

ENGINE PERFORMANCE

Engine Controls and Fuel - 1.8L (2H0) - Diagnostic Information and Procedures - Encore, Trax

DIAGNOSTIC INFORMATION AND PROCEDURES

DTC P0010 OR P0013: INTAKE/EXHAUST CAMSHAFT POSITION ACTUATOR 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 P0010

Intake Camshaft Position Actuator Solenoid Valve Control Circuit

DTC P0013

Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Intake Actuator Solenoid Control	P0010	P0010	P0010	P0011
Exhaust Actuator Solenoid Control	P0013	P0013	P0013	P0014
Intake Actuator Solenoid Low Reference	-	P0010, P0011	-	P0011
Exhaust Actuator Solenoid Low Reference	-	P0013, P0014	-	P0014

Circuit/System Description

The camshaft position actuator system enables the engine control module (ECM) to change the timing of the camshafts while the engine is operating. The camshaft position actuator solenoid valves are each supplied a dedicated pulse width modulated (PWM) control circuit and low reference circuit from the ECM. The ECM operates each camshaft position actuator solenoid valve by controlling the amount of solenoid valve signal duty cycle to control the oil flow that applies the pressure to advance or retard the camshafts.

Conditions for Running the DTC

- The ignition switch is in run or crank position.
- The ignition voltage is between 11-32 V.
- The ECM has commanded the camshaft position actuator intake or camshaft position actuator exhaust solenoid On and Off at least once during the ignition cycle.

The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

P0010

The ECM detects an open in the camshaft position actuator solenoid valve - intake and camshaft position actuator solenoid valve - exhaust solenoid circuits for greater than 1 s or a cumulative of 5 s when the solenoid is commanded Off.

P0013

The ECM detects an open in the camshaft position actuator solenoid valve - exhaust Solenoid circuits for greater than 1 s or a cumulative of 5 s when the solenoid is commanded Off.

Actions Taken When the DTC Sets

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

If equipped with a turbocharger=Type A DTC

Conditions for Clearing the DTC

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

If equipped with a turbocharger=Type A DTC

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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 for scan tool information

Circuit/System Verification

NOTE: If a crankshaft or camshaft position sensor DTC is set, the Camshaft Position Actuator output control will not function.

1. Ignition ON.
2. Verify DTC P0335, P0336, P0340, or P0341 is not set.

- If the DTC is set

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

- If the DTC is not set

3. Engine Running.

4. Verify the scan tool parameters listed below do not display Malfunction while commanding the appropriate Camshaft Position Actuator to 10 degrees:
 - Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit Open Test Status
 - Intake Camshaft Position Actuator Solenoid Valve Control Circuit Open Test Status
 - Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit Low Voltage Test Status
 - Intake Camshaft Position Actuator Solenoid Valve Control Circuit Low Voltage Test Status
 - Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit High Voltage Test Status
 - Intake Camshaft Position Actuator Solenoid Valve Control Circuit High Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
5. Verify that none of the scan tool Camshaft Position Actuator Solenoid Valve Control Circuit Test Status parameters change from OK or Not Run to Malfunction while moving the related harness/connectors of the Q6 Camshaft Position Actuator Solenoid Valves.
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
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 appropriate Q6 Camshaft Position Actuator Solenoid Valve. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 5 Ω between the low reference circuit terminal 1 or A 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.

NOTE: A test lamp must be used for this test. The control circuit is pulled-up to a low current voltage, 1.5-3.5 V on the control circuit is normal.

4. Verify that a test lamp does not illuminate between the control circuit terminal 2 or B and ground.
 - **If the test lamp illuminates**
 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 the test lamp does not illuminate**
5. Remove the test lamp.
 6. Connect a digital multimeter (DMM) black lead to the control circuit terminal 2 or B and the red lead to B+. Set the DMM on the diode setting. Command the Camshaft Position Actuator Solenoid On and Off with a scan tool.
 7. Verify the DMM display transitions from OL when commanded Off to less than 1 V when commanded On.
 - **If the DMM does not transition as specified**
 1. Ignition OFF, 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 or short to ground in the circuit
 - If less than 2 Ω , replace the K20 Engine Control Module
 - **If the DMM transitions as specified**
 8. Test or replace the Q6 Camshaft Position Actuator Solenoid Valve.

Component Testing

1. Ignition OFF, disconnect the harness connector at the appropriate Q6 Camshaft Position Actuator Solenoid Valve.
2. Test for 7-12 Ω between the control terminal 2 or B and the low reference circuit terminal 1 or A.
 - **If not between 7-12 Ω**
Replace the Q6 Camshaft Position Actuator Solenoid Valve.
 - **If between 7-12 Ω**
3. Test for infinite resistance between each terminal and the Q6 Camshaft Position Actuator Solenoid Valve housing.
 - **If not infinite resistance**
Replace the Q6 Camshaft Position Actuator Solenoid Valve.
 - **If infinite resistance**
4. All OK

Repair Instructions

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

- [Camshaft Position Actuator Solenoid Valve Replacement](#)
- [Control Module References](#) for ECM replacement, programming, and setup.

DTC P0011 OR P0014: INTAKE/ EXHAUST CAMSHAFT POSITION 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 Descriptors

DTC P0011

Intake Camshaft Position System Performance

DTC P0014

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Intake Actuator Solenoid Control	P0010	P0010	P0010	P0011
Exhaust Actuator Solenoid Control	P0013	P0013	P0013	P0014
Intake Actuator Solenoid Low Reference	-	P0010, P0011	-	P0011
Exhaust Actuator Solenoid Low Reference	-	P0013, P0014	-	P0014

Circuit/System Description

The camshaft position actuator system enables the engine control module (ECM) to change the timing of the camshafts while the engine is operating. The camshaft position actuator solenoid signal from the ECM is pulse width modulated (PWM). The ECM controls the camshaft position actuator solenoid duty cycle by controlling the amount of solenoid On time. The camshaft position actuator solenoid controls the advance or the retard of each camshaft. The camshaft position actuator solenoid controls the oil flow that applies the pressure to advance or retard the camshafts.

Conditions for Running the DTC

- DTC P0010, P0013, P0016, P0017, P0335, P0336, P0340, P0341, P0365, or P0366 is not set.
- The engine is running.
- The ignition voltage is between 11-32 V.
- The camshaft position actuator is enabled.
- The rate of change in the camshaft position is less than 5° for 4 s.

The DTCs run continuously once the above conditions are met.

Conditions for Setting the DTC

The actual camshaft position does not match the commanded position.

Actions Taken When the DTC Sets

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

If equipped with a turbocharger=Type A DTC

Conditions for Clearing the DTC

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

If equipped with a turbocharger=Type A DTC

Diagnostic Aids

- A low oil level or condition may set this DTC.
- Inspect the engine for any recent engine mechanical repairs. An incorrectly installed camshaft, camshaft actuator, or timing chain can cause this DTC to set.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

Connector End View Reference

Component View Reference

Powertrain Component Views (Buick) Powertrain Component Views (Chevrolet)

Description and Operation

Camshaft Actuator System Description

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Verification

NOTE:

- The engine oil level and the oil pressure are critical to the correct operation of the camshaft position actuator system. Verify that the engine has the correct oil level and the correct oil pressure before continuing with this diagnostic.
- The engine oil condition has a major impact on the camshaft actuator system. Debris in the oil can interfere with the camshaft position actuator solenoid and the mechanical camshaft actuator operation. Inspect for dirty or degraded crankcase oil. The engine may require an oil change. Inquire with the customer when the last oil change was performed. You may also monitor the scan tool Engine Oil Life Remaining parameter. Advise the customer an oil change may be required.

1. Verify the engine has the proper oil condition, level, and pressure. Refer to **Oil Pressure Diagnosis and Testing**.

- If the oil condition, level, and oil pressure are not correct

Repair as necessary

- If the oil condition, level, and oil pressure are correct

2. Verify DTC P0010, P0011, P0013, P0014, P0016, P0017, P0335, P0336, P0340, P0341, P0365, P0366, P2088, P2089, P2090 or P2091 is not set.

- If any DTCs other than P0011 or P0014 are set

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

- If only DTC P0011 or P0014 is set

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, all OK.

- If none of the DTCs are set

3. All OK.

Circuit/System Testing

NOTE:

You must complete the Circuit/System Verification before proceeding with Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate Q6 Camshaft Position Actuator Solenoid Valve, ignition ON.
 2. Verify a test lamp illuminates between the control circuit terminal 2 or B and ground when commanding the appropriate Camshaft Position Actuator Solenoid Valve On with a scan tool.
 - **If the test lamp does not illuminate**
 1. Ignition OFF, 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 or short to ground in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If the test lamp illuminates**
 3. Ignition OFF.
 4. Remove the appropriate Q6 Camshaft Position Actuator Solenoid Valve. Inspect the Camshaft Position Actuator Solenoid Valve and mounting area for the following conditions:
 - For a torn, restricted, incorrect positioned, or missing screens at the Q6 Camshaft Position Actuator Solenoid Valve
 - For engine oil leaks between the oil sealing lands of the Q6 Camshaft Position Actuator Solenoid Valve
 - For oil seepage at the Q6 Camshaft Position Actuator Solenoid Valve connector
 - **If a condition is found**

Replace the Q6 Camshaft Position Actuator Solenoid Valve.
 - **If a condition is not found**
- NOTE:** This step is testing the mechanical operation of the camshaft position actuator solenoid valve that set the DTC.
5. Exchange the suspected Q6 Camshaft Position Actuator Solenoid Valve with a Q6 Camshaft Position Actuator Solenoid Valve that is operating correctly.
 6. Engine Running.
 7. Command the appropriate camshaft position actuator from 0 degrees to 20 degrees and back to zero while observing the appropriate scan tool Intake/Exhaust Camshaft Position Variance parameters. The Intake/Exhaust Camshaft Position Variance should be less than 2 degrees in each of the commanded states.
 - **If the Camshaft Position Variance parameter is greater than 2 degrees**

Replace or repair the mechanical camshaft position actuator
 - **If the Camshaft Position Variance parameter is less than 2 degrees**
 8. Test or replace the Q6 Camshaft Position Actuator Solenoid Valve.

Component Testing

1. Ignition OFF, disconnect the harness connector at the appropriate Q6 Camshaft Position Actuator Solenoid Valve.
2. Test for 7-12 Ω between terminal 2 or B and terminal 1 or A.
 - **If not between 7-12 Ω**

Replace the Q6 Camshaft Position Actuator Solenoid Valve.
 - **If between 7-12 Ω**
3. Test for infinite resistance between each terminal and the Q6 Camshaft Position Actuator Solenoid Valve housing.
 - **If not infinite resistance**

Replace the Q6 Camshaft Position Actuator Solenoid Valve.

- If infinite resistance

4. All OK

Repair Instructions

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

- **Camshaft Position Actuator Solenoid Valve Replacement**
- **Control Module References** for ECM replacement, programming, and setup

DTC P0016 OR P0017: CRANKSHAFT POSITION - INTAKE/EXHAUST CAMSHAFT POSITION 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 P0016

Crankshaft Position - Intake Camshaft Position Not Plausible

DTC P0017

Crankshaft Position - Exhaust Camshaft Position Not Plausible

Circuit/System Description

The engine control module (ECM) uses the crankshaft position sensor, camshaft position sensor - intake, and the camshaft position sensor - exhaust information to monitor the correlation between the crankshaft, intake camshaft, and exhaust camshaft position.

Conditions for Running the DTC

- Crankshaft and camshaft position sensor signals are synchronized.
- The engine is cranking or running.
- The camshaft position actuator solenoid valves are in the parked position.
- DTCs P0335, P0336, P0340, P0341, P0365, P0366, P0641, or P0651 is not set.
- Time since last execution of the diagnostic is less than 1 s.

Conditions for Setting the DTC

The ECM detects a camshaft to crankshaft misalignment. The DTC sets if the crankshaft position sensor detects 3 sensor pulses that are greater than 12 degrees before or after the normal position during 1 camshaft revolution.

Action Taken When the DTC Sets

DTCs P0016 and P0017 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0016 and P0017 are Type B DTCs.

Diagnostic Aids

The following conditions can also set the DTCs:

- A short to ground in a camshaft position actuator solenoid valve control circuit.
- Crankshaft end play out of specification.

- A crankshaft reluctor wheel that has moved in relationship to top dead center (TDC).

Reference Information

Description and Operation

Camshaft Actuator 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. Ignition ON.
2. Verify DTC P0335, P0336, P0340, P0341, P0365, P0366, P0641 or P0651 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. Engine Running at normal operating temperature.
 4. Verify DTC P0016 or P0017 is not set.

- **If the DTC is set**

Inspect for the following and repair as necessary:

- A Q6 Camshaft Position Actuator Solenoid Valve that is stuck in the full advance or retard position.
 - The correct installation of the Q6 Camshaft Position Actuator Solenoid Valves.
 - The correct installation of the B23 Camshaft Position Sensors.
 - The correct installation of the B26 Crankshaft Position Sensor.
 - A timing belt tensioner condition.
 - An incorrectly installed timing belt.
 - Excessive play in the timing belt.
 - A timing belt with damaged teeth.
 - A crankshaft reluctor wheel that has moved in relationship to top dead center (TDC) on the crankshaft.
 - **If the DTC is not set**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 6. Verify the DTC does not set.
 - **If the DTC sets**

A mechanical condition listed above still exists.
 - **If the DTC does not set**
 7. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Camshaft Position Actuator Solenoid Valve Replacement
- Camshaft Position Sensor Replacement

- [Crankshaft Position Sensor Replacement](#)
- [Timing Belt Replacement](#)

DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, OR P0141: HO2S HEATER

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 P0030

HO2S Heater Control Circuit Sensor 1

DTC P0031

HO2S Heater Control Circuit Low Voltage Sensor 1

DTC P0032

HO2S Heater Control Circuit High Voltage Sensor 1

DTC P0036

HO2S Heater Control Circuit Sensor 2

DTC P0037

HO2S Heater Control Circuit Low Voltage Sensor 2

DTC P0038

HO2S Heater Control Circuit High Voltage Sensor 2

DTC P0053

HO2S Heater Resistance Sensor 1

DTC P0054

HO2S Heater Resistance Sensor 2

DTC P0135

HO2S Heater Performance Sensor 1

DTC P0141

HO2S Heater Performance Sensor 2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
HO2S Heater Voltage Supply	P0030, P0036, P0037, P0132, P0134, P0135, P0138, P0141, *	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0690	P0135, P0141

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
HO2S Heater Control	P0030, P0031, P0036, P0037, P0053, P0054, P0135, P0141	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0030, P0032, P0036, P0038, P0132, P0134, P0135, P0138, P0140, P0141, P0690	P0135, P0141
* Opens Fuse				

Circuit/System Description

Heated oxygen sensors (HO2S) are used for fuel control and post-catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. Each HO2S must reach operating temperature to provide an accurate voltage signal. A heating element inside each of the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by an ignition voltage circuit through a fuse. With the engine running, ground is provided to the heater by the HO2S heater low control circuit, through a low side driver within the ECM. The ECM uses pulse-width modulation (PWM) to control the HO2S heater operation to maintain a specific HO2S operating temperature range.

Conditions for Running the DTC

P0030, P0031, P0032, P0036, P0037 and P0038

- The engine speed is greater than 400 RPM.
- The Ignition voltage is between 11-32 V.
- The DTCs run continuously when the above conditions are met for greater than 5 s.

P0053 and P0054

- DTCs P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119 or P2610 are not set.
- The ignition is OFF for greater than 8 h.
- The engine is running.
- The engine coolant temperature (ECT) and the intake air temperature (IAT) are within 8Â°C (14Â°F).
- The ECT is between -30 to +45Â°C (-22 to +113Â°F).
- The Ignition voltage is less than 32 V.
- The DTCs run once per valid cold start-up when the above conditions are met.

P0135 and P0141

- DTCs P0116, P0117, P0118, P0119 or P0128 are not set.
- The system voltage is between 10-32 V.
- The HO2S heaters are at operating temperature.
- The scan tool HO2S Heater device control is not active.
- The commanded HO2S heater duty cycle is greater than 0%.
- The DTCs run twice per drive cycle when the above conditions are met for greater than 30 s.

Conditions for Setting the DTC

P0030, P0031, P0032, P0036, P0037 and P0038

The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match for greater than 5 s.

P0053 and P0054

The ECM detects the HO2S heater resistance is not within a specified range at engine start-up.

P0135 and P0141

The ECM detects the HO2S heater current is less than 0.30 A or greater than 2.5 A for greater than 8 s.

Action Taken When the DTC Sets

DTC P0030, P0031, P0032, P0036, P0037, P0038, P0053, P0054, P0135, and P0141 are Type B DTCs.

Conditions for Clearing the DTC

DTC P0030, P0031, P0032, P0036, P0037, P0038, P0053, P0054, P0135, and P0141 are Type B DTCs.

Diagnostic Aids

- If the condition is intermittent, move the related harnesses and connectors, with the engine operating, while monitoring the scan tool circuit status parameters for the component. The circuit status parameters will change from OK or Not Run to Malfunction if there is a condition with the circuit or a connection.
- An open fuse in the heated oxygen sensor heater circuit may be caused by the heater element in one of the sensors. The condition may not be present until the sensor operates for a period of time. If no fault is present in the heater circuit, monitor the amperage of each heater with a scan tool to determine if one of the heater elements is the cause of the open fuse. Inspect the sensor pigtail or the harness for contacting the exhaust system.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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. Engine running.
2. Verify the parameters listed below do not display Malfunction.
 - HO2S 1 or 2 Heater Control Circuit High Voltage Test Status
 - HO2S 1 or 2 Heater Control Circuit Open Voltage Test Status
 - HO2S 1 or 2 Heater Control Circuit Low Voltage Test Status
 - **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**

3. Observe the scan tool HO2S 1 Heater or HO2S 2 Heater parameter. The amperage should be between 0.3-2.4 A.

- **If not between 0.3-2.4 A**

Refer to Circuit/System Testing.

- **If between 0.3-2.4 A**

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

5. Verify the DTC 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 appropriate B52 Heated Oxygen Sensor, ignition ON.

2. Verify that a test lamp illuminates between the ignition voltage circuit terminal 1 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 fuse and replace as necessary.

- **If the test lamp illuminates**

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

- **If the test lamp illuminates**

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 the test lamp does not illuminate**

4. Remove the test lamp.

5. Engine running, verify the scan tool HO2S 1 or 2 Heater Control Circuit Open Test Status parameter displays Malfunction.

- **If Malfunction 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 Malfunction is displayed**

NOTE:

- Less than 10 Ω of additional resistance on the ignition voltage circuit, or control circuit may set a DTC. If there is a resistance on a circuit, the driver will remain ON and the scan tool HO2S High Voltage Test Status parameter will display OK.
 - Performing this test may set additional DTCs.
6. Ignition OFF, install a 3A fused jumper wire between the control circuit terminal 2 and ground. Engine running.
 7. Verify the scan tool HO2S 1 or 2 Heater Control Circuit Low Voltage Test Status parameter is Malfunction.
 - **If Malfunction is not displayed**
 1. Ignition OFF, 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 B52 Heated Oxygen Sensor.

Repair Instructions

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

- [Heated Oxygen Sensor Replacement - Sensor 1 \(2H0\)](#)
- [Heated Oxygen Sensor Replacement - Sensor 2 \(2H0\)](#)
- Perform the scan tool Heated Oxygen Sensor Resistance Learn Reset after replacing a HO2S.
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0068 OR P1101: THROTTLE BODY AIR FLOW PERFORMANCE/INTAKE AIR FLOW 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 P0068

Throttle Body Air Flow Performance

DTC P1101

Intake Air Flow System Performance

Circuit/System Description

The engine control module (ECM) compares actual airflow based on throttle position to a calculated airflow based on manifold absolute pressure (MAP) sensor, and mass air flow (MAF).

Conditions for Running the DTC

DTC P0068

- DTC P0102, P0103, P0107, P0108, or P0651 is not set
- The engine speed is at least 800 RPM.
- The Ignition signal is at least 6.0 V.
- The throttle actuator control system is not in reduced power mode, without LUW

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

DTC P1101

- DTC P0102, P0103, P0107, P0108, P0117, P0118, P0128, P0335, or P0336 is not set
- The engine speed is between 400-7 000 RPM; 400-6 000 RPM with LUW
- The engine coolant temperature (ECT) is between -7 to +125Â°C (+19 to +257Â°F).
- The intake air temperature (IAT) is between -20 to +125Â°C (-4 to +257Â°F).
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the airflow rate is more than the calculated airflow for greater than 0.2 s.

Action Taken When the DTC Sets

- DTC P0068 is a Type A DTC
- DTC P1101 is a Type B DTC.

Conditions for Clearing the DTC

- DTC P0068 is a Type A DTC
- DTC P1101 is a Type B DTC.

Diagnostic Aids

Use a solution of dish soap and water in a spray bottle to pinpoint any suspected air leaks in the induction system. This includes vacuum lines, positive crankcase ventilation system, intake manifold, throttle body.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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, verify that DTC P0641, P0651, P0697, or P06A3 is not set.

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

Refer to DTC P0641, P0651, P0697, or P06A3 (ECM) for further diagnosis.

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

2. Ignition ON, verify the scan tool Throttle Body Idle Airflow Compensation parameter is less than 90 %.

- **If 90 % or greater**

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

- **If less than 90 %**

3. Verify the scan tool Throttle Position Sensors 1 and 2 Agree/Disagree parameter displays Agree while performing the Throttle Sweep Test with a scan tool.

- **If Disagree**

Refer to [DTC P0121-P0123, P0222, P0223, or P2135](#) for further diagnosis.

- **If Agree**

4. Determine the current vehicle testing altitude.

5. Verify the scan tool MAP Sensor pressure parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.

- **If the MAP Sensor parameter is not in range**

Refer to [DTC P0106](#) for further diagnosis.

- **If the MAP Sensor parameter is within range**

6. Engine idling, verify the scan tool MAP Sensor pressure parameter is between 26-52 kPa (3.8-7.5 PSI) and changes with accelerator pedal input.

- **If not between 26-52 kPa (3.8-7.5 PSI) or does not change**

Refer to [DTC P0106](#) for further diagnosis.

- **If between 26-52 kPa (3.8-7.5 PSI) and changes**

7. Verify the scan tool MAF Sensor g/s parameter changes smoothly and gradually as the engine speed is increased and decreased while performing the actions listed below.

1. Engine idling
2. Perform the scan tool snapshot function.
3. Increase the engine speed slowly to 3, 000 RPM and then back to idle.
4. Exit from the scan tool snapshot and review the data.
5. Observe the MAF Sensor parameter frame by frame with a scan tool.

- **If the MAF Sensor parameter does not change smoothly and gradually**

Refer to [DTC P0101](#) for further diagnosis.

- **If the MAF Sensor parameter changes smoothly and gradually**

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 no DTCs set**

10. All OK

Circuit/System Testing

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

1. Verify the integrity of the entire air induction system by verifying that none of the following conditions exist:

- Any damaged, improperly installed, collapsed, or restricted components
- Loose clamps, cracks, or other damage
- An air flow restriction
- Restricted air filter
- Splits, kinks, leaks, or improper connections at the vacuum hoses
- Vacuum leaks at the intake manifold, MAP sensor, and throttle body
- Water intrusion
- Any snow or ice buildup, in cold climates
- Contamination of the MAF sensor element
- Missing, restricted, or leaking exhaust components-Refer to [Symptoms - Engine Exhaust](#) for further diagnosis.
- **If a condition is found**

Repair or replace component as appropriate.

- **If no condition is found**

2. Test the engine for a mechanical condition. Refer to [Symptoms - Engine Mechanical](#) for diagnosis.

- **If a condition is found**

Repair or replace component as appropriate.

- **If no condition is found**

3. All OK

Repair Instructions

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

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

DTC P0101: MASS AIR FLOW (MAF) 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 P0101

Mass Air Flow (MAF) Sensor Performance

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Ignition Voltage	P0102	P0101, P0102	P0102	-	P0101, P0103
Signal	P0102	P0102	P0102	P0102	P0101, P0103, P1101
Ground	-	P0102	P0102	-	P0102

Typical Scan Tool Data

MAF Sensor

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Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 2, 000-9, 500 Hz			
Ignition Voltage	0 Hz	0 Hz	-
Signal	0 Hz	0 Hz	0 Hz
Ground	-	0 Hz	-

Circuit Description

The engine control module (ECM) uses the following information to calculate an expected airflow rate:

- The throttle position (TP)
- The barometric pressure (BARO)
- The manifold absolute pressure (MAP)
- The intake air temperature (IAT)
- The engine RPM

The intake flow rationality diagnostic provides the within-range rationality check for the mass air flow (MAF), manifold absolute pressure (MAP), and the throttle position (TP) sensors. This is an explicit model-based diagnostic containing separate models for the intake system.

The estimates of MAF, MAP, and TP obtained from this system of models and calculations are then compared to the actual measured values from the MAF, MAP, and the TP sensors and to each other to determine the appropriate DTC to fail.

Conditions for Running the DTC

- DTCs P0102, P0103, P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0119, P0335, P0336 are not set.
- The engine speed is between 400-7, 000 RPM.
- The engine speed is between 400-6, 000 RPM; with RPO 2H0.
- The engine coolant temperature (ECT) sensor is between -7 to $+125^{\circ}\text{C}$ ($+19.4$ to $+257^{\circ}\text{F}$).
- The IAT sensor is between -20 to $+125^{\circ}\text{C}$ (-4 to $+257^{\circ}\text{F}$); with RPO 2H0.
- The IAT sensor is between -20 to $+100^{\circ}\text{C}$ (-4 to $+212^{\circ}\text{F}$).
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM determines if the MAF sensor is stuck within the normal operating range.

Action Taken When the DTC Sets

DTC P0101 is a Type B DTC.

Conditions for Clearing the DTC

DTC P0101 is a Type B DTC.

Diagnostic Aids

- Any type of contamination on the MAF sensor heating elements will degrade the proper operation of the sensor. Certain types of contaminants act as a heat insulator, which will impair the response of the sensor to airflow changes. Water or snow can create the opposite effect, and cause the signal to increase rapidly.
- A MAF sensor that is installed incorrectly may set this DTC.
- Certain aftermarket air filters may cause this DTC to set.
- Certain aftermarket air induction systems may cause this DTC to set.
- Modifications to the air induction system may cause this DTC to set.

Reference Information

[Engine Controls Schematics \(Chevrolet with 2H0\)](#)

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 Component Views

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

DTC Type Reference

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

Scan Tool Reference

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

Special Tools

EL-38522-A Variable Signal Generator

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

Circuit/System Verification

1. Ignition ON.
2. Verify that DTC DTC P0641, P0651, P0697, or P06A3 is not set.
 - **If any of the DTCs are set**

Refer to [DTC P0641, P0651, P0697, or P06A3 \(ECM\)](#) for further diagnosis.
 - **If none of the DTCs are set**
3. Ignition ON, verify the scan tool Throttle Body Idle Airflow Compensation parameter is less than 90 %.
 - **If 90 % or greater**

Refer to [Throttle Body Inspection and Cleaning](#) .
 - **If less than 90 %**
4. Verify the scan tool TP Sensors 1 and 2 Agree/Disagree parameter displays Agree while performing the Throttle Sweep Test with a scan tool.
 - **If Disagree**

Refer to [DTC P0121-P0123, P0222, P0223, or P2135](#) for further diagnosis.
 - **If Agree**
5. Determine the current vehicle testing altitude.
6. Verify the scan tool MAP Sensor pressure parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.

- **If the MAP Sensor parameter is not in range**

Refer to **DTC P0106** for further diagnosis.

- **If the MAP Sensor parameter is within range**

7. Engine idling, verify the scan tool MAP Sensor pressure parameter is between 26-52 kPa (3.8-7.5 PSI) and changes with accelerator pedal input.

- **If not between 26-52 kPa (3.8-7.5 PSI) or does not change**

Refer to **DTC P0106** for further diagnosis.

- **If between 26-52 kPa (3.8-7.5 PSI) and changes**

8. Verify the scan tool MAF Sensor g/s parameter changes smoothly and gradually as the engine speed is increased and decreased while performing the actions listed below.

1. Engine idling
2. Perform the scan tool snapshot function.
3. Increase the engine speed slowly to 3,000 RPM and then back to idle.
4. Exit from the scan tool snapshot and review the data.
5. Observe the MAF Sensor parameter frame by frame with a scan tool.

- **If the MAF Sensor parameter does not change smoothly and gradually**

Refer to Circuit/System Testing.

- **If the MAF Sensor parameter changes smoothly and gradually**

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

10. Verify the DTC does not set.

- **If the DTC does set**

Refer to Circuit/System Testing for further diagnosis.

- **If the DTC does not set**

11. All OK

Circuit/System Testing

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

1. Check the integrity of the entire air induction system by verifying that none of the following conditions exist:

- Any damaged components
- Improper operation of turbocharger wastegate actuator or bypass valve; where equipped
- Improperly installed components
- Collapsed, restricted, or damaged components
- Loose clamps, cracks, or other damage
- An air flow restriction
- Restricted air filter
- Splits, kinks, leaks, or improper connections at the vacuum hoses
- Vacuum leaks at the intake manifold, MAP sensor, and throttle body
- Water intrusion
- Any snow or ice buildup, in cold climates
- Contamination of the Multifunction Intake Air sensor element
- **If a condition is found**

Repair or replace component as appropriate.

- **If no condition is found**
- 2. Ignition OFF, disconnect the harness connector at the B75B Mass Air Flow/Intake Air Temperature sensor.
- 3. Test for less than 2 Ω between the ground circuit terminal 2 and ground.
 - **If 2 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 2 Ω**
- 4. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 4 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp and remove the fuse for the ignition circuit.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp and remove the fuse for the ignition circuit.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for greater than 2 Ω between the ignition circuit terminal 4 and ground.
 - If less than 2 Ω , repair the short to ground on the circuit.
 - If greater than 2 Ω , test all the components connected to the circuit and repair or replace as necessary.
 - **If the test lamp illuminates**
- 5. Ignition ON, test for 4.8-5.2 V between the signal 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 signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector 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**
- 6. 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 10.

- **If the DTC does not set**

4. All OK.

- **EL-38522-A, Variable Signal Generator; or equivalent is available**

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

- Red lead to the signal circuit terminal 5 at the harness connector
- Black leads to ground
- Battery voltage supply lead to B+

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

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

9. Engine idling, verify the scan tool MAF Sensor parameter is between 4, 950-5, 050 Hz.

- **If not between 4, 950-5, 050 Hz.**

Replace the K20 Engine Control Module.

- **If between 4, 950-5, 050 Hz.**

10. Replace the B75B Mass Air Flow/Intake Air Temperature sensor.

Repair Instructions

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

- **Mass Airflow Sensor Replacement (2H0)**
- **Control Module References** for ECM replacement, programming, and setup

DTC P0102 OR P0103: MASS AIR FLOW (MAF) SENSOR CIRCUIT LOW FREQUENCY

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 P0102

Mass Air Flow (MAF) Sensor Circuit Low Frequency

DTC P0103

Mass Air Flow (MAF) Sensor Circuit High Frequency

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Ignition Voltage	P0102	P0101, P0102	P0102	-	P0101, P0103
Signal	P0102	P0102	P0102	P0102	P0101, P0103, P1101
Ground	-	P0102	P0102	-	P0102

Typical Scan Tool Data

MAF Sensor

Circuit	Short to Ground	Open	Short to Voltage
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Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 2, 000-9, 500 Hz			
Ignition Voltage	0 Hz	0 Hz	-
Signal	0 Hz	0 Hz	0 Hz
Ground	-	0 Hz	-

Circuit Description

The mass air flow (MAF) sensor is integrated with the intake air temperature (IAT) sensor. The MAF sensor is an air flow meter that measures the amount of air entering the engine. The engine control module (ECM) uses the MAF sensor signal to provide the correct fuel delivery for all engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle condition. A large quantity of air entering the engine indicates an acceleration or high load condition.

The ECM applies 5 V to the MAF sensor on the MAF sensor signal circuit. The sensor uses the voltage to produce a frequency based on the inlet air flow through the sensor bore. The MAF sensor is also supplied with ignition voltage and chassis ground circuits.

Conditions for Running the DTC

- The engine is running for greater than 1.0 s.
- The engine speed is greater than 300 RPM.
- The ignition voltage is greater than 10.0 V.
- The DTCs run continuously when the above conditions are met for greater than 1.0 s.

Conditions for Setting the DTC

P0102

The ECM detects that the MAF sensor signal is less than 1, 827 Hz (0 g/s) for greater than 1.0 s.

P0103

The ECM detects that the MAF sensor signal is greater than 13, 200 Hz (810 g/s) for greater than 1 s.

Action Taken When the DTC Sets

DTCs P0102 and P0103 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0102 and P0103 are Type B DTCs.

Diagnostic Aids

A MAF sensor that is installed incorrectly may set this DTC.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0)

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 Component Views

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

DTC Type Reference

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

Scan Tool Reference

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

Special Tools

EL-38522-A Variable Signal Generator

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

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool MAF Sensor g/s parameter changes smoothly and gradually as the engine speed is increased and decreased while performing the actions listed below.
 1. Engine idling
 2. Perform the scan tool snapshot function.
 3. Increase the engine speed slowly to 3,000 RPM and then back to idle.
 4. Exit from the scan tool snapshot and review the data.
 5. Observe the MAF Sensor parameter frame by frame with a scan tool.
 - **The MAF Sensor parameter does not change smoothly and gradually**

Refer to Circuit/System Testing.

 - **The MAF Sensor parameter changes smoothly and gradually**
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 for further diagnosis.

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

Circuit/System Testing

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

1. Ignition OFF, disconnect the harness connector at the B75B Mass Air Flow/Intake Air Temperature sensor.
2. Test for less than 2 Ω between the ground circuit terminal 2 and ground.
 - **If 2 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.

- If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 2 Ω**
3. Ignition ON, verify that a test lamp illuminates between the ignition voltage circuit terminal 4 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp and remove the fuse for the ignition voltage circuit.
 2. Test for less than 2 Ω in the ignition voltage circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp and remove the fuse for the ignition voltage circuit.
 2. Test for infinite resistance between the ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for greater than 2 Ω between the ignition voltage circuit terminal 4 and ground.
 - If less than 2 Ω , repair the short to ground on the circuit.
 - If greater than 2 Ω , test all the components connected to the circuit and repair or replace as necessary.
 - **If the test lamp illuminates**
 4. Ignition ON, test for 4.8-5.2 volts between the signal 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 signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 1. Ignition OFF, disconnect the harness connector 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. 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 B75B Mass Air Flow/Intake Air Temperature sensor.
 2. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 3. Verify the DTC does not set.
 - **If the DTC sets**

Replace the K20 Engine Control Module.
 - **If the DTC does not set**
 - **EL-38522-A, Variable Signal Generator; or equivalent is available**
 6. Ignition OFF, connect the leads of the **EL-38522-A** Variable Signal Generator as follows:
 - Red lead to the signal circuit terminal 5 at the harness connector

- Black leads to ground
 - Battery voltage supply lead to B+
- Set the **EL-38522-A** Variable Signal Generator to the following specifications.
 - Signal switch to 5 V
 - Frequency switch to 5 kHz
 - Duty Cycle switch to 50 % (Normal)
 - Engine idling, verify the scan tool MAF Sensor parameter is between 4, 950-5, 050 Hz.
 - **If not between 4, 950-5, 050 Hz.**

Replace the K20 Engine Control Module.

- **If between 4, 950-5, 050 Hz.**

- Replace the B75B Mass Air Flow/Intake Air Temperature sensor.

Repair Instructions

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

- **Mass Airflow Sensor Replacement (2H0).**
- **Control Module References** for ECM replacement, programming and setup

DTC P0106: MANIFOLD ABSOLUTE PRESSURE (MAP) 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 P0106

Manifold Absolute Pressure (MAP) Sensor Performance

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5 V Reference	P0106, P0107, P0697	P0106, P0107	P0107	P0106, P0108, P0697	P0106
Signal	P0106, P0107	P0106, P0107	P0106, P0107	P0106, P0108*	P0106, P1101
Low Reference	-	P0106, P0108	P0106, P0108	-	P0106
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.					

Typical Scan Tool Data

MAP Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 12-103 kPa (1.7-14.9 PSI) (varies with altitude)			
5 V Reference	0 kPa (0 PSI)	0 kPa (0 PSI)	128 kPa (18.6 PSI)
Signal	0 kPa (0 PSI)	0 kPa (0 PSI)	128 kPa (18.6 PSI)*

Circuit	Short to Ground	Open	Short to Voltage
Low Reference	-	80-128 kPa (11.6-18.6 PSI)	-
* Internal ECM or Sensor damage may occur if the circuit is shorted to B+.			

MAP Sensor, if equipped with Turbocharger

Circuits	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 12-225 kPa (1.7-32.6 PSI) (varies with altitude)			
5 V Reference	0 kPa (0 PSI)	0 kPa (0 PSI)	255 kPa (36.9 PSI)
Signal	0 kPa (0 PSI)	0 kPa (0 PSI)	255 kPa (36.9 PSI)*
Low Reference	-	255 kPa (36.9 PSI)	-
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.			

Circuit Description

The manifold absolute pressure (MAP) sensor measures the pressure inside the intake manifold. Pressure in the intake manifold is affected by engine speed, throttle opening, air temperature, barometric pressure (BARO) and if equipped, turbocharger output. A diaphragm within the MAP sensor is displaced by the pressure changes that occur from the varying load and operating conditions of the engine. The sensor translates this action into electrical resistance.

The MAP sensor wiring includes 3 circuits. The engine control module (ECM) supplies a regulated 5 volts to the sensor on a 5 V reference circuit. The ECM supplies a ground on a low reference circuit. The MAP sensor provides a signal voltage to the ECM, relative to the pressure changes, on the MAP sensor signal circuit. The ECM converts the signal voltage input to a pressure value.

Under normal operation the greatest pressure that can exist in the intake manifold is at ignition ON, engine OFF, which is equal to the BARO. If equipped, a turbocharger can increase the pressure above BARO, when the vehicle is operated at wide-open throttle (WOT). The lowest manifold pressure occurs when the vehicle is idling or decelerating. The ECM monitors the MAP sensor signal for pressure outside of the normal range.

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0125, P0128, P222C, P222D, P0335, P0336, P0401, P042E or P2610 are not set
- The engine speed is between 400-6500 RPM.
- The engine coolant temperature (ECT) Sensor is between -7 to +125Â°C (19.4-257Â°F).
- The intake air temperature (IAT) sensor is between -20 to +100Â°C (-4 to +212Â°F).
- This DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM determines if the MAP Sensor is not within the normal operating range. It accomplishes this by running 3 different models within the software to determine the values, for greater than 0.5 S.

Action Taken When the DTC Sets

DTC P0106 is a Type B DTC.

Conditions for Clearing the DTC

DTC P0106 is a Type B DTC.

Reference Information

Schematic Reference

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

GE-23738-A Vacuum Pump

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

Circuit/System Verification

1. Ignition ON, verify that DTC P0641, P0651, P0697, or P06A3 is not set.
 - **If any of the DTCs are set**
Refer to [DTC P0641, P0651, P0697, or P06A3 \(ECM\)](#) for further diagnosis.
 - **If none of the DTCs are set**
2. If you were sent here from DTC P0068, P0101, P0121, or P1101; refer to Circuit/System Testing.
3. Ignition ON, 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](#) for this publication.
 - **If less than 90%**
4. Verify the scan tool Throttle Position Sensors 1 and 2 Agree/Disagree parameter displays Agree while performing the Throttle Sweep Test with a scan tool.
 - **If Disagree**
Refer to [DTC P0121-P0123, P0222, P0223, or P2135](#) for further diagnosis.
 - **If Agree**
5. Determine the current vehicle testing altitude.
6. Verify the scan tool MAP Sensor pressure parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.
 - **If the MAP Sensor parameter is not in range**
Refer to Circuit/System Testing.
 - **If the MAP Sensor parameter is within range**

7. Engine idling, verify the scan tool MAP Sensor pressure parameter is between 26-52 kPa (3.8-7.5 PSI) and changes with accelerator pedal input.

- **If not between 26-52 kPa (3.8-7.5 PSI) or does not change**

Refer to Circuit/System Testing.

- **If between 26-52 kPa (3.8-7.5 PSI) and changes**

8. Verify the scan tool MAF Sensor g/s parameter changes smoothly and gradually as the engine speed is increased and decreased while performing the actions listed below.

1. Engine idling
2. Perform the scan tool snapshot function.
3. Increase the engine speed slowly to 3000 RPM and then back to idle.
4. Exit from the scan tool snapshot and review the data.
5. Observe the MAF Sensor parameter frame by frame with a scan tool.

- **If the MAF Sensor parameter does not change smoothly and gradually**

Refer to [DTC P0101](#) for further diagnosis.

- **If the MAF Sensor parameter changes smoothly and gradually**

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

10. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing.

- **If the DTC does not set**

11. All OK

Circuit/System Testing

1. Verify the integrity of the entire air induction system and verify that none of the following conditions exist:

- Any damaged components
- Improper operation of turbocharger wastegate actuator or bypass valve, if equipped
- Loose or improper installation of the turbocharger and the charge air cooler, including the flexible ductwork, if equipped
- An air flow restriction
- Any vacuum leak
- Improperly routed vacuum hoses
- In cold climates, inspect for any snow or ice buildup at the BARO port on the ECM, if equipped
- A restriction in the MAP Sensor port or the BARO port, if equipped
- Proper operation of the Positive Crankcase Ventilation (PCV) system
- Missing, restricted or leaking exhaust components. Refer to [Symptoms - Engine Exhaust](#)
- Engine mechanical condition; for example: low compression or incorrect timing chain or belt installation. Refer to [Symptoms - Engine Mechanical](#).
- **If a condition is found**

Repair or replace the component as appropriate.

- **If no condition is found**

2. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Disconnect the B74 Manifold Absolute Pressure Sensor.

3. Test for less than 2 Ω between the low reference circuit terminal 2 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 $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
- **If less than $2\ \Omega$**
4. Ignition ON, 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 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 $2\ \Omega$ in the 5 V reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.

NOTE: If the signal circuit is shorted to a voltage the ECM or the MAP Sensor may be damaged.

-
- **If greater than 5.2 V**
 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**
- 5. Ignition ON, verify the scan tool MAP Sensor parameter is less than 0.5 V.
 - **If 0.5 V or greater**
 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 terminal 3 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 0.5 V**
- 6. Ignition OFF, install a 3 A fused jumper wire between the signal circuit terminal 3 and the 5 V reference circuit terminal 1.
- 7. Ignition ON, verify the scan tool MAP Sensor voltage parameter is greater than 4.5 V.
 - **If 4.5 V or less**
 1. Ignition OFF, disconnect the K20 Engine Control Module.
 2. Remove the jumper wire, test for infinite resistance between the signal circuit terminal 3 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Test for less than $2\ \Omega$ in the signal circuit end to end.
 - If $2\ \Omega$ or greater, repair the open or high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **If greater than 4.5 V**
- 8. Test or replace the B74 Manifold Absolute Pressure Sensor.

Component Testing

NOTE: You must perform the Circuit/System Testing in order to verify the integrity of the MAP Sensor circuits before proceeding with the

Skewed Sensor Test

1. Ignition OFF, remove the B74 Manifold Absolute Pressure Sensor from the engine. Connect the harness to the sensor, if disconnected.
2. Ignition ON, apply 17 kPa (5.0 in Hg) of vacuum to the B74 Manifold Absolute Pressure Sensor, with the **GE-23738-A**. Verify the scan tool MAP Sensor pressure parameter decreases between 13-21 kPa (1.8-3.0 PSI).

- **If the parameter does not decrease between 13-21 kPa (1.8-3.0 PSI).**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If the parameter does decrease between 13-21 kPa (1.8-3.0 PSI).**

3. Apply 34 kPa (10.0 in Hg) of vacuum to the B74 Manifold Absolute Pressure Sensor, with the **GE-23738-A**. Verify the scan tool MAP Sensor pressure parameter decreases between 30-38 kPa (4.4-5.5 PSI).

- **If the parameter does not decrease between 30-38 kPa (4.4-5.5 PSI).**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If the parameter does decrease between 30-38 kPa (4.4-5.5 PSI).**

4. All OK.

Erratic Signal Test

1. Ignition OFF, remove the B74 Manifold Absolute Pressure Sensor and disconnect the harness.
2. Install a 3 A fused jumper wire between the 5 V reference circuit terminal 1 of the sensor and the sensor harness.
3. Install a jumper wire between the low reference circuit terminal 2 of the sensor and ground.
4. Install a jumper wire to the signal circuit terminal 3 of the sensor.
5. Connect a DMM between the jumper wire and ground.
6. Ignition ON, observe the DC voltage on the DMM. Slowly apply between 0-15 kPa (0-4.4 in Hg) of vacuum to the sensor with the **GE-23738-A**. Verify the voltage changes, without any spikes or dropouts and is between 0.2-4.9 V.

- **If not between 0.2-4.9 V or has spikes or dropouts**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If between 0.2-4.9 V and there are no spikes or dropouts**

7. All OK.

Repair Instructions

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

- [Manifold Absolute Pressure Sensor Replacement \(2H0\)](#).
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0107 OR P0108: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW VOLTAGE

Diagnostic Instructions

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

DTC Descriptors

DTC P0107

Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage

DTC P0108

Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5 V Reference	P0106, P0107, P0697	P0106, P0107	P0107	P0106, P0108, P0697	P0106
Signal	P0106, P0107	P0106, P0107	P0106, P0107	P0106, P0108*	P0106, P1101
Low Reference	-	P0106, P0108	P0106, P0108	-	P0106
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.					

Typical Scan Tool Data

MAP Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 12-103 kPa (1.7-14.9 PSI)			
5 V Reference	0 kPa (0 PSI)	0 kPa (0 PSI)	128 kPa (18.6 PSI)
Signal	0 kPa (0 PSI)	0 kPa (0 PSI)	128 kPa (18.6 PSI)*
Low Reference	-	80-128 kPa (11.6-18.6 PSI)	-
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.			

MAP Sensor, if equipped with Turbocharger

Circuits	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 12-225 kPa (1.7 to 32.6 PSI) (Varies with altitude)			
5 V Reference	0 kPa (0 PSI)	0 kPa (0 PSI)	255 kPa (36.9 PSI)
Signal	0 kPa (0 PSI)	0 kPa (0 PSI)	255 kPa (36.9 PSI)*
Low Reference	-	255 kPa (36.9 PSI)	-
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.			

Circuit Description

The manifold absolute pressure (MAP) sensor measures the pressure inside the intake manifold. Pressure in the intake manifold is affected by engine speed, throttle opening, air temperature, barometric pressure (BARO) and if equipped turbocharger output. A diaphragm within the MAP sensor is displaced by the pressure changes that occur from the varying load and operating conditions of the engine. The sensor translates this action into electrical resistance.

The MAP sensor wiring includes 3 circuits. The engine control module (ECM) supplies a regulated 5 volts to the sensor on a 5 V reference circuit. The ECM supplies a ground on a low reference circuit. The MAP sensor provides a signal voltage to the ECM, relative to the pressure changes, on the MAP sensor signal circuit. The ECM converts the signal voltage input to a pressure value.

Under normal operation the greatest pressure that can exist in the intake manifold is at ignition ON, engine OFF, which is equal to the BARO. If equipped, a turbocharger can increase the pressure above BARO, when the vehicle is operated at wide-open throttle (WOT). The lowest manifold pressure occurs when the vehicle is idling or decelerating. The ECM monitors the MAP sensor signal for pressure outside of the normal range.

Conditions for Running the DTC

P0107

This DTC runs continuously.

P0108

This DTC runs continuously.

Conditions for Setting the DTC

P0107

The ECM detects that the MAP Sensor voltage is less than 0.15 V for greater than 13 ms.

P0108

The ECM detects that the MAP Sensor voltage is more than 4.50 V for greater than 13 ms.

Action Taken When the DTC Sets

DTCs P0107 and P0108 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0107 and P0108 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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

GE-23738-A Vacuum Pump

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

Circuit/System Verification

1. Ignition ON, verify that DTC P0641, P0651, P0697, or P06A3 is not set.

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

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

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

2. Determine the current vehicle testing altitude.

3. Verify the scan tool MAP Sensor pressure parameter is within the range specified in the [Altitude Versus Barometric Pressure](#) table.

- **If the MAP Sensor parameter is not in range**

Refer to Circuit/System Testing for further diagnosis.

- **If the MAP Sensor parameter is within range**

4. Verify the engine is equipped with a turbocharger.

- **If not equipped with a turbocharger**

Refer to Step 6.

- **If equipped with a turbocharger**

5. Engine idling, verify the scan tool MAP Sensor voltage parameter is between 0.3-4.8 V and changes with accelerator pedal input.

- **If not between 0.3-4.8 V or does not change**

Refer to Circuit/System Testing.

- **If between 0.3-4.8 V and changes**

Refer to Step 7.

6. Engine idling, verify the scan tool MAP Sensor voltage parameter is between 0.2-4.5 V and changes with accelerator pedal input.

- **If not between 0.2-4.5 V or does not change**

Refer to Circuit/System Testing.

- **If between 0.2-4.5 V and changes**

7. 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.

8. Verify a DTC does not set.

- **If any DTC sets**

Refer to Circuit/System Testing.

- **If no DTC sets**

9. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B74 Manifold Absolute Pressure Sensor.

2. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down. Test for less than 2 Ω between the low reference circuit terminal 2 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/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 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 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.

NOTE: If the signal circuit is shorted to a voltage the ECM or the MAP Sensor may be damaged.

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- **If greater than 5.2 V**

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, verify the scan tool MAP Sensor parameter is less than 0.5 V.

- **If 0.5 V or greater**

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 terminal 3 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 0.5 V**

5. Ignition OFF, install a 3 A fused jumper wire between the signal circuit terminal 3 and the 5 V reference circuit terminal 1.

6. Ignition ON, verify the scan tool MAP Sensor voltage parameter is greater than 4.5 V.

- **If 4.5 V or less**

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

2. Remove the jumper wire, test for infinite resistance between the signal circuit terminal 3 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 or high resistance in the circuit.
- If less than 2 Ω , replace the K20 Engine Control Module.

- **If greater than 4.5 V**

7. Test or replace the B74 Manifold Absolute Pressure Sensor.

Component Testing

NOTE: You must perform the Circuit/System Testing in order to verify the integrity of the MAP Sensor circuits before proceeding with the Component Testing.

Skewed Sensor Test

1. Ignition OFF, remove the B74 Manifold Absolute Pressure Sensor from the engine. Connect the harness to the sensor, if disconnected.
2. Ignition ON, apply 17 kPa (5.0 in Hg) of vacuum to the B74 Manifold Absolute Pressure Sensor, with the **GE-23738-A**. Verify the scan tool MAP Sensor pressure parameter decreases between 13-21 kPa (1.8-3.0 PSI).
 - **If the parameter does not decrease between 13-21 kPa (1.8-3.0 PSI).**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If the parameter does decrease between 13-21 kPa (1.8-3.0 PSI).**
3. Apply 34 kPa (10.0 in Hg) of vacuum to the B74 Manifold Absolute Pressure Sensor, with the **GE-23738-A**. Verify the scan tool MAP Sensor pressure parameter decreases between 30-38 kPa (4.4-5.5 PSI).
 - **If the parameter does not decrease between 30-38 kPa (4.4-5.5 PSI).**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If the parameter does decrease between 30-38 kPa (4.4-5.5 PSI).**
4. All OK.

Erratic Signal Test

1. Ignition OFF, remove the B74 Manifold Absolute Pressure Sensor and disconnect the harness.
2. Install a 3 A fused jumper wire between the 5 V reference circuit terminal 1 of the sensor and the sensor harness.
3. Install a jumper wire between the low reference circuit terminal 2 of the sensor and ground.
4. Install a jumper wire to the signal circuit terminal 3 of the sensor.
5. Connect a DMM between the jumper wire and ground.
6. Ignition ON, observe the DC voltage on the DMM. Slowly apply between 0-15 kPa (0-4.4 in Hg) of vacuum to the sensor with the **GE-23738-A**. Verify the voltage changes, without any spikes or dropouts and is between 0.2-4.9 V.

- **If not between 0.2-4.9 V or has spikes or dropouts**

Replace the B74 Manifold Absolute Pressure Sensor.

- **If between 0.2-4.9 V and there are no spikes or dropouts**

7. All OK.

Repair Instructions

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

- [Manifold Absolute Pressure Sensor Replacement \(2H0\)](#)
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0112, P0113, OR P0114: INTAKE AIR TEMPERATURE (IAT) 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 P0112

Intake Air Temperature (IAT) Sensor Circuit Low Voltage

DTC P0113

Intake Air Temperature (IAT) Sensor Circuit High Voltage

DTC P0114

Intake Air Temperature (IAT) Sensor Circuit Intermittent

Diagnostic Fault Information

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

Typical Scan Tool Data**IAT Sensor**

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+			

Circuit/System Description

The intake air temperature (IAT) sensor is integrated with the mass air flow (MAF) sensor. The IAT is a variable resistor that changes the voltage on the engine control module (ECM) supplied 5 V signal circuit. The ECM provides a low reference circuit for the IAT. The signal varies with inlet air temperature in the Mass Air Flow (MAF) sensor bore and is displayed by the scan tool as Â°C (Â°F).

IAT Sensor - Temperature, Resistance, Voltage Table

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

Conditions for Running the DTC

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

Conditions for Setting the DTC**P0112**

The ECM detects that the IAT sensor temperature is greater than 150Â°C (302Â°F) for greater than 4 s.

P0113

The ECM detects that the IAT sensor temperature is less than -60Â°C (-76Â°F) for greater than 4 s.

P0114*

- The ECM detects that the IAT reading changed greater than 10Â°C (18Â°F) within 0.1 s.

- The condition exists for greater than 2 s.
- *Where used.

Action Taken When the DTC Sets

- DTCs P0112, P0113 and P0114 are Type B DTCs.
- The ECM commands the cooling fans ON.

Conditions for Clearing the DTC

DTCs P0112, P0113 and P0114 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0)

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 Component Views

Powertrain Component Views (Buick) Powertrain Component Views (Chevrolet)

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

NOTE: To minimize the effects of residual engine heat and sensor internal heating elements, perform steps 1 and 2 of this verification procedure only if the ignition has been OFF for 8 hours or more.

1. Ignition ON.
2. Verify the following scan tool parameters are within 25Â°C (45Â°F) of each other.
 - IAT Sensor
 - Start-Up ECT
 - **If not within 25Â°C (45Â°F)**
Refer to Circuit/System Testing.
 - **If within 25Â°C (45Â°F)**
3. Engine idling.
4. Verify the following scan tool parameters are between: -38 and +149Â°C (-36 and +300Â°F).
 - IAT Sensor
 - ECT Sensor

- **If not between: -38 and +149°C (-36 and +300°F)**

Refer to Circuit System Testing.

- **If between: -38 and +149°C (-36 and +300°F)**

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 for further diagnosis.

- **If the DTC does not set**

7. 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 B75B Mass Air Flow/Intake Air Temperature sensor.

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

- **If 2 Ω or greater**

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

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

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

- **If less than 2 Ω**

3. Ignition ON.

4. 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 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.

3. 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 parameter is colder than -39°C (-38°F).

- **If warmer than -39°C (-38°F)**

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

2. Test for infinite resistance between the signal circuit terminal 3 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 3 and the low reference circuit terminal 1.
7. Verify the scan tool IAT Sensor parameter is warmer than 148 $^{\circ}$ C (298 $^{\circ}$ F).
 - **If colder than 148 $^{\circ}$ C (298 $^{\circ}$ F)**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If warmer than 148 $^{\circ}$ C (298 $^{\circ}$ F)**
8. Test or replace the B75B Mass Air Flow/Intake Air Temperature sensor.

Component Testing

Mass Air Flow/Intake Air Temperature sensor

1. Ignition OFF, disconnect the harness connector at the B75B Mass Air Flow/Intake Air Temperature sensor.

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

2. Test the IAT sensor 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 B75B Mass Air Flow/Intake Air Temperature sensor.

- **If within the specified range**

3. All OK.

Repair Instructions

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

- [Mass Airflow Sensor Replacement \(2H0\)](#)
- [Control Module References](#) for ECM replacement, programming and setup

DTC P0117, P0118, OR P0119: ENGINE COOLANT TEMPERATURE (ECT) 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 P0117

Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

DTC P0118

Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

DTC P0119

Engine Coolant Temperature (ECT) Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0117	P0118, P0119	P0118*, P0119	P0116, P0128
Low Reference	-	P0118, P0119	-	P0128
*ECM or sensor damage may occur if the circuit is shorted to B+.				

Typical Scan Tool Data

ECT Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running			
Parameter Normal Range: -39 to 149Â°C (-38 to 300Â°F)			
ECT Sensor	150Â°C (302Â°F)	-40Â°C (-40Â°F)	-40Â°C (-40Â°F)
Low Reference	-	-40Â°C (-40Â°F)	-

Circuit/System Description

The engine coolant temperature (ECT) sensor is a variable resistor that measures the temperature of the engine coolant. The engine control module (ECM) supplies 5 V to the ECT sensor signal circuit and a ground for the low reference circuit. This diagnostic checks for an open, short to ground or an intermittent circuit condition between the ECM and ECT sensor.

Conditions for Running the DTC

P0117

- The ignition is ON.
- OR
- The engine is running.
 - This DTC runs continuously within the enabling conditions.

P0118

- The ignition is ON.
- OR
- The engine is running for greater than 15 s.
- OR
- The engine run time is less than 15 s when the IAT is warmer than -7Â°C (19Â°F).

- This DTC runs continuously within the enabling conditions.

P0119

- No active DTCs set.
- The ignition is ON.
- This DTC runs continuously within the enabling conditions.

Conditions for Setting the DTC

P0117

The ECM detects that the ECT is warmer than 149Â°C (300Â°F) for greater than 5 s.

P0118

The ECM detects that the ECT is colder than -39Â°C (-38Â°F) for greater than 5 s.

P0119

The ECM detects that the ECT is intermittent or has abruptly changed for greater than 3 seconds.

Action Taken When the DTC Sets

- DTC P0117, P0118 or P0119 are a Type B DTC.
- The cooling fans will be commanded ON.
- The Engine Coolant Temperature Gauge is inoperative.
- The AC compressor will be commanded OFF.

Conditions for Clearing the DTC

DTC P0117, P0118 or P0119 are a Type B DTC.

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

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. Ignition ON.
2. Verify the scan tool ECT Sensor parameter is warmer than -40°C (-40°F) and colder than 150°C (302°F) and changes with engine run time.
 - **If colder than -39°C (-38°F) or warmer than 149°C (300°F) or does not change**

Refer to Circuit/System Testing.

- **If warmer than -40°C (-40°F) and colder than 150°C (302°F) and changes**
3. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
 4. Verify 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 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 $5\ \Omega$ between the low reference circuit terminal A or 2 and ground.
 - **If $5\ \Omega$ or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than $2\ \Omega$ in the low reference circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.
 - **If less than $5\ \Omega$**
3. Ignition ON.
4. Verify the scan tool ECT Sensor parameter is colder than -39°C (-38°F).
 - **If warmer than -39°C (-38°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, replace the K20 Engine Control Module.
 - **If colder than -39°C (-38°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 149°C (300°F).
 - **If 149°C (300°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 $1\ \text{V}$ between the signal circuit and ground.
 - If $1\ \text{V}$ or greater, repair the short to voltage on the circuit.
 - If less than $1\ \text{V}$
3. Ignition OFF.
4. Test for less than $2\ \Omega$ in the signal circuit end to end.
 - If $2\ \Omega$ or greater, repair the open/high resistance in the circuit.
 - If less than $2\ \Omega$, replace the K20 Engine Control Module.

- If warmer than 149Å° C (300Å° F)

7. Test or replace the B34 Engine Coolant Temperature Sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B34 Engine Coolant Temperature Sensor.
2. Test the ECT sensor by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the [Temperature Versus Resistance - Engine Coolant Temperature Sensor](#) table. The resistance values should be in range of the table values.

- **If not within the specified range**

Replace the B34 Engine Coolant Temperature Sensor.

- **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 \(Water Outlet\)](#), [Engine Coolant Temperature Sensor Replacement \(Radiator\)](#).
- [Engine Control Module Replacement](#) engine control module replacement, programming, and setup

DTC P0121-P0123, P0222, P0223, OR P2135: THROTTLE 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 P0121

Throttle Position Sensor 1 Performance

DTC P0122

Throttle Position Sensor 1 Circuit Low Voltage

DTC P0123

Throttle Position Sensor 1 Circuit High Voltage

DTC P0222

Throttle Position Sensor 2 Circuit Low Voltage

DTC P0223

Throttle Position Sensor 2 Circuit High Voltage

DTC P2135

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5 V Reference	P06A3, P2135	P2135	P0122, P0222	P06A3, P2135	P0068, P0121
Throttle Position Sensor 1 Signal	P0122	P2135	P0122	P0123	P0068, P0121
Throttle Position Sensor 2 Signal	P0222	P2135	P0223	P0223	P0068, P0121
Low Reference	-	P2135	P0123, P0223	-	P0068, P0121

Typical Scan Tool Data

Throttle Position Sensor 1

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Normal Range: 4.75-0.35 V			
5 V Reference	0 V	0 V	5 V
Throttle Position Sensor 1 Signal	0 V	0 V	5 V
Low Reference	-	4-5 V	-

Throttle Position Sensor 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running at various operating conditions Parameter Normal Range: 0.35-4.65 V			
5 V Reference	0 V	0 V	5 V
Throttle Position Sensor 2 Signal	0 V	5 V	5 V
Low Reference	-	4-5 V	-

Circuit/System Description

The throttle body assembly contains 2 throttle position sensors. The throttle position sensors are mounted to the throttle body assembly and are not serviceable. The throttle position sensors provide a signal voltage that changes relative to throttle blade angle. The engine control module (ECM) supplies the throttle position sensors with a common 5 V reference circuit, a common low reference circuit, and two independent signal circuits.

The throttle position sensors have opposite functionality. throttle position sensor 1 signal voltage decreases and throttle position sensor 2 signal voltage increases as the accelerator pedal increases to wide open throttle (WOT).

Conditions for Running the DTC

P0122, P0123, P0222, and P0223

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

P0121

- DTCs P0102, P0103, P0107, P0108, P0112, P0113, P0114, P0116, P0117, P0118, P0128, P0315, P0335, P0336, or is not set.
- The engine speed is between 400 and 6,000 RPM.

- The engine coolant temperature (ECT) is between -7 to +125Â°C (19-257Â°F).
- The intake air temperature (IAT) is between -20 to +100Â°C (-4 to +212Â°F).
- DTC P0121 runs continuously when the above conditions are met.

P2135

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

Conditions for Setting the DTC

P0121

The ECM detects the throttle position sensor is stuck within range for greater than 1 s.

P0122

The ECM detects the throttle position sensor 1 voltage is less than 0.325 V for greater than 1 s.

P0123

The ECM detects the throttle position sensor 1 voltage is greater than 4.75 V for greater than 1 s.

P0222

The ECM detects that the throttle position sensor 2 voltage is less than 0.25 V for greater than 1 s.

P0223

The ECM detects the throttle position sensor 2 voltage is greater than 4.59 V for greater than 1 s.

P2135

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

Action Taken When the DTC Sets

- DTC P0122, P0123, P0222, P0223, and P2135 are Type A DTCs.
- DTC P0121 is a Type B DTC.
- The ECM 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 P0122, P0123, P0222, P0223, and P2135 are Type A DTCs.
- DTC P0121 is a Type B DTC.

Diagnostic Aids

- A high resistance condition on the throttle position and throttle actuator control circuits could cause a DTC to set.
- If the accelerator pedal is pressed to the wide open throttle position, the throttle blade angle or Throttle Position angle is limited to less than 40 percent.

Reference Information

Schematic Reference

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. If you were sent here from DTC P0068, P0101, P0106, or P1101 refer to Circuit/System Testing.
3. Verify that DTC P0641, P0651, P0697, or P06A3 is not set.
 - **If any of the DTCs are set**

Refer to [DTC P0641, P0651, P0697, or P06A3 \(ECM\)](#) for further diagnosis.
 - **If none of the DTCs are set**
4. 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 %**
5. Verify the scan tool Throttle Position Sensor 1 and Throttle Position Sensor 2 voltage parameters are between 1.0-4.0 V and change with accelerator pedal input.
 - **If not between 1.0-4.0 V or does not change**

Refer to Circuit/System Testing
 - **If between 1.0-4.0 V and changes**
6. Verify the scan tool Throttle Position Sensor 1 and 2 Agree/Disagree parameter displays Agree while performing the Throttle Sweep Test with a scan tool.
 - **If Disagree**

Refer to Circuit/System Testing
 - **If Agree**
7. Determine the current vehicle testing altitude.
8. Verify the scan tool MAP Sensor pressure parameter is within range specified in the [Altitude Versus Barometric Pressure](#) table.
 - **The MAP Sensor pressure is not in range**

Refer to [DTC P0106](#).

- **The MAP Sensor pressure is within range**

9. Engine idling.

10. Verify the scan tool MAP Sensor pressure parameter is between 26-52 kPa (3.8-7.5 psi) and changes with accelerator pedal input.

- **If not between 26-52 kPa (3.8-7.5 psi) or does not change**

Refer to [DTC P0106](#).

- **If between 26-52 kPa (3.8-7.5 psi) and changes**

11. Verify the scan tool MAF Sensor g/s parameter changes smoothly and gradually as the engine speed is increased and decreased while performing the actions listed below.

1. Engine idling
2. Perform the scan tool snapshot function.
3. Increase the engine speed slowly to 3,000 RPM and then back to idle.
4. Exit from the scan tool snapshot and review the data.
5. Observe the MAF Sensor parameter frame by frame with a scan tool.

- **The MAF Sensor parameter does not change smoothly and gradually**

Refer to [DTC P0101](#).

- **The MAF Sensor parameter changes smoothly and gradually**

12. 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.

13. Verify the DTC does not set.

- **If the DTC sets**

Refer to Circuit/System Testing

- **If the DTC does not set**

14. All OK

Circuit/System Testing

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

1. Ignition OFF, and all vehicle systems OFF, disconnect the harness connector at Q38 Throttle Body. 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 C or 6 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 E or 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**
- 5. Ignition ON.
- 6. Test for less than 1 V between the throttle position sensor 1 signal circuit terminal D or 1 and ground.
 - **If 1.0 V or greater**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **If 1.0 V or less**
- 7. Install a 3 A fused jumper wire between throttle position sensor 1 signal circuit terminal D or 1 and the 5 V reference circuit terminal E or 2.
- 8. Verify the scan tool Throttle Position Sensor 1 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 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 4.8 or greater**
- 9. Test for 4.8-5.2 V between the throttle position sensor 2 signal circuit terminal F or 4 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**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the signal circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V, replace the K20 Engine Control Module.
 - **If between 4.8-5.2 V**
- 10. Test or replace the Q38 Throttle Body.

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

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. Ignition OFF and all vehicle systems OFF. It may take up to 2 minutes for all vehicle systems to power down.
5. Ignition ON.
6. Verify the Throttle Position Sensors 1 and 2 Agree/Disagree parameter displays Agree while performing the Throttle Sweep Test with a scan tool.
 - **If Disagree**
Test or replace the Q38 Throttle Body assembly.
 - **If Agree**
7. 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**
8. All OK

DTC P0128: ENGINE COOLANT TEMPERATURE (ECT) BELOW THERMOSTAT REGULATING TEMPERATURE

Diagnostic Instructions

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

DTC Descriptor

DTC P0128

Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature

Diagnostic Fault Information

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

Typical Scan Tool Data

ECT Sensor Temperature

Circuit	Short to Ground	Open	Short to Voltage
Parameter Normal Range: -39 to +139Å°C (-38 to +282Å°F)			
ECT Sensor 1 Signal	140Å°C (284Å°F)	-40Å°C (-40Å°F)	-40Å°C (-40Å°F)
Low Reference	-	-40Å°C (-40Å°F)	-40Å°C (-40Å°F)

Circuit/System Description

NOTE: The engine coolant temperature sensor is referred to as B34A Engine Coolant Temperature Sensor 1 in schematics and other areas.

The engine control module (ECM) monitors the temperature of the engine coolant for engine control and enabling criteria for some diagnostics. The amount of air flow into an engine is proportional to the amount of heat an engine generates. The ECM monitors the amount of air flow into the engine to calculate engine coolant temperature (ECT). The ECM uses the calculated temperature to determine if the engine has warmed up to the thermostat regulating temperature. If the ECT does not increase normally or does not reach the thermostat regulating temperature, diagnostics that use the ECT as enabling criteria, may not run when expected. If the ECT fails to reach the thermostat regulating temperature, before a predetermined amount of air flow enters the engine, the DTC sets.

Conditions for Running the DTC

- DTCs P00B3, P00B6, P0101, P0102, P0103, P0111, P0112, P0113, P0116, P0117 or P0118 are not set.
- The engine OFF time is greater than 30 min.
- The start-up ECT sensor is between -40°C to 74°C (-40°F to 165°F).
- Commanded Thermostat Heater duty cycle is less than 20%.
- Engine run time between 30 s and 30 m.
- The Ethanol in the fuel is less than 87 %.
- The vehicle has traveled greater than 1 kilometer (0.6 miles).
- The DTC runs once per ignition cycle when the above conditions are met.

Conditions for Setting the DTC

- The ECM determines that the modeled ECT has met the calibrated target of 79°C (174°F) and the measured ECT is less than 53°C (127°F) and the start-up ambient temperature is between 10°C and 52°C (50°F and 126°F), for greater than 1 s.

OR

- The ECM determines that the modeled ECT has met the calibrated target of 59°C (138°F) and the measured ECT is less than 13°C (55°F) and the start-up ambient temperature is between -7°C and 10°C (19°F and 50°F), for greater than 1 s.

Action Taken When the DTC Sets

DTC P0128 is a Type B DTC.

Conditions for Clearing the DTC

DTC P0128 is a Type B DTC.

Diagnostic Aids

- DTC P0128 occurring with insufficient vehicle interior heating is an indication of improper thermostat operation.
- Corrosion in the ECT sensor terminals or the ECT harness connector results in a greater voltage on the ECT sensor signal circuit, which is interpreted by the ECM as a colder ECT.
- A slight to moderate resistance in the ECT sensor signal circuit or low reference circuit will affect this diagnostic. This condition results in a greater voltage on the ECT sensor signal circuit, which is interpreted by the ECM as a colder ECT.

Reference Information

Schematic Reference

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

Connector End View Reference

Description and Operation

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

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify the DTC P00B7, P0116, P0117, P0118, P0597, P0598, or P0599 is not set.
 - **If a DTC is set**

Refer to **Diagnostic Trouble Code (DTC) List - Vehicle**
 - **If a DTC is not set**
2. Verify the cooling system is filled to the correct coolant level. Refer to **Cooling System Draining and Filling** , and **Loss of Coolant** .
 - **If the coolant level is not correct**

Repair as necessary
 - **If the coolant level is correct**
3. Engine running for 15 min with the A/C OFF, increase the engine speed to 3, 000 RPM.
4. Verify the scan tool ECT Sensor parameter is greater than 79Â°C (174Â°F) when commanding the Engine Coolant Thermostat Heater to 0%.
 - **If less than 79Â°C (174Â°F)**

Replace the Engine Coolant Thermostat.
 - **If greater than 79Â°C (174Â°F)**
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 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 -39°C (-38°F).

- **If warmer than -39°C (-38°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, replace the K20 Engine Control Module.

- **If colder than -39°C (-38°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 139°C (282°F).

- **If 139°C (282°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 139°C (282°F)**

7. Test the B34 Engine Coolant Temperature Sensor.

Refer to Component Testing.

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. Refer to [Thermostat Diagnosis](#).

Repair Instructions

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

- [Engine Coolant Temperature Sensor Replacement \(Water Outlet\)](#), [Engine Coolant Temperature Sensor Replacement \(Radiator\)](#)
- [Engine Coolant Thermostat Replacement \(2H0\)](#)
- [Control Module References](#) for engine control module replacement, programming and setup.

DTC P0131, P0132, P0134, P0137, P0138, OR P0140: HO2S CIRCUIT

Diagnostic Instructions

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

DTC Descriptors

DTC P0131

HO2S Circuit Low Voltage Sensor 1

DTC P0132

HO2S Circuit High Voltage Sensor 1

DTC P0134

HO2S Circuit Insufficient Activity Sensor 1

DTC P0137

HO2S Circuit Low Voltage Sensor 2

DTC P0138

HO2S Circuit High Voltage Sensor 2

DTC P0140

HO2S Circuit Insufficient Activity Sensor 2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
HO2S High Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P1133*, P015A*, P015B*
HO2S Low Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P1133*, P015A*, P015B*
*If equipped				

Typical Scan Tool Data

HO2S 1 or 2

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Engine operating in Closed Loop Parameter Normal Range: 200-800 mV			
HO2S 1 or 2 High Signal	0 mV	1700-2 100 mV	1700-2 100 mV
HO2S 1 or 2 Low Signal	-	1700-2 100 mV	1700-2 100 mV

Circuit/System Description

The heated oxygen sensors (HO2S) are used for fuel control and catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content of the exhaust stream. When the engine is started, the control module operates in an open loop mode, ignoring the HO2S signal voltage while calculating the air to fuel ratio. While the engine runs, the HO2S heats up and begins to generate a voltage within a range of 0-1 000 mV. Once sufficient HO2S voltage fluctuation is observed by the control module, closed loop is entered. The control module uses the HO2S voltage to determine the air to fuel ratio. An HO2S voltage that increases toward 1 000 mV indicates a rich fuel mixture. An HO2S voltage that decreases toward 0 mV indicates a lean fuel mixture.

The heating elements inside each HO2S heat the sensor to bring the sensor up to operating conditions faster. This allows the system to enter closed loop earlier and the control module to calculate the air to fuel ratio sooner.

Conditions for Running the DTC

DTC P0131 or P0137

- DTCs P0068, P0106, P0108, P0122, P0123, P0201, P0202, P0203, P0204, P0222, P0223, P0442, P0443, P0449, P0452, P0455, P0496, P0606, P16F3 and P2101 are not set.
- The Ignition voltage is between 10-32 V.
- The fuel level is greater than 10%.
- The fuel composition is less than 87% ethanol.
- The fuel system is in Closed Loop.
- The engine is not decelerating.
- DTC P0131 runs continuously when the above conditions are met for greater than 3 s.
- DTC P0137 runs continuously when the above conditions are met for greater than 5 s.

DTC P0132 or P0138

- DTCs P0106, P0108, P0201, P0202, P0203, P0204, P0442, P0443, P0449, P0452, P0453, P0455 and P0496 are not set.
- The Ignition voltage is between 10-32 V.
- The fuel level is greater than 10%.
- The fuel composition is less than 87% ethanol.
- The fuel system is in Closed Loop.
- The engine runtime is greater than 60 s.
- The engine is not decelerating.
- DTC P0132 and P0138 run continuously when the above conditions are met for greater than 3 s.

DTC P0134 or P0140

- DTCs P0068, P0101, P0102, P0103, P0122, P0123, P0222, P0223, P0606 and P16F3 are not set.
- The Ignition voltage is between 10-32 V.
- The heated oxygen sensor heater warm up is completed.
- The engine runtime is greater than 50 s.
- The fuel composition is less than 87% ethanol.
- DTC P0134 and P0140 run continuously when the above conditions are met.

Conditions for Setting the DTC

P0131 or P0137

The engine control module detects that the heated oxygen sensor voltage is less than 20 mV for greater than 38 s.

P0132 or P0138

The engine control module detects that the heated oxygen sensor voltage is greater than 1 050 mV for greater than 10 s.

P0134 or P0140

The engine control module detects that the heated oxygen sensor voltage is greater than 1 700 mV for greater than 10 s.

Action Taken When the DTC Sets

DTCs P0131, P0132, P0134, P0137, P0138 and P0140 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0131, P0132, P0134, P0137, P0138 and P0140 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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 no HO2S heater DTCs are set.
 - **If a HO2S heater DTC is set.**

Refer to **DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141.**
 - **If no HO2S heater DTC is set.**
3. Allow the engine to reach operating temperature, engine running.
4. Verify the scan tool HO2S 1 or 2 voltage parameters are between 50-1 050 mV.
 - **If not between 50-1 050 mV.**

Refer to Circuit/System Testing.
 - **If between 50-1 050 mV.**
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.**

- **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 B52 Heated Oxygen Sensor. It may take up to 2 min for all vehicle systems to power down.
Ignition ON.
2. Test for 1.7-3.0 V between the high signal circuit terminal 4 and ground.
 - **If less than 1.7 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the high 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 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 3.0 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 1.7-3.0 V**
3. Verify the scan tool heated oxygen sensor Bank 1 or 2 Sensor 1 or 2 parameter is between 1.7-2.1 V.
 - **If less than 1.7 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 3 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If between 1.7-2.1 V**
4. Connect a 3 A fused jumper wire between the high signal circuit terminal 4 and the low signal circuit terminal A.

NOTE: The low signal circuit is tied to a pull-up circuit within the engine control module. A voltage of 0.0-1.10 V on the low signal circuit is normal.

5. Verify the scan tool heated oxygen sensor Bank 1 or 2 Sensor 1 or 2 parameter displays 0.0 V.
 - **If greater than 0.0 V**
 1. Ignition OFF, disconnect the harness connector at the K20 Engine Control Module, ignition ON.
 2. 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 .
 3. Test for less than 1 V between the low signal circuit terminal 3 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 0.0 V**
6. Verify none of the following conditions exist:

- Lean or rich fuel injectors. Refer to [Fuel Injector Diagnosis](#).
- Water intrusion in the HO2S harness connector
- Low or high fuel system pressure. Refer to [Fuel System Description](#).
- Fuel that is contaminated. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Fuel saturation of the evaporative emission (EVAP) canister
- Exhaust leaks near the HO2S
- Engine vacuum leaks
- **If any of the conditions exist**

Repair as necessary.

- **If none of the conditions exist**

7. Test or replace the B52 Heated Oxygen Sensor.

Repair Instructions

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

- [Heated Oxygen Sensor Replacement - Sensor 1 \(2H0\)](#).
- [Heated Oxygen Sensor Replacement - Sensor 2 \(2H0\)](#).
- Perform the scan tool Heated Oxygen Sensor Resistance Learn Reset after replacing a HO2S.
- [Control Module References](#) for ECM replacement, programming, and setup

DTC P0133, P1133, P2270, OR P2271: HO2S

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 P0133

HO2S Slow Response Sensor 1

DTC P1133

HO2S Insufficient Switching Sensor 1

DTC P2270

HO2S Signal Stuck Lean Sensor 2

DTC P2271

HO2S Signal Stuck Rich Sensor 2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
HO2S 1 or 2 Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P1133, P2270, P2271
HO2S 1 or 2 Low Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P1133, P2270, P2271

Typical Scan Tool Data

HO2S 1 or 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine operating in Closed Loop Parameter Normal Range: 50-1 050 mV			
HO2S 1 or 2 Signal	0 mV	1700-2 100 mV	1700-2 100 mV
HO2S 1 or 2 Low Signal	-	1700-2 100 mV	1700-2 100 mV

Circuit/System Description

The heated oxygen sensors (HO2S) are used for fuel control and catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content of the exhaust stream. When the engine is started, the control module operates in an open loop mode, ignoring the HO2S signal voltage while calculating the air to fuel ratio. While the engine runs, the HO2S heats up and begins to generate a voltage within a range of 0-1 275 mV. Once sufficient HO2S voltage fluctuation is observed by the control module, closed loop is entered. The control module uses the HO2S voltage to determine the air to fuel ratio. An HO2S voltage that increases toward 1 000 mV indicates a rich fuel mixture. An HO2S voltage that decreases toward 0 mV indicates a lean fuel mixture.

The heating elements inside each HO2S heat the sensor to bring the sensor up to operating conditions faster. This allows the system to enter closed loop earlier and the control module to calculate the air to fuel ratio sooner.

Conditions for Running the DTC

P0133

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0119, P0122, P0123, P0128, P0131, P0132, P0134, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P0442, P0443, P0449, P0452, P0455, P0496, P16F3, P2101 or P2135 is not set.
- The Ignition voltage is between 10-32 V.
- The device controls are not active.
- The engine speed is between 1 200-3 500 RPM.
- The engine coolant temperature (ECT) is hotter than 60°C (140°F).
- The intake air temperature (IAT) is hotter than -40°C (-40°F).
- The barometric pressure (BARO) is greater than 70 kPa (10 PSI).
- The engine run time is greater than 150 s.
- The mass air flow (MAF) is between 8-30 g/s.
- The HO2S heater is commanded ON for greater than 40 s.
- The fuel system is in Closed Loop.
- The vehicle is not decelerating.
- The learned heater resistance is valid.
- The fuel composition is less than 87% ethanol.
- The DTCs run continuously when the above conditions are met for greater than 1 s.

P1133

- DTCs P0068, P0101, P0102, P010, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0120, P0121, P0122, P0123, P0201, P0202, P0203, P0204, P0220, P0222, P0223, P0443, P1516, P2101, P2119, P2135, P2176 are not set.
- The Ignition voltage is between 11-32 V.
- The engine speed is between 1 500-3 500 RPM.
- The ECT is hotter than 70°C (158°F).
- The engine run time is greater than 200 s.
- The fuel system is in Closed Loop.
- The fuel level is greater than 10%.
- The manifold absolute pressure (MAP) is greater than 30 kPa.
- The MAF is between 11-50 g/s.

- The DTCs run continuously when the above conditions are met for greater than 2 s.

P2270

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0119, P0122, P0123, P0128, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P16F3, P2101 or P2135 is not set.
- The Ignition voltage is between 10-32 V.
- The fuel level is greater than 10%.
- The engine speed is between 1 400-3 500 RPM to initially enable the test.
- The vehicle speed is between 45-125 km/h (28-78 mph) to initially enable the test.
- The engine speed is between 1 350-3 650 RPM to keep the test enabled.
- The vehicle speed is between 40-130 km/h (25-81 mph) to keep the test enabled.
- The mass air flow (MAF) is between 2-20 g/s.
- The fuel system is in Closed Loop.
- The evaporative emission (EVAP) diagnostics are not in control of purge.
- The HO2S heater is commanded ON for greater than 40 s.
- The predicted catalyst temperature is between 550-900Â°C (1 022-1 652Â°F).
- DTC P013A, P013B, P013E, P013F, P2270 or P2271 have failed this key cycle.
- The DTC runs once per trip, during the fuel enrich mode, when the above conditions are met for 1.5 s.

P2271

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0116, P0117, P0118, P0119, P0122, P0123, P0128, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P16F3, P2101 or P2135 is not set.
- The Ignition voltage is between 10-32 V.
- The fuel level is greater than 10%.
- The engine speed is between 1 400-3 500 RPM.
- The vehicle speed is between 45-125 km/h (28-78 mph).
- The mass air flow (MAF) is between 2-20 g/s.
- The fuel system is in Closed Loop.
- The evaporative emission (EVAP) diagnostics are not in control of purge.
- The HO2S heater is commanded ON for greater than 40 s.
- The predicted catalyst temperature is between 550-900Â°C (1 022-1 652Â°F).
- DTC P013A, P013B, P013E, P013F or P2270 have failed this key cycle.
- DTC P013A, P013E and P2270 have passed.
- The DTC runs once per trip, during deceleration fuel cut-off mode, when the above conditions are met.

Conditions for Setting the DTC

P0133

- The ECM detects that the HO2S 1 average response time is greater than a calculated value.
- DTC P0133 sets within 60 s when the above condition is met.

P1133

- The ECM detects that the heated oxygen sensor (HO2S) 1 rich to lean counts, or the lean to rich counts are less than a calibrated value.
- DTC P1133 sets within 60 s when the above condition is met.

P2270

- The ECM detects that the heated oxygen sensor (HO2S) 2 sensor cannot achieve voltage less than 775 mV.

and

- The ECM detects that the accumulated mass air flow monitored during the Stuck Lean Voltage Test is greater than a calibrated value.

P2271

- The ECM detects that the heated oxygen sensor (HO2S) 2 sensor cannot achieve voltage greater than 100 mV.

and

- The ECM detects that the accumulated mass air flow monitored during the stuck rich voltage test is greater than a calibrated value.

Action Taken When the DTC Sets

DTCs P0133, P1133, P2270, P2271 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0133, P1133, P2270, P2271 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0)

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 no HO2S heater DTCs are set.

- **If a HO2S heater DTC is set.**

Refer to **DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141.**

- **If no HO2S heater DTC is set.**

3. Allow the engine to reach operating temperature, engine running.
4. Verify the scan tool HO2S 1 or 2 voltage parameters are between 50-1 050 mV.

- **If not between 50-1 050 mV.**

Refer to [DTC P0131, P0132, P0134, P0137, P0138, or P0140](#)

- **If between 50-1 050 mV.**

5. Verify none of the following conditions exist:

- Lean or rich fuel injectors.
- Water intrusion in the HO2S harness connector
- Low or high fuel system pressure.
- Fuel that is contaminated. Refer to [Alcohol/Contaminants-in-Fuel Diagnosis](#).
- Fuel saturation of the evaporative emission (EVAP) canister
- Exhaust leaks near the HO2S
- Engine vacuum leaks
- Engine oil consumptions. Refer to [Oil Consumption Diagnosis](#) .
- Engine coolant consumption. Refer to [Symptoms - Engine Cooling](#) .
- **If any of the above conditions exist**

Repair as necessary.

- **If none of the above conditions exist**

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**

Replace the B52 Heated Oxygen Sensor.

- **If the DTC does not set**

8. All OK.

Repair Instructions

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

- [Heated Oxygen Sensor Replacement - Sensor 1 \(2H0\)](#).
- [Heated Oxygen Sensor Replacement - Sensor 2 \(2H0\)](#).
- Perform the scan tool Heated Oxygen Sensor Resistance Learn Reset after replacing a HO2S.
- [Control Module References](#) for ECM replacement, programming, and setup

DTC P0171 OR P0172: FUEL TRIM 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](#) provides an overview of each diagnostic category.

DTC Descriptors

DTC P0171

Fuel Trim System Lean

DTC P0172

Fuel Trim System Rich

Circuit/System Description

The engine control module (ECM) controls a Closed Loop air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. The ECM monitors the heated oxygen sensor (HO2S) signal voltage, and adjusts the fuel delivery based on the signal voltage while in Closed Loop. A change made to the fuel delivery changes the long and short term fuel trim values. The short term fuel trim values change rapidly in response to the HO2S signal voltages. These changes fine tune the engine fueling. The long term fuel trim values change in response to trends in the short term fuel trim. The long term fuel trim makes coarse adjustments to fueling in order to re-center and restore control to short term fuel trim. The ideal fuel trim values are around 0 %. A positive fuel trim value indicates that the ECM is adding fuel in order to compensate for a lean condition. A negative fuel trim value indicates that the ECM is reducing the amount of fuel in order to compensate for a rich condition.

Conditions for Running the DTC

- DTCs P0030, P0053, P0101, P0102, P0103, P0106, P0107, P0108, P0131-P0135, P015A, P015B, P0178, P0179, P0201-P0204, P0236, P0237, P0238, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300-P0304, P0411, P0442, P0455, P0458, P0496, P0506, P0507, P1133, P1248, P1249, P124A, P124B, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P2227, P2228, P2229, P2230, P2269, P2440, or P2444 are not set.
- The engine is in Closed Loop status.
- The catalyst monitor diagnostic intrusive test, post 02 diagnostic intrusive test, and evaporative emissions system leak test are not active.
- The engine coolant temperature (ECT) is between -20Â°C and +150Â°C (-4Â°F and +302Â°F).
- The intake air temperature (IAT) is between -20Â°C and +150Â°C (-4Â°F and +302Â°F).
- The manifold absolute pressure (MAP) is between 10-255 kPa (1.5-37 psi).
- The engine speed is between 400-7, 000 RPM.
- The mass air flow (MAF) is between 1-512 g/s.
- The barometric pressure (BARO) is greater than 70 kPa (10.2 psi).
- The fuel level is greater than 10 %.
- This diagnostic runs continuously when the above conditions have been met.

Conditions for Setting the DTC

- The average long term fuel trim weighted average value is greater or less than a calibrated value.
- The above condition is present for approximately 3 min after the Conditions for Running the DTC have been met.

Action Taken When the DTC Sets

DTCs P0171 and P0172 are Type B DTCs.

Conditions for Clearing the MIL/DTC

DTCs P0171 and P0172 are Type B DTCs.

Diagnostic Aids

- Allow the engine to reach operating temperature. With the engine running, observe the HO2S parameter with a scan tool. The HO2S value should vary from approximately 40 mV to approximately 900 mV, and respond to fueling changes.
- The normal Short Term Fuel Trim and Long Term Fuel Trim parameters should be between +10 and -10 % with 0 % the optimum, with the engine running at operating temperature.
- Any un-metered air into the engine causes this DTC to set. Thoroughly inspect all areas of the engine for vacuum leaks.
- A MAF sensor condition can cause this DTC without setting a MAF DTC. If there is a MAF sensor condition, the MAF sensor parameters will appear to be within range.
- Verify that the air filter is the correct one for this application, the engine oil fill cap is in place and is tight, and the engine oil dip stick is fully seated.
- 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

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 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 P0171 or P0172 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 P0171 or P0172 is not set.
 - **If any of the DTCs set**
Refer to Circuit/System Testing.
 - **If none of the DTCs set**
6. All OK.

Circuit/System Testing

1. Ignition ON.
2. Verify the manifold absolute pressure sensor is within the range specified for your altitude. Refer to [Altitude Versus Barometric Pressure](#)
 - **If not within the specified range**
Refer to [DTC P0106](#)
 - **If within the specified range**

3. Engine running at the operating temperature.

4. Verify the Long Term Fuel Trim parameter is between -10 % and +10 %.

- **If greater than +10 %**

1. Ignition OFF.

2. Inspect for the conditions listed below:

- Mass air flow (MAF) sensor signal skewed. If the Short Term Fuel Trim parameter changes greater than 20 % when the MAF sensor is disconnected, refer to [**DTC P0101**](#).
- Fuel contamination. Refer to [**Alcohol/Contaminants-in-Fuel Diagnosis**](#).
- Missing, restricted, or leaking exhaust components.
- Malfunctioning fuel injectors. Refer to [**Fuel Injector Diagnosis**](#).
- Split, kinked, or improperly connected vacuum hoses
- Insufficient fuel in the tank
- Low fuel pressure. Refer to [**Fuel System Diagnosis**](#).
- Vacuum leaks at the intake manifold, the throttle body, and the injector O-rings.
- Leaks in the air induction system and the air intake ducts
- Missing air filter element
- Cracked EVAP canister
- Evaporative pipes obstructed or leaking
- Leaks in the crankcase ventilation system. Refer to [**Crankcase Ventilation System Inspection/Diagnosis**](#).
 - If a condition is found, repair as necessary.
 - If no condition is found, inspect the engine for a mechanical condition. Refer to [**Symptoms - Engine Mechanical**](#).

- **If less than -10 %**

1. Ignition OFF.

2. Inspect for the conditions listed below:

- Mass air flow (MAF) sensor signal skewed. If the Short Term Fuel Trim parameters for both banks changes greater than 20 % when the MAF sensor is disconnected, refer to [**DTC P0101**](#).
- Fuel contamination. Refer to [**Alcohol/Contaminants-in-Fuel Diagnosis**](#).
- Missing, restricted, or leaking exhaust components.
- Malfunctioning fuel injectors. Refer to [**Fuel Injector Diagnosis**](#)
- Collapsed or restricted air intake duct
- Excessive fuel pressure. Refer to [**Fuel System Diagnosis**](#)
- Dirty or restricted air filter
- Objects blocking the throttle body
- Improper operation of the evaporative emissions control system
- Excessive fuel in the crankcase. Change the engine oil as necessary.
 - If a condition is found, repair as necessary.
 - If no condition is found, inspect the engine for a mechanical condition. Refer to [**Symptoms - Engine Mechanical**](#).

- **If between -10 % and +10 %**

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 DTC P0171 or P0172 is not set.

- **If any of the DTCs set**

Refer to conditions listed above.

- **If none of the DTCs set**

7. All OK.

Repair Instructions

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

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

DTC P0201, P0202, P0203, P0204, P0261, P0262, P0264, P0265, P0267, P0268, P0270, OR P0271: CYLINDER INJECTOR 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 P0201

Cylinder 1 Injector Control Circuit

DTC P0202

Cylinder 2 Injector Control Circuit

DTC P0203

Cylinder 3 Injector Control Circuit

DTC P0204

Cylinder 4 Injector Control Circuit

DTC P0261

Cylinder 1 Injector Control Circuit Low Voltage

DTC P0262

Cylinder 1 Injector Control Circuit High Voltage

DTC P0264

Cylinder 2 Injector Control Circuit Low Voltage

DTC P0265

Cylinder 2 Injector Control Circuit High Voltage

DTC P0267

Cylinder 3 Injector Control Circuit Low Voltage

DTC P0268

Cylinder 3 Injector Control Circuit High Voltage

DTC P0270

Cylinder 4 Injector Control Circuit Low Voltage

DTC P0271

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	P0201*, P0202*, P0203*, P0204*, P0261*, P0264*, P0267*, P0270*	P0201**, P0202**, P0203**, P0204**, P0261**, P0264**, P0267**, P0270**	-	-
Injector 1 Control	P0201, P0261	P0201, P0300	P0262, P0300	-
Injector 2 Control	P0202, P0264	P0202, P0300	P0265, P0300	-
Injector 3 Control	P0203, P0267	P0203, P0300	P0268, P0300	-
Injector 4 Control	P0204, P0270	P0204, P0300	P0271, P0300	-
* Open fuse, cranks no start. ** Cranks no start if the condition is between the fuse and the splice.				

Circuit/System Description

The engine control module (ECM) enables the appropriate fuel injector pulse for each cylinder. Ignition voltage is supplied to the fuel injectors. The ECM controls each fuel injector by grounding the control circuit via a solid state device called a driver. The ECM monitors the status of each driver. If the ECM detects an incorrect voltage for the commanded state of the driver, a fuel injector control circuit DTC sets.

Conditions for Running the DTC

- The engine is running for greater than 1 s.
- The ignition voltage is greater than 11 V.
- The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

The control module detects an incorrect voltage on the fuel injector control circuit for more than 5 s.

Action Taken When the DTC Sets

DTCs P0201, P0202, P0203, P0204, P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0201, P0202, P0203, P0204, P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type B DTCs.

Diagnostic Aids

Performing the Fuel Injector Diagnosis may help isolate an intermittent condition. Refer to [Fuel Injector Diagnosis](#).

Reference Information

Schematic Reference

[Engine Controls Schematics \(Chevrolet with 2H0\)](#)

Connector End View Reference

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tool

CH 34730-2C Noid Light, if available

Circuit/System Verification

1. Engine cranking or running.
2. Verify the scan tool parameters listed below do not display Malfunction.
 - Cylinder 1-4 Injector Control Circuit Low Voltage Test Status
 - Cylinder 1-4 Injector Control Circuit Open Test Status
 - Cylinder 1-4 Injector Control Circuit High Voltage 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, disconnect the harness connector at the appropriate Q17 Fuel Injector, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminal 1 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 Ω in the ignition circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp, and disconnect all components on the circuit.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.

- If infinite resistance
3. Replace the fuse, ignition ON.
 4. Verify the fuse is good after connecting each of the components one at a time.
 - If the fuse opens, replace the component that opens the fuse when connected.
 - If the fuse is good, all OK.
 - **If the test lamp illuminates**
3. Ignition OFF, connect the test lamp to the affected fuel injector connector.
 4. Engine cranking.
 5. Verify the test lamp turns ON and OFF.
 - **If the test lamp is always OFF**
 1. Ignition OFF, remove the test lamp, disconnect the X2 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the control circuit and ground.
 - If 1 V or greater, repair the short to voltage on the circuit.
 - If less than 1 V
 3. Ignition OFF.
 4. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If the test lamp is always ON**
 1. Ignition OFF, remove the test lamp, 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, replace the K20 Engine Control Module.
 - **If the test lamp turns ON and OFF**
 6. Test or replace the appropriate Q17 Fuel Injector.

Component Testing

Fuel Injector Diagnosis

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Injector Replacement (2H0)
- Control Module References for Engine Control Module replacement, programming, and setup

DTC P0300-P0304: ENGINE/CYLINDER MISFIRE 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 Descriptors

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

The engine control module (ECM) uses information from the crankshaft position sensor and the camshaft position sensor to determine when a engine cylinder misfire is occurring. By monitoring variations in the crankshaft rotation speed for each cylinder, the ECM can detect individual cylinder misfire events.

Extreme cylinder misfire events can cause catalytic converter damage. The malfunction indicator lamp (MIL) will flash when the conditions for catalytic converter damage are present. DTCs P0301 through P0304 correspond to cylinders 1 through 4. When the ECM detects that one or more specific cylinders are misfiring, the DTC for the respective misfiring cylinder will set and up to 2 of the corresponding fuel injectors are disabled for a minimum of 30 s. The ECM will then re-enable the fuel injector and, after approximately 200 engine revolutions, will determine if the misfire is still present. If the misfire is still present, the ECM will disable the fuel injector again repeating the process. If the misfire is not present, the fuel injector will remain enabled by the ECM. In Spark Ignition Direct Injection (SIDI) system applications, if a fuel injector fault DTC is set during a misfire event, the ECM will not re-enable the injector.

Conditions for Running the DTC

- DTCs P0016, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0222, P0223, P0315, P0335, P0336, P0502, P0651, and P2135 are not set.
- The engine speed is greater than 1000 RPM.
- The crankshaft and camshaft are synchronized.
- The ignition voltage is between 11-18 V.
- The engine coolant temperature (ECT) sensor is between -7 to +125°C (+19 to +257°F).
- The A/C compressor clutch is not changing states.
- The fuel tank level is greater than 15%.
- The ECM is not in fuel cut-off or deceleration fuel cut-off mode.
- The ECM is not receiving a rough road signal.
- The throttle angle is steady within 5%.
- The throttle angle is greater than 3% when the vehicle speed is greater than 5 km/h (3 MPH).
- The transmission is not changing gears.
- The antilock brake system (ABS) and the traction control system, if equipped, is not active.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P0300

The ECM 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, or P0304

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

Action Taken When the DTC Sets

- DTCs P0300, P0301, P0302, P0303 and P0304 are Type B DTCs.
- The malfunction indicator lamp (MIL) will flash when the conditions for catalytic converter damage are present.

Conditions for Clearing the DTC

DTCs P0300, P0301, P0302, P0303 and P0304 are Type B DTCs.

Diagnostic Aids

- A misfire DTC could be caused by an excessive vibration from sources other than the engine. Inspect for the following possible sources:
 - A tire or wheel that is out of round or out of balance
 - Variable thickness brake rotors
 - An unbalanced drive shaft
 - Certain rough road conditions
 - Transmission operation
 - Cracked Spark Plug Insulators
 - Broken or weak valve spring
 - A damaged or defective accessory drive component or belt; remove the belt and safely operate the engine to evaluate if misfire counts go away.
- High resistance in the circuits of the injectors may set a misfire DTC without setting an injector DTC. Test the injector circuits of the affected cylinder(s) for a high resistance if you suspect a condition.
- If the condition is intermittent, observing the scan tool IC Circuit Test and Fuel Injector Circuit Test Status parameters may help isolate the condition. The circuit test status parameters will change from OK or Not Run to Fault/Malfunction if a condition exists.
- A condition in the heated O2 sensor (HO2S) heater control circuits may set a DTC P0300.

Reference Information

Description and Operation

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

DTC Type Reference

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

Scan Tool Reference

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

Special Tools

EL 26792 HEI Spark Tester

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

Circuit/System Verification

NOTE: Before starting the engine, review the freeze frame failure records data to determine if the misfire sets during a cold start or at operating temperature. If there is a cold start condition and the engine is started, the engine will need to be cooled down before the next attempt to start the engine within the fail conditions.

1. Engine Running at normal operating temperature.
2. Verify there is no abnormal engine noise.
 - **If abnormal engine noise is present**
Refer to [Symptoms - Engine Mechanical](#).
 - **If abnormal engine noise is not present**
3. Perform the scan tool [Crankshaft Position Variation Learn](#) procedure.
4. Verify no DTCs are set.
 - **If any DTCs other than P0300-P0304 are set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - **If DTC P0300-P0304 is set**
Refer to Circuit/System Testing.
 - **If no DTCs are set**
5. Verify the scan tool Cylinder 1-4 Current Misfire Counter parameters do not increment.
 - **If increments**
Refer to Circuit/System Testing.
 - **If does not increment**
6. Engine Running, perform the Cylinder Power Balance Test with a scan tool.
7. Verify the engine speed changes when each injector is disabled and then enabled.
 - **If engine speed does not change**
Refer to Circuit/System Testing.
 - **If engine speed does change**
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

1. Verify none of the following conditions listed below exist:
 - Damage, carbon tracking, or fluid intrusion of the spark plug boots and/or spark plugs
 - Vacuum hose splits, kinks, and incorrect connections
 - Engine vacuum leaks
 - Crankcase ventilation system for vacuum leaks
 - Fuel pressure that is too low or too high. Refer to [Fuel System Diagnosis](#).
 - Contaminated fuel
 - Exhaust system restrictions
 - **If a condition exists**
Repair or replace as necessary.
 - **If no conditions exist**

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

2. Ignition OFF, remove the K35 Ignition Coil Module from the spark plugs and connect the **EL 26792** HEI Spark Tester to the appropriate spark plug boot, engine Cranking.

3. Verify the spark output.

- **If no output or the output is weak**

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

- **If the output is good**

4. Ignition OFF.

5. Verify the conditions listed below. Refer to [Ignition System Specifications](#) .

- The correct spark plug type
- The correct spark plug gap
- The correct spark plug torque
- **If a condition exists**

Repair or replace as necessary.

- **If no conditions exist**

6. Exchange the suspect spark plug with another cylinder that is operating correctly.

7. Engine Running.

8. Verify the scan tool Cylinder 1-4 Current Misfire Counter does not increment for the cylinder where the suspect spark plug was installed.

- **If increments**

Replace the spark plug.

- **If does not increment**

9. Test or inspect for the conditions listed below:

- A lean or rich Q17 Fuel Injector-Refer to [Fuel Injector Diagnosis](#).
- An engine mechanical condition-Refer to [Symptoms - Engine Mechanical](#) .

Repair Instructions

- [Ignition Coil Replacement](#)
- [Spark Plug Replacement](#)

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Turn OFF the ignition for 60 s.
5. If the repair was related to a DTC, duplicate the Conditions for Running the DTC and use the Freeze Frame/Failure Records, if applicable, in order to verify the DTC does not reset. If the DTC resets or another DTC is present, refer to the [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) and perform the appropriate diagnostic procedure.
6. Engine Running, verify the scan tool Cylinder 1-4 Current Misfire Counter parameters do not increment.
 - If the misfire counter parameters increment, a misfire condition still exists.
7. To verify that the performance of the catalytic converter has not been affected by the condition that set this DTC, perform the Repair Verification for DTC P0420. Refer to [DTC P0420](#).

DTC P0315: CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED

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 P0315

Crankshaft Position System Variation Not Learned

Circuit/System Description

The crankshaft position variation learn feature 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 engine control module (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 conditions.

The crankshaft position system variation compensating values are stored in ECM memory after a learn procedure has been performed and the ignition switch is turned to the OFF position for at least 30 s. If the actual variation is not within the crankshaft position system variation compensating values stored in the ECM, DTC P0300 may set.

If the crankshaft position system variation values are not stored in the ECM memory or a proper ECM power down does not occur after completing the Crankshaft Position Learn Procedure, DTC P0315 sets.

Conditions for Running the DTC

Engine is Running.

The DTC runs continuously when the above condition is met.

Conditions for Setting the DTC

The ECM detects that the crankshaft position system variation values are not stored in memory.

Action Taken When the DTC Sets

DTC P0315 is a Type A DTC.

Conditions for Clearing the DTC

DTC P0315 is a 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](#) for scan tool information

Circuit/System Verification

1. Perform the scan tool [Crankshaft Position Variation Learn](#) procedure.
2. 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.
3. Verify the DTC is not set.

- If the DTC sets

Replace the K20 Engine Control Module.

- If the DTC does not set

4. All OK

Repair Instructions

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

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

DTC P0324, P0326, OR P06B6: KNOCK SENSOR 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 Descriptors

DTC P0324

Knock Sensor System Performance

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 -40Â°C (-40Â°F).
- The intake air temperature (IAT) sensor 1 is warmer than -40Â°C (-40Â°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 \(2H0\)](#)
- [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**

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
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 -40°C (-40°F) or warmer.
- The intake air temperature (IAT) sensor is -40°C (-40°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 \(Chevrolet with 2H0\)](#)

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](#)

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 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 \(2H0\)](#)
- [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
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 a magnetic biased digital output integrated circuit sensing device. The sensor detects magnetic flux changes of invisible magnetic segments on the edge of the crankshaft position reluctor ring mounted on the crankshaft. Each magnetic segment on the ring is spaced at a 60 segment spacing with 2 missing spaces for a 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 position reluctor ring to the ECM as each segment on the ring rotates past the crankshaft position sensor. The ECM uses each crankshaft position signal pulse to determine crankshaft speed and decodes the crankshaft position reluctor ring 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

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

Condition 2

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

Condition 3

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

P0336 Condition 1

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

Condition 2

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

Condition 3

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

OR

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

Condition 4

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

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 ring for greater than 0.4 s.

Condition 3

The ECM does not detect the synchronization gap on the reluctor ring 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, if applicable.

Conditions for Clearing the DTC

DTCs P0335 and P0336 are Type B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0).

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 (ECM).
 - **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 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 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 1 and ground.
 - **If less than 4.8 V**
 1. Ignition OFF, disconnect the X2 harness connector at the K20 Engine Control Module.
 2. Test for infinite resistance between the signal circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance.
 3. Test for less than 2 Ω in the signal circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , replace the K20 Engine Control Module.
 - **If greater than 5.2 V**
 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 1, 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**

NOTE: The crankshaft position reluctor ring is magnetic and may be functionally damaged if any magnetic object comes in contact with it. This type of damage is not visually detectable but will set the DTC.

1. Inspect for the conditions listed below:

- Excessive play or looseness of the B26 Crankshaft Position Sensor or the crankshaft position reluctor ring
- Improper installation of the B26 Crankshaft Position Sensor
- Foreign material passing between the B26 Crankshaft Position Sensor and the crankshaft position reluctor ring
- Damaged crankshaft position reluctor ring
- Excessive air gap between the B26 Crankshaft Position Sensor and the crankshaft position reluctor ring
- Timing chain or belt, tensioner, and sprockets for wear or damage
- If a condition is found

Repair or replace as necessary.

- If a condition is not found

2. Replace the B26 Crankshaft Position Sensor.

3. Clear the DTC and test drive the vehicle.

4. Verify the DTC is not set.

- If the DTC is set, replace the crankshaft position reluctor ring.
- If the DTC is not set, all OK.

- **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	P0340, P0365, P0532, P0641	P0340	P0641	-
Signal	P0340	P0340	P0340	P0341, P0366
Low Reference	-	P0340	-	-

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 (Chevrolet with 2H0).

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 P0641 or P0651 is not set.

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

Refer to DTC P0641, P0651, P0697, or P06A3 (ECM).

- **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. 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 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 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 (Chevrolet with 2H0)

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 DTCs 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 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

- DTC P0016, P0017, P0030, P0036, P0053, P0054, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P013A, P013B, P013E, P013F, P0140, P0141, P015A, P015B, P0171, P0172, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0340, P0341, P0365, P0366, P0443, P0506, P0507, P0606, P0697, P06A3, P16F3, P2101, P2122, P2123, P2127, P2128, P2135, P2138, P2270 or P2271 is not set.
- Before the ECM performs the idle test, the vehicle must be driven under the conditions listed below:
 - The engine speed is greater than 1,100 RPM.
 - The engine run time is greater than a calibrated value
 - Both conditions exist for at least 5 s
- The vehicle speed is less than 2 km/h (1.24 mph).
- Driver's foot is off accelerator pedal
- The throttle is in the rest position.
- The run/crank voltage is greater than 11 V.
- The intake air temperature (IAT) is between -20 to +250°C (-4 to +482°F).
- The engine coolant temperature (ECT) is between 40-140°C (104-284°F).
- The engine has been idling less than 50 s.
- The short term fuel trim is between 0.8-1.3 %.
- The barometric pressure (BARO) is greater than 70 kPa.
- The intake mass air flow (MAF) is between 1.5-7.0 g/s.
- The engine is operating in closed loop.
- The calculated catalyst temperature is between 550-950°C (1,022-1,742°F).
- The Evaporative Emission (EVAP), Fueltrim, Post O2, or other intrusive tests are not active
- The transmission is not in P/N (automatic transmission only).
- This diagnostic attempts one test during each valid idle period once the above conditions have been met. This diagnostic attempts up to 8 tests during each drive cycle.

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:

- An engine misfire
- High engine oil or high coolant consumption
- Retarded spark timing
- A weak or poor spark
- A lean fuel mixture
- A rich fuel mixture
- A damaged oxygen sensor or wiring harness

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 a DTC is set**
Refer to [Diagnostic Trouble Code \(DTC\) List - Vehicle](#).
 - **If a DTC is not 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 Pass 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 the Catalyst Monitor Test Result parameter indicates No Result**
Repeat steps 3-6 until the Test Result parameter indicates Passed or Failed
 - **If the Catalyst Monitor Test Result parameter indicates Failed**
Refer to Circuit /System Testing
 - **If the Catalyst Monitor Test Result parameter indicates Pass**
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(s).

- **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. Test or replace the catalytic converter and the exhaust front pipe.

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.

- [Catalytic Converter Replacement \(2H0\)](#)
- [Exhaust Front Pipe Replacement \(2H0\)](#)
- [Heated Oxygen Sensor Replacement - Sensor 2 \(2H0\)](#)

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 Pass 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 the Catalyst Monitor Test Result parameter indicates No Result

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

- If the Catalyst Monitor Test Result parameter indicates Failed

Refer to Circuit /System Testing

- If the Catalyst Monitor Test Result parameter indicates Pass

9. All OK.

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	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 (Chevrolet with 2H0).

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 Valve 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 scan tool 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 a test lamp illuminates between the ignition 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, and disconnect all components on the circuit.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance
 3. Replace the fuse, ignition ON.
 4. Verify the fuse is good after connecting each of the components one at a time.
 - If the fuse opens, replace the component that opens the fuse when connected.
 - If the fuse is good, all OK.
 - **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 scan tool EVAP Purge Solenoid Valve Control Circuit High Voltage Test Status parameter is OK when commanding the EVAP Purge Solenoid Valve to 50% with a scan tool.
 - **If OK is not displayed**
 1. Ignition OFF, disconnect the 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 scan tool EVAP Purge Solenoid Valve Control Circuit High Voltage Test Status parameter is Malfunction when commanding the EVAP Purge Solenoid Valve to 50% with a scan tool.
 - **If Malfunction is not displayed**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the control circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω replace the K20 Engine Control Module.
 - **If Malfunction is displayed**
8. Test or replace the Q12 Evaporative Emission Purge Solenoid Valve.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the Q12 Evaporative Emission Purge Solenoid Valve.
2. Test for 10-30 Ω between the control terminal 1 and the ignition 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 and off/clicks and flows vacuum.
 - **If it does not turn on and off/click or flow vacuum**

Replace the Q12 Evaporative Emission Purge Solenoid Valve.

- If it does turn on and 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 \(2H0\)](#)
- [Control Module References](#) for ECM replacement, programming and setup

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

- DTCs P057C, or P057D are not set.
- Ignition voltage is greater than 10 V.
- Shift lever has been in Park at least once during key ON.
- Shift lever is not in Park.
- Vehicle speed is 8 km/h (5 MPH) or greater.
- Accelerator Pedal Position is less than 5 %.
- DTC runs continuously 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 BPP sensor signal is stuck in a range.

P057C

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

P057D

ECM detects the BPP sensor voltage is greater than 4.75 V for 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 \(Chevrolet with 2H0\)](#)
- [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 \(ENCORE\)](#)

- [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 in the ECM displays 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 displays less than 4.75 V when the brake pedal is fully applied.
 - **If the voltage does not change, or is greater than 4.74 V**
Refer to Circuit/System Testing.
 - **If the voltage changes and less than 4.75 V**
6. Verify the scan tool Brake Pedal Position Sensor Learned Release Position parameter is within 0.1 V of the Brake Pedal Position Sensor parameter when the brake pedal is fully released.
 - **If difference is greater than 0.1 V**
Perform the [Brake Pedal Position Sensor 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 P2610: CONTROL MODULE/VIN NOT PROGRAMMED OR MISMATCHED (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

Control Module Redundant Memory Performance

DTC P2610

Control Module Ignition 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, or P0108 are not set.
- DTC P16F3 runs continuously when the above conditions are met.

P2610

DTC P2610 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.
- DTCs P062F is a Type C DTC.
- DTCs P2610 is a Type B DTC.

Conditions for Clearing the MIL/DTC

- DTCs P0601, P0602, P0603, P0604, P0606, P0630, and P16F3 are Type A DTCs.
- DTCs P062F is a Type C DTC.
- DTCs P2610 is a Type B DTC.

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.
- The ECM ground circuits do not have an open or high resistance.
- The ECM power circuits do not have an open, short to ground, or high resistance.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Chevrolet with 2H0\)](#)

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
 - 3. All OK.
 - **If none of the DTCs are set**
4. Verify DTC P0601, P0603, P0604, P0606, P062F, P16F3, or P2610 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 P0627-P0629: FUEL PUMP RELAY 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 P0627

Fuel Pump Relay Control Circuit Open

DTC P0628

Fuel Pump Relay Control Circuit Low Voltage

DTC P0629

Fuel Pump Relay Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Fuel Pump Relay Control	P0628	P0627	P0629	-

Circuit/System Description

The engine control module (ECM) provides ignition voltage to the coil side of the fuel pump relay whenever the engine is cranking or running. The ECM enables the fuel pump relay as long as the engine is cranking or running. The fuel pump relay control circuit is equipped with a feedback circuit that is pulled up to voltage within the ECM. The ECM can determine if the control circuit is open, shorted to ground, or shorted to voltage by monitoring the feedback voltage.

Conditions for Running the DTC

- The engine speed is greater than 0 RPM.
- The ignition voltage is greater than 11 V.
- The DTCs run continuously when the conditions above are met.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTCs P0627, P0628, and P0629 are Type C DTCs.

Conditions for Clearing the DTC

DTCs P0627, P0628, and P0629 are Type C DTCs.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Chevrolet with 2H0\)](#)

Connector End View Reference

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

- [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 scan tool parameters listed below do not display Malfunction when commanding the Fuel Pump ON and OFF.
 - Fuel Pump Relay Control Circuit Low Voltage Test Status
 - Fuel Pump Relay Control Circuit Open Test Status
 - Fuel Pump Relay Control Circuit High Voltage 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 KR23A Fuel Pump Relay. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 86 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Verify that a test lamp does not illuminate between the control circuit terminal 85 and ground.
 - **If the test lamp illuminates**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module, ignition ON.
 2. Test for less than 1 V between the 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 Relay Control Circuit Low Voltage Test Status parameter is OK when commanding the Fuel Pump Relay 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 85 and the ground circuit terminal 86.
 7. Verify the scan tool Fuel Pump Relay Control Circuit Low Voltage Test Status parameter is Malfunction when commanding the Fuel Pump Relay 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 KR23A Fuel Pump Relay.

Repair Instructions

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

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

DTC P0641, P0651, P0697, OR P06A3: 5V REFERENCE (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 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 5V reference circuit can affect all the components connected to the same internal 5V reference circuit.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

P0641

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

- Air conditioning (A/C) refrigerant pressure sensor
- Exhaust and intake camshaft position sensors
- Transmission output shaft speed sensor (manual transmission)

P0651

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

- Brake pedal position sensor (automatic transmission)
- Clutch pedal position sensor (manual transmission)
- Crankshaft position 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 (Chevrolet with 2H0).

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

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

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

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

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

[Circuit/System Verification](#)

1. Ignition ON.
2. Verify all scan tool 5V Reference 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 that 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 \(2H0\)](#)
- [Brake Pedal Position Sensor Replacement](#)
- [Camshaft Position Sensor Replacement](#)
- [Clutch Pedal Position Sensor Replacement](#)
- [Crankshaft Position Sensor Replacement](#)
- [Manifold Absolute Pressure Sensor Replacement \(2H0\)](#)
- [Throttle Body Assembly Replacement](#)
- [Control Module References](#) for engine control module replacement, programming, and setup.

DTC P0660, P0661, OR P0662: INTAKE MANIFOLD TUNING CONTROL 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 P0660

Intake Manifold Tuning Control Valve Control Circuit

DTC P0661

Intake Manifold Tuning Control Valve Control Circuit Low Voltage

DTC P0662

Intake Manifold Tuning Control Valve Control Circuit High Voltage

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
Ignition Voltage	P0031, P0037, P0135, P0141, P0443, P0597, P0598, P0660, P0661	-	P0660	-	-
Control	P0660, P0661	-	P0660	P0662	-

Circuit/System Description

The intake manifold tuning valve controls the length of the intake runners in the intake manifold. The intake manifold contains both long and short runners. The tuning valve controls only the short runners. When the valve is closed, the short runners are blocked, which forces the air through the long runners. This results in tuning effects in the manifold that increases the torque produced by the engine at lower engine speeds. When the valve is open, both the long runners and short runners are open, but the majority of the air travels through the short runners, since the air will naturally follow the shortest path into the cylinder. This allows the air to flow through the short runners, which results in increased torque at higher engine speeds.

Ignition voltage is supplied directly to the intake manifold tuning 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 signal.

Conditions for Running the DTC

- Engine speed is at least 400 RPM.
- The battery voltage is at least 11 V.
- DTCs P0660, P0661 and P0662 run continuously when the above conditions are met.

Conditions for Setting the DTC

P0660

The ECM detects an open circuit on the intake manifold tuning valve control circuit for greater than 0.5 s.

P0661

The ECM detects a short to ground or an open circuit on the intake manifold tuning valve control circuit for greater than 0.5 s.

P0662

The ECM detects a short to voltage on the intake manifold tuning valve control circuit for greater than 0.5 s.

Action Taken When the DTC Sets

DTCs P0660, P0661 and P0662 are Type B DTCs.

Conditions for Clearing the DTC

DTCs P0660, P0661 and P0662 are Type B DTCs.

Reference Information

[Engine Controls Schematics \(Chevrolet with 2H0\).](#)

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. Engine running.
2. Verify a click is heard or felt from the Q22 Intake Manifold Tuning Solenoid Valve when commanding the Intake Manifold Tuning Control Valve Open and Closed with a scan tool.
 - **If a click is not heard or felt**
Refer to Circuit/System Testing
 - **If a click is heard or felt**
3. Verify the circuit status parameters listed below do not display Malfunction when commanding the Intake Manifold Tuning Control Valve Open and Closed with a scan tool:
 - Intake Manifold Tuning Control Valve Control Circuit High Voltage Test Status
 - Intake Manifold Tuning Control Valve Control Circuit Open Test Status
 - Intake Manifold Tuning Control Valve Control Circuit Low 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.
 - **If a DTC sets**
Refer to Circuit/System Testing
 - **If a DTC does not set**
5. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the Q22 Intake Manifold Tuning Solenoid Valve. Ignition On.
2. Verify that a test lamp illuminates between the ignition 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.

NOTE: An internal short in any component supplied by the fuse may cause the fuse to open and set a DTC when the component is activated.

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 control circuit terminal 1 and the ignition circuit terminal 2.

• **If the test lamp illuminates**

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 the test lamp does not illuminate**

4. Remove the test lamp.

5. Verify the Intake Manifold Tuning Control Valve Control Circuit High Voltage Test Status parameter is OK when commanding the Intake Manifold Tuning Control Valve Open 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 Intake Manifold Tuning Control Valve Control Circuit High Voltage Test Status parameter is Malfunction when commanding the Intake Manifold Tuning Control Valve Open with a scan tool.

• **If Malfunction is not displayed**

1. Ignition Off, 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 Q22 Intake Manifold Tuning Solenoid Valve.

Repair Instructions

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

- [Intake Manifold Tuning Valve Actuator Replacement \(2H0\)](#)
- [Control Module References](#) for Engine Control Module replacement, programming, and setup.

DTC P0685-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 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	P0689, P1682	-
Relay Control Circuit	P0690	P0689, P1682	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	-
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

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

P0687

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

P0689

- 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

- The engine controls ignition relay is commanded OFF.
- The DTC runs continuously when the above conditions are met.

P1682

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

Conditions for Setting the DTC

P0687

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

P0689

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

P0690

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

P1682

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

Action Taken When the DTC Sets

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

Conditions for Clearing the DTC

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

Diagnostic Aids

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

Reference Information

Schematic Reference

- [Engine Controls Schematics \(Chevrolet with 2H0\)](#)
- [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

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

Scan Tool Reference

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

Circuit/System Verification

NOTE:

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

1. Ignition ON, command the engine controls ignition relay ON and OFF with a scan tool while observing the following parameters:

- Engine Controls Ignition Relay Control Circuit Low Voltage Test Status
- Engine Controls Ignition Relay Control Circuit Open Test Status
- Engine Controls Ignition Relay Control Circuit High Voltage Test Status

Each parameter should display OK or Not Run in each commanded state.

- **If Malfunction is displayed**

Refer to Circuit/System Testing.

- **If Malfunction is not displayed**

2. Verify DTC 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 any of the DTCs are set**

Refer to Circuit/System Testing.

- **If none of the DTCs are 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 relay circuit terminals listed below:

- Terminal 86
- 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 X1 harness connector at the K20 Engine Control Module.

2. Ignition ON.

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

- 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 relay switch B+ circuit terminal 30 and the relay switch ignition voltage circuit terminal 87.

6. Ignition ON.
7. Verify the scan tool Engine Controls Ignition Relay Feedback Signal parameter displays B+.
 - **If B+ is not displayed**
 1. Ignition OFF, disconnect the X1 harness connector at the K20 Engine Control Module.
 2. Test for less than 2 Ω in the relay switch ignition voltage circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω
 3. Test for infinite resistance between the relay switch ignition voltage circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, replace the K20 Engine Control Module.
 - **If B+ is displayed**
8. Ignition OFF, connect a DMM, set to the diode setting, between control circuit terminal 85 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 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

Scan Tool Reference

[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 P1380 OR P1381: MISFIRE 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](#) provide an overview of each diagnostic category.

DTC Descriptors

DTC P1380

Misfire Detected and Rough Road Data Not Available

DTC P1381

Misfire Detected and No Communication with Brake Control Module

System Description

The engine control module (ECM) detects engine misfire by detecting variations in crankshaft deceleration between firing strokes. For accurate detection of engine misfire, the ECM must distinguish between crankshaft deceleration caused by actual misfire and deceleration caused by rough road conditions. The antilock brake system (ABS) can detect if the vehicle is on a rough road based on wheel acceleration/deceleration data supplied by the wheel speed sensors. If the electronic brake control module (EBCM) detects rough road above a predetermined threshold, this information is sent to the ECM. The ECM uses the rough road information when calculating engine misfire. If the ABS is malfunctioning and cannot detect rough roads, the misfire diagnostic will continue to run; however, if an engine misfire DTC sets, this DTC also sets indicating that rough road data was not available or there was no communication with the EBCM during the misfire calculation due to an ABS malfunction.

Conditions for Running the DTC

- The vehicle speed is greater than 8 km/h (5 mph).
- The engine speed is less than 7,000 RPM.
- The engine load is less than 60 percent.
- Engine misfire is detected and DTC P0300 sets with the MIL illuminated.

The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P1380

- The EBCM sends a message to the ECM indicating that a failure has occurred in the EBCM.
- Engine misfire is detected and DTC P0300 set.

P1381

- An ABS malfunction exists for more than 10 s preventing the ECM from receiving rough road detection data.
- Engine misfire is detected and DTC P0300 set.

Action Taken When the DTC Sets

DTCs P1380 and P1381 are Type C DTCs.

Conditions for Clearing the DTC

DTCs P1380 and P1381 are Type C DTCs.

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

Verify there are no ABS DTCs set.

- If ABS DTCs are set

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

- If ABS DTCs are not set

Refer to [Symptoms - Antilock Brake System](#) .

Repair Instructions

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

DTC P150C: TRANSMISSION CONTROL MODULE ENGINE SPEED REQUEST SIGNAL MESSAGE COUNTER INCORRECT

Diagnostic Instructions

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

DTC Descriptor

DTC P150C

Transmission Control Module Engine Speed Request Signal Message Counter Incorrect

Circuit/System Description

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTC P150C is a Type B DTC.

Conditions for Clearing the DTC

DTC P150C is a Type B DTC.

Reference Information

Description and Operation

[Data Link Communications Description and Operation](#)

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

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.
- 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 5.5 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 runs continuously when the above conditions are met.

Conditions for Setting the DTC**P1516**

The ECM detects an unstable throttle position for greater than 1 s.

P2101

The ECM detects the actual throttle position does not match the predicted throttle position for greater than 1 s.

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 (TP) sensors were greater than a predetermined voltage during the minimum throttle learn procedure for greater than 2 s.

Action Taken When the DTC Sets

- DTCs P2101 and P2176 are Type A DTCs.
- DTC P1516 is a Type B DTC.
- 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
- 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

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0)

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**

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 Assembly, 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 or 3
- TAC Motor Control Open circuit terminal B or 5
- **If the test lamp is always ON**

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

2. Test for less than 1 V between the 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 or 3
 - TAC Motor Control Open circuit terminal B or 5
 - **If the test lamp illuminates**
 1. Ignition OFF, 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, 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 or 3
 - TAC Motor Control Open circuit terminal B or 5
 - **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.

Repair Instructions

- [**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**

Test or replace the Q38 Throttle Body assembly.

- 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 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	P06A3, P2122	P2122	P06A3, P2123	-
APP Sensor 2 5V Reference	P0106, P0107, P0697, P2127	P2127	P0106, P0108, P0697, P2128	-
APP Sensor 1 Signal	P2122	P2122	P2123	P2138
APP Sensor 2 Signal	P2127	P2127	P2128	P2138
APP Sensor 1 Low Reference	-	P2123	-	-
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: 0.46-4.75 V			

Circuit	Short to Ground	Open	Short to Voltage
APP Sensor 1 5V Reference	0 V	0 V	5 V
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: 0.32-2.6 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, P2123, P2127, P2128

- The system voltage is greater than 6.4 V.
- The ignition is in the unlock, accessory, run, or crank position.
- DTC P06A3 or P0697 are not set.
- The DTCs run continuously when the above conditions are met.

P2138

- The system voltage is greater than 6.4 V.
- The ignition is in the unlock, accessory or run position.
- DTC P06A3, P0697, P2122, P2123, P2127 or P2128 are not set.
- 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 0.5 V for greater than 0.5 s.

P2123

The ECM detects that APP sensor 1 voltage is greater than 4.75 V for greater than 0.5 s.

P2127

The ECM detects that APP sensor 2 voltage is less than 0.3 V for greater than 0.5 s.

P2128

The ECM detects that APP sensor 2 voltage is greater than 2.6 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 (Chevrolet with 2H0)

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

Refer to for DTC P0641, P0651, P0697, or P06A3 (ECM) further diagnosis.
 - **If none of the DTCs are set**
3. Verify the APP Sensor 1 Circuit Status and APP Sensor 2 Circuit Status displays 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 min 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 4
- Low reference circuit terminal 3

- **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 6
- 5 V reference circuit terminal 1

- **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 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 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 an 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

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 \(2H0 or LDE\)](#), and [Cooling System Description and Operation \(2H0\)](#) 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 -40°C and +149°C (-40°F and +300°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 3°C (5°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

Condition	Causes
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 engine control module (ECM) and the transmission control module (TCM) monitor powertrain conditions for any condition which may adversely affect vehicle emissions. The ECM and TCM communicate these conditions through the serial data network. When the ECM or TCM detects the adverse condition, a request is sent to the instrument panel cluster to illuminate the malfunction indicator lamp (MIL). Ignition 1 voltage is supplied internally through the instrument panel cluster to the MIL. The instrument panel cluster turns the MIL ON by internally grounding the MIL. The MIL should be on steady with the ignition ON and the engine OFF. The MIL should turn OFF when the engine is started.

Reference Information

Schematic Reference

- [Engine Controls Schematics \(Chevrolet with 2H0\)](#)
- [Instrument Cluster Schematics \(Buick\)](#), [Instrument Cluster Schematics \(Chevrolet\)](#)

Connector End View Reference

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

Description and Operation

[Instrument Cluster Description and Operation](#)

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

1. Engine running
2. Verify the malfunction indicator lamp turns ON and OFF when commanding the Malfunction Indicator Lamp (MIL) On and Off with a scan tool.
 - **If the malfunction indicator lamp does not turn ON and OFF**
 Replace the instrument panel cluster
 - **If the malfunction indicator lamp does turn ON and OFF**
3. All OK

Repair Instructions

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

[Control Module References](#) for instrument cluster replacement, programming, and setup

ENGINE CRANKS BUT DOES NOT RUN

Diagnostic Instructions

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

Circuit/System Description

The engine cranks but does not run is an organized approach to identify a condition which causes the engine to crank but not start. This diagnostic directs the technician to the appropriate system diagnosis.

Diagnostic Aids

Inspect for any of the conditions listed below:

- If equipped with a key type ignition system, a partially retracted or folded over ignition key. When attempting to start the engine, the mechanical portion of the vehicle key must be locked in the fully extended position with the fob parallel to the key. Leaving the key partially retracted or folded over when starting may interrupt transponder authentication and result in an intermittent no-start condition. In such instances, DTC B3055 may also be set. If an intermittent no-start complaint is received, it may be necessary to discuss with the customer their starting habits and verify they are locking the key in the fully extended position, fob parallel to the key, before starting.
- An unstable crankshaft position sensor engine reference signal. Check the crankshaft position sensor engine reference signal with a scan tool. Observe the engine speed parameter while cranking the engine. The scan tool should indicate a steady 200-300 RPM while cranking. If erratic values, such as sudden spikes in the engine speed, are displayed, the engine reference signal is not stable enough for the engine to start and run properly.
- Insufficient fuel. Thoroughly inspect the fuel delivery system for sufficient fuel volume to the fuel injectors. Inspect the fuel supply components for partial blockage or restrictions.
- Fuel injectors with partially blocked and restricted nozzles, or a malfunctioning solenoid. Refer to [Fuel Injector Diagnosis](#) for diagnosis.
- Fuel injector ON time inadequate. When this condition is present, there may be fuel spray at the fuel injectors and the indicated fuel pressure may be correct, yet there may not be enough fuel to start the engine. If the engine control module (ECM) receives incorrect inputs from the various information sensors, the fuel delivered by the fuel injectors may be inadequate to start the engine. Check all the engine data parameters with a scan tool and compare the values indicated with the expected values or the values from a known good vehicle.
- Loose, unsecured engine electrical grounds. Inspect the engine for good secure electrical grounds.
- Water or foreign material in the fuel, which can cause either a no start or a engine will not stay running condition. During freezing weather water can freeze inside the fuel system. The engine may start after 30 min in a heated repair shop. The malfunction may not recur until parked overnight in freezing temperatures. Extreme weather conditions can cause contaminated fuel to prevent the vehicle from starting.
- An ignition system that is susceptible to moisture. If the engine starts and runs after being brought into a warm, dry repair shop, the ignition system may be susceptible to moisture. Spray water on the ignition system components and wiring while cranking the engine in order to check for an engine starting or will not stay running concern.
- If the engine almost starts and then stalls, check for an open in the ground circuits of the crankshaft position sensor and the camshaft position sensor - Intake or camshaft position sensor - Exhaust.

Reference Information

[Engine Controls Schematics \(Chevrolet with 2H0\).](#)

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

Special Tools

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

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

[Circuit/System Testing](#)

NOTE: This diagnostic assumes the following:

- The battery is completely charged.
 - The engine cranking speed is acceptable.
 - There is adequate fuel in the fuel tank.
1. Crank the engine for up to 15 s.
 2. Verify that DTC P0016, P0017, P0117, P0118, P0122, P0123, P0201, P0202, P0203, P0204, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0335, P0336, P0351, P0352, P0353, P0354, P0627, P0628, P0629, P0641, P0651, P0685, P0689, P0690, or P1682 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 security indicator on the instrument cluster illuminates momentarily.
 - **If the security indicator stays ON or is flashing**

Review the [Diagnostic Trouble Code \(DTC\) List - Vehicle](#) , for Immobilizer system DTCs. For additional information, refer to [Immobilizer Description and Operation](#) .
 - **If the security indicator does not stay ON and is not flashing**
 5. Verify the scan tool Engine Speed parameter indicates an engine speed greater than 0 rpm while cranking the engine.
 - **If 0 rpm**

Refer to [DTC P0335 or P0336](#).

- If greater than 0 rpm

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

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

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

9. 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

10. Ignition ON.

11. Verify that the fuel pump turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.

- If the fuel pump does not turn ON and OFF.

Refer to [Fuel Pump Electrical Circuit Diagnosis](#).

- If the fuel pump turns ON and OFF.

NOTE:

- The Fuel Pump Relay 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.

12. Ignition OFF, all accessories OFF, install a CH 48027 Digital Pressure Gauge.

13. Ignition ON.

14. Command the Fuel Pump Relay On several times with a scan tool.

15. Verify the fuel pressure is between 345-414 kPa (50-60 PSI) with the fuel pump running.

- If not within the specified range

Refer to [Fuel System Diagnosis](#).

- If within the specified range

16. Verify that the fuel pressure does not decrease greater than 34 kPa (5 PSI) in 1 minute.

- If not within the specified range

Refer to [Fuel System Diagnosis](#).

- If within the specified range

17. Ignition OFF, disconnect the harness connector of a fuel injector.

18. 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

19. Verify the test lamp flashes while cranking the engine.

- If the test lamp does not flash

Refer to [Fuel Injector Diagnosis](#).

20. Verify the conditions listed below do not exist:

- Collapsed air intake duct to the throttle body
- Air filter and air intake system for restrictions and obstructions
- Spark plugs gas or coolant fouled. Refer to [Spark Plug Inspection](#) .
- A skewed manifold absolute pressure (MAP) sensor.
- A skewed engine coolant temperature (ECT) sensor.
- Restricted exhaust system.
- Contaminated fuel. 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 conditions exist**

21. All OK.

Repair Verification

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

FUEL SYSTEM DIAGNOSIS

Diagnostic Instructions

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

Circuit/System Description

The engine control module (ECM) enables the fuel pump relay when the ignition switch is turned ON. The ECM will disable the fuel pump relay within 2 seconds unless the control module detects ignition reference pulses. The ECM continues to enable the fuel pump relay as long as ignition reference pulses are detected. The ECM disables the fuel pump relay within 2 seconds if ignition reference pulses cease to be detected and the ignition remains ON.

The fuel system is a returnless on - demand design. The fuel pressure regulator is a part of the fuel tank fuel pump module, eliminating the need for a return pipe from the engine. 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.

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 pressure regulator has a T-joint that diverts the needed fuel to the fuel rail with the unused fuel dropping back into the reservoir of the fuel tank fuel pump module. The fuel tank fuel pump module contains a reverse flow check valve. The check valve and the fuel pressure regulator maintain fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

Reference Information

Description and Operation

[Fuel System Description](#)

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 41769** Fuel Line Quick Disconnect Tool
- **CH 48027** Digital Pressure Gauge
- **EN 37287** Fuel Line Shut-off Adapter
- **J 42982** Fuel Pressure Gauge Adapter

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

Circuit/System Verification

NOTE:

- **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 Relay 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 ON.

2. Verify that the fuel pump turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.

- **If the fuel pump does not turn ON and OFF**

Refer to [Fuel Pump Electrical Circuit Diagnosis](#).

- **If the fuel pump does turn ON and OFF**

3. Ignition OFF, all accessories OFF, install a **J 42982** Fuel Pressure Gauge Adapter and a **CH 48027** Gauge.

4. Ignition ON, engine OFF.

5. Command the Fuel Pump Relay On several times with a scan tool.

6. Verify the fuel pressure is between 345-414 kPa (50-60 psi) with the fuel pump running.

- **If less than 345 kPa (50 psi)**

Refer to Circuit/System Testing - Fuel Pressure Low.

- **If greater than 414 kPa (60 psi)**

Replace the G12 Fuel Pump.

- **If between 345-414 kPa (50-60 psi)**

7. 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)**

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

9. 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)**
- 10. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the **CH 48027** Gauge.
- 11. Verify the fuel pressure does not drop off during acceleration, cruise or hard cornering.
 - **If the fuel pressure drops off**

Refer to Circuit/System Testing - Fuel Pressure Drops Off.
 - **If the fuel pressure does not drop off**
- 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 none of the 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 Relay On with a scan tool and bleed the air from the **CH 48027** Gauge.
5. Command the Fuel Pump Relay 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 none of the conditions exist**

Replace the G12 Fuel Pump.

Repair Instructions

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

- [Fuel Feed Pipe Replacement \(2H0\)](#) [Fuel Feed Pipe Replacement \(At Tank FWD\)](#)
- [Fuel Injector Replacement \(2H0\)](#)
- [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#)

FUEL PUMP ELECTRICAL CIRCUIT DIAGNOSIS

Diagnostic Instructions

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

Circuit/System Description

The engine control module (ECM) provides ignition voltage to the coil side of the fuel pump relay whenever the engine is cranking or running. The ECM enables the fuel pump relay as long as the engine is cranking or running. The fuel pump relay control circuit is equipped with a feedback circuit that is pulled up to voltage within the ECM. The ECM can determine if the control circuit is open, shorted to ground, or shorted to voltage by monitoring the feedback voltage.

Diagnostic Aids

The following conditions may cause the fuel pump fuse to open:

- The fuse is faulty.
- There is an intermittent short to ground in the supply voltage circuit of the fuel pump.
- The fuel pump has an intermittent internal condition.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Chevrolet with 2H0\)](#)

Connector End View Reference

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

Description and Operation

[Fuel System Description](#)

Electrical Information Reference

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

Scan Tool Reference

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

Special Tools

J 43244 Relay Puller Pliers

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

Circuit/System Verification

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

Refer to Circuit/System Testing.
 - **If Malfunction is not displayed**
3. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the KR23A Fuel Pump Relay. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 86 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
3. Ignition ON.
4. Verify a test lamp illuminates between the ignition circuit terminal 30 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is OK**
 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 OK 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
 3. Disconnect the harness connector at the G16 Fuel Pump.
 4. Test for infinite resistance between the output control circuit terminal 87 and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - If infinite resistance, test or replace the G12 Fuel Pump.
 - **If the test lamp illuminates**
5. Verify that a test lamp does not illuminate between the control circuit terminal 85 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**
6. Remove the test lamp.
 7. Verify the scan tool Fuel Pump Relay Control Circuit Low Voltage Test Status parameter is OK when commanding the Fuel Pump Relay ON.
 - **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**
 8. Install a 3 A fused jumper wire between the control circuit terminal 85 and the ground circuit terminal 86.
 9. Verify the scan tool Fuel Pump Relay Control Circuit Low Voltage Test Status parameter is Malfunction when commanding the Fuel Pump Relay ON.
 - **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**
 10. Verify that a test lamp does not illuminate between the output control circuit terminal 87 and ground.
 - **If the test lamp illuminates**

Repair the short to voltage on the control circuit
 - **If the test lamp does not illuminate**
 11. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the G16 Fuel Pump. It may take up to 2 minutes for all vehicle systems to power down.
 12. Test for less than 10 Ω between the G16 Fuel Pump ground circuit terminal 2 and ground.
 - **If 10 Ω or greater**
 1. Ignition OFF.
 2. Test for less than 2 Ω in the ground circuit end to end.
 - If 2 Ω or greater, repair the open/high resistance in the circuit.
 - If less than 2 Ω , repair the open/high resistance in the ground connection.
 - **If less than 10 Ω**
 13. Connect the harness connector at the G16 Fuel Pump.
 14. Ignition ON, connect a 20 A fused jumper wire between the ignition circuit terminal 30 and the output control circuit terminal 87.
 15. Verify the G16 Fuel Pump is activated.
 - **If the G16 Fuel Pump does not activate**
 1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the G16 Fuel Pump.
 2. Test for less than 2 Ω in the output 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 G16 Fuel Pump.
 - **If the G16 Fuel Pump activates**
 16. Replace the KR23A Fuel Pump Relay.

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

- [Fuel Tank Fuel Pump Module Replacement \(FWD\)](#) for fuel pump replacement.
- [Relay Replacement \(Attached to Wire Harness\)](#) [Relay Replacement \(Within an Electrical Center\)](#)
- [Control Module References](#) for ECM replacement, programming, and setup.

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.

Reference Information

Schematic Reference

Engine Controls Schematics (Chevrolet with 2H0)

Connector End View Reference

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

Description and Operation

Fuel System Description

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 \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

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](#).
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 Relay 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 Relay 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](#).
2. Command the Fuel Pump Relay 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 \(2H0\)](#)

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 \(Diagnostic Tools\)](#) [Special Tools \(Mechanical Tools\)](#).

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](#)

ELECTRONIC IGNITION SYSTEM DIAGNOSIS

Diagnostic Instructions

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

Circuit/System Description

This ignition system uses an ignition coil module. The engine control module (ECM) controls the spark events by transmitting the timing pulses on the ignition control (IC) circuits to the cylinder ignition coils in firing order sequence.

Diagnostic Aids

- An open/high resistance on the low reference circuit to the ignition coil may cause a misfire.
- An erratic or weak spark is considered a no spark condition.

Reference Information

Schematic Reference

[Engine Controls Schematics \(Chevrolet with 2H0\).](#)

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](#)

Scan Tool Reference

[Control Module References](#)

Circuit/System Testing

NOTE: Do not perform this diagnostic procedure unless you were sent here from a misfire DTC or the Engine Cranks But Does Not Run diagnostic.

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the K35 Ignition Coil Module. It may take up to 2 min for all vehicle systems to power down.

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

- **If 5 Ω or greater**

1. Ignition OFF.

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

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

- **If less than 5 Ω**

3. Test for less than 5 Ω between the low reference circuit terminal C 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 less than 2 Ω , replace the K20 Engine Control Module.

- **If less than 5 Ω**

4. Ignition ON.

5. Verify a test lamp illuminates between the ignition circuit terminal A and ground.

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

1. Ignition OFF, remove the test lamp.

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

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

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

NOTE:

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

1. Ignition OFF, remove the test lamp, and disconnect all components on the circuit.

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

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

3. Replace the fuse, ignition ON.

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

- If the fuse opens, replace the component that opens the fuse when connected.
- If the fuse is good, all OK.

- **If the test lamp illuminates**

6. 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.

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 40Â°C (104Â°F).
- The difference between the start-up IAT and ECT are within 3Â°C (5Â°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 12Â°C (22Â°F).
 - The start-up ECT minus start-up IAT are within 50Â°C (90Â°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
If an inspection/maintenance system status indicator did NOT update to YES during the Inspection/Maintenance System Check , review each indicator and reference this table to determine each DTC associated with the inspection/maintenance system status indicator. Each DTC listed below has specific conditions that must be met for the diagnostic to run. Included within the conditions are additional DTCs which, if set, may inhibit the DTCs listed below from running. Reviewing and operating the vehicle within the conditions for running for each DTC listed below will allow the inspection/maintenance system status indicators to transition to YES.	
Catalyst Monitor	DTC P0420
Oxygen Sensor	• DTC P0131, P0132, P0134, P0137, P0138, or P0140 • DTC P0133, P1133, P2270, or P2271
Oxygen Sensor Heater	DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141
Camshaft System	DTC P0011 or P0014