVAP Purge/Seal function to Not Venting or System Seal with a scan tool to seal the EVAP system.
4. Verify that there is no leak in the EVAP system using the flow meter on the **GE-41413-A**, calibrated to 0.51 mm (0.020 in).

- **If a leak is detected**

1. Apply smoke to the EVAP system at the service access port adapter with the **GE-41413-A**.
2. Locate the leak using the **GE-41413-SPT**.

- When the leak is located, repair or replace the affected component as necessary.

- **Go to next step: If no leak detected**

NOTE: The steps below test for a restriction in the purge path.

5. Connect the **GE-41413-A** nitrogen/smoke hose to the **J-41413-311** or **GE-41415-60** for capless vehicles.
6. Disconnect the hose at the fuel cap end of the **GE-41415-30** and connect to the **J-41413-311**.
7. Install the **GE-41415-30**, filler neck end only, or **GE-41415-60** to the vehicle.
8. Engine idling, command the Purge/Seal function to Not Venting or System Seal with a scan tool to seal the system.

NOTE: The scan tool will abort purge when a predetermined value is reached. This is to prevent damage to the fuel tank.

9. Command the EVAP Purge Solenoid Valve to 10-30% with a scan tool.
10. Verify the vacuum/pressure gauge on the **GE-41413-A** and the scan tool Fuel Tank Pressure Sensor parameter both show vacuum.

- **If the vacuum/pressure gauge shows vacuum but the Fuel Tank Pressure Sensor parameter does not show vacuum**

Replace the B150 Fuel Tank Pressure Sensor.

- **If both do not show vacuum**

Repair the restriction in the purge path.

- **Go to next step: If both show vacuum**

11. Verify that the Fuel Tank Pressure Sensor parameter increases to greater than 3.2 V, and the pressure values are similar between the scan tool Fuel Tank Pressure Sensor and the vacuum/pressure gauge on the **GE-41413-A**.

- **If not within the specified range**

Replace the B150 Fuel Tank Pressure Sensor.

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

12. All OK

Repair Instructions

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

- [Fuel Tank Pressure Sensor Replacement \(FWD\)](#), [Fuel Tank Pressure Sensor Replacement \(AWD\)](#).
- [Control Module References](#) for control module replacement, programming and setup.

DTC P0496: EVAPORATIVE EMISSION (EVAP) SYSTEM FLOW DURING NON-PURGE

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

DTC Descriptor

DTC P0496

Evaporative Emission (EVAP) System Flow During Non-Purge

Circuit/System Description

This DTC tests for undesired intake manifold vacuum flow to the evaporative emission (EVAP) system. The engine control module (ECM) seals the EVAP system by commanding the EVAP purge solenoid valve OFF and the vent solenoid valve ON. The ECM monitors the fuel tank pressure sensor to determine if a vacuum is being drawn on the EVAP system. If vacuum in the EVAP system is more than a predetermined value within a predetermined time, this DTC sets.

The following table illustrates the relationship between the ON and OFF states, and the Open or Closed states of the EVAP purge and vent solenoid valves.

ECM Command	EVAP Purge Solenoid Valve	EVAP Vent Solenoid Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P00C8, P00C9, P010C, P010D, P16A0, P16A1, P16A2, P160E, P160D, P16F3, P0068, P0101, P0102, P0103, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0122, P0123, P0125, P0128, P0191, P0192, P0193, P0222, P0223, P0443, P0449, P0452, P0453, P0454, P0502, P0503, P0601, P0604, P0606, P0722, P0723, P1104, P1682, P2100, P2101, P2102, P2103, P2135, P2176, P2227, P2228, P2229, P2230 are not set.
- The ignition voltage is between 11 - 32 V.
- The engine OFF time is greater than 8 h,
- The barometric pressure (BARO) is greater than 70 kPa.
- The fuel level is between 10 - 90%.
- The startup engine coolant temperature (ECT) is less than 35Â°C (95Â°F).
- The startup intake air temperature (IAT) is between 4 - 30Â°C (39 - 86Â°F).
- DTC P0496 runs once per cold start, for up to 17 min, when the above conditions are met.

Conditions for Setting the DTC

The ECM detects more than 10 in H₂O vacuum for 5 s during a non-purge condition.

Action Taken When the DTC Sets

DTC P0496 is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P0496 is a Type B DTC.

Diagnostic Aids

An intermittent condition could be caused by an improperly installed or damaged EVAP purge solenoid valve or by a temporary blockage or restriction in the EVAP purge solenoid valve.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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. 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.
2. 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**

3. All OK

Circuit/System Testing

1. Ignition ON, engine OFF.
2. Seal the EVAP system using the Purge/Seal function with a scan tool.
3. Start the engine.
4. Observe the fuel tank pressure sensor with a scan tool. The Fuel Tank Pressure Sensor parameter should be less than 1.7 V after 90 s.

- **If not within specifications**

Replace the Q12 Evaporative Emission Purge Solenoid Valve

- **Go to next step: If within Specifications**

5. All OK

Repair Instructions

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

Evaporative Emission Canister Purge Solenoid Valve Replacement

DTC P0506 OR P0507: IDLE SPEED LOW OR 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0506

Idle Speed Low

DTC P0507

Idle Speed High

Circuit/System Description

The throttle actuator control (TAC) motor is a DC motor that is part of the throttle body assembly. The TAC motor drives the throttle valve. The engine control module (ECM) controls the TAC motor based on throttle position sensor input. The idle speed is controlled by the ECM based on various inputs. The ECM commands the TAC motor to open or close the throttle valve in order to maintain the desired idle speed.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171, P0172, P0174, P0175, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0300 - P0306, P0351 - P0356, P0461 - P0464, P0496, P0627, P0628, P0629, P0722, P1516, P2066 - P2068, are not set.
- The barometric pressure (BARO) is greater than 70 kPa.
- The engine coolant temperature (ECT) is warmer than 60°C (140°F).
- The engine run time is greater than 60 s.
- The ignition voltage is between 11 - 32 V.
- The transmission is not changing gears.
- The torque converter clutch (TCC) is not changing states.
- The intake air temperature (IAT) is warmer than -20°C (-4°F).
- The vehicle speed is less than 3 km/h (2 mph).
- The commanded engine speed is steady within 25 RPM.
- The engine is idling for greater than 5 s.
- The DTCs run when the above conditions are met.

Conditions for Setting the DTC

P0506

The actual engine speed is 94 RPM less than the desired idle speed for 10 s.

P0507

The actual engine speed is 188 RPM greater than the desired idle speed for 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

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Throttle Actuator Control (TAC) 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 there are no other DTCs 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**
3. Verify the scan tool Throttle Body Idle Airflow Compensation parameter is less than 90 %.
 - **If 90 % or greater**
Refer to Throttle Body Inspection and Cleaning .
 - **Go to next step: If less than 90 %**
4. Engine Idling at the normal operating temperature.
5. Verify the actual Engine Speed is not 100 RPM less than the Desired Idle Speed.
 - **If 100 RPM less than the Desired Idle Speed**
Refer to Circuit/System Testing.
 - **Go to next step: If 100 RPM greater than the Desired Idle Speed**
6. Verify the actual Engine Speed is not 200 RPM greater than the Desired Idle Speed.
 - **If 200 RPM greater than the Desired Idle Speed**
Refer to Circuit/System Testing.

- **Go to next step: If 200 RPM less than the Desired Idle Speed**

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**

Refer to Circuit/System Testing.

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

9. All OK

Circuit/System Testing

P0506

1. Verify the conditions listed below do not exist.

- 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 the conditions listed below do not exist.

- Vacuum leaks
- A throttle valve that does not close correctly
- Verify the correct operation of the crankcase ventilation system. Inspect for the conditions listed below:
 - Improper routing of the positive crankcase ventilation (PCV) system
 - Vacuum leaks in the PCV system - Refer to [Crankcase Ventilation System Inspection/Diagnosis](#).
- **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.

Throttle Body Assembly Replacement

DTC P050D: COLD START ROUGH IDLE

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

DTC Descriptor

Cold Start Rough Idle**Circuit/System Description**

During a cold start, the engine control module (ECM) commands dual-pulse mode during Open Loop operation to improve cold start emissions. In dual-pulse mode, the injectors are energized twice during each injection event. As with misfire diagnosis, in dual-pulse mode the ECM monitors the crankshaft position sensor and the camshaft position sensors to calculate crankshaft rotation speed. In normal operation, optimum fuel delivery during dual-pulse mode produces a steady crankshaft rotation speed. If the variations exceed a calibrated value, the code will be set.

Conditions for Running the DTC

- DTCs P0010, P0011, P0013, P0014, P0020, P0021, P0023, P0024, P0090, P0091, P0092, P00C8, P00C9, P00CA, P0101 - P0103, P0106 - P0108, P010B, P010C, P010D, P0112, P0113, P0117, P0118, P0119, P0122, P0123, P0128, P0192, P0193, P0201 - P0204, P0205, P0206, P0207, P0208, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0335, P0336, P0351 - P0354, P0355, P0356, P0357, P0358, P0502, P0503, P0506, P0507, P05CC, P05CD, P05CE, P05CF, P0627, P0628, P0629, P0697, P06A3, P0722, P0723, P0806, P0807, P0808, P111E, P1248, P1249, P124A, P127C, P127D, P124B, P128A, P128B, P128F, P16A0, P16A1, P16A2, P16E4, P16E5, P16F3, P182E, P1824, P182A, P182B, P182C, P182D, P182F, P1838, P1839, P1840, P1841, P18B5, P18B6, P18B7, P18B8, P18B9, P18BA, P18BB, P18BC, P18BD, P18BE, P18BF, P18C0, P18C1, P18C2, P18C3, P1915, P2088, P2089, P2090, P2091, P2092, P2093, P2094, P2095, P2122, P2123, P2127, P2128, P2135, P2138, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P216B, P216C, P216E, P216F, P217B, P217C, P217E, P217F, P1248, P1249, P124A, P124B, P124C, P124D, P124E, P124F, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310, P2312, P2313, P2315, P2316, P2318, P2319, P2321, P2322 are not set.
- The catalyst temperature is less than 350Â°C (662Â°F).
- The engine coolant temperature is between -15 - 56Â°C (5 - 132.8Â°F).
- The barometric pressure is greater than 76 kPa.
- The engine speed is between 450 - 2200 RPM.
- The accelerator pedal position is less than 110%.
- The engine is running for less than 30 s and a cold start has been detected.
- DTC P050D runs once per cold start.

Conditions for Setting the DTC

This DTC will set if the ECM detects variations in crankshaft rotation speed caused by the lack of adequate fuel delivery during dual-pulse mode.

Action Taken When the DTC Sets

- DTC P050D is a Type B DTC.
- The ECM disables dual pulse mode and energizes the fuel injector as it would for a warm engine.

Conditions for Clearing the DTC

DTC P050D is a Type B DTC.

Diagnostic Aids

- This DTC may be set with a misfire DTC, however the existence of this DTC is a higher priority and indicates the condition to diagnose is related to fuel and/or injectors, not the ignition/spark system.
- A restricted fuel injector may cause this DTC to set.
- High resistance in the circuits of the injectors could set this DTC without setting an injector DTC. Test the injector circuits of the affected cylinders for a high resistance if you suspect a condition.
- A drop in system voltage during cold start may set this DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

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Powertrain Component View

Powertrain Component Views

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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

NOTE: **Circuit/System Verification requires cold start. Do not start vehicle prior to connecting scan tool and preparing to evaluate the condition during engine crank.**

1. Engine Cranking, start the engine and verify that the scan tool Cylinder 1-4 Current Misfire Counters are not incrementing during first 500 engine cycles.
 - **If Cylinder 1-4 Current Misfire Counters are incrementing**
Refer to Circuit/System Testing.
 - **Go to next step: If Cylinder 1-4 Current Misfire Counters are not incrementing**
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. Verify that the fuel pressure is not too low or too high - Refer to Fuel System Diagnosis.
 - **If a condition is found**
Repair or replace components as necessary
 - **Go to next step: If the fuel pressure is OK**
2. Verify that the fuel is not contaminated - Refer to Alcohol/Contaminants-in-Fuel Diagnosis.

- If the fuel is contaminated

Clean the fuel system - Refer to [Fuel System Cleaning](#) .

- Go to next step: If the fuel is not contaminated

3. Replace fuel injectors as indicated by high misfire counts.

Repair Instructions

Fuel Injector Replacement

Repair Verification

NOTE: Repair Verification requires cold start.

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Turn OFF the ignition for 60 s.
5. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) and perform the appropriate diagnostic procedure.

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

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 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
5 V Reference	P057C, P0651*	P057C	P0651*	-
Signal	P057C	P057C	P057D	P057B
Low Reference	-	P057D	-	-
* Additional DTCs may set.				

Brake Pedal Position Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition=On Parameter Normal Range: 0.25 to 4.75 V			
5 V Reference	0 V	0 V	2.2 V
Signal	0 V	0 V	5 V
Low Reference	-	5 V	-

Circuit/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 ground.
Low Reference	Grounded through the control module.

Component	Description
B22 Brake Pedal Position Sensor	The input voltage varies depending on the position of the sensor.
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.

The pedal assembly contains 2 potentiometer-type brake pedal position sensors. When the pedal is pressed, the voltage of one sensor goes up and the voltage of the other sensor goes down.

Conditions for Running the DTC**P057B**

- DTC P057C, P057D = Not set
- Ignition Voltage = Greater than 10 V
- Shift Lever = Park - At least 1 time(s) during the ignition cycle
- Shift Lever = Not in Park
- Vehicle Speed = Greater than 8 km/h (5 MPH)
- Accelerator Pedal Position = Less than 5%

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

P057C, P057D, P057E

Ignition Voltage = Greater than 10 V

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

Conditions for Setting the DTC**P057B**

Brake Pedal Position Sensor = Stuck in range - For greater than 1 s

P057C

Brake Pedal Position Sensor = Less than 0.25 V- For greater than 1 s

P057D

Brake Pedal Position Sensor = Greater than 4.75 V - For greater than 1 s

P057E

Brake Pedal Position Sensor = Signal noisy or erratic

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 1.5L (LYX)

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

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify the scan tool parameter:Brake Pedal Position Sensor = 0.26 to 4.74 V
 - **If not between 0.26 and 4.74 V**

Refer to: Circuit/System Testing
 - **Go to next step: If between 0.26 and 4.74 V**
3. Verify the scan tool parameter:Brake Pedal Position Sensor = The value should change while moving the sensor through the entire range.
 - **If the value does not change**

Refer to: Circuit/System Testing
 - **Go to next step: If the value changes**
4. Verify the scan tool parameter:Brake Pedal Position Sensor = The value should not spike or drop out.

Perform the action while monitoring the parameter:

- Wiggle the harness and connector:B22 Brake Pedal Position Sensor
- Wiggle the harness and connector: K20 Engine Control Module

- **If the value spikes or drops out**

Repair as necessary - Wiring / Terminal(s) / Electrical Connector(s)

- **Go to next step: If the value does not spike or drop out**

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.

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**

6. 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: B22 Brake Pedal Position Sensor

3. Test for less than 10 ohms between the test points: Low Reference circuit terminal 6 & Ground

- **If 10 ohms or greater**

1. Disconnect the appropriate electrical connector: K20 Engine Control Module

2. Test for less than 2 ohms between the test points: Low Reference circuit terminal 6

@Component harness & The other end of the circuit@ Control module harness

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

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

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 5 & Low Reference circuit terminal 6

- **If less than 4.8 V**

1. Ignition/Vehicle - Off

2. Disconnect the appropriate electrical connector: K20 Engine Control Module

3. Test for infinite resistance between the test points: 5 V Reference circuit terminal 5 @ 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 ohms between the test points: 5 V Reference circuit terminal 5 @ Component harness & The other end of the circuit@ Control module harness

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

- **If greater than 5.2 V**

1. Ignition/Vehicle - Off

2. Disconnect the appropriate 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 5 @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:Brake Pedal Position Sensor = Less than 0.25 V

- **If 0.25 or greater**

1. Ignition/Vehicle - Off
2. Disconnect the appropriate 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 4 @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 less than 0.25 V**

7. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 4 & 5 V Reference circuit terminal 5

8. Verify the scan tool parameter:Brake Pedal Position Sensor = Greater than 4.8 V

- **If 4.8 V or less**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
2. Disconnect the appropriate electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points:Signal circuit terminal 4 @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 ohms between the test points:Signal circuit terminal 4 @Component harness & The other end of the circuit@Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module

- **Go to next step: If greater than 4.8 V**

9. Test or replace the component:B22 Brake Pedal Position Sensor

Repair Instructions

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

- [Brake Pedal Position Sensor Replacement](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0601, P0602, P0603, P0604, P0606, P062B, P062F, P0630, P16F3, OR P262B: CONTROL MODULE 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.
- [Diagnostic Procedure Instructions](#) provides 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

Control Module Power Off Timer Performance

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 1.5L (LYX)

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.

[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.
- [Diagnostic Procedure Instructions](#) provides 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	P0628, P12A6	P0506, P0627, P0629, P12A6	P0627, P0629, P12A6	P12A6

Circuit/System Description

The engine control module (ECM) provides ignition voltage to the fuel pump driver control module whenever the engine is cranking or running. The ECM enables the fuel pump driver control module as long as the engine is cranking or running, and ignition system reference pulses are received. While this enable voltage is being received, the fuel pump driver control module supplies a varying voltage to the in-tank fuel pump module in order to maintain the desired fuel line pressure.

Conditions for Running the DTC

- The engine speed is greater than 0 RPM.
- The ignition voltage is greater than or equal to 11 V.
- The fuel pump enable circuit is commanded ON.

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 2.5 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.

Diagnostic Aids

An open in the fuel pump driver control module ground circuit may set DTCs P0627 and P0629.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

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. Verify that DTC P0627, P0628, or P0629 is not set.
 - **If a DTC is set**

Refer to Circuit/System Testing.
 - **Go to next step: If a DTC is not set**
3. 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**
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 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 2 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 2 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. Test or replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

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

- **Fuel Pump Power Control Module Replacement (FWD)**, **Fuel Pump Power Control Module Replacement (AWD)**
- **Control Module References** for control module replacement, programming and setup.

DTC P0641, P0651, P0697, P06A3, OR P06D2: 5V REFERENCE 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.
- **Diagnostic Procedure Instructions** provides 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

DTC P06D2

5V Reference 5 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, P06A3, and P06D2 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P0641, P0651, P0697, P06A3, and P06D2 are Type A DTCs.

Diagnostic Aids

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

- Air conditioning (A/C) refrigerant pressure sensor
- Exhaust and intake camshaft position sensors
- Manifold absolute pressure/air temperature sensor
- Fuel pressure sensor

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

- Engine oil pressure sensor
- Crankshaft position sensor

- Brake pedal position sensor
- Brake booster vacuum sensor
- Turbocharger boost 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
- Throttle position sensor

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

- Fuel rail pressure sensor
- Multifunction intake air sensor
- Fuel tank 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 1.5L (LYX)

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 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.

- [Air Conditioning Cycling and Fan Control Refrigerant Pressure Sensor Replacement](#)
- [Camshaft Position Sensor Replacement - Exhaust](#)
- [Camshaft Position Sensor Replacement - Intake](#)
- [Intake Air Pressure and Temperature Sensor Replacement](#)
- [Engine Oil Pressure Sensor Replacement](#)
- [Crankshaft Position Sensor Replacement \(FWD\)](#), [Crankshaft Position Sensor Replacement \(AWD\)](#).

- [Brake Pedal Position Sensor Replacement](#)
- [Power Brake Booster Vacuum Pipe Replacement \(LYX\)](#)
- [Accelerator Pedal Assembly Replacement](#)
- [Throttle Body Assembly Replacement](#)
- [Fuel Injection Fuel Rail Fuel Pressure Sensor Replacement](#)
- [Intake Air Pressure and Temperature Sensor Replacement](#) for turbocharger boost/intake air temperature sensor replacement.
- [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.
- [Diagnostic Procedure Instructions](#) provides 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](#)
- [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 71 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 71 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 71 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 8 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.

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

DTC P0685, P0686, P0687, P0689, P0690, OR P1682: ENGINE CONTROLS IGNITION RELAY 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 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

DTC P1682

Ignition 1 Switch Circuit 2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ - Relay Coil	P0689, P1682	P0685, P0689, P1682, P16A7, P16AF	-	-

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ - Relay Switch	P0689, P1682	P0685, P0689, P1682, P16A7, P16AF	-	-
Control - Component	P0689, P1682	P0689, P1682, P16A7, P16AF	P0690, P16B3	-
Control - Relay Coil	P0686, P0690	P0685, P0689, P1682, P16A7, P16AF	P0685, P0687, P0689, P1682*	-
* Internal control module or component damage may occur if the circuit shorts to B+.				

Circuit/System Description

Circuit	Description
B+ - Relay Coil	Supplied directly from the battery.
B+ - Relay Switch	Supplied directly from the battery.
Control - Component	The output circuit is switched to 12 V to activate the component.
Control - Relay Coil	The output circuit is switched to ground to activate the component.

Components

Component	Description
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.
KR75 Engine Controls Ignition Relay	Relays are used to control a high power circuit with a low power signal.

4 ignition voltage circuits supply the ECM. The 4 circuits are supplied by 2 relay(s):

- KR73 Ignition Main Relay
- KR75 Engine Controls Ignition Relay

The ECM monitors and compares the voltages supplied by the relay(s).

Conditions for Running the DTC

P0685, P0686, P0687

Ignition Voltage = Greater than 11 V

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

P0689

- Ignition Voltage = Greater than 9 V
- Engine Controls Ignition Relay Command = On

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

P0690

- DTC P0685 = Not set
- Engine Controls Ignition Relay Command = Off - For greater than 2 s

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

P1682

- Engine Controls Ignition Relay Command = On
- Ignition Voltage = Greater than 5.5 V

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

Conditions for Setting the DTC

P0685, P0686, P0687

Commanded state does not match the actual state - For greater than 2 s

P0689

Engine Controls Ignition Relay Feedback Circuit = Less than 5 V - For greater than 5 s

P0690

Engine Controls Ignition Relay Feedback Circuit = Greater than 4 V - For greater than 5 s

P1682

The following parameters are not within 3 V of each other:

- Ignition 1 Signal
- Engine Controls Ignition Relay Feedback Signal
- Engine Controls Ignition Relay Feedback 2 Signal

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C DTC - Exceptions listed below

DTC P1682 = Type A DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C DTC - Exceptions listed below

DTC P1682 = Type A DTC

Diagnostic Aids

If the condition is intermittent, wiggle the related wiring harnesses and connectors, with the ignition/vehicle on or engine running, while monitoring the scan tool circuit status parameters for the component. The parameters will display if there is a condition with the circuit or a connection.

Reference Information

Schematic Reference

- [Engine Controls Wiring Schematics 1.5L \(LYX\)](#)
- Power Distribution Wiring Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Electrical Center Identification Views](#)

- Relay Replacement (Attached to Wire Harness) Relay Replacement (Within an Electrical Center)
- 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 P0685, P0686, P0687, P0689, P0690, P1682 is not set.
 - **If DTC P0685, P0686, P0687, P0689, P0690, P1682 is set**

Refer to: Circuit/System Testing

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

3. Ignition/Vehicle - Cycle On and Off

Verify the component produces a clicking sound:KR75 Engine Controls Ignition Relay

- **If the component does not produce a sound**

Refer to: Circuit/System Testing

- **Go to next step: If the component produces a sound**

4. Verify the following parameters are within 3 V of each other:

- Ignition 1 Signal
- Engine Controls Ignition Relay Feedback Signal
- **If not within 3 V of each other**

Refer to: Circuit/System Testing

- **Go to next step: If within 3 V of each other**

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.

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**

6. All OK.

Circuit/System Testing

1. Ignition/Vehicle - Off
2. Remove the component:KR75 Engine Controls Ignition Relay
3. Verify a test lamp turns On between the test points:
 - B+ circuit terminal 3 & Ground
 - B+ circuit terminal 1 & Ground
 - **If the test lamp does not turn On**

- **Go to next step: If the test lamp turns On**

4. Ignition - On / Vehicle - In Service Mode

5. Connect a test lamp between the test points:Control circuit terminal 2 & B+ circuit

6. Perform the scan tool control function:Engine Controls Ignition Relay - On and Off

Verify the test lamp turns On and Off.

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

1. Ignition/Vehicle - Off & Remove - Test lamp

2. Disconnect the electrical connector:X1 @ 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 2 @ Relay Socket & Terminal 67 @ Control module harness

- 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 ohms between the test points:Control circuit terminal 2 @Relay Socket & Terminal 67 @ Control module harness

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

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

1. Ignition/Vehicle - Off & Remove - Test lamp

2. Disconnect the electrical connector:X1 @ K20 Engine Control Module

3. Test for infinite resistance between the test points:Control circuit terminal 2 @ Relay Socket & 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 turns On and Off**

7. Verify the fuse is not open:

- F14UA Fuse
- F20UA Fuse

- **If the fuse is open**

1. Ignition/Vehicle - Off

2. Disconnect the electrical connector: X1 @ K20 Engine Control Module

3. Test for infinite resistance between the test points:Output terminal @ F20UA Fuse & Ground

- If less than infinite resistance - Repair the short to ground on the circuit.
- If infinite resistance - Replace the component: K20 Engine Control Module

8. Disconnect the electrical connector: X3 @ K20 Engine Control Module

9. Test for infinite resistance between the test points:Output terminal @ F14UAFuse & 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 fuse is not open**

10. Ignition - On / Vehicle - In Service Mode

11. Verify a test lamp does not turn On between the test points:Control circuit terminal 2 & Ground

- **Go to next step: If the test lamp turns On**

12. Disconnect the electrical connector: X1 & X3 @ K20 Engine Control Module

13. Test for less than 1 V between the test points:

- Control circuit terminal 73 @ Control module harness & Ground

- Control circuit terminal 16 @ Control module harness & Ground
- **If 1 V or greater**

Repair the short to voltage on the circuit.

- **Go to next step: If less than 1 V**
- **Go to next step: If the test lamp does not turn On**

14. Ignition/Vehicle - Off

15. Connect a 30 A fused jumper wire between the test points:Control circuit terminal 5 & B+ circuit terminal 3

16. Ignition - On / Vehicle - In Service Mode

17. Verify the scan tool parameter:Engine Controls Ignition Relay Feedback Signal = Within 1 V of the battery voltage

- **If not within 1 V of the battery voltage**

1. Ignition/Vehicle - Off & Remove - Jumper wire(s)

2. Disconnect the electrical connector: X1 & X3 @ K20 Engine Control Module

3. Test for less than 2 ohms between the test points:

- Control circuit terminal 5 @Relay Socket & Control circuit terminal 73 @ Control module harness
- Control circuit terminal 5 @Relay Socket & Control circuit terminal 16 @ Control module harness
- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component: K20 Engine Control Module

- **Go to next step: If within 1 V of the battery voltage**

18. Test or replace the component:KR75 Engine Controls Ignition Relay

Component Testing

Relay Test

1. Ignition/Vehicle - Off

2. Remove the component:KR75 Engine Controls Ignition Relay

3. Test for 70 to 110 ohms between the test points:B+ circuit terminal 1 & Control circuit terminal 2

- **If not between 70 and 110 ohms**

Replace the component:KR75 Engine Controls Ignition Relay

- **Go to next step: If between 70 and 110 ohms**

4. Test for infinite resistance between the test points:

- Component terminal 3 & 1
- Component terminal 3 & 2
- Component terminal 3 & 5
- Component terminal 1 & 5
- **If less than infinite resistance**

Replace the component:KR75 Engine Controls Ignition Relay

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

5. Connect a 3 A fused jumper wire between the test points:B+ circuit terminal 1 & B+

Connect a jumper wire between the test points:Control circuit terminal 2 & Ground

6. Test for less than 2 ohms between the test points:Control circuit terminal 5 & B+ circuit terminal 3

- **If 2 ohms or greater**

Replace the component:KR75 Engine Controls Ignition Relay

- Go to next step: If less than 2 ohms

7. All OK.

Repair Instructions

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

- [Engine Wiring Harness Junction Block Replacement](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P0700: TRANSMISSION CONTROL MODULE REQUESTED MIL ILLUMINATION

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.
- [Diagnostic Procedure Instructions](#) provides an overview of each of the diagnostic category.

DTC Descriptor

DTC P0700

Transmission Control Module Requested MIL Illumination

Circuit/System Description

The Transmission Control Module (TCM) constantly monitors the transmission system for any condition which may adversely affect vehicle emissions. If a condition is detected, the TCM sets a DTC and sends a serial data message to the ECM. The ECM sets DTC P0700 to inform the technician that the TCM has set the emission related DTC. The serial data message sent by the TCM also contains a request for the ECM to illuminate the Malfunction Indicator Lamp (MIL)

The technician can observe the DTC that was set by the TCM by reviewing the ECM Freeze Frame records on the scan tool. The ECM Freeze Frame records also contain the engine operating conditions present when the transmission DTC set.

Conditions for Running the DTC

- The ignition is ON or the engine is running.
- DTC P0700 runs continuously.

Conditions for Setting the DTC

The ECM receives a serial data message from the TCM indicating that an emission related DTC has set in the TCM.

Action Taken When the DTC Sets

DTC P0700 is a Type A DTC.

Conditions for Clearing the MIL/DTC

DTC P0700 is a Type A DTC.

Diagnostic Aids

Communication codes, U-codes, as well as powertrain codes, P-codes, set in the TCM can cause the TCM to request DTC P0700 to be set in the ECM.

Reference Information

DTC Type Reference

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

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

Circuit/System Verification

NOTE:

- Do not replace the engine control module for this DTC. DTC P0700 is an informational DTC.
- Correct any engine control and communication DTCs before diagnosing transmission control module DTCs.

1. Verify there are no engine control or communication 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 there are no transmission control module 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

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

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

5. All OK.

Repair Instructions

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

DTC C1201, P1000, P1001, P1003, P1008, P1009, P100A, P100E, P103D, P103E, P10B6-P10B9, P10BF, P10C6-P10C8, P10F5, P1100, P1103, P117A, P11FF, P1200, P128C-P128F, P129E, P12A8, P130F, P135C-P135F, P1436, P143A, P143B, P1472, P14A0, P14B6, P14BD, P14CD, P14CE, P14D4-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: 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 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

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 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.
- [Diagnostic Procedure Instructions](#) provides 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 1.5L (LYX)

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. 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.

- [Engine Coolant Temperature Sensor Replacement - Water Outlet](#)
- [Control Module References](#) for ECM replacement, programming, and setup

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.
- [Diagnostic Procedure Instructions](#) provides 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 when the ECM detects that the ignition is on. The voltage from the ECM to the fuel pump driver control module remains active for 2 s, unless the engine is in crank or run. While this voltage is being received, the fuel pump driver control module supplies a varying voltage to the fuel tank fuel pump module in order to maintain the desired fuel pressure.

Conditions for Running the DTC

- The ignition voltage is between 9 - 32 V.
- The engine is cranking or running.
- The fuel pump enable circuit 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 or equal to 320°F (160°C) for less than 0.2 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.

Diagnostic Aids

Using the Failure Records data may help locate an intermittent condition. If you cannot duplicate the DTC, the information in the Failure Records can help determine how many miles since the DTC set. The Fail Counter and Pass Counter can help determine how many ignition cycles that the diagnostic test reported a pass and/or a fail.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.5L \(LYX\)](#)

Connector End View Reference

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. Verify DTC P0231, P0232, or P023F 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 is not set
 - **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.

Fuel Pump Power Control Module Replacement (FWD). Fuel Pump Power Control Module Replacement (AWD).

DTC P127C, P128A, P128B, P128C, P128D, P128F, P16E4, OR P16E5: FUEL RAIL PRESSURE SENSOR 1 AND 2 OR FUEL RAIL PRESSURE-TEMPERATURE SENSOR 1 AND 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P127C

Fuel Rail Pressure Sensor 2 Circuit Low Voltage

DTC P128A

Fuel Rail Pressure Sensor 1 Internal Performance

DTC P128B

Fuel Rail Pressure Sensor 2 Internal Performance

DTC P128C

Fuel Rail Pressure-Temperature Sensor Temperature 1 Message Incorrect

DTC P128D

Fuel Rail Pressure-Temperature Sensor Temperature 2 Message Incorrect

DTC P128F

Fuel Rail Pressure-Temperature Sensor Pressure Message Incorrect

DTC P16E4

Sensor Communication Circuit 3 Low Voltage

DTC P16E5

Sensor Communication Circuit 3 High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0452, P06D2, P16E5	P16E4	P06D2, P128A, P128B	P0191
Signal	P16E4	P128C, P128D, P16E5	P16E5	P0191
Low Reference	-	P128C, P128D, P16E5	-	P0191

Typical Scan Tool Data

Fuel Rail Pressure Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating with the throttle closed. All accessories OFF. Parameter Normal Range: 2.9-3.2 MPa			
5 V Reference	655.4 MPa	655.4 MPa	655.4 MPa
Signal	655.4 MPa	655.4 MPa	655.4 MPa
Low Reference	-	655.4 MPa	-

Circuit/System Description

The fuel pressure/temperature sensor transmits fuel pressure and temperature information by serial data using the Society of Automotive Engineers (SAE) J2716 Single Edge Nibble Transmission (SENT)

protocol. The fuel pressure/temperature sensor internal microprocessor allows 4 separate sensor outputs from one 3 wire sensor. The engine control module (ECM) supplies the fuel pressure/temperature sensor with a 5 V reference circuit, a low reference circuit, and an asynchronous signal/serial data circuit. The asynchronous signal means communication is only going from the fuel pressure/temperature sensor to the ECM. The ECM decodes the serial data signal into separate voltages.

Conditions for Running the DTC

P127C, P16E4 or P16E5

- Ignition is ON.
- No DTC clear code.
- The DTCs run continuously when the above conditions are met.

P128A or P128B

- DTC P128F, P16E4 or P16E5 is not set.
- Ignition is ON.
- The DTCs run continuously when the above conditions are met.

P128C, P128D, or P128F

- DTC P16E4 or P16E5 is not set.
- Ignition is ON.
- The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P127C

The engine control module detects the fuel pressure sensor 2 SENT digital read value is less than or equal to 76 for greater than 30 s with the engine running or greater than 10 s with the engine cranking.

P128A

The engine control module detects the fuel pressure sensor 1 SENT digital read value is greater than or equal to 4,089 for greater than 3 s.

P128B

The engine control module detects the fuel pressure sensor 2 SENT digital read value is greater than or equal to 4,089 for greater than 3 s.

P128C

The engine control module detects communication errors on the fuel pressure sensor temperature 1 SENT signal circuit for greater than 1 s.

P128D

The engine control module detects communication errors on the fuel pressure sensor temperature 2 SENT signal circuit for greater than 1 s.

P128F

The engine control module detects fuel pressure sensor SENT signal discrepancies for greater than 3 s.

P16E4

The engine control module detects the fuel pressure sensor SENT signal shorted low for greater than 3 s.

P16E5

The engine control module detects the fuel pressure sensor SENT signal shorted high for greater than 3 s.

Action Taken When the DTC Sets

- DTCs P127C, P128A, P128B, P128F, P16E4, and P16E5 are Type A DTCs.
- DTCs P128C and P128D are Type B DTCs.
- A message center or an indicator displays Propulsion Power is Reduced and Service Stabilitrak.

Conditions for Clearing the DTC

- DTCs P127C, P128A, P128B, P128F, P16E4, and P16E5 are Type A DTCs.
- DTCs P128C and P128D are Type B DTCs.

Diagnostic Aids

- A high resistance condition on the fuel pressure/temperature sensor circuits could cause a DTC to set.
- Inspect for a contaminated fuel system.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Powertrain Component View

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/Vehicle in Service Mode.
2. Verify that DTC P0641, P0651, P0697, or P06A3 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 that DTC P0182, P0183, P0187, P0188, P111F, P126E, P126F, P127C, P128A, P128B, P128C, P128D, P128F, P16E4, or P16E5 are not set.

- **If DTC P128A, P128B, P128C, P128D, or P128F are the only DTCs set**

Replace the B310 Fuel Pressure/Temperature Sensor.

- **If DTC P0183, P0184, P0187, P0188, P111F, P126E, P126F, P127C, P16E4, or P16E5 is set with any of the DTCs**

Refer to Circuit/System Testing.

- **Go to next step: If none of the DTCs are 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: Disconnecting the fuel pressure/temperature sensor harness connector causes additional DTCs to set.

1. Ignition/Vehicle OFF, and all vehicle systems OFF, disconnect the harness connector at B310 Fuel Pressure/Temperature Sensor. It may take up to 2 min for all vehicle systems to power down.

2. Test for less than 5 Ω between the low reference circuit terminal 1 and ground.

- **If 5 Ω or greater**

1. Ignition/Vehicle 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/Vehicle ON.

4. Test for 4.8 - 5.2 V between the 5 V reference circuit terminal 2 and ground.

- **If less than 4.8 V**

1. Ignition/Vehicle 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/Vehicle OFF, disconnect the harness connector at the K20 Engine Control Module, ignition/vehicle 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. Test for 4.8 - 5.2 V between the signal circuit terminal 3 and ground.

- **If less than 4.8 V**

1. Ignition/Vehicle 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 greater than 5.2 V**

1. Ignition/Vehicle OFF, disconnect the harness connector at the K20 Engine Control Module, ignition/vehicle 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**

6. Replace the B310 Fuel Pressure/Temperature Sensor.

Repair Instructions

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

- [Fuel Injection Fuel Rail Fuel Pressure Sensor Replacement](#) for B310 Fuel Pressure/Temperature Sensor
- [Control Module References](#) for K20 Engine Control Module replacement, programming, and setup

DTC P129E OR P12A8: FUEL PUMP DRIVER CONTROL STATUS SIGNAL MESSAGE COUNTER INCORRECT OR FUEL PUMP CONTROL SIGNAL MESSAGE COUNTER INCORRECT

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

DTC Descriptors

DTC P129E

Fuel Pump Driver Control Status Signal Message Counter Incorrect

DTC P12A8

Fuel Pump Control Signal Message Counter Incorrect

Circuit/System Description

The fuel pump power control module is in constant communication with the 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 that too many of the counts/samples contain an error value, the ECM sets DTC P129E or P12A8.

Conditions for Running the DTC

- The ignition voltage is greater than 7 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 P129E and P12A8 are Type A DTCs.

Conditions for Clearing the DTC

DTC P129E and P12A8 are Type A DTCs.

Diagnostic Aids

An intermittent fault in the CAN circuits will cause the ECM to set DTC P129E or P12A8.

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- **DTC P129E and P12A8 are informational DTCs.**
- **Diagnose all other engine control module DTCs prior to DTC P129E or P12A8.**

1. Verify that no other DTCs are set except for DTC P129E or P12A8.

- **If any other DTCs are set**

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

- **Go to next step: If only DTC P129E or P12A8 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.

- Fuel Pump Power Control Module Replacement (FWD) Fuel Pump Power Control Module Replacement (AWD) for K111 Fuel Pump Power Control Module Replacement
- Control Module References for K20 Engine Control Module replacement, programming, and setup

DTC P129D: FUEL PUMP DRIVER CONTROL MODULE IGNITION ON/START SWITCH CIRCUIT LOW 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

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	-	-

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

The DTC runs continuously when the modules are awake.

Conditions for Setting the DTC

The fuel pump driver control module Power Mode does not agree with the engine control module (ECM) Power Mode for 1 s.

Action Taken When the DTC Sets

DTC P129D is a Type B DTC.

Conditions for Clearing the DTC

DTC P129D is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

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

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 is not set.

- **If the DTC sets**

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

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

4. Verify DTC P129D is not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

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

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 P129D is 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: 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 6 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, and disconnect all components on the circuit.

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

3. Replace the fuse, ignition ON.

4. Verify the fuse is good after connecting each of the components one at a time.

- If the fuse opens, replace the component that opens the fuse when connected.

- If the fuse is good, all OK.

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

4. Replace the K111 Fuel Pump Driver Control Module.

Repair Instructions

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

Fuel Pump Power Control Module Replacement (FWD), Fuel Pump Power Control Module Replacement (AWD)

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.
- [Diagnostic Procedure Instructions](#) provides 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	P0171, P0506, P0628, P12A6	P0171, P0506, P12A6	-	P12A6

Circuit/System Description

The engine control module (ECM) provides ignition voltage to the fuel pump driver control module whenever the engine is cranking or running. The control module enables the fuel pump driver control module as long as the engine is cranking or running, and ignition system reference pulses are received. While this enable voltage is being received, the fuel pump driver control module supplies a varying voltage to the in-tank fuel pump module in order to maintain the desired fuel line pressure.

Conditions for Running the DTC

- The ignition voltage is greater than or equal to 9 V.
- The DTC runs continuously when the condition above is met.

Conditions for Setting the DTC

The ECM state of the fuel pump enable circuit does not match the state of the fuel pump enable circuit sensed by the fuel pump driver control module for 1 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 1.5L(LYX)

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. Verify that DTC P12A6 is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing.
 - **Go to next step: If the DTC is not set**
3. 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**
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 does not set**

5. All OK.

Circuit/System Testing

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 for 10 s.
3. Verify that a test lamp does not illuminate between the control circuit terminal 2 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 2 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 repair.

- [Fuel Pump Power Control Module Replacement \(FWD\)](#), [Fuel Pump Power Control Module Replacement \(AWD\)](#)
- [Control Module References](#) for control module replacement, programming and setup.

DTC P135A: IGNITION COIL SUPPLY VOLTAGE CIRCUIT BANK 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P135A

Ignition Coil Supply Voltage Circuit Bank 1

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	P0201, P0202, P0203, P0204, P0300, P0351, P0352, P0353, P0354, P135A	P0201, P0202, P0203, P0204, P0300, P0351, P0352, P0353, P0354, P135A	-	-

Circuit/System Description

The ignition system uses an individual ignition coil for each cylinder. The engine control module (ECM) monitors the ignition voltage from the fuse to the individual coils.

Conditions for Running the DTC

- Delay starting at ignition On for 5 engine revolutions.
- Ignition Run/Crank relay voltage is greater than 5 V
- PT relay voltage is greater than 11 V

The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects less than 2.5 V on the ignition coil supply voltage circuit.

Action Taken When the DTC Sets

DTC P135A is a Type B DTC.

Conditions for Clearing the DTC

DTC P135A is a Type B DTC.

Reference Information

Schematic Reference

Engine Controls Wiring 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Electronic Ignition System Description

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool Ignition 1 Signal parameter displays On.
 - If On is not displayed

Refer to Circuit/System Testing.

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

5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
2. Connect a 3 A fused jumper wire between the control circuit terminal 67 and ground, ignition ON.
3. Verify a test lamp illuminates between the ignition circuit terminal 51 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**

NOTE: The ignition circuit may supply voltage to other components. Make sure to test all circuits and components for a short to ground that share the ignition circuit.

1. Ignition OFF, remove the test lamp, and disconnect all components on the circuit.
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
3. Replace the fuse, ignition ON.
4. Verify the fuse is good after connecting each of the components one at a time.
 - If the fuse opens, replace the component that opens the fuse when connected.
 - If the fuse is good, all OK.

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

4. Replace the K20 Engine Control Module.

Repair Instructions

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

- [Ignition Coil Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup

DTC P1400: COLD START EMISSION REDUCTION CONTROL SYSTEM

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

DTC Descriptor

DTC P1400

Cold Start Emission Reduction Control System

Circuit/System Description

The catalyst must be warmed to efficiently reduce the emissions. The cold start strategy is to reduce the amount of time it takes to warm the catalyst. During a cold start, the engine spark timing is altered to allow the catalyst to warm quickly. This diagnostic monitors the following to build an exhaust energy model:

- Spark advance
- Engine airflow
- Engine coolant temperature
- Engine run time

The actual model is then compared to the expected exhaust energy model.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0114, P0116, P0117, P0118, P0121, P0122, P0123, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0641, P0651, P0697, P06A3, P2122, P2123, P2127, P2128, P2135, and P2138 are not set.
- The engine coolant temperature (ECT) is between -12 to $+56^{\circ}\text{C}$ (10 - 132°F).
- The calculated 3-way catalyst temperature is colder than 500°C (932°F).
- The barometric (BARO) pressure is greater than 75 kPa.
- The engine control module (ECM) will exit the diagnostic if the calculated 3-way catalyst temperature is greater than $1,000^{\circ}\text{C}$ (1832°F) when the engine run time is greater than 17 s.
- Vehicle speed is less than 1.6 km/h (1 mph).
- The accelerator pedal is not depressed.
- The ECM will exit the diagnostic if the engine run time is greater than a calibrated value.
- This DTC runs within the first 15 s of start-up. This diagnostic runs once per trip when a cold start has been determined.

Conditions for Setting the DTC

The actual exhaust energy model does not match the expected exhaust energy model.

Action Taken When the DTC Sets

DTC P1400 is a Type A DTC.

Conditions for Clearing the DTC

DTC P1400 is a Type A DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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. Verify that none of the conditions listed below exists with the air intake system:

- Damage, restriction, or modification
- Dirty or deteriorating air filter element
- Crankcase ventilation system for correct operation
- Water intrusion
- Vacuum leak and other unmetered air downstream of the mass air flow (MAF) sensor
- Intake manifold leak
- **If any of the above conditions exist**

Repair as necessary.

- **Go to next step: If none of the conditions exist**

2. Verify that none of the conditions listed below exists with the exhaust system:

- Exhaust leak
- Damaged, restricted, or modified exhaust system - Refer to [Symptoms - Engine Exhaust](#) .
- **If any of the above conditions exist**

Repair as necessary.

- **Go to next step: If none of the conditions exist**

3. If all of the above conditions test normal, inspect for an engine mechanical condition that could alter the air flow into the combustion chamber. Refer to [Symptoms - Engine Mechanical](#) .

- **If a condition exists - Repair or replace as necessary**
- **Go to next step: If none of the conditions exists**

4. Vehicle OFF, allow the engine to cool to be within the temperatures listed in the Conditions for Running the DTC.

5. Engine running.

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 step 1

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

8. All OK.

[Repair Instructions](#)

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

DTC P150C: TRANSMISSION CONTROL MODULE ENGINE SPEED REQUEST SIGNAL MESSAGE COUNTER 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P150C

Transmission Control Module Engine Speed Request Signal Message Counter Incorrect

Circuit/System Description

To improve vehicle shift feel, the transmission control module (TCM) is constantly sending the ECM serial data messages with requests to modify engine speed or torque. These serial data messages are sent through two circuits which are part of a communication network called the controller area network (CAN). The ECM sets DTC P150C when it detects a discrepancy in the structure of this message causing its integrity to be questioned.

An intermittent fault in the controller area network (CAN) circuits will cause DTC P150C to set.

Conditions for Running the DTC

- DTCs P0506, P0507, or U0101 are not set.
- The engine is running for greater than 0.5 s.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the TCM engine speed request does not match the expected engine speed request.

Action Taken When the DTC Sets

DTC P150C is a Type B DTC.

Conditions for Clearing the DTC

DTC P150C is a Type B DTC.

Reference Information

Description and Operation

Data Link Communications Description and Operation

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Circuit/System Verification

NOTE:

- **DTC P150C is an informational DTC.**
- **Diagnose all other engine control module DTCs prior to DTC P150C.**

1. Verify that no other DTCs are set except for DTC P150C.

- **If any other DTCs are set**

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

- **Go to next step: If only DTC P150C is set**
- 2. Replace the K71 Transmission Control Module.
- 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 K20 Engine Control Module.
 - **Go to next step: If the DTC does not set**
- 5. All OK.

Repair Instructions

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

[Control Module References](#) for ECM or TCM replacement, programming, and setup

DTC P1516, P2101, P2119, OR P2176: THROTTLE ACTUATOR CONTROL (TAC)

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 P1516

Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance

DTC P2101

Throttle Actuator Position Performance

DTC P2119

Throttle Closed Position Performance

DTC P2176

Minimum Throttle Position Not Learned

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Close	P1516, P2101	P1516, P2101	P1516, P2101	P1516, P2101, P2176
Control - Open	P1516, P2101, P2119	P1516, P2101	P1516, P2101	P1516, P2101, P2176

Circuit/System Description

Circuit	Description
Control - Close	The output circuit is switched from ground to 12 V to activate the component.
Control - Open	The output circuit is switched from ground to 12 V to activate the component.

Component	Description
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.
Q38 Throttle Body	The throttle valve is actuated by a bidirectional DC motor. A spring pulls the valve to a rest or default position, in which the valve is almost closed. The throttle actuator motor can push against the force of the spring to open or close the valve. The more current flow through the motor, the more the valve moves.

The ECM determines the driver's intent based on input from the accelerator pedal position sensors, then calculates the appropriate throttle response based on the throttle position sensors.

Conditions for Running the DTC

P1516

- DTC P0606, P1682 = Not set
- Ignition Voltage = Greater than 6.4 V
- Reduced Engine Power = Not Activated
- Desired Throttle Position = Steady State - For greater than 4 s

DTC runs continuously when the above conditions are met.

P2101 Condition 1

- DTC P0606, P1682 = Not set
- Ignition Voltage = Greater than 6.4 V
- Reduced Engine Power = Not Activated
- Engine = Running

Condition 2

- Engine = Not Running
- Ignition Voltage = Greater than 8.4 V
- Throttle Position = Learned
- Throttle Actuator Control System = Active
- Battery Saver Mode = Not Activated

DTC runs continuously when the above conditions are met.

P2119

- DTC P0122, P0123, P0222, P0223, P06A3 = Not set
- Battery Saver Mode = Not Activated
- Reduced Engine Power = Not Activated
- Ignition Voltage = Greater than 5.5 V
- Throttle Actuator Control System = Not Activated

DTC runs continuously when the above conditions are met.

P2176

- Ignition Voltage = Greater than 6.4 V
- Reduced Engine Power = Not Activated
- Throttle Position Learn = Active

DTC runs continuously when the above conditions are met for greater than 2 s.

Conditions for Setting the DTC

P1516

- The following parameters are not within 2% of each other:
 - Desired Throttle Position
 - Throttle Position

DTC P2101 Condition 1

- The following parameters are not within 10% of each other:
 - Desired Throttle Position
 - Throttle Position

Condition 2

- Throttle Position Learn = Active
- Throttle Position = Greater than 36%

Condition 3

- Reduced Engine Power = Active
- Throttle Position = Greater than 35%

P2119

The throttle blade has not reached the closed position after the engine has been turned off.

P2176

Minimum Throttle Position Not Learned = Exceeded Number of Attempts

Actions Taken When the DTC Sets

- DTC P1516 is a Type B DTC.
- DTCs P2101, P2176 are Type A DTCs.
- DTC P2119 is a Type C DTC.
- Reduced Engine Power = Active
- P16 Instrument Cluster = Reduced Engine Power
- Under certain conditions, the control module commands the engine Off.

Conditions for Clearing the DTC

- DTC P1516 is a Type B DTC.
- DTCs P2101, P2176 are Type A DTCs.
- DTC P2119 is a Type C DTC.

Diagnostic Aids

- A high resistance condition on the throttle position and throttle actuator control circuits could cause a DTC to set.
- A weak battery may cause this DTC to set.
- If the throttle blade becomes stuck, a DTC will set. Depending on the position of the throttle blade, the ECM may enter Engine Shutdown Mode. The ECM will disable fuel and de-energize the throttle actuator. If the condition remains present during the next ignition cycle, the ECM may disable engine cranking. Inspect the throttle body assembly for a stuck throttle blade if a throttle actuator DTC is current and the engine won't crank.

- Inspect for a condition in which the throttle blade may have been held open. For example, ice may have formed in the throttle bore causing the throttle blade not to close.
- Under cold start conditions, it might happen briefly that the desired and the actual throttle blade position do not match.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Throttle Actuator Control (TAC) 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

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC P0121, P0122, P0123, P0222, P0223, P0562, P0621, P0622, P16A0-P16A2, P2135 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: Throttle Body Idle Air Flow Compensation = Less than 90%
 - **If 90% or greater**
 Refer to: [Throttle Body Inspection and Cleaning](#) .
 - **Go to next step: If less than 90%**
4. Clear the DTCs.
5. Ignition/Vehicle - Off
6. Ignition - On / Vehicle - In Service Mode
7. Perform the scan tool control function: Throttle Sweep

Verify the scan tool parameter: TAC Motor = Enabled

- **If not the specified state**

Refer to: Circuit/System Testing

- **Go to next step: If the specified state**

8. Verify the scan tool parameter:TAC Motor = Enabled

Perform the action while monitoring the parameter:

- Wiggle the harness and connector:Q38 Throttle Body
- Wiggle the harness and connector:K20 Engine Control Module
- **If not the specified state**

Repair as necessary - Wiring / Terminal(s) / Electrical Connector(s)

- **Go to next step: If the specified state**

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 the DTC does not set.

- **If the DTC sets**

Refer to: Circuit/System Testing

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

11. All OK.

Circuit/System Testing

1. Ignition/Vehicle - Off

2. Verify the following conditions do not exist:

WARNING: Turn OFF the ignition before inserting fingers into the throttle bore. Unexpected movement of the throttle blade could cause personal injury.

- The throttle blade has not reached the closed position after the engine has been turned off.
- The throttle blade is not closed by the spring.
- The throttle blade is binding in open or closed position.
- **If a condition exists**

Replace the component:Q38 Throttle Body

- **Go to next step: If no condition exists**

NOTE: Disconnecting the component electrical connector causes additional DTCs to set.

3. Disconnect the electrical connector:Q38 Throttle Body

4. Ignition - On / Vehicle - In Service Mode

5. Test for 6 to 9 V between the test points:

- Control circuit terminal 1 & Ground
- Control circuit terminal 2 & Ground
- **If less than 6 V**

1. Ignition/Vehicle - Off

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
- Control circuit terminal 2 @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 ohms between the test points:

- Control circuit terminal 1 @Component harness & The other end of the circuit@Control module harness
- Control circuit terminal 2 @Component harness & The other end of the circuit@Control module harness
- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component:K20 Engine Control Module

• **If greater than 9 V**

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
- Control circuit terminal 2 @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 6 and 9 V**

6. Ignition/Vehicle - Off

7. Disconnect the electrical connector: X2 @K20 Engine Control Module

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

- Control circuit terminal 1 @Component harness & The other end of the circuit@Control module harness
- Control circuit terminal 2 @Component harness & The other end of the circuit@Control module harness
- **If 2 ohms or greater - Repair the open/high resistance in the circuit.**
- **Go to next step: If less than 2 ohms**

9. Test or replace the component:Q38 Throttle Body

Repair Instructions

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

- [Throttle Body Assembly Replacement](#)
- For control module replacement, programming, and setup refer to:[Control Module References](#)

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

DTC Descriptor

DTC P163A

Control Module Fuel Pressure Regulator 1 Control System Circuitry Performance

Circuit/System Description

This diagnostic applies to internal microprocessor integrity conditions within the engine control module (ECM). The ECM monitors the current required to control fuel pressure regulator and compares the current value to calibrated low and high thresholds.

Conditions for Running the DTC

- DTC P0016, P0017, P0090, P0091, P0092, P00C8, P00C9, P00CA, P0111, P0112, P0113, P0114, P0117, P0118, P0119, P0128, P0192, P0193, P0335, P0336, P0340, P0341, P0365, P0366, P0627, P0628, P0629, or P1682 are not present.
- The engine is running.
- Battery voltage is greater than or equal to 11 V.
- Low side fuel pressure is greater than 300 kPa (43.5 PSI).
- Intake air temperature (IAT) is warmer than or equal to -10°C (14°F).
- Barometric pressure is greater than 70 kPa.
- Fuel temperature is between -10°C and +132°C (14°F and 270°F).
- DTC P163A runs continuously when the conditions are met for greater than 500 ms.

Conditions for Setting the DTC

The ECM detects a condition with the integrated circuits of the high pressure fuel pump actuator driver module or the ECM detects that the current used to drive the high pressure fuel pump actuator is out of range for greater than 4 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 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Powertrain Component View

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/Vehicle in Service Mode.
2. Verify 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 DTCs are set**

3. Verify that DTC P163A is not set.

- **If the DTC is set**

Refer to Circuit/System Testing.

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

4. 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.

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

1. Ignition/Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the G18 High Pressure Fuel Pump. It may take up to 2 min for all vehicle systems to power down.

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

2. Test for 1.09 - 1.21 Ω at 20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$) between the high control circuit terminal 2 and the low control circuit terminal 1 on the G18 High Pressure Fuel Pump.

- **If not between 1.09 - 1.21 Ω**

Replace the G18 High Pressure Fuel Pump.

- **Go to next step: If between 1.09 - 1.21 Ω**

3. Ignition ON, verify that a test lamp does not illuminate between ground and the terminals listed below:

- High control circuit terminal 2
- Low control circuit terminal 1

- **If the test lamp illuminates**

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

2. Test for less than 1 V between the appropriate 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. Test for B+ between the high control circuit terminal 2 and ground.

- **If less than B+**

1. Ignition OFF, disconnect the appropriate 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 B+**
5. Ignition OFF, connect a test lamp between the high control circuit terminal 2 and the low control circuit terminal 1.
 6. Ignition ON, command the Fuel Pressure Regulator On and Off with a scan tool.
 7. Verify the test lamp turns ON and OFF.
 - **If the test lamp does not turn ON and OFF**
 1. Ignition OFF, disconnect the appropriate harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the low control 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 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.
 - **Go to next step: If the test lamp turns ON and OFF**
 8. Test or replace the G18 High Pressure Fuel Pump.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the G18 High Pressure Fuel Pump.

NOTE: The DMM and test leads must be calibrated to 0 Ω in order to prevent misdiagnosis.
2. Test for 1.09 - 1.21 Ω at 20 $^{\circ}$ C (68 $^{\circ}$ F) between the high control circuit terminal 2 and the low control circuit terminal 1.
 - **If not between 1.09 - 1.21 Ω**
Replace the G18 High Pressure Fuel Pump.
 - **Go to next step: If between 1.09 - 1.21 Ω**
3. Test for infinite resistance between each terminal and the G18 High Pressure Fuel Pump housing.
 - **If less than infinite resistance**
Replace the G18 High Pressure Fuel Pump.
 - **Go to next step: If infinite resistance**
4. All OK

Repair Instructions

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

- [Fuel Pump Replacement](#) for G18 High Pressure Fuel Pump replacement
- [Control Module References](#) for control module replacement, programming and setup
- Perform the Fuel Rail Pressure Relief Valve Reset procedure, if supported on the scan tool.

DTC P16A7, P16AF, OR P16B3: ENGINE CONTROLS IGNITION RELAY

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

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
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 1.5L \(LYX\)](#)
- Power Distribution Wiring Schematics

Connector End View Reference

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 87 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 87 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 $2\ \Omega$ 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 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 $70 - 110\ \Omega$ between terminals 85 and 86:

- **If less than $70\ \Omega$ or greater than $110\ \Omega$**

Replace the KR75 Engine Controls Ignition Relay.

- **Go to next step: If between $70 - 110\ \Omega$**

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 $2\ \Omega$ between terminals 30 and 87.

- **If $2\ \Omega$ or greater**

Replace the KR75 Engine Controls Ignition Relay.

- **Go to next step: If less than $2\ \Omega$**

6. All OK.

Repair Instructions

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

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

DTC P16FF: ENGINE CONTROLS IGNITION RELAY REQUEST 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

NOTE: This procedure may also diagnose malfunctions that are not detected by a DTC.

DTC P16FF

Engine Controls Ignition Relay Request 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/Vehicle in Service Mode.
- Ignition Voltage = Greater than 11 V

Conditions for Setting the DTC

Serial Data = Message Counter Incorrect - Between the following control modules:

- K20 Engine Control Module
- K38 Chassis Control Module

Actions Taken When the DTC Sets

DTC 16FF is a Type B DTC.

Conditions for Clearing the DTC

DTC 16FF is a 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. 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. Replace the component: K20 Engine Control Module
2. Operate the vehicle within the Conditions for Running the DTC.
3. Verify the DTC does not set.
 - If the DTC sets - Replace the component: K38 Chassis Control Module
 - If the DTC is not set

4. All OK.

- **Go to next step: If no DTC is set**

2. All OK.

Repair Instructions

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

DTC P2096 OR P2097: POST CATALYST FUEL TRIM SYSTEM LOW LIMIT OR HIGH 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P2096

Post Catalyst Fuel Trim System Low Limit

DTC P2097

Post Catalyst Fuel Trim System High Limit

Circuit Description

Fuel trim bias is used to keep the post catalyst air/fuel ratio within a predetermined range. This allows optimal catalyst efficiency under various operating conditions. The engine control module (ECM) constantly monitors how lean or rich the fuel trim bias is commanded, to determine if the fuel trim bias is greater than a calibrated amount.

Conditions for Running the DTC

- DTC P0016, P0017, P0030, P0036, P0053, P0054, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P013A, P013B, P013E, P013F, P0140, P0141, P015A, P015B, P0178, P0179, P0201, P0202, P0203, P0204, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0340, P0341, P0365, P0366, P0411, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0458, P0459, P0496, P0498, P0499, P111E, P1133, P1248, P1249, P124A, P124B, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P219A, P2227, P2228, P2229, P2230, P2269, P2270, P2271, P2440, P2444, or P2A00 is not set.
- The barometric pressure (BARO) is greater than 70 kPa (10.2 PSI).
- The manifold absolute pressure (MAP) is between 0 - 200 kPa (0 - 29 PSI).
- The intake air temperature (IAT) is between - 20Â°C and +200Â°C (-4 and +392Â°F).
- The start up engine coolant temperature is warmer than - 20Â°C (- 4Â°F).
- The fuel control intrusive diagnostics are not active.
- The engine is operating under light acceleration, heavy acceleration, or cruise conditions.
- DTCs P2096 and P2097 run continuously when the conditions above have been met.

Conditions for Setting the DTC

The correction limit for a condition causing a lean or rich air/fuel ratio has been exceeded.

Action Taken when the DTC Sets

DTCs P2096 and P2097 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P2096 and P2097 are Type B DTCs.

Diagnostic Aids

- The post catalyst fuel trim diagnostic is very sensitive to heated oxygen sensor (HO2S) design. A non-OE sensor or an incorrect part number may cause a DTC to set.

- Certain aftermarket air filters may cause a DTC to set.
- Certain aftermarket air induction systems or modifications to the air induction system may cause a DTC to set.
- Certain aftermarket exhaust system components may cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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 no other HO2S or fuel trim DTC is set.
 - **If any other HO2S or fuel trim DTC is set**

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

 - **Go to next step: If no other HO2S or fuel trim DTC is set**
3. Verify DTC P2096 or P2097 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 in the Freeze Frame/Failure Records data.
5. Verify DTC P2096 or P2097 is not set.
 - **If a DTC is set**

Refer to Circuit/System Testing.

 - **Go to next step: If no DTC is set**
6. All OK.

Circuit/System Testing

Inspect for the conditions listed below:

P2096

- Air intake duct collapsed or restricted.
- Air filter dirty or restricted.
- Objects blocking the throttle body.
- Excessive fuel in the crankcase. Change engine oil as necessary.
- Rich fuel injectors. Refer to [Fuel Injector Diagnosis](#).
- Excessive fuel system pressure. Refer to [Fuel System Diagnosis](#).
- Fuel contamination. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Fuel saturation of the evaporative emissions (EVAP) canister
- Stuck open or leaking EVAP purge valve
- Restricted exhaust. Refer to [Symptoms - Engine Exhaust](#) .
- Improperly operating crankcase ventilation system. Refer to [Crankcase Ventilation System Inspection/Diagnosis](#) .

P2097

- Exhaust system leaks. Refer to [Symptoms - Engine Exhaust](#) .
- Split, kinked, or improperly connected vacuum hoses
- Insufficient fuel in the tank
- Leaks in the air induction system and air intake ducts
- Missing air filter element
- Cracked evaporative canister
- Evaporative pipes plugged, obstructed, or leaking
- Crankcase ventilation system leaking. Refer to [Crankcase Ventilation System Inspection/Diagnosis](#) .
- Engine vacuum leaks
- Low fuel system pressure. Refer to [Fuel System Diagnosis](#).
- Contaminated fuel. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Lean fuel injectors. Refer to [Fuel Injector Diagnosis](#).
- If a condition is found

Repair as necessary.

Repair Instructions

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

Perform the scan tool Fuel Trim Reset after completing the repair.

DTC P2122, P2123, P2127, P2128, OR P2138: ACCELERATOR PEDAL POSITION (APP) SENSOR 1 OR ACCELERATOR PEDAL POSITION (APP) SENSOR 2

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 P2122

Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage

DTC P2123

Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage

DTC P2127

Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage

DTC P2128

Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage

DTC P2138

Accelerator Pedal Position (APP) Sensors 1-2 Not Plausible

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference - APP Sensor 1	P06A3	P2122, P2138	P06A3	P2138
Signal - APP Sensor 1	P2122	P2122, P2138	P2123	P2138
Low Reference - APP Sensor 1	-	P2123, P2138	-	P2138
5V Reference - APP Sensor 2	P0108, P0697	P2127, P2138	P0107, P0522, P0532, P0697	P2138
Signal - APP Sensor 2	P2127	P2127, P2138	P2128	P2138
Low Reference - APP Sensor 2	-	P2128, P2138	-	P2138

Typical Scan Tool Data**APP Sensor 1**

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine idling. Parameter Normal Range: 0.88 to 1.08 V			
5 V Reference	0 V	0 V	2 to 4 V
Signal	0 V	0 V	4 to 5 V
Low Reference	-	4 to 5 V	-

APP Sensor 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine idling. Parameter Normal Range: 0.39 to 0.59 V			
5 V Reference	0 V	0 V	1 to 3 V
Signal	0 V	0 V	4 to 5 V
Low Reference	-	4 to 5 V	-

Circuit/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 ground.
Low Reference	Grounded through the control module.

Component	Description
B107 Accelerator Pedal Position Sensor	The sensor is an input to the control module. The input voltage varies depending on the position of the sensor.

Component	Description
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.

The pedal assembly contains 2 potentiometer-type accelerator pedal position sensors, which are not serviceable. When the accelerator pedal is pressed, the voltages of both sensors goes up. This redundant design enables the ECM to detect if the 2 signals indicate the same accelerator pedal position.

Conditions for Running the DTC

DTC P2122, P2123, P2127, P2128

- DTC P0697, P06A3 = Not set
- Ignition = On or Engine Running
- Ignition Voltage = Greater than 6.4 V

DTC runs continuously when the above conditions are met.

P2138

- DTC P0697, P06A3, P2122, P2123, P2127, P2128 = Not set
- Ignition Voltage = Greater than 6.4 V
- Reduced Engine Power = Inactive

DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P2122

APP Sensor 1 = Less than 0.46 V - For greater than 175 ms

P2123

APP Sensor 1 = Greater than 4.75 V - For greater than 175 ms

P2127

APP Sensor 2 = Less than 0.33 V - For greater than 175 ms

P2128

APP Sensor 2 = Greater than 2.6 V - For greater than 175 ms

P2138

APP Sensor 1 and 2 = Not within a calibrated range - For greater than 188 ms

Action Taken When the DTC Sets

- DTCs P2122, P2123, P2127, P2128, 2138 are Type A DTCs.
- ECM commands the throttle actuator control (TAC) system to operate in a Reduced Engine Power mode.
- A message and/or warning indicator may be displayed to the driver.
- Under certain conditions, the control module commands the engine Off.

Conditions for Clearing the DTC

DTCs P2122, P2123, P2127, P2128, 2138 are Type A DTCs.

Diagnostic Aids

- A high resistance condition on the component circuits may cause a DTC to set.
- Ensure that the inline harness connector seals are installed correctly. Incorrect installation could result in water intrusion into the connector and may cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Throttle Actuator Control (TAC) 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

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC P0697, P06A3 is not set.

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

Refer to: DTC P0641, P0651, P0697, P06A3, or P06D2

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

3. Verify the scan tool parameter:

- APP Sensor 1 Circuit Status = OK
- APP Sensor 2 Circuit Status = OK
- **If not the specified state**

Refer to: Circuit/System Testing

- **Go to next step: If the specified state**

4. Verify the scan tool parameter:

- APP Sensor 1 = 0.8 to 4.0 V - The value should not spike or drop out while moving the sensor through the entire range.
- APP Sensor 2 = 0.4 to 2.0 V - The value should not spike or drop out while moving the sensor through the entire range.
- **If not in the specified range or does not change**

Refer to: Circuit/System Testing

- **Go to next step: If in the specified range and changes**

5. Verify the scan tool parameter: APP Sensor 1 and 2 = Agree

- **If not the specified state**

Refer to: Circuit/System Testing

- **Go to next step: If the specified state**

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: 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: B107 Accelerator Pedal Position Sensor

3. Test for less than 5 ohms between the test points:

- {APP Sensor 1} Low Reference circuit terminal 4 & Ground
- {APP Sensor 2} Low Reference circuit terminal 5 & Ground
- **If 5 ohms or greater**

1. Disconnect the electrical connector: K20 Engine Control Module

2. Test for less than 2 ohms between the test points:

- {APP Sensor 1} Low Reference circuit terminal 4 @ Component harness & The other end of the circuit @ Control module harness
- {APP Sensor 2} Low Reference circuit terminal 5 @ Component harness & The other end of the circuit @ Control module harness
- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component: K20 Engine Control Module

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

4. Ignition - On / Vehicle - In Service Mode

5. Test for 4.8 to 5.2 V between the test points:

- {APP Sensor 1} 5 V Reference circuit terminal 2 & Low Reference circuit terminal 4
- {APP Sensor 2} 5 V Reference circuit terminal 1 & Low Reference circuit terminal 5
- **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 2 @ Component harness & Ground
- 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 ohms between the test points:

- 5 V Reference circuit terminal 2 @ Component harness & The other end of the circuit @ Control module harness

- 5 V Reference circuit terminal 1 @ Component harness & The other end of the circuit@ Control module harness
- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - 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 2 @ Component harness & Ground
 - 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:
 - APP Sensor 1 = Less than 0.2 V
 - APP Sensor 2 = Less than 0.2 V
 - **If 0.2 V or greater**
 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:
 - {APP Sensor 1}Signal circuit terminal 3 @Component harness & Ground
 - {APP Sensor 2}Signal circuit terminal 6 @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 less than 0.2 V**
- 7. Connect a 3 A fused jumper wire between the test points:
 - {APP Sensor 1}Signal circuit terminal 3 & 5 V Reference circuit terminal 2
 - {APP Sensor 2}Signal circuit terminal 6 & 5 V Reference circuit terminal 1
- 8. Verify the scan tool parameter: = Greater than 4.8 V
 - **If 4.8 V or less**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:K20 Engine Control Module
 3. Test for infinite resistance between the test points:
 - {APP Sensor 1}Signal circuit terminal 3 @Component harness & Ground
 - {APP Sensor 2}Signal circuit terminal 6 @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 ohms between the test points:
 - {APP Sensor 1}Signal circuit terminal 3 @Component harness & The other end of the circuit@ Control module harness
 - {APP Sensor 2}Signal circuit terminal 6 @Component harness & The other end of the circuit@ Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If greater than 4.8 V**
- 9. Test or replace the component:B107 Accelerator Pedal Position Sensor

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

- [Accelerator Pedal Assembly Replacement](#)
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P2199: INTAKE AIR TEMPERATURE (IAT) SENSOR 1-2 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P2199

Intake Air Temperature (IAT) Sensor 1-2 Not Plausible

Diagnostic Fault Information

IAT Sensor 1

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0112, P0114**, P2199	P0111, P0113, P0114**, P2199	P0113*, P0114**, P2199	P0111, P2199
Low Reference	-	P0111, P0113, P0114**, P2199	P0113*, P0114**	-
*Internal ECM or sensor damage may occur if the circuit is shorted to B+.				
**Where used.				

IAT Sensor 2

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	P0096, P0097, P00F4, P0102, P2199	P0096, P0097, P00F4, P0102, P2199	-	P0096
Signal	P0096, P0097, P00F5, P2199	P0096, P0097, P00F4, P0102, P2199	P0096*, P0097, P00F4, P0102, P2199	P0096
Ground	-	P0096, P0097, P00F4, P0102, P2199	-	P0096
*Internal ECM or sensor damage may occur if the circuit is shorted to B+.				

Typical Scan Tool Data

IAT Sensor 1

Circuit	Short to Ground	Open or High Resistance	Short to Voltage
Operating Conditions: Engine Running			
Parameter Normal Range: Varies with ambient temperature			
Signal	150Â°C (302Â°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+			

IAT Sensor 2

Circuit	Short to Ground	Open or High Resistance	Short to Voltage
Operating Conditions: Engine Running Parameter Normal Range: Varies with ambient temperature			
Ignition Voltage	-40Â°C (-40Â°F) 10 Hz	-40Â°C (-40Â°F) 10 Hz	-
Signal	-40Â°C (-40Â°F) 10 Hz	-40Â°C (-40Â°F) 10 Hz	-40Â°C (-40Â°F) 10 Hz*
Ground	-	-40Â°C (-40Â°F) 10 Hz	-
*Internal ECM or sensor damage may occur if the circuit is shorted to B+			

Circuit/System Description

The intake air temperature (IAT) sensor 1 is a variable resistor that measures the temperature of the air in the sensor bore. The engine control module (ECM) supplies 5 V to the IAT sensor 1 signal circuit and a ground for the IAT sensor 1 low reference circuit. The signal varies with inlet air temperature and is displayed by the scan tool as Â°C (Â°F).

The IAT sensor 2 produces a frequency signal based on the inlet air temperature very close to the humidity sensor within the sensor bore. The signal varies with inlet air temperature and is displayed by the scan tool as Â°C (Â°F) and Hertz (Hz). The ECM applies 5 V to the circuit. The signal circuit is shared by the IAT sensor 2 and the humidity sensor. Ignition voltage and ground circuits are also supplied to the multifunction intake air sensor's internal circuits for these sensors:

- IAT sensor 2
- Humidity sensor
- MAF sensor

The multifunction intake air sensor houses the following:

- IAT sensor 1
- IAT sensor 2
- Humidity sensor
- MAF sensor
- BARO pressure sensor

IAT Sensor 1 - Temperature, Resistance, Voltage Table

IAT Sensor 1	IAT Sensor 1 Resistance	IAT Sensor 1 Signal Voltage
Cold	High	High
Warm	Low	Low

IAT Sensor 2 - Temperature, Frequency Table

IAT Sensor 2	IAT Sensor 2 Frequency	IAT Sensor 2 Temperature
Cold	45 Hz	-40Â°C (-40Â°F)
Warm	302 Hz	104Â°C (219Â°F)

Conditions for Running the DTC

- The ignition is ON.
- Ignition 1 voltage is at least 11 V.
- This DTC runs continuously within the enabling conditions.

Conditions for Setting the DTC

The ECM detects that the absolute difference between the IAT sensor 1 and the IAT sensor 2 temperatures is greater than 55Â°C (99Â°F) for longer than 5 s.

Action Taken When the DTC Sets

DTC P2199 is a Type B DTC.

Conditions for Clearing the MIL/DTC

DTC P2199 is a Type B DTC.

Diagnostic Aids

- With the ignition ON, the engine OFF, if the engine is cold, a properly functioning IAT sensor 2 will gradually increase the scan tool IAT Sensor 2 parameter. This is due to the heat that is generated by the multifunction intake air sensor heating elements.
- The humidity sensor and the IAT sensor 2 signals are sent to the ECM on the same circuit. If the IAT Sensor 2 parameter displays the values: 10 Hz; -40Â°C (-40Â°F), and there are Humidity Sensor DTCs, check for a circuit problem.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

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](#)

Powertrain Component Views

Powertrain Component Views

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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

Special Tools

EL-38522-A Variable Signal Generator

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#) .

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC DTC P0641, P0651, P0697, or P06A3 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**

NOTE: To minimize the effects of residual engine heat and sensor internal heating elements, perform Steps 3 and 4 of this verification procedure only if the ignition has been OFF for 8 hours or more.

3. Ignition ON.

4. Verify the following scan tool parameters are within 30Â°C (54Â°F) of each other.

- Start-Up IAT Sensor 1
- IAT Sensor 2
- IAT Sensor 3; where equipped
- **If not within 30Â°C (54Â°F)**

Refer to Circuit/System Testing.

- **Go to next step: If within 30Â°C (54Â°F)**

5. Engine idling, verify the following scan tool parameters are between: -38 and +149Â°C (-36 and +300Â°F).

- IAT Sensor 1
- IAT Sensor 2
- IAT Sensor 3; where equipped
- **If not between: -38 and +149Â°C (-36 and +300Â°F)**

Refer to Circuit/System Testing.

- **Go to next step: If between: -38 and +149Â°C (-36 and +300Â°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.

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: You must perform the Circuit/System Verification before proceeding with 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. Disconnect the harness connector at the B75C Multifunction Intake Air sensor.

2. Test for less than 2 Ω between the low reference circuit terminal 3 and ground.

- **If 2 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 or high resistance in the circuit.
- If less than 2 Ω replace the K20 Engine Control Module.

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

3. Ignition OFF, all vehicle systems OFF, test for less than 2 Ω between the ground circuit terminal 7 and ground.

- **If 2 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 ground circuit end to end.

- If 2 Ω or greater, repair the open or 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 2 Ω**
4. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 5 and ground.
- **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp and remove the fuse for the ignition voltage circuit.
 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 , 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 and remove the fuse for the ignition voltage circuit.
 2. 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, test all components connected to the ignition circuit, replace as necessary.
 - **Go to next step: If a test lamp illuminates**
5. Ignition ON, test for 4.8 - 5.2 V between the intake air temperature sensor 1 signal circuit terminal 1 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 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 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**
6. Ignition ON, verify the scan tool IAT Sensor 1 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).**
7. Ignition OFF, install a 3 A fused jumper wire between the signal circuit terminal 1 and the low reference circuit terminal 3.
8. Verify the scan tool IAT Sensor 1 parameter is warmer than 148 $^{\circ}$ C (298 $^{\circ}$ F).
- **If colder than 148 $^{\circ}$ C (298 $^{\circ}$ 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
3. Ignition OFF.
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.
- **Go to next step: If warmer than 148 $^{\circ}$ C (298 $^{\circ}$ F).**
9. Ignition ON, test for 4.8 - 5.2 V between the intake air temperature sensor 2 signal circuit terminal 8 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 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 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**

10. Determine if **EL-38522-A** Variable Signal Generator or equivalent is available.

- **EL-38522-A, Variable Signal Generator; or equivalent is not available**

1. Test or replace the B75C Multifunction Intake Air sensor.
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**

Replace the K20 Engine Control Module.

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

4. All OK.

- **Go to next step: EL-38522-A, Variable Signal Generator; or equivalent is available**

11. Ignition OFF, connect the leads of the **EL-38522-A** Variable Signal Generator as follows:

- Red lead to the signal circuit terminal 8 at the harness connector
- Black leads to ground
- Battery voltage supply lead to B+

12. Set the **EL-38522-A** Variable Signal Generator to the following specifications.

- Signal switch to 5 V
- Duty Cycle switch to 50 % (Normal)
- Frequency switch to 30 Hz

13. Ignition ON, verify the scan tool IAT Sensor 2 parameter is between 28 - 32 Hz.

- **If not between 28 - 32 Hz**

Replace the K20 Engine Control Module.

- **Go to next step: If between 28 - 32 Hz**

14. 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 B111B Turbocharger Boost/Intake Air Temperature sensor.

15. Test for less than 2 Ω between the intake air temperature sensor 3 low reference circuit terminal 1 and ground.

- **If 2 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 or high resistance in the circuit.
- If less than 2 Ω replace the K20 Engine Control Module.

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

16. Ignition ON, test for 4.8 - 5.2 V between the signal circuit terminal 2 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 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 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**

17. Test or replace the B75C Multifunction Intake Air Sensor.

Component Testing

Multifunction Intake Air Sensor

1. Ignition OFF, disconnect the harness connector at the B75C Multifunction Intake Air Sensor.

NOTE: A thermometer can be used to test the sensor off the vehicle.

2. Test the IAT sensor 1 by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the [Temperature Versus Resistance - Intake Air Temperature Sensor \(Hitachi Sensor\)](#) [Temperature Versus Resistance - Intake Air Temperature Sensor \(Delco Sensor\)](#) table for Hitachi Sensors. The resistance values should be in range of the table values.

- **If not within the specified range**

Replace the B75C Multifunction Intake Air Sensor.

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

3. All OK.

Multifunction Intake Air Sensor

1. Test the IAT Sensor 2 by varying the sensor temperature while monitoring the air temperature with a thermometer. Compare the readings with the scan tool IAT Sensor 2 parameter. The values should be within 5%.

- **If not within the specified range**

Replace the B75C Multifunction Intake Air Sensor.

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

2. All OK.

Repair Instructions

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

- [Mass Airflow Sensor Replacement](#) for multifunction intake air sensor replacement
- [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P219A: FUEL TRIM CYLINDER BALANCE

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

DTC Descriptor

DTC P219A

Fuel Trim Cylinder Balance

Circuit/System Description

The Fuel Trim Cylinder Balance diagnostic detects a rich or lean cylinder to cylinder air/fuel ratio imbalance. The diagnostic monitors the pre-catalyst heated oxygen sensor (HO2S) signal's frequency and amplitude characteristics by calculating an accumulated voltage over a predetermined sample period. An imbalance is indicated when multiple samples of the accumulated voltage are consistently higher than the desired value.

Conditions for Running the DTC

- DTCs P0016, P0017, P0030, P0036, P0053, P0054, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0019, P0122, P0123, P0128, P0131 - P0135, P0137, P0138, P013A, P013B, P013E, P013F, P0140, P0141, P0171, P0172, P0201 - P0204, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301 - P0304, P0340, P0341, P0365, P0366, P0411, P0442, P0455, P0458, P0496, P111E, P1133, P1248, P1249, P124A, P124B, P16A0, P16A1, P16A2, P16F3, P2101, P2135, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2270, P2271, P2440, P2444 or P2A00 are not set.
- The evaporative emission system device control and intrusive diagnostics are not active.
- The engine overspeed protection is not active.
- The engine is in closed loop status.
- The system voltage is greater than 11 V.
- The engine coolant temperature (ECT) is warmer than -20°C (-4°F).
- The engine speed is between 1, 200 - 4, 000 RPM.
- The mass air flow is between 0 - 100 g/s.
- The secondary air injection pump (if equipped) is not ON.
- The Exhaust Camshaft Position and Intake Camshaft Position are between 0 - 35 degrees.

- Engine run time is greater than 30 s.
- Fuel level is greater than 10% and no fuel level sensor fault is present.
- The DTC runs continuously when the above conditions have been met.

Conditions for Setting the DTC

Multiple samples of the pre-catalyst HO2S accumulated voltage are consistently greater than the desired value.

Action Taken When the DTC Sets

DTC P219A is a Type A DTC.

Conditions for Clearing the MIL/DTC

DTC P219A is a Type A DTC.

Diagnostic Aids

- The fuel trim cylinder balance diagnostic is very sensitive to heated oxygen sensor (HO2S) design. A non-OE sensor or an incorrect part number may cause a DTC to set.
- Monitoring the misfire current counters, or misfire graph, may help to isolate the cylinder that is causing the condition.
- Certain aftermarket air filters may cause a DTC to set.
- Certain aftermarket air induction systems or modifications to the air induction system may cause a DTC to set.
- Certain aftermarket exhaust system components may cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Powertrain Component Views

Electrical Information Reference

- Circuit Testing
- Troubleshooting with a Test Lamp
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs
- Connector 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 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**

3. Verify DTC P219A 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 in the Freeze Frame/Failure Records data.

5. Verify DTC P219A is not set.

- **If a DTC is set**

Refer to Circuit/System Testing.

- **Go to next step: If no DTC is set**

6. All OK.

Circuit/System Testing

1. Engine idling, transmission in Park or Neutral, verify the manifold absolute pressure (MAP) sensor parameter is between 20 - 48 kPa.

- **If not within the specified range .**

Refer to [DTC P0106](#) .

- **Go to next step: If within the specified range, inspect for the conditions listed below:**

- Modified, damaged, leaking, or restricted air induction system components.
- Improperly operating crankcase ventilation system. Refer to [Crankcase Ventilation System Inspection/Diagnosis](#) .
- Split, kinked, or improperly connected vacuum hoses.
- Restricted, damaged, leaking, or modified exhaust system from the catalytic converter forward. Refer to [Symptoms - Engine Exhaust](#) .
- Improperly operating fuel injectors. Refer to [Fuel System Diagnosis](#).
- Fuel contamination. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Excessive fuel in the crankcase due to leaking injectors. Change engine oil as necessary.
- Improperly operating ignition system. Refer to [Electronic Ignition System Diagnosis](#).
- **If a condition is found**

Repair as necessary.

- **Go to next step: If no condition is found**

2. Test the engine for any mechanical conditions such as sticking valves, lifters, etc., which could alter the flow into the combustion chamber. Refer to [Symptoms - Engine Mechanical](#) .

Repair Instructions

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

Perform the scan tool Fuel Trim Reset after completing the repair.

DTC P2227, P2228, P2229, OR P2230: BAROMETRIC PRESSURE (BARO) SENSOR PERFORMANCE

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

NOTE: This procedure may also diagnose malfunctions that are not detected by a DTC.

DTC P2227

Barometric Pressure (BARO) Sensor Performance

DTC P2228

Barometric Pressure (BARO) Sensor Circuit Low Voltage

DTC P2229

Barometric Pressure (BARO) Sensor Circuit High Voltage

DTC P2230

Barometric Pressure (BARO) Sensor Circuit Erratic

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P06D2, P2228	P2227, P2228	P06D2, P2227, P2229	P2227
Signal	P2227, P2228	P2227, P2229	P2227, P2229	P2227
Low Reference	-	P0113, P2199, P2227, P2229	-	P2227

Typical Scan Tool Data

BARO

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition - On / Vehicle - In Service Mode & Engine - Off Parameter Normal Range: 56 to 105 kPa (8.1 to 15.2 PSI)			
5 V Reference	0 kPa (0.0 PSI)	0 kPa (0.0 PSI)	127 kPa (18.4 PSI)
Signal	0 kPa (0.0 PSI)	127 kPa (18.4 PSI)	127 kPa (18.4 PSI)
Low Reference	-	127 kPa (18.4 PSI)	-

Circuit/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

Component	Description
B75C Multifunction Intake Air Sensor	The assembly has several functions: - The mass air flow sensor is a hot film type sensor that measures the mass of air (not the volume) entering the engine. The signal varies with engine load and is displayed by the scan tool in Hertz (Hz) and grams per second (g/s). - The intake air humidity sensor uses the same signal circuit as the intake air temperature sensor 2. The intake air humidity sensor modulates the pulse width of the signal. The intake air temperature sensor 2 modulates the frequency of the signal. That means the signal is both, PWM and FM modulated. - The barometric pressure sensor generates an analog voltage that is proportional to the ambient air pressure. - The intake air temperature sensor 1 varies its resistance depending on the temperature. - Low temperature produces a high resistance: 5.6 k ohms @ 0°C (32°F) - High temperature produces a low resistance: 187 ohms @ 100°C (212°F)
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.

Component	Description
B75C Multifunction Intake Air Sensor	The barometric pressure sensor generates an analog voltage that is proportional to the ambient air pressure.
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.

The barometric pressure sensor is integrated into the multifunction intake air sensor.

Conditions for Running the DTC

P2227 Condition 1

- DTC P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0117, P0118, P0119, P0121, P0122, P0123, P0222, P0223, P0236, P0237, P0238, P1516, P2101, P2135, P2228, P2229 = Not set
- Engine Running = For greater than 30 s

Condition 2

- DTC P0106, P0107, P0108, P0237, P0238, P2228, P2229, P2230, P2610 = Not set
- Ignition = On
- Engine Off = For greater than 6 min

DTC runs continuously when the above conditions are met.

P2228, P2229

Engine Running = For greater than 30 s

DTC runs continuously when the above condition is met.

P2230

- DTC P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0117, P0118, P0119, P0121, P0122, P0123, P0222, P0223, P0236, P0237, P0238, P1516, P2101, P2135, P2228, P2229 = Not set
- Ignition = On

DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2227 Condition 1

BARO & Calculated BARO = The actual value is not within a predetermined range of the calculated value.

Condition 2

BARO = Less than 50 kPa (7.3 PSI) or Greater than 115 kPa (16.7 PSI)

P2228

BARO = Less than 2 V - For greater than 5 s

P2229

BARO = Greater than 4.5 V - For greater than 5 s

P2230

BARO = Signal noisy or erratic - For greater than 5 s

Actions Taken When the DTC Sets

DTCs P2227, P2228, P2229, P2230 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P2227, P2228, P2229, P2230 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Component View Reference

Disassembled Views

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

Circuit/System Verification

1. Ignition - On / Vehicle - In Service Mode
2. Verify DTC P0106, P0107, P0108, P0641, P0651, P0697, P06A3, P06D2 is not set.
 - If any of the DTCs are set

Refer to: **Diagnostic Trouble Code (DTC) List - Vehicle**
 - If none of the DTCs are set
3. Determine the current vehicle testing altitude.
4. Verify the scan tool parameter:
 - MAP Sensor = **Altitude Versus Barometric Pressure** - The value should be within the range listed in the table.
 - Boost Pressure = **Altitude Versus Barometric Pressure** - The value should be within the range listed in the table.
 - BARO = **Altitude Versus Barometric Pressure** - The value should be within the range listed in the table.
 - **If not in the specified range**
 - {MAP Sensor} Refer to: **DTC P0106** .
 - {Boost Pressure} Refer to: **DTC P0236** .
 - {BARO} Refer to: Circuit/System Testing.
 - **Go to next step: If in the specified range**
5. Verify the scan tool parameter:BARO = The value should not spike or drop out.

Perform the action while monitoring the parameter:

- Wiggle the harness and connector:B75C Multifunction Intake Air Sensor
- Wiggle the harness and connector:X3 @K20 Engine Control Module
- If the value spikes or drops out

Repair as necessary - Wiring / Terminal(s) / Electrical Connector(s)

- If the value does not spike or drop out
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 is not set**
 8. 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:B75C Multifunction Intake Air Sensor
3. Test for less than 2 ohms between the test points:Low Reference circuit terminal 3 & Ground

- **If 10 ohms or greater**
 1. Disconnect the electrical connector:X2 @K20 Engine Control Module
 2. Test for less than 2 ohms between the test points:Low Reference circuit terminal 3 @Component harness & The other end of the circuit@Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **Go to next step: If less than 10 ohms**
- 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 2 & Low Reference circuit terminal 3
 - **If less than 4.8 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:X1 @K20 Engine Control Module
 3. Test for infinite resistance between the test points:5 V Reference circuit terminal 2 @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 ohms between the test points:5 V Reference circuit terminal 2 @Component harness & The other end of the circuit@Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component:K20 Engine Control Module
 - **If greater than 5.2 V**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:X1 @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 2 @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:BARO = Greater than 4.7 V
 - **If 4.7 V or less**
 1. Ignition/Vehicle - Off
 2. Disconnect the electrical connector:X3 @K20 Engine Control Module
 3. Test for infinite resistance between the test points:Signal circuit terminal 4 @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 4.7 V**
- 7. Connect a 3 A fused jumper wire between the test points:Signal circuit terminal 4 & Low Reference circuit terminal 3
- 8. Verify the scan tool parameter:BARO = Less than 0.2 V
 - **If 0.2 V or greater**
 1. Ignition/Vehicle - Off & Remove - Jumper wire(s)
 2. Disconnect the electrical connector:X3 @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 4 @Component harness & Ground
 - If 1 V or greater - Repair the short to voltage on the circuit.
 - If less than 0.2 V

5. Ignition/Vehicle - Off

6. Test for less than 2 ohms between the test points: Signal circuit terminal 4 @Component harness & The other end of the circuit@Control module harness

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - Replace the component: K20 Engine Control Module

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

9. Test or replace the component: B75C Multifunction Intake Air Sensor

Repair Instructions

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

- [Mass Airflow Sensor Replacement](#) - B75C Multifunction Intake Air Sensor
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P2261: TURBOCHARGER BYPASS VALVE STUCK

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

DTC Descriptor

DTC P2261

Turbocharger Bypass Valve Stuck

Circuit/System Description

The dual-scroll turbocharger incorporates a wastegate that is controlled by the engine control module (ECM) by means of a pulse width modulation (PWM) solenoid, to regulate the pressure ratio of the compressor. An ECM controlled compressor bypass valve is integrated into the unit to prevent compressor surging and damage from vibrations by opening during abrupt closed throttle conditions. The bypass valve is open during closed throttle deceleration conditions to allow air to recirculate in the turbocharger and maintain compressor speed.

As engine load and speed increase, the turbocharger bypass valve is commanded closed by the ECM. As soon as the throttle closes, the valve is commanded open to allow the turbocharger air to recirculate to prevent compressor surging.

Conditions for Running the DTC

- DTC P0033, P0034, P0035, P0101, P0102, P0103, P0236, P0237, or P0238 is not set.
- Engine speed is at least 1,500 RPM
- Boost pressure versus the BARO pressure ratio is between 1.0 - 3.2.
- Turbocharger bypass valve has been commanded Open greater than 6% for greater than 1.5 s immediately after an abrupt closed throttle has occurred and the resulting pressure ratio across the compressor exceeds the calibrated pressure ratio limit.

The DTC runs continuously when the above conditions have been met.

Conditions for Setting the DTC

The ECM has detected a series of pulsations in the induction system that exceed a calibrated threshold.

Action Taken When the DTC Sets

- DTC P2261 is a Type C DTC.
- The Service Vehicle Soon Indicator may illuminate.

DTC P2261 is a Type C DTC.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Turbocharger 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 that DTC P0033, P0034, or P0035 is not set
 - **If any of the DTCs are set**
Refer to DTC P0033-P0035.
 - **Go to next step: If none of the DTCs are set**
3. Verify the scan tool BARO Sensor parameter is within the range specified in the Altitude Versus Barometric Pressure table for the current testing altitude.
 - **If the parameter is not within the range specified in the table.**
Refer to DTC P2227-P2230.
 - **Go to next step: If the parameter is within the range specified in the table.**
4. Verify the scan tool Boost Pressure Sensor and BARO Sensor parameters are within 3 kPa (0.4 psi).
 - **If the parameters are not within 3 kPa (0.4 psi).**
Refer to DTC P0236.
 - **Go to next step: If the parameters are within 3 kPa (0.4 psi).**
5. Verify a click is heard or felt from the Q40 turbocharger bypass solenoid valve when commanding the Turbocharger Bypass Solenoid Valve between Active and Inactive with a scan tool.
 - **If a click is not heard or felt**

Refer to Circuit/System Testing

- **Go to next step: If a click is heard or felt**
- 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 a DTC does not set.
 - **If a DTC sets**

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

Circuit/System Testing

NOTE: Leave harness connector connected or re-connect it after removing valve.

1. Ignition Off. Disconnect the Q40 turbocharger bypass solenoid valve, ignition On.
2. Verify the turbocharger bypass valve plunger retracts and extends when commanding the Turbocharger Bypass Solenoid Valve between Active and Inactive with a scan tool.
 - **The valve plunger does not retract and extend**

Replace the Q40 turbocharger bypass solenoid valve
 - **Go to next step: The valve plunger retracts and extends**
3. Verify the conditions listed below do not exist with the turbocharger assembly. Refer to **Turbocharger Cleaning and Inspection**
 - Cracked, damaged or worn turbine blades
 - Restricted wastegate, turbine, ports or passages
 - Foreign material
 - **If a condition exists**

Repair or replace the turbocharger as necessary
 - **Go to next step: If none of the conditions exist**
4. Replace the Q40 turbocharger bypass solenoid valve

Component Testing

Static Test

1. Ignition Off, disconnect the harness connector at the Q40 turbocharger bypass solenoid valve.
2. Test for 10 - 14 Ω between the control terminal 2 and the Ignition terminal 1 of the Q40 turbocharger bypass solenoid valve.
 - **If not between 10 - 14 Ω**

Replace the Q40 turbocharger bypass solenoid valve.
 - **Go to next step: If between 10 - 14 Ω**
3. All OK

Dynamic Test

1. Install a 15 A fused jumper wire between the ignition terminal 2 of the Q40 turbocharger bypass solenoid valve and 12 V. Install a jumper wire between the control terminal 1 and ground.
2. Verify the Q40 turbocharger bypass solenoid valve plunger retracts.
 - **If the plunger does not retract.**

Replace the Q40 turbocharger bypass solenoid valve.

- Go to next step: If the plunger retracts.

3. All OK

Repair Instructions

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

- [Turbocharger Bypass Valve Solenoid Replacement](#)
- [Turbocharger Replacement](#)

DTC P2544: TRANSMISSION TORQUE REQUEST CIRCUIT MESSAGE COUNTER INCORRECT

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

DTC Descriptors

DTC P2544

Transmission Torque Request Circuit Message Counter Incorrect

Circuit/System Description

To improve shift feel, the transmission control module (TCM) is constantly sending the engine control module (ECM) serial data messages with requests to modify engine speed or torque. These serial data messages are sent through two circuits which are part of a communication network called the controller area network (CAN). The ECM sets DTC P2544 when it detects a discrepancy in the structure of the message causing the integrity of the message to be questioned.

Conditions for Running the DTC

- The engine run time is greater than 0.5 s.
- No other CAN errors are present.

Conditions for Setting the DTC

The ECM detects that the engine speed and torque modification messages from the TCM are either corrupted or intermittently missing for greater than 4 s.

Action Taken When the DTC Sets

- DTC P2544 is a Type B DTC.
- The TCM commands maximum line pressure during shifts, which results in harsh shifts.
- The TCM freezes adaptive functions.

Conditions for Clearing the DTC

DTC P2544 is a Type B DTC.

Diagnostic Aids

An intermittent fault in the CAN circuits will cause the ECM to set DTC P2544.

Reference Information

DTC Type Reference

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

Circuit/System Verification

NOTE:

- DTC P2544 is an informational DTC.
- Diagnose all other engine control module DTCs prior to DTC P2544.

1. Verify that no other DTCs are set except for DTC P2544.

- If any other DTCs are set

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

- Go to next step: If only DTC P2544 is set

2. Replace the K71 Transmission Control Module.

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 DTC sets

Replace the K20 Engine Control Module.

- Go to next step: If DTC does not set

5. All OK.

Repair Instructions

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

[Control Module References](#) for ECM or TCM replacement, programming, and setup

DTC P25CA, P25CB, OR P25CC: INTAKE CAMSHAFT POSITION ACTUATOR PARK LOCK SOLENOID 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 P25CA**

Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit

DTC P25CB

Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit Low Voltage

DTC P25CC

Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P25CB*	P25CB*	P0690*	-
Control	P0016, P25CB	P25CA	P25CC	-
* Additional DTCs may set.				

Circuit/System Description

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

Circuit	Description
Ignition	Supplied from a fuse.
Control	The output circuit is switched to ground to activate the component.

Component	Description
Q84 Camshaft Position Actuator Park Lock Solenoid Valve	A solenoid valve is an electro-mechanically operated valve. The valve is controlled by an electric current through the solenoid.
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

- Ignition Voltage = Greater than 11 V
- Ignition = On or Engine = Running
- Intake Camshaft Position Actuator Park Lock Solenoid Valve Command = On

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 5 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 1.5L \(LYX\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX](#)

Component View Reference

[Master Electrical Component List](#)

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

Circuit/System Verification

NOTE: **Verify the engine has the correct oil level and the correct oil pressure before continuing with this diagnostic.**

1. Engine - Running@ 1, 000 to 1, 500 RPM

2. Verify the scan tool parameter:

- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit High Voltage Test Status = OKorNot Run
- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit Low Voltage Test Status = OKorNot Run
- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit Open Test Status = OKorNot Run
- **If not the specified state**

Refer to: Circuit/System Testing

- **Go to next step: If the specified state**

3. Verify the scan tool parameter:

- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit High Voltage Test Status = OKorNot Run
- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit Low Voltage Test Status = OKorNot Run
- Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit Open Test Status = OKorNot Run
- Perform the action while monitoring the parameter:
- Wiggle the harness and connector:Q84 Camshaft Position Actuator Park Lock Solenoid Valve
- Wiggle the harness and connector:K20 Engine Control Module
- **If not the specified state**

Repair as necessary - Wiring / Terminal(s) / Electrical Connector(s)

- **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:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

3. Ignition - On / Vehicle - In Service Mode

4. Verify a test lamp turns On between the test points:Ignition circuit terminal 1 & 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 ohms between the test points: Ignition circuit terminal 1 & Output terminal @ Fuse

- If 2 ohms or greater - Repair the open/high resistance in the circuit.
- If less than 2 ohms - 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. Ignition/Vehicle - Off & Remove - Test lamp

2. Connect the electrical connector: Q84 Camshaft Position Actuator Park Lock Solenoid Valve

3. Ignition - On / Vehicle - In Service Mode

4. Replace the component: Fuse

5. Verify the fuse does not open.

- If the fuse opens and there are components connected to the circuit - Disconnect a component and repeat step 4
- 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.

6. Operate each component on the circuit, one at a time. It might be necessary to use scan tool control functions to operate the components.

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.

7. 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 2 & B+

• **If the test lamp turns On**

1. Ignition/Vehicle - Off & Remove - Test lamp

2. Disconnect the electrical connector: X3 @ K20 Engine Control Module

3. Test for infinite resistance between the test points: Control 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 the test lamp does not turn On**

6. Remove - Test Lamp

7. Engine - Running @ 1,000 to 1,500 RPM

8. Verify the scan tool parameter: Intake Camshaft Position Actuator Park Lock Solenoid Valve Control Circuit High Voltage Test Status = OK

• **If not the specified state**

1. Ignition/Vehicle - Off

2. Disconnect the electrical connector: X3 @ K20 Engine Control Module

3. Test for less than 1 V between the test points: Control circuit terminal 2 @ 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**

9. Ignition/Vehicle - Off

10. Connect a 3 A fused jumper wire between the test points: Control circuit terminal 2 & Ignition circuit terminal 1

11. Engine - Running @ 1,000 to 1,500 RPM

12. Verify the scan tool parameter: Intake Camshaft Position Actuator Park Lock Solenoid 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: X3 @K20 Engine Control Module
3. Test for less than 2 ohms between the test points:Control circuit terminal 2 @Component harness & The other end of the circuit@Control module harness
 - If 2 ohms or greater - Repair the open/high resistance in the circuit.
 - If less than 2 ohms - Replace the component: K20 Engine Control Module

- **Go to next step: If the specified state**

13. Test or replace the component:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

Component Testing

Static Test

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector:Q84 Camshaft Position Actuator Park Lock Solenoid Valve
3. Test for 11 to 30 ohms between the test points:Control terminal 2 & Ignition terminal 1

- **If not between 11 and 30 ohms**

Replace the component:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

- **Go to next step: If between 11 and 30 ohms**

4. Test for infinite resistance between the test points:Each terminal of the component & The component's housing

- **If less than infinite resistance**

Replace the component:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

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

5. All OK.

Dynamic Test

1. Ignition/Vehicle - Off
2. Disconnect the electrical connector:Q84 Camshaft Position Actuator Park Lock Solenoid Valve
3. Connect a 3 A fused jumper wire between the test points:Ignition terminal 1 & 12 V

CAUTION: Complete the testing as quickly as possible in order to prevent overheating and damaging the component.

- 4.
5. Momentarily connect a jumper wire between the test points:Control terminal 2 & Ground

Verify the component turns On and Off when connecting and disconnecting the jumper wire:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

- **If the component does not turn On and Off**

Replace the component:Q84 Camshaft Position Actuator Park Lock Solenoid Valve

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

6. All OK.

Repair Instructions

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

- [Camshaft Position Actuator Locating Pin Control Valve Replacement](#) - Q84 Camshaft Position Actuator Park Lock Solenoid Valve
- For control module replacement, programming, and setup refer to: [Control Module References](#)

DTC P2618: CRANKSHAFT POSITION SIGNAL OUTPUT CIRCUIT LOW VOLTAGE OR 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 P2618

Crankshaft Position Signal Output Circuit Low Voltage

DTC P2619

Crankshaft Position Signal Output Circuit High Voltage

Conditions for Running the DTC

- Ignition Voltage = Greater than 11 V
- Ignition = On
- Crankshaft Position Sensor Circuit = Active

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

Conditions for Setting the DTC

P2618

Crankshaft Position Signal Output Circuit = Short to Ground or Open - For greater than 5 s

P2619

Crankshaft Position Signal Output Circuit = Short to Voltage - For greater than 5 s

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

Circuit/System Verification

1. Engine - Running
2. Verify there are no DTCs/symptoms related to the following system/component, if equipped:
 - K71 Transmission Control Module
 - K103 Fuel Injector Control Module
 - T3 Audio Amplifier

- T6 Power Inverter Module
- If a DTC or symptom exists

Refer to:

- [Diagnostic Trouble Code \(DTC\) List - Vehicle](#)
- [Symptoms - Vehicle](#)
- Go to next step: If no DTC or symptom exists

3. All OK.

DTC P2635: FUEL PUMP FLOW 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.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

DTC Descriptor

DTC P2635

Fuel Pump Flow Performance

Circuit/System Description

The engine control module (ECM) supplies voltage to the fuel pump driver control module when the ECM detects that the ignition is on. The voltage from the ECM to the fuel pump driver control module remains active for 2 s, unless the engine is in crank or run. While this voltage is being received, the fuel pump driver control module closes the ground switch of the fuel pump. The fuel pump driver control module maintains correct fuel pressure based on the information from the fuel pressure sensor and varying the pulse width modulated controlled current to the fuel pump.

Conditions for Running the DTC

- DTC P018B, P018C, P018D, P0231, P0232, P023F, P0641, or P1255 are not active.
- Fuel pump control is enabled and the fuel pump control state is normal.
- The ignition voltage is between 11 - 32 V.
- The engine has been running for greater than or equal to 30 s.
- The engine fuel flow is not 0.
- Low fuel level warning not present.
- The DTC runs continuously when the conditions above are met.

Conditions for Setting the DTC

The fuel pump driver control module detects a difference of $\hat{A} \pm 60$ kPa (8.7 PSI) at 400 kPa (58 PSI) request or $\hat{A} \pm 45$ kPa (6.5 PSI) at 300 kPa (43.5 PSI) request between the desired fuel pressure and the actual fuel pressure for approximately 10 s.

Action Taken When the DTC Sets

DTC P2635 is a Type B DTC.

Conditions for Clearing the DTC

DTC P2635 is a Type B DTC.

Diagnostic Aids

Using the Failure Records data may help locate an intermittent condition. If you cannot duplicate the DTC, the information in the Failure Records can help determine how many miles since the DTC set. The

Fail Counter and Pass Counter can help determine how many ignition cycles that the diagnostic test reported a pass and/or a fail.

On vehicles equipped with a high pressure mechanical pump on Direct Fuel Injection engines, the vehicle may continue to run even though the pump in the fuel tank is not operating.

A restricted or dislocated fuel feed front pipe check valve may cause fuel pump flow performance issues.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Powertrain Component View

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 U0074 or U18A2 is not set or stored in history.
 - **If DTC U0074 or U18A2 is set or stored in history**
Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
 - **Go to next step: If DTC U0074 or U18A2 is not set or stored in history**
3. Verify that DTC P018B, P018C, P018D, P0231, P0232, or P023F 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**
4. Command the Fuel Pressure to 300 kPa (43.5 PSI) using the scan tool Control Function: Fuel Pressure Increase/Decrease.
5. Verify the scan tool parameter: Fuel Pressure Sensor & Desired Fuel Pressure are within 45 kPa (6.5 PSI) of each other at 300 kPa (43.5 PSI) request.
 - **If greater than 45 kPa (6.5 PSI)**

Refer to Circuit/System Testing.

- **Go to next step: If less than 45 kPa (6.5 PSI)**

6. Command the Fuel Pressure to 400 kPa (58 PSI) using the scan tool Control Function: Fuel Pressure Increase/Decrease.

7. Verify the scan tool parameter: Fuel Pressure Sensor & Desired Fuel Pressure are within 60 kPa (8.7 PSI) of each other at 400 kPa (58 PSI) request.

- **If greater than 60 kPa (8.7 PSI)**

Refer to Circuit/System Testing.

- **Go to next step: If less than 60 kPa (8.7 PSI)**

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:

Do not replace the fuel pump driver control module based on a history DTC P2635. DTC P2635 may be stored but that does not indicate a failure of the fuel pump driver control module. Refer to [Strategy Based Diagnosis](#) for further history DTC diagnostics.

1. Verify the proper fuel system pressure. Refer to [Fuel System Diagnosis](#).

- **If the fuel pressure is not normal**

Repair the fuel system as necessary.

- **Go to next step: If the fuel pressure is normal**

2. All OK.

Repair Instructions

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

- [Fuel Feed Front Pipe Replacement](#)
- [Fuel Feed Intermediate Pipe Replacement](#)
- [Fuel Feed Pipe Replacement \(FWD\)](#), [Fuel Feed Pipe Replacement \(AWD\)](#)
- [Fuel Injector Replacement](#)
- [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#), [Fuel Tank Fuel Pump Module Replacement \(AWD\)](#)

Repair Verification

1. Install any components that have been removed or replaced during diagnosis.
2. Perform any adjustments, programming or setup procedures that are required when a component is removed or replaced.
3. Clear the DTCs with a scan tool.
4. Turn OFF the ignition for 60 s.
5. Operate the vehicle within the Conditions for Running the DTC.
6. Command the Fuel Pressure to 300 kPa (43.5 PSI) using the scan tool Control Function: Fuel Pressure Increase/Decrease.

7. Verify the scan tool parameter: Fuel Pressure Sensor & Desired Fuel Pressure are within 45 kPa (6.5 PSI) of each other at 300 kPa (43.5 PSI) request.

- **If greater than 45 kPa (6.5 PSI)**

Refer to Circuit/System Testing.

- **Go to next step: If less than 45 kPa (6.5 PSI)**

8. Command the Fuel Pressure to 400 kPa (58 PSI) using the scan tool Control Function: Fuel Pressure Increase/Decrease.

9. Verify the scan tool parameter: Fuel Pressure Sensor & Desired Fuel Pressure are within 60 kPa (8.7 PSI) of each other at 400 kPa (58 PSI) request.

- **If greater than 60 kPa (8.7 PSI)**

Refer to Circuit/System Testing.

- **Go to next step: If less than 60 kPa (8.7 PSI)**

10. All OK.

DTC P26C8: CHASSIS CONTROL MODULE REQUESTED MIL ILLUMINATION

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

DTC Descriptor

DTC P26C8

Chassis Control Module Requested MIL Illumination

Circuit/System Description

The chassis control module constantly monitors the chassis control system for any condition which may adversely affect vehicle emissions. If a condition is detected, the chassis control module sets a DTC and sends a serial data message to the engine control module (ECM). The ECM sets DTC P26C8 to inform the technician that the chassis control module has set the emission related DTC. The serial data message sent by the chassis control module also contains a request for the ECM to illuminate the malfunction indicator lamp (MIL).

The technician can observe the DTC that was set by the chassis control module by reviewing the ECM Freeze Frame records on the scan tool. The ECM Freeze Frame records also contain the engine operating conditions present when the chassis control module DTC set.

Conditions for Running the DTC

The ignition is ON, or the engine is running for greater than 3 s.

Conditions for Setting the DTC

The ECM receives a serial data message from the chassis control module indicating that an emission related DTC has set in the chassis control module.

Action Taken When the DTC Sets

- DTC P26C8 is a Type A DTC.
- DTC P26C8 will continue to be current or active as long as the chassis control module is requesting MIL illumination.

Conditions for Clearing the DTC

DTC P26C8 is a Type A DTC.

Diagnostic Aids

Communication codes, U-codes, as well as powertrain codes, P-codes, set in the chassis control module will cause the chassis control module to request DTC P26C8 to be set in the ECM.

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

- Do not replace the engine control module for this DTC. DTC P26C8 is an informational DTC.
- Correct any engine control and communication DTCs before diagnosing chassis control module DTCs.

1. Verify there are no engine control or communication 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 there are no chassis control module 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

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 Diagnostic Trouble Code (DTC) List - Vehicle .

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

5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

SYMPTOMS - ENGINE CONTROLS

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.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

Symptoms Description

Symptoms cover conditions that are not covered by DTCs. Certain conditions can cause multiple symptoms. These conditions are listed together under Symptoms Testing. Conditions that may only

cause specific symptoms are listed separately under additional symptoms testing. Perform the symptoms testing before using the additional symptoms testing.

Symptoms Definition

Backfire

Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.

Cuts Out, Misses

A steady pulsation or jerking that follows engine speed, which is usually more pronounced as the engine load increases. This condition is not normally felt above 1 500 RPM or 48 km/h (30 MPH). The exhaust has a steady spitting sound at idle or at low speed.

Detonation/Spark Knock

A mild to severe ping which usually gets worse while under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

Dieseling, Run-On

Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.

Engine Control Module (ECM) Commanded Reduced Engine Power

The ECM illuminates the Reduced Engine Power lamp and will limit engine power under potential engine damaging or emissions related conditions. A DTC may not set.

Hard Start

Engine cranks OK, but does not start for a long time. The vehicle does eventually run, or may start but immediately stalls.

Hesitation, Sag, Stumble

Momentary lack of response as the accelerator is pushed down. This condition can occur at any vehicle speed. This condition is usually more pronounced when first trying to make the vehicle move, as from a stop. This condition may cause the engine to stall in severe conditions.

Lack of Power, Sluggishness, or Sponginess

The engine delivers less than expected power. Little or no increase in speed when the accelerator pedal is pushed down part way.

Poor Fuel Economy

Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, the fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Poor Fuel Fill Quality

Difficulty when refueling the vehicle.

Rough, Unstable, or Incorrect Idle and Stalling

The engine runs unevenly at idle. If severe, the engine or the vehicle may shake. Engine idle may vary in speed. Either condition may be severe enough to stall the engine.

Surges/Chuggles

Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

Before using the Symptom tables, perform the following inspections:

- Verify that the MIL is operating correctly. Use the scan tool to command the lamp ON and OFF.
- Verify that there are no DTCs that are stored.
- Verify that the scan tool data is within a normal operating range. Refer to [Control Module References](#) for scan tool information.
- Verify that the vehicle tires are correctly inflated and meet original equipment specifications.
- Verify that the Flex Fuel reservoir has a sufficient amount of fuel in it.
- Verify the customer concern.
- Perform the Visual/Physical Inspection in this section. The visual/physical inspection is extremely important, and can lead to correcting a condition without additional testing. It may also help reveal the cause of an intermittent condition.

Identifying Intermittent Conditions

Many intermittent conditions occur with harness or connector movement due to engine torque, rough pavement, vibration or physical movements of a component. Refer to the following for a list of issues that may cause an intermittent condition:

- Moisture and water intrusion in connectors, terminals, and components
- Incomplete connector mating
- Poor terminal contact
- High circuit or component resistance - High resistance can include any resistance, regardless of the amount, which can interrupt the operation of the component.
- Harness that is too short or tight
- Wire insulation that is chaffed or cut
- High or low ambient temperature
- High or low engine coolant temperatures
- High underhood temperatures
- Heat build up in component or circuit due to circuit resistance, poor terminal contact, or high electrical load
- High or low system voltage
- High vehicle load conditions
- Rough road surfaces
- Electromagnetic Interference (EMI)/circuit interference from relays, solenoids or other electrical surge
- Incorrect installation of aftermarket, add on accessories

Visual/Physical Check

- Verify that the control module grounds are clean, tight, and correctly located.
- Verify that the vacuum hoses are not split or kinked, and are properly connected, as shown on the Vehicle Emission Control Information label.
- Verify that the air filter is clean and free from restrictions.
- Verify that there is no water intrusion in connectors terminals and components.
- Inspect the air intake ducts for the conditions listed below:
 - Collapsed
 - Damaged areas
 - Looseness
 - Incorrect installation
 - Leaking

If any condition listed above has allowed non-metered air to enter the air induction system, the **Throttle Body Idle Air Flow Compensation Reset** procedure must be performed after the repair is complete.

- Inspect for air leaks at the throttle body mounting area, the Mass Air Flow (MAF) sensor and intake manifold sealing surfaces.
- Inspect the wiring harness for the following conditions:
 - Poor connections
 - Pinches
 - Cuts
- Inspect for loose, damaged, unseated, or missing sensors/components.
- Inspect the terminals for corrosion and correct contact.

Symptoms Testing

Backfire, Cuts Out/Misses, Detonation/Spark Knock, Dieseling/Run-On, Engine Control Module (ECM) Commanded Reduced Engine Power, Hard Start, Hesitation/Sag/Stumble, Lack of Power/Sluggishness/Sponginess, Poor Fuel Economy, Rough, Unstable, or Incorrect Idle and Stalling, or Surges/Chuggles

1. Test for the following conditions:

- Incorrectly operating fuel system. Test/inspect for the following:
 - Incorrect system operation or fuel pressure. Refer to **Fuel System Diagnosis**.
 - Leaking or incorrectly operating fuel injectors. Refer to **Fuel Injector Diagnosis**.
 - Contaminated or poor quality fuel. Refer to **Alcohol/Contaminants-in-Fuel Diagnosis**.
- Incorrectly operating ignition system. Test/Inspect for the following:
 - Spark plugs with incorrect heat range or an abnormal condition. Refer to **Spark Plug Inspection** , and **Ignition System Specifications** .
 - Coolant or oil fouled spark plugs. For diagnosis, refer to **Oil Consumption Diagnosis** , and **Coolant in Combustion Chamber** .
 - Secondary ignition system susceptible to moisture. Wet down the secondary ignition system with water from a spray bottle to help locate damaged or deteriorated components. Look/listen for arcing or misfiring as the water is applied.
 - Weak spark using the EL 26792 HEI Spark Tester. For equivalent regional tools, refer to **Special Tools (Diagnostic Tools) Special Tools (Mechanical Tools)** . Refer to **Electronic Ignition System Diagnosis**.
- Non-metered air flow into the air induction system. If a leak is found, repair as necessary. The **Throttle Body Idle Air Flow Compensation Reset** procedure must be performed when the repair is complete.
- An incorrectly installed MAF/Intake Air Temperature (IAT) Sensor. Refer to **Mass Airflow Sensor Replacement** .
- An incorrectly operating transmission Torque Converter Clutch (TCC). The scan tool should indicate an engine speed drop when the TCC is commanded ON.
- An incorrectly operating A/C compressor
- Items that can cause an engine to run lean or rich. Refer to **DTC P0171 or P0172** .
- Split or kinked vacuum hoses. Verify that the routing and connections are as shown on the vehicle emission control information label.
- Excessive knock sensor system spark retard activity. Refer to **DTC P0324-P0333, P06B6, or P06B7** , **DTC P0324-P0333, P06B6, or P06B7** , and **Knock Sensor Replacement (Sensor 1) Knock Sensor Replacement (Sensor 2)** .
- An incorrectly operating turbocharger system, if equipped.
- Leaking turbocharger charge air cooler system, if equipped.
- Electromagnetic interference on the reference circuit, which can cause a misfire condition. You can usually detect electromagnetic interference with a scan tool by monitoring the

engine speed parameter. A sudden increase in the engine speed parameter with little change in actual engine speed indicates that electromagnetic interference is present. Inspect the high voltage components near the ignition control circuit if a condition exists.

- An incorrectly operating positive crankcase ventilation system. Inspect all connections for leaks or restrictions. Refer to [Crankcase Ventilation System Inspection/Diagnosis](#)
- A stuck open Evaporative Emission (EVAP) Canister Purge Solenoid Valve.
- An incorrectly operating variable camshaft actuator system. Engine warm and idling, command the intake and exhaust camshaft actuators from 0 degrees to 20 degrees and back to zero while observing the scan tool Intake Camshaft Position Variance and Exhaust Camshaft Position Variance parameters. Each parameter should be less than 2 degrees in each of the commanded states.
 - If any of the parameters is greater than 2 degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage. Refer to [Camshaft Actuator System Description](#) , [Camshaft Position Actuator Solenoid Valve Replacement - Exhaust](#) , and [Camshaft Position Actuator Solenoid Valve Replacement - Intake](#) .
- An incorrectly operating engine cooling system. Test/Inspect for the following:
 - A thermostat with incorrect heat range. Refer to [Thermostat Diagnosis](#) .
 - Incorrectly operating engine coolant thermostat heater, if equipped. Refer to DTC P0597 - P0599.

Incorrect engine coolant level. Refer to [Cooling System Draining and Filling \(GE 47716\) Cooling System Draining and Filling \(Static\)](#) .

- An incorrectly operating exhaust system. Test/Inspect the components for the following:
 - Physical damage or possible internal malfunction.
 - Restricted 3-way catalytic converters.

For more information, refer to [Symptoms - Engine Exhaust](#) .

- An engine mechanical condition. Test/Inspect for the following:
 - Too much oil in the combustion chamber or leaking valve seals
 - Incorrect cylinder compression
 - Sticking or leaking valves
 - Worn camshaft lobes
 - Incorrect valve timing
 - Broken valve springs
 - Too much carbon buildup in the combustion chambers. Clean the chambers with Top Engine Cleaner, if necessary. Follow the instructions on the can.
 - Incorrect engine parts

For additional information, refer to [Symptoms - Engine Mechanical](#) .

2. If the above conditions do not address the symptom, refer to the additional symptoms tests.

Additional Symptoms Tests

Detonation/Spark Knock:

- Test the engine for an overheating condition. Refer to [Symptoms - Engine Cooling](#) .
- Inspect for excessive carbon buildup in the combustion chambers. Clean the chambers with Top Engine Cleaner, if necessary. Follow the instructions on the can.
- If there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicle minimum octane requirements.

ECM Commanded Reduced Engine Power

Under certain conditions the engine control module may limit engine power by reducing engine torque and, for some vehicles, fuel pressure as well. For most, but not all of the conditions, the engine control module will illuminate the reduced engine power lamp on the instrument cluster. If equipped with the driver information center feature, a reduced engine power message may be displayed as well. A DTC may not be set.

A repair may not be necessary. Observe the scan tool Reduced Engine Power History parameter or refer to [K20 Engine Control Module: Scan Tool Information](#) to determine the reason for the reduced engine power event.

Verify or inspect for the following:

- Vehicle being operated at sustained high engine speeds, or, towing heavy loads up an incline for an extended period of time, which may cause the engine oil or coolant to overheat. Inspect the airflow passageways in front of the engine for obstructions and clear away any debris or foreign material that is found. If no obstructions are found, review approved driving habits with the customer. The customer may need to operate the vehicle at a higher engine speed to improve cooling system performance, or, at a slower engine speed to reduce engine load.
- A cooling fan condition which may cause the ECM to reduce engine power. Refer to [Cooling Fan Description and Operation](#) , and [Cooling System Description and Operation](#) to verify correct operation of the cooling fan.
- Fuel temperature out of range too high.
- High pressure fuel system condition. Refer to [Fuel System Diagnosis](#), and [Fuel System Description](#) to verify high pressure fuel system operation.
- Reduced engine power due to OnStar® remote command. Verify the vehicle is not in the OnStar® initiated Stolen Vehicle Slowdown mode.
- Turbocharger boost pressure out of range, if equipped. Refer to [DTC P0234 or P0299](#) .
- Intake air temperature out of range too high. Engine running, observe the scan tool IAT sensor parameter. The readings should be between -40Â° C and +149Â° C (-40Â° F and +300Â° F. Refer to [DTC P0112, P0113, or P0114](#) for additional information.
- If equipped with manual transmission, excessively hot manual transmission fluid. Under severe operating conditions the fluid may become overheated, which may result in ECM commanded reduced engine power. Allow the transmission and fluid to cool down. Review the maintenance recommendation in the owners manual to determine if the transmission fluid is due to be serviced.
- If equipped with automatic transmission, an incorrect learned brake pedal position (BPP) sensor. Verify the following actions have not occurred:
 - An engine control module has been replaced
 - A BPP sensor that has been replaced
 - A BPP sensor is misaligned or incorrectly installed

If any of the above actions have occurred, the [Brake Pedal Position Sensor Calibration](#) procedure must be performed.

Fuel Odor

- Inspect for leaking, damaged, or deteriorated fuel lines and components.
- Inspect for a saturated EVAP canister. Refer to [Evaporative Emission Control System Description](#) .
- Inspect for a condition with the internal components of the fuel tank assembly. Refer to [Fuel System Description](#) .

Hard Start

- Observe the scan tool Throttle Body Idle Airflow Compensation parameter. A value greater than 90% may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body and bore and clean, if necessary. Refer to [Throttle Body Inspection and Cleaning](#) .
- Test the engine coolant temperature (ECT) sensor. Compare the ECT sensor value to the intake air temperature (IAT) sensor value on a cold engine. The ECT and IAT sensor values should be within approximately 3Â°C (5Â°F). If the ECT sensor is out of range with the IAT sensor, test the

resistance of the ECT sensor. Refer to [Temperature Versus Resistance - Intake Air Temperature Sensor \(Hitachi Sensor\)](#). [Temperature Versus Resistance - Intake Air Temperature Sensor \(Delco Sensor\)](#) for resistance specifications. Replace the ECT sensor if the resistance is not within specification. If the sensor is within the specification, test the ECT circuits for a high resistance.

- Verify that the fuel system operates correctly and provides adequate pressure for engine start-up. The fuel pump should turn ON for 2 s when the ignition is turned ON. Refer to [Fuel System Diagnosis](#), and [Fuel System Description](#) for fuel pressure specifications and additional information.

Hesitation, Sag, Stumble

- Test the fuel pressure. Refer to [Fuel System Diagnosis](#).
- Test the manifold absolute pressure (MAP) sensor. Refer to [DTC P0106](#).
- Test the generator. Refer to [Symptoms - Engine Electrical](#). Repair the charging system if the generator output voltage is less than 9 V or more than 16 V.

Lack of Power, Sluggishness, or Sponginess

- Inspect the engine electrical system for incorrect operation. Refer to [Symptoms - Engine Electrical](#).
- Verify that each injector harness is connected to the correct injector.
- Inspect the MAF sensor for obstruction, contamination, and damage. Refer to [Mass Airflow Sensor Replacement](#).
- If equipped with a Supplemental Transmission Auto Shift, verify that the brake sensor is not stuck in the applied position. The Enhanced Electronic Pedal Override functionality in the ECM reduces the driver torque request if the accelerator pedal and the brake pedal are applied simultaneously.
- Verify the correct operation of the turbocharger system. Perform the following:
 - Inspect the turbocharger moving components for looseness, binding, wear and damage.
 - Verify that the turbocharger air inlet ducts and outlet ducts are tightly sealed and that the air passages are not obstructed. Engine running, use a smoke generating device or a solution of dish soap and water in a spray bottle to pinpoint any air leaks.
 - Inspect the turbocharger system for external fluid leaks. Inspect the gaskets and sealing surfaces and look for cracks in the turbocharger components.
 - Inspect for excessive turbocharger system noise. Operate the vehicle at various acceleration modes and compare the turbocharger noise to the noise made by a known good system.
 - For additional information, refer to [Turbocharger Cleaning and Inspection](#).

Poor Fuel Economy

- Observe the scan tool Throttle Body Idle Airflow Compensation parameter. A value greater than 90% may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body and bore and clean, if necessary. Refer to [Throttle Body Inspection and Cleaning](#).
- Inspect for heavy loads being carried or towed
- Inspect for acceleration rate too much or too often
- Inspect for incorrect operation of the speedometer.
- Inspect the brake system for brake drag.

Rough, Unstable, or Incorrect Idle and Stalling

- An excessively high idle may be due to the floor mat interfering with the accelerator pedal. With this condition present, it may not be possible to shift the transmission into gear. Inspect the accelerator pedal for binding and verify that the floor mat is not interfering with the accelerator pedal movement.
- Engine idle speed be unstable or the engine may stall if the ECM has learned an incorrect idle/airflow compensation value. A DTC may also set. Observe the scan tool Throttle Body Idle Airflow Compensation parameter. A value greater than 90 % may indicate an excessive

accumulation of deposits in the throttle bore. If the throttle body needs cleaning, refer to [Throttle Body Inspection and Cleaning](#).

The actions listed below may also cause the ECM to learn an incorrect idle value:

- The ECM has been replaced
- The throttle body has been replaced
- The throttle body has been cleaned but the idle learn procedure was not performed after completing the cleaning
- The air induction system was leaking, allowing non-metered air to enter the combustion chamber. The leak was repaired, but the idle learn procedure was not performed after repairing the leak.

If any of the actions listed above have occurred, the [Throttle Body Idle Air Flow Compensation Reset](#) procedure must be performed.

- Inspect the engine mounts for looseness, damage, and wear.
- Inspect the intake and exhaust manifolds for casting flash.
- Inspect engine for a slushy or frozen condition. Refer to [Cooling System Draining and Filling \(GE 47716\) Cooling System Draining and Filling \(Static\)](#).

Surges/Chuggles

- Verify that each injector harness is connected to the correct injector.
- Inspect for slow responding Heated Oxygen Sensors (HO2S). The HO2S should respond quickly to a change in throttle position. If the HO2S do not respond to different throttle positions, inspect for contamination from fuel, silicon, or the incorrect use of room temperature vulcanizing sealant. The sensors may have a white powdery coating and result in a high, but false, signal voltage, which gives a rich exhaust indication. The ECM reduces the amount of fuel delivered to the engine, causing a driveability condition.

ENGINE CRANKS BUT DOES NOT RUN

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

Circuit/System Description

The engine cranks but does not run is an organized approach to identify a condition which causes the engine to crank but not start. This diagnostic directs the technician to the appropriate system diagnosis.

Diagnostic Aids

Inspect for any of the conditions listed below:

- If equipped with a key type ignition system, a partially retracted or folded over ignition key. When attempting to start the engine, the mechanical portion of the vehicle key must be locked in the fully extended position with the fob parallel to the key. Leaving the key partially retracted or folded over when starting may interrupt transponder authentication and result in an intermittent no-start condition. In such instances, DTC B3055 may also be set. If an intermittent no-start complaint is received, it may be necessary to discuss with the customer their starting habits and verify they are locking the key in the fully extended position, fob parallel to the key, before starting.
- A crankshaft position sensor condition. Check the crankshaft position sensor engine reference signal with a scan tool. Observe the Engine Speed parameter while cranking the engine. The scan tool should indicate a steady 200 - 300 RPM while cranking. If erratic values, such as sudden spikes in the engine speed, are displayed, the engine reference signal is not stable enough for the engine to start and run properly.

- Insufficient fuel. Thoroughly inspect the fuel delivery system for sufficient fuel volume to the fuel injectors. Inspect the fuel supply components for partial blockage or restrictions.
- Fuel injectors with partially blocked and restricted nozzles, or a malfunctioning solenoid. Refer to [Fuel Injector Diagnosis](#) for diagnosis.
- Fuel injector ON time inadequate. When this condition is present, there may be fuel spray at the fuel injectors and the indicated fuel pressure may be correct, yet there may not be enough fuel to start the engine. If the engine control module (ECM) receives incorrect inputs from the various information sensors, the fuel delivered by the fuel injectors may be inadequate to start the engine. Check all the engine data parameters with a scan tool and compare the values indicated with the expected values or the values from a known good vehicle.
- Loose unsecured engine electrical grounds. Inspect the engine for good secure electrical grounds.
- Water or foreign material in the fuel, which can cause either a no start or a engine will not stay running condition. During freezing weather water can freeze inside the fuel system. The engine may start after 30 min in a heated repair shop. The malfunction may not recur until parked overnight in freezing temperatures. Extreme weather conditions can cause contaminated fuel to prevent the vehicle from starting.
- An ignition system that is susceptible to moisture. If the engine starts and runs after being brought into a warm, dry repair shop, the ignition system may be susceptible to moisture. Spray water on the ignition system components and wiring while cranking the engine in order to check for an engine starting or will not stay running concern.
- If the engine almost starts and then stalls, check for an open in the ground circuits of the crankshaft position sensor and the camshaft position sensor - Intake or camshaft position sensor - Exhaust.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.5L \(LYX\)](#)

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](#)

Scan Tool Reference

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

Special Tools

- **EL 26792** HEI Spark Tester

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

Circuit/System Verification

NOTE: This diagnostic assumes the following:

- The battery is completely charged.
- The engine cranking speed is acceptable.
- There is adequate fuel in the fuel tank.

1. Crank the engine for up to 15 s.
2. Verify that DTC P0117, P0118, P0122, P0123, P0222, P0223, P0335, P0336, P0513, P0562, P0563, P0601, P0602, P0603, P0604, P0606, P062F, P0633, P0641, P0651, P0685, P0689, P0690, P0697, P06A3, P06D2, P1516, P1631, P1682, P16F3, P2101, P2119, 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. Ignition ON.

4. Verify the security indicator on the instrument cluster illuminates momentarily.

- **If the indicator stays ON or is flashing**

Review the [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) , for Immobilizer system DTCs. For additional information, refer to [Immobilizer Description and Operation](#) .

- **Go to next step: If the indicator does not stay ON and is not flashing**

5. Verify the scan tool Engine Speed parameter displays greater than 0 RPM while cranking the engine.

- **If 0 RPM**

Refer to [DTC P0335 or P0336](#) .

- **Go to next step: If greater than 0 RPM**

6. Connect the EL 26792 HEI Spark Tester between the boot of a spark plug wire and ground.

NOTE: An erratic or weak spark is considered a no spark condition.

7. Verify the spark tester sparks while cranking the engine.

- **If the spark tester does not spark**

Refer to [Electronic Ignition System Diagnosis](#).

- **Go to next step: If the spark tester sparks**

8. Ignition ON.

NOTE:

- **If the engine is too hot, high fuel pressure readings may result due to hot soak fuel boiling. Allow the engine coolant temperature to cool to less than 60Â° C (150Â° F) before attempting to verify fuel pressure.**
- **The Fuel Pump Enable may need to be commanded On a few times in order to obtain the highest possible fuel pressure.**
- **Additional DTCs may set when using the fuel pump output control.**

9. Command the Fuel Pump Enable On several times with a scan tool.

10. Verify the scan tool Fuel Pressure Sensor parameter is between 345 - 650 kPa (50 - 94 PSI) with the fuel pump running.

- **If not within the specified range**

Refer to [Fuel System Diagnosis](#).

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

11. Verify the scan tool Fuel Pressure Sensor parameter, after the fuel pump has turned OFF, decreases to less than 600 kPa (87 PSI) and does not decrease greater than 34 kPa (5 PSI) in 1 minute.

- **If not within the specified range**

Refer to [Fuel System Diagnosis](#).

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

12. Verify the conditions listed below do not exist:

- Collapsed air intake duct to the throttle body
- Air filter and air intake system for restrictions and obstructions
- Spark plugs for being gas or coolant fouled
- A skewed manifold absolute pressure (MAP) sensor
- A skewed engine coolant temperature (ECT) sensor
- Test the exhaust system for restrictions. Refer to [Restricted Exhaust](#) .
- Test the fuel for contamination. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Engine mechanical condition, for example, worn timing belt or low compression. Refer to [Symptoms - Engine Mechanical](#) .
- **If a condition exists**

Repair as necessary.

- **Go to next step: If no conditions exist**

13. All OK.

Repair Verification

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

MALFUNCTION INDICATOR LAMP (MIL) DIAGNOSIS

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

Circuit/System Description

The engine control module (ECM) and the transmission control module (TCM) monitor powertrain conditions for any condition which may adversely affect vehicle emissions. The ECM and the TCM communicate these conditions through the serial data network. When the ECM or TCM detects the adverse condition, a request is sent to the instrument panel cluster to illuminate the malfunction indicator lamp (MIL). Ignition 1 voltage is supplied internally through the instrument panel cluster to the MIL. The instrument panel cluster turns the MIL ON by internally grounding the MIL. The MIL should be on steady with the ignition ON and the engine OFF. The MIL should turn OFF when the engine is started.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.5L \(LYX\)](#)

[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. Command the Malfunction Indicator Lamp On and Off with a scan tool.
 - **If the MIL does not turn ON and OFF**

Refer to Circuit/System Testing.
 - **Go to next step: If the MIL turns ON and OFF**
3. All OK.

[Circuit/System Testing](#)

1. Ignition OFF, disconnect the harness connector at the P16 Instrument Cluster.
2. Ignition ON.
3. Verify a test lamp illuminates between the Ignition voltage circuit terminal 8 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 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 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 voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, test all components connected to the ignition voltage circuit and replace as necessary.
 - **Go to next step: If the test lamp illuminates**
4. Replace the P16 Instrument Cluster.

[Repair Instructions](#)

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

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

FUEL SYSTEM DIAGNOSIS

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

[Circuit/System Description](#)

The engine control module (ECM) supplies voltage to the fuel pump driver control module when the ECM detects that the ignition is ON. The voltage signal from the ECM to the fuel pump driver control module remains active for 2 s, unless the engine is in Crank or Run. While this voltage is being received, the fuel pump driver control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank fuel pump module in order to maintain the desired fuel rail pressure.

The fuel system is an electronic returnless on-demand design. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

The fuel tank stores the fuel supply. An electric turbine style fuel pump attaches to the fuel tank fuel pump module inside the fuel tank. The fuel pump supplies fuel through the fuel feed pipe and the fuel feed front pipe check valve to the high pressure fuel pump. The fuel pump also supplies fuel to a venturi pump located on the bottom of the fuel tank fuel pump module. The function of the venturi pump is to fill the fuel tank fuel pump module reservoir. The fuel tank fuel pump module contains a reverse flow check valve. Both check valves maintain fuel pressure in the fuel feed pipe in order to prevent long cranking times.

Diagnostic Aids

- A faulty fuel feed front pipe check valve may cause a rattle, tick, knock, or buzz noise. The noise may be more pronounced at idle, approximately 600-800 RPM.
- An erratic low side fuel pressure reading may be caused by a faulty fuel feed front pipe check valve.
- Observe the Misfire Counters or perform the Fuel Injector Diagnosis to help identify a leaking fuel injector.

Reference Information

Description and Operation

Fuel System Description

Electrical Information Reference

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

Scan Tool Reference

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

Special Tools

- **CH-41769** Fuel Line Quick Disconnect Tool
- **EN-37287** Fuel Line Shut-off Adapter

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

Circuit/System Verification

NOTE:

- **Repair all fuel system related DTCs, except P2635, before performing this diagnostic.**
- **Inspect the fuel system for damage or external leaks before proceeding.**
- **Verify that adequate fuel is in the fuel tank before proceeding.**

- The Fuel Pump Enable may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.
- DO NOT perform the Fuel System Diagnosis if the engine coolant temperature is above 60°C (150°F). High fuel pressure readings may result due to hot soak fuel boiling. With the engine OFF, the fuel pressure may increase beyond the pressure relief regulator valve's setting point of 690 kPa (100 PSI) $\pm$ 5%.

1. Ignition ON, engine OFF, command the Fuel Pump Enable On several times with a scan tool.
2. Verify that the scan tool Fuel Pressure Sensor parameter is between 345 - 650 kPa (50 - 94 PSI).
 - **If less than 345 kPa (50 PSI)**
Refer to Circuit/System Testing - Fuel Pressure Low.
 - **If greater than 650 kPa (94 PSI)**
Replace the G12 Fuel Pump.
 - **Go to next step: If between 345 - 650 kPa (50 - 94 PSI)**
3. Verify that the scan tool Fuel Pressure Sensor parameter, after the fuel pump is turned off, decreases to less than 600 kPa (87 PSI).
 - **If greater than 600 kPa (87 PSI)**
Replace the G12 Fuel Pump
 - **Go to next step: If less than 600 kPa (87 PSI)**
4. Verify that the scan tool Fuel Pressure Sensor parameter does not decrease greater than 34 kPa (5 PSI) in 1 min.
 - **If greater than 34 kPa (5 PSI)**
Refer to Circuit/System Testing - Fuel Pressure Leaks Down.
 - **Go to next step: If less than 34 kPa (5 PSI)**
5. Engine idling.
6. Verify that the scan tool Fuel Pressure Sensor parameter is between 300 - 400 kPa (43 - 58 PSI).
 - **If less than 300 kPa (43 PSI)**
Refer to Circuit/System Testing - Fuel Pressure Low.
 - **If greater than 400 kPa (58 PSI)**
Replace the G12 Fuel Pump.
 - **Go to next step: If between 300 - 400 kPa (43 - 58 PSI)**
7. Verify that the scan tool Fuel Pressure Sensor and the Desired Fuel Pressure are within 45 kPa (6.5 PSI) at 300 kPa (43.5 PSI) request or 60 kPa (8.7 PSI) at 400 kPa (58 PSI) request of each other while operating the vehicle through varying loads.
 - **If greater than 45 kPa (6.5 PSI) / 60 kPa (8.7 PSI)**
Refer to Circuit/System Testing - Fuel Pressure Drops Off.
 - **Go to next step: If less than 45 kPa (6.5 PSI) / 60 kPa (8.7 PSI)**
8. If the fuel system components test normal, refer to [Symptoms - Engine Controls](#), and [Fuel Injector Diagnosis](#).

Circuit/System Testing

Fuel Pressure Low

1. Verify none of the conditions listed below exist:

- Restricted or dislocated fuel feed front pipe check valve
- Restricted fuel feed pipe
- Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
- **If a condition exists**

Repair as necessary.

- **Go to next step: If no conditions exist**

Replace the G12 Fuel Pump.

Fuel Pressure Leaks Down

1. Ignition OFF, relieve the fuel pressure. Refer to [Fuel Pressure Relief](#) .

2. Install the **EN-37287** between the chassis fuel feed hose and the engine compartment fuel feed pipe.

3. Open the valve on the **EN-37287** .

4. Ignition ON, command the Fuel Pump Enable On and then Off with a scan tool.

5. Close the valve on the **EN-37287** .

6. Verify that the scan tool Fuel Pressure Sensor parameter does not decrease more than 34 kPa (5 PSI) in 1 min.

- **If greater than 34 kPa (5 PSI)**

Replace the G12 Fuel Pump.

- **Go to next step: If less than 34 kPa (5 PSI)**

7. Test for a faulty fuel feed front pipe check valve.

- **If a condition exists**

Replace the fuel feed front pipe.

- **Go to next step: If no condition exists**

8. Test for a leaking G18 High Pressure Fuel Pump.

- **If a condition exists**

Replace the G18 High Pressure Fuel Pump.

- **Go to next step: If no condition exists**

Locate and replace the leaking Q17 Fuel Injector.

Fuel Pressure Drops Off

1. Verify none of the conditions listed below exist:

- Restricted or dislocated fuel feed front pipe check valve
- Restricted fuel feed pipe
- Inspect the harness connectors and the ground circuits of the fuel pump for poor connections
- **If a condition exists**

Repair as necessary.

- **Go to next step: If no conditions exist**

Replace the G12 Fuel Pump.

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

- [Fuel Feed Front Pipe Replacement](#)
- [Fuel Feed Pipe Replacement \(FWD\)](#), [Fuel Feed Pipe Replacement \(AWD\)](#)
- [Fuel Feed Intermediate Pipe Replacement](#)
- [Fuel Injector Replacement](#)
- [Fuel Pump Replacement](#) for G18 High Pressure Fuel Pump replacement
- [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#), [Fuel Tank Fuel Pump Module Replacement \(AWD\)](#)

FUEL LEAK DIAGNOSIS

Reference Information

Special Tools

- **J-28428-E** High Intensity Black Light Kit
- **J-42220** Leak Detection Lamp

CAUTION: When performing a Fuel Leak Diagnosis, it is VERY IMPORANT to use only GM approved Oil Dye, Part Number 88861206. If any other oil dye is used, it will cause damage to the fuel injection system components, as well as the emission control components. This will result in necessary replacement of the damaged components.

1. Clean all of the fuel lines in the suspected area using brake cleaning solvent, and let dry.
2. Add 8 ounces of oil dye 88861206 to the fuel tank.
3. Start and idle the engine for 3 - 5 minutes.
4. Using a scan tool, increase the Fuel Rail Pressure, if applicable.
5. Verify there are no fuel leaks with **J-28428-E** or **J-42220** around the:
 - Fuel pump
 - Fuel rails
 - Fuel injector supply lines
 - Fuel supply lines
 - Fuel return lines, if equipped,
 - **High pressure or supply side fuel leak is found**

Repair or replace the leaking component

- **If equipped, return side fuel leak is found.**

1. Verify that the fuel return line is not restricted
 - If the fuel return line is restricted, repair or replace as necessary
 - If the fuel return line is not restricted, repair or replace the leaking component
- **Go to next step: No fuel leak is found**

6. All OK.

FUEL INJECTOR DIAGNOSIS

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

Circuit/System Description

Two methods of testing fuel injector balance are available, the Active Fuel Injector Tester or a scan tool. The Active Fuel Injector Tester and SIDI adaptor connects to the engine control module harness connectors to test the high pressure fuel pump performance, fuel injector wiring, and fuel injector operation. The Active Fuel Injector Tester displays step by step instructions to precisely determine pressure drop of each fuel injector. The scan tool fuel injector balance test is performed while the engine is running at idle. The scan tool pressurizes the fuel rail to a predetermined pressure before each fuel injector is pulsed for a precise amount of time allowing a measured amount of the fuel to be injected. This causes a drop in the system fuel pressure that is recorded and used to compare each fuel injector.

Diagnostic Aids

- Monitoring the scan tool Cylinder 1-4 Current Misfire Counters may help to isolate the fuel injector that is causing the condition.
- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.

Reference Information

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Electrical Information Reference

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

Special Tools

- CH-47976 Active Fuel Injector Tester
- CH-47976-500 Active Fuel Injection Tester SIDI Adapter Kit
- CH-47976 - 503 Active Fuel Injection Tester cable G3
- CH-47976 - 512 Active Fuel Injection Tester cable G3b Adapter

For equivalent regional tools, refer to Special Tools (Diagnostic Tools) Special Tools (Mechanical Tools).

Fuel Injector Coil Test

NOTE:

- The resistance test must be performed at the fuel injector or mis-diagnosis will occur.
- The DMM and test leads must be calibrated to 0 Ω in order to prevent mis-diagnosis.

1. Disconnect the appropriate Q17 Fuel Injector.
2. Test for 1.3 - 1.44 Ω at 20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$) between the control + circuit terminal 2 and the control - circuit terminal 1 at the Q17 Fuel Injector.

- **If not between 1.3 - 1.44 Ω**

Replace the Q17 Fuel Injector.

- **Go to next step: If between 1.3 - 1.44 Ω**

3. Test for infinite resistance between each terminal at the Q17 Fuel Injector and the Q17 Fuel Injector housing/case.

- **If less than infinite resistance**

Replace the Q17 Fuel Injector.

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

4. All OK. Perform the Fuel Injector Balance Test.

Fuel Injector Balance Test

NOTE:

- **DO NOT perform this test if the engine coolant temperature (ECT) is above 60°C (140°F). Irregular fuel pressure readings may result due to hot soak fuel boiling.**
- **Verify that adequate fuel is in the fuel tank before proceeding with this diagnostic.**

Fuel Injector Balance Test with Active Fuel Injector Tester - Preferred Method

1. Verify the battery is fully charged and all accessories are OFF.
2. Ignition OFF, all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Install **CH-47976** and **CH-47976-500** . Connect **CH-47976 - 503** and **CH-47976 - 512** to **CH-47976-500** .

NOTE:

- **Important that voltage is jumped to the correct fuse terminal.**
 - **Not all (KL9) vehicle are affected. Only vehicles listed below require this jumper step.**
3. For applications with Start/Stop (KL9), battery voltage must be jumped to the low/negative side of the fuse for the KR27 Starter Relay using a 3 amp fused jumper wire. Reference below to determine the appropriate fuse to remove for your application.
 - Cruze (LE2) - Fuse F16UA, Fuse 16, "Fuel Injection"
 - Envision (LCV / LTG) - Fuse F3UA, Fuse F03, "NON/WALK"
 - Equinox/Terrain (LYX / LTG) - Fuse F3UA, Fuse 3, "Lambda 1"
 - Malibu (LFV / LKN / LTG) - Fuse F76UA, Fuse 76, "PWR/TRN OFF Engine"
 - Regal (LGX / LTG) - Fuse F46UA, Fuse 46, "ECM IGN"
 4. Turn ON the Active Fuel Injector Tester and select the vehicle.
 5. Ignition ON, perform the Injector Test with the Active Fuel Injector Tester.
 - **If the Active Fuel Injector Tester aborts testing due to incorrect fuel pressure or fuel leak down**

Refer to [Fuel System Diagnosis](#).

- **Go to next step: If the Active Fuel Injector Tester does not abort testing**
6. Compare the test results with the appropriate recommended tolerance.
 - **If any fuel injector exceeds the recommended tolerance**

Replace the appropriate Q17 Fuel Injector(s).

 - **Go to next step: If all fuel injectors are within the recommended tolerance**
 7. All OK.

Fuel Injector Balance Test with Scan Tool

1. Verify the correct low side fuel pressure. Refer to [Fuel System Diagnosis](#).
2. Engine idling, verify the scan tool Fuel Rail Pressure Sensor parameter is approximately 3 MPa (435 PSI).

NOTE:

The engine speed must be between 600 - 1000 RPM to perform this test.

3. Select the Fuel Injector Balance function within the Control Functions menu of a scan tool.

4. Select and test an injector. Repeat for each injector.
5. Obtain and record a pressure drop value for each injector.
6. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
7. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop.
8. Multiply the average pressure drop by 0.20. This is the acceptable variance from the average pressure drop, 20 percent.
9. Verify the difference between any individual pressure drop and the average pressure drop is not greater than the acceptable variance.

- **If greater than the acceptable variance**

Replace the Q17 Fuel Injector.

- **Go to next step: If within the acceptable variance**

10. All OK.

Repair Instructions

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

Fuel Injector Replacement

FUEL INJECTOR CIRCUIT DIAGNOSIS

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Injector 1 Control +	P2147	P0201	P2148	P1248
Fuel Injector 1 Control -	P0261	P0201	P0262, P2148	P1248
Fuel Injector 2 Control +	P2150	P0202	P2151	P1249
Fuel Injector 2 Control -	P0264	P0202	P0265, P2151	P1249
Fuel Injector 3 Control +	P2153	P0203	P2154	P124A
Fuel Injector 3 Control -	P0267	P0203	P0268, P2154	P124A
Fuel Injector 4 Control +	P2156	P0204	P2157	P124B
Fuel Injector 4 Control -	P0270	P0204	P0271, P2157	P124B

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 injector high voltage control circuits. When a fuel injector circuit condition is detected by the ECM, the affected fuel injector(s) is disabled.

Diagnostic Aids

- Performing the fuel injector coil test may help isolate an intermittent condition. Refer to [Fuel Injector Diagnosis](#).
- If the condition is intermittent, move the related harnesses and connectors, with the engine operating, while monitoring the scan tool Injector Control Circuit Status parameters. An Injector Control Circuit Status parameter will change from OK or Not Run to Malfunction if there is a condition with the circuit or a connection.

Schematic Reference

Engine Controls Wiring Schematics 1.5L (LYX)

Connector End View Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: Do Not perform this procedure unless directed here from the Fuel Injector Balance Test.

1. Engine idling.
2. Verify the scan tool Cylinder 1 - 4 Current Misfire Counter parameters do not increment.
 - **If the Cylinder 1 - 4 Current Misfire Counters increment**
Refer to Circuit/System Testing.
 - **Go to next step: If the Cylinder 1 - 4 Current Misfire Counters do not increment**
3. Verify the scan tool Cylinder 1 - 4 Injector Control Circuit Status parameters display OK.
 - **If the Cylinder 1 - 4 Injector Control Circuit Status parameters do not display OK**
Refer to Circuit/System Testing.
 - **Go to next step: If the Cylinder 1 - 4 Injector Control Circuit Status parameters display OK**
4. All OK.

Circuit/System Testing

1. Ignition OFF, all vehicle systems OFF, disconnect the X2 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 infinite resistance between the appropriate Q17 Fuel Injector control + circuit and ground.
 - **If less than infinite resistance**
 1. Disconnect the harness connector of the Q17 Fuel Injector.
 2. Test for infinite resistance between the Q17 Fuel Injector control + circuit and ground.
 - If infinite resistance
 3. Test for infinite resistance between the Q17 Fuel Injector control - circuit and ground.
 - If less than infinite, repair the short to ground in the circuit.
 - If infinite, replace the Q17 Fuel Injector.
 - **Go to next step: If infinite resistance**

3. Ignition ON.

4. Test for less than 1 V between the Q17 Fuel Injector control + circuit and ground.

- **If 1 V or greater**

1. Disconnect the harness connector of the Q17 Fuel Injector, ignition ON.

2. Test for less than 1 V between the Q17 Fuel Injector control + circuit and ground.

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

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

5. Ignition OFF.

6. Test for less than 3 Ω between the Q17 Fuel Injector control + circuit and control - circuit.

- **If 3 Ω or greater**

1. Disconnect the harness connector of the Q17 Fuel Injector.

2. Test for less than 2 Ω on 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 less than 2 Ω on 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 Q17 Fuel Injector.

- **Go to next step: If less than 3 Ω**

7. Replace the K20 Engine Control Module.

Repair Instructions

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

- [Fuel Injector Replacement](#)
- [Control Module References](#) for K20 Engine Control Module replacement, setup, and programming

ALCOHOL/CONTAMINANTS-IN-FUEL DIAGNOSIS

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

Circuit/System Description

Water contamination in the fuel system may cause driveability conditions such as hesitation, stalling, no start, or misfires in one or more cylinders. Water may collect near a single fuel injector at the lowest point in the fuel injection system and cause a misfire in that cylinder. If the fuel system is contaminated with water, inspect the fuel system components for rust or deterioration.

Ethanol concentrations of greater than 10% in non-blended gasoline or greater than 85% with E85 blended gasoline for flexible fuel applications can cause driveability conditions such as hesitation, lack of power, stalling, or no start. Excessive concentrations of ethanol used in vehicles not designed for it may cause fuel system corrosion, deterioration of rubber components, and fuel filter restriction.

Reference Information

Special Tool

CH 44175-A Alcohol Tester Kit, if available

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

1. Remove a sample of fuel from the bottom of the fuel tank and place in a clean, clear container.
2. Place the sample on a level surface for 2 min.
3. Verify the sample is clear and bright in color.
 - **If the sample appears cloudy, or contaminated with water, as indicated by a water layer at the bottom of the sample**

Refer to Circuit/System Testing - Particulate Contaminants in Fuel.

- **If alcohol contamination is suspected**

Refer to Circuit/System Testing - Alcohol in Fuel Testing.

- **Go to next step: If the sample remains clear and bright**

4. All OK.

Circuit/System Testing

Alcohol in Fuel Testing with Special Tool, if Available

1. Test the fuel composition using **CH 44175 - A Alcohol Tester Kit and Instruction Manual**.
2. Verify no water appears in the fuel sample.
 - **If water appears in the fuel sample**

Clean the fuel system.
 - **Go to next step: If no water appears in the fuel sample**
3. Subtract 50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
4. Verify the non-blended gasoline fuel sample does not measure greater than 15% or an E85 blended gasoline fuel sample measures greater than 91% ethanol.
 - **If greater than the specified value**
 1. Add fresh regular gasoline to the vehicle's fuel tank.
 2. Remove a new sample of fuel from the tank.
 3. Test the fuel composition using **CH 44175 - A Alcohol Tester Kit and Instruction Manual**.
 4. Subtract 50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
 5. Verify the non-blended gasoline fuel sample does not measure greater than 15% or an E85 blended gasoline fuel sample measures greater than 91% ethanol.
 - If additional testing indicates that the ethanol percentage is still above 15% for a non-blended gasoline sample, drain and replace the vehicle's fuel. Refer to **Fuel Tank Draining**.
 - If additional testing indicates that the E85 blended gasoline sample still measures above 91%, continue adding fresh, regular gasoline until the ethanol content is 85% or less.
 - **Go to next step: If the specified value or less**
5. All OK.

Alcohol in Fuel Testing without Special Tool

NOTE: This procedure is for non-blended gasoline only. If excessive alcohol content is suspected with E85 fuel add 15% tank volume of fresh, regular gasoline to the fuel tank.

1. Using a 100 ml (3.38 oz) specified cylinder with 1 ml (0.034 oz) graduation marks, fill the cylinder with fuel to the 90 ml (3.04 oz) mark.

2. Add 10 ml (0.34 oz) of water in order to bring the total fluid volume to 100 ml (3.38 oz) and install a stopper.
3. Shake the cylinder vigorously for 10 - 15 s.
4. Carefully loosen the stopper in order to release the pressure.
5. Re-install the stopper and shake the cylinder vigorously again for 10 - 15 s.
6. Put the cylinder on a level surface for approximately 5 min in order to allow adequate liquid separation. If alcohol is present in the fuel, the volume of the lower layer, which would now contain both alcohol and water, will be more than 10 ml (0.34 oz). For example, if the volume of the lower layer is increased to 15 ml (0.51 oz), this indicates at least 5% alcohol in the fuel. The actual amount of alcohol may be somewhat more because this procedure does not extract all of the alcohol from the fuel.
7. Verify the non-blended gasoline fuel sample does not measure greater than 15%.
 - **If greater than the specified value**
 1. Add fresh regular gasoline to the vehicle's fuel tank.
 2. Remove a new sample of fuel from the tank.
 3. Test the fuel composition of the new sample.
 4. Verify the non-blended gasoline fuel sample does not measure greater than 15%.
 - If greater than the specified value, drain and replace the vehicle's fuel. Refer to [Fuel Tank Draining](#).
 - If the specified value or less, all OK.
 - **Go to next step: If the specified value or less**
8. All OK.

Particulate Contaminants in Fuel

1. Using an approved fuel container, draw approximately 0.5 liter (0.53 qt) of fuel from the bottom of the fuel tank.
2. Place the container on a level surface for approximately 5 min in order to allow settling of the particulate contamination. Particulate contamination will show up in various shapes and colors. Sand will typically be identified by a white or light brown crystals. Rubber will appear as black and irregular particles.
3. Verify there are no physical contaminants or water present in the fuel sample.
 - **If any physical contaminants or water are present**

Clean the fuel system.
 - **Go to next step: If no physical contaminants or water are present**
4. All OK.

Repair Instructions

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

- [Fuel System Cleaning](#)
- [Fuel Tank Draining](#)

EVAPORATIVE EMISSION CONTROL SYSTEM DIAGNOSIS

Special Tools

- CH-44284-2 Fuel Flapper Door Holder
- EN-41413-VLV EVAP Service Port Vent Fitting
- GE-41415-60 Engine Induction System Leak Test Adapter/Capless Fuel Fill Adapter

Operating Instructions for the Evaporative Emission System Tester

Vehicle Setup

WARNING: Refer to Fuel and Evaporative Emission Pipe Warning .

CAUTION: Refer to Clean, Dry, Low Pressure Gas Source Caution .

NOTE: When servicing the evaporative emission (EVAP) system, test pressure must not exceed 13 in H₂O (0.5 PSI) as pressure in excess of this could cause system components to perform inaccurately.

NOTE: A large difference between the vehicle temperature and shop temperature will seriously affect the accuracy of the tests. Always allow at least 15 min for the vehicle temperature to adjust to the shop temperature. Refer to Temperature Variation Instructions for more information about vehicle versus shop temperatures.

1. Engine OFF, open the hood. Position a large fan to blow air under the vehicle onto the fuel tank area.
2. Connect the red battery clip from the tester to the positive battery terminal.

NOTE: The vehicle battery must be fully charged for optimum tester performance.

3. Connect the black battery clip from the tester to chassis ground.

Flow Meter Test - Leak Detection

CAUTION: Refer to Fuel and Evaporative Emission Hose/Pipe Connection Cleaning Caution .

1. Open the Nitrogen tank valve and turn the NITROGEN / SMOKE valve on the front control panel to NITROGEN.
2. Connect the hose to the correct test orifice on the bottom front of the tester. For orifice size, refer to the vehicle specific information found in service procedures for DTCs that relate to EVAP system leaks.
3. Press and release the remote switch to activate the tester.

NOTE: The tester will time out after about 15 min. You may press the remote switch to reactivate the tester as desired.

4. Position the sliding red flag on the flow meter to align with the floating indicator. When the red flag is set, press and release the remote switch to deactivate the tester.
5. Remove the hose from the test orifice and install the hose onto the vehicle. For proper connection location, and the special tool numbers for any adapters that may be required, refer to the service procedures for DTCs that relate to EVAP system leaks.
6. Ignition ON, seal the EVAP system per instructions in the service procedures for DTCs that relate to EVAP system leaks. Most systems can be sealed using a scan tool output control for the EVAP Vent Solenoid Valve, other systems require that the vent system be plugged.

NOTE:

- Larger volume fuel tanks, and/or those with lower fuel levels, may require several minutes to fill with nitrogen.
- Static buildup may cause the float indicator to stick. It may be necessary to tap on the flow meter to free up the float.
- If fuel level is 90% or greater it will take longer to fill the system with smoke because the fuel fill tube check valve will be closed and force any smoke to pass through the on-board refueling vapor recovery pipe and orifice.

7. Press and release the remote switch to activate the nitrogen flow and fill the system.
8. Verify the stable floating indicator position to the red flag.

- Above the red flag, result is unacceptable - fail

Go to the Smoke Procedure

- **Go to next step: Below the red flag - pass. Test complete**

9. Press and release the remote switch to deactivate the tester.

Smoke Procedure - Locate the Leak

NOTE: It is not recommended to use the tester in an outside repair bay area because wind and sunlight may affect temperature and your ability to see the smoke.

1. Turn OFF any fans that may cause air movement around or near the vehicle.

NOTE: Completely unwind the nitrogen/smoke hose from the bracket to optimize the tester's performance.

2. Connect the nitrogen/smoke hose to the vehicle as directed in the service procedures. Some vehicles require that the nitrogen/smoke hose be connected at the front of the EVAP system at the EVAP service port. An adapter may be necessary. Other vehicles require the connection be made at the rear of the system using an adapter at the fuel fill cap or capless fuel fill. Consult the service procedures for DTCs that relate to EVAP system leaks for vehicle specific instructions regarding connection location and adapters.

3. Open the Nitrogen tank valve and turn the nitrogen/smoke valve on the control panel to smoke.

NOTE: The remote switch operates on a push ON, push OFF fashion.

4. Press and release the remote switch to activate the tester and inject smoke into the EVAP system.
5. Verify smoke has filled the EVAP system by opening the system opposite the end where smoke is injected.

- NOTE:**
- **When injecting smoke at the service port:**
 - Vehicles with gas cap - remove fill cap
 - Vehicles with capless fuel fill - open flappers with CH-44284-2 or GE-41415-60

Until smoke is observed, then close the system and continue testing.

- If using a special tool fuel fill cap / capless fuel fill adapter at the filler neck, vent the system at the service port, with special tool EN-41413-VLV until smoke is observed then remove the vent fitting tool and close the system to continue with the test.
- Inject smoke in less than 2 min cycles for optimum tester performance.

6. Press and release the remote switch to deactivate the tester.

NOTE: For optimum visual smoke performance, deactivate the smoke flow and allow the system pressure to drop. Allowing the smoke to exit small holes at a low flow rate greatly enhances visibility.

7. Introduce smoke into the system for an additional 60 s. Continue introducing smoke at 15 s intervals, as necessary until leak source is identified.

8. Using a high-intensity white light, inspect the entire EVAP system path, and look for the source of the leak indicated by the exiting smoke.

- **Smoke seen leaking**

Repair or replace the affected component.

- **Go to next step: No smoke seen leaking**

9. All OK

Temperature Variation Instructions

The Concern

Ideal circumstances for conducting the EVAP flow meter test require equal temperatures between the Nitrogen gas and the vehicle EVAP system. Significant differences in temperature between them can result in a flow or pressure change during testing, causing misleading results. Typically, the evaporative emission system tester is stored indoors, approximately 21°C (70°F). Vehicles brought in for diagnosis may have an EVAP system at significantly different temperatures.

For Example

NOTE: With no temperature difference between the Nitrogen gas and EVAP system, the resulting vehicle EVAP system pressure will remain stable at 13 in. H₂O (0.5 PSI) once pressurized, providing no leaks are present.

When the EVAP flow meter tests are performed with significant differences in temperature between the Nitrogen gas and the vehicle EVAP system, the following results can occur:

- An increase in flow during the flow meter test can be caused by a vehicle's warm EVAP system cooling down.
- A decrease in flow during the flow meter test can be caused by a vehicle's cool EVAP system warming up.

The Solution

When working on a vehicle with significant temperature differences between the vehicle EVAP system and the Nitrogen gas, allow the vehicle EVAP system temperature to stabilize as close as possible to the temperature of the Nitrogen gas before conducting the flow meter test.

INSPECTION/MAINTENANCE SYSTEM CHECK

Diagnostic Instructions

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

Circuit/System Description

Several states require for a vehicle to pass on-board diagnostic (OBD) system tests and inspection/maintenance (I/M) emission inspections in order to renew license plates. This is accomplished by viewing the Inspection/Maintenance System Status or Data display on a scan tool. Using a scan tool, the technician can observe the I/M status in order to verify that the vehicle meets the criteria that complies with the local area requirements.

Condition for Updating the Inspection/Maintenance Emission System Status

NOTE: New vehicles may not report an Inspection/Maintenance System Check pass or fail status for certain post catalyst oxygen sensor or heated oxygen sensor 2 diagnostics prior to 700 miles. After replacing a catalytic converter on a vehicle with greater than 700 miles, it may require up to an additional 700 miles to prevent a false failure status.

Each system monitor requires at least one, and sometimes several, diagnostic tests. The result of each test is reported by a diagnostic trouble code (DTC). A system monitor is complete when either all of the DTCs composing the monitor have Run and Passed, or when any one of the DTCs comprising the

monitor has illuminated the malfunction indicator lamp (MIL). Once the system monitor is complete, the Inspection/Maintenance System Status or Data will indicate YES in the Completed or Value column.

For example, when the HO2S heater status indicates YES, either all of the oxygen sensor heater tests have passed or one of the tests has illuminated the MIL. If the vehicle has two heated oxygen sensors, either both heater circuit tests have passed or one of the heater circuit tests has illuminated the MIL. The Inspection/Maintenance System Status or Data will indicate NO under the Completed or Value column when any of the required tests for that system have not run. The following is a list of conditions that may set the Inspection/Maintenance System Status or Data indicator to NO:

- The vehicle is new from the factory and has not yet been driven through the necessary drive conditions to complete the tests.
- The battery has been disconnected or discharged below operating voltage.
- The engine control module (ECM) power or ground has been interrupted.
- The ECM has been reprogrammed.
- The ECM DTCs have been cleared.

Monitored Emission Control Systems

The OBD II System monitors all emission control systems that are on-board. The OBD II regulations require monitoring of the following:

- The air conditioning system
- The catalyst efficiency
- Comprehensive component monitoring, emission related inputs and outputs
- The evaporative emission (EVAP) system
- The fuel delivery system
- Heated catalyst monitoring
- Misfire monitoring
- The oxygen sensor system (HO2S)
- The oxygen sensor heater system (HO2S heater)

For the specific DTCs required for each system, refer to **Inspection/Maintenance (I/M) System DTC Table**. Systems such as fuel delivery, misfire, and comprehensive components may not be listed in a system status list. These tests run continuously and do not require an inspection/maintenance system status indicator.

Circuit/System Verification

1. Verify that all Inspection/Maintenance System Status or Data indicators report YES, and that no I/M Test DTCs are present.
 - **If any I/M Test DTCs are set**
Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**.
 - **Go to next step: If no I/M Test DTCs are set**
2. All OK.

Circuit/System Testing

NOTE: Many DTC related repairs will instruct the technician to clear the DTC information. Clearing the DTC will reset the Inspection/Maintenance System Status or Data indicators to NO. Performing the I/M Complete System Set Procedure will set each of the I/M System Status indicators to YES.

1. Verify no I/M DTCs are present.
 - **If an I/M DTC is set that would prevent the I/M System Status tests from completing, diagnose that DTC before continuing.**

Refer to [Inspection/Maintenance \(I/M\) System DTC Table](#).

- **Go to next step: If no I/M DTCs are set**
- 2. Review applicable service bulletins for software updates that would prevent the I/M System Status tests from completing.
 - **If a control module re-program or other repair is required,**
Perform the [Inspection/Maintenance Complete System Set Procedure](#) after repair.
 - **Go to next step: If no repair is required**
- 3. Observe the Inspection/Maintenance System Status or Data indicators.
 - **If any Inspection/Maintenance System Status or Data indicators report NO**
Perform the [Inspection/Maintenance Complete System Set Procedure](#).
 - **Go to next step: If no Inspection/Maintenance System Status or Data indicators report NO**
- 4. All OK.

INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE

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

Circuit/System Description

The purpose of the inspection/maintenance complete system set procedure is to satisfy the enable criteria necessary to execute all of the inspection/maintenance readiness diagnostics and complete the trips for those particular diagnostics. When all inspection/maintenance monitored diagnostic tests are completed, the inspection/maintenance system status indicators are set to yes. Perform the inspection/maintenance complete system set procedure if any inspection/maintenance system status indicators are set to NO.

Condition for Meeting a Cold Start

- The ignition voltage between 10 - 18 V.
- The barometric pressure (BARO) is more than 75 kPa (10.15 PSI).
- The engine coolant temperature (ECT) at start-up is greater than -5°C (23°F).
- The intake air temperature (IAT) at start-up is less than 40°C (104°F).
- The difference between the start-up IAT and ECT are within 3°C (5°F).
- The engine is OFF for greater than 6 h or the following conditions must be met:
 - The start-up IAT minus start-up ECT 1 are within 12°C (22°F).
 - The start-up ECT minus start-up IAT are within 50°C (90°F).
- Fuel level is between 25 - 75%.

Circuit/System Verification

1. Verify that all I/M System Status indicators report YES, and that no I/M Test DTCs are present.
 - **If any I/M Test DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - **Go to next step: If no I/M Test DTCs are set**
2. All OK.

Inspection/Maintenance System Set Procedure

NOTE: Whenever the ignition is turned ON, ignition positive voltage is supplied

to the heated oxygen sensor (HO2S) heaters. After verifying the enable criteria, turn OFF the ignition for approximately 5 minutes to allow the sensors to cool before continuing with the test. Once the engine is started, do NOT turn the engine OFF for the remaining portion of the set procedure.

1. Ensure that the vehicle meets the conditions for a cold start listed above.
 - If the Evaporative Emission (EVAP) inspection/maintenance system status indicator displays NO, perform the EVAP Service Bay test if applicable.
2. Turn OFF all accessories; HVAC system, other electrical loads, including aftermarket/add-on equipment, etc., and open the hood.
3. Set the vehicle parking brake and ensure the vehicle is in park for automatic transmission or neutral for manual transmission.
4. Turn the ignition ON for 1 min.
5. Start and idle the engine for 5 min.
6. Run the engine for 6 min within the following conditions:
 - Calculated air flow is between 9 - 30 g/s
 - Engine speed is steady between 1 300 - 3 000 RPM
7. Apply and hold brake pedal, and shift to Drive for automatic, or apply clutch pedal for manual and operate the vehicle within the following conditions for 2 min:
 - Manifold Absolute Pressure (MAP) signal is greater than 12 g/s
 - Engine speed is greater than 1 000 RPM

NOTE: Do NOT touch the accelerator pedal until told to do so. A change in throttle position sensor angle or an increase in engine speed may invalidate this portion of the test.

8. Release the accelerator pedal and shift the vehicle to Park for automatic, or Neutral and release clutch pedal for manual, and allow the engine to idle for 2 min.
9. Close the hood, release the parking brake and drive vehicle at 90 km/h (55 MPH) for 2 min.
10. Release the accelerator pedal for at least 10 s. This will allow the vehicle to enter the deceleration fuel cut off.
11. Safely stop the vehicle, with the engine in drive for automatic or neutral with the clutch pedal depressed and parking brake applied for manual. Allow the vehicle to idle for 2 min.

NOTE: Do NOT disturb the vehicle or turn ON the ignition until told to do so. Disturbing the vehicle may invalidate this portion of the test.

12. Shift the vehicle to park for automatic and neutral for manual. Turn OFF the ignition and exit the vehicle. Do NOT disturb the vehicle for 45 min.
13. Observe the Inspection/Maintenance System Status with a scan tool. All of the inspection/maintenance System Status indicators should display YES.
 - If the EVAP inspection/maintenance system status indicator displays NO, turn OFF the ignition, ensure that the vehicle meets the conditions for a cold start, and repeat steps 6 through 11 three more times, or until the EVAP inspection/maintenance system status indicator transitions to yes. If the indicator continues to display NO, refer to the [Inspection/Maintenance \(I/M\) System DTC Table](#) to identify the DTCs that did not run.
 - If any of the inspection/maintenance system status indicators display NO, refer to the [Inspection/Maintenance \(I/M\) System DTC Table](#) for the indicator which did not display yes. The inspection/maintenance system DTC table identifies the DTCs associated with each inspection/maintenance system status Indicator.

POOR FUEL FILL QUALITY

Problem	Causes
DEFINITION: During the fueling process a continual, occasional, or no-fuel nozzle shut-off condition has occurred.	

Problem	Causes
Difficult to fill	- Fuel fill limiter vent valve stuck closed - Evaporative emission (EVAP) canister restricted - EVAP vent valve stuck closed - Hose between canister and canister vent solenoid twisted or kinked if applicable - High fuel temperature - Fuel filler hose is kinked - Faulty dispensing nozzle - Ignition switch ON, vent valve closed
Over fill	- Fill limiter vent valve stuck open or leaking - Fuel inlet check valve stuck open
Pre-mature shut-off of the fuel dispensing nozzle occurs immediately after engaging dispensing nozzle, tank empty	- Restricted vapor lines or fuel fill pipe - High fuel temperature - Inlet check valve at tank stuck closed, fill pipe full of fuel - Fuel tank full, gauge not accurate
Pre-mature shut-off of the fuel dispensing nozzle, more than 1/8 of tank capacity dispensed	- Kinked, pinched or plugged lines in fuel tank vent system - EVAP vent valve stuck closed or restricted - EVAP canister restricted - Fuel limiting vent valve stuck closed or obstruction at top of fuel tank
Fuel Spitback	- Restricted EVAP canister - High fuel temperature - Ignition switch ON, EVAP vent valve closed

INSPECTION/MAINTENANCE (I/M) SYSTEM DTC TABLE

System	DTCs Required to Set System Status to YES
If an inspection/maintenance system status indicator did NOT update to YES during the Inspection/Maintenance System Check, review each indicator and reference this table to determine each DTC associated with the inspection/maintenance system status indicator. Each DTC listed below has specific conditions that must be met for the diagnostic to run. Included within the conditions are additional DTCs which, if set, may inhibit the DTCs listed below from running. Reviewing and operating the vehicle within the conditions for running for each DTC listed below will allow the inspection/maintenance system status indicators to transition to YES.	
Boost System	<u>DTC P0234 or P0299</u>
Catalyst Monitor	<u>DTC P0420</u>
EGR/CMP	<u>DTC P0010-P0014 or P2088-P2091</u>
EVAP	<u>DTC P0442</u> <u>DTC P0446</u> <u>DTC P0455</u>
Fuel	<u>DTC P0089, P00C6, P228C, P228D, or P2C1E-P2C20</u> <u>DTC P219A</u>
Oxygen Sensor	<u>DTC P0133, P013A, P013B, P013E, P013F, P015A, P015B, P2270, or P2271</u>

System	DTCs Required to Set System Status to YES
Oxygen Sensor Heater	<u>DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, P0141, P103B, or P103C</u>

SERVICE BAY TEST

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

Description

The purpose of the evaporative emission (EVAP) Service Bay Test is to aid in resetting the EVAP Inspection/Maintenance (I/M) System Status. For this vehicle, that is equipped with the engine off natural vacuum diagnostic, the Service Bay Test uses the scan tool to initiate the engine control module (ECM) regular sequence of EVAP system DTC tests, but with different enable criteria. By using the Service Bay Test the I/M indicator can be set without the need for multiple cold soaks.

The scan tool displays for the Service Bay Test are based on the events that occur within the following three categories:

EVAP Service Bay Test Status - Running

The vehicle must remain at rest, in Park, or in Neutral, during this portion of the test. This test inspects for large leaks and vent system restrictions. The purge valve leak diagnostic may run, but is not required. The scan tool will display test progress or the reason for an abort or failure.

EVAP Service Bay Test Status - Vehicle Ready for Drive Cycle

The scan tool will display time and distance needed to warm the fuel. The drive distance remaining rounds down to zero when there is anything less than 1 mile or kilometer remaining. The vehicle must be driven until the "return to service bay" message is displayed.

EVAP Service Bay Test Status - Engine Off Conditions Met

During this portion of the test, the ECM will remain active for up to 45 min when the ignition is turned OFF to allow control of the EVAP vent solenoid valve and run the engine off natural vacuum test. The ECM inspects for small leaks during this period by monitoring fuel tank pressure or vacuum. If the system is sealed, there will be a pressure or vacuum change. Pressure or vacuum changes that are not within the calibrated values indicate a leak.

NOTE:

- **Do not reorder the scan tool screen display. The EVAP Service Bay Test Status parameter is the main status message to observe. It will indicate when each category is active with the Test Results status parameter right beneath it.**
- **There are many possible screen messages. It is very important that you watch these messages and record any failure or abort message as this will aid the diagnosis.**
- **If any of these issues occur during or after the engine running portion of the test, the vehicle will need to soak for at least 8 h before retrying.**
- **An incorrect "drive distance not met" message is an indication that the service bay test aborted earlier and the vehicle was keyed off followed by retrying without waiting for at least 10 min before retrying.**

When the EVAP diagnostics are initiated by the Service Bay Test, the scan tool will indicate if the enable conditions listed below are not met, or will display a specific reason if the test aborts. When

complete, the display will indicate that the tests completed or failed.

If

- The Service Bay Test aborts
- The scan tool resets
- The scan tool locks up
- The scan tool sets an error
- The diagnostic connector becomes disconnected

Before starting the engine, the vehicle should be left keyed off for at least 10 min before retrying.

After the ignition off portion of the test has completed, the Service Bay Test will delay ECM shut down for 10 min to allow for analysis of scan tool data. A complete Test Results status message along with EVAP Monitor Complete value of YES is the goal.

Conditions for Running the Test

The following conditions must be met in order to enable the Service Bay Test:

- The battery voltage is between 11 - 32 V.
- The engine coolant temperature (ECT) is less than 35Â°C (95Â°F) at start-up.
- The intake air temperature (IAT) is less than 34Â°C (93Â°F) at start-up.
- The ambient air temperature is between 0 - 40Â°C (32 - 104Â°F) at start-up.
- The fuel level is within 10 - 90% capacity and cannot be refueled during the tests.
- The vehicle must have sat for 8 h since the last run time.
- The EVAP I/M System Status indicator is set to NO.

NOTE: The use of the scan tool Clear DTCs function will reset all I/M statuses.

- There are no DTCs displayed.
- The vehicle must be driven for the time and distance specified on the scan tool.
- The ignition must remain OFF during the engine OFF portion of the test, and the vehicle must remain at rest.

Test Procedure

NOTE:

- If the Service Bay Test aborts or fails, a DTC will NOT be set.
- You must not rush the scan tool selections or erroneous results or error messages could occur.

1. Select the Service Bay Test with the scan tool.

WARNING: Refer to [Road Test Warning](#) .

2. Follow the instructions on the scan tool. The EVAP Service Bay Test should complete and should not abort or fail.

- **If the test aborts**

Correct the condition for running the test, then retest.

or

- **If the test fails**

Repair the vehicle for the condition indicated by the failure message, then retest.

- Go to next step: If the test passes

NOTE: There are several test parameters displayed and can vary by engine RPO.

3. Verify that the EVAP Monitor Complete parameter, is set to YES.

ELECTRONIC IGNITION SYSTEM DIAGNOSIS

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

Circuit/System Description

This ignition system uses an individual coil for each cylinder. The engine control module (ECM) controls the spark events by transmitting the timing pulses on the ignition control (IC) circuits to the individual ignition coils in firing order sequence.

Diagnostic Aids

- An open/high resistance on the low reference circuit to the ignition coil may cause a misfire.
- An erratic or weak spark is considered a no spark condition.

Reference Information

Schematic Reference

[Engine Controls Wiring Schematics 1.5L \(LYX\)](#).

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Electronic Ignition System Description

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Special Tools

EL 26792 HEI Spark Tester

For equivalent regional tools, refer to [Special Tools \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#) .

Circuit/System Testing

NOTE: Do not perform this diagnostic procedure unless you were sent here from a misfire DTC or the Engine Cranks But Does Not Run diagnostic.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate T8 Ignition Coil. 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 1 or A and ground.
 - **If 5 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground 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 5 Ω**
3. Test for less than 5 Ω between the low reference circuit terminal 2 or B 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**
4. Ignition ON.
5. Verify a test lamp illuminates between the ignition circuit terminal 4 or D and ground.
 - **If the test lamp does not illuminate**
 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.
 - **Go to next step: If the test lamp illuminates**
6. Ignition OFF, exchange the suspect T8 Ignition Coil with the T8 Ignition Coil of a known functioning cylinder.
7. Engine Running.
8. Verify the scan tool Cylinder 1 - 4 Current Misfire Counter does not increment for the same cylinder that the suspect T8 Ignition Coil was removed from.
 - **If increments**

Replace the K20 Engine Control Module.
 - **Go to next step: If does not increment**
9. Test or replace the T8 Ignition Coil.

Component Testing

NOTE: You must perform the Circuit/System Testing before proceeding with Component Testing.

1. Ignition OFF, connect the **EL 26792** HEI Spark Tester to the appropriate T8 Ignition Coil.
2. Engine Running.
3. Verify the spark output of the T8 Ignition Coil.
 - **If no output or the output is weak**

Replace the T8 Ignition Coil
 - **Go to next step: If the output is good**
4. All OK.

Repair Instructions

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

- [Ignition Coil Replacement](#)
 - [Control Module References](#) for engine control module replacement, programming, and setup.
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