

2017 ENGINE PERFORMANCE

Engine Controls and Fuel - 1.4L (LUV) - Diagnostic Information and Procedures - Encore, Trax

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0300-P0304: ENGINE/CYLINDER MISFIRE DETECTED

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 P0300

Engine Misfire Detected

DTC P0301

Cylinder 1 Misfire Detected

DTC P0302

Cylinder 2 Misfire Detected

DTC P0303

Cylinder 3 Misfire Detected

DTC P0304

Cylinder 4 Misfire Detected

Circuit/System Description

For an overview of the component/system, refer to:

- [Electronic Ignition System Description](#)
- [Fuel System Description \(LUV\)](#)

A misfiring cylinder causes slight variations in the rotational speed of the crankshaft. The ECM is able to detect these variations by closely monitoring the crankshaft position sensor signal. The signals of the camshaft position sensors are used to determine which cylinder is misfiring. If the ECM detects a misfire rate sufficient to cause emission levels to exceed mandated standards, DTC P0300-P0304 sets. Under certain driving conditions, a misfire rate can be high enough to cause the catalytic converter to overheat, possibly damaging the converter. The malfunction indicator lamp (MIL) flashes when converter overheating, damaging conditions are present and DTC 0300-P0304 is set.

Conditions for Running the DTC

- DTC P0010, P0011, P0013, P0014, P0016, P0017, P0068, P00C8, P00C9, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0117, P0118, P0119, P0122, P0123, P0191, P0192, P0193, P0222, P0223, P0335, P0336, P0340, P0341, P0365, P0366, P0601, P0604, P0606, P0651, P16A0, P16A1, P16A2, P16F3, P2101, P2135, P2227, P2228, P2229, P2230 = Not set
- Crankshaft/Camshaft Sensors=Synchronized

- Engine Coolant Temperature= 7 to 127 Å°C (19.4 to 261Å°F)
- Engine Load= 0%
- Engine Speed=Greater than 1, 400 RPM
- Engine Speed=Less than 1000 RPM - DTC P0315 is set.
- Fuel Cut-Off System=Inactive
- Fuel level=Greater than 11 %
- Rough Road Signal=Not Detected
- System Voltage=9 to 32 V

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

Conditions for Setting the DTC

P0300

The control module K20 detects a crankshaft rotation speed variation indicating a misfire rate sufficient to cause emissions levels to exceed a predetermined value or a misfire rate high enough to cause catalyst damage.

P0301, P0302, P0303, P0304

The control module K20 detects a crankshaft rotation speed variation indicating a single cylinder misfire rate sufficient to cause emissions levels to exceed mandated standards.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category=Type B DTC

Malfunction Indicator Lamp (MIL)=Flashing - During catalyst damaging misfire.

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category=Type B DTC

Diagnostic Aids

Verify the following conditions do not exist:

- Accessory drive bracket - Defective/Loose/Visual Damage
- Belt Driven Device - Defective/Loose/Visual Damage
- Brake Rotor - Excessive runout
- Drive Belt - Defective/Loose/Visual Damage
- Drive Shaft - Excessive runout
- During certain road conditions:Rough
- Tire and wheel assemblies which exhibit excessive runout can produce vibrations even if the assemblies are balanced.
- Incorrect operation of the component:Transmission
- Command the Cylinder Deactivation system On with a scan tool, then observe the misfire counters when commanding the system Off. If the misfire counters are incrementing, inspect for a sticking valve lifter. - If equipped
- High resistance in the circuits of the component may set DTC P0300-P0304 without setting the DTC for the component:Q17 Fuel Injector
- If the condition is intermittent, wiggle the related wiring harnesses and connectors, with the 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.
- DTC P0300 may set when there is a condition with the component circuits:B52 Heated Oxygen Sensor

Reference Information

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Special Tools

J-26792 Ignition Spark Tester

Equivalent regional tools: Special Tools (Diagnostic Tools)

Circuit/System Verification

1. Engine»Running
2. Verify there is no abnormal noise from the component:Engine
 - **If an abnormal noise is present**
Refer to: Symptoms - Engine Mechanical
 - **If no abnormal noise is present**
3. Perform the scan tool learn/reset function: Crankshaft Position Variation Learn
4. Verify there are no DTCs set related to the following system/component:
 - B23 Camshaft Position Sensor
 - B26 Crankshaft Position Sensor
 - B52 Heated Oxygen Sensor
 - Fuel System
 - Ignition System
 - Mechanical Condition
 - **If other DTCs are set**
Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
 - **If no other DTCs are set**
5. Verify the scan tool parameter:Cylinder 1 - 4 Current Misfire Counter=Does not Increment.
 - **If the parameter value increments**
Refer to: Circuit/System Testing
 - **If the parameter value does not increment**
6. Perform the scan tool control function:Cylinder Power Balance»Enable
Verify the sound of the engine changes the same way when turning off each individual injector.
 - **If the engine sound does not change the same way for one or more cylinders**
Refer to: Circuit/System Testing
 - **If the engine sound changes the same way for all cylinders**
7. Verify the scan tool parameter:Cylinder 1-4 Current Misfire Counter=Does not Increment.

Perform the action while monitoring the parameter:

- Wiggle the harness and connector:K20 Engine Control Module
- Wiggle the harness and connector:Q17 Fuel Injector
- Wiggle the harness and connector:T8 Ignition Coil
- Wiggle the component:Vacuum Hoses

- **If not the specified state**

Repair or replace as necessary.

- **If the specified state**

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.

Verify the DTC does not set.

- **If the DTC sets**

Refer to: Circuit/System Testing

- **If the DTC does not set**

9. All OK.

Circuit/System Testing

1. Verify the following conditions do not exist:

- Engine - Vacuum leak
- Exhaust System - Leaking/Missing components/Restricted Â» Refer to: [Symptoms - Engine Exhaust](#)
- Fuel - Contaminated/Dirty/Fill Level=Low Â» Refer to: [Alcohol/Contaminants-in-Fuel Diagnosis](#)
- Fuel Pressure - High/Low Â» Refer to: [Fuel System Diagnosis \(LUY\)](#)
- Positive Crankcase Ventilation System - Leaking/Improper connection/Restricted
- Spark Plug Boot - Carbon Tracking/ Fluid intrusion/Visual Damage
- Spark Plug - Carbon Tracking/Fouled/Visual Damage
- Vacuum Hoses - Kinked/Leaking/Improper connection/Restricted
- **If a condition exists**

Repair or replace as necessary.

- **If no conditions exist**

2. Ignition/Vehicle Â» Off

3. Remove the appropriate component: T8 Ignition Coil - Leave the electrical connector connected.

4. Install the special tool: J-26792 Ignition Spark Tester @ T8 Ignition Coil

5. Engine Â» Running

NOTE: An erratic or weak spark is considered a no spark condition.

6. Verify there is spark at the special tool.

- **If there is no spark**

Refer to: [Electronic Ignition System Diagnosis](#)

- **If there is spark**

7. Ignition/Vehicle Â» Off

8. Verify the component specifications are correct: Spark Plug - Gap / Heat Range /Torque Â» Refer to: [Ignition System Specifications](#)

- **If not correct**

Repair or replace as necessary.

- **If correct**

9. Swap the two components: Spark Plug - The original component that set the DTC & Another known good component from the vehicle

10. Engine » Running

11. Verify the scan tool parameter: Cylinder 1 - 4 Current Misfire Counter=Increments - At the original component location the DTC set.

- **If the parameter value does not increment**

Replace the component: Spark Plug - The original component that set the DTC

- **If the parameter value increments**

12. Perform the following procedure/test: Fuel Injector Balance » Refer to: [Fuel Injector Diagnosis](#)

Verify the procedure/test passes.

- **If the procedure/test does not pass**

Replace the component that failed the test: Q17 Fuel Injector

- **If the procedure/test passes**

13. Verify the condition does not exist: An engine mechanical condition. » Refer to: [Symptoms - Engine Mechanical](#)

- **If a condition exists**

Repair or replace as necessary.

- **If no condition exists**

14. All OK.

Repair Instructions

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

After any repair, perform DTC P0420 Circuit/System Verification, to verify the performance of the component: Catalytic Converter » Refer to: [DTC P0420](#)

- [Crankshaft Position Variation Learn](#)
- [Ignition Coil Replacement](#)
- [Spark Plug Replacement](#)

DTC P0315: CRANKSHAFT POSITION SYSTEM

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 P0315

Crankshaft Position System Variation Not Learned

Circuit/System Description

The crankshaft position sensor variation or reluctor ring learn is used to calculate reference period errors caused by slight tolerance variations in the crankshaft and the crankshaft position sensor. The calculated error allows the ECM to accurately compensate for reference period variations. This enhances the ability of the ECM to detect misfire events over a wider range of engine speed and load. The compensation values are stored in ECM memory after a learn procedure has been performed.

Conditions for Running the DTC

Engine=Running

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

Conditions for Setting the DTC

Crankshaft Position Variation Learn=Not Learned

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

Diagnostic Aids

This test procedure requires that the vehicle battery has passed a load test and is completely charged. Refer to: [Battery Inspection/Test](#)

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition $\hat{\text{A}}$ » On / Vehicle $\hat{\text{A}}$ » In Service Mode
2. Perform the scan tool learn/reset function: [Crankshaft Position Variation Learn](#)
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.

Verify the DTC does not set.

- **If the DTC sets**

Replace the component: K20 Engine Control Module

- **If the DTC is not set**

4. 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 P0324, P0326, OR P06B6: KNOCK 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 Descriptor

DTC P0324

DTC P0326

Knock Sensor Performance

DTC P06B6

Control Module Knock Sensor Processor Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Signal	P0327, P06B6	P0325	P0328	P0324*, P0326**
Low Signal	P0327	P0325	P0328	P0324*, P0326**
* Signal Performance High				
** Signal Performance Low				

Circuit/System Description

The knock sensor enables the engine control module (ECM) to control the ignition timing for the best possible performance while protecting the engine from potentially damaging levels of detonation. The knock sensor produces an alternating current (AC) voltage signal that varies depending on the vibration level during engine operation. The ECM adjusts the spark timing based on the amplitude and the frequency of the knock sensor signal. The ECM learns a minimum knock sensor noise level for all of the engine speed ranges and monitors the normal knock sensor signal. The ECM monitors the internal knock sensor processor test circuits which perform the open circuit diagnostic.

Conditions for Running the DTCs**P0324 or P0326**

- Engine speed is between 400 and 8, 500 RPM.
- Engine is running for greater than 2 s.
- The engine coolant temperature (ECT) is warmer than -40°C (-40°F).
- The intake air temperature (IAT) sensor 1 is warmer than -40°C (-40°F).

AND

- Engine speed is 400 RPM or greater for 200 or more cumulative revolutions.

OR

- Engine speed is 8, 500 RPM or greater.

P06B6

- Engine speed is between 500 and 5, 500 RPM for 100 or more cumulative revolutions.
- Engine is running for greater than 2 s.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTCs**P0324**

The ECM detects that the knock sensor signal performance is out of the normal calibrated range due to excessive engine knock on a per cylinder basis.

P0326

The ECM detects that the knock sensor signal performance is out of the normal calibrated range due to a low signal level.

P06B6

The ECM has detected a fault in the knock sensor processor open circuit diagnostic internal test circuit.

Action Taken When the DTCs Set

- DTCs P0324, P0326, and P06B6, are Type B DTCs.
- The ignition timing is retarded to reduce the potential of engine damaging spark knock.

Conditions for Clearing the DTCs

DTCs P0324, P0326, and P06B6 are Type B DTCs.

Reference Information

Description and Operation

Electronic Ignition System Description

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine Running
2. Verify DTC P0325, P0327, P0328 or P06B6 is not set.
 - **IF DTC P0325, P0327, or P0328 is set with P06B6**
Refer to DTC P0325, P0327, or P0328.
 - **If only DTC P06B6 is set**
Replace the K20 Engine Control Module.
 - **If none of the DTCs are set**
3. Ignition OFF.
4. Verify none of the conditions listed below exist:
 - B68 Knock Sensor or wiring harness damage.
 - Incorrect B68 Knock Sensor installation. Refer to Fastener Specifications .
 - B68 Knock Sensor and engine mounting surface burrs, casting flash, and foreign material.
 - Close proximity of hoses, brackets, and engine wiring.
 - Loose brackets.
 - Loose or broken accessory drive belts, brackets, components.
 - An engine mechanical condition. Refer to Symptoms - Engine Mechanical .
 - Contaminated or poor quality fuel.
 - **If a condition exists**
Repair or replace as necessary.
 - **If no conditions exist**
5. Operate the vehicle within the conditions for running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

- If the DTC sets

Test or replace the B68 Knock Sensor.

- If the DTC does not set

6. All OK.

Repair Instructions

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

- [Knock Sensor Replacement \(FWD, Without BTM\)](#), [Knock Sensor Replacement \(FWD, With BTM\)](#), [Knock Sensor Replacement \(AWD\)](#).
- [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P0325, P0327, OR P0328: KNOCK SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0325

Knock Sensor Circuit

DTC P0327

Knock Sensor Circuit Low Voltage

DTC P0328

Knock Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
High Signal	P0327, P06B6	P0325	P0328	P0324*, P0326**
Low Signal	P0327	P0325	P0328	P0324*, P0326**
* Signal Performance High ** Signal Performance Low				

Circuit/System Description

The knock sensor enables the engine control module (ECM) to control the ignition timing for the best possible performance while protecting the engine from potentially damaging levels of detonation. The knock sensor produces an alternating current (AC) voltage signal that varies depending on the vibration level during engine operation. The ECM adjusts the spark timing based on the amplitude and the frequency of the knock sensor signal. The ECM learns a minimum knock sensor noise level for all of the engine speed ranges and monitors the normal knock sensor signal. The ECM monitors the internal knock sensor processor test circuits which perform the open circuit diagnostic.

Conditions for Running the DTCs

P0325

- Engine is running for 2 s or greater.
- Engine speed is between 500-7000 RPM for 67 or more cumulative revolutions.
- The engine coolant temperature (ECT) is -40Â°C (-40Â°F) or warmer.

- The intake air temperature (IAT) sensor is -40Å°C (-40Å°F) or warmer.

P0327 or P0328

Engine speed is less than 8, 500 RPM.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTCs

P0325

The ECM detects that a knock sensor signal circuit is open for greater than 6 s.

P0327

The ECM detects that a knock sensor signal circuit is shorted to ground for greater than 6 s.

P0328

The ECM detects that a knock sensor signal circuit is shorted to voltage for greater than 6 s.

Action Taken When the DTCs Set

- DTCs P0325, P0327 and P0328 are Type B DTCs.
- The ignition timing is retarded to reduce the potential of engine damaging spark knock.

Conditions for Clearing the DTCs

DTCs P0325, P0327 and P0328 are Type B DTCs.

Diagnostic Aids

The following conditions listed below may cause a knock sensor DTC to set:

- Sensor damage.
- Knock sensor and engine mounting surface burrs, casting flash, and foreign material.
- Close proximity of hoses, brackets, and engine wiring.
- Loose brackets.
- Loose or broken accessory drive belts, brackets, components.
- An engine mechanical condition. Refer to [Symptoms - Engine Mechanical](#) .

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Description and Operation

[Electronic Ignition System Description](#)

Electrical Information Reference

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

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine Running
2. Verify DTC P0325, P0327 or P0328 is not set.
 - **If the DTC is set**

Refer to Circuit/System Testing.
 - **If the DTC is not set**
3. Verify the B68 Knock Sensor mounting bolt is properly tightened. Refer to Fastener Specifications .
 - **If not tightened to the correct specification**

Repair a necessary.
 - **If tightened to the correct specification**
4. Verify the scan tool parameters listed below display No while moving the related harnesses and connectors of the B68 Knock Sensor.
 - Cylinder 1 Knock Detected
 - Cylinder 2 Knock Detected
 - Cylinder 3 Knock Detected
 - Cylinder 4 Knock Detected
 - **If No is not displayed**

Repair the wiring harness or connectors.
 - **If No is displayed**
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 the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B68 Knock Sensor, ignition ON.
2. Test for 1-2 V between the low signal circuit terminal 2 and ground.
 - **If less than 1 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the low signal circuit terminal 2 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 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 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 low 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.
 - **If between 1-2 V**
- 3. Test for 2-4 V between the high signal circuit terminal 1 and ground.
 - **If less than 2 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the high 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 high 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 4 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 high 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.
 - **If between 2-4 V**
- 4. Test or replace the B68 Knock Sensor.

Repair Instructions

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

- [Knock Sensor Replacement \(FWD, Without BTM\)](#), [Knock Sensor Replacement \(FWD, With BTM\)](#), [Knock Sensor Replacement \(AWD\)](#).
- [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P0335 OR P0336: CRANKSHAFT POSITION SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0335

Crankshaft Position Sensor Circuit

DTC P0336

Crankshaft Position Sensor Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P057C, P0335, P0651	P0335	P0651	P0336

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0335, P0506	P0335	P0335	P0336
Low Reference	-	P0335	-	P0336

Circuit/System Description

The crankshaft position sensor circuits consist of an engine control module (ECM) supplied 5 V reference circuit, low reference circuit, and an output signal circuit. The crankshaft position sensor is an internally magnetic biased digital output integrated circuit sensing device. The sensor detects magnetic flux changes of the teeth and slots of a 58-tooth reluctor wheel on the crankshaft. Each tooth on the reluctor wheel is spaced at 60-tooth spacing, with 2 missing teeth for the reference gap. The crankshaft position sensor produces an ON/OFF DC voltage of varying frequency, with 58 output pulses per crankshaft revolution. The frequency of the crankshaft position sensor output depends on the velocity of the crankshaft. The crankshaft position sensor sends a digital signal, which represents an image of the crankshaft reluctor wheel, to the ECM as each tooth on the wheel rotates past the crankshaft position sensor. The ECM uses each crankshaft position signal pulse to determine crankshaft speed and decodes the crankshaft reluctor wheel reference gap to identify crankshaft position. This information is then used to determine the optimum ignition and injection points of the engine. The ECM also uses crankshaft position sensor output information to determine the camshaft relative position to the crankshaft, to control camshaft phasing, and to detect cylinder misfire.

Conditions for Running the DTC

P0335 Condition 1

- DTCs P0101, P0102 and P0103 are not set.
- OR
- The starter is engaged and the engine control module detects camshaft position sensor pulses.
- AND
- The airflow into the engine is greater than 2 g/s.

Condition 2

- DTC P0651 is not set.
- The engine is running and the starter is not engaged.

Condition 3

- DTCs P0365, P0366, P0641, or P0651 are not set.
- The engine is running or the starter is engaged.

P0336 Condition 1

- DTCs P0335 or P0651 are not set.
- The airflow into the engine is greater than 2 g/s.
- Engine speed is greater than 450 RPM.

Condition 2

- DTC P0651 is not set.
- The engine is running and the starter is not engaged.

Condition 3

- DTCs P0101, P0102, and P0103 are not set.
- The airflow into the engine is greater than 2 g/s.

OR

- The starter is engaged and the engine control module detects camshaft position sensor pulses.

Condition 4

- DTCs P0365, P0366, P0641, or P0651 are not set.
- The engine is running or the starter is engaged.

The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

P0335 Condition 1

The ECM does not detect a crankshaft position sensor pulse for greater than 4 s.

Condition 2

The ECM does not detect a crankshaft position sensor pulse for greater than 0.1 s.

Condition 3

The ECM does not detect a crankshaft position sensor pulse for 2 out of 10 engine revolutions.

P0336 Condition 1

The ECM detects that 10 or more crankshaft resynchronizations have occurred within 10 s.

Condition 2

The ECM does not detect the synchronization gap on the reluctor wheel for greater than 0.4 s.

Condition 3

The ECM does not detect the synchronization gap on the reluctor wheel for greater than 1.5 s after the starter was engaged.

Condition 4

The ECM detects less than 51 or greater than 65 crankshaft position sensor pulses during 1 engine revolution for 8 out of 10 engine revolutions.

Action Taken When the DTC Sets

- DTCs P0335 and P0336 are Type B DTCs.
- The camshaft position sensor is used to determine engine position.
- The camshaft actuators are commanded to the parked position.

Conditions for Clearing the DTC

DTCs P0335 and P0336 are Type B DTCs.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0651 is not set.
 - **If the DTC is set**

Refer to [DTC P0641, P0651, P0697, or P06A3](#).
 - **If the DTC is not set**
3. Engine Running.
4. Verify the scan tool Crankshaft Position Active Counter parameter increments.
 - **If the counter does not increment**

Refer to Circuit/System Testing.
 - **If the counter increments**
5. Verify the scan tool Crankshaft Position Resync Counter parameter displays 0 counts and the engine does not stumble or stall while moving the related harness/connectors of the B26 Crankshaft Position Sensor.
 - **If greater than 0 counts and the engine stumbles or stalls**

Refer to Circuit/System Testing.
 - **If 0 counts and the engine does not stumble or stall**
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.
 - **If the DTC does not set**
8. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B26 Crankshaft Position 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 X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.

- If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If 2 Ω or less, replace the K20 Engine Control Module.
 - **If less than 5 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
- **If less than 4.8 V**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the 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 X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 5 V reference 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.
 - **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 OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 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.
 - **If between 4.8-5.2 V**
6. Ignition OFF, connect a 3 A fused jumper wire to the signal circuit terminal 3, ignition ON.

NOTE: Additional DTCs may set when performing this test.

7. Verify the scan tool Crankshaft Position Sensor Active Counter parameter increments while rapidly tapping the fused jumper wire end to ground.
- **If the counter does not increment**
Replace the K20 Engine Control Module.
 - **If the counter increments**
8. Verify DTC P0336 is not set.
- **If the DTC is set**
Inspect for the conditions listed below:

- Excessive play or looseness of the B26 Crankshaft Position Sensor or the reluctor wheel
- Improper installation of the B26 Crankshaft Position Sensor
- Foreign material passing between the B26 Crankshaft Position Sensor and the reluctor wheel
- Damaged reluctor wheel
- Excessive air gap between the B26 Crankshaft Position Sensor and the reluctor wheel
- Engine oil for debris
- Timing chain, tensioner, and sprockets for wear or damage
 - If any of the conditions above are found, repair as necessary.
 - If all components test normal, test or replace the B26 Crankshaft Position Sensor.
- **If the DTC is not set**

9. Test or replace the B26 Crankshaft Position Sensor.

Repair Instructions

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

- [Crankshaft Position Sensor Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup

DTC P0340, P0341, P0365, OR P0366: INTAKE/EXHAUST CAMSHAFT POSITION SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P0340

Intake Camshaft Position Sensor Circuit

DTC P0341

Intake Camshaft Position Sensor Performance

DTC P0365

Exhaust Camshaft Position Sensor Circuit

DTC P0366

Exhaust Camshaft Position Sensor Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0107, P0452, P0532, P0641	P0340, P0365	P0641	-
Signal	P0340, P0365	P0340, P0365	P0340, P0365	P0341, P0366
Low Reference	-	P0340, P0365	P0340, P0365	-

Circuit/System Description

The camshaft position sensors each have 3 circuits consisting of an engine control module (ECM) supplied 5 V reference circuit, low reference circuit, and an output signal circuit. The camshaft position sensor is an internally magnetic biased digital output integrated circuit sensing device. The sensor

detects magnetic flux changes of the teeth and slots of a 4-tooth reluctor wheel attached to the camshaft. As each reluctor wheel tooth rotates past the camshaft position sensor, the resulting change in the magnetic field is used by the sensor electronics to produce a digital output pulse. The sensor returns a digital ON/OFF DC voltage pulse of varying frequency with 4 varying width output pulses per camshaft revolution that represent an image of the camshaft reluctor wheel. The frequency of the camshaft position sensor output depends on the velocity of the camshaft. The ECM decodes the narrow and wide tooth pattern to identify camshaft position. This information is then used to determine the optimum ignition and injection points of the engine. The ECM uses the exhaust camshaft position sensor to determine injector and ignition system synchronization. The intake and exhaust camshaft position sensors are also used to determine camshaft to crankshaft relationship. The ECM also uses camshaft position sensor output information to determine the camshaft relative position to the crankshaft to control camshaft phasing and limp-home operation.

Conditions for Running the DTC

P0340 or P0365 Condition 1

- DTCs P0101, P0102, and P0103 are not set.
- The airflow into the engine is greater than 2 g/s.

OR

- The starter is engaged and the engine control module detects camshaft position sensor pulses.

Condition 2

- DTC P0651 is not set.
- The engine is running and the starter is not engaged.

Condition 3

- DTC P0335, P0336, P0641, or P0651 are not set.
- The crankshaft is synchronized.
- The starter is engaged.

Condition 4

- DTC P0335, P0336, P0641, or P0651 are not set.
- The crankshaft is synchronized.

P0341 or P0366 Condition 1

- DTC P0335, P0336, P0641, or P0651 are not set.
- The crankshaft is synchronized.
- The starter is engaged.

Condition 2

- DTC P0335, P0336, P0641, or P0651 are not set.
- The crankshaft is synchronized.

The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

P0340 or P0365 Condition 1

The ECM does not detect a camshaft position sensor pulse for greater than 5.5 s or greater than 4.0 s since the time the starter has been engaged.

Condition 2

The ECM detects less than 4 camshaft position sensor pulses for greater than 3.0 s.

Condition 3

The ECM does not detect a camshaft position sensor pulse during the first 2 engine revolutions.

Condition 4

The ECM does not detect a camshaft position sensor pulse during 200 engine revolutions.

P0341 or P0366 Condition 1

The ECM detects less than 4 or greater than 6 camshaft position sensor pulses during the first 2 engine revolutions.

Condition 2

The ECM detects less than 398 or greater than 402 camshaft position sensor pulses during 200 engine revolutions.

Action Taken When the DTC Sets

- DTCs P0340, P0341, P0365, and P0366 are Type B DTCs.
- The camshaft position actuator is commanded to the Home or Parked position.
- The ignition system defaults to a failed camshaft position sensor limp home mode.

Conditions for Clearing the MIL/DTC

DTCs P0340, P0341, P0365, and P0366 are Type B DTCs.

Diagnostic Aids

- With a DTC set, the engine may crank for an extended period of time at start-up
- The exhaust camshaft position sensor is used for injector and ignition system synchronization. A stalling condition will occur if the camshaft position sensor signal is intermittent and a DTC may not set. Inspect the intake and exhaust camshaft position sensor circuits for poor connections.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0641 or P0651 is not set.
 - **If any of the DTCs are set**

Refer to **DTC P0641, P0651, P0697, or P06A3.**
 - **If none of the DTCs are set**
3. Engine Running.
4. Verify the scan tool parameters listed below increment:
 - Exhaust Camshaft Position Active Counter
 - Intake Camshaft Position Active Counter
 - **If any counter does not increment**

Refer to Circuit/System Testing.
 - **If all counters increment**
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 the DTC does not set.
 - **If the DTC sets**

Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate B23 Camshaft Position 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 X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the low reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If 2 Ω or less, replace the K20 Engine Control Module.
 - **If less than 5 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 1 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the 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 X2 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.
 - **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 OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 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.
 - **If between 4.8-5.2 V**
6. Verify DTC P0341 or P0366 is not set.
- **If any of the DTCs are set**

Inspect for the conditions listed below:

 - Excessive play or looseness of the B23 Camshaft Position Sensor or the reluctor wheel
 - Improper installation of the B23 Camshaft Position Sensor
 - Foreign material passing between the B23 Camshaft Position Sensor and the reluctor wheel
 - Damaged reluctor wheel
 - Excessive air gap between the B23 Camshaft Position Sensor and the reluctor wheel
 - Engine oil for debris
 - Timing chain, tensioner, and sprockets for wear or damage
 - If any of the conditions above are found, repair as necessary.
 - If all components test normal, test or replace the B23 Camshaft Position Sensor.
 - **If none of the DTCs are set**
7. Test or replace the B23 Camshaft Position Sensor.

Repair Instructions

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

- [Camshaft Position Sensor Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup

DTC P0351-P0354, P2300, P2301, P2303, P2304, P2306, P2307, P2309, OR P2310: IGNITION COIL

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

DTC P2310

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, P0351*, P2300*	P0300, P0351	P0300, P0351*, P2301*	P0300, P0351
Ignition Coil 2 Control	P0300, P0352*, P2303*	P0300, P0352	P0300, P0352*, P2304*	P0300, P0352
Ignition Coil 3 Control	P0300, P0353*, P2306*	P0300, P0353	P0300, P0353*, P2307*	P0300, P0353
Ignition Coil 4 Control	P0300, P0354*, P2309*	P0300, P0354	P0300, P0354*, P2310*	P0300, P0354
* Depending on the application, either DTC could set.				

Circuit/System Description

The ignition system on this engine uses an ignition coil module. The engine control module (ECM) controls the spark event for each cylinder through the individual ignition coil control circuits. 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 running.
- Ignition voltage is greater than 5 V.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The engine control module detects that the voltage command 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, or P2310 are Type B DTCs.

Conditions for Clearing the MIL/DTC

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

Reference Information

Schematic Reference

Engine Controls Schematics (Buick with LUV), **Engine Controls Schematics (Chevrolet with LUV)**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX (ENCORE), **COMPONENT CONNECTOR END VIEWS - INDEX (TRAX)**

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

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.
 - **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.
 - **If the DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K35 Ignition Coil Module.
2. Remove the fuel injector fuse.
3. Connect a DMM between the appropriate K35 Ignition Coil Module control circuit listed below and ground. Set the DMM to the DC Hz scale and utilize the Min-Max function:
 - Ignition Coil 1 terminal D
 - Ignition Coil 2 terminal E
 - Ignition Coil 3 terminal F
 - Ignition Coil 4 terminal G
4. Verify the DMM displays greater than 1.5 Hz while cranking the engine.
 - **If less than 1.5 Hz**
 1. Ignition OFF, disconnect the X2 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
 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
 4. Ignition ON.
 5. 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.
 - **If greater than 1.5 Hz**
5. Replace the K35 Ignition Coil 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 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 catalytic converter 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 catalytic converter also stores oxygen. The engine control module (ECM) monitors this process by using a heated oxygen sensor (HO2S) that is in the exhaust stream after the 3-way catalytic converter. The HO2S 2 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 allowing the catalyst to heat, then wait for a stabilization period while the engine is idling. The ECM then adds and removes fuel while monitoring the HO2S 2. When the catalyst is functioning properly, the HO2S 2 response to the extra fuel is slow compared to the response of the HO2S 1, which is located before the 3-way catalytic converter. When the HO2S 2 response is near that of the HO2S 1, the oxygen storage capability and efficiency of the catalyst may be degraded below an acceptable threshold.

Conditions for Running the DTC

- DTCs P0016, P0017, P0030, P0036, P0053, P0054, P0068, P0090, P0091, P0092, P00C8, P00C9, P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117, P0118, P0119, P0122, P0123, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P013A, P013B, P013E, P013F, P0140, P0141, P015A, P015B, P0171, P0172, P0191, P0192, P0193, P0222, P0223, P0300, P0301, P0304, P0443, P0458, P0459, P0506, P0507, P0601, P0604, P0606, P0697, P06A3, P06DE, P1101, P1133, P15F2, P1682, P16A0, P16A1, P16A2, P16F3, P2101, P2102, P2103, P2122, P2123, P2127, P2128, P2135, P2138, P2176, P2227, P2228, P2229, P2230, P2232, P2235, P2270, P2271, P228C, P228D, U0073, U0074, U1817 are not set.
- Before the ECM performs the idle test, the vehicle must be driven under the following conditions:
 - Engine speed is greater than 1,100 RPM
 - Engine run time is greater than a calibrated value
 - Both conditions exist for greater than 25 s
- Throttle is in the rest position.
- Intake air temperature (IAT) is between -20 to +250°C (-4 to +482°F).
- Ignition voltage is greater than 10.9 V.
- Engine coolant temperature (ECT) is between 50-130°C (122-266°F).
- Barometric pressure (BARO) is greater than 70 kPa.
- Engine has been idling less than 50 s.
- Vehicle speed is less than 2 km/h (1 mph).
- Short term fuel trim is learned.
- Mass air flow (MAF) is between 2.5-11 g/s.
- Evaporative emissions (EVAP) purge concentration is learned.
- Catalytic converter calculated temperature is between 600-900°C (1,112-1,652°F).
- Engine is operating in Closed Loop.
- Transmission is not in P/N (automatic transmission only).

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTC P0420 is a Type A DTC.

Conditions for Clearing the DTC

DTC P0420 is a Type A DTC.

Diagnostic Aids

Inspect for the conditions listed below, which may cause a catalytic converter 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](#)

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 other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .
 - **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.
 - **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

- **If Passed is displayed**

7. All OK.

Circuit/System Testing

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

- 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.

- **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.

- **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.

- **If no condition is found**

4. Replace the exhaust front pipe and the warm up three-way catalytic converter.

Repair Instructions

NOTE:

A new converter with less than 160 km (100 mi) on it may set DTC P0420 due to outgassing of the internal matting. Operating the vehicle at highway speeds for approximately 1 h may correct the condition.

- [Exhaust Front Pipe Replacement \(LUV\)](#)
- [Heated Oxygen Sensor Replacement - Sensor 2](#)
- Perform the HO2S Heater Learn procedure with a scan tool after replacing a heated oxygen sensor.
- [Catalytic Converter Replacement \(LUV\)](#)

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.
 - **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
 - **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

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 ECM using the fuel tank pressure (FTP) 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 P010C, P010D, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0125, P0128, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0461, P0462, P0463, P0464, P0496, P0502, P0503, P0722, P0723, P2227, P2228, P2229, P2230, P2610. are not set.
- The barometric pressure (BARO) is greater than 70 kPa.
- The engine coolant sensor (ECT) is greater than 63Â°C (145Â°F)
- No fuel filling during the EONV test period.
- 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 (46Â°F).
- The engine run time before shut-off was greater than 10 min.
- The drive distance before engine shut-off was more 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 controller will not make more than 2 test attempts per day. The time since the last completed EONV 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 EONV 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 FTP parameter for vacuum decay.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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 (EEST)
- **GE 41413-300** EVAP Cap and Plug Kit
- **GE 41413-SPT** High Intensity White Light

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

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 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 until the leak is located using the **GE 41413-SPT**

- **No leak in the EVAP system**

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

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
Ignition Voltage	P0031, P0037, P0134 P0135, P0443, P0458, P0597, P0598, P0660, P0661	P0031, P0037, P0135, P0443, P0458, P0597, P0598, P0660, P0661	-
Control	P0443, P0458	P0443	P0459

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.

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.25 s.

P0458

The ECM detects the EVAP purge solenoid valve control circuit is shorted to ground within 25 s.

P0459

The ECM detects the EVAP purge solenoid valve control circuit is shorted to voltage within 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 Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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.
2. Command the EVAP purge solenoid from 0 to 50% and back to 0% with a scan tool while observing the following control circuit status parameters:
 - EVAP Purge Solenoid Valve Control Circuit High Voltage Test Status
 - EVAP Purge Solenoid Valve Control Circuit Open Test Status
 - EVAP Purge Solenoid Valve Control Circuit Low Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing

- **If Malfunction is not displayed**

3. Verify the EVAP Purge Solenoid Valve control circuit 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

- **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

- **If the DTC does not set**

6. 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 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 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.

- **If the test lamp illuminates**

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

- **If the test lamp does not illuminate**

4. Remove the test lamp.

5. Verify the 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 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.

- **If OK is displayed**

6. Install a 3 A fused jumper wire between the control circuit terminal 1 and the ignition circuit terminal 2.
7. Verify the 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.
 - **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 circuit terminal 1 and the ignition circuit, terminal 2.
 - **If not between 10-30 Ω**

Replace the Q12 Evaporative Emission Purge Solenoid Valve.
 - **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 2 and 12 V. Install a jumper wire between the control terminal 1 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.
 - **If it does turns 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

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 (FTP) 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 P00C8, P00C9, P010C, P010D, P0068, P16F3, P0102, P0103, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0122, P0123, P0125, P0128, P160E, P160D, P0191, P0192, P0193, P0222, P0223, P0443, P0449, P0452, P0453, P0454, P0502, P0503, P0606, P0722, P0723, P1104, P2100, P2101, P2102, P2103, P2135, P2227, P2228, P2229, or P2230 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 2 stages to setting this DTC. Stage 1, prep test, then stage 2 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 liters (0.5 gallons) 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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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 41415-30** Fuel Tank Cap Adapter
- **GE 41413-A** Evaporative Emissions System Tester (EEST)

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

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](#) .

- **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](#).

- **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.

- **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.

- **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.

- **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.

- **If the DTC does not set**

9. All OK.

Repair Instructions

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

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

DTC P0449, P0498, OR P0499: EVAPORATIVE EMISSION (EVAP) VENT SOLENOID VALVE CONTROL

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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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

1. Ignition ON.
2. Command the EVAP Vent Solenoid Valve to ON (Not Venting) and OFF (Venting) with a scan tool while observing the following control circuit status parameters:
 - 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
 - **If Malfunction is not displayed**
3. Verify the EVAP Vent Solenoid Valve control circuit 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
 - **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
 - **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.
 - **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.
 - **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.
 - **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.
- **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.
 - **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-P0454: FUEL TANK PRESSURE SENSOR

Diagnostic Instructions

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

Fuel Tank Pressure Sensor Circuit High Voltage

DTC P0454

Fuel Tank Pressure Sensor Circuit Intermittent

Diagnostic Fault Information

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

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5 V Reference	P0236, P0237, P0452, P0532, P0641	P0451	P0452	P0236, P0238, P0453, P0641, P1101, P2227	-
Signal	P0452	P0451	P0452	P0453	P0451, P0454
Low Reference	-	P0446, P0451	P0453, P0463	-	P0451

Typical Scan Tool Data

FTP Sensor Voltage

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

Circuit/System Description

The Fuel Tank Pressure (FTP) sensor measures 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 FTP sensor. The FTP sensor signal voltage varies depending on EVAP system pressure or vacuum. The controller also uses this FTP 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 and the EVAP Vent Solenoid Valve is closed.
- 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.

Conditions for Setting the DTC

P0451

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

P0452

The FTP sensor voltage is less than 0.15 V for more than 10 s.

P0453

The FTP sensor voltage is more than 4.9 V for more than 10 s.

P0454

If, during the engine-off natural vacuum small leak test, P0442, the ECM detects an abrupt FTP signal change, other than a refueling event, this DTC will set. An abrupt change is defined as a change of 0.45 in H₂O in the span of 1 s but less than 1 in H₂O in 12.5 ms.

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 code to set.
- Ensure that the reference port on the FTP sensor is unobstructed.
- An FTP sensor that is skewed or does not have a linear transition from low to high may cause this code to set. Scan tool output controls, 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 Schematics (Buick with LUY). Engine Controls Schematics (Chevrolet with LUY).

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX (ENCORE). COMPONENT CONNECTOR END VIEWS - INDEX (TRAX).

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

GE 41413-A Evaporative Emission System Tester (EEST)

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

Circuit/System Verification

1. Remove the fuel cap.
2. Ignition ON, engine OFF.
3. Verify the scan tool FTP sensor parameter is between 1.3 and 1.7 V.

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

Refer to Circuit/System Testing

- **If between 1.3-1.7 V**

4. 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.

- **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.

- **If between 4.8-5.2 V**

5. Verify the scan tool FTP 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.
- **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 FTP 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.
 - **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](#)
- [Control Module References](#) for ECM replacement, setup, and programming.

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 Descriptor

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 calibrated level of vacuum before a calibrated amount of purge volume has passed through the system.

Conditions for Running the DTC

- DTCs P0068, P00C8, P00C9, P00CA, P0090, P0091, P0092, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P012B, P012C, P012D, P017B, P017C, P017D, P0191, P0192, P0193, P0222, P0223, P06A3, P06DB, P06DE, P0A1D, P0443, P0449, P0452, P0454, P0453, P0458, P0459, P0498, P0499, P0502, P0503, P0601, P0604, P0606, P0697, P0722, P0723, P111E, P117B, P117C, P117D, P117E, P117F, P160D, P160E, P1682, P16A0, P16A1, P16A2, P16F3, P1104, P127A, P127C, P127D, P15F2, P1221, P2100, P2101, P2102, P2103, P2122, P2123, P2127, P2128, P2135, P2138, P215B, P2176, P2227, P2228, P2229, P2230, P228C, P228D, U0073, U0074, U0293, U1817 are not set.
- The cold startup engine coolant temperature (ECT) and the startup intake air temperature (IAT) are within 8 $^{\circ}$ C (14 $^{\circ}$ F).
- The ignition voltage is between 11-32 V.
- The barometric pressure (BARO) is greater than 70 kPa.

- The start up engine coolant temperature (ECT) is less than 35Â°C (95Â°F).
- The start up intake air temperature (IAT) is between 4-34Â°C (39-93Â°F).
- The EVAP purge is greater than 2.80%.
- The fuel level is between 10-90%.
- 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 less than 2.74 kPa (11 in H20) 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 passes if tank vacuum is greater than 2.74 kPa (11 in H20). This test will run for a maximum of 22 min. This test runs until it passes.

Action Taken When the DTC Sets

DTC P0455 is a Type B DTC.

Conditions for Clearing the DTC

DTC P0455 is a Type B DTC.

Diagnostic Aids

- Inspect for a loose, missing, incorrect, or damaged 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, use the **GE-41413-A** to introduce smoke into the EVAP system. 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 H20 (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 FTP parameter for vacuum decay.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Powertrain Component View

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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 Access Port Tool
- **GE-41413-A** Evaporative Emissions System Tester
- **GE-41413-SPT** High Intensity White Light
- **GE-41415-30** Fuel Tank Cap 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 \(Diagnostic Tools\)](#) .

Circuit/System Verification

1. Ignition ON,
2. Verify P0455 is set
 - **If the DTC is set**

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

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 Q12 Evaporative Emission 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 System Seal or Not Venting 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.
 - **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** .
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, to the vehicle.
8. Engine idling, command the Purge/Seal function to System Seal or Not Venting 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.
 - **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.
 - **If within the specified range**
12. All OK

Repair Instructions

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

- **Fuel Tank Pressure Sensor Replacement**
- **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 (FTP) 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 table listed below 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, P00CA, P0090, P0091, P0092, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0122, P0123, P0125, P0128, P0191, P0192, P0193, P0222, P0223, P0601, P0604, P0606, P0697, P06A3, P06DB, P06DE, P0A1D, P1104, P127A, P127C, P127D, P15F2, P160D, P160E, P1682, P16A0, P16A1, P16A2, P16F3, P0443, P0449, P0452, P0453, P0454, P0502, P0503, P0722, P0723, P2100, P2101, P2102, P2103, P2122, P2123, P2127, P2128, P2135, P2138, P215B, P2176, P228C, P228D, U0073, U0074, U0293, U1817, are not set.
- The ignition voltage is between 11-32 V.
- The engine OFF time is greater than 48 min,
- 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 4-34Â°C (39-93Â°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.
- This test will run with the purge valve closed and the vent valve closed.

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:

- Improper installation
- Damaged
- Temporary blockage
- Valve or system tubing restriction

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Powertrain Component View

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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

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
 - **If the DTC does not set**
3. All OK

Circuit/System Testing

NOTE:

- **Vehicle and service department temperature and fuel level (vapor pressure) can affect the fuel tank pressure sensor parameter. Ensure the vehicle temperature has stabilized to service department temperature to ensure greatest accuracy.**
- **Be sure the EVAP Purge Solenoid Valve command is 0% or this test will not work.**

1. Ignition ON.
2. Command the EVAP Purge/Seal function to System Seal or Not Venting with a scan tool.
3. Engine Running.
4. Verify the Fuel Tank Pressure Sensor parameter is less than 1.9 V for greater than 90 s.

- If greater than 1.9 V

Replace the Q12 Evaporative Emission Purge Solenoid Valve

- If less than 1.9 V

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/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](#) provide 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 controlled by the engine control module (ECM). The DC motor located in the throttle body drives the throttle blade. In order to decrease idle speed, along with spark and fuel delivery changes the ECM commands the throttle closed reducing air flow into the engine and the idle speed decreases. In order to increase idle speed, the ECM commands the throttle plate open allowing more air to pass the throttle plate.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0128, P0171, P0172, P0201-P0204, P0220, P0222, P0223, P0300-P0304, P0351-P0354, P0461- P0463, P0496, P0606, P0722, P0723, P1516, P2066-P2068, P2101, P2135 are not set.
- The engine is operating for at least 60 s.
- The barometric pressure (BARO) is greater than 70 kPa (11 psi).
- The engine coolant temperature (ECT) is greater than 60°C (140°F).
- The system 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.
- A scan tool output control is not active.
- DTC P0506 and P0507 run continuously when the above conditions are met for greater than 10 s.

Conditions for Setting the DTC

P0506

The actual idle speed is approximately 91 RPM lower than the desired idle speed.

P0507

The actual idle speed is approximately 182 RPM greater than the desired idle speed.

Action Taken When the DTC Sets

DTCs P0506 and P0507 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P0506 and P0507 are Type B DTCs.

Diagnostic Aids

- A stalling condition can cause DTC P0506 to set.
- An intermittent vehicle speed sensor (VSS) signal can cause DTC P0507 to set.
- An intermittent clutch pedal position sensor signal, if equipped, can cause DTC P0506 to set.

Reference Information

Schematic Reference

Engine Controls Schematics (Buick with LUY). Engine Controls Schematics (Chevrolet with LUY).

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX (ENCORE). COMPONENT CONNECTOR END VIEWS - INDEX (TRAX).

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 no other DTCs set.
 - **If any other DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** for further diagnosis.
 - **If no other DTC is set**
3. Verify the scan tool Throttle Body Idle Airflow Compensation parameter is less than 90 %.
 - **90 % or greater**

Refer to **Throttle Body Inspection and Cleaning** .

- **If less than 90 %**

4. Engine Idling at the normal operating temperature.

NOTE: The engine must run for greater than 60 s, then idle at a steady state for an additional 10 s before comparing the actual and desired engine speed parameters.

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

- **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

- **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

- **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.

- **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.
- **If a condition is found**

Repair as necessary.

- 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 P057B-P057D: BRAKE PEDAL POSITION SENSOR

Diagnostic Instructions

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

DTC Descriptors

DTC P057B

Brake Pedal Position Sensor Performance

DTC P057C

Brake Pedal Position Sensor Circuit Low Voltage

DTC P057D

Brake Pedal Position Sensor Circuit High Voltage

Diagnostic Fault Information

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

Typical Scan Tool Data

Brake Pedal Position Sensor

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

Circuit/System Description

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

The BPP sensor is a six wire sensor, and is part of a dual brake position sensor. One BPP Sensor is used for the stop lamps and the other BPP Sensor is used for the engine brake pedal override feature. The BPP Sensor for engine brake pedal override communicates with the ECM. The ECM supplies a 5 V

reference circuit, low reference circuit, and signal circuit to the BPP sensor. The BPP sensor sends a voltage signal to the ECM on the signal circuit. The voltage on the signal circuit will vary from a voltage greater than 0.25 V when the brake pedal is released to a voltage less than 4.75 V when the brake pedal is fully applied.

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

Conditions for Running the DTC

P057B

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

P057C or P057D

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

Conditions for Setting the DTC

P057B

ECM detects the brake pedal position sensor signal is stuck in a range for less than 1 s.

P057C

ECM detects the brake pedal position sensor voltage is less than 0.25 V for less than 1 s.

P057D

ECM detects the brake pedal position sensor voltage is greater than 4.75 V for less than 1 s.

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

P057B, P057C, and P057D are Type A DTCs

Reference Information

Schematic Reference

- [Engine Controls Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#).
- [Exterior Lights Schematics \(Buick\)](#), [Exterior Lights Schematics \(Chevrolet\)](#).

Connector End View Reference

- [COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#).

- [INLINE HARNESS CONNECTOR END VIEWS - INDEX \(TRAX\)](#), [INLINE HARNESS CONNECTOR END VIEWS - INDEX \(ENCORE\)](#).

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

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

9. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

10. All OK.

Circuit/System Testing

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

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

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

2. Test for less than 10 Ω between the low reference circuit terminal 6 and ground.

- **If 10 Ω or greater**

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

- **If less than 10 Ω**

3. Ignition ON.

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

- **If less than 4.8 V**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the 5 V reference circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
3. Test for less than 2 Ω in the 5 V reference circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.

- **If greater than 5.2 V**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 1 V between the 5 V reference circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.

- **If between 4.8-5.2 V**

5. Verify the scan tool Brake Pedal Position Sensor parameter is less than 0.25 V.

- **If 0.25 V or greater**

1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
2. Test for less than 0.25 V between the signal circuit terminal 4 and ground.
 - If 0.25 V or greater, repair the short to voltage on the circuit.
 - If less than 0.25 V, replace the K20 Engine Control Module.

- **If less than 0.25 V**

6. Install a 3 A fused jumper wire between the signal circuit terminal 4 and the 5 V reference circuit terminal 5.

7. Verify the scan tool Brake Pedal Position Sensor parameter is greater than 4.8 V.

- **If 4.8 V or less**

1. Ignition OFF, remove the jumper wire, and disconnect the harness connector at the K20 Engine Control Module.
2. Test for infinite resistance between the signal circuit terminal 4 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 4.8 V**

8. Replace the B22 Brake Pedal Position Sensor.

Repair Instructions

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

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

DTC P0601-P0604, P0606, P062B, P062F, P0630, P16F3, OR P262B: CONTROL MODULE (ECM)

Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [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 P062F

Control Module Long Term Memory Performance

DTC P0630

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

DTC P16F3

DTC P262B

Control Module Power Off Timer Performance

Circuit/System Description

This diagnostic applies to internal microprocessor integrity conditions within the engine control module (ECM). This diagnostic also addresses if the ECM is not programmed.

Conditions for Running the DTCs**P0601, P0602, P0630**

These DTCs run continuously when the ignition is in ON.

P0603, P062F

These DTCs run during ECM power up.

P0604

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

P0606

DTC P0606 runs continuously when Ignition 1 Signal voltage is greater than 11 V.

P16F3

- The engine speed is greater than 500 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, P0630, and P16F3 are Type A DTCs.
- DTC P062F and P262B are Type B DTCs.

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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, clear the DTC information with a scan tool.
2. Verify no other DTCs are set.
 - **If any other DTCs are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.
 - **If no other DTCs are set**
3. 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
 - **If none of the DTCs are set**
4. Verify DTC P0601, P0603, P0604, P0606, P062F, P16F3, or P262B is not set.
 - **If any of the DTCs are set**
Replace the K20 Engine Control Module.
 - **If none of the DTCs are set**
5. 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 P0628: FUEL PUMP ENABLE CIRCUIT LOW VOLTAGE (LUV)

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 P0628

Fuel Pump Enable Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control	P0628	P0628	-	-

Circuit/System Description

The engine control module (ECM) provides ignition voltage to the chassis control module whenever the engine is cranking or running. The control module enables the chassis 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 chassis 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 11 V or greater.
- The ECM has commanded the fuel pump ON.
- The DTC runs continuously when the above conditions are met for greater than 1 s.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTC P0628 is a Type B DTC.

Conditions for Clearing the DTC

DTC P0628 is a Type B DTC.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Electrical Information Reference

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

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC P0628 is not set.
 - **If a DTC is set**

Refer to Circuit/System Testing.
 - **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.
 - **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.
 - **If the DTC does not set**
6. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the K38 Chassis Control Module.
2. Ignition ON for 10 s.
3. Verify that a test lamp does not illuminate between the control circuit terminal 20 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.
 - **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.
 - **If OK is displayed**
6. Install a 3 A fused jumper wire between the control circuit terminal 20 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.
 - **If Malfunction is displayed**
 8. Replace the K38 Chassis Control Module.

Repair Instructions

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

[Control Module References](#) for Engine Control Module or Chassis Control Module replacement, programming, and setup

DTC P0641 OR P06A6: 5 V REFERENCE (CHASSIS CONTROL MODULE)

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

5 V Reference Circuit

DTC P06A6

5 V Reference 1 Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P018C, P0641, P06A6	P018C	P018D, P0641, P06A6	P06A6
Signal	P018C	P018B, P018C	P018D	P018B
Low Reference	-	P0641, P06A6	-	P06A6

Circuit/System Description

The fuel pressure sensor is located on the fuel line. The fuel pressure sensor monitors the fuel pressure in the fuel line. The chassis control module monitors the voltage signal from the fuel pressure sensor.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The chassis control module detects that the fuel pressure 5 V reference is above or below a predetermined voltage threshold.

Action Taken When the DTC Sets

DTCs P0641 and P06A6 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P0641 and P06A6 are Type A DTCs.

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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Description and Operation

[Fuel System Description \(LUV\)](#)

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B47 Fuel Pressure Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.
 - **If less than 10 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 K38 Chassis 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 K38 Chassis Control Module.
- **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.
- **If between 4.8-5.2 V**
5. Verify the scan tool Fuel Pressure Sensor Voltage parameter is less than 1 V.
 - **If 1 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.
 - **If less than 1 V**
6. Install a 3 A fused jumper wire between the signal circuit terminal 1 and the 5 V reference circuit terminal 3, wait 15 seconds.
7. Verify the scan tool Fuel Pressure Sensor Voltage parameter is greater than 4.8 V.
 - **If 4.8 V or less**
 1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.
 - **If greater than 4.8 V**
8. Test or replace the B47 Fuel Pressure Sensor.

Repair Instructions

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

[Control Module References](#) for chassis control module replacement, programming and setup

DTC P0641, P0651, P0697, OR P06A3: 5V REFERENCE

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

Circuit/System Description

The engine control module (ECM) has 4 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 5 V reference circuit can affect all the components connected to the same internal 5V reference circuit.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

P0641

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

- Exhaust and intake camshaft position sensors
- Air conditioning (A/C) refrigerant pressure sensor
- Multifunction intake air sensor
- Fuel tank pressure sensor

P0651

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

- Brake pedal position sensor
- Crankshaft position sensor
- Turbocharger boost/intake air temperature sensor

P0697

The 5V reference 3 circuit provides 5 V circuits to the sensors listed below:

- Accelerator pedal position sensor 2
- Manifold absolute pressure sensor

P06A3

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

- Accelerator pedal position sensor 1
- Throttle position 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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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 1-4 Circuit Status parameters do not display Malfunction.
 - **If Malfunction is displayed**
Refer to Circuit/System Testing.
 - **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.
 - **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.
 - **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, or 4 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.
 - **If OK is displayed after all components have been connected**
5. All OK.

Repair Instructions

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

- [Accelerator Pedal Position Sensor Replacement](#)
- [Air Conditioning \(A/C\) Refrigerant Pressure Sensor Replacement \(LUV\)](#)
- [Brake Pedal Position Sensor Replacement](#)
- [Camshaft Position Sensor Replacement](#)
- [Crankshaft Position Sensor Replacement](#)
- [Fuel Tank Pressure Sensor Replacement](#)
- [Intake Air Pressure and Temperature Sensor Replacement](#) for turbocharger boost/intake air temperature sensor replacement.
- [Manifold Absolute Pressure Sensor Replacement](#)
- [Mass Airflow Sensor Replacement](#) for multifunction intake air sensor replacement.
- [Throttle Body Assembly Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup.

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

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.
- Remote vehicle start is not active
- The DTCs run 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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)
- [Instrument Cluster Schematics \(Buick\)](#), [Instrument Cluster Schematics \(Chevrolet\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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.
 - **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.
 - **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.

- **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.

- **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 52 and ground.

- If less than infinite resistance, repair the short to ground in the circuit.
- If infinite resistance, replace the P16 Instrument Cluster.

- **If the malfunction indicator lamp does not illuminate**

4. Connect a 3 A fused jumper wire between the control circuit terminal X1 52 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 52 and ground.

- If 1 V or greater, repair the short to voltage on 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 31 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 on 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.

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

DTC P0685, P0686, P0687, P0689, P0690, OR P1682: 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 Descriptors

DTC P0685

Engine Controls Ignition Relay Control Circuit

DTC P0686

Engine Controls Ignition Relay Control Circuit Low Voltage

DTC P0687

Engine Controls Ignition Relay Control Circuit High Voltage

DTC P0689

Engine Controls Ignition Relay Feedback Circuit Low Voltage

DTC P0690

Engine Controls Ignition Relay Feedback Circuit High Voltage

DTC P1682

Ignition 1 Switch Circuit 2

Diagnostic Fault Information

Engine Controls Ignition Relay

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

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	-

Circuit	Short to Ground	Open	Short to Voltage
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 2 ignition voltage circuits supplied to the engine control module (ECM). One is supplied by the engine controls ignition relay, and the other is supplied by the ignition main relay. The ECM monitors and compares the ignition voltage supplied by the 2 relays.

Conditions for Running the DTC

P0685, P0686, P0687

The DTC runs when ignition voltage is greater than 11 V.

P0689

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

P0690

- P0685 is not set.
- The engine controls ignition relay is commanded OFF for greater than 2 s.
- The DTC runs continuously when the above conditions are met.

P1682

- The engine controls ignition relay is commanded ON.
- Ignition 1 signal voltage is greater than 5.5 V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0685

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

P0686

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

P0687

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

P0689

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

P0690

The ECM detects the engine controls ignition relay feedback circuit is greater than 2 V for greater than 4 s.

P1682

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

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

Reference Information

Schematic Reference

- [Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)
- [Power Distribution Schematics \(Buick\)](#), [Power Distribution Schematics \(Chevrolet\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

Electrical Information Reference

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

DTC Type Reference

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE:

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

1. Ignition ON
2. Verify DTC P0685, P0686, P0687, P0689, P0690, or P1682 is not set.
 - If any of the DTCs are set
Refer to Circuit/System Testing.
 - If none of the DTCs are set
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 - If the DTC sets
Refer to Circuit/System Testing.
 - If the DTC does not set
4. 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.

- If the test lamp illuminates

NOTE:

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

3. Ignition ON.
4. Verify that a test lamp does not illuminate between the ignition voltage circuit terminal 87 and ground.
 - If the test lamp illuminates
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Ignition ON.

3. Test for less than 1 V between ground and connector terminals 13 and 28.
 - If 1 V or greater, repair the short to voltage in the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
- **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 X2 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the relay switch ignition voltage circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for infinite resistance between the relay switch ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **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.
 - **If OL is displayed**
10. Ignition ON.
11. Verify the DMM displays less than 1 V.
 - **If 1 V or greater**
 1. Ignition OFF, disconnect the X1 connector at the K20 Engine Control Module.
 2. Ignition ON.
 3. Test for less than 1 V on the relay control circuit.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - if less than 2 Ω , replace the K20 Engine Control Module.
 - **If less than 1 V**
12. Test or replace the KR75 Engine Controls Ignition Relay.

Component Testing

Relay Test

1. Ignition OFF, disconnect the KR75 Engine Controls Ignition Relay.
2. Test for 70-110 Ω between terminals 85 and 86:
 - **If less than 70 Ω or greater than 110 Ω**
 Replace the KR75 Engine Controls Ignition Relay.
 - **If between 70-110 Ω**
3. Test for infinite resistance between the terminals listed below:

- 30 and 86
- 30 and 87
- 30 and 85
- 85 and 87
- **If less than infinite resistance**

Replace the KR75 Engine Controls Ignition Relay.

- **If infinite resistance**

4. Install a 20 A fused jumper wire between relay terminal 85 and 12 V. Install a jumper wire between relay terminal 86 and ground.
5. Test for less than 2 Ω between terminals 30 and 87.

- **If 2 Ω or greater**

Replace the KR75 Engine Controls Ignition Relay.

- **If less than 2 Ω**

6. All OK.

Repair Instructions

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

- [Front 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 P069E: FUEL PUMP 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 P069E

Fuel Pump Control Module Requested MIL Illumination

Circuit/System Description

The chassis control module, sometimes called the fuel pump control module, constantly monitors the fuel pump 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 P069E 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 P069E is a Type A DTC.
- DTC P069E will continue to be current or active as long as the chassis control module is requesting MIL illumination.

Conditions for Clearing the DTC

DTC P069E 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 P069E to be set in the ECM.
- On some vehicle applications the chassis control module may control components other than the fuel pump, such as the active grille air shutter system. Therefore, all DTCs that may be set in the chassis control module should be investigated whenever DTC P069E is 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 P069E 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** .

- **If a DTC is not set**

2. Verify the DTCs are set only as History in the chassis control module.

- **If a DTC is not set only as History**

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

- **If a DTC is set only as History**

Refer to **Testing for Intermittent Conditions and Poor Connections** .

- **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** .

- If the DTC does not set

5. All OK.

Repair Instructions

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

DTC P0700 OR P1700: TRANSMISSION CONTROL MODULE

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

DTC P1700

Transmission Control Module (TCM) Requested SVS 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 engine control module (ECM). The ECM sets DTC P0700 or DTC P1700 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 operating.
- The DTC 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 and DTC P1700 are Type A DTCs.

Conditions for Clearing the MIL/DTC

DTC P0700 and DTC P1700 are Type A DTCs.

Diagnostic Aids

Communication codes, U-codes, as well as powertrain codes, P-codes, set in the TCM can cause the ECM to set DTC P0700 or DTC P1700.

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 these DTCs. DTC P0700 or DTC P1700 are informational DTCs.
- Correct any engine controls and communication DTCs before diagnosing transmission control module DTCs.

1. Verify that there are no engine controls or communication DTCs set.

- If a DTC is set

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for diagnosis of engine control or communications DTCs.

- If a DTC is not set

2. Verify that there are no transmission control module DTCs set.

- If a DTC is set

Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for diagnosis of transmission control module DTCs.

- 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](#).

- If the DTC does not set

5. All OK.

Repair Instructions

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

DTC P111E: ENGINE COOLANT TEMPERATURE (ECT) 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 Descriptors

DTC P111E

Engine Coolant Temperature (ECT) Sensor Not Plausible

Diagnostic Fault Information

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

Typical Scan Tool Data

ECT Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running Parameter Normal Range: -39 to 149Å°C (-38 to 300Å°F)			
ECT Sensor	150Å°C (302Å°F)	-40Å°C (-40Å°F)	-40Å°C (-40Å°F)
Low Reference	-	-40Å°C (-40Å°F)	-40Å°C (-40Å°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 or colder than the Intake Air Temperature (IAT) sensor and Radiator Coolant Temperature (RCT) sensor. 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 temperatures between the ECT, IAT, and RCT sensors.

If the ECM detects that the temperature difference between the ECT, IAT, and RCT sensors is not within an acceptable operating range, 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 P00B3, P00B4, P0111, P0112, P0113, P0114, P0117, P0118, P0128, P0601, P112F, P1621, or P2610 are not set.
- The vehicle has had a minimum ignition OFF time of 8 hours.
- The engine is running.
- The Ambient air temperature is warmer than -7Å° C (19Å° F)
- The block heater is not active.
- The fuel level is greater than 2.5 %.
- This DTC runs once per ignition cycle when the above conditions are met.

Conditions for Setting the DTC

- The ECM detects that there is a 60Å° C (140 Å°F) or greater temperature difference between the start-up Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor and the Radiator Coolant Temperature (RCT) sensor.

OR

- The ECM detects the start-up Engine Coolant Temperature (ECT) sensor is between 16Å°C (61Å°F) and 60Å°C (140Å°F) warmer than the Intake Air Temperature (IAT) sensor and Radiator Coolant Temperature (RCT) sensor when the engine is cranking for less than 10 s.

OR

- The ECM detects the start-up Engine Coolant Temperature (ECT) sensor is at least 16Å°C (61Å°F) colder than the Intake Air Temperature (IAT) sensor and Radiator Coolant Temperature (RCT) sensor.

OR

- The ECM detects the start-up Engine Coolant Temperature (ECT) sensor is 16Å°C (61Å°F) warmer than the Intake Air Temperature (IAT) sensor and Radiator Coolant Temperature (RCT) sensor when the engine is cranking without starting for greater than 10 s.

Action Taken When the DTC Sets

DTC P111E is a Type B DTC.

Conditions for Clearing the 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 Schematics (Buick with LE2)

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX (ENCORE), COMPONENT CONNECTOR END VIEWS - INDEX (TRAX)

Description and Operation

Cooling System Description and Operation (LUV, LE2), Cooling System Description and Operation (2HO)

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC P00B3, P00B4, P0111, P0112, P0113, P0114, P0117, P0118, P0128, P0601, P112F, P1621, or P2610 are not set.

- **If DTC P00B3, P00B4, P0111, P0112, P0113, P0114, P0117, P0118, P0128, P0601, P112F, P1621, or P2610 are set**

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

- **If DTC P00B3, P00B4, P0111, P0112, P0113, P0114, P0117, P0118, P0128, P0601, P112F, P1621, or P2610 are not set**

2. Ignition OFF for a minimum of 8 hours.

3. Ignition ON, observe scan tool parameters IAT Sensor 1, Radiator Coolant Temperature Sensor and the ECT Sensor and verify they are within 15Â°C (59Â°F) of each other and ambient temperature.

- **If the Radiator Coolant Temperature Sensor parameter is not within 15Â°C (59Â°F) of the ECT Sensor and IAT Sensor 1 or ambient temperature.**

Perform the diagnostic for DTC P00B3 or P00B4, Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If the IAT Sensor 1 parameter is not within 15Â°C (59Â°F) of the ECT Sensor and Radiator Coolant Temperature Sensor or ambient temperature.**

Perform the diagnostic for DTC P0112, P0113, or P0114, Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) .

- **If the ECT Sensor parameter is not within 15Â°C (59Â°F) of the IAT Sensor 1 and Radiator Coolant Temperature Sensor or ambient temperature.**

Refer to Circuit/System Testing.

- **If all the parameters are within 15Â°C (59Â°F) of each other and ambient temperature.**

4. Ignition OFF.

5. Verify the cooling system is filled to the correct coolant level. Refer to [Cooling System Leak Testing](#) , and [Cooling System Draining and Filling](#) .

- **If the coolant level is not filled to the correct level**

Repair as necessary.

- **If the coolant level is correct**

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.

- **If the DTC does not set**

8. All OK.

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 A or 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.

- **If less than 5 Ω**

3. Ignition ON.

4. Verify the scan tool ECT Sensor parameter is colder than -39Â°C (-38Â°F).

- **If warmer than -39Â°C (-38Â°F)**

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

2. Test for infinite resistance between the signal circuit terminal B or 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

- **If colder than -39Â°C (-38Â°F)**
5. Install a 3 A fused jumper wire between the signal circuit terminal B or 1 and the low reference circuit terminal A or 2.
 6. Verify the scan tool ECT sensor parameter is warmer than 149Â°C (300Â°F).
 - **If 149Â°C (300Â°F) or colder**
 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.
 - **If warmer than 149Â°C (300Â°F)**
 7. Test or replace the B34A 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.
 - **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.
 - **If infinite resistance**
4. All OK.

Repair Instructions

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

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

DTC P1255 OR P064A: FUEL PUMP CONTROL MODULE (CHASSIS CONTROL MODULE)

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 P064A

Fuel Pump Control Module Performance

DTC P1255

Fuel Pump Control Module Driver High Temperature

Circuit/System Description

The engine control module (ECM) supplies voltage to the chassis control module when the ECM detects that the ignition is on. The voltage from the ECM to the chassis control module remains active for 2 seconds, unless the engine is in crank or run. While this voltage is being received, the chassis control module supplies a varying voltage to the fuel tank pump module in order to maintain the desired fuel pressure.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

The chassis control module detects an over-temperature fault.

Action Taken When the DTC Sets

DTCs P064A and P1255 are Type A DTCs.

Conditions for Clearing the DTC

DTCs P064A and P1255 are Type A DTCs.

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.

Beginning in the 2014 model year the K27 Fuel Pump Control Module (FPCM) will now be called the chassis control module (CCM). The component code for the chassis control module will be K38. The chassis control module name will be used in Service Information, the Global Diagnostic System and the Service Programming System.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), **[Engine Controls Schematics \(Chevrolet with LUV\)](#)**

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), **[COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)**

Description and Operation

[Fuel System Description \(LUV\)](#)

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](#).

- **If none of the DTCs are set**

3. Verify that the area where the K38 Chassis Control Module is located is free of debris, clutter, or any insulating material that would cause the K38 Chassis Control Module to overheat.

- **If any debris, clutter, or other material is found**

1. Clear the area where the K38 Chassis Control Module is located.
2. Clear the DTC and test drive the vehicle.
3. Verify DTC P1255 or P064A is not set.
 - If DTC P1255 or P064A is set, replace the K38 Chassis Control Module.
 - If DTC P1255 or P064A is not set

4. All OK.

- **If no debris, clutter, or other material is found**

4. Clear the DTC and test drive the vehicle.

5. Verify DTC P1255 or P064A is not set.

- **If DTC P1255 or P064A is set**

Replace the K38 Chassis Control Module.

- **If DTC P1255 or P064A is not set.**

6. All OK.

Repair Instructions

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

[Control Module References](#) for chassis 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 idle speed is elevated and spark timing is retarded to allow the catalyst to warm quickly. This diagnostic monitors the following to build an exhaust energy model:

- Engine speed
- Spark advance
- Throttle position
- Engine airflow

- Engine coolant temperature
- Engine run time
- Park/neutral position
- Vehicle speed

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

Conditions for Running the DTC

- DTCs P00EA, P00EB, P0097, P0098, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0119, P0122, P0123, P0128, P0171, P0172, P0201-P0204, P0220, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300-P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0502, P0503, P0506, P0507, P0697, P06A3, P0806, P0807, P0808, P1248, P1249, P124A, P124B, P16A0, P16A1, P16A2, P16F3, P2101, P2122, P2123, P2127, P2128, P2135, P2138, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2176, P2300-P2310 are not set.
- The engine is running, and a cold start has been detected.
- The vehicle speed is less than 2 km/h (1 mph).
- The calculated 3-way catalyst temperature is less than 350Â°C (662Â°F).
- The coolant temperature is between -10 to +56Â°C (14-133Â°F).
- The barometric pressure is at least 72 kPa.
- The engine control module (ECM) will exit the diagnostic if the calculated 3-way catalyst temperature is greater than 900Â°C (1652Â°F) and the engine run time is greater than 19 s.
- The engine is at idle with no input from the accelerator pedal for greater than 5 s.

This DTC runs within the first 2 minutes 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

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 OFF, allow the engine to cool.
2. Engine idling for at least 2 min, observe the scan tool DTC information. DTC P1400 should run and pass.
3. 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. Inspect the air intake system for the following:
 - 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
2. Inspect the exhaust system for the following:
 - Water intrusion
 - Exhaust leak
 - Damaged, restricted, or modified exhaust system. Refer to [Symptoms - Engine Exhaust](#).
3. Inspect for an engine mechanical condition that could alter the air flow into the combustion chamber. Refer to [Symptoms - Engine Mechanical](#).

Repair Instructions

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

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.

- **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.

- **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) MODULE THROTTLE ACTUATOR POSITION 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 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
TAC Motor Control Closed	P1516, P2101, P2176	P1516, P2101, P2176	P1516, P2101, P2176	P1516, P2101, P2176
TAC Motor Control Open	P1516, P2101, P2176	P1516, P2101, P2176	P1516, P2101, P2176	P1516, P2101, P2176

Circuit/System Description

The Engine Control Module (ECM) controls the throttle valve by applying a varying voltage to the control circuits of the throttle actuator control (TAC) motor. The ECM monitors the duty cycle that is required to actuate the throttle valve. The ECM monitors the throttle position (TP) sensors 1 and 2 to determine the actual throttle valve position.

Conditions for Running the DTC

P1516

- DTC P1682 is not set.
- The run/crank or powertrain relay voltage is greater than 6.41 V and reduced power is not active.
- The desired throttle position remains steady for greater than 4 seconds.
- DTC P1516 runs continuously when the above conditions are met.

P2101

- DTC P1682 is not set.
- The run/crank or powertrain relay voltage is greater than 5.5 V and reduced power is not active.
- The engine is running or the following conditions are met:
 - The engine is not running.
 - The ignition voltage is greater than 11 V.
 - The TAC system is not in the Battery Saver mode.
 - The ECM is commanding the throttle.
 - The ECM has learned the minimum throttle position.
- DTC P2101 runs continuously when the above conditions are met.

P2119

- The ignition is ON.
- DTC P0121, P0122, P0123, P0222, P0223, P0697, P06A3, or P2135 is not set.
- The run/crank or powertrain relay voltage is greater than 6.41 V and reduced power is not active.
- DTC P2119 runs continuously when the above conditions are met.

P2176

- The ignition is ON.
- The run/crank or powertrain relay voltage is greater than 6.41 V and reduced power is not active.
- The ECM enable the minimum throttle learn procedure.
- DTC P2176 run continuously when the above conditions are met.

P1516

The ECM detects a difference of greater than 2 percent between the actual throttle position and the desired throttle position for greater than 1 s.

P2101

- The ECM detects a difference of greater than 10 percent between the actual throttle position and the predicted throttle position for greater than 1 s.

OR

- The ECM detects the throttle position is greater than 38 percent when throttle learn is active.

OR

- The ECM detects that the throttle position is greater than 50 percent when the engine is operating in reduced power mode.

P2119

The ECM detects the throttle blade did not return to the default position when the TAC motor is de-energized for greater than 1 s.

P2176

The ECM detects that both throttle position sensors are greater than 0.96 V for 2 s or greater, after 10 attempts to learn the minimum throttle position.

Action Taken When the DTC Sets

- DTCs P2101 and P2176 are Type A DTCs.
- DTC P1516 is a Type B DTC - with LUV.
- DTC P1516 is a Type C DTC - with LUJ.
- DTC P2119 is a Type C DTC.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions, the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- DTCs P2101 and P2176 are Type A DTCs.
- DTC P1516 is a Type B DTC - with LUV.
- DTC P1516 is a Type C DTC - with LUJ.
- DTC P2119 is a Type C DTC.

Diagnostic Aids

- Depending on the Start Up ECT, the Desired Throttle Position percentage maybe greater or less than the Throttle Position with the TAC motor at rest. When the ignition is initially turned ON, or when the engine is cranking or running the Desired and Actual Throttle positions should closely match.
- Inspect for a condition in which the throttle valve may have been held open. For example, ice may have formed in the throttle bore causing the throttle valve not to close.
- A high resistance condition on the throttle position and throttle actuator control circuits could cause a DTC to set.
- A low battery condition may cause a DTC to set.

Reference Information

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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.

NOTE: A low battery voltage or charging system condition may cause a DTC to set.

2. Verify DTC P0121, P0122, P0123, P0222, P0223, P0562, P0621, P0622, or P2135 is not set.

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

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

- **If none of the DTCs are set**

3. Verify the scan tool Throttle Body Idle Air flow Compensation parameter is less than 90 %.

- **If 90 % or greater**

Refer to [Throttle Body Inspection and Cleaning](#) .

- **If less than 90 %**

4. Clear the DTCs with a scan tool.

5. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.

6. Ignition ON.

7. Verify the scan tool TAC Motor parameter displays Enabled while slowly depressing the accelerator pedal.

- **If Enabled is not displayed**

Refer to Circuit/System Testing.

- **If Enabled is displayed**

8. Verify DTC P1516, P2101, P2119, or P2176 is not set.

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

Refer to Circuit/System Testing.

- If none of the DTCs are set

NOTE: If there is a condition with the throttle body, the TAC Motor Command parameter will go to 99 % for a predetermined amount of time and then a DTC sets. Once a DTC is set, the TAC Motor Command parameter will go to 0 % and the TAC Motor parameter will display Disabled.

9. Verify the scan tool TAC Motor parameter displays Enabled while performing the Throttle Sweep Test with a scan tool.

- If Enabled is not displayed

Replace the Q38 Throttle Body.

- If Enabled is displayed

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

11. Verify the DTC does not set.

- If the DTC sets

Refer to Circuit/System Testing.

- If the DTC does not set

12. All OK.

Circuit/System Testing

1. Ignition OFF.

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

2. Verify the conditions listed below do not exist with the Q38 Throttle Body:

NOTE:

- The rest position is defined as the actual Throttle Position percentage when the ignition is OFF or with the ignition ON for greater than 30 seconds.
- When the ignition is OFF, spring tension should hold the throttle plate in the rest position. You should be able to open the throttle plate to wide open throttle (WOT) or push the throttle plate to the fully closed position. In each case, the throttle plate should return to the rest position without assistance.

- A throttle blade that is not in the rest position
- A throttle blade that is binding open or closed
- A throttle blade that is free to move open or closed without spring pressure
- If a condition is found

Replace the Q38 Throttle Body.

- If a condition is not found

NOTE: Disconnecting the throttle body harness connector may cause additional DTCs to set.

3. Disconnect the harness connector at the Q38 Throttle Body, ignition ON.

NOTE: The test lamp may illuminate briefly when the ignition switch is turned on, but should not remain illuminated.

4. Verify that a test lamp does Not illuminate continuously between each motor control circuit listed below and ground.

- TAC Motor Control Closed circuit terminal A
- TAC Motor Control Open circuit terminal B

• **If the test lamp is always ON**

1. Ignition OFF, remove the test lamp. Disconnect the harness connector X2 at the K20 Engine Control Module, ignition ON
2. Test for less than 1 V between the motor 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.

• **If the test lamp is always OFF**

5. Verify that a test lamp does not illuminate between each motor control circuit listed below and B+.

- TAC Motor Control Closed circuit terminal A
- TAC Motor Control Open circuit terminal B

• **If the test lamp illuminates**

1. Ignition OFF, remove the test lamp. Disconnect the harness connector X2 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.

• **If the test lamp does not illuminate**

6. Ignition OFF, remove the test lamp. Set the DMM to the 40 V scale, select the Min/Max Recording Mode, and set the Peak Min/Max response time to 1 ms.

NOTE:

- The test lamp must be connected to circuit before turning ignition on or incorrect diagnosis may occur.
- The ignition must be OFF and the ECM completely powered down before testing each circuit or a lower voltage will be recorded. It may take up to 2 min for all vehicle systems to power down.
- The DMM Min/Max Recording Mode and the response time of 1 ms must be reset after testing each circuit or a lower voltage will be recorded.

7. Verify the Max voltage is within 3 V of B+ while using DMM Min/Max Recording Mode function on each control circuit listed below as the ignition is turned ON.

- TAC Motor Control Closed circuit terminal A
- TAC Motor Control Open circuit terminal B

• **If not within 3 V of B+**

1. Ignition OFF, disconnect the harness connector X2 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.

• **If within 3 V of B+**

8. Replace the Q38 Throttle Body.

- [Throttle Body Assembly Replacement](#)
- [Control Module References](#) for Engine Control Module replacement, programming, and setup

Repair Verification

1. Ignition OFF.
2. Install any components that have been removed or replaced during diagnosis.
3. Perform any adjustments, programming or setup procedures that are required when a component is removed or replaced.
4. Ignition ON.
5. Clear the DTCs with a scan tool.
6. Turn the ignition OFF for 60 s.
7. Ignition ON.
8. Verify the scan tool TAC Motor parameter displays Enabled while performing the Throttle Sweep Test with a scan tool.
 - **If Enabled is not displayed**
Replace the Q38 Throttle Body.
 - **If Enabled is displayed**
9. 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 set.
 - **If DTC sets**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) for further diagnosis.
 - **If DTC does not set**
10. All OK.

DTC P2096 OR P2097: POST CATALYST FUEL TRIM SYSTEM LOW/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 10-255 kPa (1.5-37 PSI).
- The intake air temperature (IAT) is between -20Â°C and +150Â°C (-4 and +302Â°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 Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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.

- **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.

- **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.

- **If no DTC is set**
6. All OK.

Circuit/System Testing

Verify none of the conditions listed below exist:

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 \(LUV\)](#).
- 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](#).
- Improper operation of the crankcase ventilation system.

P2097

- Exhaust system leaks. Refer to [Symptoms - Engine Exhaust](#).
- Vacuum hoses for splits, kinks, and proper connections
- Insufficient fuel in the tank
- Air induction system and air intake ducts for leaks
- Missing air filter element
- Cracked evaporative canister
- Evaporative pipes plugged, obstructed, or leaking
- Crankcase ventilation system leaking.
- Engine vacuum leaks
- Low fuel system pressure. Refer to [Fuel System Diagnosis \(LUV\)](#).
- 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

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 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
APP Sensor 1 5V Reference	P2122	P2122	P2123	-
APP Sensor 1 Signal	P2122	P2122	P2123	P2138
APP Sensor 1 Low Reference	-	P2123	-	-
APP Sensor 2 5V Reference	P2127	P2127	P2128	-
APP Sensor 2 Signal	P2127	P2127	P2128	P2138
APP Sensor 2 Low Reference	-	P2128	-	-

Typical Scan Tool Data

APP Sensor 1

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating at idle Parameter Normal Range: 0.13-4.88 V			
APP Sensor 1 5V Reference	0 V	0 V	5 V

Circuit	Short to Ground	Open	Short to Voltage
APP Sensor 1 Signal	0 V	0 V	5 V
APP Sensor 1 Low Reference	-	4.96 V	-

APP Sensor 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating at idle Parameter Normal Range: 0.12-2.64 V			
APP Sensor 2 5V Reference	0 V	0 V	5 V
APP Sensor 2 Signal	0 V	0 V	5 V
APP Sensor 2 Low Reference	-	4.92 V	-

Circuit/System Description

The throttle actuator control (TAC) system uses two accelerator pedal position (APP) sensors to monitor the accelerator pedal position. The APP sensors 1 and 2 are located within the pedal assembly. Each sensor has a 5 V reference circuit, a low reference circuit, and a signal circuit.

Two processors are also used to monitor the TAC motor system data. Both processors are located within the ECM. Each signal circuit provides both processors with a signal voltage proportional to pedal movement. The processors share and monitor data to verify that the indicated APP sensor calculation is correct.

Conditions for Running the DTC

P2122 and P2123

- DTC P06A3 is not set.
- The ignition is ON.
- The DTCs run continuously when the above conditions are met.

P2127 and P2128

- DTC P0697 is not set.
- The ignition is ON.
- The DTCs run continuously when the above conditions are met.

P2138

- DTCs P0697, or P06A3 is not set.
- The ignition is ON.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2122

The ECM detects that APP sensor 1 voltage is less than 0.61 V for greater than 0.5 s.

P2123

The ECM detects that APP sensor 1 voltage is greater than 4.59 V for greater than 0.5 s.

P2127

The ECM detects that APP sensor 2 voltage is less than 0.10 V for greater than 0.5 s.

P2128

The ECM detects that APP sensor 2 voltage is greater than 2.5 V for greater than 0.5 s.

P2138

The ECM detects that the difference between APP sensor 1 and APP sensor 2 exceeds a predetermined value for greater than 2 s.

Action Taken When the DTC Sets

- DTCs P2122, P2123, P2127, P2128 and P2138 are Type A DTCs.
- The ECM commands the TAC motor system to operate in reduced engine power mode.

Conditions for Clearing the DTC

DTCs P2122, P2123, P2127, P2128, and P2138 are Type A DTCs.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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.
2. Verify that DTC P0697, or P06A3 is not set.
 - **If any of the DTCs are set**

Refer to [DTC P0641, P0651, P0697, or P06A3](#).
 - **If none of the DTCs are set**
3. Verify the scan tool APP Sensor 1 Circuit Status and the APP Sensor 2 Circuit Status parameters display OK.
 - **If Malfunction is displayed**

Refer to Circuit/System Testing
 - **If OK is displayed**
4. Verify the scan tool APP Sensor 1 and 2 Agree/Disagree parameter displays Agree while performing the tests listed below:

- Rapidly depress the accelerator pedal from the rest position to the wide open throttle position (WOT) and release pedal. Repeat the procedure several times.
- Slowly depress the accelerator pedal to WOT and then slowly return the pedal to closed throttle. Repeat the procedure several times.

- **If Disagree**

Refer to Circuit/System Testing

- **If Agree**

5. Verify that DTC P2122, P2123, P2127, P2128, or P2138 is not set.

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

Refer to Circuit/System Testing

- **If none of the DTCs are set**

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

7. Verify DTC P2122, P2123, P2127, P2128, or P2138 is not set.

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

Refer to Circuit/System Testing

- **If none of the DTCs are set**

8. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B107 Accelerator Pedal Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.

2. Test for less than 5 Ω between each low reference circuit terminal listed below and ground.

- Low reference circuit terminal 3
- Low reference circuit terminal 4

- **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.

- **If less than 5 Ω**

3. Ignition ON.

4. Test for 4.8-5.2 V between each 5 V reference circuit terminal listed below and ground.

- 5 V reference circuit terminal 1
- 5 V reference circuit terminal 6

- **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.
- **If between 4.8-5.2 V**
5. Verify each APP sensor voltage 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 listed below and ground.
 - APP sensor 1 signal circuit terminal 5
 - APP sensor 2 signal circuit terminal 2
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **If less than 0.2 V**
6. Install a 3 A fused jumper wire between each signal circuit terminal listed below and the 5 V reference circuit terminal 1.
 - APP sensor 1 signal circuit terminal 5
 - APP sensor 2 signal circuit terminal 2
7. Verify the scan tool APP sensor 1 and 2 voltage parameter is greater than 4.8 V.
 - **If 4.8 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 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 4.8 V**
8. Test or replace the B107 Accelerator Pedal Position Sensor.

Repair Instructions

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

- [Accelerator Pedal Position Sensor Replacement](#)
- [Control Module References](#) for ECM replacement, programming, and setup.

DTC P2199: INTAKE AIR TEMPERATURE (IAT) SENSORS 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) Sensors 1-2 Not Plausible

Diagnostic Fault Information

IAT Sensor 1

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Sensor	P0112, P0114**, P2199	P0113, P0114**, P2199	P0113, P0114**, P2199*	P0111, P0114**
Low Reference	-	P0097, P0113, P00EA, P2227, P2229	*	-
*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
5 V Reference	P0097, P00F4, P0651, P2199, P2227, P2228	P0096, P0097, P00F4, P2199, P2227, P2228	P0097, P00F4, P0651, P2199, P2227, P2228	-
Sensor	P0097, P00F5, P2199	P0097, P00F4, P2199	P0097, P00F4, P2199*	-
Low Reference	-	P0097, P00F4, P0113, P2227, P2229	*	-
*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			
Sensor	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			
5 V Reference	-40Â°C (-40Â°F) 10 Hz	-40Â°C (-40Â°F) 10 Hz	-
Signal	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)	-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 sensors listed below are integrated within the multifunction intake air sensor:

- IAT sensor 1
- IAT sensor 2

- Humidity sensor
- MAF sensor
- BARO pressure sensor

The intake air temperature (IAT) sensor 1 is a variable resistor that changes the voltage on the engine control module (ECM) supplied 5 V signal circuit. The signal varies with inlet air temperature in the sensor bore and is displayed by the scan tool as $^{\circ}\text{C}$ ($^{\circ}\text{F}$). The IAT sensor 2 and the humidity sensor share the same circuit. The IAT sensor 2 signal is displayed by the scan tool as Hz (Hertz) and $^{\circ}\text{C}$ ($^{\circ}\text{F}$).

The IAT sensor 1 produces an analog signal on pin-8 of the sensor. The IAT sensor 2 produces a frequency modulated signal on pin-1 of the sensor.

The sensors listed below share an ECM supplied 5 V reference circuit:

- IAT sensor 2
- Humidity sensor
- Barometric pressure (BARO) sensor

The sensors listed below share an ECM supplied low reference circuit:

- IAT sensor 1
- IAT sensor 2
- Humidity sensor
- Barometric pressure (BARO) 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	-40°C (-40°F)
Warm	302 Hz	104°C (219°F)

Conditions for Running the DTC

- DTC P1682 is not set.
- The ignition is ON.
- Ignition 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 55°C (99°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, when the engine is OFF and is cold; properly functioning IAT sensors 1 and 2 will gradually increase the scan tool IAT Sensor 1 and 2 parameters. This is due to the heat that

is generated by the multifunction intake air sensor internal 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; -40°C (-40°F), and there are also Humidity Sensor DTCs, check for a circuit problem.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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-38522-A Variable Signal Generator

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

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 [DTC P0641, P0651, P0697, or P06A3](#) for further diagnosis.

- **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 25°C (45°F) of each other.
 - Start-Up IAT Sensor 1
 - IAT Sensor 2
 - IAT Sensor 3; where equipped
 - **If not within 25°C (45°F)**

Refer to Circuit/System Testing.

- **If within 25°C (45°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.

- **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.

- **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 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 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.

- **If less than 2 Ω**

3. Ignition ON, 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 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 5 V reference 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 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.

- **If between 4.8-5.2 V**

4. Ignition ON, test for 4.8-5.2 V between the 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.

- **If between 4.8-5.2 V**

5. 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 8 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 colder than -39 $^{\circ}$ C (-38 $^{\circ}$ F).**

6. Ignition OFF, install a 3 A fused jumper wire between the signal circuit terminal 8 and the low reference circuit terminal 7.

7. Verify the scan tool IAT Sensor 3 parameter is warmer than 150 $^{\circ}$ C (302 $^{\circ}$ F).

- **If colder than 150 $^{\circ}$ C (302 $^{\circ}$ 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.

- **If warmer than 150 $^{\circ}$ C (302 $^{\circ}$ F).**

8. Ignition ON, test for 4.8-5.2 V between the signal 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.
- **If between 4.8-5.2 V**
9. Determine if **EL-38522-A** Variable Signal Generator or equivalent is available.
 - **EL-38522-A, Variable Signal Generator; or equivalent is not available**
 1. Replace the K20 Engine Control Module.
 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 Step 13.
 - **If no DTCs set**
 - **EL-38522-A, Variable Signal Generator; or equivalent is available**
10. Ignition OFF, connect the leads of the **EL-38522-A** Variable Signal Generator as follows:
 - Red lead to the signal circuit terminal 1 at the harness connector
 - Black leads to ground
 - Battery voltage supply lead to B+
11. 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
12. 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.
 - **If between 28-32 Hz**
13. Test or replace the appropriate temperature 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 \(Bosch Sensor\)](#), [Temperature Versus Resistance - Intake Air Temperature Sensor \(Delco Sensor\)](#), table for Bosch 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.

- 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 5%**

Replace the B75C Multifunction Intake Air sensor.

- **If within 5%**

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 Air Fuel Imbalance 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, P015A, P015B, 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, P064D, P111E, P1133, P1248, P1249, P124A, P124B, P16A0, P16A1, P16A2, P16F3, P2101, P2135, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P223C, P223E, 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 -20Â°C (-4Â°F).
- The engine speed is between 1, 000-3, 000 RPM.
- The mass air flow is between 0-1, 000 g/s.

- The secondary air injection pump (if equipped) is not ON.
- 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 air fuel imbalance 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 Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

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.

- **If no other DTCs are set**

3. Verify DTC P219A is not set.

- **If a DTC is set**

Refer to Circuit/System Testing.

- **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.

- **If no DTC is set**

6. All OK.

Circuit/System Testing

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

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

Refer to [DTC P0106](#) .

- **If within the specified range, verify that none of the conditions listed below exist:**

- Modified, damaged, leaking, or restricted air induction system components.
- Improper operation of the crankcase ventilation system.
- 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 Injector Diagnosis](#).
- Contaminated fuel. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Excessive fuel in the crankcase due to leaking injectors. Change engine oil as necessary.
- Improper ignition system operation. Refer to [Electronic Ignition System Diagnosis](#).
- **If a condition is found**

Repair as necessary.

- **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-P2230: BAROMETRIC PRESSURE (BARO) SENSOR

Diagnostic Instructions

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

DTC Descriptors

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 - (If used)

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5V Reference	P0641, P2228	P2228	P0641, P2229	P2227
Signal	P2228	P2228	P2229	P2227
Low Reference	-	P2229	-	P2227

Typical Scan Tool Data

BARO

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition On, Engine Off			
Parameter Normal Range: 56-105 kPa, varies with altitude			
5V Reference	0 kPa	0 kPa	127 kPa
Signal	0 kPa	0 kPa	127 kPa
Low Reference	-	127 kPa	-

Circuit/System Description

The barometric pressure (BARO) sensor responds to changes in altitude and atmospheric conditions. This gives the engine control module (ECM) an indication of barometric pressure. The ECM uses this information to calculate fuel delivery. The BARO sensor provides a voltage signal to the ECM relative to the atmospheric pressure changes. The ECM monitors the BARO sensor signal for a voltage outside of the normal range.

Conditions for Running the DTC

P2227

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0222, P0223, P1516, P2135, P2228 and P2229 are not set.
- Engine is running.

OR

- DTCs P0106, P0107, P0108, P2228, P2229 and P2230 are not set and are not pending.
- Ignition On, engine Off.

- DTC P2227 runs continuously when the above conditions are met.

P2228 or P2229

- The engine is running.
- The DTCs run continuously when the above condition is met.

P2230

- The engine is running.
- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0222, P0223, P1516, P2135, P2228 and P2229 are not set.
- DTC P2230 runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2227

- Engine running, the ECM detects that the difference between the BARO signal and the calculated BARO is greater than 15 kPa (2.17 PSI) when the vehicle has traveled no more than 0.1 km (0.06 mi) since the last calculated BARO update, or if the difference is greater than 25 kPa (3.62 PSI) when the vehicle has traveled greater than 0.1 km (0.06 mi) since the last calculated BARO update.
- Ignition On, engine Off, the ECM detects that the BARO pressure is less than 50 kPa (7.25 PSI) or greater than 115 kPa (16.76 PSI).

P2228

The ECM detects that the BARO sensor voltage is less than 2 V.

P2229

The ECM detects that the BARO sensor voltage is greater than 4.5 V.

P2230

The ECM detects that the difference between the current BARO sensor reading and the previous BARO sensor reading is greater than 10 kPa (1.45 PSI).

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

Inspect the inlet port on the Barometric Pressure Sensor for moisture or debris and attempt to dry or clean the inlet, if contaminated.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUY\)](#). [Engine Controls Schematics \(Chevrolet with LUY\)](#).

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#). [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#).

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 P0106, P0107, P0108, P0641, P0651, or P0697 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. Verify the scan tool MAP Sensor parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.
 - **If not within the specified range**
Refer to [DTC P0106](#).
 - **If within the specified range**
4. Verify the scan tool BARO pressure parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.
 - **If the BARO is not within the specified range**
Refer to Circuit/System Testing.
 - **If the BARO is within the specified range**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed in the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
 - **If the DTC sets**
Refer to Circuit/System Testing.
 - **If the DTC does not set**
7. All OK.

Circuit/System Testing

1. Verify the conditions listed below do not exist with the B75C Multifunction Intake Air Sensor:
 - Damage
 - Restrictions in the inlet port
 - **If a condition exists**
Repair or replace the B75C Multifunction Intake Air Sensor as necessary.
 - **If none of the conditions exist**
2. Ignition Off, and all vehicle systems Off, it may take up to 2 minutes for all vehicle systems to power down. Disconnect the harness connector at the B75C Multifunction Intake Air Sensor.
3. Test for less than 5 Ω between the low reference circuit terminal 7 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 greater than the specified value, repair the open or high resistance in the circuit.
 - If 2 Ω or less replace the K20 Engine Control Module.
 - **If less than 5 Ω**
- 4. Ignition On.
- 5. 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 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.
 - **If between 4.8-5.2 V**
- 6. Verify the scan tool BARO Sensor 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 6 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.
 - **If less than 0.2 V**
- 7. Install a 3 A fused jumper wire between the signal circuit terminal 6 and the 5 V reference circuit terminal 2.
- 8. Verify the scan tool BARO Sensor parameter is greater than 4.5 V.
 - **If 4.5 V or less**
 1. Ignition Off, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit terminal 6 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 4.5 V**
- 9. Test or replace the B75C Multifunction Intake Air Sensor.

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 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 turbocharger incorporates a bypass valve which is controlled by the Engine Control Module (ECM), by utilizing a remotely mounted solenoid valve, to prevent turbocharger surging and damage from vibrations by opening during abrupt closed throttle conditions. When the valve is open during closed throttle deceleration conditions, it allows the air to recirculate in the turbocharger and maintain turbocharger speed. Within a calibrated range during the closed throttle event, or upon a wide open throttle command the valve will then close to optimize turbo response. The bypass solenoid valve has the following circuits:

- Ignition voltage
- Turbocharger bypass solenoid valve control

As engine load and engine speed increases, the turbocharger bypass solenoid valve remains commanded ON by the ECM. As soon as the throttle closes the turbocharger bypass solenoid valve is commanded OFF by the ECM, in order to allow the turbocharger bypass valve to open and allow the turbocharger air to recirculate, thereby preventing turbocharger surging.

Conditions for Running the DTC

- DTCs P0033, P0034, P0035, P0097, P0098, P0100, P0101, P0102, P0103, P0121, P0122, P0123, P0221, P0222, P0223, P0234, P0237, P0238, P0299, P2228, or P2229, are not set.
- The boost pressure versus the barometric pressure (BARO) ratio is between 1.1-3.3.
- The charge air bypass valve has been commanded ON for greater than 1 s immediately after an abrupt closed throttle has occurred and the resulting pressure ratio across the compressor exceeds the calibrated pressure ratio limit.
- The engine speed is greater than 1,800 RPM.
- This DTC runs continuously within the enabling conditions.

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 B DTC.

Conditions for Clearing the DTC

DTC P2261 is a Type B DTC.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUY\)](#), [Engine Controls Schematics \(Chevrolet with LUY\)](#)

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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 DTC P0033, P0034, or P0035 is not set.
 - **If any of the DTCs are set**
Refer to [DTC P0033-P0035](#).
 - **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](#).
 - **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](#).
 - **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 ON and OFF with a scan tool.
 - **If a click is not heard or felt**
Refer to Circuit/System Testing.
 - **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.

- If a DTC does not set

8. All OK

Circuit/System Testing

1. Verify the conditions listed below do not exist:

- Vacuum leaks
- Vacuum line restrictions
- Improper routing or connecting of the vacuum hoses on the Q40 Turbocharger Bypass Solenoid Valve, the bypass valve, and the bypass valve vacuum reservoir
- **If a condition exists**

Repair or replace the component as necessary.

- **If none of the conditions exist**

2. Disconnect the Q40 Turbocharger Bypass Solenoid Valve vacuum supply hose at the intake manifold.

3. Connect the **GE 23738-A** to the manifold.

NOTE: Allow engine idle to stabilize before continuing.

4. Engine Idling, verify the vacuum gauge displays between 45-67 kPa (13-20 inches Hg) of vacuum.

- **If not within the specified range**

Repair the vacuum source.

- **If within the specified range**

NOTE: The vacuum reservoir (tank) is integral to intake manifold and is located at the bottom of the manifold.

5. Ignition OFF, disconnect the vacuum hose at the turbocharger vacuum reservoir.

6. Connect the **GE 23738-A** to the vacuum reservoir and apply 34 kPa (10 inches Hg) of vacuum.

7. Verify the reservoir holds vacuum for at least 10 s.

- **If the vacuum is not held for at least 10 s**

Replace the intake manifold

- **If the vacuum is held for at least 10 s**

8. Connect the vacuum hose to the reservoir.

9. Disconnect the vacuum hose at the turbocharger bypass valve and connect the **GE 23738-A** to the hose.

NOTE: The Q40 Turbocharger Bypass Solenoid Valve is supplied with vacuum from both the intake manifold and the vacuum reservoir at idle. The vacuum supply hose from the intake manifold must be disconnected before proceeding, to allow vacuum to bleed off when changing command states.

10. Engine idling, command the Turbocharger Bypass Solenoid Valve ON and OFF with a scan tool.

11. Verify the vacuum toggles between 0 kPa (0 inches Hg) to greater than 45 kPa (13 inches Hg).

- **If not within the specified range**

Test or replace the Q40 turbocharger bypass solenoid valve

- **If within the specified range**

12. Connect any hoses that were disconnected during previous steps.

13. Verify damage to the turbocharger bypass valve assembly does not exist. Refer to [Turbocharger Cleaning and Inspection](#) .

- **If the turbocharger bypass valve assembly is damaged**

Repair or replace the turbocharger bypass valve assembly as necessary.

- **If the turbocharger bypass valve assembly is not damaged**

14. Replace the turbocharger.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the Q40 Turbocharger Bypass Solenoid Valve.
2. Test for 20-27 Ω between terminal 1 and terminal 2 of the solenoid valve.

- **If not between 20-27 Ω**

Replace the Q40 Turbocharger Bypass Solenoid Valve.

- **If between 20-27 Ω**

3. All OK

Dynamic Test

1. Install a 10 A fused jumper wire between the Ignition terminal 2 and 12 V. Install a jumper wire between the control terminal 1 and ground.
2. Verify the solenoid clicks.

- **If the solenoid does not click**

Replace the Q40 Turbocharger Bypass Solenoid Valve.

- **If the solenoid clicks**

3. All OK

Repair Instructions

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

- [Charge Air Bypass Regulator Solenoid Valve Replacement](#) for turbocharger bypass solenoid valve replacement
- [Intake Manifold Replacement](#)
- [Turbocharger Replacement](#)
- [Control Module References](#) for ECM replacement, programming and setup

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](#) .

- **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.

- **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 P2618 OR P2619: CRANKSHAFT POSITION SIGNAL

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

DTC P2618

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

DTC 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](#)
- If no DTC or symptom exists

3. All OK.

DTC P2635: FUEL PUMP FLOW PERFORMANCE (CHASSIS CONTROL MODULE)

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control	P0231	P023F	P0232	P023F, P2635
Low Reference	-	P023F	-	P023F, P2635

Circuit/System Description

The engine control module (ECM) supplies voltage to the chassis control module when the ECM detects that the ignition is on. The voltage from the ECM to the chassis control module remains active for 2 seconds, unless the engine is in crank or run. While this voltage is being received, the chassis control module closes the ground switch of the fuel pump and also supplies a varying voltage to the fuel tank pump module in order to maintain the desired fuel line pressure.

Conditions for Running the DTC

- DTC P018B, P018C, P018D, P0231, P0232, P023F, P064A, P1255 or P06A6 are not active.
- DTC P0641 has not failed this ignition cycle.
- Fuel pump control is enabled and the fuel pump control state is normal.
- The system voltage is greater than 11 V.
- The engine has been running for more than 30 seconds.
- Low fuel level warning not present.

Conditions for Setting the DTC

This DTC sets when the chassis control module detects a predetermined fuel pressure performance degradation between the desired fuel pressure and the current fuel pressure.

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.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Description and Operation

[Fuel System Description \(LUV\)](#)

Electrical Information Reference

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

DTC Type Reference

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

Scan Tool Reference

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

Circuit/System Testing

NOTE: Do not replace the chassis control module based on a history DTC P2635. The DTC P2635 may be stored but that does not indicate a failure of the chassis control module. Refer to [Strategy Based Diagnosis](#) for further history DTC diagnostics.

1. Ignition ON.
2. Verify DTCs P018B, P018C, P018D, P0231, P0232 or P023F are 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. Verify the proper fuel system pressure. Perform the fuel system pressure test, refer to [Fuel System Diagnosis \(LUV\)](#).
 - **If the fuel system pressure test is not normal**

Replace the A7 Fuel Pump and Level Sensor Assembly.
 - **If the fuel system pressure test is normal**
4. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the A7 Fuel Pump and Level Sensor Assembly. It may take up to 2 minutes for all vehicle systems to power down.
5. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.

- **If 10 Ω or greater**

1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.

- **If less than 10 Ω**

6. Connect a test lamp between the control circuit terminal 1 and the low reference circuit terminal 2.
7. Ignition ON.
8. Verify the test lamp turns ON and OFF when commanding the fuel pump ON and OFF using the scan tool ECM fuel pump enable control function.

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

1. Ignition OFF, disconnect the harness connector at the K38 Chassis Control Module.
2. Test for infinite resistance between the control circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance

3. Test for less than 2 Ω 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 K38 Chassis Control Module.

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

1. Ignition OFF, disconnect the harness connector at the K38 Chassis 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 K38 Chassis Control Module.

- **If the test lamp turns ON and OFF**

9. All OK.

Repair Instructions

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

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

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/vehicle damaging or emissions related conditions. A DTC may not be 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.

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.

Symptoms Verification

Before using the Symptom tables, perform the following inspections:

- Verify that the malfunction indicator lamp (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 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
- Electro-magnetic 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/Idle Learn** 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

- Test/inspect the fuel system for the conditions listed below:
 - 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](#) .
- Test/inspect the ignition system for the conditions listed below:
 - 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 [Coolant in Combustion Chamber](#) , or [Oil Consumption Diagnosis](#) .
 - Secondary ignition system susceptible to moisture. Engine running, 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](#) .
- Test/inspect for the conditions listed below:
 - Non-metered air flow into the air induction system. If a leak is found, repair as necessary. The [Throttle/Idle Learn](#) procedure must be performed when the repair is complete.

NOTE: **The embossed arrows on the mass air flow (MAF) sensor indicate the direction of the intake air flow. The arrows must point toward the engine.**

- Incorrect installation of the Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor. If the sensor is incorrectly installed, a hard start may be the result. Install the sensor in the correct direction. Refer to [Mass Airflow Sensor Replacement \(2H0\)](#) .
 - Incorrect operation of the transmission torque converter clutch (TCC). The scan tool should indicate an engine speed drop when the TCC is commanded ON.
 - Incorrect operation of the A/C compressor
 - Items that can cause an engine to run lean or rich. Refer to [DTC P0171 or P0172](#) .
 - Incorrect crankshaft position sensor resistance. The crankshaft position sensor resistance may be out of range after a hot soak. The resistance should be between 700-1 200 Ω .
 - 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 [Knock Sensor Replacement \(2H0\)](#) , [DTC P0324, P0326, or P06B6](#) , and [DTC P0325, P0327, or P0328](#) .
 - Incorrectly set fuel octane switch setting, if equipped. Verify the fuel octane switch is set to the proper fuel octane rating for the fuel being used in the vehicle.
 - 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.
 - A leaking or restricted positive crankcase ventilation system. Inspect all connections for leaks or restrictions.
 - A stuck open evaporative Emission (EVAP) Canister Purge Solenoid Valve.
- Test/inspect the engine cooling system for the conditions listed below:
 - A thermostat with incorrect heat range. Refer to [Thermostat Diagnosis](#) .
 - An incorrectly operating engine coolant thermostat heater. Refer to [DTC P0597-P0599](#) .
 - Incorrect engine coolant level. Refer to [Cooling System Draining and Filling](#) .

For additional information, refer to [Symptoms - Engine Cooling](#) .

- Test/inspect the exhaust system components for the conditions listed below:
 - Physical damage or possible internal malfunction.
 - Restricted 3-way catalytic converters.

For additional information, refer to [Symptoms - Engine Exhaust](#).

- Test/inspect the engine for the mechanical conditions listed below:
 - 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](#).

- If the above conditions do not address the symptom, refer to the additional symptoms tests.

Additional Symptoms Tests

Detonation/Spark Knock

- Test for an engine overheating condition. Refer to [Engine Overheating](#).
- 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.

Engine Control Module (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, however a DTC may not be set.

A repair may not be necessary. Observe the scan tool Reduced Engine Power History parameter, if applicable, 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 engine control module to reduce engine power-Refer to [Cooling Fan Description and Operation \(LUV or LUJ\)](#), and [Cooling System Description and Operation \(LUV, LE2\)](#) to verify correct operation of the cooling fan.
- If the vehicle is equipped with the OnStar® feature, reduced engine power may be due to OnStar® remote command. Verify the vehicle is not in the OnStar® initiated Stolen Vehicle Slowdown mode.
- High pressure fuel system condition-Refer to [Fuel System Diagnosis](#), and [Fuel System Description](#) to verify high pressure fuel system pressure and operation.

- If equipped with manual transmission, reduced engine power may be due to overheated transmission oil. Allow the transmission oil to cool down. Refer to the Owners Manual for scheduled maintenance recommendations to determine if the transmission is due for servicing.
- 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.
- Fuel temperature out of range too high
- An incorrect learned brake pedal position (BPP) sensor-Verify the following actions have not occurred:
 - An engine control module (ECM) has been replaced.
 - A BPP sensor has been replaced.
 - A BPP sensor is misaligned or incorrectly installed.

If any of the above actions have occurred, the [Brake Pedal Position Sensor Learn](#) procedure must be performed.

Fuel Odor

- Inspect for leaking, damaged, or deteriorated fuel lines.
- 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 Throttle Body Idle Airflow Compensation parameter with a scan tool. A value greater than 90 % may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body 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 - Engine Coolant Temperature 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 during engine start-up. The fuel pump should turn ON for 2 S when the ignition is turned to ON and fuel pressure should be as specified in [Fuel System Diagnosis](#), procedure. For additional fuel system information, refer to [Fuel System Description](#).

Hesitation, Sag, Stumble

- Test the fuel pressure. Refer to [Fuel System Diagnosis](#).
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to [Mass Airflow Sensor Replacement \(2H0\)](#).
- 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.

NOTE: The following actions may need to be repeated in order to verify an intermittent intake or exhaust camshaft actuator condition.

- Engine warm and idling, verify the correct operation of the camshaft actuator system. 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](#) , and [Camshaft Position Actuator Solenoid Valve Replacement](#) .

Poor Fuel Economy

- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value greater than 90 % may indicate an excessive accumulation of deposits in the throttle bore. Inspect the throttle body 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 for foreign material accumulation in the throttle bore, and for carbon deposits on the throttle plate and shaft. Also inspect for throttle body tampering.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to [Mass Airflow Sensor Replacement \(2H0\)](#) .
- 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 may 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 engine control module 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/Idle Learn](#) procedure must be performed.

- Inspect the engine mounts [Engine Mount Replacement](#) .
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to [Mass Airflow Sensor Replacement \(2H0\)](#) .
- Inspect the intake and exhaust manifolds for casting flash.
- Inspect the exhaust system for damaged or collapsed pipes

Surges/Chuggles

- Verify that each injector harness is connected to the correct injector.
- Inspect the mass air flow (MAF) sensor for obstruction, contamination, and damage. Refer to [Mass Airflow Sensor Replacement \(2H0\)](#) .
- 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.

- Inspect for foreign material accumulation in the throttle bore, and for carbon deposits on the throttle plate and shaft. Also inspect for throttle body tampering.

POOR FUEL FILL QUALITY

Condition	Causes
DEFINITION: During the fueling process a continual, occasional or no fuel nozzle shut-off condition has occurred.	
Difficult to fill	• Fuel fill limiter vent valve stuck closed • Evaporative emission (EVAP) canister restricted • High fuel temperature • Fuel filler hose is kinked • Faulty dispensing nozzle
Over fill	• Fill limiter vent valve stuck open or leaking • Fuel inlet check valve stuck open
Premature 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
Premature 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 canister restricted • Fuel limiting vent valve stuck closed or obstruction at top of fuel tank
Fuel spitback	• Restricted EVAP canister • High fuel temperature

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 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.

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.

Reference Information

Schematic Reference

- [Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)
- [Instrument Cluster Schematics \(Buick\)](#), [Instrument Cluster Schematics \(Chevrolet\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

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: Any MIL requesting DTCs that may be set should be diagnosed first.

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
 - **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
 - **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

- **If the malfunction indicator lamp turns ON and OFF**

6. 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 52 and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance, replace the P16 Instrument Cluster.
 - **If the malfunction indicator lamp does not illuminate**
4. Connect a 3 A fused jumper wire between the control circuit terminal X1 52 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 52 and ground.
 - If 1 V or greater, repair the short to voltage on 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 31 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 on 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.
 - **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 \(Buick\)](#), [Instrument Cluster Replacement \(Chevrolet\)](#)
- [Control Module References](#) for control module replacement, programming, and setup

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 35°C (95°F) at start-up.
- The intake air temperature (IAT) is less than 34°C (93°F) at start-up.
- The ambient air temperature is between 0-40°C (32-104°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.

- **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.

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:

- Insufficient fuel can cause a no start condition. 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, can cause a no start condition. Refer to [Fuel Injector Diagnosis](#).
- 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 fuel injectors and the injector circuit are OK, and fuel spray is detected, the fuel injector ON time may be inadequate. 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 vehicle in good 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.
- Inspect the engine for good secure electrical grounds.
- 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.
- Water or foreign material in the fuel can cause a no start or 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 engine that starts and runs after being brought to the repair shop for a no start condition, may have an ignition system that is susceptible to moisture. Spray water on the ignition system components and the wiring in order to check for an engine starting or will not stay running concern.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Electrical Information Reference

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

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

Special Tools

- **CH 48027** Digital Pressure Gauge
- **EL 26792** HEI Spark Tester
- **EN 36012-A** Ignition System Diagnostic Harness

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

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.

Circuit/System Testing

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, P0685, P0689, P0690, 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](#).

- **If none of the DTCs are set**

3. Ignition ON

4. Verify the Theft Deterrent LED located in the driver information center illuminates momentarily.

- **If the LED stays ON or is flashing**

Review the [Diagnostic Trouble Code \(DTC\) List - Vehicle](#), for Immobilizer system DTCs. Refer to [Immobilizer Description and Operation](#) for additional information.

- **If the LED 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](#).

- **If greater than 0 RPM**

6. Ignition OFF.

NOTE: It may be necessary to secure the EN 36012-A Ignition System Diagnostic Harness to the spark plug boots with electrical tape.

7. Install the EN 36012-A Ignition System Diagnostic Harness to the spark plug boots.
8. Connect the EL 26792 HEI Spark Tester between the boot of a spark plug wire and ground.
9. Connect the remaining wires to the appropriate cylinders.

NOTE:

- Perform the spark test on at least 3 of the cylinders.
- An erratic or weak spark is considered a no spark condition.

10. Verify the spark tester sparks while cranking the engine.

- **If the spark tester does not spark**

Refer to [Electronic Ignition System Diagnosis](#).

- **If the spark tester sparks**

11. Ignition OFF.

12. Disconnect the harness connector at a Q17 Fuel Injector.

13. Connect a test lamp between the control circuit and the ignition voltage circuit of the harness connector.

NOTE: Perform the fuel injector test on at least 3 fuel injectors

14. Verify the injector test lamp flashes while cranking the engine.

- **If the injector test lamp does not flash**

Refer to [DTC P0201, P0202, P0203, P0204, P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271](#).

- **If the injector test lamp flashes**

15. Ignition OFF.

16. Install the **CH 48027** Digital Pressure Gauge.

17. 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.**

18. Command the Fuel Pump Enable On several times with a scan tool.

19. Verify the fuel pressure is between 345-650 kPa (50-94 PSI) while the fuel pump is running.

- **If not within the specified range**

Refer to [Fuel System Diagnosis \(LUV\)](#).

- **If within the specified range**

20. Verify that the fuel pressure, after the fuel pump has turned OFF, decreases to less than 600 kPa (87 PSI) and does not decrease more than 34 kPa (5 PSI) in 1 minute.

- **If not within the specified range**

Refer to [Fuel System Diagnosis](#).

- **If within the specified range**

21. Verify none of the conditions listed below 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.

- **If no condition exists**

22. All OK.

Repair Verification

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

Spark Plug Replacement

FUEL SYSTEM DIAGNOSIS (LUV)

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 chassis control module when the ECM detects that the ignition is ON. The voltage from the ECM to the chassis control module remains active for 2 s, unless the engine is in Crank or Run. While this voltage is being received, the chassis 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 line 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 high pressure fuel through the fuel feed pipe to the fuel injection system. 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. The check valve maintains fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

Diagnostic Aids

Observe the Misfire Counters or perform the Fuel Injector Balance Test to help identify a leaking fuel injector.

Reference Information

Description and Operation

[Fuel System Description \(LUV\)](#)

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

- **CH 48027** Digital Pressure Gauge
- **EN 37287** Fuel Line Shut-off Adapter

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

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.**
- **Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.**

1. Ignition OFF, all accessories OFF, install a **CH 48027** Gauge.

NOTE:

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) ± 5 percent.

2. Ignition ON, engine OFF, command the Fuel Pump Enable On several times with a scan tool.

3. Verify the fuel pressure is between 345-650 kPa (50-94 psi) with the fuel pump running.

- **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.

- **If between 345-650 kPa (50-94 psi)**

4. Verify that the fuel pressure decreases to less than 600 kPa (87 psi) after the fuel pump is turned off.

- **If greater than 600 kPa (87 psi)**

Replace the G12 Fuel Pump.

- **If less than 600 kPa (87 psi)**

5. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 minute.

- **If greater than 34 kPa (5 psi)**

Refer to Circuit/System Testing - Fuel Pressure Leaks Down.

- **If less than 34 kPa (5 psi)**

6. Relieve the fuel pressure to 69 kPa (10 psi).

7. Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 min.

- **If greater than 14 kPa (2 psi)**

Replace the G12 Fuel Pump.

- **If less than 14 kPa (2 psi)**

8. Engine idling.
9. Verify the Chassis Control Module 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.
 - **If between 300-400 kPa (43-58 psi)**
10. Verify the scan tool Short Term Fuel Pump Trim and the Long Term Fuel Pump Trim when multiplied together are less than 1.5.
- **If greater than 1.5**
Refer to Circuit/System Testing - Fuel Pressure Low.
 - **If less than 1.5**
11. Verify 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.
 - **If less than 45 kPa (6.5 psi)/60 kPa (8.7 psi)**
12. 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 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.
 - **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** Adapter between the chassis fuel feed hose and the engine compartment fuel feed pipe.
3. Open the valve on the **EN 37287** Adapter.
4. Ignition ON, command the Fuel Pump Enable On with a scan tool and bleed the air from the **CH 48027** Gauge.
5. Command the Fuel Pump Enable On and then Off with a scan tool.
6. Close the valve on the **EN 37287** Adapter.
7. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 min.
 - **If greater than 34 kPa (5 psi)**

Locate and replace the leaking Q17 Fuel Injector.

- **If less than 34 kPa (5 psi)**

Replace the G12 Fuel Pump.

Fuel Pressure Drops Off

1. Verify none of the conditions listed below exist:

- 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.

- **If no conditions exist**

Replace the G12 Fuel Pump.

Repair Instructions

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

- [Fuel Feed Pipe Replacement \(Engine to Tank\)](#), [Fuel Feed Pipe Replacement \(At Tank AWD\)](#), [Fuel Feed Pipe Replacement \(At Tank FWD\)](#)
- [Fuel Injector Replacement](#)
- [Fuel Tank Fuel Pump Module Replacement \(AWD\)](#), [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#)

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

The engine control module (ECM) enables the appropriate fuel injector pulse for each cylinder. The ignition voltage is supplied directly to the fuel injectors. The ECM controls each fuel injector by grounding the control circuit via a solid state device called a driver. A fuel injector coil winding resistance that is too high or too low will affect the engine driveability. A fuel injector control circuit DTC may not set, but a misfire may be apparent. The fuel injector coil windings are affected by temperature. The resistance of the fuel injector coil windings will increase as the temperature of the fuel injector increases.

When performing the fuel injector balance test with the fuel injector tester or the scan tool, the scan tool is first used to enable the fuel pump. The fuel injector tester or the scan tool is then used to pulse each injector for a precise amount of time, allowing a measured amount of fuel to be injected. This causes a drop in the system fuel pressure that can be recorded and used to compare each injector.

Diagnostic Aids

- Operating the vehicle over a wide temperature range may help isolate the fuel injector that is causing the condition.
- Perform the fuel injector coil test within the conditions of the concern from the customer. A fuel injector condition may only be apparent at a certain temperature, or under certain conditions.
- Monitoring the Current Misfire Counters, or misfire graph, may help to isolate the fuel injector that is causing the condition.

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Description and Operation

[Fuel System Description \(LUV\)](#)

Electrical Information Reference

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

Special Tools

- **CH 48027** Digital Pressure Gauge
- **EL 39021** Fuel Injector Coil and Balance Tester

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

Fuel Injector Coil Test

Verify the resistance of each Q17 Fuel Injector with one of the following methods:

- If the engine coolant temperature (ECT) sensor is between 10-32°C (50-90°F), the resistance of each fuel injector should be 11-14 Ω. If the injectors measure OK, perform the Fuel Injector Balance Test.
 - If not within the specified range, replace the Q17 Fuel Injector.
- If the ECT sensor is not between 10-32°C (50-90°F), measure and record the resistance of each fuel injector. Subtract the lowest resistance value from the highest resistance value. The difference between the lowest value and the highest value should be equal to or less than 3 Ω. If the injectors measure OK, perform the Fuel Injector Balance Test.
 - If not within the specified range, add all of the fuel injector resistance values to obtain a total resistance value. Divide the total resistance value by the number of fuel injectors to obtain an average resistance value. Subtract the lowest individual fuel injector resistance value from the average resistance value. Compute the difference between the highest individual fuel injector resistance value and the average resistance value. Replace the Q17 Fuel Injector that displays the greatest difference above or below the average.

Fuel Injector Balance Test with Special Tool

NOTE:

- **DO NOT perform this test if the engine coolant temperature (ECT) is above 94°C (201°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.**
- **Before proceeding with this test review the User Manual CH 48027-5 for Safety Information and Instructions.**

1. Verify the correct fuel system pressure. Refer to [Fuel System Diagnosis \(LUV\)](#).

2. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5-2.5 A position.
3. Connect the **EL 39021** fuel injector coil and balance tester to a Q17 Fuel Injector.
4. Command the Fuel Pump Enable On and then Off three times with a scan tool. On the last command, as the fuel pressure begins to slowly degrade and stabilize, select a fuel pressure within 34 kPa (5 psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each injector.
5. Command the Fuel Pump Enable On one more time and energize the fuel injector by depressing the Push to Start Test button on the **EL 39021** fuel injector coil and balance tester at the previously selected pressure.
6. After the injector stops pulsing, select Min from the Display Mode on the **CH 48027** gauge and record the Min pressure.

NOTE: **New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.**

7. Clear the Min/Max results on the **CH 48027** gauge.
8. Select Normal from the Display Mode on the **CH 48027** gauge.
9. Repeat steps 3 and 5 through 8 for each fuel injector.
10. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
11. Obtain a pressure drop value for each fuel injector.
12. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
13. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop. The difference between any individual pressure drop and the average pressure drop should not be more than 20 kPa (3 psi).
 - If the difference between any individual pressure drop and the average pressure drop is more than 20 kPa (3 psi), replace the Q17 Fuel Injector.

Fuel Injector Balance Test with Scan Tool

1. Verify the correct fuel system pressure. Refer to **Fuel System Diagnosis (LUV)**.
2. Command the Fuel Pump Enable On and then Off three times with a scan tool. On the last command, as the fuel pressure begins to slowly degrade and stabilize, select a fuel pressure within 34 kPa (5 psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each injector.
3. With a scan tool, select the Fuel Injector Balance Test function within the Special Functions menu.
4. Select an injector to be tested.
5. Press Enter to prime the fuel system.
6. Energize the fuel injector by depressing the Pulse Injector button on the scan tool at the previously selected pressure.
7. After the injector stops pulsing, select Min from the Display Mode on the **CH 48027** gauge and record the Min pressure.

NOTE: **New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.**

8. Clear the Min/Max results on the **CH 48027** gauge.
9. Select Normal from the Display Mode on the **CH 48027** gauge.
10. Press Enter on the scan tool to bring you back to the Select Injector screen.
11. Repeat steps 4 through 10 for each fuel injector.
12. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
13. Obtain a pressure drop value for each fuel injector.

14. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
15. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop. The difference between any individual pressure drop and the average pressure drop should not be more than 20 kPa (3 psi).
 - If the difference between any individual pressure drop and the average pressure drop is more than 20 kPa (3 psi), replace the Q17 Fuel Injector.

Repair Instructions

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

Fuel Injector Replacement

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.

Test 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 percent can cause driveability conditions and fuel system deterioration. Fuel with more than 10 percent ethanol could result in 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 Fuel Composition Tester, if available

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

System Verification

The fuel sample should be drawn from the bottom of the tank so that any water present in the tank will be detected. The sample should be bright and clear.

- If the sample appears cloudy, or contaminated with water, as indicated by a water layer at the bottom of the sample, perform the Particulate Contaminants in Fuel Testing Procedure.
- If alcohol contamination is suspected, perform the Alcohol in Fuel Testing procedure.

Alcohol in Fuel Testing with Special Tool, If Available

1. Test the fuel composition using the **CH 44175-A** Fuel Composition Tester and the Instruction Manual.
2. If water appears in the fuel sample, clean the fuel system.
3. Subtract 50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
4. If the fuel sample contains more than 15 percent ethanol, add fresh, regular gasoline to the vehicle's fuel tank.
5. Test the fuel composition.

6. If testing shows the ethanol percentage is still more than 15 percent, replace the fuel in the vehicle.

Alcohol in Fuel Testing without Special Tool

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 seconds.
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 seconds.
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 percent 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.

Particulate Contaminants in Fuel Testing Procedure

1. Using an approved fuel container, draw approximately 0.5 liter (0.53 qt) of fuel.
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. Observe the fuel sample. If any physical contaminants or water are present, clean the fuel system.

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

EN-41413-VLV EVAP Service Port Vent Fitting

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

- 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, remove the fuel fill cap until smoke is observed. Then close the system and continue testing.
- If using a special tool fuel fill cap 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.
 - **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.

ELECTRONIC IGNITION SYSTEM DIAGNOSIS

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](#)

Circuit/System Description

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

The ECM controls the spark event for each cylinder through individual ignition coil control circuits. When the ECM commands the ignition control circuit On, electrical current flows through the primary winding of the ignition coil, creating a magnetic field. When a spark event is requested, the ECM commands the ignition control circuit Off, interrupting current flow through the primary winding. The collapsing magnetic field created by the primary winding induces a high voltage in the secondary winding, which is connected to the spark plugs. The ignition system on this engine uses an ignition coil module with integrated power transistors.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Buick with LUV\)](#), [Engine Controls Schematics \(Chevrolet with LUV\)](#)

Connector End View Reference

[COMPONENT CONNECTOR END VIEWS - INDEX \(ENCORE\)](#), [COMPONENT CONNECTOR END VIEWS - INDEX \(TRAX\)](#)

Component View Reference

[Powertrain Component Views \(Buick\)](#), [Powertrain Component Views \(Chevrolet\)](#)

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Special Tools

J-26792/Ignition Spark Tester

Equivalent regional tools: [Special Tools \(Diagnostic Tools\)](#)

NOTE: Do NOT perform this procedure unless directed here from the following diagnostic:

- DTC P0300-P0304
- Engine Cranks But Does Not Run

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:K35 Ignition Coil Module
3. Test for less than 10 Ω between the test points: Ground circuit terminal B & Ground
 - **If 10 Ω or greater**
 1. Disconnect the ground connection:Ground terminal
 2. Test for less than 2 Ω between the test points: Ground circuit terminal B @Component harness & The other end of the circuit
 - 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.
 - **If less than 10 Ω**
4. Test for less than 10 Ω between the test points: Low Reference circuit terminal C & Ground
 - **If 10 Ω or greater**
 1. Disconnect the electrical connector:K20 Engine Control Module
 2. Test for less than 2 Ω between the test points: Low Reference circuit terminal C @Component harness & The other end of the circuit
 - If 2 Ω or greater > Repair the open/high resistance in the circuit.
 - If less than 2 Ω > Replace the component:K20 Engine Control Module
 - **If less than 10 Ω**
5. Ignition > On / Vehicle > In Service Mode
6. Verify a test lamp turns On between the test points:Ignition circuit terminal A & Ground
 - **If the test lamp does not turn On**
 1. Ignition/Vehicle > Off & Remove > Test lamp
 2. Test for less than 2 Ω between the test points: Ignition circuit terminal A @Component harness& Output terminal@Fuse
 - If 2 Ω or greater > Repair the open/high resistance in the circuit.
 - If less than 2 Ω > Verify the fuse is OK and there is voltage at the fuse.
 - **If the test lamp turns On**
7. Test or replace the component:K35 Ignition Coil Module

Component Testing

With Special Tool

NOTE: Circuit/System Testing must be performed before proceeding with Component Testing.

1. Ignition/Vehicle > Off
2. Remove the appropriate component:K35 Ignition Coil Module - Leave the electrical connector connected.
3. Install the special tool: J-26792 /Ignition Spark Tester
4. Engine>Running

NOTE: An erratic or weak spark is considered a no spark condition.

5. Verify there is spark at the special tool.

- **If there is no spark**

Test or replace the component:K35 Ignition Coil Module

- **If there is spark**

6. All OK.

Without Special Tool

1. Ignition/Vehicle Â» Off

2. Swap the two components:K35 Ignition Coil Module - The original component that set the DTC&#amp;#226;Another known good component from the vehicle

3. EngineÂ»Running

4. Verify the scan tool parameter:Cylinder 1-4 Current Misfire Counter=Increments - At the original component location the DTC set.

- **If the parameter value does not increment**

Replace the component:K35 Ignition Coil Module - The original component that set the DTC

- **If the parameter value increments**

5. Refer to: Circuit/System Testing

Repair Instructions

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

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

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**](#).
 - **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](#).

- **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.
 - **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](#).
 - **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](#).
 - **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.

INSPECTION/MAINTENANCE (I/M) SYSTEM DTC TABLE

System	DTCs Required to Set System Status to YES

System	DTCs Required to Set System Status to YES
If an inspection/maintenance system status indicator did not update to yes during the <u>Inspection/Maintenance Complete System Set Procedure</u>, 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.	
Camshaft System	<u>DTC P0011 or P0014</u>
Catalyst Monitor	<u>DTC P0420</u>
Evaporative Emission (EVAP)	• <u>DTC P0442</u> • <u>DTC P0446</u> • <u>DTC P0455</u>
Fuel System	<u>DTC P219A</u>
Oxygen Sensor	<u>DTC P0133, P013A, P013B, P013E, P013F, P015A, P015B, P2270, or P2271</u>
Oxygen Sensor Heater	<u>DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141</u>