Engine Controls and Fuel - 1.0L, 1.19L, or 1.2L

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Description and Operation

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Air Intake System Description

Circuit/System Description

The primary function of the air intake system is to provide filtered air to the engine. The system uses a filter-element mounted in a housing. The filter-housing is remotely mounted and uses intake ducts to route the incoming air into the throttle body. The secondary function of the air intake system is to muffle air induction noise. This is achieved by the use of resonators attached to the air intake ducts. The resonators are tuned to the specific powertrain. The intake air temperature (IAT) sensor is used to measure the temperature of the air entering the engine.

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Camshaft Actuator System Description

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Camshaft Position (CMP) Actuator System

The camshaft position (CMP) actuator system is an electro-hydraulic operated device used for a variety of engine performance and operational enhancements. These enhancements include lower emission output through exhaust gas dilution of the intake charge in the combustion chamber, a broader engine torque range, and improved fuel economy. The CMP actuator system accomplishes this by changing the angle or timing of the camshaft relative to the crankshaft position. The CMP actuator simply allows earlier or later intake and exhaust valve opening during the four stroke engine cycle. The CMP actuator cannot vary the duration of valve opening, or the valve lift.

During engine Off, engine idling conditions, and engine shutdown, the camshaft actuator is held in the Park position. Internal to the CMP actuator assembly is a return spring and a locking pin. During non-phasing modes of the camshaft, the return spring rotates the camshaft back to the Park position, and the locking pin retains the CMP actuator sprocket to the camshaft.

CMP Actuator System Operation

The CMP actuator system is controlled by the engine control module (ECM). The ECM sends a signal to a CMP actuator solenoid in order to control the amount of engine oil flow to a Cam Actuator passage. The pressurized engine oil is sent to unseat the locking pin, and to the vane and rotor assembly of the CMP actuator. There are 2â€‰different passages for oil to flow through, a passage for cam advance and a passage for cam retard. The Cam Actuator is attached to a camshaft and is hydraulically operated in order to change the angle of the camshaft relative to crankshaft position (CKP). Engine oil pressure (EOP), viscosity, temperature and engine oil level can have an adverse affect on Cam Actuator performance.

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Electronic Ignition System Description

The electronic ignition system produces and controls a high-energy secondary spark. This spark is used to ignite the compressed air/fuel mixture at precisely the correct time. This provides optimal performance, fuel economy, and control of exhaust emissions. This ignition system uses an individual coil for each cylinder. The ignition coils are mounted near each cylinder with short integrated boots or high tension wires connecting the coils to the spark plugs. The driver modules within each ignition coil are commanded ON/OFF by the Engine Control Module (ECM). The ECM uses engine speed, the mass air flow (MAF) sensor signal, and position information from the crankshaft position and the camshaft position sensors to control the sequence, dwell, and timing of the spark.

The electronic ignition system consists of the following components:

Crankshaft Position Sensor

The crankshaft position sensor works in conjunction with a reluctor wheel on the crankshaft (front mounted crankshaft position sensor) or a reluctor wheel that is part of the flywheel (rear mounted crankshaft position sensor). The ECM monitors the voltage frequency on the crankshaft position sensor signal circuit. As each reluctor wheel tooth rotates past the sensor, the sensor creates a digital ON/OFF pulse. This digital signal is processed by the ECM. This creates a signature pattern that enables the ECM to determine the crankshaft position. The ECM uses the signal to determine which pair of cylinders is approaching top dead center based on the crankshaft position signal alone. The camshaft position sensor signals are used in order to determine which of these 2 cylinders is on a firing stroke, and which is on the exhaust stroke. The ECM uses this to properly synchronize the ignition system, the fuel injectors, and the knock control. This sensor is also used in order to detect misfire.

The ECM also has a dedicated replicated crankshaft position sensor signal output circuit that may be used as an input signal to other modules for monitoring engine RPM.

Camshaft Position Sensor

This engine uses a camshaft position sensor for each camshaft. The camshaft position sensor is a three wire hall effect type sensor. The ECM supplies the camshaft position sensor with a 5â€‰V reference circuit, a signal circuit and a low reference circuit. The camshaft position sensor signals are an input to the ECM. These signals are also used to detect camshaft alignment with the crankshaft. The camshaft position sensor does not directly affect the operation of the ignition system. The camshaft position sensor information is used by the ECM to determine the position of the camshaft relative to the crankshaft position. By monitoring the camshaft position and crankshaft position signals the ECM can accurately time the operation of the fuel injectors.

The ECM also has a dedicated replicated camshaft position sensor signal output circuit that may be used as an input signal to other modules for monitoring engine RPM.

Knock Sensor

The knock sensor system enables the ECM to control the ignition timing for the best possible performance while protecting the engine from potentially damaging levels of detonation, also known as spark knock. The knock sensor system uses 1 or 2 flat response 2-wire sensors. The sensor uses piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency depend upon the level of knock that the knock sensor detects. The ECM receives the knock sensor signal through the high and low signal circuits.

The ECM learns a minimum noise level, or background noise, at idle from the knock sensor and uses calibrated values for the rest of the RPM range. The ECM uses the minimum noise level to calculate a noise channel. A normal knock sensor signal will ride within the noise channel. As engine speed and load change, the noise channel upper and lower parameters will change to accommodate the normal knock sensor signal, keeping the signal within the channel. In order to determine which cylinders are knocking, the ECM only uses knock sensor signal information when each cylinder is near top dead center (TDC) of the firing stroke. If knock is present, the signal will range outside of the noise channel.

If the ECM has determined that knock is present, it will retard the ignition timing to attempt to eliminate the knock. The ECM will always try to work back to a zero compensation level, or no spark retard. An abnormal knock sensor signal will stay outside of the noise channel or will not be present. Knock sensor diagnostics are calibrated to detect faults with the knock sensor circuitry inside the ECM, the knock sensor wiring, or the knock sensor voltage output. Some diagnostics are also calibrated to detect constant noise from an outside influence such as a loose/damaged component or excessive engine mechanical noise.

Ignition Coils

Each ignition coil has an ignition voltage feed and a ground circuit. The engine control module (ECM) supplies a low reference and an ignition control (IC) circuit. Each ignition coil contains a solid state driver module. The ECM will command the IC circuit ON, which allows the current to flow through the primary coil windings. When the ECM commands the IC circuit OFF, this will interrupt current flow through the primary coil

windings. The magnetic field created by the primary coil windings will collapse across the secondary coil windings, which induces a high voltage across the spark plug electrodes.

Engine Control Module (ECM)

The ECM controls all ignition system functions and constantly corrects the spark timing. The ECM monitors information from various sensor inputs that may include the following components, if applicable:

- Throttle position sensor
- Engine coolant temperature (ECT) sensor
- Mass air flow (MAF) sensors
- Intake air temperature (IAT) sensors
- Vehicle speed sensor (VSS)
- Transmission gear position or range information sensors
- Engine knock sensors
- Ambient pressure sensors (BARO)

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Engine Control Module Description

The Engine Control Module (ECM) interacts with many emission related components and systems, and monitors emission related components and systems for deterioration. OBD II diagnostics monitor the system performance and a diagnostic trouble code (DTC) sets if the system performance degrades. The ECM is part of a network and communicates with various other vehicle control modules.

Malfunction indicator lamp (MIL) operation and DTC storage are dictated by the DTC type. A DTC is ranked as a Typeâ€‰A or Typeâ€‰B if the DTC is emissions related. Type C is a non-emissions related DTC.

The ECM is the control center of the engine controls system. Review the components and wiring diagrams in order to determine which systems are controlled by the ECM.

The ECM constantly monitors the information from various sensors and other inputs, and controls the systems that affect engine performance and emissions. The ECM also performs diagnostic tests on various parts of the system and can turn on the MIL when it recognizes an operational problem that affects emissions. When the ECM detects a malfunction, the ECM stores a DTC. The condition area is identified by the particular DTC that is set. This aids the technician in making repairs.

ECM Function

The ECM can supply 5â€‰V or 12â€‰V to various sensors or switches. This is done through pull-up resistors to regulated power supplies within the ECM. In some cases, even an ordinary shop voltmeter will not give an accurate reading due to low input resistance. Therefore, a digital multimeter (DMM) with at least 10â€‰megaohms input impedance is required in order to ensure accurate voltage readings.

The ECM controls the output circuits by controlling the ground or the power feed circuit through transistors or a device called an output driver module.

EEPROM

The electronically erasable programmable read only memory (EEPROM) is an integral part of the ECM. The EEPROM contains program and calibration information that the ECM needs in order to control engine operation.

Special equipment, as well as the correct program and calibration for the vehicle, are required in order to reprogram the ECM.

Data Link Connector (DLC)

The data link connector (DLC) provides serial data communication for ECM diagnosis. This connector allows the technician to use a scan tool in order to monitor various serial data parameters, and display DTC information. The DLC is located inside the driver's compartment, underneath the instrument panel.

Malfunction Indicator Lamp (MIL)

The malfunction indicator lamp (MIL) is inside the instrument panel cluster (IPC). The MIL is controlled by the ECM and illuminates when the ECM detects a condition that affects vehicle emissions.

ECM Service Precautions

The ECM, by design, can withstand normal current draws that are associated with vehicle operations. However, care must be used in order to avoid overloading any of these circuits. When testing for opens or shorts, do not ground or apply voltage to any of the ECM circuits unless the diagnostic procedure instructs you to do so. These circuits should only be tested with a DMM unless the diagnostic procedure instructs otherwise.

Emissions Diagnosis For State I/M Programs

This OBDâ€‰II equipped vehicle is designed to diagnose any conditions that could lead to excessive levels of the following emissions:

- Hydrocarbons (HC)
- Carbon monoxide (CO)
- Oxides of nitrogen (NOx)
- Evaporative emission (EVAP) system losses

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Should this vehicle's on-board diagnostic system (ECM) detect a condition that could result in excessive emissions, the ECM turns ON the MIL and stores a DTC that is associated with the condition.

Aftermarket (Add-On) Electrical And Vacuum Equipment

Caution:

Do not attach add-on vacuum operated equipment to this vehicle. The use of add-on vacuum equipment may result in damage to vehicle components or systems.

Caution:

Connect any add-on electrically operated equipment to the vehicle's electrical system at the 12 V battery (power and ground) in order to prevent damage to the vehicle.

Aftermarket, add-on, electrical and vacuum equipment is defined as any equipment installed on a vehicle after leaving the factory that connects to the vehicle's electrical or vacuum systems. No allowances have been made in the vehicle design for this type of equipment.

Add-on electrical equipment, even when installed to these strict guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system, such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain condition is to eliminate all of the aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, the problem may be diagnosed in the normal manner.

Electrostatic Discharge (ESD) Damage

Note:

In order to prevent possible electrostatic discharge damage to the ECM, DO NOT touch the connector pins on the ECM.

The electronic components that are used in the control systems are often designed to carry very low voltage. These electronic components are susceptible to damage caused by electrostatic discharge. Less than 100â€‰V of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000â€‰V for a person to even feel a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.

Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

Emissions Control Information Label

The underhood Vehicle Emissions Control Information Label contains important emission specifications. This identifies the year, the displacement of the engine in liters, and the class of the vehicle.

This label is located in the engine compartment of every General Motors vehicle. If the label has been removed, it can be ordered from GM service parts operations (GMSPO).

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Evaporative Emission Control System Description (LC5, LMU)

Typical Evaporative Emission (EVAP) System Hose Routing Diagram

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- (1) Evaporative Emissions (EVAP) Purge Solenoid Valve
- (2) Purge Tube Check Valve, Turbo-Charged Applications Only
- (3) EVAP Canister
- (4) EVAP Vapor Tube
- (5) Vapor Recirculation Tubeâ€‰(ORVR)
- (6) Fuel Tank Pressure Sensor
- (7) Fuel Filler Cap (Some Vehicles May Have A Capless Design)
- (8) Fuel Tank
- (9) Fuel Fill Pipe Inlet Check Valve
- (10) Liquid Fuel
- (11) Fill Limit Vent Valveâ€‰(FLVV)
- (12) Fuel Vapor
- (13) EVAP Canister Vent Solenoid Valve

EVAP System Operation

The EVAP control system limits fuel vapors from escaping into the atmosphere. Fuel tank vapors are allowed to move from the fuel tank, due to pressure in the tank, through the EVAP vapor tube, into the EVAP canister. Carbon in the canister absorbs and stores the fuel vapors. Excess pressure is vented through the vent hose and EVAP vent solenoid valve to the atmosphere. The EVAP canister stores the fuel vapors until the engine is able to use them. At an appropriate time, the engine control module (ECM) will command the EVAP purge solenoid valve ON, allowing engine vacuum to be applied to the EVAP canister. With the normally open EVAP vent solenoid valve OFF, fresh air is drawn through the vent solenoid valve and the vent hose to the EVAP canister. Fresh air is drawn through the canister, pulling fuel vapors from the carbon. The air/fuel vapor mixture continues through the EVAP purge tube and EVAP purge solenoid valve into the intake manifold to be consumed during normal combustion. The ECM uses several tests to determine if the EVAP system is leaking or restricted.

Purge Solenoid Valve Leak Test

If the EVAP purge solenoid valve does not seal properly fuel vapors could enter the engine at an undesired time, causing driveability concerns. The ECM tests for this by commanding the EVAP purge solenoid valve OFF and the vent solenoid valve ON which seals the system. With the engine running, the ECM then monitors the fuel tank pressure sensor for an increase in vacuum. The ECM will set a DTC if a vacuum develops in the tank under these test conditions.

Large Leak Test

This diagnostic creates a vacuum condition in the EVAP system. When the enabling criteria has been met, the ECM commands the normally open EVAP vent solenoid valve closed and the EVAP purge solenoid valve open, creating a vacuum in the EVAP system. The ECM then monitors the fuel tank pressure sensor voltage to verify that the system is able to reach a predetermined level of vacuum within a set amount of time. Failure to achieve the expected level of vacuum indicates the presence of a large leak in the EVAP system or a restriction in the purge path. The ECM will set a DTC if it detects a weaker than expected vacuum level under these test conditions.

Canister Vent Restriction Test

If the EVAP vent system is restricted, fuel vapors will not be properly purged from the EVAP canister. The ECM tests this by commanding the EVAP purge solenoid valve ON while commanding the EVAP vent solenoid valve OFF, and then monitoring the fuel tank pressure sensor for an increase in vacuum. If the vacuum increases more than the expected amount, in a set amount of time, a fault will be logged by the ECM.

Small Leak Test

The engine off natural vacuum diagnostic is the small-leak detection diagnostic for the EVAP system. The engine off natural vacuum diagnostic monitors the EVAP system pressure with the ignition OFF. Because of this, it may be normal for the ECM to remain active for up to 40â€‰min after the ignition is turned OFF. This is important to remember when performing a parasitic draw test on vehicles equipped with engine off natural vacuum.

When the vehicle is driven, the temperature rises in the tank due to heat transfer from the exhaust system. After the vehicle is parked, the temperature in the tank continues to rise for a period of time, then starts to drop. The engine off natural vacuum diagnostic relies on this

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temperature change, and the corresponding pressure change in a sealed system, to determine if an EVAP system leak is present.

The engine off natural vacuum diagnostic is designed to detect leaks as small as 0.51â€‰mm (0.020â€‰in).

EVAP System Components

The EVAP system consists of the following components:

EVAP Purge Solenoid Valve

The EVAP purge solenoid valve controls the flow of vapors from the EVAP system to the intake manifold. The purge solenoid valve opens when commanded ON by the ECM. This normally closed valve is pulse width modulated (PWM) by the ECM to precisely control the flow of fuel vapor to the engine. The valve will also be opened during some portions of the EVAP testing when the engine is running, allowing engine vacuum to enter the EVAP system.

Purge Tube Check Valve
Note**:**

The presence of this one-way check valve prevents pressure testing the EVAP system for leaks at the EVAP canister purge tube connector.

Turbocharged vehicles have a check valve in the purge tube between the EVAP purge solenoid valve and the intake manifold to prevent pressurization of the EVAP system under boost conditions. Some applications may have this check valve between the EVAP purge solenoid valve and the EVAP canister.

EVAP Canister

The canister is filled with carbon pellets used to absorb and store fuel vapors. Fuel vapor is stored in the canister until the ECM determines that the vapor can be consumed in the normal combustion process.

Vapor Recirculation Tube

A vapor path between the fuel fill pipe and the vapor tube to the carbon canister is necessary for Vehicle Onboard Diagnostics to fully diagnose the EVAP system. It also accommodates service diagnostic procedures by allowing the entire EVAP system to be diagnosed from either end of the system.

The On-Board Refueling Vapor Recovery System is an on-board vehicle system designed to recover fuel vapors during the vehicle refueling operation. The flow of liquid fuel down the fuel filler pipe provides a liquid seal which prevents vapor from leaving the fuel filler pipe. An EVAP pipe transports the fuel vapor to the EVAP canister for use by the engine.

Fuel Tank Pressure Sensor

The fuel tank pressure sensor measures the difference between the pressure or vacuum in the fuel tank and outside air pressure. Depending on the vehicle, the sensor can be located in the vapor space on top of the fuel tank, in the vapor tube between the canister and the tank, or on the EVAP canister. A high fuel tank pressure sensor voltage indicates a low fuel tank pressure or vacuum. A low fuel tank pressure sensor voltage indicates a high fuel tank pressure.

Fuel Fill Pipe Check Valve

The check valve on the fuel fill pipe is there to prevent spit-back during refueling.

EVAP Vent Solenoid Valve

The EVAP vent solenoid valve controls fresh airflow into the EVAP canister. The valve is normally open. The canister vent solenoid valve is closed only during EVAP system tests performed by the ECM like large leak and engine off natural vacuum test.

Fuel Fill Cap

The fuel fill cap is equipped with a seal and a vacuum relief valve and is tethered. A torque-limiting device prevents the cap from being over tightened. To install the cap, turn the cap clockwise until you hear clicks. This indicates that the cap is correctly torqued and fully seated. A built-in device indicates that the fuel filler cap is fully seated. A fuel filler cap that is not fully seated may cause a malfunction in the emission system.

Capless Fuel Fill

Some vehicles may have a capless fuel fill design behind a locking fuel door. There is no fuel fill cap to remove. One just fully inserts the fuel nozzle into the fill neck, making sure it latches before refueling. Flapper valves close to seal this interface once the fill nozzle is removed.

Fill Limit Vent Valve

This acts as a shut off valve during refueling. This will vary based on fuel tank design. The fill limit vent valve has the following functions:

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- This valve is not serviced separately. Depending on design, will be located in the top of the fuel tank or on the underside of the pump module flange.
- Controls the fuel tank fill level by closing the primary vent from the fuel tank and forcing the fuel fill nozzle to shut off.
- Prevents liquid fuel from exiting the fuel tank via the EVAP pipe to the canister.
- Provides fuel-spillage protection in the event of a vehicle rollover by closing the vapor path from the tank to the EVAP canister.

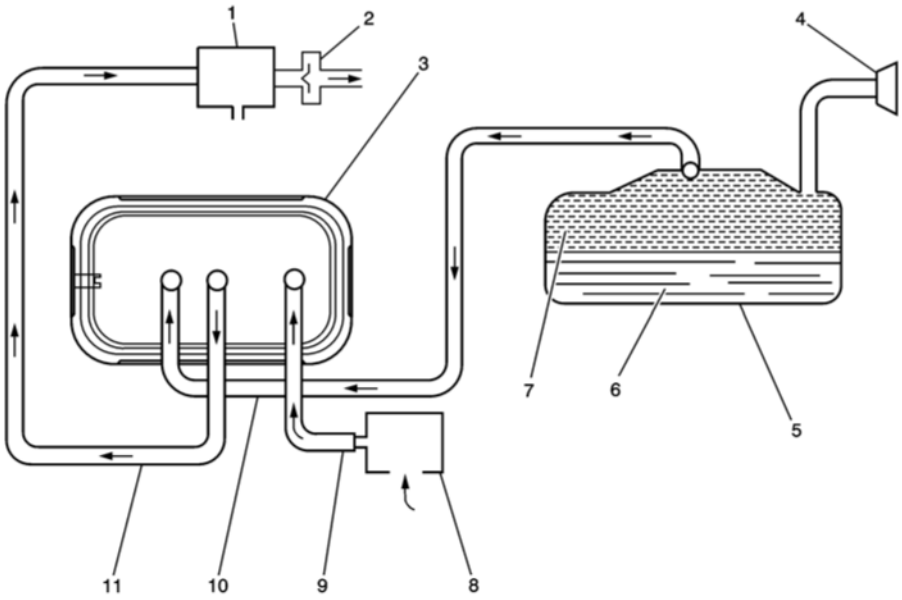
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Evaporative Emission Control System Description (LKY)

Typical Evaporative Emission (EVAP) System (Non Enhanced) Hose Routing Diagram

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- (1) EVAP Canister Purge Solenoid Valve
- (2) Purge Tube Check Valve, Turbo-Charged Applications Only
- (3) EVAP Canister
- (4) Fuel Fill Cap/Fill Neck (Some Vehicles May Have A Capless Design)
- (5) Fuel Tank
- (6) Liquid Fuel
- (7) Fuel Vapor
- (8) EVAP Air Inlet
- (9) EVAP Vent Pipe

EVAP System Operation

The evaporative emission (EVAP) control system limits fuel vapors from escaping into the atmosphere. Fuel tank vapors are allowed to move from the fuel tank, due to pressure in the tank, through the vapor pipe, into the EVAP canister. Carbon in the canister absorbs and stores the fuel vapors. Excess pressure is vented through the vent pipe and EVAP air inlet to atmosphere. The EVAP canister stores the fuel vapors until the engine is able to use them. At an appropriate time, the engine control module (ECM) will command the EVAP purge solenoid valve open, allowing engine vacuum to be applied to the EVAP canister. Fresh air will be drawn through the EVAP air inlet and vent pipe to the EVAP canister. Fresh air is drawn through the EVAP canister, pulling fuel vapors from the carbon. The air/fuel vapor mixture continues through the EVAP purge pipe and EVAP purge solenoid valve into the intake manifold to be consumed during normal combustion.

EVAP System Components

The EVAP system is made up of the following components:

EVAP Canister

The EVAP canister is a sealed unit with 3â€‰ports. It is filled with carbon pellets used to absorb and store fuel vapors. Fuel vapor is stored in the canister until the ECM determines that the vapor can be consumed in the normal combustion process.

EVAP Purge Solenoid Valve

The EVAP purge solenoid valve controls the flow of vapors from the EVAP system to the intake manifold. This normally closed valve is pulse width modulated (PWM) by the ECM to precisely control the flow of fuel vapor to the engine.

EVAP Air Inlet

The EVAP air inlet filters air entering the EVAP canister.

Purge Tube Check Valve

Turbocharged vehicles have a check valve in the purge tube, between the EVAP purge solenoid valve and the intake manifold to prevent pressurization of the EVAP system under boost conditions. There is one application, the 2.0L LHU that has this check valve between the EVAP purge solenoid valve and the EVAP canister.

Fuel Fill Cap

The fuel fill cap is equipped with a seal and a vacuum relief valve and is tethered. A torque-limiting device prevents the cap from being over tightened. To install the cap, turn the cap clockwise until you hear clicks. This indicates that the cap is correctly torqued and fully seated. A built-in device indicates that the fuel filler cap is fully seated.

Capless Fuel Fill

Some vehicles may have a capless fuel fill design behind a locking fuel door. There is no fuel fill cap to remove. One just fully inserts the fuel nozzle into the fill neck, making sure it latches before refueling. Flapper valves close to seal this interface once the fill nozzle is removed.

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Exhaust Gas Recirculation (EGR) System Description

The exhaust gas recirculation (EGR) system is used to reduce the amount of nitrogen oxide emission levels caused by combustion temperatures exceeding 816Â°â€‰C (1500Â°â€‰F). It does this by introducing small amounts of exhaust gas back into the combustion chamber. The exhaust gas absorbs a portion of the thermal energy produced by the combustion process and thus decreases combustion temperature. The EGR system will only operate under specific temperature, barometric pressure, and engine load conditions in order to prevent driveability concerns and to increase engine performance. The engine control module (ECM) calculates the amount of EGR needed based on the following inputs:

- The engine coolant temperature (ECT) sensor
- The intake air temperature (IAT) sensor
- The barometric pressure (BARO)
- The manifold absolute pressure (MAP) sensor
- The throttle position sensor

EGR Valve Circuits

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- (1) Position Sensor
- (2) Coil Assembly
- (3) Base
- (4) Pintle
- (5) Exhaust In Port
- (6) Armature

The exhaust gas recirculation (EGR) valve consists of the following circuits:

- An ignition circuit which supplies 12â€‰V to the coil of the EGR valve
- A control circuit which grounds the coil of the EGR valve. The control circuit is a pulse width modulated ground produced by an internal low side driver of the ECM.
- A 5â€‰V reference circuit supplied from the ECM to the internal position sensor of the EGR valve
- A signal circuit which sends a feedback voltage from the internal position sensor of the EGR valve to the ECM. This voltage varies depending on the position of the EGR valve pintle. The ECM interprets this voltage as the position of the EGR valve pintle
- A low reference circuit supplied from the ECM to the internal position sensor of the EGR valve

EGR Diagnostics

The ECM tests the EGR flow during deceleration by momentarily commanding the EGR valve to open while monitoring the signal of the manifold absolute pressure (MAP) sensor. When the EGR valve is opened, the ECM will expect to see a predetermined increase in MAP. If the expected increase in MAP is not detected, the ECM records the amount of MAP difference that was detected and adjusts a calibrated fail counter towards a calibrated fail threshold level. When the fail counter exceeds the fail threshold level, the ECM will set a DTC.

The ECM monitors the position of the EGR valve pintle via the EGR position sensor. If the ECM detects a calibrated variance between the desired EGR valve pintle position and actual position for a calibrated amount of time, a DTC will set.

The ECM also monitors the circuits of the EGR valve for electrical faults. If a circuit fault is detected for a calibrated amount of time, a DTC will set.

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Fuel System Description

Fuel System Overview

The fuel system is a returnless onâ€“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 is attached to the fuel tank fuel pump module inside the fuel tank. The fuel pump supplies high pressure fuel through the fuel feed pipe to the fuel injection system. The fuel pump provides fuel at a higher rate of flow than is needed by the fuel injection system. The fuel pressure regulator, a part of the fuel tank fuel pump module, maintains the correct fuel pressure to the fuel injection system. 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.

Fuel Tank

The fuel tank stores the fuel supply. The fuel tank is located in the rear of the vehicle. The fuel tank is held in place by 2â€‰metal straps that are attached to the underbody. The fuel tank is molded from highâ€“density polyethylene.

Fuel Tank Fuel Pump Module

The fuel tank fuel pump module consists of the following components:

- The fuel level sensor
- The fuel pump
- The fuel strainer
- The fuel pressure regulator
- The jet pump

Fuel Level Sensor

The fuel level sensor consists of a float, a wire float arm, and a ceramic resistor card. The position of the float arm indicates the fuel level. The fuel level sensor contains a variable resistor which changes resistance in correspondence with the position of the float arm. The ECM sends the fuel level information to the instrument panel cluster. This information is used for the instrument panel cluster fuel gauge and the low fuel warning indicator, if applicable. The ECM also monitors the fuel level input for various diagnostics.

Fuel Pump

The fuel pump is mounted in the fuel tank fuel pump module reservoir. The fuel pump is an electric high-pressure pump. Fuel is pumped to the fuel injection system at specified rates of flow and pressure. The fuel pump delivers a constant flow of fuel to the engine even during low fuel conditions and aggressive vehicle maneuvers. The ECM controls the electric fuel pump operation through a fuel pump relay.

Fuel Strainer

The fuel strainer is attached to the lower end of the fuel tank fuel pump module. The fuel strainer is made of woven plastic. The functions of the fuel strainer are to filter contaminants and to wick away fuel. Normally, the fuel strainer does not require maintenance. Fuel stoppage at this point indicates that the fuel tank contains an abnormal amount of sediment or contamination.

Jet Pump

The jet pump is located in the fuel tank fuel pump module. Fuel pump flow loss, caused by vapor expulsion in the pump inlet chamber, is diverted to the jet pump through a restrictive orifice located on the pump cover. The jet pump fills the reservoir of the fuel tank fuel pump module.

Fuel Pressure Regulator

The fuel pressure regulator is contained in the fuel tank fuel pump module near the fuel pump outlet. The fuel pressure regulator is a diaphragm relief valve. The diaphragm has fuel pressure on one side and regulator spring pressure on the other side. The fuel pressure regulator is not vacuum biased. Fuel pressure is controlled by a pressure balance across the regulator. The fuel system pressure is constant.

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Nylon Fuel Pipes

Warning:

Refer to Fuel and Evaporative Emission Pipe Warning.

Nylon pipes are constructed to withstand maximum fuel system pressure, exposure to fuel additives, and changes in temperature.

Heat resistant rubber hose or corrugated plastic conduit protect the sections of the pipes that are exposed to chafing, high temperature, or vibration.

Nylon fuel pipes are somewhat flexible and can be shaped around gradual turns under the vehicle. However, if nylon fuel pipes are forced into sharp bends, the pipes may kink and restrict the flow of fuel. Also, once exposed to fuel, nylon pipes may become stiffer and are more likely to kink if bent too far. Exercise special care when working on a vehicle with nylon fuel pipes.

Quick-Connect Fittings

Quick-connect fittings provide a simplified means of installing and connecting fuel system components. The fittings consist of a unique female connector and a compatible male pipe end. O-rings, located inside the female connector, provide the fuel seal. Integral locking tabs inside the female connector hold the fittings together.

Fuel Rail Assembly

The fuel rail assembly is attached to the engine intake manifold. The fuel rail assembly performs the following functions:

- Positions the injectors in the intake manifold
- Distributes fuel evenly to the injectors

Fuel Injectors

The fuel injector assembly is a solenoid device controlled by the ECM that meters pressurized fuel to a single engine cylinder. The ECM energizes the injector solenoid to open a ball valve, normally closed. This allows fuel to flow into the top of the injector, past the ball valve, and through a director plate at the injector outlet. The director plate has machined holes that control the flow of fuel, generating a spray of finely atomized fuel at the injector tip. Fuel from the injector tip is directed at the intake valve, causing the fuel to become further atomized and vaporized before entering the combustion chamber. This fine atomization improves fuel economy and emissions.

Fuel Metering Modes of Operation

The ECM monitors signals from several sensors in order to determine how much fuel to feed to the engine. The ECM controls the amount of fuel delivered to the engine by changing the fuel injector pulse width. The fuel is delivered under one of several modes.

Starting Mode

When the ignition is first turned ON, the control module energizes the fuel pump for 2s. This allows the fuel pump to build pressure in the fuel system. The control module calculates the air/fuel ratio based on inputs from the engine coolant temperature (ECT), manifold absolute pressure (MAP), mass air flow (MAF), and throttle position sensors. The system stays in starting mode until the engine speed reaches a predetermined RPM.

Clear Flood Mode

If the engine floods, clear the engine by pressing the accelerator pedal down to the floor and then crank the engine. When the throttle position sensor is at wide open throttle (WOT), the control module reduces the fuel injector pulse width in order to increase the air to fuel ratio. The control module holds this injector rate as long as the throttle stays wide open and the engine speed is below a predetermined RPM. If the throttle is not held wide open, the control module returns to the starting mode.

Run Mode

The run mode has 2â€‰conditions called Open Loop and Closed Loop. When the engine is first started and the engine speed is above a predetermined RPM, the system begins Open Loop operation. The control module ignores the signal from the heated oxygen sensor (HO2S). The control module calculates the air/fuel ratio based on inputs from the engine coolant temperature (ECT), manifold absolute pressure (MAP), mass air flow (MAF), and throttle position sensors. The system stays in Open Loop until meeting the following conditions:

- The heated oxygen sensor (HO2S) has varying voltage output, showing that the heated oxygen sensor (HO2S) is hot enough to operate properly.
- The ECT sensor is above a specified temperature.

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- A specific amount of time has elapsed after starting the engine.

Specific values for the above conditions exist for each different engine, and are stored in the programmable read-only memory (EEPROM), which may be erased electrically. The system begins closed loop operation after reaching these values. In closed loop, the ECM calculates the air/fuel ratio, injector ON time, based upon the signal from various sensors, but mainly from the heated oxygen sensor (HO2S). This allows the air/fuel ratio to stay very close to 14.7:1.

Acceleration Mode

When the driver pushes on the accelerator pedal, air flow into the cylinders increases rapidly. To prevent possible hesitation, the control module increases the pulse width to the injectors to provide extra fuel during acceleration. This is also known as power enrichment. The control module determines the amount of fuel required based upon the throttle position, the engine coolant temperature (ECT), the manifold absolute pressure (MAP), the mass air flow (MAF), and the engine speed.

Deceleration Mode

When the driver releases the accelerator pedal, air flow into the engine is reduced. The control module monitors the corresponding changes in the throttle position, the mass air flow (MAF), and the manifold absolute pressure (MAP). The control module shuts OFF fuel completely if the deceleration is very rapid, or for long periods, such as long, closed-throttle coast-down. The fuel shuts OFF in order to prevent damage to the catalytic converters.

Battery Voltage Correction Mode

When the battery voltage is low, the ECM compensates for the weak spark delivered by the ignition system in the following ways:

- Increasing the amount of fuel delivered
- Increasing the idle RPM
- Increasing the ignition dwell time

Fuel Cutoff Mode

The ECM cuts OFF fuel from the fuel injectors when the following conditions are met in order to protect the powertrain from damage and improve driveability:

- The ignition is OFF. This prevents engine run-on.
- The ignition is ON but there is no ignition reference signal. This prevents flooding or backfiring.
- The engine speed is too high, above red line.
- During an extended, high speed, closed throttle coast down. This reduces emissions and increases engine braking.
- During extended deceleration, in order to prevent damage to the catalytic converters

Fuel Trim

The ECM controls the 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 while in closed loop and regulates the fuel delivery by adjusting the pulse width of the injectors based on this signal. The ideal fuel trim values are around 0â€‰percent for both short and long term fuel trim. A positive fuel trim value indicates the ECM is adding fuel in order to compensate for a lean condition by increasing the pulse width. A negative fuel trim value indicates that the ECM is reducing the amount of fuel in order to compensate for a rich condition by decreasing the pulse width. 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 heated oxygen sensor (HO2S) signal voltage. These changes fine-tune the engine fueling. The long term fuel trim makes rough adjustments to fueling in order to recenter and restore control to short term fuel trim. A scan tool can be used to monitor the short and long term fuel trim values. The long term fuel trim diagnostic is based on an average of several of the long term speed load learn cells. The ECM selects the cells based on the engine speed and engine load. If the ECM detects an excessively lean or rich condition, the ECM will set a fuel trim diagnostic trouble code (DTC).

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DESCRIPTION AND OPERATION
4.

Knock Sensor System Description

Circuit/System Description

The knock sensor system 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 ECM uses the knock sensor system to test for abnormal engine noise that may indicate detonation, also known as spark knock.

Sensor Description

The knock sensor system uses a flat response sensor. The sensor uses a piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency are dependant upon the level of knock that the knock sensor detects. The knock sensor is connected to the engine control module (ECM) by a signal circuit and a low reference circuit. Both knock sensor circuits are protected from electromagnetic interference by a shielding ground circuit. The shielding ground circuit is grounded through the ECM.

The ECM learns a minimum noise level, or back ground noise, at idle from the knock sensor and uses calibrated values for the rest of the engine speed range. The control module uses the minimum noise level to calculate a noise channel. A normal knock sensor signal is within the noise channel. As engine speed and load changes, the noise channel upper and lower parameters change to accommodate the normal knock sensor signal, keeping the signal within the channel. In order to determine which cylinders are knocking, the ECM only uses knock sensor signal information when each cylinder is near top dead center of the firing stroke. If knock is present, the ECM detects that the signal is outside of the noise channel.

If the ECM detects that knock is present, the ECM retards the ignition timing to attempt to eliminate the knock. The ECM always attempts to adjust back to a zero compensation level, or no spark retard. An abnormal knock sensor signal stays outside of the noise channel or will not be present. Knock sensors diagnostics are calibrated to detect faults with the knock sensor circuitry inside the ECM, the knock sensor wiring, or the knock sensor voltage output. Some diagnostics are also calibrated to detect constant noise from an outside influence such as a loose, damaged component, or excessive engine mechanical noise.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DESCRIPTION AND OPERATION
4.

Throttle Actuator Control (TAC) System Description

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The engine control module (ECM) is the control center for the throttle actuator control (TAC) system. The ECM determines the driver's intent based on input from the accelerator pedal position sensors, then calculates the appropriate throttle response based on the throttle position sensors. The ECM achieves throttle positioning by providing a pulse width modulated voltage to the throttle actuator motor. The throttle blade is spring loaded in both directions, and the default position is slightly open.

Modes Of Operation

Normal Mode

During the operation of the TAC system, several modes, or functions, are considered normal. The following modes may be entered during normal operations:

- Minimum pedal valueâ€"At key-up, the ECM updates the learned minimum pedal value.
- Minimum throttle position valuesâ€"At key-up, the ECM updates the learned minimum throttle position value. In order to learn the minimum throttle position value, the throttle blade is moved to the Closed position.
- Ice break modeâ€"If the throttle blade is not able to reach a predetermined minimum throttle position, the ice break mode is entered. During the ice break mode, the ECM commands the maximum pulse width several times to the throttle actuator motor in the closing direction.
- Minimum pedal valueâ€"At key-up, the ECM updates the learned minimum pedal value.
- Battery saver modeâ€"After a predetermined time without engine RPM, the ECM commands the Battery Saver mode. During the Battery Saver mode, the TAC module removes the voltage from the motor control circuits, which removes the current draw used to maintain the idle position and allows the throttle to return to the spring loaded default position.

Reduced Engine Power Mode

When the ECM detects a condition with the TAC system, the ECM may enter a reduced engine power mode. Reduced engine power may cause one or more of the following conditions:

- Acceleration limitingâ€"The ECM will continue to use the accelerator pedal for throttle control, however, the vehicle acceleration is limited.
- Limited throttle modeâ€"The ECM will continue to use the accelerator pedal for throttle control, however, the maximum throttle opening is limited.
- Throttle default modeâ€"The ECM will turn OFF the throttle actuator motor, and the throttle will return to the spring loaded default position.
- Forced idle modeâ€"The ECM will perform the following actions:
-
    - Limit engine speed to idle positioning the throttle position, or by controlling the fuel and spark if the throttle is turned OFF.
    - Ignore the accelerator pedal input.
- Engine shutdown modeâ€"The ECM will disable fuel and de-energize the throttle actuator.

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Diagnostic Information and Procedures

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141 (LMT, LMU with FX3)

Symptoms

Diagnostic Trouble Codes - P0031

Diagnostic Trouble Codes - P0037

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 P0031

HO2S Heater Control Circuit Low Voltage Sensor 1

DTC P0032

HO2S Heater Control Circuit High Voltage Sensor 1

DTC P0037

HO2S Heater Control Circuit Low Voltage Sensor 2

DTC P0038

HO2S Heater Control Circuit High Voltage Sensor 2

DTC P0135

HO2S Heater Performance Sensor 1

DTC P0141

HO2S Heater Performance Sensor 2

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Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	â€”	P0031, P0037	â€”	â€”
HO2S 1 Heater Control	P0031	P0031	P0032	P0135
HO2S 2 Heater Control	P0037	P0037	P0038	P0141

CircuitSystem Description

The 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. The HO2S must reach operating temperature to provide an accurate voltage signal. A heating element inside the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by the ignition circuit through a fuse. Ground is provided to the heater on the low control circuit by a low side driver within the control module.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit

- A heater control circuit

Conditions for Running the DTC

P0031, P0032, P0037, or P0038

- DTC P0562 or P0563 is not set.
- The engine is running.
- The ignition voltage is between 11â€“16V.
- The DTC runs continuously when the above conditions are met.

P0135 or P0141

- DTC P0031, P0032, P0037, P0038, P0106, P0107, P0108, P0117, P0118, P0135, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0507, P0562, P0563, or P2110 is not set.
- The engine is running for greater than 60s.
- The minimum commanded HO2S heater duty cycle is greater than 0.1.
- The change in commanded HO2S heater duty cycle is less than 0.05.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0031 or P0037

The ECM detects a short to ground or an open on the HO2S heater control circuit.

P0032 or P0038

The ECM detects a short to battery on the HO2S heater control circuit.

P0135 or P0141

The ECM detects that the filtered HO2S heater current is less than the predetermined values.

Action Taken When the DTC Sets

DTC P0031, P0032, P0037, P0038, P0135, and P0141 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0031, P0032, P0037, P0038, P0135, and P0141 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

CircuitSystem Verification

1. Engine idling, observe the HO2S heater control circuit test status parameters. Each of the HO2S heater control circuit test status parameters should display OK or Not Run.
2. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze FrameFailure Records data.

CircuitSystem Testing

1. Ignition OFF, disconnect the harness connector at the appropriate heated oxygen sensor (HO2S).
2.
    - B52A Heated Oxygen Sensor 1 (HO2S1)
    - B52B Heated Oxygen Sensor 2 (HO2S2)
3. Ignition ON, verify that a test lamp illuminates between the ignition circuit of the appropriate HO2S and ground.
4.
    - Ignition circuit terminal 4 of the B52A HO2S1 and ground
    - Ignition circuit terminal 4 of the B52B HO2S2 and ground
5.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an openhigh resistance. If the circuit tests normal and its fuse is open, test all components connected to the fuse and replace as necessary.
6. Ignition ON, verify that a test lamp does not illuminate between the control circuit and the ignition circuit of the appropriate HO2S.
7.
    - Control circuit terminal 2 and ignition circuit terminal 4 of the B52A HO2S1
    - Control circuit terminal 2 and ignition circuit terminal 4 of the B52B HO2S2
8.
    - If the test lamp illuminates, test the control circuit for a short to ground. If the circuit tests normal, replace the K20 engine control module (ECM).
9. Engine running, leave the test lamp connected from the previous step. The lamp should flash or be ON steady.
10.
    - If the test lamp is not ON steady or flashing, test the control circuit of the appropriate HO2S for a short to voltage or an openhigh resistance. If the circuit tests normal, replace the K20 ECM.
11. If all circuits test normal, replace the appropriate HO2S.

Component Testing

1. Ignition OFF, disconnect the harness connector at the HO2S.
2. Test for 3â€“23Î© between the control terminal and the ignition terminal of the appropriate HO2S.
3.
    - Control terminal 2 and ignition terminal 4 of the B52A HO2S1

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- Control terminal 2 and ignition terminal 4 of the B52B HO2S2

4.

- If not within the specified range, replace the HO2S sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming.

Related Part Information

Part Name	Catalog Name	Part Code

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141 (LCP, LC5, LMT, LMU without FX3)

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 P0031

HO2S Heater Control Circuit Low Voltage Sensorâ€‰1

DTC P0032

HO2S Heater Control Circuit High Voltage Sensorâ€‰1

DTC P0037

HO2S Heater Control Circuit Low Voltage Sensorâ€‰2

DTC P0038

HO2S Heater Control Circuit High Voltage Sensorâ€‰2

DTC P0053

HO2S Heater Resistance Sensorâ€‰1

DTC P0054

HO2S Heater Resistance Sensorâ€‰2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	â€”	P0031, P0037	â€”	â€”
HO2S 1 Heater Control	P0031	P0031, P0053	P0032	â€”
HO2S 2 Heater Control	P0037	P0037, P0054	P0038	â€”

Circuit Description

The 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. The HO2S must reach operating temperature to provide an accurate voltage signal. A heating element inside the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by the ignition circuit through a fuse. Ground is provided to the heater on the low control circuit by a low side driver within the control module.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit
- A heater control circuit

Conditions for Running the DTC

P0031, P0032, P0037, or P0038

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- The engine is running.
- The HO2S heater pulse width modulation (PWM) is between 2.3â€“98%.
- The DTC runs continuously when the above conditions are met

  P0053 or P0054
- The engine is running for greater than 300â€“600 s depending on the coolant temperature.
- The HO2S heater pulse width modulation (PWM) is between 2.3â€“98%.
- The mass air flow is between 25â€“65 kg/h.
- The exhaust gas temperature is between 300â€“900Â°C (572â€“1652Â°F).
- The battery voltage is between 11â€“16â€‰V.
- The DTC runs for 40â€‰s when the above conditions are met.

Conditions for Setting the DTC

P0031 or P0037

The ECM detects a short to ground or an open on the HO2S heater control circuit.

P0032 or P0038

The ECM detects a short to voltage on the HO2S heater control circuit.

P0053

The ECM detects that the HO2Sâ€‰1 heater resistance is less than 4â€‰Î© or greater than 18â€‰Î©.

P0054

The ECM detects that the HO2Sâ€‰2 heater resistance is less than 4â€‰Î© or greater than 33â€‰Î©.

Action Taken When the DTC Sets

DTC P0031, P0032, P0037, P0038, P0053, and P0054 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0031, P0032, P0037, P0038, P0053, and P0054 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

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.

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Circuit/System Verification

Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate heated oxygen sensor (HO2S).
2.
    - B52A Heated Oxygen Sensorâ€‰1 (HO2S1)
    - B52B Heated Oxygen Sensorâ€‰2 (HO2S2)
3. Ignition ON, verify that a test lamp illuminates between the ignition circuit of the appropriate HO2S and ground.
4.
    - Ignition circuit terminalâ€‰4 of the B52A HO2S1 and ground
    - Ignition circuit terminalâ€‰4 of the B52B HO2S2 and ground
5.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all components connected to the fuse and replace as necessary.
6. Ignition ON, verify that a test lamp does not illuminate between the control circuit and the ignition circuit of the appropriate HO2S.
7.
    - Control circuit terminalâ€‰2 and ignition circuit terminalâ€‰4 of the B52A HO2S1
    - Control circuit terminalâ€‰2 and ignition circuit terminalâ€‰4 of the B52B HO2S2
8.
    - If the test lamp illuminates, test the control circuit for a short to ground. If the circuit tests normal, replace the K20 Engine Control Module (ECM).
9. Engine running, leave the test lamp connected from the previous step. The lamp should flash or be ON steady.
10.
    - If the test lamp is not ON steady or flashing, test the control circuit of the appropriate HO2S for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module (ECM).
11. If all circuits test normal, replace the appropriate HO2S.

Component Testing

1. Ignition OFF, disconnect the harness connector at the HO2S.
2. Test for 3â€“23â€‰Î© between the control terminal and the ignition terminal of the appropriate HO2S.
3.
    - Control terminalâ€‰2 and ignition terminalâ€‰4 of the B52A HO2S1
    - Control terminalâ€‰2 and ignition terminalâ€‰4 of the B52B HO2S2
4.
    - If not within the specified range, replace the HO2S sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141 (LL0)

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

DTCâ€‰P0030

HO2S Heater Control Circuit Sensorâ€‰1

DTCâ€‰P0031

HO2S Heater Control Circuit Low Voltage Sensorâ€‰1

DTCâ€‰P0032

HO2S Heater Control Circuit High Voltage Sensorâ€‰1

DTCâ€‰P0036

HO2S Heater Control Circuit Sensorâ€‰2

DTCâ€‰P0037

HO2S Heater Control Circuit Low Voltage Sensorâ€‰2

DTCâ€‰P0038

HO2S Heater Control Circuit High Voltage Sensorâ€‰2

DTCâ€‰P0053

HO2S Heater Resistance Sensorâ€‰1

DTCâ€‰P0054

HO2S Heater Resistance Sensorâ€‰2

DTCâ€‰P0135

HO2S Heater Performance Sensorâ€‰1

DTCâ€‰P0141

HO2S Heater Performance Sensorâ€‰2

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
HO2S High Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P2A00
HO2S Low Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0133, P2A00

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Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
HO2S Heater Voltage Supply	P0030, P0036, P0132, P0135, P0138, P0141, *	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0690	P0135, P0141
HO2S Heater Control	P0030, P0036, P0053, P0054, P0135, P0141	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0030, P0036, P0132, P0134, P0135, P0138, P0140, P0141	P0135, P0141
* Opens fuse					

Circuit Description

The heated oxygen sensor (HO2S) heater reduces the time required for the oxygen sensor to reach operating temperature and maintains the operating temperature during extended idle periods. When the ignition is turned to the ON position, ignition voltage is supplied directly to the sensor heater. The engine control module (ECM) controls the heater operation by first modulating the control circuit to ground when the sensors are cold. This prevents the possibility of thermal shock to the sensor, from condensation build-up on the sensor, by controlling the sensors rate of heating. After a predetermined amount of time, the ECM commands the heaters ON continuously. Once the sensor reaches operating temperature, the ECM may modulate the heater control circuit to ground, to maintain a desired temperature.

The ECM controls the heater 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 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

P0030-P0032 or P0036-P0038

- The ignition voltage is greater than 11â€‰V.
- The engine speed is greater than 400â€‰RPM.
- The DTCs run continuously once the above conditions are met for 5â€‰s.

P0053 or P0054

- DTCsâ€‰P0112, P0113, P0117, P0118, P0128, P2610 are not set.
- Ignition voltage is less than 32â€‰V.
- The ignition is OFF for more than 8â€‰h.
- The engine is running.
- The Engine Coolant Temperature (ECT) Sensor parameter is between â’’30 to +45Â°C (â’’22 to +113Â°F) at engine start-up.
- Engine coolant temperature and intake air temperature are within 8Â°C (47Â°F).
- DTCsâ€‰P0053 and P0054 run once per drive cycle when the above conditions are met.

P0135 or P0141

- DTCsâ€‰P0116, P0117, P0118, P0128 are not set.
- Ignition voltage is between 10-32â€‰V.
- The engine coolant temperature is greater than 70Â°C (158Â°F).
- DTCsâ€‰P0135 and P0141 run twice per drive cycle when the above conditions are met for 2â€‰min.

Conditions for Setting the DTC

P0030-P0032 or P0036-P0038

- The ECM detects that the affected HO2S heater low control circuit voltage is not within a specified range.
- DTCsâ€‰P0030 and P0036 set within 3â€‰s when the above condition is met.

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P0053 or P0054

- The ECM detects that the affected HO2S heater low control circuit resistance is not within a specified range at engine start-up.
- DTCsâ€‰P0053 and P0054 set within 1â€‰s when the above condition is met.

P0135 or P0141

- The ECM detects that the affected HO2Sâ€‰1 heater current parameter is more than 3.5â€‰A or less than 0.5â€‰A.
- DTCsâ€‰P0135 and P0141 set within 60â€‰s when the above condition is met.

Action Taken When the DTC Sets

DTCsâ€‰P0030-P0032, P0036-P0038, P0053, P0054, P0135, and P0141 are Typeâ€‰B DTCs.

Conditions for Clearing the MIL/DTC

DTCsâ€‰P0030-P0032, P0036-P0038, P0053, P0054, P0135, and P0141 are Typeâ€‰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 test status parameters for the component. The circuit test status parameters change from OK or Not Run to Malfunction if there is a condition with the circuit or a connection.
- An open fuse in the HO2S 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 using the DMM 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

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, command the appropriate HO2S heater ON and OFF with a scan tool while observing the HO2S Heater Circuit Test Status parameter. The parameter should display OK or Not Run.
2. Engine idling at operating temperature, observe the scan tool HO2S Heater parameter . The amperage should be within 0.2â€“1.5â€‰A.
3. Engine idling at operating temperature, move the related wiring and connectors while observing the HO2S Heater parameter with a scan tool. The parameter should not change with movement.

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4.
    - If movement affects the parameter, repair the appropriate harness or connector.
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.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate B52â€‰HO2S.
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminalâ€‰D and ground.
3.
    - If the test lamp does not illuminate, test the ignition voltage circuit for a short to ground or an open/high resistance. If the circuit tests normal and the B52â€‰HO2S heater circuit fuse is open, test all components connected to the fuse and replace as necessary.
4. Ignition ON, observe the appropriate scan tool HO2S Heater Control Open Circuit Test Status parameter. The parameter should display Malfunction.
5.
    - If not the specified value, test the heater control circuit terminalâ€‰C for a short to ground, or for a short to voltage. If the circuit tests normal, replace the K20 ECM.
6. Connect a 3â€‰A fused jumper wire between the heater control circuit terminalâ€‰C and ground. Observe the appropriate scan tool HO2S Heater Control Circuit Low Voltage Test Status parameter. The parameter should transition from OK to Malfunction.
7.
    - If not the specified value, test the heater control circuit terminalâ€‰C for an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
8. Note**:**
    - Less than 10â€‰â„¦ of additional resistance on the ignition voltage circuit, or control circuit may set a DTC. If there is 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.
9. Ignition OFF, connect a 10â€‰A fused jumper wire between the control circuit terminalâ€‰C and the ignition circuit terminalâ€‰D.
10. Engine idling, observe the appropriate HO2S Control Circuit High Voltage Test Status parameter. The parameter should transition from Not Run to Malfunction.
11.
    - If not the specified value, test the control circuit and the ignition voltage circuit for high resistance. If the circuits test normal, replace the K20â€‰ECM.
12. If all circuits test normal, test or replace the appropriate B52â€‰HO2S.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, programming and setup.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0031, P0032, P0037, P0038, P0053, or P0054 (LKY)

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 P0031

HO2S Heater Control Circuit Low Voltage Sensorâ€‰1

DTC P0032

HO2S Heater Control Circuit High Voltage Sensorâ€‰1

DTC P0037

HO2S Heater Control Circuit Low Voltage Sensorâ€‰2

DTC P0038

HO2S Heater Control Circuit High Voltage Sensorâ€‰2

DTC P0053

HO2S Heater Resistance Sensorâ€‰1

DTC P0054

HO2S Heater Resistance Sensorâ€‰2

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	â€”	P0032, P0038	â€”	â€”
HO2S 1 Heater Control	P0031	P0032, P0053	P0032	â€”
HO2S 2 Heater Control	P0037	P0038, P0054	P0038	â€”

Circuit Description

The 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. The HO2S must reach operating temperature to provide an accurate voltage signal. A heating element inside the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by the ignition circuit through a fuse. Ground is provided to the heater on the low control circuit by a low side driver within the control module.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit
- A heater control circuit

Conditions for Running the DTC

P0031, P0032, P0037, or P0038

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- The engine is running.
- The HO2S heater pulse width modulation (PWM) is between 1.2â€“99.2%.
- The exhaust gas temperature is greater than 400Â°C (752Â°F).
- The battery voltage is between 10â€“16 V.
- The DTC runs continuously when the above conditions are met

  P0053 or P0054
- The engine coolant temperature at stop is 54.8Â°C (130.6Â°F) greater than the start-up ECT.
- The exhaust gas temperature is less than 600Â°C (1112Â°F).
- HO2S heater duty cycle is between 0â€“60%.
- The exhaust gas temperature is between 300â€“900Â°C (572â€“1652Â°F).
- The battery voltage is between 11â€“16â€‰V.
- The DTC runs for 40â€‰s when the above conditions are met.

Conditions for Setting the DTC

P0031 or P0037

The ECM detects a short to ground on the HO2S heater control circuit.

P0032 or P0038

The ECM detects a short to voltage or an open on the HO2S heater control circuit.

P0053 or P0054

The ECM detects that the HO2S heater resistance is out of range.

Action Taken When the DTC Sets

DTC P0031, P0032, P0037, P0038, P0053, and P0054 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0031, P0032, P0037, P0038, P0053, and P0054 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

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.

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Circuit/System Verification

Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate heated oxygen sensor (HO2S).
2.
   - B52A Heated Oxygen Sensorâ€‰1 (HO2S1)
   - B52B Heated Oxygen Sensorâ€‰2 (HO2S2)
3. Ignition ON, verify that a test lamp illuminates between the ignition circuit of the appropriate HO2S and ground.
4.
   - Ignition circuit terminalâ€‰D of the B52A HO2S1 and ground
   - Ignition circuit terminalâ€‰D of the B52B HO2S2 and ground
5.
   - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal and its fuse is open, test all components connected to the fuse and replace as necessary.
6. Ignition ON, verify that a test lamp does not illuminate between the control circuit and the ignition circuit of the appropriate HO2S.
7.
   - Control circuit terminalâ€‰C and ignition circuit terminalâ€‰D of the B52A HO2S1
   - Control circuit terminalâ€‰C and ignition circuit terminalâ€‰D of the B52B HO2S2
8.
   - If the test lamp illuminates, test the control circuit for a short to ground. If the circuit tests normal, replace the K20 Engine Control Module (ECM).
9. Command the HO2S heater ON and OFF with a scan tool. The test lamp should be ON and OFF with each command.
10.
    - If the test lamp is not ON and OFF, test the control circuit of the appropriate HO2S for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20 Engine Control Module (ECM).
11. If all circuits test normal, replace the appropriate HO2S.

Component Testing

1. Ignition OFF, disconnect the harness connector at the HO2S.
2. Test for 3â€“23â€‰â„¦ between the control terminal and the ignition terminal of the appropriate HO2S.
3.
   - Control terminalâ€‰C and ignition terminalâ€‰D of the B52A HO2S1
   - Control terminalâ€‰C and ignition terminalâ€‰D of the B52B HO2S2
4.
   - If not within the specified range, replace the HO2S sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0106

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	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0107	P0107, P0106	P0108	P0106
Signal	P0107	P0107, P0106	P0108	P0106
Low Reference	â€”	P0108, P0106	â€”	P0106

Typical Scan Tool Data

MAP Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in Closed Loop, idling, and accessories OFF. **Parameter Normal Range:** 26â€“52â€‰kPa			
5 V Reference	0â€‰kPa	0â€‰kPa	255â€‰kPa
Signal	0â€‰kPa	0â€‰kPa	255â€‰kPa
Low Reference	â€”	255â€‰kPa	â€”

CircuitSystem Description

The manifold absolute pressure (MAP) sensor responds to pressure changes in the intake manifold. The pressure changes occur based on the engine load. The engine control module (ECM) supplies 5V to the MAP sensor on the 5V reference circuit. The ECM provides a ground on the low reference circuit. The MAP sensor provides a signal to the ECM on the MAP sensor signal circuit which is relative to the pressure changes in the manifold. The ECM detects a low signal voltage at a low MAP, such as during an idle or a deceleration. The ECM detects a high signal voltage at a high MAP, such as the ignition is ON, with the engine OFF, or at a wide open throttle (WOT). The MAP sensor is also used to determine the barometric pressure (BARO).

Conditions for Running the DTC

DTC P0107, P0108, P0112, P0113, P0117, P0118, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0502, P0562, P0563, or P2110 is not set.

Test 1 â€“ Decel. mode

- The engine speed is between 1300â€“6000 RPM.
- The Idle airflow is stable.
- The engine coolant temperature is greater than 10Â°C (10Â°F).
- The throttle position is less than 0.2 percent.
- The vehicle speed is greater than 15â€‰kmh (9.3â€‰mph).

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

  Test 2 â€“ Power mode

- The engine speed is between 1300â€“6000 RPM.
- The AC clutch is not transitioning.
- The traction control is not active.
- The torque fuel reduction is not active.
- The engine coolant temperature is greater than 60Â°C (140Â°F).
- The change in engine speed is less than 200 RPM.
- The change in throttle position is less than 3 percent.
- The idle airflow is stable.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects that the MAP reading is not within the expected high and low limits based on the engine speed and the throttle position.

Action Taken When the DTC Sets

DTC P0106 is a Type E DTC.

Conditions for Clearing the DTC

DTC P0106 is a Type E DTC.

Diagnostic Aids

A high resistance condition in the MAP sensor circuits will cause this DTC.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Special Tools

J 35555 Metal Mity-Vac

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Circuit/System Verification

1. Ignition ON, verify that DTC P0107 or P0108 is not set.
2.
   - If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle
3. Verify none of the following conditions exist:
4.
   - Leaking exhaust gas recirculation (EGR) valve.
   - Restricted exhaust--Refer to Restricted Exhaust.
   - Engine mechanical condition--For example, low compression or incorrect timing chain installation. Refer to Symptoms - Engine Mechanical.
5. Determine the current vehicle testing altitude. Compare the MAP sensor pressure parameter to the reading in the Altitude Versus Barometric Pressure table. The MAP sensor pressure parameter should be within the specified range indicated in the table.
6. Note**:**

   In extreme cold weather conditions ice may form in the vacuum source to the MAP sensor and may set a DTC. Inspect the MAP sensor and the vacuum source for ice, moisture, or other restrictions.
7. Start the engine, verify that the scan tool MAP sensor pressure parameter changes while starting the engine.
8. Engine running, verify that the scan tool MAP Sensor pressure parameter is between 26-52 kPa.
9. Snap the throttle while observing the scan tool MAP sensor pressure parameter. The MAP sensor pressure parameter should change rapidly when the throttle position changes.
10. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze FrameFailure Records data.

CircuitSystem Testing

1. Verify the integrity of the entire air induction system by inspecting for the following conditions:
2.
   - Any damaged components
   - Loose or improper installation
   - An air flow restriction
   - Any vacuum leak
   - Improperly routed vacuum hoses
   - In cold climates, inspect for any snow or ice buildup
   - Verify that restrictions do not exist in the MAP sensor port or vacuum source.
3. Ignition OFF, disconnect the harness connector at the B74 manifold absolute pressure (MAP) sensor.
4. Ignition OFF for 1 minute, test for less than 5Î© between the low reference circuit terminal 2 and ground.
5.
   - If greater than the specified range, test the low reference circuit for an openhigh resistance. If the circuit tests normal, replace the K20 ECM.
6. Ignition ON, test for 4.8â€“5.2V between the 5V reference circuit terminal 1 and ground.
7.
   - If less than the specified range, test the 5V reference circuit for a short to ground or openhigh resistance. If the circuit tests normal,

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replace the K20 ECM.

- If greater than the specified range, test the 5V reference circuit for a short to voltage. If the circuit tests normal, replace the K20 ECM.

8. Verify the scan tool MAP sensor parameter is less than 0.5V.
9.
   - If greater than the specified range, test the signal circuit terminal 3 for a short to voltage. If the circuit tests normal, replace the K20 ECM.
10. Install a 3A fused jumper wire between the signal circuit terminal 3 and the 5V reference circuit terminal 1. Verify the scan tool MAP sensor parameter is greater than 4.5V.
11.
    - If less than the specified range, test the signal circuit for a short to ground or an openhigh resistance. If the circuit tests normal, replace the K20 ECM.
12. If all circuits test normal, test or replace the B74 MAP sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the HO2S.
2. Test for 3â€“23Î© between the control terminal and the ignition terminal of the appropriate HO2S.
3.
   - Control terminal 2 and ignition terminal 4 of the B52A HO2S1
   - Control terminal 2 and ignition terminal 4 of the B52B HO2S2
4.
   - If not within the specified range, replace the HO2S sensor.

Component Testing

The ignition ON, engine OFF MAP sensor scan tool value should decrease within 4â€‰kPa by the amount of vacuum applied with the *J 35555* metal mity-vac or equivalent . For example, at 92â€‰kPa, the MAP sensor scan tool reading should be between 71â€“79â€‰kPa with 5â€‰inâ€‰Hg (17â€‰kPa) of vacuum applied to the sensor.

Ignition ON, Engine OFF, MAP Sensor Parameter	MAP Sensor Parameter With 5 Inches of Vacuum Applied	MAP Sensor Parameter With 10 Inches of Vacuum Applied
100	79â€“87	62â€“70
90	69â€“77	52â€“60
80	59â€“67	42â€“50
70	49â€“57	32â€“40
60	39â€“47	22â€“30

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Manifold Absolute Pressure Sensor Replacement
- Control Module References for ECM replacement, setup, and programming

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0107 or P0108

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

DTCâ€‰P0107

Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage

DTCâ€‰P0108

Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuits	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5â€‰V Reference	P0107	P0106, P0107	P0107	P0108	P0106
Signal	P0107	P0106, P0107	P0107	P0108*	P0106
Low Reference	â€”	P0106, P0108	P0106, P0108	â€”	P0106
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.					

Typical Scan Tool Data

MAP Sensor

Circuits	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine operating in closed loop, idling, and accessories OFF. **Parameter Normal Range:** 26â€“52â€‰kPa (3.8 to 7.6â€‰PSI) (Varies with altitude)			
5â€‰V Reference	0â€‰kPa (0â€‰PSI)	0â€‰kPa (0â€‰PSI)	120â€‰kPa (17.4â€‰PSI)
Signal	0â€‰kPa (0â€‰PSI)	0â€‰kPa (0â€‰PSI)	120â€‰kPa (17.4â€‰PSI)*
Low Reference	â€”	120â€‰kPa (17.4â€‰PSI)	â€”
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.			

Circuit Description

The manifold absolute pressureâ€‰(MAP) sensor measures the pressure inside the intake manifold. Pressure in the intake manifold is affected by engine speed, throttle opening, air temperature, and barometric pressureâ€‰(BARO). 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 3â€‰circuits. The engine control moduleâ€‰(ECM) supplies a regulated 5â€‰volts to the sensor on a 5â€‰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. . 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

- Ignition is ON.

- System voltage is 10â€“16â€‰V.
- This DTC runs continuously within the enabling conditions.

P0108 (Test 1)

- Ignition is ON.
- System voltage is 10â€“16â€‰V.
- This DTC runs continuously within the enabling conditions.

P0108 (Test 2)

- Ignition is ON.
- System voltage is 10â€“16â€‰V.
- The throttle position is less than 3.28â€“37.96Â°.
- This DTC runs continuously within the enabling conditions.

Conditions for Setting the DTC

P0107

The ECM detects that the MAP sensor voltage is less than 0.024â€‰V.

P0108 (Test 1)

The ECM detects that the MAP sensor voltage is greater than 4.98â€‰V.

P0108 (Test 2)

The ECM detects that the MAP sensor voltage is greater than 4.8289â€‰V.

Action Taken When the DTC Sets

DTCsâ€‰P0107 and P0108 are Typeâ€‰A DTCs.

Conditions for Clearing the DTC

DTCsâ€‰P0107 and P0108 are Typeâ€‰A DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

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Special Tools

J 35555 Metal Mity-vac

For equivalent regional tools, refer to Special Tools.

Circuit/System Verification

1. Determine the current vehicle testing altitude.
2. Verify the scan tool MAP Sensor parameter is within the range specified in the Altitude Versus Barometric Pressure table.
3.
   - **If the MAP Sensor parameter is not in range**
   - Refer to Circuit/System Testing for further diagnosis.
4.
   - **If the MAP Sensor parameter is within range**
5. Engine idling, verify the scan tool MAP voltage parameter is between 0.2â€“4.5â€‰V and changes with accelerator pedal input.
6.
   - **If not between 0.2â€“4.5â€‰V or does not change**
   - Refer to Circuit/System Testing.
7.
   - **If between 0.2â€“4.5â€‰V and changes**
8. 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.
9. Verify the DTC does not set.
10.
    - **If any DTC sets**
    - Refer to Circuit/System Testing.
11.
    - **If no DTC sets**
12. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B74â€‰Manifold Absolute Pressure sensor.
2. Ignition OFF and all vehicle systems OFF. It may take up to 2â€‰min for all vehicle systems to power down. Test for less than 5â€‰â„¦ between the reference circuit terminalâ€‰2 and ground.
3.
   - **If 5â€‰â„¦ or greater**
4.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 5â€‰â„¦ in the low reference circuit end to end.
   3.
      - If 5â€‰â„¦ or greater, repair the open/high resistance in the circuit.

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- If less than 5â€‰â„¦, replace the K20â€‰Engine Control Module.

5.

- **If less than 5â€‰â„¦**

6. Ignition ON.
7. Test for 4.8â€“5.2â€‰V between the 5â€‰V reference circuit terminalâ€‰1 and ground.
8.

- **If less than 4.8â€‰V**

9.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the 5â€‰V reference circuit and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 5â€‰â„¦ in the 5â€‰V reference circuit end to end.
6.
   - If 5â€‰â„¦ or greater, repair the open/high resistance in the circuit.
   - If less than 5â€‰â„¦, replace the K20â€‰Engine Control Module.

10.

- Note**:**

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

- **If greater than 5.2â€‰V**

11.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Ignition ON, test for less than 1â€‰V between the 5â€‰V reference circuit and ground.
3.
   - If 1â€‰V or greater, repair the short to voltage on the circuit.
   - If less than 1â€‰V, replace the K20â€‰Engine Control Module.

12.

- **If between 4.8â€“5.2â€‰V**

13. Ignition ON, verify the scan tool MAP Sensor parameter is less than 0.5â€‰V.
14.

- **If 0.5â€‰V or greater**

15.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Ignition ON, test for less than 1â€‰V between the signal circuit terminalâ€‰3 and ground.
3.

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- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

16.

- **If less than 0.5â€‰V**

17. Ignition OFF, install a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰3 and the 5â€‰V reference circuit terminalâ€‰1.
18. Ignition ON, verify the scan tool MAP Sensor voltage parameter is greater than 4.5â€‰V.
19.

- **If 4.5â€‰V or less**

20.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Remove the jumper wire, test for infinite resistance between the signal circuit terminalâ€‰3 and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 5â€‰â„¦ in the signal circuit end to end.
6.
   - If 5â€‰â„¦ or greater, repair the open or high resistance in the circuit.
   - If less than 5â€‰â„¦, replace the K20â€‰Engine Control Module.

21.

- **If greater than 4.5â€‰V**

22. Test or replace the B74â€‰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 B74â€‰Manifold Absolute Pressure sensor from the engine. Connect the harness to the sensor, if disconnected.
2. Ignition ON, apply 17â€‰kPa (5.0â€‰inâ€‰Hg) of vacuum to the B74â€‰Manifold Absolute Pressure sensor, with the *J 35555*. Verify the scan tool MAP Sensor pressure parameter decreases between 13â€“21â€‰kPa (1.8â€“3.0â€‰PSI).
3.
   - **If the parameter does not decrease between 13â€“21â€‰kPa (1.8â€“3.0â€‰PSI).**
   - Replace the B74â€‰Manifold Absolute Pressure sensor.
4.
   - **If the parameter does decrease between 13â€“21â€‰kPa (1.8â€“3.0â€‰PSI).**
5. Apply 34â€‰kPa (10.0â€‰inâ€‰Hg) of vacuum to the B74â€‰Manifold Absolute Pressure sensor, with the *J 35555*. Verify the scan tool MAP Sensor pressure parameter decreases between 30â€“38â€‰kPa (4.4â€“5.5â€‰PSI).

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6.
    - **If the parameter does not decrease between 30â€“38â€‰kPa (4.4â€“5.5â€‰PSI).**
    - Replace the B74â€‰Manifold Absolute Pressure sensor.
7.
    - **If the parameter does decrease between 30â€“38â€‰kPa (4.4â€“5.5â€‰PSI).**
8. All OK.

Erratic Signal Test

1. Ignition OFF, remove the B74â€‰Manifold Absolute Pressure sensor and disconnect the harness.
2. Install a 3â€‰A fused jumper wire between the 5â€‰V reference circuit terminalâ€‰1 of the sensor and the sensor harness.
3. Install a jumper wire between the low reference circuit terminalâ€‰2 of the sensor and ground.
4. Install a jumper wire to the signal circuit terminalâ€‰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 0-15â€‰kPa (0â€“4.4â€‰inâ€‰Hg) of vacuum to the sensor with the *J 35555*.
7. Verify the voltage changes, without any spikes or dropouts, between 0.2â€“4.9â€‰V.
8.
    - **If not between 0.2â€“4.9â€‰V or has spikes or dropouts**
    - Replace the B74â€‰Manifold Absolute Pressure sensor.
9.
    - **If between 0.2â€“4.9â€‰V and there are no spikes or dropouts**
10. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Manifold Absolute Pressure Sensor Replacement
- Control Module References for ECM replacement, programming and setup

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0111-P0113

Symptoms

P0112

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

DTCâ€‰P0111

Intake Air Temperature (IAT) Sensor Performance

DTCâ€‰P0112

Intake Air Temperature (IAT) Sensor Circuit Low Voltage

DTCâ€‰P0113

Intake Air Temperature (IAT) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0112	P0113	P0113*	P0111
Low Reference	â€”	P0113	P0113*	P0111
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.				

Typical Scan Tool Data

IAT Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** Varies with ambient temperature			
Signal	142.5Â°C (288.5Â°F)	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°F)
Low Reference	â€”	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°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 a variable resistor that measures the temperature of the air entering the engine. The IAT sensor has a signal circuit and a low reference circuit. The engine control module (ECM) supplies 5â€‰V to the IAT signal circuit and a ground for the IAT low reference circuit.

IAT Sensor â€” Temperature, Resistance, Voltage Table

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

Conditions for Running the DTC

P0111

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- DTCsâ€‰P0112, P0113, P0117, P0118, or P0119 are not set.
- The ignition has been OFF at least 8â€‰hours.
- The ignition is ON.
- This DTC runs once per ignition cycle when the enabling conditions are met.

  P0112 or P0113
- The engine is running for greater than 5â€“110 seconds depending on the coolant temperature.
- System voltage is 10â€“16â€‰V.
- This DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0111

The ECM determines the absolute difference between IAT start-up temperature and the engine coolant temperature (ECT) start-up temperature is greater than 50Â°C (90Â°F).

P0112

The ECM detects that the measured intake air temperature sensor signal voltage is less than 0.01â€‰V.

P0113

The ECM detects that the measured intake air temperature sensor signal voltage is greater than 4.99â€‰V.

Action Taken When the DTC Sets

DTCâ€‰P0111, P0112, and P0113 are Typeâ€‰E DTCs.

Conditions for Clearing the DTC

DTCâ€‰P0111, P0112, and P0113 are Typeâ€‰E DTCs.

Diagnostic Aids

If the vehicle has sat overnight, the IAT sensor, ECT sensorâ€‰1, and the ECT sensorâ€‰2 values should display within 3Â°C (5Â°F) of each other.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that DTC P0112, P0113, P0117, P0118, P0125, P0128, P2184, or P2185 is not set.
2.
   - If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B75Bâ€‰Mass Air Flow/Intake Air Temperature sensor.
2. Ignition OFF and all systems OFF. It may take up to for 2â€‰minutes for all vehicle systems to power down. Test for less than 2â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
3.
   - **If 2â€‰â„¦ or greater**
4.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open or high resistance in the circuit.
      - If less than 2â€‰â„¦ replace the K20â€‰Engine Control Module.
5.
   - **If less than 2â€‰â„¦**
6. Ignition ON, test for 4.8â€“5.2â€‰V between the intake air temperature sensor signal circuit terminalâ€‰1 and ground.
7.
   - **If less than 4.8â€‰V**
8.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for infinite resistance between the signal circuit and ground.
   3.
      - If less than infinite resistance, repair the short to ground on the circuit.
   4.
      - If infinite resistance
   5. Test for less than 2â€‰â„¦ in the signal circuit end to end.
   6.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
9.
   - **If greater than 5.2â€‰V**

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10.
    1. Note:

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

    2. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    3. Ignition ON, test for less than 1â€‰V between the signal circuit and ground.
    4.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
        - If less than 1â€‰V, replace the K20â€‰Engine Control Module.

11.
    - **If between 4.8â€“5.2â€‰V**

12. Test or replace the B75Bâ€‰Mass Air Flow/Intake Air Temperature sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B66â€‰IAT sensor.
2. Note:

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

3. Test the B66â€‰IAT sensor by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the Temperature Versus Resistance - Intake Air Temperature Sensor table and verify that the temperature is within 5â€‰percent of the specification.
4.
    - If not within the specified range, replace the B66â€‰IAT sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Intake Air Temperature Sensor Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0112 or P0113

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

DTCâ€‰P0112

Intake Air Temperature (IAT) Sensor Circuit Low Voltage

DTCâ€‰P0113

Intake Air Temperature (IAT) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0112	P0113	P0113*	â€”
Low Reference	â€”	P0113	P0113*	â€”
* Internal ECM or sensor damage may occur if the circuit is shorted to B+.				

Typical Scan Tool Data

IAT Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** Varies with ambient temperature			
Signal	142.5Â°C (288.5Â°F)	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°F)
Low Reference	â€”	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°F)

Circuit Description

The intake air temperature (IAT) sensor is a variable resistor that measures the temperature of the air entering the engine. The IAT sensor has a signal circuit and a low reference circuit. The engine control module (ECM) supplies 5â€‰V to the IAT signal circuit and a ground for the IAT low reference circuit.

The following table illustrates the difference between temperature, resistance, and voltage:

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

Conditions for Running the DTC

P0112

- Ignition is ON.
- The battery voltage is greater than 10.5â€‰V.
- The mass air flow is less than 569 g/s.
- The DTC runs continuously when the above conditions are met.

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P0113

- Ignition is ON.
- The battery voltage is greater than 10.5â€‰V.
- The mass air flow is less than 569 g/s.
- The time after start is greater than 120 s.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0112

The ECM detects that the measured intake air temperature sensor signal voltage is less than 0.06â€‰V.

P0113

The ECM detects that the measured intake air temperature sensor signal voltage is greater than 4.96â€‰V.

Action Taken When the DTC Sets

DTC P0112 and P0113 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0112 and P0113 are Type E DTCs.

Diagnostic Aids

If the vehicle has sat overnight, the IAT sensor and the ECT sensor values should display within 3Â°C (5Â°F) of each other.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that DTC P0112, P0113, P0117, or P0118 is not set.
2.
    - If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.

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3. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B75Bâ€‰Mass Air Flow/Intake Air Temperature sensor.
2. Ignition OFF and all systems OFF. It may take up to for 2â€‰minutes for all vehicle systems to power down. Test for less than 2â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
3.
   - **If 2â€‰â„¦ or greater**
4.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open or high resistance in the circuit.
      - If less than 2â€‰â„¦ replace the K20â€‰Engine Control Module.
5.
   - **If less than 2â€‰â„¦**
6. Ignition ON, test for 4.8â€“5.2â€‰V between the intake air temperature sensor signal circuit terminalâ€‰1 and ground.
7.
   - **If less than 4.8â€‰V**
8.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for infinite resistance between the signal circuit and ground.
   3.
      - If less than infinite resistance, repair the short to ground on the circuit.
   4.
      - If infinite resistance
   5. Test for less than 2â€‰â„¦ in the signal circuit end to end.
   6.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
9.
   - **If greater than 5.2â€‰V**
10.
    1. Note**:**

       If the signal circuit is shorted to a voltage the engine control module or the sensor may be damaged.
    2. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    3. Ignition ON, test for less than 1â€‰V between the signal circuit and ground.

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4.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

11.

- **If between 4.8â€“5.2â€‰V**

12. Test or replace the B75Bâ€‰Mass Air Flow/Intake Air Temperature sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B66â€‰Intake Air Temperature Sensor.
2. Note**:**

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

3. Test the B66â€‰Intake Air Temperature Sensor by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the Temperature Versus Resistance - Intake Air Temperature Sensor table and verify that the temperature is within 5â€‰percent of the specification.

4.

- If not within the specified range, replace the B66â€‰Intake Air Temperature Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Intake Air Temperature Sensor Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0116

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

DTCâ€‰P0116

Engine Coolant Temperature (ECT) Sensor Performance

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
Signal	P0117	P0118	P0118	P0118	P0116, P0128
Low Reference	â€”	P0118	P0118	â€”	P0128

Typical Scan Tool Data

ECT Sensor Temperature

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running **Parameter Normal Range:** â˜’39 to +120Â°C (â˜’38 to +248Â°F)			
ECT Sensor	150Â°C (302Â°F)	â˜’40Â°C (â˜’40Â°F)	â˜’40Â°C (â˜’40Â°F)
Low Reference	â€”	â˜’40Â°C (â˜’40Â°F)	â˜’40Â°C (â˜’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 5â€‰V to the ECT sensor signal circuit and a ground for the low reference circuit.

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

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

Conditions for Running the DTC

- DTCs P0111, P0112, P0113, P0117, P0118, P0502, P0503, P0722, P0723, or P2610 are not set.
- The intake air temperature (IAT) is warmer than â˜’7Â°C (19Â°4F).
- The fuel level is greater than 10%.
- The ECM has no block heater detected.
- The ignition has been off for greater than 8â€‰h before the engine is started.
- This DTC runs once per cold start when the above conditions are met.

Conditions for Setting the DTC

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- The ECM detects a temperature difference at power-up that indicates that the ECT sensor is 30Â°C (86Â°F) warmer than the IAT sensor.
- OR
- The ECM detects a temperature difference at power-up that indicates that the ECT sensor is 20Â°C (68Â°F) warmer than the IAT sensor, and the time spent cranking the engine is greater than 10â€‰s when the fuel level is greater than 10%
- OR
- The ECM detects a temperature difference at power-up that indicates that the ECT sensor is 20Â°C (68Â°F) warmer than the IAT sensor. Then the vehicle must be driven for greater than 6â€‰min and 40â€‰s at greater than 24â€‰km/h (15â€‰mph) . If the IAT sensor then decreases greater than 3Â°C (37.4Â°F), an engine block heater was detected and the test is aborted. If the IAT sensor does not decrease, an engine block heater was not detected and DTC P0116 will set.

Action Taken When the DTC Sets

- DTC P0116 is a Type B DTC.
- The cooling fans will be commanded ON.
- The A/C compressor will be commanded OFF.

Conditions for Clearing the DTC

DTC P0116 is a Type B DTC.

Diagnostic Aids

- Inspect the ECT sensor terminals for corrosion and for engine coolant leaking through the sensor. Engine coolant that is leaking through the sensor will create a high resistance short to ground. This condition results in less voltage on the ECT sensor signal circuit, which is interpreted by the ECM as a warmer ECT.
- An intake air temperature (IAT) sensor that is biased colder at various ambient temperatures due to greater resistance than is normal will increase the range between these 2 sensors. Measure and record the resistance of the IAT sensor at various ambient temperatures, then compare those measurements to the Temperature vs. Resistance table. Refer to Temperature Versus Resistance - Engine Coolant Temperature Sensor.
- Test the ECT sensor at various temperature levels in order to evaluate the possibility of a biased sensor. A sensor that is biased warmer can result in a driveability condition. Refer to Temperature Versus Resistance - Engine Coolant Temperature Sensor.
- A slight to moderate resistance in the IAT sensor signal circuit or low reference circuit will increase the range between these two sensors. This condition results in a greater voltage on the IAT sensor signal circuit, which is interpreted by the ECM as a colder IAT.
- If the condition is intermittent, allow the vehicle to sit for greater than 8â€‰h with the ignition OFF, may help isolate the condition. Compare the scan tool and ECT Sensor temperature sensor values at ignition on.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Cooling System Description and Operation

Electrical Information Reference

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

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DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ECT Sensor parameter is between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) and changes with engine run time.
3.
   - **If not between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) or does not change**
   - Refer to Circuit/System Testing.
4.
   - **If between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) and changes**
5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
7.
   - **If the DTC sets**
   - Refer to Circuit/System Testing.
8.
   - **If the DTC does not set**
9. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B34â€‰Engine Coolant Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the low reference terminalâ€‰2 and ground.
3.
   - **If 5â€‰â„¦ or greater**
4.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
5.
   - **If less than 5â€‰â„¦**
6. Ignition ON.
7. Verify the scan tool ECT Sensor parameter is colder than â˜’39Â°C (â˜’38Â°F).

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8.

- **If warmer than â^'39Â°C (â^'38Â°F)**

9.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the signal circuit terminalâ€‰1 and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
   - If infinite resistance, replace the K20â€‰Engine Control Module.

10.

- **If colder than -39Â°C (-38Â°F)**

11. Install a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰2.
12. Verify the scan tool ECT sensor parameter is warmer than 140Â°C (284Â°F).
13.

- **If colder than the 140Â°C (284Â°F)**

14.

1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for less than 1â€‰V between the signal circuit and ground.
3.
   - If 1â€‰V or greater, repair the short to voltage on the circuit.
4.
   - If less than 1â€‰V
5. Ignition OFF
6. Test for less than 2â€‰â„¦ in the signal circuit end to end.
7.
   - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
   - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

15.

- **If warmer than 140Â°C (284Â°F)**

16. Test or replace the B34â€‰Engine Coolant Temperature Sensor.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the B34Aâ€‰Engine Coolant Temperature Sensor.
2. Note**:**

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

3. Test the B34Aâ€‰Engine Coolant Temperature Sensor by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the Temperature Versus Resistance - Engine Coolant Temperature Sensor table and verify that the resistance is within 5% of the specification.

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4.

    - If not within the specified range, replace the B34Aâ€‰Engine Coolant Temperature Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Engine Coolant Temperature Sensor Replacement
- Control Module References for ECM replacement, programming, and setup.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0117, P0118, or P0119

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

DTCâ€‰P0117

Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

DTCâ€‰P0118

Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

DTCâ€‰P0119

Engine Coolant Temperature (ECT) Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
ECT Sensor Signal	P0117, P0119	P0118, P0119	P0118*,P0119	P0116, P0128
Low Reference	â€”	P0118, P0119	â€”	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 at various operating conditions **Parameter Normal Range:** Varies with coolant temperature			
Signal	142.5Â°C (288.5Â°F)	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°F)
Low Reference	â€”	â^’48Â°C (â^’54.4Â°F)	â^’48Â°C (â^’54.4Â°F)

Circuit/System Description

The engine coolant temperatureâ€‰(ECT) sensor 1 is a variable resistor that measures the temperature of the engine coolant. The engine control moduleâ€‰(ECM) supplies 5â€‰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 1.

Conditions for Running the DTC

P0117

- Ignition is ON.
- System voltage is 10â€“16â€‰V.
- This DTC runs continuously within the enabling conditions.

P0118

- Ignition is ON.

- System voltage is 10â€“16â€‰V.
- This DTC runs continuously within the enabling conditions.

P0119

- DTCâ€‰P0117 or P0118 is not set.
- This DTC runs continuously within the enabling conditions.

Conditions for Setting the DTC

P0117

The ECM detects that the measured engine coolant temperature sensor signal voltage is less than 0.03â€‰V.

P0118

The ECM detects that the measured engine coolant temperature sensor signal voltage is greater than 4.98â€‰V.

P0119

The ECM detects that the ECT is intermittent or has abruptly changed for greater than 4â€‰seconds.

Action Taken When the DTC Sets

DTCâ€‰P0117, P0118 or P0119 are a Typeâ€‰B DTC.

Conditions for Clearing the DTC

DTCâ€‰P0117, P0118 or P0119 are a Typeâ€‰B DTC.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the scan tool ECT Sensor parameter is between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) and changes with engine run time.
3.
    - **If not between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) or does not change**

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- Refer to Circuit/System Testing.

4.

- **If between â˜’39 to + 120Â°C (â˜’38 to +248Â°F) and changes**

5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
6. Verify the DTC does not set.
7.

- **If the DTC sets**
- Refer to Circuit/System Testing.

8.

- **If the DTC does not set**

9. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B34â€‰Engine Coolant Temperature Sensor 1. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
3.

- **If 5â€‰â„¦ or greater**

4.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for less than 5â€‰â„¦ in the low reference circuit end to end.
3.

- If 5â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 5â€‰â„¦, replace the K20â€‰Engine Control Module.

5.

- **If less than 5â€‰â„¦**

6. Ignition ON.
7. Verify the scan tool ECT Sensor 1 parameter is colder than â˜’47Â°C (â˜’52.6Â°F).
8.

- **If warmer than â˜’47Â°C (â˜’52.6Â°F)**

9.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the signal circuit terminalâ€‰1 and ground.
3.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20â€‰Engine Control Module.

10.

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- **If colder than â^'47Â°C (â^'52.6Â°F)**

11. Install a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰2.
12. Verify the scan tool ECT sensor 1 parameter is warmer than 141.5Â°C (286.7Â°F).
13.
    - **If colder than 141.5Â°C (286.7Â°F)**
14.
    1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the signal circuit and ground.
    3.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
    4.
        - If less than 1â€‰V
    5. Ignition OFF
    6. Test for less than 5â€‰â„¦ in the signal circuit end to end.
    7.
        - If 5â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 5â€‰â„¦, replace the K20â€‰Engine Control Module.
15.
    - **If warmer than 141.5Â°C (286.7Â°F)**
16. Test or replace the B34Aâ€‰Engine Coolant Temperature Sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B34Aâ€‰Engine Coolant Temperature Sensor.
2. Test for refer to Temperature Versus Resistance - Engine Coolant Temperature Sensor between the signal circuit terminalâ€‰1 and the low reference terminalâ€‰2.
3.
    - **If the temperature versus resistance are not within the specified ranges**
    - Replace the B34Aâ€‰Engine Coolant Temperature Sensor 1.
4.
    - **If the temperature versus resistance are within the specified ranges**
5. Test for infinite resistance between each terminal and the sensor housing.
6.
    - **If less than infinite resistance**
    - Replace the B34Aâ€‰Engine Coolant Temperature Sensor 1.
7.
    - **If infinite resistance**
8. All OK.

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Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Engine Coolant Temperature Sensor Replacement
- Engine Control Module Replacement engine control module replacement, programming, and setup

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0121-P0123

Symptoms

P0122

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 (TP) Sensor Performance

DTC P0122

Throttle Position (TP) Sensor Circuit Low Voltage

DTC P0123

Throttle Position (TP) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5-Volt Reference	P0122	P0122	P0123	P0121
TP Sensor Signal	P0122	P0122	P0123	P0121
Low Reference	â€”	P0123	â€”	P0121

Circuit/System Description

The Q38 Throttle Body Assembly contains a throttle position (TP) sensor. The B106 Throttle Position Sensor is mounted externally on the throttle body assembly. The B106 Throttle Position Sensor is a potentiometer which provides a signal voltage that changes relative to the throttle blade angle. The K20 Engine Control Module supplies the B106 Throttle Position Sensor with a 5-volt reference circuit, a low reference circuit, and a signal circuit.

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

P0121

The K20 Engine Control Module detects the B106 Throttle Position Sensor is stuck within range for greater than 1 s.

P0122

The K20 Engine Control Module detects that the B106 Throttle Position Sensor voltage is less than 0.1â€‰volt.

P0123

The K20 Engine Control Module detects that the B106 Throttle Position Sensor voltage is more than 4.8â€‰volts.

Action Taken When the DTC Sets

- DTC P0121 is a Type B DTC.
- DTCâ€‰P0122 and P0123 are Type A DTCs.

Conditions for Clearing the DTC

- DTC P0121 is a Type B DTC.
- DTCâ€‰P0122 and P0123 are Type A DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

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, slowly depress the accelerator pedal from the rest position to wide open throttle and observe the scan tool TP Sensor voltage parameter. The voltage should change.
2. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

Note**:**

Disconnecting the throttle body harness connector causes additional DTCâ€™s to set.

1. Ignition OFF, and all vehicle systems OFF, disconnect the harness connector at the B106 Throttle Position Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the low reference circuit terminalâ€‰B and ground.
3.
    - **If 5â€‰â„¦ or greater**
4.
    1. Test the low reference circuit for an open/high resistance.
    2. If the circuit tests normal, replace the K20 Engine Control Module.
5.
    - **If less than 5â€‰â„¦**
6. Ignition ON.

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7. Test for 4.8â€“5.2â€‰volts between the 5-volt reference circuit terminalâ€‰A and ground.
8.
    - **If less than 4.8 volts**
9.
    1. Test the 5-volt reference circuit for a short to ground or open/high resistance.
    2.
        - If the circuit tests normal, replace the K20 Engine Control Module.
10.
    - **If greater than 5.2 volts**
11.
    1. Test the 5-volt reference circuit for a short to voltage.
    2.
        - If the circuit tests normal, replace the K20 Engine Control Module.
    3.
        - **If between 4.8â€“5.2â€‰volts**
12. Verify the scan tool TP Sensor voltage parameter is less than 0.3â€‰volts.
13.
    - **If greater than the specified range**
14.
    1. Test the signal circuit for a short to voltage.
    2.
        - If the circuit tests normal, replace the K20 Engine Control Module.
15.
    - **If 0.3â€‰volts or less**
16. Install a 3A fused jumper wire between the signal circuit terminalâ€‰C and the 5-volt reference circuit terminalâ€‰A.
17. Verify the scan tool B106 Throttle Position Sensor voltage parameter is greater than 4.8â€‰volts.
18.
    - **If less than 4.8â€‰volts**
19.
    1. Test the signal circuit for a short to ground or an open/high resistance.
    2.
        - If the circuit tests normal, replace the K20 Engine Control Module.
20.
    - **If 4.8â€‰volts or greater**
21. Test or replace the B106 Throttle Position Sensor.

Repair Instructions

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Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for engine control module replacement, setup, and programming

Related Part Information

Part Name	Catalog Name	Part Code

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0121-P0123, P0221-P0223, or P2135 (LKY)

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 P0221

Throttle Position Sensor 2 Performance

DTC P0222

Throttle Position Sensor 2 Circuit Low Voltage

DTC P0223

Throttle Position Sensor 2 Circuit High Voltage

DTC P2135

Throttle Position Sensors 1â€“2 Not Plausible

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Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	P0122, P0222	P0123, P0222	P0123, P0223	P0121, P0221
Throttle Position Sensor 1 Signal	P0122, P2135	P0123, P2135	P0123, P2135	P0121, P2135
Throttle Position Sensor 2 Signal	P0222, P2135	P0223, P2135	P0223, P2135	P0221, P2135
Low Reference	â€”	P0123, P0223	â€”	â€”

Typical Scan Tool Data

Throttle Position Sensor 1

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running **Parameter Normal Range:** Throttle position sensor 1 0.20â€“4.82V			
5V Reference	0V	0V	4.98V
Throttle Position Sensor 1 Signal	0V	0V	4.98V
Low Reference	â€”	4.98V	â€”

Throttle Position Sensor 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine Running **Parameter Normal Range:** Throttle position sensor 2 4.82â€“0.19V			
5V Reference	0.02V	0.02V	3.20V
Throttle Position Sensor 2 Signal	0V	4.98V	4.98V
Low Reference	â€”	4.98V	â€”

Circuit 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 2 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

P0121 or P0221

- DTCs P0122, P0123, P0222, P0223, P0642, P0643, or P2135 are not set.
- The ignition is ON.
- The DTC runs continuously when the above conditions are met.

P0122, P0123, P0222, or P0223

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

P2135

- DTCs P0122, P0123, P0222, P0223, P0638, P0642, P0643, or P2119 are not set.
- The ignition is ON.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0121, P0221, or P2135

The ECM detects that the difference between TP 1 and TP 2 is greater than 12Â° TPS.

P0122 or P0222

The ECM detects that the TP sensor 1 signal voltage is less than 0.15V.

P0123 or P0223

The ECM detects that the TP sensor 1 signal voltage is greater than 4.95V.

Action Taken When the DTC Sets

DTC P0121, P0122, P0123, P0221, P0222, P0223, and P2135 are Type A DTCs.

Conditions for Clearing the DTC

DTC P0121, P0122, P0123, P0221, P0222, P0223, and P2135 are Type A DTCs.

Diagnostic Aids

- It may be necessary to disconnect the battery to clear DTC P2135.

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- If a shared 5V reference circuit is shorted to ground or shorted to a voltage, other 5V reference circuits may be affected.
- A high resistance condition on the throttle actuator control circuits may cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Schematics

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, observe the Throttle Position Sensor 1 parameter. The reading should be between 0.18â€“4.63V and change with accelerator pedal input.
2. Ignition ON, observe the Throttle Position Sensor 2 parameter. The reading should be between 4.7â€“0.13V and change with accelerator pedal input.
3. Observe the DTC Information with a scan tool. DTCs P0121, P0122, P0123, P0221, P0222, P0223, and P2135 should not set.
4. Observe both Throttle Position Sensor 1 and Throttle Position Sensor 2 percentage parameters while quickly pressing the accelerator pedal from a closed throttle to WOT. Both Throttle Position Sensor 1 and Throttle Position Sensor 2 percentage parameters should change.
5. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

Note**:**

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

1. Ignition OFF, disconnect the harness connector at the Q38 Throttle Body. Allow sufficient time for the K20 Engine Control Module to completely power down.
2. Ignition OFF, test for less than 5â„¦ between the low reference circuit terminal 4 and ground.
3.
    - If greater than 5â„¦, test the low reference circuit for an open/high resistance. If the circuit tests normal, replace the K20 ECM.
4. Ignition ON, test for 4.8â€“5.2V between the 5V reference circuit terminal 5 and ground.
5.
    - If less than the specified range, test the 5V reference circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20 ECM.
    - If greater than the specified range, test the 5V reference circuit for a short to voltage. If the circuit tests normal, replace the K20 ECM.
6. Test for less than 1V between the throttle position sensor 2 signal circuit terminal 3 and ground.

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7.
    - If greater than specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20 ECM.
8. Test for 4.8â€“5.2V between the throttle position sensor 1 signal circuit terminal 6 and ground.
9.
    - If less than specified range, test the signal circuit for a short to ground, or an open/high resistance. If the circuit tests normal, replace the K20 ECM.
    - If greater than specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20 ECM.
10. Install a 3A fused jumper wire between the throttle position sensor 2 signal circuit terminal 3 and the 5V reference circuit terminal 5. Verify the scan tool throttle position sensor 2 voltage parameter is greater than 4.8V.
11.
    - If less than the specified range, test the signal circuit for a short to ground, or an open/high resistance. If the circuit tests normal, replace the K20 ECM.
12. Install a 3A fused jumper wire between the throttle position sensor 1 signal circuit terminal 6 and the low reference circuit terminal 4. Verify the scan tool throttle position sensor 1 voltage parameter is less than 0.1V.
13.
    - If greater than the specified range, test the signal circuit for a short to voltage, or an open/high resistance. If the circuit tests normal, replace the K20 ECM.
14. Ignition OFF, disconnect the ECM harness connector at the K20 ECM.
15. Test for less than 5â„¦ on all the throttle position sensor circuits between the following terminals:
16.
    - The 5V reference circuit terminal 5 to the corresponding ECM terminal 23
    - The throttle position sensor 2 signal circuit terminal 3 to the corresponding ECM terminal 36
    - The throttle position sensor 1 signal circuit terminal 6 to the corresponding ECM terminal 21
    -
        - If greater than 5â„¦, repair the affected circuit.
17. Test for infinite resistance between the throttle position sensor 1 signal circuit terminal 6 and throttle position sensor 2 signal circuit terminal 3.
18.
    - If less than infinite resistance, repair the short between the circuits.
19. If all circuits test normal, replace the Q38 Throttle Body.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Throttle Body Assembly Replacement
- Control Module References for ECM replacement, setup, and programming

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0125 or P0128

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

DTCâ€‰P0125

Engine Coolant Temperature (ECT) Insufficient for Closed Loop

DTCâ€‰P0128

Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature

Circuit/System Description

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

The purpose of this diagnostic is to analyze the performance of the thermostat by comparing the measured ECT to a modeled ECT using information from the following inputs:

- ECT
- Engine load
- Intake air temperatureâ€‰(IAT)

The ECM uses the start-up ECT and ambient air temperature to begin the diagnostic calculation. This diagnostic monitors the amount of energy going into and out of the engine cooling system during the warm up process to determine if the ECT does increase normally and then maintains that temperature within a calibrated range of the modeled ECT.

Conditions for Running the DTC

P0125

- Ignition is ON.
- System voltage is 10â€“16â€‰V.
- DTCâ€‰P0125 runs continuously once the above conditions have been met.

P0128

- DTC P0112, P0113, P0116, P0117, P0118, P0119, P0597, P0598, or P0598 is not set.
- The engine not run time is greater than 30â€‰m.
- Coolant temperature at radiator at cranking is less than 40Â°Câ€‰(72Â°F).
- ECT at cranking is between â^’7.5 and +45Â°C (13.5â€“81Â°F).
- Time if fuel cut off since engine start (as ratio) is less than 30%.
- Time of idle since engine start (as ratio) is less than 50%.
- The calculated ambient air temperature is above 7.5Â°C (13.5Â°F).
- DTCâ€‰P0128 runs continuously once the above conditions have been met.

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Conditions for Setting the DTC

P0125

The actual ECT is not within the calculated ECT after 2â€“5â€‰minutes, which depends ECT at startup.

P0128

- Difference between coolant temperature at engine and coolant temperature at radiator is 7.5Â°C (13.5Â°F).
- Coolant temperature did not reach a warmed up temperature of 83.25Â°Câ€‰(149.85Â°F)..

Action Taken When the DTC Sets

DTCâ€‰P0125 and P0128 are Typeâ€‰B DTCs.

Conditions for Clearing the MIL/DTC

DTCâ€‰P0125 and P0128 are Typeâ€‰B DTCs.

Diagnostic Aids

DTC P0128 occurring with insufficient vehicle interior heating is an indication of improper thermostat operation.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify the cooling system is filled to the correct coolant level. Refer to Cooling System Leak Testing and Cooling System Draining and Filling.
2.
   - **If the coolant level is not correct**
   - Repair as necessary
3.
   - **If the coolant level is correct**
4. Verify the DTCâ€‰P0116, P0117, P0118, P0597, P0598, or P0599 is not set.
5.

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- **If a DTC is set**
- Refer to Diagnostic Trouble Code (DTC) List - Vehicle

6.
   - **If a DTC is not set**
7. Engine running for 15â€‰min with the A/C OFF, increase the engine speed to 3,000â€‰RPM.
8. Verify the scan tool ECT Sensor parameter is greater than 79Â°Câ€‰(174Â°F) when commanding the Engine Coolant Thermostat Heater to 0%.
9.
   - **If less than 79Â°Câ€‰(174Â°F)**
   - Replace the E41â€‰Engine Coolant Thermostat Heater.
10.
    - **If greater than 79Â°Câ€‰(174Â°F)**
11. 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.
12. Verify the DTC does not set.
13.
    - **If the DTC sets**
    - Refer to Circuit/System testing.
14.
    - **If the DTC does not set**
15. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B34â€‰Engine Coolant Temperature Sensor. It may take up to 2 minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
3.
   - **If 5â€‰â„¦ or greater**
4.
    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
    3.
       - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
       - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
5.
   - **If less than 5â€‰â„¦**
6. Ignition ON.
7. Verify the scan tool ECT Sensor parameter is colder than â’’47Â°C (â’’52.6Â°F).

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8.

- **If warmer than â^'47Â°C (â^'52.6Â°F)**

9.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the signal circuit terminalâ€‰1 and ground.
3.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20â€‰Engine Control Module.

10.

- **If colder than -47Â°C (-52.6Â°F)**

11. Install a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰2.
12. Verify the scan tool ECT sensor parameter is warmer than 149Â°C (300Â°F).
13.

- **If colder than 141.5Â°C (286.7Â°F)**

14.

1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for less than 1â€‰V between the signal circuit and ground.
3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.

4.

- If less than 1â€‰V

5. Ignition OFF
6. Test for less than 2â€‰â„¦ in the signal circuit end to end.
7.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

15.

- **If warmer than 141.5Â°C (286.7Â°F)**

16. Test or replace the B34â€‰Engine Coolant Temperature Sensor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the B34â€‰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.

3.

- **If not within the specified range**
- Replace the B34â€‰Engine Coolant Temperature Sensor.

4.

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- **If within the specified range**

5. Test for infinite resistance between each terminal and the sensor housing.
6.
    - **If less than infinite resistance**
    - Replace the B34â€‰Engine Coolant Temperature Sensor.
7.
    - **If infinite resistance**
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Engine Coolant Thermostat Replacement
- Engine Coolant Temperature Sensor Replacement
- Control Module References for engine control module replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0130-P0132, P0134, or P0136-P0138 (LKY)

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 P0130

HO2S Circuit Sensorâ€‰1

DTC P0131

HO2S Circuit Low Voltage Sensorâ€‰1

DTC P0132

HO2S Circuit High Voltage Sensorâ€‰1

DTC P0133

HO2S Slow Response Sensorâ€‰1

DTC P0134

HO2S Circuit Insufficient Activity Sensorâ€‰1

DTC P0136

HO2S Circuit Sensorâ€‰2

DTC P0137

HO2S Circuit Low Voltage Sensorâ€‰2

DTC P0138

HO2S Circuit High Voltage Sensorâ€‰2

DTC P0140

HO2S Circuit Insufficient Activity Sensorâ€‰2

Diagnostic Fault Information

HO2S 1

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0131	P0130, P0134	P0132, P0134	P0133
Low Reference	â€”	P0130, P0134	â€”	P0133

HO2S 2

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0137	P0137, P0140	P0138, P0140	â€”
Low Reference	â€”	P0137, P0140	â€”	â€”

Typical Scan Tool Data

HO2S 1 and 2

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Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** Fluctuates above and below 350â€“500â€‰mV			
Signal	0â€‰mV	400â€“415â€‰mV	5000â€‰mV
Low Reference	â€”	400â€“415â€‰mV	5000â€‰mV

Circuit 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. The control module supplies the HO2S with a reference, or bias voltage of about 450â€‰mV. While the engine runs, the HO2S heats up and begins to generate a voltage within a range of 0â€“1,000â€‰mV. This voltage will fluctuate above and below the bias voltage. 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 above bias voltage toward 1,000â€‰mV indicates a rich fuel mixture. An HO2S voltage that decreases below bias voltage toward 0â€‰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.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit
- A heater control circuit

Conditions for Running the DTC

P0130, P0131, P0132

- The ignition is ON.
- The vehicle is operating in closed loop.
- The battery voltage is between 10â€“16 V.
- No failure in HO2S heater exists.
- The DTC runs continuously when the above conditions are met.

P0132, P0138

- The ignition is ON.
- The vehicle is operating in closed loop.
- The DTC runs continuously when the above conditions are met.

P0133

- The catalyst monitoring is active.
- The vehicle speed is greater than 45 km/h (30 mph).
- The vehicle is operating in closed loop.
- The DTC runs continuously when the above conditions are met.

P0134 or P0140 (Test 1)

- DTCs P0053, P0130, P0131, P0132, P0133, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, or P0304 are not set.
- The vehicle is operating in closed loop.

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- The exhaust gas temperature is greater than 650Â°C (1202Â°F).
- The total mass air flow during the decel. fuel cut-off is between 20â€“200â€‰g.
- The DTC runs continuously when the above conditions are met.

P0134 or P0140 (Test 2)

- DTCs P0053, P0130, P0131, P0132, P0134, P0171, or P0172 are not set.
- The vehicle is operating in closed loop.
- The exhaust gas temperature is greater than 650Â°C (1202Â°F).
- The DTC runs continuously when the above conditions are met.

P0136

- DTCs P0037, P0038, P0136, P0137, or P0138 are not set.
- The ignition is ON.
- The battery voltage is between 10â€“16 V.
- The exhaust gas temperature is greater than 650Â°C (1202Â°F).
- The DTC runs continuously when the above conditions are met.

P0137

- DTCs P0171, P0172, P0300, P0301, P0302, P0303, P0336, or P0337 are not set.
- The ignition is ON.
- The vehicle is operating in closed loop.
- The mass airflow is greater than 1.1 g/s.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0130

The ECM detects that the HO2S signal voltage is between 0.376â€“0.474â€‰V for 16â€‰s.

P0131

The ECM detects that the HO2S signal voltage is less than 0.024â€‰V for 16â€‰s.

P0132

The ECM detects that the HO2S signal voltage is greater than 1.201â€‰V for 1.6â€‰s.

P0133

The ECM detects that the HO2S 1 rich-to-lean or lean-to-rich response time is greater than the predetermined value.

P0134 (Test 1)

The ECM detects that the HO2S 1 signal voltage is greater than 0.298â€‰V for 5â€‰â€‰s during fuel cut off.

P0134 (Test 2)

The ECM detects that the difference between minimum and maximum HO2Sâ€‰1 signal voltage is less than 0.25â€‰V for 1.6â€‰s.

P0136

The ECM detects that the HO2S 1 circuit resistance is greater than 60 kâ„¦.

P0137

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The ECM detects that the HO2Sâ€‰2 signal voltage is less than 0.02â€‰V for 1.6â€‰s.

P0138

The ECM detects that the HO2S 2 signal voltage is greater than 1.201â€‰V for 1.6â€‰s.

P0140 (Test 1)

The ECM detects that the HO2S 2 signal voltage is greater than 0.298â€‰V for 5â€‰s during fuel cut off.

P0140 (Test 2)

The change in HO2S 2 signal voltage during the diagnostics after the end of the fuel cut off is less than 0.01â€‰V.

Action Taken When the DTC Sets

DTC P0130, P0131, P0132, P0133, P0134, P0136, P0137, P0138, and P0140 are Typeâ€‰E DTCs.

Conditions for Clearing the DTC

DTC P0130, P0131, P0132, P0133, P0134, P0136, P0137, P0138, and P0140 are Typeâ€‰E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, verify that the DTCs related to the HO2S heater are not set.
2.
    - If a DTC is set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Note:

   A front HO2S circuit condition can cause a rear HO2S DTC to set.
4. Engine running at normal operating temperature, verify that the scan tool heated oxygen sensor voltage parameter varies as follows:
5.
    - Fluctuates above and below 350â€“550â€‰mV (HO2S 1)
    - Fluctuates within 350â€“550â€‰mV (HO2S 2)
6. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the

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conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate HO2S.
2.
   - B52A Heated Oxygen Sensorâ€‰1 (HO2Sâ€‰1)
   - B52B Heated Oxygen Sensorâ€‰2 (HO2Sâ€‰2)
3. Ignition OFF for 1â€‰minute, test for less than 5â€‰â„¦ between the low reference circuit and ground.
4.
   - Low reference circuit terminalâ€‰B of the B52A HO2Sâ€‰1 and ground
   - Low reference circuit terminalâ€‰B of the B52B HO2Sâ€‰2 and ground
5.
   - If greater than the specified range, test the low reference circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
6. Ignition ON, test for 350â€“550â€‰mV between the signal circuit and ground.
7.
   - Signal circuit terminalâ€‰A of the B52A HO2Sâ€‰1 and ground
   - Signal circuit terminalâ€‰A of the B52B HO2Sâ€‰2 and ground
8.
   - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
   - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20â€‰ECM.
9. Install a 3A fused jumper wire between the signal circuit terminalâ€‰A and the low reference circuit terminalâ€‰B. Engine running, verify the scan tool HO2S parameter is less than 60â€‰mV.
10.
    - Signal circuit terminalâ€‰A and low reference circuit terminalâ€‰B of the B52A HO2Sâ€‰1
    - Signal circuit terminalâ€‰A and low reference circuit terminalâ€‰B of the B52B HO2Sâ€‰2
11.
    - If greater than the specified range, replace the K20â€‰ECM.
12. Verify none of the following conditions exist:
13.
    - Lean or rich fuel injectorsâ€”Refer to Fuel Injector Diagnosis.
    - Water intrusion in the HO2S harness connector
    - Low or high fuel system pressureâ€”Refer to Fuel System Diagnosis.
    - Fuel that is contaminatedâ€”Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
    - Fuel saturation of the evaporative emission (EVAP) canister
    - Exhaust leaks near the HO2S
    - Engine vacuum leaks

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-
    - If you find any of the above conditions, repair as necessary.

14. If all circuits test normal, test or replace the appropriate HO2S.
15.
    - B52A HO2Sâ€‰1
    - B52B HO2Sâ€‰2

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0130-P0134, P0137-P0139, P013A, or P0140 (LCP, LC5, LMT, LMU without FX3)

Symptoms

P0131

P0132

P0133

P0138

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 P0130

HO2S Circuit Sensorâ€‰1

DTC P0131

HO2S Circuit Low Voltage Sensorâ€‰1

DTC P0132

HO2S Circuit High Voltage Sensorâ€‰1

DTC P0133

HO2S Slow Response Sensorâ€‰1

DTC P0134

HO2S Circuit Insufficient Activity Sensorâ€‰1

DTC P0137

HO2S Circuit Low Voltage Sensorâ€‰2

DTC P0138

HO2S Circuit High Voltage Sensorâ€‰2

DTC P0139

HO2S Slow Response Sensorâ€‰2

DTC P013A

HO2S Slow Response Rich to Lean Sensorâ€‰2

DTC P0140

HO2S Circuit Insufficient Activity Sensorâ€‰2

Diagnostic Fault Information

HO2S 1

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Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0131	P0130, P0134	P0132, P0134	P0133
Low Reference	â€”	P0130, P0134	â€”	P0133

HO2S 2

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0137	P0137, P0140	P0138, P0140	P0139, P013A
Low Reference	â€”	P0137, P0140	â€”	P0139, P013A

Typical Scan Tool Data

HO2S 1 and 2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** Fluctuates above and below 350â€“500â€°mV			
Signal	0â€°mV	400â€“415â€°mV	5000â€°mV
Low Reference	â€”	400â€“415â€°mV	5000â€°mV

Circuit 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. The control module supplies the HO2S with a reference, or bias voltage of about 450â€°mV. While the engine runs, the HO2S heats up and begins to generate a voltage within a range of 0â€“1,000â€°mV. This voltage will fluctuate above and below the bias voltage. 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 above bias voltage toward 1,000â€°mV indicates a rich fuel mixture. An HO2S voltage that decreases below bias voltage toward 0â€°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.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit
- A heater control circuit

Conditions for Running the DTC

P0130, P0131

- The ignition is ON.
- The vehicle is operating in closed loop. The engine speed is less than 6016â€°RPM.
- The mass air flow is greater than 60â€“300â€°mg/stk depending on conditions.
- No failure in HO2S heater exists.
- The DTC runs continuously when the above conditions are met.

P0132, P0138

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

P0133

- The engine coolant temperature is greater than 80Â°C (176Â°F).
- The catalyst temperature is between 550â€“900Â°C (1022â€“1652Â°F).

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- The vehicle speed is between 40â€“110 km/h (24.9â€“68.4 mph).
- The mass air flow between 100â€“300 mg/tdc.
- The vehicle is operating in closed loop.
- The ECM did not command the canister purge solenoid valve closed.
- No errors related to HO2S1, HO2S2, misfire, ECT, CKP, CMP, VS, MAP, IAT, canister purge solenoid, injectors, and EGR exist.
- The DTC runs continuously when the above conditions are met.

P0134 (Test 1)

- The mass air flow during fuel cut off phase is between 16â€“360â€‰g.
- The DTC runs continuously when the above conditions are met.

P0134 (Test 2)

- The vehicle is operating in closed loop.
- The DTC runs continuously when the above conditions are met.

P0137 (Test 1)

- The ignition is ON.
- The fuel trim function is active.
- No fault related to the HO2S exists.
- The engine speed is less than 6016 RPM.
- The DTC runs continuously when the above conditions are met.

P0137 (Test 2)

- The ignition is ON.
- The vehicle is in fuel cut off mode.
- The engine speed is less than 6016 RPM.
- The total mass air flow is greater than 100 mg.
- The DTC runs continuously when the above conditions are met.

P0139 or P013A

- The engine coolant temperature is greater than 70Â°C (158Â°F).
- The vehicle speed is between 5â€“180 km/h (3.1â€“111.8â€‰mph).
- The catalyst temperature is greater than 400Â°C (752Â°F).
- The engine is running for greater than 240â€“800 s depending on the start temperature.
- The vehicle is in fuel cut off mode.
- The EGR valve is closed.
- The HO2S 2 signal voltage is greater than 0.55â€‰V.
- The mass air flow is between 7â€“60 kg/h.
- The DTC runs 3 times during fuel cut off when the above conditions are met.

P0140

- The engine coolant temperature is greater than 70Â°C (158Â°F).

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- The vehicle speed is between 5â€“180 km/h (3.1â€“111.8 mph).
- The catalyst temperature is greater than 400Â°C (752Â°F).
- The engine is running for greater than 240â€“800 s depending on the start temperature.
- The vehicle is in fuel cut off mode.
- The total mass air flow during fuel cut off is greater than 16â€‰g.
- The total mass air flow after the end of fuel cut off is greater than 50â€‰g.
- The DTC runs every driving cycle after leaving the fuel cut off when the above conditions are met.

Conditions for Setting the DTC

P0130

The ECM detects that the HO2S signal voltage is between 0.352â€“0.499â€‰V for 21â€‰s.

P0131

The ECM detects that the HO2S signal voltage is less than 0.024â€‰V for 21â€‰s.

P0132

The ECM detects that the HO2S signal voltage is greater than 1.403â€‰V for 5â€‰s.

P0133

The ECM detects that the HO2S 1 rich-to-lean or lean-to-rich response time is greater than the predetermined value.

P0134 (Test 1)

The ECM detects that the HO2S 1 signal voltage is greater than 0.25â€‰V for 6â€‰s.

P0134 (Test 2)

The ECM detects that the difference between minimum and maximum HO2Sâ€‰1 signal voltage is less than 0.25â€‰V for 10â€‰s.

P0137 (Test 1)

The ECM detects that the HO2Sâ€‰2 signal voltage is less than 0.024â€‰V for 21â€‰s.

P0137 (Test 2)

The ECM detects that the HO2S 2 signal voltage is between 0.352â€“0.499â€‰V for 10â€‰s.

P0138

The ECM detects that the HO2S 2 signal voltage is greater than 1.403â€‰V for 5â€‰s.

P0139

The ECM detects that the HO2S 2rich-to-lean or lean-to-rich response time is greater than the predetermined value.

P013A

The ECM detects that the HO2S 2 rich-to-lean response time during fuel cutoff is greater than the predetermined value.

P0140

The change in HO2S 2 signal voltage during the diagnostics after the end of the fuel cut off is less than 0.0098â€‰V.

Action Taken When the DTC Sets

DTC P0130, P0131, P0132, P0133, P0134, P0137, P0138, P0139, P013A, and P0140 are Typeâ€‰E DTCs.

Conditions for Clearing the DTC

DTC P0130, P0131, P0132, P0133, P0134, P0137, P0138, P0139, P013A, and P0140 are Typeâ€‰E DTCs.

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Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, verify that the DTCs related to the HO2S heater are not set.
2.
    - If a DTC is set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Note:

   A front HO2S circuit condition can cause a rear HO2S DTC to set.
4. Engine running at normal operating temperature, verify that the scan tool heated oxygen sensor voltage parameters fluctuate above and below the range of 350â€“550â€‰mV (for HO2S 1, and within 350â€“550â€‰mV for HO2S 2).
5. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate HO2S.
2.
    - B52A Heated Oxygen Sensorâ€‰1 (HO2Sâ€‰1)
    - B52B Heated Oxygen Sensorâ€‰2 (HO2Sâ€‰2)
3. Ignition OFF for 1â€‰minute, test for less than 5â€‰â„¦ between the low reference circuit and ground.
4.
    - Low reference circuit terminalâ€‰3 of the B52A HO2Sâ€‰1 and ground
    - Low reference circuit terminalâ€‰3 of the B52B HO2Sâ€‰2 and ground
5.
    - If greater than the specified range, test the low reference circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
6. Ignition ON, test for 350â€“550â€‰mV between the signal circuit and ground.

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7.
    - Signal circuit terminalâ€‰1 of the B52A HO2Sâ€‰1 and ground
    - Signal circuit terminalâ€‰1 of the B52B HO2Sâ€‰2 and ground
8.
    - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
    - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20â€‰ECM.
9. Install a 3A fused jumper wire between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰3. Engine running, verify the scan tool HO2S parameter is less than 60â€‰mV.
10.
    - Signal circuit terminalâ€‰1 and low reference circuit terminalâ€‰3 of the B52A HO2Sâ€‰1
    - Signal circuit terminalâ€‰1 and low reference circuit terminalâ€‰3 of the B52B HO2Sâ€‰2
11.
    - If greater than the specified range, replace the K20â€‰ECM.
12. Verify none of the following conditions exist:
13.
    - Lean or rich fuel injectorsâ€“Refer to Fuel Injector Diagnosis.
    - Water intrusion in the HO2S harness connector
    - Low or high fuel system pressureâ€“Refer to Fuel System Diagnosis.
    - Fuel that is contaminatedâ€“Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
    - Fuel saturation of the evaporative emission (EVAP) canister
    - Exhaust leaks near the HO2S
    - Engine vacuum leaks
    -
        - If you find any of the above conditions, repair as necessary.
14. If all circuits test normal, test or replace the appropriate HO2S.
15.
    - B52A HO2Sâ€‰1
    - B52B HO2Sâ€‰2

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming.

Related Part Information

Part Name	Catalog Name	Part Code

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0130-P0134, P0137-P0139, P013A, or P0140 (LMT, LMU with FX3)

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 P0131

HO2S Circuit Low Voltage Sensor 1

DTC P0132

HO2S Circuit High Voltage Sensor 1

DTC P0133

HO2S Slow Response 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 P013A

HO2S Slow Response Rich to Lean Sensor 2

DTC P013B

HO2S Slow Response Lean to Rich Sensor 2

DTC P0140

HO2S Circuit Insufficient Activity Sensor 2

Diagnostic Fault Information

HO2S 1

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0131	P0130, P0134	P0132, P0134	P0133
Low Reference	â€”	P0130, P0134	â€”	P0133

HO2S 2

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P0137	P0137, P0140	P0138, P0140	P013A, P013B
Low Reference	â€”	P0137, P0140	â€”	P013A, P013B

Typical Scan Tool Data

HO2S 1 and 2

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Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** Fluctuates above and below 350â€“500â€‰mV			
Signal	0â€‰mV	400â€“415â€‰mV	5000â€‰mV
Low Reference	â€”	400â€“415â€‰mV	5000â€‰mV

Circuit 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. The control module supplies the HO2S with a reference, or bias voltage of about 450â€‰mV. While the engine runs, the HO2S heats up and begins to generate a voltage within a range of 0-1,000 mV. This voltage will fluctuate above and below the bias voltage. 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 above bias voltage toward 1,000â€‰mV indicates a rich fuel mixture. An HO2S voltage that decreases below bias voltage toward 0â€‰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.

The HO2S utilizes the following circuits:

- A signal circuit
- A low reference circuit
- An ignition circuit
- A heater control circuit

Conditions for Running the DTC

P0131, P0132, P0137, P0138, or P0140

- DTC P0031, P0032, P0037, P0038, P0106, P0107, P0108, P0117, P0118, P0135, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0507, P0562, P0563, or P2110 is not set.
- The HO2S is warmed up enough.
- The engine is running for greater than 60â€‰s.
- The deceleration fuel cut-off is not active.
- The engine coolant temperature is greater than the predetermined values.
- The closed loop fuel control is active.
- The DTC runs continuously when the above conditions are met.

P0133 or P0134

- DTC P0031, P0032, P0037, P0038, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0131, P0132, P0134, P0135, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0507, P0562, P0563, or P2110 is not set.
- The engine is running for greater than 60â€‰s.
- The engine coolant temperature is greater than 60Â°C (140Â°F).
- The closed loop fuel control is active.
- The barometric pressure is greater than 72â€‰kPa (10.4â€‰psi).

P013A

- DTC P0037, P0038, P0106, P0107, P0108, P0117, P0118, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0507, P0562, P0563, or P2110 is not set.

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- The engine is running for greater than 120â€‰s.
- The engine coolant temperature is greater than 60Â°C (140Â°F).
- The deceleration fuel cut-off is active.
- The DTC runs continuously when the above conditions are met.

P013B

- DTC P0037, P0038, P0106, P0107, P0108, P0117, P0118, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0351, P0352, P0353, P0354, P0458, P0459, P0507, P0562, P0563, or P2110 is not set.
- The engine is running for greater than 120â€‰s.
- The engine coolant temperature is greater than 60Â°C (140Â°F).
- The airflow is greater than 7â€‰g/s.
- The power enrichment is active.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0131 or P0137

The ECM detects that the filtered HO2S signal voltage is less than 0.02V.

P0132 or P0138

The ECM detects that the filtered HO2S signal voltage is greater than 1.10V.

P0133

- The ECM detects that the HO2S 1 rich-to-lean or lean-to-rich counts are less than the predetermined value.
- The ECM detects that the HO2S 1 average of rich-to-lean or lean-to-rich response time is greater than the predetermined value.

P0134

The ECM detects that the filtered HO2S signal voltage is between 299â€“600â€‰mV.

P013A

The ECM detects that the average time for rich-to-lean transition is greater than 1â€‰s during the deceleration fuel cut-off.

P013B

The ECM detects that the average time for lean-to-rich is greater than predetermined values during the power enrichment.

P0140

The ECM detects that the filtered HO2S signal voltage is between 0.42â€“0.48V.

Action Taken When the DTC Sets

DTC P0131, P0132, P0133, P0134, P0137, P0138, P013A, P013B, and P0140 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0131, P0132, P0133, P0134, P0137, P0138, P013A, P013B, and P0140 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

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Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, verify that the DTCs related to the HO2S heater are not set.
2.
   - If a DTC is set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Note:

   A front HO2S circuit condition can cause a rear HO2S DTC to set.
4. Engine running at normal operating temperature, verify that the scan tool heated oxygen sensor voltage parameters fluctuate above and below the range of 350â€“550â€‰mV for HO2S 1, and within 350â€“550â€‰mV for HO2S 2.
5. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate HO2S.
2.
   - B52A Heated Oxygen Sensorâ€‰1 (HO2Sâ€‰1)
   - B52B Heated Oxygen Sensorâ€‰2 (HO2Sâ€‰2)
3. Ignition OFF for 1â€‰minute, test for less than 5â€‰â„¦ between the low reference circuit and ground.
4.
   - Low reference circuit terminalâ€‰3 of the B52A HO2Sâ€‰1 and ground
   - Low reference circuit terminalâ€‰3 of the B52B HO2Sâ€‰2 and ground
5.
   - If greater than the specified range, test the low reference circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
6. Ignition ON, test for 350â€“550â€‰mV between the signal circuit and ground.
7.
   - Signal circuit terminalâ€‰1 of the B52A HO2Sâ€‰1 and ground
   - Signal circuit terminalâ€‰1 of the B52B HO2Sâ€‰2 and ground

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8.
    - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
    - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20â€‰ECM.
9. Install a 3A fused jumper wire between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰3. Engine running, verify the scan tool HO2S parameter is less than 60â€‰mV.
10.
    - Signal circuit terminalâ€‰1 and low reference circuit terminalâ€‰3 of the B52A HO2Sâ€‰1
    - Signal circuit terminalâ€‰1 and low reference circuit terminalâ€‰3 of the B52B HO2Sâ€‰2
11.
    - If greater than the specified range, replace the K20â€‰ECM.
12. Verify none of the following conditions exist:
13.
    - Lean or rich fuel injectorsâ€”Refer to Fuel Injector Diagnosis.
    - Water intrusion in the HO2S harness connector
    - Low or high fuel system pressureâ€”Refer to Fuel System Diagnosis.
    - Fuel that is contaminatedâ€”Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
    - Fuel saturation of the evaporative emission (EVAP) canister
    - Exhaust leaks near the HO2S
    - Engine vacuum leaks
    -
        - If you find any of the above conditions, repair as necessary.
14. If all circuits test normal, test or replace the appropriate HO2S.
15.
    - B52A HO2Sâ€‰1
    - B52B HO2Sâ€‰2

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Control Module References for ECM replacement, setup, and programming.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0131, P0132, P0134, P0137, P0138, P0140, or P2A00 (LL0)

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

DTCâ€‰P0131

HO2S Circuit Low Voltage Sensorâ€‰1

DTCâ€‰P0132

HO2S Circuit High Voltage Sensorâ€‰1

DTCâ€‰P0134

HO2S Circuit Insufficient Activity Sensorâ€‰1

DTCâ€‰P0137

HO2S Circuit Low Voltage Sensorâ€‰2

DTCâ€‰P0138

HO2S Circuit High Voltage Sensorâ€‰2

DTCâ€‰P0140

HO2S Circuit Insufficient Activity Sensorâ€‰2

DTCâ€‰P2A00

HO2S Performance Sensorâ€‰1

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, P2A00	P0133, P013A, P013B, P013E, P013F, P015A, P015B
HO2S Low Signal	P0131, P0137, P0171	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140, P2A00	P0133, P013A, P013B, P013E, P013F, P015A, P015B

Typical Scan Tool Data

HO2S Sensor 1 or 2

Circuit	Short to Ground	Open	Short to Voltage
Parameter Normal Range: 200â€“800â€‰mV			
HO2S High Signal	0.00â€‰V	1.7â€“2.1â€‰â€‰V	1.7â€“2.1â€‰â€‰V
HO2S Low Signal	0.00â€‰V	1.7â€“2.1â€‰â€‰V	1.7â€“2.1â€‰â€‰V

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 0â€“1,000â€‰mV. Once sufficient HO2S voltage fluctuation is observed by the control module, Closed Loop is entered. The control

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module uses the HO2S voltage to determine the air-to-fuel ratio. An HO2S voltage that increases toward 1,000â€‰mV indicates a rich fuel mixture. An HO2S voltage that decreases toward 0â€‰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

P0131 or P0137

- DTCsâ€‰P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0220, P0222, P0223, P0442, P0443, P0446, P0449, P0455, P0496, P1516, P2101, P2119, P2135, P2176 are not set.
- The Ignition voltage is between 10â€“32â€‰V.
- The fuel system is operating in Closed Loop.
- Device controls are not active.
- The fuel level is greater than 10%.
- The throttle position (TP) is between 3â€“70%.
- Ethanol content is less than 87%.
- Decel fuel cut-off is not active.
- The DTCs run continuously when the above conditions are met for 5â€‰s.

P0132 or P0138

- DTCsâ€‰P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0220, P0222, P0223, P0442, P0443, P0446, P0449, P0455, P0496, P1516, P2101, P2119, P2135, P2176 are not set.
- The Ignition voltage is between 10â€“32â€‰V.
- The fuel system is operating in Closed Loop.
- Ethanol content is less than 87%.
- The fuel level is greater than 10%.
- The engine run time is greater than 20â€‰s.
- The DTCs run continuously when the above conditions are met for 5â€‰s.

P0134 or P0140

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0220, P0222, P0223, P0442, P0443, P0446, P0449, P0455, P0496, P1516, P2101, P2119, P2135, P2176 are not set.
- The Ignition voltage is between 10â€“32â€‰V.
- The engine run time is greater than 150â€‰s.
- The fuel system is in Closed Loop.
- Ethanol content is less than 87%.
- The DTCs run continuously when the above conditions are met.

P2A00

- DTCs P0068, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0128, P0131, P0132, P0151, P0152, P0201, P0202, P0203, P0204, P0220, P0222, P0223, P1516, P2101, P2119, P2135, P2176 are not set.
- The Ignition voltage is between 10â€“32â€‰V.

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- The engine run time is greater than 100â€‰s.
- The engine speed is between 1,000â€“3,400â€‰RPM.
- The engine air flow is between 4â€“30â€‰g/s.
- The engine coolant temperatureâ€‰(ECT) is warmer than 65Â°C (149Â°F).
- Decel fuel cut-off is not active.
- DTCâ€‰P2A00 runs continuously when the above conditions are met for 5â€‰s.

Conditions for Setting the DTC

P0131 or P0137

The engine control module detects that the heated oxygen sensor voltage is less than 50â€‰â€‰mV and the circuit is shorted to ground for greater than 50â€‰s.

P0132 or P0138

The engine control module detects that the heated oxygen sensor voltage is greater than 1,050â€‰â€‰mV and the circuit is shorted to voltage for greater than 13â€‰s.

P0134 or P0140

The engine control module detects that the heated oxygen sensor voltage is greater than 1.7â€‰â€‰V and is an open circuit for greater than 50â€‰s.

P2A00

The ECM detects that the Loop Status parameter is open for greater than 50â€‰s.

Action Taken When the DTC Sets

DTCsâ€‰P0131, P0132, P0134, P0137, P0138, P0140 and P2A00 are Typeâ€‰B DTCs.

Conditions for Clearing the MIL/DTC

DTCsâ€‰P0131, P0132, P0134, P0137, P0138, P0140 and P2A00 are Typeâ€‰B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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1. Ignition ON.
2. Verify no HO2S heater DTCs are set.
3.
   - **If a DTC is set.**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle.
4.
   - **If a DTC is not set.**
5. Engine running.
6. Verify the scan tool HO2S sensorâ€‰1 or 2 parameters are between 50â€“1,050â€‰mV.
7.
   - **If not between 50â€“1,050â€‰mV.**
   - Refer to Circuit/System Testing.
8.
   - **If between 50â€“1,050â€‰mV.**
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.
11.
    - **If the DTC sets.**
    - Refer to Circuit/System Testing.
12.
    - **If the DTC does not set.**
13. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the appropriate B52â€‰Heated Oxygen Sensor harness connector. It may take up to 2â€‰minutes for all vehicle systems to power down. Ignition ON.
2. Test for 1.7â€“3.0â€‰V between the high signal circuit terminalâ€‰B and ground.
3.
   - **If less than 1.7â€‰V**
4.
   1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for infinite resistance between the high signal circuit terminalâ€‰B and ground.
   3.
      - If less than infinite resistance repair the short to ground on the circuit.
   4.
      - If infinite resistance
   5. Test for less than 2â€‰â„¦ in the high signal circuit end to end.

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6.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

5.

- **If greater than 3.0â€‰V**

6.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module. Ignition ON.
2. Test for less than 1â€‰V between the high signal circuit terminalâ€‰B and ground.
3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

4.

- **If between 1.7â€“3.0â€‰V**

7. Verify the scan tool HO2S sensorâ€‰1 or 2 parameter is between 1.7â€“2.1â€‰V.
8.

- **If less than 1.7â€‰V**

9.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the low signal circuit terminalâ€‰A and ground.
3.

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

4.

- If infinite resistance, replace the K20â€‰Engine Control Module.

10.

- **If between 1.7â€“2.1â€‰V**

11. Connect a 3â€‰A fused jumper wire between the high signal circuit terminalâ€‰B and the low signal circuit terminalâ€‰A.
12. Note**:**

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

13. Verify the scan tool HO2S sensorâ€‰1 or 2 parameter displays 0.0â€‰V.
14.

- **If greater than 0.0â€‰V**

15.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module. Ignition ON.
2. Test for less than 2â€‰â„¦ in the low signal circuit end to end.
3.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.

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4.

- If less than 2â€‰â„¦

5. Test for less than 1â€‰V between the low signal circuit terminalâ€‰A and ground.

16.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

17.

- **If 0.0â€‰V**

18. Verify none of the conditions listed below exist:

19.

- Water intrusion in the B52â€‰Heated Oxygen Sensor harness connector
- Low or high fuel system pressureâ€”Refer to Fuel System Diagnosis.
- Fuel that is contaminatedâ€”Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Fuel saturation of the evaporative emission (EVAP) canister
- Exhaust leaks
- Engine vacuum leaks

20.

- **If any of the conditions exist**
- Repair as necessary.

21.

- **If none of the conditions exist**
- Test or replace the B52â€‰Heated Oxygen Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Heated Oxygen Sensor Replacement - Sensor 1
- Heated Oxygen Sensor Replacement - Sensor 2
- Perform the scan tool Heated Oxygen Sensor Resistance Learn Reset after replacing an HO2S.
- Control Module References for ECM replacement, programming and setup

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0133, P1133, P2270, or P2271 (LL0)

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

DTCâ€‰P0133

HO2S Slow Response Sensorâ€‰1

DTCâ€‰P1133

HO2S Insufficient Switching Sensorâ€‰1

DTCâ€‰P2270

HO2S Signal Stuck Lean Sensorâ€‰2

DTCâ€‰P2271

HO2S Signal Stuck Rich Sensorâ€‰2

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
HO2S High Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140, P2A00	P0133, P1133, P2270, P2271
HO2S Low Signal	P0131, P0137	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140	P0132, P0134, P0138, P0140, P2A00	P0133, P1133, P2270, P2271

Typical Scan Tool Data

HO2Sâ€‰1 or 2

Circuit	Short to Ground	Open	Short to Voltage
Parameter Normal Range: 200â€“800â€‰mV			
HO2S High Signal	0.00â€‰V	1.9â€‰V	1.9â€‰V
HO2S Low Signal	0.00â€‰V	1.9â€‰V	1.9â€‰V

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 0â€“1,275â€‰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 1,000â€‰mV indicates a rich fuel mixture. An HO2S voltage that decreases toward 0â€‰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

DTCâ€‰P0133

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- DTCsâ€‰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 signal parameter is between 10â€“32â€‰V.
- The device controls are not active.
- The engine speed is between 1,200â€“3,500â€‰RPM.
- The Engine coolant temperature (ECT) is greater than 60Â°C (140Â°F).
- The intake air temperature (IAT) is greater than â^'40Â°C (â^'40Â°F).
- The barometric pressure (BARO) is greater than 70â€‰kPa (10â€‰PSI).
- The engine has been operating for greater than 150â€‰s.
- The mass air flow (MAF) sensor parameter is between 8â€“30â€‰g/s.
- The HO2S heater is commanded ON for greater than 40â€‰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 1â€‰s.

P1133

- DTCsâ€‰P0068, P0101, P0102, P0103, 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 ECT sensor parameter is greater than 70Â°C (158Â°F).
- The engine speed parameter is between 1,500â€“3,500â€‰RPM.
- The system voltage is between 11â€“32â€‰V.
- The engine run time parameter is greater than 200â€‰s.
- The loop status parameter is closed.
- The fuel level sensor parameter is greater than 10%.
- The manifold absolute pressure (MAP) sensor parameter is greater than 30â€‰kPa.
- The MAF sensor parameter is between 11â€“50â€‰g/s.
- The DTCs run continuously when the above conditions are met for greater than 2â€‰s.

P2270

- DTCsâ€‰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 signal parameter is between 10â€“32â€‰V.
- The fuel level is greater than 10%.
- The engine speed is between 1,400â€“3,500â€‰RPM to initially enable the test.
- The vehicle speed is between 45â€“125â€‰km/h (28â€“78â€‰mph) to initially enable the test.
- The engine speed is between 1,350â€“3,650â€‰RPM to keep the test enabled.
- The vehicle speed is between 40â€“130â€‰km/h (25â€“81â€‰mph) to keep the test enabled.

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- The mass air flow (MAF) sensor parameter is between 2â€“20â€‰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 40â€‰s.
- The predicted catalyst temperature is between 550â€“900Â°C (1,022â€“1,652Â°F).
- The DTC runs once per trip, during the fuel enrich mode, when the above conditions are met for 1.5â€‰s.

P2271

- DTCsâ€‰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 signal parameter is between 10â€“32â€‰V.
- The fuel level is greater than 10%.
- The engine speed is between 1,400â€“3,500â€‰RPM.
- The vehicle speed is between 45â€“125â€‰km/h (28â€“78â€‰mph).
- The mass air flow (MAF) sensor parameter is between 2â€“20â€‰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 40â€‰s.
- The predicted catalyst temperature is between 550â€“900Â°C (1,022â€“1,652Â°F).
- 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 HO2Sâ€‰1 average response time is more than a calculated value.
- DTCâ€‰P0133 sets within 60â€‰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.
- DTCâ€‰P1133 sets within 60â€‰s when the above condition is met.

P2270

- The ECM detects that the heated oxygen sensor (HO2S) 2 sensor cannot achieve voltage less than 775â€‰mV.
- and
- The ECM detects that the accumulated mass air flow monitored during the Stuck Lean Voltage Test is greater than 60â€‰g.

P2271

- The ECM detects that the heated oxygen sensor (HO2S) 2 sensor cannot achieve voltage greater than 100â€‰mV.
- and
- The ECM detects that the accumulated mass air flow monitored during the stuck rich voltage test is greater than 30â€‰g.

Action Taken When the DTC Sets

DTCsâ€‰P0133, P1133, P2270, P2271 are Typeâ€‰B DTCs.

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Conditions for Clearing the DTC

DTCsâ€‰P0133, P1133, P2270, P2271 are Typeâ€‰B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify no HO2S heater DTCs are set.
3.
   - **If a HO2S heater DTC is set**
   - Refer to DTC P0030-P0032, P0036-P0038, P0053, P0054, P0135, or P0141.
4.
   - **If no HO2S heater DTC is set**
5. Allow the engine to reach operating temperature, engine running.
6. Verify the scan tool HO2S Sensorâ€‰1 or 2 voltage parameters are between 50â€“1,050â€‰mV.
7.
   - **If not between 50â€“1,050â€‰mV.**
   - Refer to DTC P0131, P0132, P0134, P0137, P0138, P0140, or P2A00
8.
   - **If between 50â€“1,050â€‰mV.**
9. Verify none of the following conditions exist:
10.
    - Lean or rich fuel injectors. Refer to DTC P0171 or P0172.
    - Water intrusion in the HO2S harness connector
    - Low or high fuel system pressure.

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- Fuel that is contaminated.
- Fuel saturation of the evaporative emissionâ€‰(EVAP) canister
- Exhaust leaks near the HO2S
- Engine vacuum leaks
- Engine oil consumption.
- Engine coolant consumption. Refer to Symptoms - Engine Cooling.

11.
    - **If any of the above conditions exist**
    - Repair as necessary.
12.
    - **If none of the above conditions exist**
13. 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.
14. Verify the DTC does not set.
15.
    - **If the DTC sets**
    - Replace the appropriate B52â€‰Heated Oxygen Sensor.
16.
    - **If the DTC does not set**
17. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

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

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0171 or P0172

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 heated oxygen sensor 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 0â€‰percent. 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. The fuel trim cells are based on the engine speed and load.

Conditions for Running the DTC

- DTCs P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0171, P0172, P0221, P0222, P0223, P0300, P0301, P0302, P0303, P0304, P0336, P0337, P0341, P0342, P0458, P0459, P0627, P0628, P0629, P2101, P2118, P2119, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310 are not set.
- The vehicle is operating in closed loop.
- The ambient air pressure is greater than 74 kPa (10.7 psi).
- The mass airflow is greater than 49 mg/stk.
- The engine speed is greater than 512 RPM.
- The engine coolant temperature is greater than 69.75Â°C (157.55Â°F).
- The intake air temperature is greater than â^’7.5Â°C (18.5Â°F).
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0171

The ECM detects that the short term fuel trim value is greater than 50% for 40â€‰s. Or, the ECM detects that the long term fuel trim value is greater than 22% for 40â€‰s.

P0172

The ECM detects that the short term fuel trim value is less than â^’40% for 40â€‰s. Or, the ECM detects that the long term fuel trim value is less than â^’20% for 40â€‰s.

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Action Taken When the DTC Sets

DTC P0171 and P0172 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0171 and P0172 are Type E DTCs.

Diagnostic Aids

- The system will become lean if a fuel injector is not supplying enough fuel â€“ DTC P0171.
- A lean condition may be present during high fuel demand due to a fuel pump that does not deliver enough fuel, a plugged fuel filter, or a restricted fuel pipe â€“ DTC P0171.
- The system will become rich if a fuel injector is supplying too much fuel â€“ DTC P0172.
- Review the freeze frame/failure records with a scan tool.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that other DTCs are not set.
2.
    - If any DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Ignition ON, verify that the scan tool MAP sensor pressure parameter is within the range specified for your altitude. Refer to Altitude Versus Barometric Pressure.
4.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
5. Verify that the scan tool HO2S 1â€‰voltage parameter fluctuates within 200â€“800â€‰mV.
6.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
7. Engine at normal operating temperature, verify that the scan tool long term fuel trim parameter is between â¯5 to +5%.

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8.

- If not within the specified range, verify none of the following conditions exist:

9.

- Fuel contaminationâ€”Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Splits, kinks, or improper connections at the vacuum hoses.
- The fuel system is operating lean or rich. Refer to Fuel System Diagnosis.
- The fuel injectors are operating lean or rich. Refer to Fuel Injector Diagnosis.
- Missing, restricted, or leaking exhaust componentsâ€”Refer to Symptoms - Engine Exhaust.
- Vacuum leaks at the intake manifold, throttle body, and injector O-rings â€“ P0171.
- Leaking crankcase ventilation system â€“ P0171.
- The air intake duct for being collapsed or restricted possibly by a restricted air filter â€“ P0172.
- Excessive fuel in the crankcase â€“ P0172.
- Restricted air filter â€“ P0172.
- The incorrect operation of the evaporative emission control system â€“ P0172.

10. If all conditions test normal, test the engine for a mechanical condition. Refer to Symptoms - Engine Mechanical.
11. 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.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0171 or P0172 (LCP, LC5, LMT, LMU without FX3)

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 heated oxygen sensor 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 0â€‰percent. 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. The fuel trim cells are based on the engine speed and load.

Conditions for Running the DTC

- The vehicle is operating in closed loop.
- No faults related to ECT, IAT, MAP, CMP, CKP, TP, EVAP purge, HO2S, HO2S heater, IAC, EGR, injectors, and misfire exist.
- The engine coolant temperature is greater than 69.75Â°C (157.55Â°F).
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0171 (LMT)

The ECM detects that the average of short term fuel trim values is greater than 35% for 350â€‰s among 600â€‰s.

P0171 (LCP)

The ECM detects that the average of short term fuel trim values is greater than 24% for 100â€‰s among 700â€‰s.

P0172 (LMT)

The ECM detects that the average of short term fuel trim values is less than â˜’24% for 150â€‰s among 600â€‰s.

P0172 (LCP)

The ECM detects that the average of short term fuel trim values is less than â˜’39% for 100â€‰s among 700â€‰s.

Action Taken When the DTC Sets

DTC P0171 and P0172 are Type E DTCs.

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Conditions for Clearing the DTC

DTC P0171 and P0172 are Type E DTCs.

Diagnostic Aids

- The system will become lean if a fuel injector is not supplying enough fuel â€“ DTC P0171.
- A lean condition may be present during high fuel demand due to a fuel pump that does not deliver enough fuel, a plugged fuel filter, or a restricted fuel pipe â€“ DTC P0171.
- The system will become rich if a fuel injector is supplying too much fuel â€“ DTC P0172.
- Review the freeze frame/failure records with a scan tool.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that other DTCs are not set.
2.
    - If any DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Ignition ON, verify that the scan tool MAP sensor pressure parameter is within the range specified for your altitude. Refer to Altitude Versus Barometric Pressure.
4.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
5. Verify that the scan tool HO2S 1â€‰voltage parameter fluctuates within 200â€“800â€‰mV.
6.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
7. Engine at normal operating temperature, verify that the scan tool long term fuel trim parameter is between â¯5 to +5%.
8.
    - If not within the specified range, verify none of the following conditions exist:

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9.

- Fuel contaminationâ€“Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Splits, kinks, or improper connections at the vacuum hoses.
- The fuel system is operating lean or rich. Refer to Fuel System Diagnosis.
- The fuel injectors are operating lean or rich. Refer to Fuel Injector Diagnosis.
- Missing, restricted, or leaking exhaust componentsâ€“Refer to Symptoms - Engine Exhaust.
- Vacuum leaks at the intake manifold, throttle body, and injector O-rings â€“ P0171.
- Leaking crankcase ventilation system â€“ P0171.
- The air intake duct for being collapsed or restricted possibly by a restricted air filter â€“ P0172.
- Excessive fuel in the crankcase â€“ P0172.
- Restricted air filter â€“ P0172.
- The incorrect operation of the evaporative emission control system â€“ P0172.

10. If all conditions test normal, test the engine for a mechanical condition. Refer to Symptoms - Engine Mechanical.
11. 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.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0171 or P0172 (LMT, LMU with FX3)

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 heated oxygen sensor 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. The fuel trim cells are based on the engine speed and load.

Conditions for Running the DTC

- DTC P0031, P0032, P0107, P0108, P0112, P0113, P0117, P0118, P0131, P0132, P0133, P0134, P0135, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0326, P0335, P0336, P0340, P0351, P0352, P0353, P0354, P0458, P0459, P0502, P0506, P0507, P0562, P0563, or P2110 is not set.
- The barometric pressure is greater than 72â€‰kPa (10.4â€‰psi).
- The intake air temperature is greater than â^’7Â°C (19.4Â°F).
- The ignition voltage is greater than 11â€‰V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0171

The average long term fuel trim cell values are greater than 28% for 60â€‰counts out of 80.

P0172 (LMT)

The average long term fuel trim cell values are less than â^’20% for 60â€‰counts out of 80.

P0172 (LMU)

The average long term fuel trim cell values are less than â^’22% for 60â€‰counts out of 80.

Action Taken When the DTC Sets

DTC P0171 and P0172 are Typeâ€‰E DTCs.

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Conditions for Clearing the DTC

DTC P0171 and P0172 are Typeâ€‰E DTCs.

Diagnostic Aids

- The system will become lean if a fuel injector is not supplying enough fuel â€“ DTC P0171.
- A lean condition may be present during high fuel demand due to a fuel pump that does not deliver enough fuel, a plugged fuel filter, or a restricted fuel pipe â€“ DTC P0171.
- The system will become rich if a fuel injector is supplying too much fuel â€“ DTC P0172.
- Review the freeze frame/failure records with a scan tool.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running, verify that other DTCs are not set.
2.
    - If any DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Ignition ON, verify that the scan tool MAP sensor pressure parameter is within the range specified for your altitude. Refer to Altitude Versus Barometric Pressure.
4.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
5. Verify that the scan tool HO2S 1â€‰voltage parameter fluctuates within 200â€“800â€‰mV.
6.
    - If not within the specified range, refer to DTC P0130-P0134, P0137-P0139, P013A, or P0140.
7. Engine at normal operating temperature, verify that the scan tool long term fuel trim parameter is between â¯5 to +5%.
8.
    - If not within the specified range, verify none of the following conditions exist:

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9.

- Fuel contaminationâ€“Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Splits, kinks, or improper connections at the vacuum hoses.
- The fuel system is operating lean or rich. Refer to Fuel System Diagnosis.
- The fuel injectors are operating lean or rich. Refer to Fuel Injector Diagnosis.
- Missing, restricted, or leaking exhaust componentsâ€“Refer to Symptoms - Engine Exhaust.
- Vacuum leaks at the intake manifold, throttle body, and injector O-rings â€“ P0171.
- Leaking crankcase ventilation system â€“ P0171.
- The air intake duct for being collapsed or restricted possibly by a restricted air filter â€“ P0172.
- Excessive fuel in the crankcase â€“ P0172.
- Restricted air filter â€“ P0172.
- The incorrect operation of the evaporative emission control system â€“ P0172.

10. If all conditions test normal, test the engine for a mechanical condition. Refer to Symptoms - Engine Mechanical.
11. 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.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271 (LC5, LMU)

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

DTCâ€‰P0261

Cylinderâ€‰1 Injector Control Circuit Low Voltage

DTCâ€‰P0262

Cylinderâ€‰1 Injector Control Circuit High Voltage

DTCâ€‰P0264

Cylinderâ€‰2 Injector Control Circuit Low Voltage

DTCâ€‰P0265

Cylinderâ€‰2 Injector Control Circuit High Voltage

DTCâ€‰P0267

Cylinderâ€‰3 Injector Control Circuit Low Voltage

DTCâ€‰P0268

Cylinderâ€‰3 Injector Control Circuit High Voltage

DTCâ€‰P0270

Cylinderâ€‰4 Injector Control Circuit Low Voltage

DTCâ€‰P0271

Cylinderâ€‰4 Injector Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	*	**	â€”	â€”
Injectorâ€‰1 Control	P0261, P0300	P0261, P0300	P0262, P0300	â€”
Injectorâ€‰2 Control	P0264, P0300	P0264, P0300	P0265, P0300	â€”
Injectorâ€‰3 Control	P0267, P0300	P0267, P0300	P0268, P0300	â€”
Injectorâ€‰4 Control	P0270, P0300	P0270, P0300	P0271, P0300	â€”
* Engine cranks but does not run and the fuse for the injector circuit opens. ** Engine cranks but does not run.				

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.

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Conditions for Running the DTC

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

Conditions for Setting the DTC

P0261, P0264, P0267, or P0270

The ECM detects the injector control circuit is open or shorted to ground.

P0262, P0265, P0268, or P0271

The ECM detects the injector control circuit is shorted to voltage.

Action Taken When the DTC Sets

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type A DTCs.

Conditions for Clearing the DTC

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type A 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

Description and Operation

Fuel System Description

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

CHâ€‰34730-2C Noid Light, if available

For regional equivalent tools, refer to Special Tools.

Circuit/System Verification

1. Important:

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If you were sent here from Engine Cranks but Does Not Run, proceed to Circuit/System Testing.

2. Ignition ON.
3. Verify DTCsâ€‰P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271 are not set.
4.
   - **If any of the DTCs are set**
   - Refer to Circuit/System Testing.
5.
   - **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 the DTC does not set.
8.
   - **If the DTC sets**
   - Refer to Circuit/System Testing.
9.
   - **If the DTC does not set**
10. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate Q17â€‰Fuel Injector, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminalâ€‰1 and ground.
3.
   - **If the test lamp does not illuminate and the circuit fuse is good**
4.
   1. Ignition OFF, remove the test lamp.
   2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, verify the fuse is not open and there is voltage at the fuse.
5.
   - **If the test lamp does not illuminate and the circuit fuse is open**
6.
   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.
   3.
      - If less than infinite resistance, repair the short to ground on the circuit.
   4.
      - If infinite resistance

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5. Replace the fuse, ignition ON.
6. Verify the fuse is good after connecting each of the components one at a time.
7.
    - If the fuse opens, replace the component that opens the fuse when connected.
8.
    - If the fuse is good, all OK.

7.
    - **If the test lamp illuminates**
8. Ignition OFF, connect the test lamp to the affected fuel injector connector.
9. Engine cranking.
10. Verify the test lamp turns ON and OFF.
11.
    - **If the test lamp is always OFF**
12.
    1. Ignition OFF, remove the test lamp, disconnect the X1 harness connector at the K20 Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the control circuit and ground.
    3.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
    4.
        - If less than 1â€‰V
    5. Ignition OFF.
    6. Test for less than 2â€‰â„¦ in the control circuit end to end.
    7.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the K20 Engine Control Module.
13.
    - **If the test lamp is always ON**
14.
    1. Ignition OFF, remove the test lamp, disconnect the X1 harness connector at the K20â€‰Engine Control Module.
    2. Test for infinite resistance between the control circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K20â€‰Engine Control Module.
15.
    - **If the test lamp turns ON and OFF**
16. Test or replace the appropriate Q17 Fuel Injector.

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Component Testing

Fuel Injector Diagnosis

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Fuel Injector Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271 (LKY)

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

DTCâ€‰P0261

Cylinderâ€‰1 Injector Control Circuit Low Voltage

DTCâ€‰P0262

Cylinderâ€‰1 Injector Control Circuit High Voltage

DTCâ€‰P0264

Cylinderâ€‰2 Injector Control Circuit Low Voltage

DTCâ€‰P0265

Cylinderâ€‰2 Injector Control Circuit High Voltage

DTCâ€‰P0267

Cylinderâ€‰3 Injector Control Circuit Low Voltage

DTCâ€‰P0268

Cylinderâ€‰3 Injector Control Circuit High Voltage

DTCâ€‰P0270

Cylinderâ€‰4 Injector Control Circuit Low Voltage

DTCâ€‰P0271

Cylinderâ€‰4 Injector Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Voltage	*	**	â€”	â€”
Injectorâ€‰1 Control	P0261, P0300	P0261, P0300	P0262, P0300	â€”
Injectorâ€‰2 Control	P0264, P0300	P0264, P0300	P0265, P0300	â€”
Injectorâ€‰3 Control	P0267, P0300	P0267, P0300	P0268, P0300	â€”
Injectorâ€‰4 Control	P0270, P0300	P0270, P0300	P0271, P0300	â€”
* Engine cranks but does not run and the fuse for the injector circuit opens. ** Engine cranks but does not run.				

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.

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Conditions for Running the DTC

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

Conditions for Setting the DTC

P0261, P0264, P0267, or P0270

The ECM detects the injector control circuit is open or shorted to ground.

P0262, P0265, P0268, or P0271

The ECM detects the injector control circuit is shorted to voltage.

Action Taken When the DTC Sets

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type A DTCs.

Conditions for Clearing the DTC

DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, and P0271 are Type A 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

Description and Operation

Fuel System Description

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

ELâ€‰44603 Injector Test Lamp, if available

For regional equivalent tools, refer to Special Tools.

Circuit/System Verification

1. Important:

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If you were sent here from Engine Cranks but Does Not Run, proceed to Circuit/System Testing.

2. Ignition ON.
3. Verify DTCsâ€‰P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271 are not set.
4.
   - **If any of the DTCs are set**
   - Refer to Circuit/System Testing.
5.
   - **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 the DTC does not set.
8.
   - **If the DTC sets**
   - Refer to Circuit/System Testing.
9.
   - **If the DTC does not set**
10. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the appropriate Q17â€‰Fuel Injector, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminalâ€‰1 and ground.
3.
   - **If the test lamp does not illuminate and the circuit fuse is good**
4.
   1. Ignition OFF, remove the test lamp.
   2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, verify the fuse is not open and there is voltage at the fuse.
5.
   - **If the test lamp does not illuminate and the circuit fuse is open**
6.
   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.
   3.
      - If less than infinite resistance, repair the short to ground on the circuit.
   4.
      - If infinite resistance

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5. Replace the fuse, ignition ON.
6. Verify the fuse is good after connecting each of the components one at a time.
7.
    - If the fuse opens, replace the component that opens the fuse when connected.
8.
    - If the fuse is good, all OK.

7.
    - **If the test lamp illuminates**
8. Ignition OFF, connect the test lamp to the affected fuel injector connector.
9. Engine cranking.
10. Verify the test lamp turns ON and OFF.
11.
    - **If the test lamp is always OFF**
12.
    1. Ignition OFF, remove the test lamp, disconnect the X1 harness connector at the K20 Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the control circuit and ground.
    3.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
    4.
        - If less than 1â€‰V
    5. Ignition OFF.
    6. Test for less than 2â€‰â„¦ in the control circuit end to end.
    7.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the K20 Engine Control Module.
13.
    - **If the test lamp is always ON**
14.
    1. Ignition OFF, remove the test lamp, disconnect the X1 harness connector at the K20â€‰Engine Control Module.
    2. Test for infinite resistance between the control circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K20â€‰Engine Control Module.
15.
    - **If the test lamp turns ON and OFF**
16. Test or replace the appropriate Q17 Fuel Injector.

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Component Testing

Fuel Injector Diagnosis

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Fuel Injector Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0300-P0304 (LKY)

Symptoms

P0301

P0302

P0303

Diagnostic Instructions

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

DTC Descriptor

Engine Misfire Detected

Cylinder 1 Misfire Detected

Cylinder 2 Misfire Detected

Cylinder 3 Misfire Detected

Cylinder 4 Misfire Detected

Circuit/System Description

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

- Electronic Ignition System Description
- Fuel System Description

A misfiring cylinder causes slight variations in the rotational speed of the crankshaft. The engine control module (ECM) is able to detect these variations by closely monitoring the crankshaft position sensor signal. The signals of the camshaft position sensors are used to determine which cylinder is misfiring. If the ECM detects a misfire rate sufficient to cause emission levels to exceed mandated standards, DTC P0300ts. Under certain driving conditions, a misfire rate can be high enough to cause the catalytic converter to overheat, possibly damaging the converter. The malfunction indicator lamp (MIL) flashes when catalyst damaging misfire conditions are present and DTC P0300 set.

Conditions for Running the DTC

- DTC P0106, P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0119, P0121, P0123, P0125, P0128, P0335, P0336, P0337, P0341, P0342, P0601, P0604, P0605, P0650
- Crankshaft/Camshaft Sensors = Synchronized
- Engine Coolant Temperature = 7> to 127Â°C (19.4o 261Â°F)
- Engine Load = 3>%
- Engine Speed = Greater than 1,000insp;RPM
- Engine Speed = Less than 1,000insp;RPM - DTC P0315 set.
- Fuel Cut-Off System = Inactive
- Fuel level = Greater than 15%
- Rough Road Signal = Not Detected

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- System Voltage = 11 to 18 V

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

Conditions for Setting the DTC

P0300

The control module K20detects a crankshaft rotation speed variation indicating a misfire rate sufficient to cause emissions levels to exceed a predetermined value or a misfire rate high enough to cause catalyst damage.

P0301, P0302, P0303, P0304

The control module K20detects a crankshaft rotation speed variation indicating a single cylinder misfire rate sufficient to cause emissions levels to exceed mandated standards.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type B> DTC

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

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type B> DTC

Diagnostic Aids

Verify the following conditions do not exist:

- { If equipped } Command the Cylinder Deactivation system On with a scan tool, then observe the misfire counters when commanding the system Off. If the misfire counters are incrementing, inspect for a sticking valve lifter.
- DTC P0300y set when there is a condition with the component circuits: B52 Heated Oxygen Sensor
- High resistance in the circuits of the component may set DTC P0300â€“P0304tting the DTC for the component: Q17 Fuel Injector
- If the condition is intermittent, wiggle the related wiring harnesses and connectors, with the ignition/vehicle on or engine running, while monitoring the scan tool circuit status parameters for the component. The parameters will display if there is a condition with the circuit or a connection.
- Accessory drive bracket - Defective / Loose / Visible Damage
- Belt Driven Device - Defective / Loose / Visible Damage
- Brake Rotor - Excessive runout
- Drive Belt - Defective / Loose / Visible Damage
- Drive Shaft - Excessive runout
- During certain road conditions: Rough
- Tire and wheel assemblies which exhibit excessive runout can produce vibrations even if the assemblies are balanced.
- Transmission - Incorrect Operation

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Special Tools

<sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>

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Equivalent regional tools: Special Tools

Circuit/System Verification

1. Engine >> Running
2. Verify there is no abnormal noise from the component: Engine
3.
   - **If an abnormal noise is present**
   - Refer to: Symptoms - Engine Mechanical
4.
   - **If no abnormal noise is present**
5. Verify there are no DTCs set related to the following component/system:
6.
   - B23 Camshaft Position Sensor
   - B26 Crankshaft Position Sensor
   - B52 Heated Oxygen Sensor
   - T8 Ignition Coil
   - Fuel System
   - Ignition System
   - Mechanical Condition
7.
   - **If a related DTC is set**
   - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
8.
   - **If a related DTC is not set**
9. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Does not Increment
10.
    - **If the parameter value increments**
    - Refer to: Circuit/System Testing
11.
    - **If the parameter value does not increment**
12. Perform the scan tool control function: Cylinder Power Balance >> Enable
13. Verify the sound of the engine changes the same way when turning off each individual injector.
14.
    - **If the engine sound does not change the same way for one or more cylinders**
    - Refer to: Circuit/System Testing
15.
    - **If the engine sound changes the same way for all cylinders**

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16. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Does not Increment
17. Perform the action while monitoring the parameter:
18.
    - Wiggle the harness and connector: K20 Engine Control Module
    - Wiggle the harness and connector: Q17 Fuel Injector
    - Wiggle the harness and connector: T8 Ignition Coil
    - Wiggle the component: Vacuum Hoses
19.
    - **If not the specified state**
    - Repair or replace as necessary
20.
    - **If the specified state**
21. 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.
22. Verify the DTC does not set.
23.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
24.
    - **If the DTC does not set**
25. All OK.

Circuit/System Testing

1. Verify the following conditions do not exist:
2.
    - Engine - Vacuum leak
    - Exhaust System - Leaking / Missing components / Restricted >> Refer to: Symptoms - Engine Exhaust
    - Fuel - Contaminated / Dirty / Fill Level = Low >> Refer to: Alcohol/Contaminants-in-Fuel Diagnosis
    - Fuel Pressure - High / Low >> Refer to: Fuel System Diagnosis
    - Positive Crankcase Ventilation System - Leaking / Incorrect connection / Restricted
    - Vacuum Hoses - Kinked / Leaking / Incorrect connection / Restricted
3.
    - **If a condition exists**
    - Repair or replace as necessary
4.
    - **If no conditions exist**
5. Ignition/Vehicle >> Off
6. Remove the appropriate component: T8 Ignition Coil - Leave the electrical connector connected.

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7. Verify a condition does not exist with the component: Spark Plug Boot - Carbon Tracking / Fluid intrusion / Visible Damage
8.
    - **If a condition exists**
    - Repair or replace as necessary
9.
    - **If no conditions exist**
10. Install the special tool: <sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool> - Leave the electrical connector connected.
11. Engine >> Running
12. Note **:**

    An erratic or weak spark is considered a no spark condition.
13. Verify there is spark at the tool.
14.
    - **If there is no spark**
    - Refer to: Electronic Ignition System Diagnosis
15.
    - **If there is spark**
16. Ignition/Vehicle >> Off
17. Remove the appropriate component: Spark Plug
18. Verify the component specifications are correct: Spark Plug - Gap / Heat Range / Torque
19. Refer to: Ignition System Specifications
20.
    - **If not correct**
    - Repair or replace as necessary
21.
    - **If correct**
22. Verify the component specifications are correct: Spark Plug - Carbon Tracking / Fouled / Visible Damage
23.
    - **If a condition exists**
    - Repair or replace as necessary
24.
    - **If no conditions exist**
25. Swap the two components: Spark Plug - The original component that set the DTC & Another known good component from the vehicle
26. Engine >> Running
27. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Increments - At the original component location the DTC set.
28.
    - **If the parameter value does not increment**

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- **If the parameter value does not increment**
- Replace the component: Spark Plug - The original component that set the DTC

29.
- **If the parameter value increments**

30. Perform the following procedure/test: Fuel Injector Balance >> Refer to: Fuel Injector Diagnosis
31. Verify the procedure/test passes.
32.
- **If the procedure/test does not pass**
- Replace the component that failed the test: Q17 Fuel Injector

33.
- **If the procedure/test passes**

34. Verify the condition does not exist: An engine mechanical condition >> Refer to: Symptoms - Engine Mechanical
35.
- **If a condition exists**
- Repair or replace as necessary

36.
- **If no condition exists**

37. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

After any repair, perform DTC P0420rcuit/System Verification, to verify the performance of the component: Catalytic Converter >> Refer to: DTC P0420

- Ignition Coil Replacement
- Spark Plug Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0300-P0304

Symptoms

P0301

P0302

P0303

Diagnostic Instructions

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

DTC Descriptor

Engine Misfire Detected

Cylinder 1 Misfire Detected

Cylinder 2 Misfire Detected

Cylinder 3 Misfire Detected

Cylinder 4 Misfire Detected

Circuit/System Description

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

- Electronic Ignition System Description
- Fuel System Description

A misfiring cylinder causes slight variations in the rotational speed of the crankshaft. The engine control module (ECM) is able to detect these variations by closely monitoring the crankshaft position sensor signal. The signals of the camshaft position sensors are used to determine which cylinder is misfiring. If the ECM detects a misfire rate sufficient to cause emission levels to exceed mandated standards, DTC P0300ts. Under certain driving conditions, a misfire rate can be high enough to cause the catalytic converter to overheat, possibly damaging the converter. The malfunction indicator lamp (MIL) flashes when catalyst damaging misfire conditions are present and DTC P0300 set.

Conditions for Running the DTC

- DTC P0106, P0107, P0108, P0111, P0112, P0113, P0117, P0118, P0119, P0121, P0123, P0125, P0128, P0335, P0336, P0337, P0341, P0342, P0601, P0604, P0605, P0650
- Crankshaft/Camshaft Sensors = Synchronized
- Engine Coolant Temperature = 7> to 127Â°C (19.4o 261Â°F)
- Engine Load = 3>%
- Engine Speed = Greater than 1,000insp;RPM
- Engine Speed = Less than 1,000insp;RPM - DTC P0315 set.
- Fuel Cut-Off System = Inactive
- Fuel level = Greater than 15%
- Rough Road Signal = Not Detected

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- System Voltage = 11 to 18 V

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

Conditions for Setting the DTC

P0300

The control module K20detects a crankshaft rotation speed variation indicating a misfire rate sufficient to cause emissions levels to exceed a predetermined value or a misfire rate high enough to cause catalyst damage.

P0301, P0302, P0303, P0304

The control module K20detects a crankshaft rotation speed variation indicating a single cylinder misfire rate sufficient to cause emissions levels to exceed mandated standards.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type B> DTC

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

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type B> DTC

Diagnostic Aids

Verify the following conditions do not exist:

- { If equipped } Command the Cylinder Deactivation system On with a scan tool, then observe the misfire counters when commanding the system Off. If the misfire counters are incrementing, inspect for a sticking valve lifter.
- DTC P0300y set when there is a condition with the component circuits: B52 Heated Oxygen Sensor
- High resistance in the circuits of the component may set DTC P0300â€“P0304tting the DTC for the component: Q17 Fuel Injector
- If the condition is intermittent, wiggle the related wiring harnesses and connectors, with the ignition/vehicle on or engine running, while monitoring the scan tool circuit status parameters for the component. The parameters will display if there is a condition with the circuit or a connection.
- Accessory drive bracket - Defective / Loose / Visible Damage
- Belt Driven Device - Defective / Loose / Visible Damage
- Brake Rotor - Excessive runout
- Drive Belt - Defective / Loose / Visible Damage
- Drive Shaft - Excessive runout
- During certain road conditions: Rough
- Tire and wheel assemblies which exhibit excessive runout can produce vibrations even if the assemblies are balanced.
- Transmission - Incorrect Operation

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Special Tools

<sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>

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Equivalent regional tools: Special Tools

Circuit/System Verification

1. Engine >> Running
2. Verify there is no abnormal noise from the component: Engine
3.
   - **If an abnormal noise is present**
   - Refer to: Symptoms - Engine Mechanical
4.
   - **If no abnormal noise is present**
5. Verify there are no DTCs set related to the following component/system:
6.
   - B23 Camshaft Position Sensor
   - B26 Crankshaft Position Sensor
   - B52 Heated Oxygen Sensor
   - T8 Ignition Coil
   - Fuel System
   - Ignition System
   - Mechanical Condition
7.
   - **If a related DTC is set**
   - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
8.
   - **If a related DTC is not set**
9. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Does not Increment
10.
    - **If the parameter value increments**
    - Refer to: Circuit/System Testing
11.
    - **If the parameter value does not increment**
12. Perform the scan tool control function: Cylinder Power Balance >> Enable
13. Verify the sound of the engine changes the same way when turning off each individual injector.
14.
    - **If the engine sound does not change the same way for one or more cylinders**
    - Refer to: Circuit/System Testing
15.
    - **If the engine sound changes the same way for all cylinders**

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16. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Does not Increment
17. Perform the action while monitoring the parameter:
18.
    - Wiggle the harness and connector: K20 Engine Control Module
    - Wiggle the harness and connector: Q17 Fuel Injector
    - Wiggle the harness and connector: T8 Ignition Coil
    - Wiggle the component: Vacuum Hoses
19.
    - **If not the specified state**
    - Repair or replace as necessary
20.
    - **If the specified state**
21. 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.
22. Verify the DTC does not set.
23.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
24.
    - **If the DTC does not set**
25. All OK.

Circuit/System Testing

1. Verify the following conditions do not exist:
2.
    - Engine - Vacuum leak
    - Exhaust System - Leaking / Missing components / Restricted >> Refer to: Symptoms - Engine Exhaust
    - Fuel - Contaminated / Dirty / Fill Level = Low >> Refer to: Alcohol/Contaminants-in-Fuel Diagnosis
    - Fuel Pressure - High / Low >> Refer to: Fuel System Diagnosis
    - Positive Crankcase Ventilation System - Leaking / Incorrect connection / Restricted
    - Vacuum Hoses - Kinked / Leaking / Incorrect connection / Restricted
3.
    - **If a condition exists**
    - Repair or replace as necessary
4.
    - **If no conditions exist**
5. Ignition/Vehicle >> Off
6. Remove the appropriate component: Spark Plug Wire @ Spark Plug

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7. Verify a condition does not exist with the component: Spark Plug Boot - Carbon Tracking / Fluid intrusion / Visible Damage
8.
    - **If a condition exists**
    - Repair or replace as necessary
9.
    - **If no conditions exist**
10. Install the special tool: <sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool> @ Spark Plug Wire & Ground
11. Engine >> Running
12. Note **:**

    An erratic or weak spark is considered a no spark condition.
13. Verify there is spark at the tool.
14.
    - **If there is no spark**
15.
    1. Remove the appropriate component: Spark Plug Wire
    2. Test for 1,850 2,250insp;Ω between the test points: Each terminal of the component
    3.
        - If not between 1,850d 2,250insp;Ω >> Replace the component: Spark Plug Wire
        - If between 1,850d 2,250insp;Ω >> Refer to: Electronic Ignition System Diagnosis
16.
    - **If there is spark**
17. Ignition/Vehicle >> Off
18. Remove the appropriate component: Spark Plug
19. Verify the component specifications are correct: Spark Plug - Gap / Heat Range / Torque
20. Refer to: Ignition System Specifications
21.
    - **If not correct**
    - Repair or replace as necessary
22.
    - **If correct**
23. Verify the component specifications are correct: Spark Plug - Carbon Tracking / Fouled / Visible Damage
24.
    - **If a condition exists**
    - Repair or replace as necessary
25.
    - **If no conditions exist**

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26. Swap the two components: Spark Plug - The original component that set the DTC & Another known good component from the vehicle
27. Engine >> Running
28. Verify the scan tool parameter: Cylinder 1â€“4rrent Misfire Counter = Increments - At the original component location the DTC set.
29.
    - **If the parameter value does not increment**
    - Replace the component: Spark Plug - The original component that set the DTC
30.
    - **If the parameter value increments**
31. Perform the following procedure/test: Fuel Injector Balance >> Refer to: Fuel Injector Diagnosis
32. Verify the procedure/test passes.
33.
    - **If the procedure/test does not pass**
    - Replace the component that failed the test: Q17 Fuel Injector
34.
    - **If the procedure/test passes**
35. Verify the condition does not exist: An engine mechanical condition >> Refer to: Symptoms - Engine Mechanical
36.
    - **If a condition exists**
    - Repair or replace as necessary
37.
    - **If no condition exists**
38. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

After any repair, perform DTC P0420rcuit/System Verification, to verify the performance of the component: Catalytic Converter >> Refer to: DTC P0420

- Ignition Coil Replacement
- Spark Plug Replacement

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0315

Diagnostic Instructions

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

DTC Descriptor

Crankshaft Position System Variation Not Learned

Circuit/System Description

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

Conditions for Running the DTC

Engine = Running

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

Conditions for Setting the DTC

Crankshaft Position Variation Learn = Not Learned

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type A> DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type A> DTC

Diagnostic Aids

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

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Verify there are no other DTCs set, except for DTC P0315
2.
    - **If other DTCs are set**
    - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle

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3.
    - **If no other DTCs are set**
4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.
5. Verify the DTC does not set.
6.
    - **If the DTC sets**
    - Replace the component: K20 Engine Control Module
7.
    - **If the DTC is not set**
8. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0326 (LKY)

Diagnostic Instructions

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

DTC Descriptor

Knock Sensor Performance

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
Signal - Terminal 1/A	The control module input circuit has an internal resistance connected to 5> V.
Signal - Terminal 2/B	The control module input circuit has an internal resistance connected to 1.33hinsp;V.

Component	Description
B68 Knock Sensor	The sensor uses piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency depend upon the level of knock that the knock sensor detects.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

The knock sensor measures vibrations of the engine block. To some extent it is comparable to a microphone. The sensor produces an AC voltage that is proportional in frequency and amplitude to the vibrations. The ECM can deduce from the signal if and which cylinder is knocking. This enables the ECM to adjust the spark timing so that the best fuel efficiency is gained. The ECM learns a minimum knock sensor noise level at idle and uses calibrated values for the rest of the engine speed range.

Conditions for Running the DTC

- Engine = Running - For greater than 2> s
- Engine Coolant Temperature = Greater than 65Â°C (149Â°F)
- Engine Speed = Greater than 2050hinsp;RPM
- Mass Air Flow Per Cylinder = Greater than 169thinsp;mg

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

Conditions for Setting the DTC

Signal Performance = Low Frequency

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C> DTC

The ignition timing is retarded to reduce potentially engine-damaging knocking.

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C> DTC

Diagnostic Aids

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- Inspect the knock sensor for physical damage. A damaged sensor may cause a DTC to set.
- The knock sensor mounting surface should be free of burrs, casting flash, and foreign material.
- Tightening the retaining bolt too much or simply dropping the knock sensor on the ground can damage it.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Engine >> Running
2. Verify the scan tool parameter: Cylinder 1â€“4ock Detected = No
3. Perform the action while monitoring the parameter:
4.
    - Wiggle the harness and connector: B68 Knock Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
5.
    - **If not the specified state**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
6.
    - **If the specified state**
7. Verify DTC P0326 not set.
8.
    - **If the DTC is set**
9.
    1. Verify a condition does not exist with the component: B68 Knock Sensor
    2.
        - Incorrect installation >> Refer to: Fastener Specifications

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- Interference with other components - Bracket / Engine Wiring Harness / Hoses / Lines
- Visible Damage

3.

- If a condition exists >> Repair or replace as necessary

4.

- If no condition exists

5. Verify the condition did not cause the DTC to set:

6.

- Accessory drive bracket - Loose / Visible Damage
- Drive Belt & Belt Driven Device - Loose / Visible Damage
- Engine - Mechanical Condition >> Refer to: Symptoms - Engine Mechanical
- Fuel - Contaminated / Poor Quality

7.

- If a condition exists >> Repair or replace as necessary
- If all conditions test normal >> Test or replace the component: B68 Knock Sensor

10.

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

11. 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.
12. Verify the DTC does not set.
13.

- **If the DTC sets**
- Refer to: Circuit/System Testing

14.

- **If the DTC is not set**

15. All OK.

Circuit/System Testing

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: B68 Knock Sensor
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for 1> to 2> V between the test points:Signal circuit terminal 2/B & Ground
5.

- **If less than 1> V**

6.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 2/B @ Component harness & Ground

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4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

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

7.

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

7.

- **If greater than 2> V**

8.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 2/B @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.
- If less than 1> V >> Replace the component: K20 Engine Control Module

9.

- **If between 1> and 2> V**

10. Test for 2> to 4> V between the test points:Signal circuit terminal 1/A & Ground
11.

- **If less than 2> V**

12.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 1/A @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: Signal circuit terminal 1/A @ Component harness & The other end of the circuit @ Control module harness
7.

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

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13.

- **If greater than 4> V**

14.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 1/A @ Component harness & Ground
5.
    - If 1> V or greater >> Repair the short to voltage on the circuit.
    - If less than 1> V >> Replace the component: K20 Engine Control Module

15.

- **If between 2> and 4> V**

16. Test or replace the component: B68 Knock Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Knock Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0326 (LMU)

Diagnostic Instructions

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

DTC Descriptor

Knock Sensor Performance

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
Signal - Terminal 1/A	The control module input circuit has an internal resistance connected to 5> V.
Signal - Terminal 2/B	The control module input circuit has an internal resistance connected to 1.33hinsp;V.
Low Reference - Terminal 3/C	Grounded through the control module.

Component	Description
B68 Knock Sensor	The sensor uses piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency depend upon the level of knock that the knock sensor detects.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

The knock sensor measures vibrations of the engine block. To some extent it is comparable to a microphone. The sensor produces an AC voltage that is proportional in frequency and amplitude to the vibrations. The ECM can deduce from the signal if and which cylinder is knocking. This enables the ECM to adjust the spark timing so that the best fuel efficiency is gained. The ECM learns a minimum knock sensor noise level at idle and uses calibrated values for the rest of the engine speed range.

Conditions for Running the DTC

- Engine = Running - For greater than 2> s
- Engine Coolant Temperature = Greater than 65Â°C (149Â°F)
- Engine Speed = Greater than 2050hinsp;RPM
- Mass Air Flow Per Cylinder = Greater than 169thinsp;mg

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

Conditions for Setting the DTC

Signal Performance = Low Frequency

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C> DTC

The ignition timing is retarded to reduce potentially engine-damaging knocking.

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C> DTC

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Diagnostic Aids

- Inspect the knock sensor for physical damage. A damaged sensor may cause a DTC to set.
- The knock sensor mounting surface should be free of burrs, casting flash, and foreign material.
- Tightening the retaining bolt too much or simply dropping the knock sensor on the ground can damage it.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Engine >> Running
2. Verify the scan tool parameter: Cylinder 1â€“4ock Detected = No
3. Perform the action while monitoring the parameter:
4.
    - Wiggle the harness and connector: B68 Knock Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
5.
    - **If not the specified state**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
6.
    - **If the specified state**
7. Verify DTC P0326 not set.
8.
    - **If the DTC is set**
9.
    1. Verify a condition does not exist with the component: B68 Knock Sensor
    2.

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- Incorrect installation >> Refer to: Fastener Specifications
- Interference with other components - Bracket / Engine Wiring Harness / Hoses / Lines
- Visible Damage

3.

- If a condition exists >> Repair or replace as necessary

4.

- If no condition exists

5. Verify the condition did not cause the DTC to set:

6.

- Accessory drive bracket - Loose / Visible Damage
- Drive Belt & Belt Driven Device - Loose / Visible Damage
- Engine - Mechanical Condition >> Refer to: Symptoms - Engine Mechanical
- Fuel - Contaminated / Poor Quality

7.

- If a condition exists >> Repair or replace as necessary
- If all conditions test normal >> Test or replace the component: B68 Knock Sensor

10.

- **If the DTC is not set**

11. 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.
12. Verify the DTC does not set.
13.

- **If the DTC sets**
- Refer to: Circuit/System Testing

14.

- **If the DTC is not set**

15. All OK.

Circuit/System Testing

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: B68 Knock Sensor
3. Test for less than 10 Ω between the test points: Low Reference circuit terminal 3/C & Ground
4.

- **If 10 Ω or greater**

5.

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 3/C @ Component harness & The other end of the circuit @ Control module harness

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3.

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

6.

- **If less than 10 Ω**

7. Ignition >> On / Vehicle >> In Service Mode
8. Test for 1> to 2> V between the test points:Signal circuit terminal 2/B & Ground
9.

- **If less than 1> V**

10.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 2/B @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: Signal circuit terminal 2/B @ Component harness & The other end of the circuit @ Control module harness
7.

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

11.

- **If greater than 2> V**

12.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 2/B @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.
- If less than 1> V >> Replace the component: K20 Engine Control Module

13.

- **If between 1> and 2> V**

14. Test for 2> to 4> V between the test points:Signal circuit terminal 1/A & Ground
15.

- **If less than 2> V**

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16.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 1/A @ Component harness & Ground
4.
   - If less than infinite resistance >> Repair the short to ground on the circuit.
5.
   - If infinite resistance
6. Test for less than 2> Ω between the test points: Signal circuit terminal 1/A @ Component harness & The other end of the circuit @ Control module harness
7.
   - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
   - If less than 2> Ω >> Replace the component: K20 Engine Control Module

17.

- **If greater than 4> V**

18.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 1/A @ Component harness & Ground
5.
   - If 1> V or greater >> Repair the short to voltage on the circuit.
   - If less than 1> V >> Replace the component: K20 Engine Control Module

19.

- **If between 2> and 4> V**

20. Test or replace the component: B68 Knock Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Knock Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0326 (LC5)

Diagnostic Instructions

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

DTC Descriptor

Knock Sensor Performance

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
Signal - Terminal 2/B	The control module input circuit has an internal resistance connected to 5> V.
Signal - Terminal 3/C	The control module input circuit has an internal resistance connected to 1.33hinsp;V.
Low Reference - Terminal 1/A	Grounded through the control module.

Component	Description
B68 Knock Sensor	The sensor uses piezo-electric crystal technology that produces an AC voltage signal of varying amplitude and frequency based on the engine vibration or noise level. The amplitude and frequency depend upon the level of knock that the knock sensor detects.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

The knock sensor measures vibrations of the engine block. To some extent it is comparable to a microphone. The sensor produces an AC voltage that is proportional in frequency and amplitude to the vibrations. The ECM can deduce from the signal if and which cylinder is knocking. This enables the ECM to adjust the spark timing so that the best fuel efficiency is gained. The ECM learns a minimum knock sensor noise level at idle and uses calibrated values for the rest of the engine speed range.

Conditions for Running the DTC

- Engine = Running - For greater than 2> s
- Engine Coolant Temperature = Greater than 65Â°C (149Â°F)
- Engine Speed = Greater than 2050hinsp;RPM
- Mass Air Flow Per Cylinder = Greater than 169thinsp;mg

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

Conditions for Setting the DTC

Signal Performance = Low Frequency

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C> DTC

The ignition timing is retarded to reduce potentially engine-damaging knocking.

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C> DTC

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Diagnostic Aids

- Inspect the knock sensor for physical damage. A damaged sensor may cause a DTC to set.
- The knock sensor mounting surface should be free of burrs, casting flash, and foreign material.
- Tightening the retaining bolt too much or simply dropping the knock sensor on the ground can damage it.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Engine >> Running
2. Verify the scan tool parameter: Cylinder 1â€“4ock Detected = No
3. Perform the action while monitoring the parameter:
4.
    - Wiggle the harness and connector: B68 Knock Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
5.
    - **If not the specified state**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
6.
    - **If the specified state**
7. Verify DTC P0326 not set.
8.
    - **If the DTC is set**
9.
    1. Verify a condition does not exist with the component: B68 Knock Sensor
    2.

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- Incorrect installation >> Refer to: Fastener Specifications
- Interference with other components - Bracket / Engine Wiring Harness / Hoses / Lines
- Visible Damage

3.

- If a condition exists >> Repair or replace as necessary

4.

- If no condition exists

5. Verify the condition did not cause the DTC to set:

6.

- Accessory drive bracket - Loose / Visible Damage
- Drive Belt & Belt Driven Device - Loose / Visible Damage
- Engine - Mechanical Condition >> Refer to: Symptoms - Engine Mechanical
- Fuel - Contaminated / Poor Quality

7.

- If a condition exists >> Repair or replace as necessary
- If all conditions test normal >> Test or replace the component: B68 Knock Sensor

10.

- **If the DTC is not set**

11. 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.
12. Verify the DTC does not set.
13.

- **If the DTC sets**
- Refer to: Circuit/System Testing

14.

- **If the DTC is not set**

15. All OK.

Circuit/System Testing

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: B68 Knock Sensor
3. Test for less than 10 Ω between the test points: Low Reference circuit terminal 1/A & Ground
4.

- **If 10 Ω or greater**

5.

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 1/A @ Component harness & The other end of the circuit @ Control module harness

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3.

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

6.

- **If less than 10 Ω**

7. Ignition >> On / Vehicle >> In Service Mode
8. Test for 1> to 2> V between the test points:Signal circuit terminal 3/C & Ground
9.

- **If less than 1> V**

10.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 3/C @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: Signal circuit terminal 3/C @ Component harness & The other end of the circuit @ Control module harness
7.

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

11.

- **If greater than 2> V**

12.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 3/C @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.
- If less than 1> V >> Replace the component: K20 Engine Control Module

13.

- **If between 1> and 2> V**

14. Test for 2> to 4> V between the test points:Signal circuit terminal 2/B & Ground
15.

- **If less than 2> V**

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16.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 2/B @ Component harness & Ground
4.
   - If less than infinite resistance >> Repair the short to ground on the circuit.
5.
   - If infinite resistance
6. Test for less than 2> Ω between the test points: Signal circuit terminal 2/B @ Component harness & The other end of the circuit @ Control module harness
7.
   - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
   - If less than 2> Ω >> Replace the component: K20 Engine Control Module

17.

- **If greater than 4> V**

18.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points: Signal circuit terminal 2/B @ Component harness & Ground
5.
   - If 1> V or greater >> Repair the short to voltage on the circuit.
   - If less than 1> V >> Replace the component: K20 Engine Control Module

19.

- **If between 2> and 4> V**

20. Test or replace the component: B68 Knock Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Knock Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0335-P0337 (LMU)

Diagnostic Instructions

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

DTC Descriptor

Crankshaft Position Sensor Circuit

Crankshaft Position Sensor Performance

Crankshaft Position Sensor Circuit Low Duty Cycle

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5> V Reference	P0335, P0642	P0335, P0337	P0643	P0336, P0337
Signal	P0335	P0335, P0337	P0335	P0336, P0337
Low Reference	-	P0335	-	P0336, P0337

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
5> V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5> V.
Low Reference	Grounded through the control module.

Component	Description
B26 Crankshaft Position Sensor	The sensor contains a hall-effect sensor and additional electronics that processes the signal. It detects the change of strength of the magnetic field caused by the reluctor ring. When the strength changes, the sensor changes the amount of current it consumes. This results in a square wave signal of the current, while the voltage stays constant. The control module detects the frequency in which the current changes, which is proportional to the rotational speed.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
Reluctor Ring	There are 58 teeth or invisible magnetic segments on the edge of the crankshaft position reluctor ring mounted on the crankshaft. Each tooth or magnetic segment on the ring is spaced at a 60 segment spacing with 2> missing segments for a reference gap.

The ECM uses information from the crankshaft position sensor and the camshaft position sensor(s) for sequencing and timing of the spark events.

Conditions for Running the DTC

P0335, P0336

- Engine = Running

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

P0337

- DTC P0335, P0341, P0342, P0642, P0643
- Starter = Active

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

Conditions for Setting the DTC

P0335Condition 1>

Crankshaft Position Sensor = Less than 1.3thinsp;V - For greater than 1> s

Condition 2>

Crankshaft Position Sensor = Greater than 2.3thinsp;V - For greater than 1> s

P0336

Crankshaft Position Sensor = No Signal - During 1> engine revolution(s)

P0337

Crankshaft Position Sensor = No Signal - During 12 engine revolution(s)

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type E> DTC

Camshaft Position Sensor = Used for engine position

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type E> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify DTC P0642, P0643t.
3.
    - **If the DTC is set**
    - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle

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4.
    - **If the DTC is not set**
5. Engine >> Running
6. Verify DTC P0336 not set.
7.
    - **If the DTC is set**
    - Refer to: Circuit/System Testing
8.
    - **If the DTC is not set**
9. Perform the following action:
10.
    - Wiggle the harness and connector: B26 Crankshaft Position Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
    - - The engine should not stumble/stall.
11.
    - **If a condition exists**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
12.
    - **If no condition exists**
13. 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.
14. Verify the DTC does not set.
15.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
16.
    - **If the DTC is not set**
17. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.
2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the electrical connector: B26 Crankshaft Position Sensor
4. Test for less than 10 Ω between the test points: Low Reference circuit terminal 1> & Ground
5.
    - **If 10 Ω or greater**

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6.

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 1> @ Component harness & The other end of the circuit @ Control module harness
3.

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

7.

- **If less than 10 Ω**

8. Ignition >> On / Vehicle >> In Service Mode
9. Test for 4.8to 5.2thinsp;V between the test points: 5> V Reference circuit terminal 3> & Ground
10.

- **If less than 4.8thinsp;V**

11.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: 5> V Reference circuit terminal 3> @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: 5> V Reference circuit terminal 3> @ Component harness & The other end of the circuit @ Control module harness
7.

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

12.

- **If greater than 5.2thinsp;V**

13.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:5> V Reference circuit terminal 3> @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.
- If less than 1> V >> Replace the component: K20 Engine Control Module

14.

- **If between 4.8and 5.2thinsp;V**

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- **If between 4.8and 5.2 V**

15. Rapidly tap a 3> A fused jumper wire between the test points:Signal circuit terminal 2> & Ground
16. Verify the scan tool parameter: Crankshaft Position Active Counter = Increments
17.
    - **If the parameter value does not increment**
18.
    1. Ignition/Vehicle >> Off
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Ignition >> On / Vehicle >> In Service Mode
    4. Test for less than 1> V between the test points:Signal circuit terminal 2> @ Component harness & Ground
    5.
        - If 1> V or greater >> Repair the short to voltage on the circuit.
    6.
        - If less than 1> V
19.
    1. Ignition/Vehicle >> Off
    2. Test for infinite resistance between the test points: Signal circuit terminal 2> @ Component harness & Ground
    3.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
    4.
        - If infinite resistance
    5. Test for less than 2> Ω between the test points: Signal circuit terminal 2> @ Component harness & The other end of the circuit @ Control module harness
    6.
        - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
        - If less than 2> Ω >> Replace the component: K20 Engine Control Module
20.
    - **If the parameter value increments**
21. Verify DTC P0336 not set.
22.
    - **If the DTC is set**
    - Verify the following conditions do not exist:
23.
    - B26 Crankshaft Position Sensor & Reluctor Ring - Excessive play / Foreign material passing between the components / Incorrect air gap / Incorrect installation / Loose / Visible Damage
    - Camshaft Sprocket - Visible Damage / Worn
    - Crankshaft Sprocket - Visible Damage / Worn

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- Engine Oil - Contaminated / Dirty
- Timing Chain or Timing Belt - Visible Damage / Worn
- Timing Chain Tensioner or Timing Belt Tensioner - Visible Damage / Worn
-
    - If a condition exists >> Repair or replace as necessary
    - If no condition exists >> Test or replace the component: B26 Crankshaft Position Sensor

24.

- **If the DTC is not set**

25. Test or replace the component: B26 Crankshaft Position Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Crankshaft Position Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0335-P0337 (LKY)

Symptoms

Diagnostic Trouble Codes - P0336

Diagnostic Instructions

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

DTC Descriptor

Crankshaft Position Sensor Circuit

Crankshaft Position Sensor Performance

Crankshaft Position Sensor Circuit Low Duty Cycle

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5> V Reference	P0335, P0642	P0335, P0337	P0643	P0336, P0337
Signal	P0335	P0335, P0337	P0335	P0336, P0337
Low Reference	-	P0335	-	P0336, P0337

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
5> V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5> V.
Low Reference	Grounded through the control module.

Component	Description
B26 Crankshaft Position Sensor	The sensor contains a hall-effect sensor and additional electronics that processes the signal. It detects the change of strength of the magnetic field caused by the reluctor ring. When the strength changes, the sensor changes the amount of current it consumes. This results in a square wave signal of the current, while the voltage stays constant. The control module detects the frequency in which the current changes, which is proportional to the rotational speed.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
Reluctor Ring	There are 58 teeth or invisible magnetic segments on the edge of the crankshaft position reluctor ring mounted on the crankshaft. Each tooth or magnetic segment on the ring is spaced at a 60 segment spacing with 2> missing segments for a reference gap.

The ECM uses information from the crankshaft position sensor and the camshaft position sensor(s) for sequencing and timing of the spark events.

Conditions for Running the DTC

P0335, P0336

- Engine = Running

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

P0337

- DTC P0335, P0341, P0342, P0642, P0643
- Starter = Active

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

Conditions for Setting the DTC

P0335Condition 1>

Crankshaft Position Sensor = Less than 1.3thinsp;V - For greater than 1> s

Condition 2>

Crankshaft Position Sensor = Greater than 2.3thinsp;V - For greater than 1> s

P0336

Crankshaft Position Sensor = No Signal - During 1> engine revolution(s)

P0337

Crankshaft Position Sensor = No Signal - During 12 engine revolution(s)

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type E> DTC

Camshaft Position Sensor = Used for engine position

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type E> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify DTC P0642, P0643t.
3. **If the DTC is not**

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- **If the DTC is set**
- Refer to: Diagnostic Trouble Code (DTC) List - Vehicle

4.
   - **If the DTC is not set**
5. Engine >> Running
6. Verify DTC P0336 not set.
7.
   - **If the DTC is set**
   - Refer to: Circuit/System Testing
8.
   - **If the DTC is not set**
9. Perform the following action:
10.
    - Wiggle the harness and connector: B26 Crankshaft Position Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
    - - The engine should not stumble/stall.
11.
    - **If a condition exists**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
12.
    - **If no condition exists**
13. 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.
14. Verify the DTC does not set.
15.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
16.
    - **If the DTC is not set**
17. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.
2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the electrical connector: B26 Crankshaft Position Sensor
4. Test for less than 10 Ω between the test points: Low Reference circuit terminal 2> & Ground

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5.

- **If 10 Ω or greater**

6.

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 2> @ Component harness & The other end of the circuit @ Control module harness
3.

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

7.

- **If less than 10 Ω**

8. Ignition >> On / Vehicle >> In Service Mode
9. Test for 4.8to 5.2thinsp;V between the test points: 5> V Reference circuit terminal 1> & Ground
10.

- **If less than 4.8thinsp;V**

11.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: 5> V Reference circuit terminal 1> @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: 5> V Reference circuit terminal 1> @ Component harness & The other end of the circuit @ Control module harness
7.

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

12.

- **If greater than 5.2thinsp;V**

13.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:5> V Reference circuit terminal 1> @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.

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- If less than 1> V >> Replace the component: K20 Engine Control Module

14.

- **If between 4.8and 5.2thinsp;V**

15. Rapidly tap a 3> A fused jumper wire between the test points:Signal circuit terminal 3> & Ground
16. Verify the scan tool parameter: Crankshaft Position Active Counter = Increments
17.

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

18.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:Signal circuit terminal 3> @ Component harness & Ground
5.
   - If 1> V or greater >> Repair the short to voltage on the circuit.
6.
   - If less than 1> V

19.

1. Ignition/Vehicle >> Off
2. Test for infinite resistance between the test points: Signal circuit terminal 3> @ Component harness & Ground
3.
   - If less than infinite resistance >> Repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 2> Ω between the test points: Signal circuit terminal 3> @ Component harness & The other end of the circuit @ Control module harness
6.
   - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
   - If less than 2> Ω >> Replace the component: K20 Engine Control Module

20.

- **If the parameter value increments**

21. Verify DTC P0336 not set.
22.

- **If the DTC is set**
- Verify the following conditions do not exist:

23.

- B26 Crankshaft Position Sensor & Reluctor Ring - Excessive play / Foreign material passing between the components / Incorrect air gap / Incorrect installation / Loose / Visible Damage

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- Camshaft Sprocket - Visible Damage / Worn
- Crankshaft Sprocket - Visible Damage / Worn
- Engine Oil - Contaminated / Dirty
- Timing Chain or Timing Belt - Visible Damage / Worn
- Timing Chain Tensioner or Timing Belt Tensioner - Visible Damage / Worn
-
    - If a condition exists >> Repair or replace as necessary
    - If no condition exists >> Test or replace the component: B26 Crankshaft Position Sensor

24.

- **If the DTC is not set**

25. Test or replace the component: B26 Crankshaft Position Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Crankshaft Position Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

Related Part Information

Part Name	Catalog Name	Part Code

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0335-P0337 (LC5)

Symptoms

Diagnostic Trouble Codes - P0336

Diagnostic Instructions

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

DTC Descriptor

Crankshaft Position Sensor Circuit

Crankshaft Position Sensor Performance

Crankshaft Position Sensor Circuit Low Duty Cycle

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5> V Reference	P0335, P0642	P0335, P0337	P0643	P0336, P0337
Signal	P0335	P0335, P0337	P0335	P0336, P0337
Low Reference	-	P0335	-	P0336, P0337

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
5> V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5> V.
Low Reference	Grounded through the control module.

Component	Description
B26 Crankshaft Position Sensor	The sensor contains a hall-effect sensor and additional electronics that processes the signal. It detects the change of strength of the magnetic field caused by the reluctor ring. When the strength changes, the sensor changes the amount of current it consumes. This results in a square wave signal of the current, while the voltage stays constant. The control module detects the frequency in which the current changes, which is proportional to the rotational speed.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
Reluctor Ring	There are 58 teeth or invisible magnetic segments on the edge of the crankshaft position reluctor ring mounted on the crankshaft. Each tooth or magnetic segment on the ring is spaced at a 60 segment spacing with 2> missing segments for a reference gap.

The ECM uses information from the crankshaft position sensor and the camshaft position sensor(s) for sequencing and timing of the spark events.

Conditions for Running the DTC

P0335, P0336

- Engine = Running

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

P0337

- DTC P0335, P0341, P0342, P0642, P0643
- Starter = Active

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

Conditions for Setting the DTC

P0335Condition 1>

Crankshaft Position Sensor = Less than 1.3thinsp;V - For greater than 1> s

Condition 2>

Crankshaft Position Sensor = Greater than 2.3thinsp;V - For greater than 1> s

P0336

Crankshaft Position Sensor = No Signal - During 1> engine revolution(s)

P0337

Crankshaft Position Sensor = No Signal - During 12 engine revolution(s)

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type E> DTC

Camshaft Position Sensor = Used for engine position

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type E> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify DTC P0642, P0643t.
3. **If the DTC is not**

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- **If the DTC is set**
- Refer to: Diagnostic Trouble Code (DTC) List - Vehicle

4.
   - **If the DTC is not set**
5. Engine >> Running
6. Verify DTC P0336 not set.
7.
   - **If the DTC is set**
   - Refer to: Circuit/System Testing
8.
   - **If the DTC is not set**
9. Perform the following action:
10.
    - Wiggle the harness and connector: B26 Crankshaft Position Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
    - - The engine should not stumble/stall.
11.
    - **If a condition exists**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
12.
    - **If no condition exists**
13. 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.
14. Verify the DTC does not set.
15.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
16.
    - **If the DTC is not set**
17. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.
2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the electrical connector: B26 Crankshaft Position Sensor
4. Test for less than 10 Ω between the test points: Low Reference circuit terminal 3> & Ground

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5.

- **If 10 Ω or greater**

6.

1. Disconnect the electrical connector: K20 Engine Control Module
2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 3> @ Component harness & The other end of the circuit @ Control module harness
3.

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

7.

- **If less than 10 Ω**

8. Ignition >> On / Vehicle >> In Service Mode
9. Test for 4.8to 5.2thinsp;V between the test points: 5> V Reference circuit terminal 1> & Ground
10.

- **If less than 4.8thinsp;V**

11.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: 5> V Reference circuit terminal 1> @ Component harness & Ground
4.

- If less than infinite resistance >> Repair the short to ground on the circuit.

5.

- If infinite resistance

6. Test for less than 2> Ω between the test points: 5> V Reference circuit terminal 1> @ Component harness & The other end of the circuit @ Control module harness
7.

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

12.

- **If greater than 5.2thinsp;V**

13.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:5> V Reference circuit terminal 1> @ Component harness & Ground
5.

- If 1> V or greater >> Repair the short to voltage on the circuit.

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- If less than 1> V >> Replace the component: K20 Engine Control Module

14.

- **If between 4.8and 5.2thinsp;V**

15. Rapidly tap a 3> A fused jumper wire between the test points:Signal circuit terminal 2> & Ground
16. Verify the scan tool parameter: Crankshaft Position Active Counter = Increments
17.

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

18.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:Signal circuit terminal 2> @ Component harness & Ground
5.
   - If 1> V or greater >> Repair the short to voltage on the circuit.
6.
   - If less than 1> V

19.

1. Ignition/Vehicle >> Off
2. Test for infinite resistance between the test points: Signal circuit terminal 2> @ Component harness & Ground
3.
   - If less than infinite resistance >> Repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 2> Ω between the test points: Signal circuit terminal 2> @ Component harness & The other end of the circuit @ Control module harness
6.
   - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
   - If less than 2> Ω >> Replace the component: K20 Engine Control Module

20.

- **If the parameter value increments**

21. Verify DTC P0336 not set.
22.

- **If the DTC is set**
- Verify the following conditions do not exist:

23.

- B26 Crankshaft Position Sensor & Reluctor Ring - Excessive play / Foreign material passing between the components / Incorrect air gap / Incorrect installation / Loose / Visible Damage

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- Camshaft Sprocket - Visible Damage / Worn
- Crankshaft Sprocket - Visible Damage / Worn
- Engine Oil - Contaminated / Dirty
- Timing Chain or Timing Belt - Visible Damage / Worn
- Timing Chain Tensioner or Timing Belt Tensioner - Visible Damage / Worn
-
    - If a condition exists >> Repair or replace as necessary
    - If no condition exists >> Test or replace the component: B26 Crankshaft Position Sensor

24.

- **If the DTC is not set**

25. Test or replace the component: B26 Crankshaft Position Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Crankshaft Position Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0341 or P0342 (LC5, LMU)

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 P0341

Camshaft Position (CMP) Sensor Performance

DTC P0342

Camshaft Position (CMP) Sensor Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	â€”	P0342	â€”	P0341
Signal	P0342	P0342	P0342	P0341
Low Reference	â€”	P0342	â€”	P0341

Circuit/System Description

The camshaft position (CMP) sensor correlates the crankshaft to camshaft position so that the engine control module (ECM) can determine which cylinder is ready to be fueled by an injector. As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor and sends a signal to the ECM through the signal circuit. The CMP sensor circuits are directly connected to the ECM. The CMP sensor also determines which cylinder is misfiring. The CMP sensor circuits consist of the following:

- An ignition voltage
- A low reference
- A CMP signal

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0341

The ECM detects no transition of CMP signal between 25th and 33th CKP pulse and detects change in polarity.

P0342

The ECM detects no transition of CMP signal between 25th and 33th CKP pulse and detects no change in polarity.

Action Taken When the DTC Sets

DTC P0341 and P0342 are Type E DTCs.

Conditions for Clearing the DTC

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DTC P0341 and P0342 are Type E DTCs.

Diagnostic Aids

The following conditions can also set the DTC:

- Physical damage to the CMP sensor or the reluctor wheel.
- Excessive play or looseness of the CMP sensor or the reluctor wheel.
- Improper installation of the CMP sensor or the reluctor wheel.
- Foreign material passing between the CMP sensor and the reluctor wheel.
- Excessive air gap between the CMP sensor and the reluctor wheel.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

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

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Circuit/System Verification

1. Engine running, verify that the DTCs P0341 or P0342 is not set.
2. Operate the vehicle within the Conditions For Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B23â€‰Camshaft Position Sensor.
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminalâ€‰1 and ground.
3.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal and the ignition circuit fuse is open, test all components connected to the ignition circuit and replace as necessary.
4. Ignition ON, verify the test lamp illuminates between the ignition circuit terminalâ€‰1 and the low reference circuit terminalâ€‰2.
5.
    - If the test lamp does not illuminate, test the low reference circuit for an open/high resistance. If circuit tests normal, replace the

K20â€‰ECM.

6. Ignition ON, test for 4.8â€“5.2â€‰V between the signal circuit terminalâ€‰3 and the low reference circuit terminalâ€‰2.
7.
    - If less than the specified range, test the signal circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the K20â€‰ECM.
    - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20â€‰ECM.
8. If all circuits test normal, test or replace the B23â€‰CMP sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Camshaft Position Sensor Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0341 or P0342 (LKY)

Diagnostic Instructions

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

DTC Descriptor

Camshaft Position Sensor Performance

Intake Camshaft Position Sensor Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5> V Reference	P0342	P0342	P0653*	P0341
Signal	P0342	P0342	P0342	P0341
Low Reference	-	P0342	-	P0341
*> Additional DTCs may set.				

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
5> V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5> V.
Low Reference	Grounded through the control module.

Component	Description
B23 Camshaft Position Sensor	The sensor contains a hall-effect sensor and additional electronics that processes the signal. It detects the change of strength of the magnetic field caused by the reluctor ring. When the strength changes, the sensor changes the amount of current it consumes. This results in a square wave signal of the current, while the voltage stays constant. The control module detects the frequency in which the current changes, which is proportional to the rotational speed.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
Reluctor Ring	There are 4> equally spaced teeth on the edge of the camshaft position reluctor ring mounted on the camshaft.

The ECM uses information from the crankshaft position sensor and the camshaft position sensor(s) for sequencing and timing of the spark events.

Conditions for Running the DTC

P0341

Engine = Running

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

P0342Condition 1>

- DTC P0335, P0336, P0337, P0652, P0653
- M64 Starter Motor = Active

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

Conditions for Setting the DTC

P0341

Camshaft Position Sensor = Less than 4> pulse(s) - For greater than 3> s

P0342Condition 1>

The ECM detects a camshaft to crankshaft misalignment.

Condition 2>

The ECM detects a difference between the actual and the desired camshaft position angle.

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type E> DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type E> DTC

Diagnostic Aids

The cranking period may take longer.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify DTC P0652, P0653t.
3.
    - **If the DTC is set**
    - Refer to: DTC P0642, P0643, P0652, or P0653
4.
    - **If the DTC is not set**

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5. Engine >> Running
6. Verify DTC P0341 not set.
7.
   - **If the DTC is set**
   - Refer to: Circuit/System Testing
8.
   - **If the DTC is not set**
9. Perform the following action:
10.
    - Wiggle the harness and connector: B23 Camshaft Position Sensor
    - Wiggle the harness and connector: K20 Engine Control Module
    - - The engine should not stumble/stall.
11.
    - **If a condition exists**
    - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
12.
    - **If no condition exists**
13. 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.
14. Verify the DTC does not set.
15.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
16.
    - **If the DTC is not set**
17. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.
2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the appropriate electrical connector: B23 Camshaft Position Sensor
4. Test for less than 10 Ω between the test points: Low Reference circuit terminal 2> & Ground
5.
   - **If 10 Ω or greater**
6.
   1. Disconnect the electrical connector: K20 Engine Control Module

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2. Test for less than 2> Ω between the test points: Low Reference circuit terminal 2> @ Component harness & The other end of the circuit @ Control module harness
3.
    - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
    - If less than 2> Ω >> Replace the component: K20 Engine Control Module
7.
    - **If less than 10 Ω**
8. Ignition >> On / Vehicle >> In Service Mode
9. Test for 4.8to 5.2thinsp;V between the test points: 5> V Reference circuit terminal 1> & Ground
10.
    - **If less than 4.8thinsp;V**
11.
    1. Ignition/Vehicle >> Off
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for infinite resistance between the test points: 5> V Reference circuit terminal 1> @ Component harness & Ground
    4.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
    5.
        - If infinite resistance
    6. Test for less than 2> Ω between the test points: 5> V Reference circuit terminal 1> @ Component harness & The other end of the circuit @ Control module harness
    7.
        - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
        - If less than 2> Ω >> Replace the component: K20 Engine Control Module
12.
    - **If greater than 5.2thinsp;V**
13.
    1. Ignition/Vehicle >> Off
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Ignition >> On / Vehicle >> In Service Mode
    4. Test for less than 1> V between the test points:5> V Reference circuit terminal 1> @ Component harness & Ground
    5.
        - If 1> V or greater >> Repair the short to voltage on the circuit.
        - If less than 1> V >> Replace the component: K20 Engine Control Module
14.
    - **If between 4.8and 5.2thinsp;V**
15. Test for 4.8to 5.2thinsp;V between the test points: Signal circuit terminal 3> & Ground

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16.

- **If less than 4.8thinsp;V**

17.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Test for infinite resistance between the test points: Signal circuit terminal 3> @ Component harness & Ground
4.
   - If less than infinite resistance >> Repair the short to ground on the circuit.
5.
   - If infinite resistance
6. Test for less than 2> Ω between the test points: Signal circuit terminal 3> @ Component harness & The other end of the circuit @ Control module harness
7.
   - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
   - If less than 2> Ω >> Replace the component: K20 Engine Control Module

18.

- **If greater than 5.2thinsp;V**

19.

1. Ignition/Vehicle >> Off
2. Disconnect the electrical connector: K20 Engine Control Module
3. Ignition >> On / Vehicle >> In Service Mode
4. Test for less than 1> V between the test points:Signal circuit terminal 3> @ Component harness & Ground
5.
   - If 1> V or greater >> Repair the short to voltage on the circuit.
   - If less than 1> V >> Replace the component: K20 Engine Control Module

20.

- **If between 4.8and 5.2thinsp;V**

21. Verify DTC P0341 not set.

22.

- **If the DTC is set**
- Verify the following conditions do not exist:

23.

- B23 Camshaft Position Sensor & Reluctor Ring - Excessive play / Foreign material passing between the components / Incorrect air gap / Incorrect installation / Loose / Visible Damage
- Engine Oil - Contaminated / Dirty
- Timing Chain or Timing Belt - Visible Damage / Worn
- Timing Chain Tensioner or Timing Belt Tensioner - Visible Damage / Worn

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-
    - If a condition exists >> Repair or replace as necessary
    - If no condition exists >> Test or replace the component: B23 Camshaft Position Sensor

24.
    - **If the DTC is not set**
25. Test or replace the component: B23 Camshaft Position Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Camshaft Position Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0351 or P0352

Diagnostic Instructions

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

DTC Descriptor

Ignition Coil 1 and 4 Control Circuit

Ignition Coil 2 and 3 Control Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Control - Terminal 3/C @ T8A Ignition Coil 1	P0300, P0351	P0300, P0351	P0300, P0351	P0300
Control - Terminal 3/C @ T8B Ignition Coil 2	P0300, P0352	P0300, P0352	P0300, P0352	P0300
Control - Terminal 3/C @ T8C Ignition Coil 3	P0300, P0352	P0300, P0352	P0300, P0352	P0300
Control - Terminal 3/C @ T8D Ignition Coil 4	P0300, P0351	P0300, P0351	P0300, P0351	P0300
Ground - Terminal 1/A @ T8A Ignition Coil 1	-	P0300, P0351	-	P0300
Ground - Terminal 1/A @ T8B Ignition Coil 2	-	P0300, P0352	-	P0300
Ground - Terminal 1/A @ T8C Ignition Coil 3	-	P0300, P0352	-	P0300
Ground - Terminal 1/A @ T8D Ignition Coil 4	-	P0300, P0351	-	P0300

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
Control	The output circuit is switched to ground to activate the component.
Ground	Chassis Ground

Component	Description
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
T8 Ignition Coil	The ignition system on this engine uses ignition coils with integrated power transistors.

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

Conditions for Running the DTC

- Engine = Cranking or Running
- Ignition Voltage = Greater than 11 V

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

Conditions for Setting the DTC

Control Circuit = Commanded state does not match the actual state

Actions Taken When the DTC Sets

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DTCs listed in the DTC Descriptor Category = Type B> DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type B> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Special Tools

<sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>

Equivalent regional tools: Special Tools

Circuit/System Verification

1. Engine >> Running
2. Verify the scan tool parameter:
3.
    - Ignition Coil 1â€“4ntrol Circuit High Voltage Test Status = OK or Not Run
    - Ignition Coil 1â€“4ntrol Circuit Low Voltage Test Status = OK or Not Run
    - Ignition Coil 1â€“4ntrol Circuit Open Test Status = OK or Not Run
4.
    - **If not the specified state**
    - Refer to: Circuit/System Testing
5.
    - **If the specified state**
6. Verify the scan tool parameter:
7.
    - Ignition Coil 1â€“4ntrol Circuit High Voltage Test Status = OK or Not Run
    - Ignition Coil 1â€“4ntrol Circuit Low Voltage Test Status = OK or Not Run

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- Ignition Coil 1â€“4ntrol Circuit Open Test Status = OK or Not Run

8.

- Perform the action while monitoring the parameter:

9.

- Wiggle the harness and connector: T8 Ignition Coil
- Wiggle the harness and connector: K20 Engine Control Module

10.

- **If not the specified state**
- Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)

11.

- **If the specified state**

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.
14.

- **If the DTC sets**
- Refer to: Circuit/System Testing

15.

- **If the DTC is not set**

16. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the appropriate electrical connector: T8 Ignition Coil
4. Test for less than 10 Ω between the test points: Ground circuit terminal 1/A & Ground
5.

   - **If 10 Ω or greater**

6.

   1. Disconnect the ground connection: Ground terminal
   2. Test for less than 2> Ω between the test points: Ground circuit terminal 1/A @ Component harness & The other end of the circuit @ Ground terminal
   3.

      - 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.

7.

   - **If less than 10 Ω**

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8. Ignition >> On / Vehicle >> In Service Mode
9. Verify a test lamp does not turn On between the test points: Control circuit terminal 3/C & B+
10.
    - **If the test lamp turns On**
11.
    1. Ignition/Vehicle >> Off & Remove >> Test lamp
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for infinite resistance between the test points: Control circuit terminal 3/C @ Component harness & Ground
    4.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
        - If infinite resistance >> Replace the component: K20 Engine Control Module
12.
    - **If the test lamp does not turn On**
13. Remove >> Test Lamp
14. Engine >> Running
15. Verify the scan tool parameter: Ignition Coil 1â€“6ntrol Circuit High Voltage Test Status = OK or Not Run
16.
    - **If not the specified state**
17.
    1. Ignition/Vehicle >> Off
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for less than 1> V between the test points:Control circuit terminal 3/C @ Component harness & Ground
    4.
        - If 1> V or greater >> Repair the short to voltage on the circuit.
        - If less than 1> V >> Replace the component: K20 Engine Control Module
18.
    - **If the specified state**
19. Ignition/Vehicle >> Off
20. Connect a 3> A fused jumper wire between the test points:Control circuit terminal 3/C & Ignition circuit terminal 4/D
21. Engine >> Running
22. Verify the scan tool parameter: Ignition Coil 1â€“6ntrol Circuit High Voltage Test Status = OK or Not Run
23.
    - **If not the specified state**
24.
    1. Ignition/Vehicle >> Off & Remove >> Jumper wire(s)
    2. Disconnect the electrical connector: K20 Engine Control Module

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3. Test for less than 2> Ω between the test points:Control circuit terminal 3/C @ Component harness & The other end of the circuit @ Control module harness
4.
    - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
    - If less than 2> Ω >> Replace the component: K20 Engine Control Module

25.
    - **If the specified state**

26. Test or replace the component: T8 Ignition Coil

Component Testing

1. Note **:**

   Circuit/System Testing must be performed before proceeding with Component Testing.
2. Ignition/Vehicle >> Off
3. Remove the appropriate component: T8 Ignition Coil - Leave the electrical connector connected.
4. Install the special tool: <sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>
5. Engine >> Running
6. Note **:**

   An erratic or weak spark is considered a no spark condition.
7. Verify there is spark at the tool.
8.
    - **If there is no spark**
    - Replace the component: T8 Ignition Coil

9.
    - **If there is spark**

10. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Ignition Coil Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0400-P0402

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 P0400

Exhaust Gas Recirculation (EGR) Flow Incorrect

DTC P0401

Exhaust Gas Recirculation (EGR) Flow Insufficient

DTC P0402

Exhaust Gas Recirculation (EGR) Flow Excessive

Circuit/System Description

The engine control module (ECM) performs a flow test on the exhaust gas recirculation (EGR) system during deceleration. The ECM does this by momentarily commanding the EGR valve to open while monitoring the signal of the manifold absolute pressure (MAP) sensor and the EGR position sensor. If the MAP signal is incorrect for the EGR pintle position, the ECM records the amount of MAP difference that was detected and adjusts a calibrated fail counter towards a calibrated fail threshold level. The number of EGR flow tests required to exceed the fail threshold may vary according to the amount of detected EGR flow error.

Normally, the ECM will only allow one EGR flow test during an ignition cycle. To aid in verifying a repair, the ECM will allow multiple EGR flow tests following a code clear event.

Conditions for Running the DTC

- The engine coolant temperature is greater than 50Â°C (122Â°F).
- The vehicle is in fuel cut off mode.
- The engine speed is between 2,592â€“3,400 RPM.
- The ambient pressure is greater than 74â€‰kPa (10.7â€‰psi).
- The intake air temperature is greater than â^’6Â° C (21.2Â°F).
- The vehicle speed is between 70â€“120â€‰km/h (43.5â€“74.6â€‰mph).
- The EVAP canister purge valve solenoid pulse width modulation (PWM) is less than 1.2%.
- The idle air control valve pulse width modulation (PWM) is between 0â€“55%.
- The transmission is in 4th or 5th gear.
- The DTC runs once per ignition cycle when the above conditions are met and the vehicle is decelerating for 7â€‰s.

Conditions for Setting the DTC

P0400

The ECM detects that an incorrect amount of EGR flow is indicated.

P0401

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The MAP changes monitored by the ECM during the EGR flow tests indicate an insufficient amount of EGR flow.

P0402

The MAP changes monitored by the ECM during the EGR flow tests indicate an excessive amount of EGR flow.

Action Taken When the DTC Sets

DTC P0400, P0401, and P0402 are Type E DTCs

Conditions for Clearing the DTC

DTC P0400, P0401, and P0402 are Type E DTCs

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Exhaust Gas Recirculation (EGR) 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, verify that the DTCs P0107, P0108, P0403, P0404, P0405, or P0406 is not set.
2.
    - If any DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3. Verify that the DTC P0400, P0401, or P0402 is not set.
4. Ignition ON, verify that the scan tool EGR Position Sensor parameter is between 0â€“4%.
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.

Circuit/System Testing

1. Verify none of the following conditions exist:
2.
    - Incorrect EGR valve for engine application
    - A vacuum leak between the EGR valve and the intake manifold

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- Signs of external leakage usually indicated by carbon buildup around the mating surfaces of the components or an audible exhaust noise
- Restrictions in the passages or EGR valve caused by carbon deposits or casting flash
- Note:

  Restrictions can cause excessive back pressure and low engine vacuum.
- Leaks or restrictions at the MAP sensor
- Leaking, restricted, or modified exhaust systemâ€”refer to Symptoms - Engine Exhaust
- Mechanical failure in the engine such as worn piston rings, camshaft or incorrect timing chain installationâ€”refer to Symptoms - Engine Mechanical

3. If all conditions test normal, test or replace the Q14â€‰Exhaust Gas Recirculation (EGR) Valve.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Exhaust Gas Recirculation Valve Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0403-P0406

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 P0403

Exhaust Gas Recirculation (EGR) Control Circuit

DTC P0404

Exhaust Gas Recirculation (EGR) Open Position Performance

DTC P0405

Exhaust Gas Recirculation (EGR) Position Sensor Circuit Low Voltage

DTC P0406

Exhaust Gas Recirculation (EGR) Position Sensor Circuit High Voltage

DTC P042E

Exhaust Gas Recirculation (EGR) Closed Position Performance

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	1	P0403	â€”	â€”
Control	P0403, P0406	P0403	P0403	â€”
5V Reference	P0405	P0405	P0405	â€”
Signal	P0405	P0405	P0406	P0404, P042E
Low Reference	â€”	P0406	P0406	â€”
1. Engine cranks but does not run and the fuse for the ignition circuit opens.				

Typical Scan Tool Data

EGR Position Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine running in closed loop **Parameter Normal Range:** 0.0â€“1.0V			
Ignition	â€”	â€”	â€”
Control	4.98V	â€”	â€”
5V Reference	0.0V	0.0V	1.8V
Signal	0.0V	0.0V	4.98V
Low Reference	â€”	4.98V	1
1. Internal ECM damage may occur if the circuit is shorted to B.			

CircuitSystem Description

Voltage is provided to the exhaust gas recirculation (EGR) valve by the ignition circuit through a fuse. Ground is provided to the EGR valve on the

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control circuit by a low side driver within the engine control module (ECM). The ECM monitors the voltage on the control circuit of the EGR valve to determine if a failure is present.

The ECM monitors the position of the EGR valve through the EGR valve position sensor. The EGR valve position sensor sends a feedback voltage on the signal circuit to the ECM. The EGR position sensor voltage varies depending on the position of the EGR valve.

The EGR valve utilizes the following circuits:

- Ignition
- Control
- 5V reference
- Signal
- Low reference

Conditions for Running the DTC

P0403

- DTC P0562 or P0563 is not set.
- The engine is running.
- The ignition voltage is between 11â€“16V.
- The DTC runs continuously when the above conditions are met.

P0404

- DTC P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0351, P0352, P0402, P0404, P0405, P0406, P042E, P0502, P0506, P0507, or P2110 is not set.
- The engine is running.
- The intake air temperature is between â€“3 and 120Â°C (26.6 and 248Â°F).
- The DTC runs continuously when the above conditions are met.

P0405 or P0406

- DTC P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0351, P0352, P0402, P0404, P0405, P0406, P042E, P0502, P0506, P0507, or P2110 is not set.
- The engine is running.
- The ignition voltage is between 11.7â€“16V.
- The DTC runs continuously when the above conditions are met.

P042E

- DTC P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0351, P0352, P0402, P0404, P0405, P0406, P042E, P0502, P0506, P0507, or P2110 is not set.
- The intake air temperature is between 3 and 120Â°C (26.6 and 248Â°F).
- The desired EGR position is 0.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0403

The ECM detects a short to voltage, a short to ground, or an open on the EGR solenoid control circuit.

P0404

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The ECM detects that the difference between current and commanded EGR position is greater than 15.

P0405

The ECM detects that the EGR position is less than 2.

P0406

The ECM detects that the EGR position is greater than 98.

P042E

The ECM detects that the actual EGR position is greater than 10.

Action Taken When the DTC Sets

DTC P0403-P0406 and P042E are Type E DTCs.

Conditions for Clearing the DTC

DTC P0403-P0406 and P042E are Type E DTCs.

Diagnostic Aids

If a shared 5V reference circuit is shorted to ground or shorted to a voltage, other 5V reference circuits may be affected.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Exhaust Gas Recirculation (EGR) 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

CircuitSystem Verification

1. Note:

   The scan tool EGR position sensor parameter will display less than 5 V when the EGR is commanded to 100.

2. Ignition ON, verify that the scan tool EGR Position Sensor parameter is greater than 4.0V while commanding the EGR valve to 100.
3. Engine running, verify that the scan tool EGR Position Sensor parameter is less than 1.0V.
4. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze framefailure records data.

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CircuitSystem Testing

1. Ignition OFF, disconnect the harness connector at the Q14 exhaust gas recirculation (EGR) valve.
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal E and ground.
3.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an openhigh resistance. If the circuit tests normal and the ignition circuit fuse F6UB is open, test all components connected to the ignition circuit and replace as necessary.
4. Connect a test lamp between the control circuit terminal A and the ignition circuit terminal E.
5. Command the EGR Solenoid Valve from 0â€“100 with a scan tool. The test lamp should respond to the scan tool commands.
6.
    - If test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the K20 Engine Control Module.
7. Ignition OFF, test for less than 1Î© between the low reference circuit terminal B and ground.
8.
    - If greater than the specified range, test the low reference circuit for an openhigh resistance. If the circuit tests normal, replace the K20 Engine Control Module.
9. Ignition ON, test for 4.8â€“5.2V between the 5V reference circuit terminal D and ground.
10.
    - If less than the specified range, test the 5V reference circuit for a short to ground or openhigh resistance. If the circuit tests normal, replace the K20 engine control module.
    - If greater than the specified range, test the 5V reference circuit for a short to voltage. If the circuit tests normal, replace the K20 engine control module.
11. Verify the scan tool EGR Position Sensor parameter is greater than 4.8V.
12.
    - If less than the specified range, test the signal circuit for a short to ground or an openhigh resistance. If the circuit tests normal, replace the K20 engine control module.
13. Install a 3A fused jumper wire between the signal circuit terminal C and the low reference circuit terminal B. Verify the scan tool EGR Position Sensor parameter is less than 0.2V.
14.
    - If greater than the specified range, test the signal circuit for a short to voltage. If the circuit tests normal, replace the K20 engine control module.
15. If all circuits test normal, test or replace the Q14 exhaust gas recirculation (EGR) valve.

Component Testing

1. Ignition OFF, disconnect the harness connector at the Q14 exhaust gas recirculation (EGR) valve.
2. Test for 6â€“10Î© of resistance between the ignition terminal E and control terminal A.
3.
    - If not within the specified range, replace the Q14 exhaust gas recirculation (EGR) valve.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Exhaust Gas Recirculation Valve Replacement

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- Control Module References for ECM replacement, setup, and programming

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0420

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 (TWC) controls emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converter promotes a chemical reaction, which oxidizes the HC and the CO that are present in the exhaust gas. This process converts the HC and the CO into water vapor and carbon dioxide (CO2), and reduces the NOx, converting the NOx into nitrogen. The catalytic converter also stores oxygen. The engine control module (ECM) monitors this process by using a heated oxygen sensor (HO2S) that is in the exhaust stream after the TWC. 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 TWC. 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

P0420 (Without FX3)

- The engine coolant temperature is greater than 80Â°C (176Â°F).
- The catalyst temperature is between 550â€“900Â°C (1022â€“1652Â°F).
- The vehicle speed is between 40â€“110â€‰km/h (24.9â€“68.4â€‰mph).
- The mass air flow between 100â€–300â€‰mg/tdc.
- The vehicle is operating in closed loop.
- The ECM did not command the canister purge solenoid valve closed.
- No errors related to HO2S1, HO2S2, misfire, ECT, CKP, CMP, VS, MAP, IAT, canister purge solenoid, injectors, and EGR exist.
- The DTC runs continuously when the above conditions are met.

P0420 (FX3)

- DTC P0016, P0031, P0032, P0037, P0038, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0300, P0301, P0302, P0303, P0304, P0335, P0336, P0340, P0351, P0352, P0353, P0354, P0458, P0459, P0502, P0506, P0507, P0562, P0563, or P2110 is not set.
- The engine is running for greater than 330â€‰s.
- The airflow is between 1.1â€“7.5â€‰g/s.
- The throttle position is less than 1.5%.
- The engine coolant temperature is between 60â€“109Â°C (140â€“228.2Â°F).

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- The barometric pressure is greater than 72â€‰kPa (10.4â€‰psi).
- The closed loop fuel control is active.
- The torque management is not active.
- The catalyst temperature is between 300â€“975Â°C (572â€“1787Â°F).
- The vehicle speed is less than 3â€‰km/h (1.9â€‰mph).

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 E DTC.

Conditions for Clearing the DTC

DTC P0420 is a Type E DTC.

Diagnostic Aids

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

Inspect for the following conditions, 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
- If the condition is determined to be intermittent, refer to Testing for Intermittent Conditions and Poor Connections.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

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Control Module References for scan tool information

Circuit/System Testing

1. Engine idling, verify there are no HO2S or misfire DTCs set.
2.
    - If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle to diagnosis the applicable DTC, before proceeding with this diagnostic procedure.
3. Verify the following conditions do not exist with the catalytic converter:
4.
    - Dents
    - A severe discoloration caused by excessive temperatures
    - Road damage
    - An internal rattle caused by damaged catalyst substrate
    - Restrictions
5.
    - If a condition is found, replace the catalytic converter.
6. Verify the following conditions do not exist with the exhaust system:
7.
    - Leaks
    - Physical damage
    - Loose or missing hardware
    - Properly torqued HO2S
8.
    - If a condition is found, repair the exhaust system.
9. Verify the following conditions do not exist with the B52Bâ€‰heated oxygen sensorâ€‰2 (HO2Sâ€‰2):
10.
    - A grounded wiring harness
    - Damage
11.
    - If a condition is found, replace the B52B HO2Sâ€‰2.
12. If no physical condition is detected and the B52B HO2Sâ€‰2 is as active as the B52A HO2Sâ€‰1 after operating the engine at 1,500â€‰RPM for 1â€‰minute and then returning to a stabilized idle, then replace the catalytic converter.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Heated Oxygen Sensor Replacement - Sensor 2
- Catalytic Converter Replacement

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0441 (LC5, LMU)

Diagnostic Instructions

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

DTC Descriptor

DTC P0441

Evaporative Emission (EVAP) System Incorrect Purge Flow

Circuit Description

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

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

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

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P0137, P0138, P0140, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0300, P0402, P0404, P0405, P0406, P0452, P0453, P0462, P0463, P0501, and P2422 are not set.
- The ignitionâ€‰1 voltage is between 11â€“32â€‰V.
- The barometric pressure (BARO) is greater than 70â€‰kPa.
- The engine coolant temperature (ECT) is greater than 70Â°C (158Â°F).
- The estimated ambient air temperature is greater than 10Â°C (50Â°F).
- The purge enable time is greater than 15 seconds.
- The engine run time is greater than 10â€‰min.
- The fuel tank pressure is greater than â’7.50â€‰mmHg (â’4.0â€‰inH2O) and less than +2.25â€‰mmHg (+1.2â€‰inH2O).
- The fuel level is between 10â€“90â€‰%.
- The engine is idling.
- The vehicle speed is less than 2 km/h (1 mph).
- DTCâ€‰P0441 runs once an ignition cycle when the above conditions are met.

Conditions for Setting the DTC

The FTP sensor indicates vacuum during a non-purge condition.

Action Taken When the DTC Sets

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DTCâ€‰P0441 is a Type B DTC.

Conditions for Clearing the DTC

DTCâ€‰P0441 is a Type B DTC.

Diagnostic Aids

An intermittent condition could be caused by an improperly installed or damaged Evaporative Emission Purge Solenoid Valve or by a temporary blockage or restriction in the Evaporative Emission Purge Solenoid Valve.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Evaporative Emission Control System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

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

Circuit/System Testing

1. Ignition ON, verify DTCâ€‰P0458 and P0459 is not set.
2.
    - **If a DTC is set**

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

3.
   - **If a DTC is not set**

4. Ignition OFF, disconnect the harness connector at the Q12â€‰Evaporative Emission Purge Solenoid Valve.
5. Connect a vacuum gauge to the purge port of the Q12â€‰Evaporative Emission Purge Solenoid Valve.
6. Engine running, verify the vacuum gauge is at zero.
7.
   - **If greater than zero**
   - Replace the Q12â€‰Evaporative Emission Purge Solenoid Valve.

8.
   - **If zero**

9. Ignition OFF, connect the harness connector at the Q12â€‰Evaporative Emission Purge Solenoid Valve.
10. Engine running, verify the vacuum gauge reads manifold vacuum when commanding the Q12â€‰Evaporative Emission Purge Solenoid Valve On with a scan tool.
11.
    - **If not manifold vacuum**
    - Replace the Q12â€‰Evaporative Emission Purge Solenoid Valve.

12.
    - **If manifold vacuum**

13. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Evaporative Emission Canister Purge Solenoid Valve Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0442 (LC5, LMU)

Diagnostic Instructions

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

DTC Descriptor

DTC P0442

Evaporative Emission (EVAP) System Small Leak Detected

Circuit/System Description

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

Conditions for Running the DTC

- DTCsâ€‰P010C, P010D, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0125, P0128, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0461, P0462, P0463, P0464, P0496, P0502, P0503, P0722, P0723, P2227, P2228, P2229, P2230, P2610. are not set.
- The barometric pressure (BARO) is greater than 70â€‰kPa.
- The engine coolant sensor (ECT) is greater than 70Â°C (158Â°F)
- No fuel filling during the EONV test period.
- The fuel level is between 10â€“90â€‰%.
- The start-up engine coolant temperature (ECT) and the start-up intake air temperature (IAT) are within 8Â°C (46Â°F).
- The engine run time before shut-off was greater than 10â€‰min.
- The drive distance before engine shut-off was more than 8â€‰km (5â€‰mi).
- The ambient air temperature at the end of the drive cycle is between 0â€“34Â°C (32â€“93Â°F).
- DTCâ€‰P0442 runs once per drive cycle during the hot soak period after the ignition is turned OFF and may require up to 40â€‰min to complete. The controller will not make more than 2â€‰test attempts per day. The time since the last completed EONV test must be at least 17â€‰h.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

DTCâ€‰P0442 is a Typeâ€‰E DTC.

Conditions for Clearing the DTC

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DTCâ€‰P0442 is a Typeâ€‰E DTC.

Diagnostic Aids

- The EVAP system can be filled with smoke more quickly and completely by opening the system opposite the end where the smoke is injected. When injecting smoke at the service port tool temporarily leave the EVAP vent solenoid valve open until smoke is observed then close the system and continue testing.
- To help locate intermittent leaks using the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST), move all EVAP components while observing smoke with the *GEâ€‰41413-SPT* High Intensity White Light.
- Individual components can be isolated and tested using adapters in the *GEâ€‰41413-300* EVAP Cap and Plug Kit.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. This type of leak may be detected by using the scan tool Purge/Seal function to create a vacuum in the EVAP system and then observe the FTP parameter for vacuum decay.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Evaporative Emission Control System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- *CHâ€‰48096* EVAP Service Port Access Tool
- *GEâ€‰41413â€“A* Evaporative Emissions System Tester (EEST)
- *GEâ€‰41413â€“300* EVAP Cap and Plug Kit
- *GEâ€‰41413â€“SPT* High Intensity White Light

For equivalent regional tools, refer to Special Tools.

Circuit/System Testing

Note:

- Refer to the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST) operation manual for detailed instructions in Evaporative Emission System Diagnosis
- Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize or produce smoke from a leak.

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- Ensure that the underbody temperature of the vehicle and the tester are similar.

1. Disconnect the purge tube at the quick connector on the EVAP canister side of the Q12â€‰Evaporative Emission Canister Purge Solenoid Valve and install the *CHâ€‰48096* EVAP Service Port Access Tool.
2. Connect the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST) to the *CHâ€‰48096* EVAP Service Port Access Tool.
3. Using a scan tool close the EVAP vent solenoid valve to seal the EVAP system.
4. Use the flow meter on the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST), calibrated to 0.51â€‰mm (0.020â€‰in) to determine if there is a leak.
5.
    - **If a leak is detected**
6.
    1. Use the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST) to apply smoke to the EVAP system at the purge tube until the leak is located using the *GEâ€‰41413-SPT* High Intensity White Light
7.
    - **No leak in the EVAP system**
8. All OK.

Repair Verification

1. Seal the EVAP system and use the flow meter on the *GEâ€‰41413-A* Evaporative Emissions System Tester (EEST), calibrated to 0.51â€‰mm (0.020â€‰in) to determine that there is no leak in the EVAP system.
2. Clear DTCs.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0451-P0454 (LC5, LMU)

Diagnostic Instructions

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

DTC Descriptors

DTC P0451

Fuel Tank Pressure Sensor Performance

DTC P0452

Fuel Tank Pressure Sensor Circuit Low Voltage

DTC P0453

Fuel Tank Pressure Sensor Circuit High Voltage

DTC P0454

Fuel Tank Pressure Sensor Circuit Intermittent

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
5â€‰V	P0452, P0532, P0641	P0451	P0446, P0452	P0453, P0641	â€”
Signal	P0452	P0451	P0452	P0453	P0451, P0454
Low Reference	â€”	P0446, P0451	P0446, P0453, P0463	â€”	P0451

Typical Scan Tool Data

FTP Sensor Voltage

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Ignition ON, Engine OFF **Parameter Normal Range:** 1.3â€“1.7â€‰V			
5â€‰V	0â€‰V	0â€‰V	4.2â€“5â€‰V
Signal	0â€‰V	0â€‰V	5â€‰V
Low Reference	â€”	4.9â€‰V	â€”

Circuit/System Description

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

Conditions for Running the DTC

P0451

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

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P0452 and P0453

DTCâ€‰P0452 and P0453 run continuously when the ignition is ON.

P0454

- DTCâ€‰P0454 runs only when the engine-off natural vacuum small leak test, P0442, executes and the EVAP Vent Solenoid Valve is closed.
- This test can run once per engine-off period. The length of the test can be up to 10â€‰min.
- A refueling event is not detected. A refueling event is confirmed if the fuel level has a persistent change of 10â€‰% for 30â€‰s.

Conditions for Setting the DTC

P0451

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

P0452

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

P0453

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

P0454

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

Action Taken When the DTC Sets

- DTCsâ€‰P0451 and P0454 are Typeâ€‰A DTCs.
- DTCsâ€‰P0452 and P0453 are Typeâ€‰B DTCs.

Conditions for Clearing the MIL/DTC

- DTCsâ€‰P0451 and P0454 are Typeâ€‰A DTCs.
- DTCsâ€‰P0452 and P0453 are Typeâ€‰B DTCs.

Diagnostic Aids

P0451 and P0454

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

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

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Description and Operation

Evaporative Emission Control System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

*GEâ€‰41413-AS*Evaporative Emission System Tester (EEST)

For equivalent regional tools, refer to Special Tools

Circuit/System Verification

1. Ignition ON.
2. Verify DTC P0641 is not set.
3.
   - **If the DTC is set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle
4.
   - **If the DTC is not set**
5. Ignition OFF, remove the fuel tank filler cap. Ignition ON.
6. Verify the scan tool Fuel Tank Pressure Sensor parameter is between 1.3 and 1.7â€‰V.
7.
   - **If not between 1.3â€“1.7â€‰V**
   - Refer to Circuit/System Testing
8.
   - **If between 1.3â€“1.7â€‰V**
9. All OK.

Circuit/System Testing

1. Ignition OFF, all vehicle systems OFF, this may take up to 2â€‰min, for all vehicle systems to power down. Disconnect the harness connector at the B150â€‰Fuel Tank Pressure Sensor.
2. Test for less than 5â€‰â„¦ of resistance between the low reference circuit terminalâ€‰2 or B and ground.
3.
   - **If 5â€‰â„¦ or greater**

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4.

    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
    3.

        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

5.

    - **If less than 5â€‰â„¦**

6. Ignition ON.
7. Test for 4.8â€“5.2â€‰V between the 5â€‰V reference circuit terminalâ€‰3 or C and ground.
8.

    - **If less than 4.8â€‰V**

9.

    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    2. Test for infinite resistance between the 5â€‰V reference circuit and ground.
    3.

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

    4.

        - **If infinite resistance**

    5. Test for less than 2â€‰â„¦ in the 5â€‰V reference circuit end to end.
    6.

        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

    7.

        - **If greater than 5.2â€‰V**

10.

    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the 5â€‰V reference circuit and ground.

11.

    - If 1â€‰V or greater, repair the short to voltage on the circuit.
    - If less than 1â€‰V, replace the K20â€‰Engine Control Module.

12.

    - **If between 4.8â€“5.2â€‰V**

13. Verify the scan tool Fuel Tank Pressure Sensor parameter is less than 0.2â€‰V.
14.

    - **If 0.2â€‰V or greater**

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15.
    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the signal circuit terminalâ€‰1 or A and ground.
16.
    - If 1â€‰V or greater, repair the short to voltage on the circuit.
    - If less than 1â€‰V, replace the K20â€‰Engine Control Module.
17.
    - **If less than 0.2â€‰V**
18. Install a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰1 or A and the 5â€‰V reference circuit terminalâ€‰3 or C.
19. Verify the scan tool Fuel Tank Pressure Sensor parameter is greater than 4.7â€‰V.
20.
    - **If 4.7â€‰V or less**
21.
    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
    2. Test for infinite resistance between the signal circuit terminalâ€‰1 or A and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
    4.
        - If infinite resistance
    5. Test for less than 2â€‰â„¦ in the signal circuit end to end.
22.
    - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
    - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
23.
    - **If greater than 4.7â€‰V**
24. Test or replace the B150â€‰Fuel Tank Pressure Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Tank Pressure Sensor Replacement
- Control Module References for ECM replacement, setup, and programming.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0455 (LC5, LMU)

Diagnostic Instructions

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

DTC Descriptor

DTC P0455

Evaporative Emission (EVAP) System Large Leak Detected

Circuit/System Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

- The EVAP system is not able to achieve or maintain a calibrated level of vacuum less than â’2.74â€‰kPa (â’11â€‰inâ€‰H20) before a calibrated amount of purge volume has passed through the system.
- After setting the DTC for the first time, 2â€‰L (0.5â€‰gal) of fuel must be consumed before setting the DTC for the second time.
- With a DTCâ€‰P0455 detected a weak vacuum follow-up test (fuel cap replacement test) will run and passes if tank vacuum is less than â’2.74â€‰kPa (â€“11â€‰inâ€‰H20). This test will run for a maximum of 22â€‰min. This test runs until it passes.

Action Taken When the DTC Sets

DTCâ€‰P0455 is a Typeâ€‰B DTC.

Conditions for Clearing the MIL/DTC

DTCâ€‰P0455 is a Typeâ€‰B DTC.

Diagnostic Aids

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- Inspect for a loose, missing, damaged, or incorrect fuel fill cap.
- Inspect for a damaged fuel filler neck seal surface.
- A blockage or restriction in the EVAP purge solenoid valve, purge pipe, EVAP canister, or vapor pipe, can cause this DTC to set.
- The EVAP system can be filled with smoke more quickly and completely by opening the system opposite the end where the smoke is injected. For example, when injecting smoke at the service port remove the fuel fill cap, or temporarily leave the vent open, until smoke is observed, then close the system and continue testing. If using a fuel cap adapter at the filler neck, use the *J-41413-VLV* at the service port to allow the system to fill faster.
- To help locate intermittent leaks using the *GE-41413-A*, move all EVAP components while observing smoke with the *GE-41413-SPT*.
- Individual components can be isolated and tested using adapters in the *J-41413-300*.
- When servicing the EVAP system, test pressure must not exceed 13â€‰inâ€‰H20 (0.5â€‰PSI) as pressure in excess of this could cause system components to perform inaccurately.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. This type of leak may be detected by using the scan tool Purge/Seal function to create a vacuum in the EVAP system and then observe the Fuel Tank Pressure Sensor parameter for vacuum decay.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Powertrain Component View

Powertrain Component Views

Description and Operation

Evaporative Emission Control System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- *CH-48096* EVAP Service Access Port Tool
- *GE-41415-30* Fuel Tank Cap Adapter
- *GE-41413-A* Evaporative Emissions System Tester (EEST)
- *J-41413-300* EVAP Cap and Plug Kit
- *GE-41413-SPT* High Intensity White Light
- *J-41413-311* EVAP Plug

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- *J-41413-VLV* EVAP Service Port Vent Fitting

For equivalent regional tools, refer to Special Tools

Circuit/System Testing

Note:

- Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize or produce smoke from a leak.
- Refer to the *GE-41413-A* operation manual for detailed instructions in Evaporative Emission System Diagnosis.

1. Disconnect the purge tube at the quick connector on the EVAP canister side of the Q12â€‰Evaporative Emission Purge Solenoid Valve and install the *CH-48096*.
2. Connect the *GE-41413-A* to the vehicle with *CH-48096*.
3. Command the EVAP Purge/Seal function to System Seal with a scan tool to seal the EVAP system.
4. Verify that there is no leak in the EVAP system using the flow meter on the *GE-41413-A*, calibrated to 0.51â€‰mm (0.020â€‰in).
5.
    - **If a leak is detected**
6.
    1. Apply smoke to the EVAP system at the service access port adapter with the *GE-41413-A*.
    2. Locate the leak using the *GE-41413-SPT*.
    3.
        - When the leak is located, repair or replace the affected component as necessary.
7.
    - **If no leak detected**
    - Note:

      The steps below test for a restriction in the purge path.
8. Connect the *GE-41413-A* nitrogen/smoke hose to the *J-41413-311*.
9. Disconnect the hose at the fuel cap end of the *GE-41415-30* and connect to the *J-41413-311*.
10. Install the *GE-41415-30*, filler neck end only, to the vehicle.
11. Engine idling, command the Purge/Seal function to System Seal with a scan tool to seal the system.
12. Command the EVAP Purge Solenoid Valve to 10% with a scan tool.
13. Verify the vacuum/pressure gauge on the *GE-41413-A* and the scan tool Fuel Tank Pressure Sensor parameter both show vacuum.
14.
    - **If the vacuum/pressure gauge shows vacuum, and the Fuel Tank Pressure Sensor parameter does not show vacuum**
    - Replace the B150â€‰Fuel Tank Pressure Sensor.
15.
    - **If both the Fuel Tank Pressure Sensor parameter and the vacuum/pressure gauge do not show vacuum**
    - Repair the restriction in the purge path.
16. Verify that the Fuel Tank Pressure Sensor parameter increases to greater than 3.2â€‰V, and the pressure values are similar between the scan tool Fuel Tank Pressure Sensor and the vacuum/pressure gauge on the *GE-41413-A*.

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17.

- **If not within the specified range**
- Replace the B150â€‰Fuel Tank Pressure Sensor.

18.

- **If within the specified range**

19. All OK

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

Fuel Tank Pressure Sensor Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0458 or P0459 (LC5, LKY, LMU)

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 P0458

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

DTC P0459

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P0458	P0458	â€”	â€”
Control	P0458	P0458	P0459	â€”

Circuit/System Description

The evaporative emission (EVAP) canister purge solenoid valve is used to purge fuel vapor from the EVAP canister to the intake manifold. The EVAP canister purge solenoid valve is pulse width modulated (PWM). Ignition voltage is supplied directly to the EVAP canister purge solenoid valve. The engine control module (ECM) controls the solenoid valve by grounding the control circuit with a solid state device called a driver. The driver is equipped with a feedback circuit that is pulled-up to a voltage. The ECM can determine if the control circuit is open, shorted to ground, or shorted to a voltage by monitoring the feedback voltage. A scan tool will display the amount of ON time as a percentage.

Conditions for Running the DTC

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

Conditions for Setting the DTC

P0458

The ECM detects a short to ground or an open on the EVAP canister purge solenoid control circuit.

P0459

The ECM detects a short to voltage on the EVAP canister purge solenoid control circuit.

Action Taken When the DTC Sets

DTCs P0458 and P0459 are Type E DTCs.

Conditions for Clearing the DTC

DTCs P0458 and P0459 are Type E DTCs.

Reference Information

Schematic Reference

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Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

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. Engine running.
2. Verify the Q12â€‰Evaporative Emission Purge Solenoid Valve turns on & off/clicks when commanding the EVAP Purge Solenoid Valve Command Up and Down with a scan tool.
3.
    - **If the EVAP Purge Solenoid Valve does not turn on and off/clicks**
    - Refer to Circuit/System Testing.
4.
    - **If the EVAP Purge Solenoid Valve turns on and off/clicks**
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.
7.
    - **If the DTC sets**
    - Refer to Circuit/System Testing.
8.
    - **If the DTC does not set**
9. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the Q12â€‰Evaporative Emission Purge Solenoid Valve, ignition ON.

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2. Verify a test lamp illuminates between the ignition circuit terminalâ€‰B and ground.
3.
    - **If the test lamp does not illuminate and the circuit fuse is good**
4.
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, verify the fuse is not open and there is voltage at the fuse.
5.
    - **If the test lamp does not illuminate and the circuit fuse is open**
6.
    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.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
    4.
        - If infinite resistance
    5. Replace the fuse, ignition ON.
    6. Verify the fuse is good after connecting each of the components one at a time.
    7.
        - If the fuse opens, replace the component that opens the fuse when connected.
    8.
        - If the fuse is good, all OK.
7.
    - **If the test lamp illuminates**
8. Connect a test lamp between the control circuit terminalâ€‰A and the ignition circuit terminalâ€‰B.
9. Verify the test lamp turns ON and OFF when commanding the EVAP Purge Solenoid Valve Command Up and Down with a scan tool.
10.
    - **If the test lamp is always OFF**
11.
    1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the control circuit and ground.
    3.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
    4.

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- If less than 1â€‰V

5. Ignition OFF.
6. Test for less than 2â€‰â„¦ in the control circuit end to end.
7.
    - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
    - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

12.
    - **If the test lamp is always ON**

13.
    1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module.
    2. Test for infinite resistance between the control circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
        - If infinite resistance, replace the K20â€‰Engine Control Module.

14.
    - **If the test lamp turns ON and OFF**

15. Test or replace the Q12â€‰Evaporative Emission Purge Solenoid Valve.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the Q12â€‰Evaporative Emission Purge Solenoid Valve.
2. Test for 19â€“22â€‰â„¦ at 20Â°C (68Â°F) between the control terminalâ€‰A and the ignition terminalâ€‰B.
3.
    - **If not between 19â€“22â€‰â„¦**
    - Replace the Q12â€‰Evaporative Emission Purge Solenoid Valve.

4.
    - **If between 19â€“22â€‰â„¦**

5. All OK.

Dynamic Test

1. Ignition OFF, disconnect the harness connector at the Q12â€‰Evaporative Emission Purge Solenoid Valve.
2. Install a 3â€‰A fused jumper wire between the ignition terminalâ€‰B and 12â€‰V. Install a jumper wire between the control terminalâ€‰A and ground.
3. Verify the Q12â€‰Evaporative Emission Purge Solenoid Valve turns on & off/clicks and flows vacuum.
4.
    - **If the solenoid does not turn on and off/clicks or flow vacuum**
    - Replace the Q12â€‰Evaporative Emission Purge Solenoid Valve.

5.
    - **If the solenoid turns on and off/clicks and flows vacuum**

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6. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Evaporative Emission Canister Purge Solenoid Valve Replacement
- Control Module References for ECM replacement, programming, and setup.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0498 or P0499 (LC5, LMU)

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 P0498

Evaporative Emission (EVAP) Vent Solenoid Valve Control Circuit Open

DTC P0499

Evaporative Emission (EVAP) Vent Solenoid Valve Control Circuit Shorted

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignitionâ€‰1 Voltage	P0498	P0498	â€”	â€”
EVAP Canister Vent Solenoid Valve Control Circuit	P0498	P0498	P0499	â€”

Circuit/System Description

The evaporative emission (EVAP) vent solenoid valve is used for EVAP system diagnostics. The EVAP vent solenoid valve is a normally open valve. Ignition voltage is supplied directly to the EVAP vent solenoid valve. The engine control module (ECM) controls the solenoid by grounding the control circuit with a solid state device called a driver.

Conditions for Running the DTC

- The ignition is ON or the engine is operating.
- The DTCs runs continuously once the above conditions are met.

Conditions for Setting the DTC

P0498

The ECM detects the EVAP vent solenoid valve control circuit is open.

P0499

The ECM detects the EVAP vent solenoid valve control circuit is shorted to ground or voltage.

Action Taken When the DTC Sets

- DTC P0498 and P0499 are Type B DTCs.
- The EVAP system will only purge during open loop.

Conditions for Clearing the DTC

DTC P0498 and P0499 are Type B DTCs.

Reference Information

Schematic Reference

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Engine Controls Schematics

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. Command the EVAP Vent Solenoid ON and OFF with a scan tool. You should feel or hear an audible click as the solenoid is commanded ON and OFF.
2. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the EVAP vent solenoid valve .
2. Ignition ON, verify a test lamp illuminates between the ignitionâ€‰1 voltage circuit terminalâ€‰2 and ground.
3.
    - If the test lamp does not illuminate, test the ignitionâ€‰1 voltage circuit for a short to ground or an open/high resistance. If the circuit tests normal and the ignitionâ€‰1 voltage circuit fuse is open, test all components connected to the ignitionâ€‰1 voltage circuit and replace as necessary.
4. Ignition OFF, connect a test lamp between the control circuit terminalâ€‰1 and the ignitionâ€‰1 voltage circuit terminalâ€‰2.
5. Ignition ON, command the EVAP vent solenoid valve ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
6.
    - If the test lamp is always ON, test for a short to ground on the control circuit. If the circuit tests normal, replace the ECM.
7.
    - If the test lamp is always OFF, test for a short to voltage or an open/high resistance on the control circuit. If the circuit tests normal, replace the ECM.
8. If all circuits test normal, test or replace the EVAP vent solenoid valve.

Component Testing

1. Ignition OFF, disconnect the harness connector of the EVAP vent solenoid.
2. Test for 18â€“28â€‰ohms of resistance between the control terminalâ€‰1 and the ignitionâ€‰1 voltage terminalâ€‰2.
3.
    - If not within the specified range, replace the EVAP vent solenoid valve .
4. Test for infinite resistance between each terminal of the EVAP vent solenoid valve and the EVAP vent solenoid valve housing.
5.
    - If not the specified value, replace the EVAP vent solenoid valve.

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Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0506 or P0507 (LKY and LL0)

Diagnostic Instructions

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

DTC Descriptors

DTC P0506

Idle Speed Low

DTC P0507

Idle Speed High

Circuit/System Description

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

Conditions for Running the DTC

- DTCsâ€‰P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0111, P0112, P0113, P0114, P0116, P0117, P0118, P0119, P0121, P0122, P0123, P0128, P0171, P0172, P0201, P0202, P0203, P0204, P0222, P0223, P0300, P0351, P0352, P0353, P0354, P0461, P0462, P0463, P0496, P0502, P0503, P0606, P0697, P06A3, P0806, P0807, P0808, P16F3, P2101, P2122, P2123, P2127, P2128, P2135, P2138 or P2771 are not set.
- The barometric pressure (BARO) is greater than 70â€‰kPa.
- The engine runtime is greater than 60â€‰s.
- The engine is idling for greater than 10â€‰s.
- The torque converter clutch (TCC) is not changing states.
- The transmission is not changing gears.
- The intake air temperature (IAT) is greater than â^’20Â°C (â^’4Â°F).
- The engine coolant temperature (ECT) is between 60â€“120Â°C (140â€“248Â°F).
- The ignition voltage is between 11â€“32â€‰V.
- The vehicle speed is less than 3.2â€‰km/h (2â€‰mph).
- The commanded engine speed is steady within 25â€‰RPM.
- The DTCs run continuously when the above conditions are met for greater than 10â€‰s.

Conditions for Setting the DTC

P0506

The ECM detects that the actual idle speed is approximately 91â€‰RPM lower than the desired idle speed.

P0507

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The ECM detects that the actual idle speed is approximately 182â€‰RPM higher than desired idle speed.

Action Taken When the DTC Sets

DTCâ€‰P0506 and P0507 are Typeâ€‰B DTCs.

Conditions for Clearing the DTC

DTCâ€‰P0506 and P0507 are Typeâ€‰B DTCs.

Diagnostic Aids

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

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Throttle Actuator Control (TAC) System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify no other DTCs set.
3.
    - **If any other DTC is set**
    - Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.
4.
    - **If no other DTC is set**
5. Verify the scan tool Throttle Body Idle Airflow Compensation parameter is less than 90â€‰%.
6.
    - **90â€‰% or greater**

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- Refer to Throttle Body Inspection and Cleaning.

7.
   - **If less than 90â€‰%**
8. Engine Idling at the normal operating temperature.
9. Note**:**

   The engine must run for greater than 60â€‰s, then idle at a steady state for an additional 10â€‰s before comparing the actual and desired engine speed parameters.
10. Verify the actual Engine Speed is not 100â€‰RPM less than the Desired Idle Speed.
11.
    - **If 100â€‰RPM less than the Desired Idle Speed**
    - Refer to Circuit/System Testing
12.
    - **If 100â€‰RPM greater than the Desired Idle Speed**
13. Verify the actual Engine Speed is not 200â€‰RPM greater than the Desired Idle Speed.
14.
    - **If 200â€‰RPM greater than the Desired Idle Speed**
    - Refer to Circuit/System Testing
15.
    - **If 200â€‰RPM less than the Desired Idle Speed**
16. 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.
17. Verify the DTC does not set.
18.
    - **If the DTC sets**
    - Refer to Circuit/System Testing
19.
    - **If the DTC does not set**
20. All OK

Circuit/System Testing

P0506

1. Verify the conditions listed below do not exist.
2.
    - Restricted exhaust
    - Mechanical conditions that limits engine speed
    - Parasitic load on the engineâ€”For example, a transmission condition, a belt driven accessory condition.
3.
    - **If a condition is found**

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- Repair as necessary.

4.
   - **If a condition is not found**

5. All OK.

P0507

1. Verify the conditions listed below do not exist.
2.
   - Vacuum leaks
   - A throttle valve that does not close correctly
   - Verify the correct operation of the crankcase ventilation system. Inspect for the conditions listed below:
   -
     - Improper routing of the positive crankcase ventilation (PCV) system
     - Vacuum leaks in the PCV systemâ€”Refer to Crankcase Ventilation System Inspection/Diagnosis.
3.
   - **If a condition is found**
   - Repair as necessary.
4.
   - **If a condition is not found**
5. All OK.

Repair Verification

Perform the Diagnostic Repair Verification after completing the repair.

- Throttle Body Inspection and Cleaning
- Throttle Body Assembly Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0506 or P0507 (LC5)

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

DTCâ€‰P0506

Idle Speed Low

DTCâ€‰P0507

Idle Speed High

Circuit/System Description

The engine control module (ECM) controls the engine idle speed by adjusting the position of the idle air control (IAC) valve pintle. The IAC valve is a stepper motor driven by 2â€‰internal coils. The movement of the IAC valve is controlled electrically by 4â€‰circuits. Drivers within the ECM control the polarity of the 2â€‰windings inside the IAC valve through these circuits. The ECM, by commanding the correct polarity in sequence, is able to command the motor within the IAC valve to rotate clockwise or counterclockwise in steps. In order for the armature of the stepper motor of the IAC valve to turn one revolution, it needs to move approximately 24â€‰steps. The IAC valve motor is linked by a gear drive to the IAC valve pintle. The electrical pulses sent to the IAC valve coils, by the ECM, allows the pintle to extend or retract into the passage in the throttle body. By retracting the pintle, air is allowed to bypass the throttle valve, which will increase air flow and raise engine speed. When the pintle is extended, bypass air is decreased which lowers engine speed. IAC valve movement is measured in counts on the scan tool. Each count is equivalent to a step of the IAC valve. When the IAC valve is fully extended, and seated in the throttle body bore, the scan tool displays zero and the engine speed is slow. As the IAC valve pintle retracts the counts will raise along with engine speed.

IAC Valve Reset

When the ignition switch is turned OFF for greater than 10â€‰seconds, an IAC valve reset occurs. At that time, the ECM commands the IAC valve to extend for a certain period which allows the IAC pintle to seat in the throttle body bore. This position is then sensed as zero count position for the IAC valve by the ECM. It must be observed that the IAC valve position is only sensed by the ECM measuring counts or steps of the driver circuit, there is no direct sensing of its exact position. When this extend time period ends, the ECM then commands the IAC valve to retract a predetermined amount. This will allow for a high engine speed on the next ignition cycle. If for any reason the IAC valve pintle moves after this reset, before the next ignition cycle, the ECM will not be able to detect it and will affect the ability to control engine idle. When the IAC valve is removed for any reason, the reset must be performed.

Conditions for Running the DTC

- DTCsâ€‰P0107, P0108, P0117, P0118, P0501, P0502 or P0511 is not set.
- The BARO is greater than 70â€‰kPaâ€‰(10â€‰psi).
- The engine is idling for greater than 30â€‰s.
- The engine coolant temperature (ECT) is greater than 70Â°Câ€‰(158Â°F).
- The DTCs runs continuously when the above conditions are met for 5â€‰seconds.

Conditions for Setting the DTC

P0506

The actual engine speed is at least 100â€‰RPM less than the desired idle speed.

P0507

The actual engine speed is at least 200â€‰RPM greater than the desired idle speed.

Action Taken When the DTC Sets

DTCsâ€‰P0506 and P0507 are Typeâ€‰B DTCs.

Conditions for Clearing the DTC

DTCsâ€‰P0506 and P0507 are Typeâ€‰B DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify DTCâ€‰P0511 is not set.
3.
    - **If the DTC is set**
    - Refer to DTC P0511 for further diagnosis.
4. Engine running for 1â€‰minute at normal operating temperature.
5. Verify the scan tool Engine Speed parameter is not 100â€‰RPM less or 200â€‰RPM greater than the Desired Idle Speed parameter.
6.
    - **If not within the specified range**
    - Refer to Circuit/System Testing.
7.
    - **If within the specified range**
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 DTCâ€‰P0506 or P0507 is not set.
10.

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- **If the DTC is set**
- Refer to Circuit/System Testing.

11.

- **If the DTC is not set**

12. All OK.

Circuit/System Testing

1. Inspect for the following conditions:
2.
    - A clogged IAC passage
    - Excessive deposits on the throttle plate or bore
    - Excessive deposits on IAC valve pintle or bore
    - Restricted air intake system
    - The throttle body for damage and/or tampering
    - Vacuum leaks
    - Malfunctioning PCV valve
3.
    - **If a condition is found**
    - Clean, repair, or replace components as necessary.
4.
    - **If a condition is not found**
5. Test or replace the Q50â€‰Idle Air Control Valve.

Component Testing

1. Disconnect the harness connector at the Q50â€‰Idle Air Control Valve.
2. Test for 40â€“80â€‰â„¦ between the following terminals of the IAC valve.
3.
    - A and B
    - C and D
4.
    - **If not within the specified range**
    - Replace the Q50â€‰Idle Air Control Valve.
5.
    - **If within the specified range**
6. Test for infinite resistance between the following terminals of the IAC valve.
7.
    - A and C

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- B and C

8.
   - **If less than infinite resistance**
   - Replace the Q50â€‰Idle Air Control Valve.

9.
   - **If infinite resistance**

10. Test for infinite resistance between each terminal of the IAC valve, and the housing of the IAC valve.

11.
   - **If less than infinite resistance**
   - Replace the Q50â€‰Idle Air Control Valve.

12.
   - **If infinite resistance**

13. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Idle Air Control Valve Replacement
- Throttle or Idle Learn
- Control Module References for engine control module replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0511

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 P0511

Idle Air Control (IAC) Valve Control Circuit

Circuit/System Description

The engine control module (ECM) controls the engine idle speed by adjusting the position of the idle air control (IAC) valve pintle. The IAC valve is a stepper motor driven by 2â€‰internal coils. The movement of the IAC valve is controlled electrically by 4â€‰circuits. Drivers within the ECM control the polarity of the 2â€‰windings inside the IAC valve through these circuits. The ECM, by commanding the correct polarity in sequence, is able to command the motor within the IAC valve to rotate clockwise or counterclockwise in steps. In order for the armature of the stepper motor of the IAC valve to turn one revolution, it needs to move approximately 24â€‰steps. The IAC valve motor is linked by a gear drive to the IAC valve pintle. The electrical pulses sent to the IAC valve coils, by the ECM, allows the pintle to extend or retract into the passage in the throttle body. By retracting the pintle, air is allowed to bypass the throttle valve, which will increase air flow and raise engine speed. When the pintle is extended, bypass air is decreased which lowers engine speed. IAC valve movement is measured in counts on the scan tool. Each count is equivalent to a step of the IAC valve. When the IAC valve is fully extended, and seated in the throttle body bore, the scan tool displays zero and the engine speed is slow. As the IAC valve pintle retracts the counts will raise along with engine speed.

The IAC valve utilizes the following circuits:

- An IAC Coil A High
- An IAC Coil A Low
- An IAC Coil B High
- An IAC Coil B Low

IAC Valve Reset

When the ignition switch is turned OFF for greater than 10â€‰seconds, an IAC valve reset occurs. At that time, the ECM commands the IAC valve to extend for a certain period which allows the IAC pintle to seat in the throttle body bore. This position is then sensed as zero count position for the IAC valve by the ECM. It must be observed that the IAC valve position is only sensed by the ECM measuring counts or steps of the driver circuit, there is no direct sensing of its exact position. When this extend time period ends, the ECM then commands the IAC valve to retract a predetermined amount. This will allow for a high engine speed on the next ignition cycle. If for any reason the IAC valve pintle moves after this reset, before the next ignition cycle, the ECM will not be able to detect it and will affect the ability to control engine idle. When the IAC valve is removed for any reason, the reset must be performed.

Conditions for Running the DTC

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

Conditions for Setting the DTC

The ECM detects a short to battery, a short to ground, or an open on the idle air control (IAC) valve control circuit.

Action Taken When the DTC Sets

DTC P0511 is a Type E DTC.

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Conditions for Clearing the DTC

DTC P0511 is a Type E DTC.

Diagnostic Aids

If the IAC valve is removed for any reason, perform the idle learn procedure to complete the repair or replacement.

Reference Information

Schematic Reference

Engine Controls Schematics

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. Allow the engine to idle within the Conditions For Running the DTCs for 1â€‰minute.
2. Verify DTC P0511 not set.
3.
   - **If the DTC is set**
   - Refer to: Circuit/System Testing
4.
   - **If the DTC is not set**
5. Perform the following action:
6.
   - Battery voltage check.
   - IAC valve reset.
   - Refer to: IAC Valve Reset.
7.
   - **If a condition exists**
   - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
8.
   - **If no condition exists**
9. Verify that the scan tool Current idle air control valve position parameter.
10.

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1. Engine Â» Running
2. Verify the scan tool parameter: Current idle air control valve position parameter at idle speed condition.
3. In neutral gear & park brake applied, increase engine speed to the range of 3000 to 4000 RPM & bring back to idle RPM.
4. Repeat the Step **4.3** for 3 times.
5. Check the Current idle air control valve position parameter at idle speed condition.
6. Difference of Current idle air control valve position parameter should not exceed 10 counts.

11.
    - **If the DTC is set**
    - Refer to: Circuit/System Testing
12.
    - **If the DTC is not set**
13. Cleaning the IAC valve. Refer to: Idle Air Control Valve Cleaning
14. Go to Step 4 and repeat and verify. Check for any DTC codes / erratic idle issue. If still Issue persist then check further as per below.
15.
    - Excessive deposits on the throttle plate or bore.
    - Restricted air intake system.
    - Throttle body damage or tampering.
    - Vacuum leaks.
    - Malfunctioning positive crankcase ventilation (PCV) valve.
    -
        - **If the DTC is set**
        - Refer to: Circuit/System Testing
    -
        - **If the DTC is not set**
16. 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.
17.
    - **If the DTC is set**
    - Refer to: Circuit/System Testing
18.
    - **If the DTC is not set**
19. All OK.

Circuit/System Testing

1. Ignition ON with engine OFF.
2. Check for 12V at IAC wiring harness terminal.
3.
    - IAC A and â€‰B

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- IAC C and â€‰D

4.

- Test IAC control circuit for a short to ground or an open/high resistance and a short to voltage. If the circuit tests normal, replace the K20â€‰Engine Control Module.

5. If all conditions test normal, test or replace the IAC valve.

Component Testing

1. Ignition OFF, disconnect the harness connector at the IAC valve.
2. Test for 40â€“80â€‰â„¦ between the following terminals of the IAC valve:
3.

- A and B
- C and D

4.

- If not within the specified range, replace the IAC valve.

5. Test for infinite resistance between the following terminals of the IAC valve:
6.

- A and C
- A and D
- B and C
- B and D

7.

- If not the specified range, replace the IAC valve.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Idle Air Control Valve Replacement
- Throttle Body Idle Air Flow Compensation Reset
- Control Module References for engine control module replacement, setup, and programming.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P05CC or P05CE

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

DTCâ€‰P05CC

Cold Start Intake Camshaft Position System Performance

DTCâ€‰P05CE

Cold Start Exhaust Camshaft Position System Performance

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, P0340, P0341, P0365, or P0366 is not set.
- Engine is running.
- Ignition voltage is greater than 11â€‰V.
- Camshaft position actuator is enabled.
- The rate of change in the camshaft position is less than 3Â° for 4â€‰s.
- The DTCs run continuously once the above conditions are met for greater than 0.1â€‰s.

Conditions for Setting the DTC

The ECM detects a difference between the camshaft position angle and the desired camshaft position angle is greater than 6 to 10Â° based on engine coolant temperature and engine speed.

Action Taken When the DTC Sets

DTCs P05CC and P05CE are Type B DTCs.

Conditions for Clearing the DTC

DTCs P05CC and P05CE are Type B DTCs.

Diagnostic Aids

- The engine oil condition has a major impact on the camshaft actuator system.
- A low oil level condition may set this DTC. 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.
- Inspect the engine for any recent engine mechanical repairs. An incorrectly installed camshaft, camshaft actuator, or timing belt can cause

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this DTC to set.

- A resistance greater than 8â€‰â„¦ on the camshaft position actuator solenoid valve control circuit may set this DTC. If you suspect high resistance, ground the control circuit while the engine is idling. The scan tool Intake or Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit Low Voltage Test Status should display Malfunction. If the parameter displays OK, test the control circuit for high resistance.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Camshaft Actuator 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. 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.
2. Ignition On.
3. Verify the correct engine oil pressure.
4.
    - **If the oil level and the oil pressure are not correct**
    - Repair as necessary
5.
    - **If the oil level and the oil pressure are correct**
6. Note:

    If a crankshaft or camshaft position sensor DTC is set, the scan tool Camshaft Position Actuator output control will not function.
7. Verify DTCâ€‰P0010, P0013, P0016, P0017, P0335, P0336, P0340, P0341, P0365, P0366, P2088, P2089, P2090 or P2091 is not

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set.

8.
   - **If any of the DTCs are set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.

9.
   - **If none of the DTCs are set**

10. Engine idling.
11. Verify the scan tool parameters are less than 2Â° in each of the commanded states when commanding the Camshaft Position Actuator from 0â€“20Â° and back to 0Â° with the scan tool.
12.
   - Intake Camshaft Position Variance
   - Exhaust Camshaft Position Variance

13.
   - **If 2Â° or greater**
   - Refer to Circuit/System Testing.

14.
   - **If less than 2Â°**

15. Verify that DTCâ€‰P0011 or P0014 is not set.
16.
   - **If any of the DTCs are set**
   - Refer to Circuit/System Testing.

17.
   - **If none of the DTCs set**

18. 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.
19. Verify the DTC does not set.
20.
   - **If the DTC sets**
   - Refer to Circuit/System Testing.

21.
   - **If the DTC does not set**

22. All OK.

Circuit/System Testing

1. Ignition Off, disconnect the harness connector at the appropriate Q6â€‰Camshaft Position Actuator Solenoid Valve. It may take up to 2â€‰minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the low reference circuit terminalâ€‰1 and ground.
3.
   - **If 5â€‰â„¦ or greater**

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4.

1. Ignition Off, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.

5.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

6.

- **If less than 5â€‰â„¦**

7. Ignition On.
8. Note**:**

   A test lamp must be used for this test. The control circuit is pulled-up to a low current voltage, 1.5â€“4.5â€‰V on the control circuit is normal.

9. Verify that a test lamp does not illuminate between the control circuit terminalâ€‰2 and ground.

10.

- **If the test lamp illuminates**

11.

1. Ignition Off, disconnect the harness connector at the K20â€‰Engine Control Module, ignition On.
2. Test for less than 1â€‰V between the control circuit and ground.

12.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

13.

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

14. Remove the test lamp.
15. Verify the scan tool parameters listed below do not display Malfunction when commanding the appropriate Camshaft Position Actuator Solenoid Valve On with a scan tool.

16.

- Intake Camshaft Position Actuator Solenoid Valve Control Circuit Low Voltage Test Status
- Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit Low Voltage Test Status
- Intake Camshaft Position Actuator Solenoid Valve Control Circuit High Voltage Test Status
- Exhaust Camshaft Position Actuator Solenoid Valve Control Circuit High Voltage Test Status

17.

- **If Malfunction is displayed**

18.

1. Ignition Off, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for less than 2â€‰â„¦ in the control circuit end to end.

19.

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- If 2â€‰â„¦ or greater, repair the open/high resistance or short to ground in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

20.

- **If Malfunction is not displayed**

21. Ignition Off, remove the Q6â€‰Camshaft Position Actuator Solenoid Valve.
22. Verify the conditions listed below do not exist with the Q6â€‰Camshaft Position Actuator Solenoid Valve:
23.

1. Torn, restricted, mis-positioned, or missing screens.
2. Engine oil leak between the oil sealing lands of the solenoid. Inspect the lands of the solenoid for nicks.
3. Oil seepage at the solenoid connector.

24.

- **If a condition is found**
- Replace the Q6â€‰Camshaft Position Actuator Solenoid Valve.

25.

- **If a condition is not found**

26. Note**:**

    After swapping toe solenoids, install jumper wires to the appropriate terminals of the harness connectors and the solenoids.

27. Ignition Off, swap the Q6â€‰Camshaft Position Actuator Solenoid Valve with the Q6â€‰Camshaft Position Actuator Solenoid Valve that is operating correctly.
28. Engine idling.
29. Verify the scan tool Camshaft Position Variance parameter is less than 2Â° in each of the commanded states when commanding the Camshaft Position Actuator from 0â€“20Â° and back to 0Â° with a scan tool.
30.

- **If 2Â° or greater**
- Replace the mechanical camshaft position actuator.

31.

- **If less than 2Â°**

32. Test or replace the Q6â€‰Camshaft Position Actuator Solenoid Valve.

Component Testing

1. Ignition Off, disconnect the harness connector at the Q6â€‰Camshaft Position Actuator Solenoid Valve.
2. Test for 7-12â€‰â„¦ between the control terminalâ€‰2 and the low reference circuit terminalâ€‰1.
3.

- **If not between 7-12â€‰â„¦**
- Replace the Q6â€‰Camshaft Position Actuator Solenoid Valve.

4.

- **If between 7-12â€‰â„¦**

5. Test for infinite resistance between each terminal and the Q6â€‰Camshaft Position Actuator Solenoid Valve housing.

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6.
    - **If not infinite resistance**
    - Replace the Q6â€‰Camshaft Position Actuator Solenoid Valve.
7.
    - **If infinite resistance**
8. 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

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0601, P0604, or P0605 (LC5, LKY, or LMU)

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 P0601

Control Module Read Only Memory Performance

DTC P0604

Control Module Random Access Memory Performance

DTC P0605

Control Module Programming Read Only Memory Performance

Circuit/System Description

This diagnostic applies to internal microprocessor integrity conditions within the engine control module (ECM).

Conditions for Running the DTC

- The ignition is ON or the engine is running.
- The DTCs run once an ignition cycle.

Conditions for Setting the DTC

P0601

The ECM detects that the checksum calculation does not match the expected checksum.

P0604 or P0605

The ECM detects an internal condition for greater than 3â€‰seconds.

Action Taken When the DTC Sets

DTCsâ€‰P0601, P0604, and P0605 are Typeâ€‰A DTCs.

Conditions for Clearing the DTC

DTCsâ€‰P0601, P0604, and P0605 are Typeâ€‰A DTCs.

Reference Information

Description and Operation

Engine Control Module Description

Connector End View Reference

Master Electrical Component List

DTC Type Reference

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Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Circuit/System Testing

Ignition ON, verify that the DTCs P0601, P0604, or P0605 is not set.

- If DTCs P0601, P0604, or P0605 failed this ignition, replace the K20â€‰ECM.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0627-P0629 (LKY)

Symptoms

Diagnostic Trouble Codes - P0628

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 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
Relay Switch B+	*	**	â€”	â€”
Relay Coil Ground	P0628	P0627	â€”	â€”
Output Control	*	**	***	â€”
Relay Coil Control	P0628	P0627	P0629	â€”
Component Ground	â€”	**	â€”	â€”

* The fuel pump fuse opens and the engine cranks but does not run.

** The engine cranks but does not run.

*** The fuel pump operates continuously and the battery will discharge.

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 ignition is ON.
- The ignition voltage is between 10â€“16â€‰V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0627

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The ECM detects an open/high resistance on the fuel pump relay control circuit for 3.9â€‰s.

P0628

The ECM detects a short to ground on the fuel pump relay control circuit for 3.9â€‰s.

P0629

The ECM detects a short to voltage on the fuel pump relay control circuit for 3.9â€‰s.

Action Taken When the DTC Sets

DTC P0627, P0628, and P0629 are Type E DTCs.

Conditions for Clearing the DTC

DTC P0627, P0628, and P0629 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Fuel System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON.
2. Verify the KR23Aâ€‰Fuel Pump Relay turns on and off/clicks when commanding the Fuel Pump Relay On and Off with a scan tool.
3.
    - **If the fuel pump relay does not turn on and off/clicks**
    - Refer to Circuit/System Testing.
4.
    - **If the fuel pump relay turns on and off/clicks**
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.

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7.
    - **If the DTC sets**
    - Refer to Circuit/System Testing.
8.
    - **If the DTC does not set**
9. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the KR23Aâ€‰Fuel Pump Relay. It may take up to 2â€‰minutes for all vehicle systems to power down.
2. Test for less than 10â€‰â„¦ between the ground circuit terminalâ€‰86 and ground.
3.
    - **If 10â€‰â„¦ or greater**
4.
    1. Ignition OFF.
    2. Test for less than 2â€‰â„¦ in the ground circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, repair the open/high resistance in the ground connection.
5.
    - **If less than 10â€‰â„¦**
6. Ignition ON.
7. Verify a test lamp illuminates between the B+ circuit terminalâ€‰30 and ground.
8.
    - **If the test lamp does not illuminate and the circuit fuse is OK**
9.
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2â€‰â„¦ in the B+ circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, verify the fuse is OK and there is voltage at the fuse.
10.
    - **If the test lamp does not illuminate and the circuit fuse is open**
11.
    1. Ignition OFF, remove the test lamp.
    2. Test for infinite resistance between the B+ circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.

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4.
    - If infinite resistance
5. Disconnect the harness connector at the G16â€‰Fuel Pump.
6. Test for infinite resistance between the output control circuit terminalâ€‰87 and ground.
7.
    - If less than infinite resistance, repair the short to ground on the circuit.
8.
    - If infinite resistance
9. Connect the KR23Aâ€‰Fuel Pump Relay and install a new fuse.
10. Connect a test lamp between the output control circuit terminalâ€‰87 and ground, ignition ON.
11. Verify the test lamp turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.
12.
    - If the test lamp does not turn ON and OFF, replace the KR23Aâ€‰Fuel Pump Relay.
    - If the test lamp turns ON and OFF, test or replace the G16â€‰Fuel Pump.

12.

- **If the test lamp illuminates**

13. Connect a test lamp between the control circuit terminalâ€‰85 and the ground circuit terminalâ€‰86.
14. Verify the test lamp turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.
15.

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

16.

1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the control circuit and ground.
3.
    - If less than infinite resistance, repair the short to ground on the circuit.
4.
    - If infinite resistance
5. Test for less than 2â€‰â„¦ in the control circuit end to end.
6.
    - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
    - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

17.

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

18.

1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for less than 1â€‰V between the control circuit and ground.

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3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V , replace the K20â€‰Engine Control Module.

19.

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

20. Replace the KR23Aâ€‰Fuel Pump Relay.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Relay Replacement
- Control Module References for ECM replacement, programming, and setup

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0628 or P0629 (LC5, LMU)

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 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
Relay Switch B+	*	**	â€”	â€”
Relay Coil Ignition	P0628	P0628	P0563	â€”
Relay Switch Control	*	**	***	â€”
Relay Coil Control	P0628	P0628	P0629	â€”
Component Ground	â€”	**	â€”	â€”
* The fuel pump fuse opens and the engine cranks but does not run. ** The engine cranks but does not run. *** The fuel pump operates continuously and the battery will discharge.				

Circuit Description

The engine control module (ECM) provides a ground to the coil side of the fuel pump relay. When the ignition switch is first turned ON, the ECM energizes the fuel pump relay, which applies power to the fuel pump. The ECM enables the fuel pump relay as long as the engine is cranking or running, and crankshaft reference pulses are received. If no crankshaft reference pulses are received, the ECM de-energizes the fuel pump relay after about 3â€‰seconds.

Conditions for Running the DTC

- The ignition is ON.
- The DTCs run continuously when the above conditions are met.

Conditions for Setting the DTC

P0628

The ECM detects a short to ground or an open/high resistance on the fuel pump relay control circuit.

P0629

The ECM detects a short to voltage on the fuel pump relay control circuit.

Action Taken When the DTC Sets

DTC P0628 and P0629 are Type C DTCs.

Conditions for Clearing the DTC

DTC P0628 and P0629 are Type C DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Fuel System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.
2. Verify the KR23Aâ€‰Fuel Pump Relay turns on and off/clicks when commanding the Fuel Pump Relay On and Off with a scan tool.
3.
    - **If the fuel pump relay does not turn on and off/clicks**
    - Refer to Circuit/System Testing.
4.
    - **If the fuel pump relay turns on and off/clicks**
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.
7.
    - **If the DTC sets**
    - Refer to Circuit/System Testing.
8.
    - **If the DTC does not set**
9. All OK.

Circuit/System Testing

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1. Ignition OFF, disconnect the KR23Aâ€‰Fuel Pump Relay, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminalâ€‰86 and ground.
3.
    - **If the test lamp does not illuminate and the circuit fuse is OK**
4.
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, verify the fuse is OK and there is voltage at the fuse
5.
    - **If the test lamp does not illuminate and the circuit fuse is open**
6.
    1. Ignition OFF, remove the test lamp.
    2. Test for infinite resistance between the ignition circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
    4.
        - If infinite resistance, replace the KR23Aâ€‰Fuel Pump Relay.
7.
    - **If the test lamp illuminates**
8. Connect a test lamp between the ignition circuit terminalâ€‰86 and the control circuit terminalâ€‰85.
9. Verify the test lamp turns ON and OFF when commanding the KR23Aâ€‰Fuel Pump Relay On and Off with a scan tool.
10.
    - **If the test lamp is always OFF**
11.
    1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
    2. Test for less than 1â€‰V between the control circuit and ground.
    3.
        - If 1â€‰V or greater, repair the short to voltage on the circuit.
    4.
        - If less than 1â€‰V
    5. Ignition OFF.
    6. Test for less than 2â€‰â„¦ in the control circuit end to end.
    7.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.

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- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

12.

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

13.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the control circuit and ground.
3.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20â€‰Engine Control Module.

14.

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

15. Replace the KR23Aâ€‰Fuel Pump Relay.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Relay Replacement
- Control Module References for K20 ECM replacement, programming, and setup.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0638, P2101, P2118, or P2119 (LKY)

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 P0638

Throttle Actuator Control (TAC) Command Performance

DTC P2101

Throttle Actuator Position Performance

DTC P2118

Throttle Actuator Control (TAC) Motor Current Performance

DTC P2119

Throttle Closed Position Performance

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 sensorsâ€‰1 and 2 to determine the actual throttle valve position.

Conditions for Running the DTC

P0638

- The ignition is ON.
- ECM is learning the minimum throttle position.
- DTC runs continuously when the above conditions are met.

P2101

- The ignition is On.
- The engine is not cranking.
- The ECM is not commanding the throttle during the open circuit check.
- The ECM is commanding the throttle during the short circuit check.
- The DTC runs continuously when the above conditions are met.

P2118

- The ignition is ON.
- ECM has learned the minimum throttle position.
- Ignition voltage is greater than 9.0â€‰V.
- DTC runs continuously when the above conditions are met.

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P2119

- The ignition is ON.
- ECM is learning the minimum throttle position.
- DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0638

ECM detects the difference between the expected throttle position (TP) and the actual TP at the limp home position is greater than 0.33â€‰V for greater than 1â€‰s.

Or

ECM detects the difference between the expected throttle position (TP) and the actual TP at the rest position is greater than 0.5â€‰V for greater than 1â€‰s.

Or

ECM detects the difference between the expected throttle position (TP) and the actual TP at the lower mechanical stop position is greater than 0.33â€‰V for greater than 1â€‰s.

P2101

ECM detects an open or shorted TAC circuit for greater than 1â€‰s.

P2118

ECM detects that the difference between actual TP and expected TP is greater than a predetermined voltage for greater than 1â€‰s.

Or

ECM detects that the duty cycle needed to move the throttle plate is greater than 95% for more than 2.4â€‰s.

P2119

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

Action Taken When the DTC Sets

- DTCâ€‰P0638 is a Typeâ€‰E DTC.
- DTCsâ€‰P2101 and P2118 are Typeâ€‰A DTCs.
- DTCâ€‰P2119 is a Typeâ€‰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

- DTCâ€‰P0638 is a Typeâ€‰E DTC.
- DTCsâ€‰P2101 and P2118 are Typeâ€‰A DTCs.
- DTCâ€‰P2119 is a Typeâ€‰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

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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

Connector End View Reference

Master Electrical Component List

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. Note**:**

   A low battery voltage or charging system condition may cause a DTC to set.
3. Verify DTCâ€‰P0121, P0122, P0123, P0222, P0223, P0562, or P2135 is not set.
4.
   - **If any of the DTCs are set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.
5.
   - **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 the DTC does not set.
8.
   - **If the DTC sets**
   - Refer to Circuit/System Testing.
9.
   - **If the DTC does not set**

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10. All OK.

Circuit/System Testing

1. Ignition OFF.
2. Warning**:**

   Turn OFF the ignition before inserting fingers into the throttle bore. Unexpected movement of the throttle blade could cause personal injury.
3. Verify the conditions listed below do not exist with the Q38â€‰Throttle Body:
4.
   - 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 30â€‰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
5.
   - **If a condition is found**
   - Replace the Q38â€‰Throttle Body.
6.
   - **If a condition is not found**
7. Note**:**

   Disconnecting the throttle body harness connector may cause additional DTCs to set.
8. Disconnect the harness connector at the Q38â€‰Throttle Body Assembly, ignition ON.
9. Note**:**

   The test lamp may illuminate briefly when the ignition switch is turned on, but should not remain illuminated.
10. Verify that a test lamp does Not illuminate continuously between each motor control circuit listed below and ground.
11.
    - TAC Motor Control Closed circuit terminalâ€‰Aâ€‰orâ€‰1
    - TAC Motor Control Open circuit terminalâ€‰Bâ€‰orâ€‰2
12.
    - **If the test lamp is always ON**
13.
    1. Ignition OFF, disconnect the harness connectorâ€‰X2 at the K20â€‰Engine Control Module, ignition ON
    2. Test for less than 1â€‰V between the motor control circuit and ground.
    3.
       - If 1â€‰V or greater, repair the short to voltage on the circuit.

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- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

14.

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

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

16.

- TAC Motor Control Closed circuit terminalâ€‰Aâ€‰orâ€‰1
- TAC Motor Control Open circuit terminalâ€‰Bâ€‰orâ€‰2

17.

- **If the test lamp illuminates**

18.

1. Ignition OFF, disconnect the harness connectorâ€‰X2 at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the control circuit and ground.
3.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20â€‰Engine Control Module.

19.

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

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

21. 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 2â€‰min for all vehicle systems to power down.
- The DMM Min/Max Recording Mode and the response time of 1â€‰ms must be reset after testing each circuit or a lower voltage will be recorded.

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

23.

- TAC Motor Control Closed circuit terminalâ€‰Aâ€‰orâ€‰1
- TAC Motor Control Open circuit terminalâ€‰Bâ€‰orâ€‰2

24.

- **If not within 3â€‰V of B+**

25.

1. Ignition OFF, disconnect the harness connectorâ€‰X2 at the K20â€‰Engine Control Module.
2. Test for less than 2â€‰â„¦ in the control circuit end to end.
3.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

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26.

    - **If within 3â€‰V of B+**

27. Replace the Q38â€‰Throttle Body.

Repair Instructions

- Throttle Body Assembly Replacement
- Control Module References for engine control module replacement, programming, and setup

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0642, P0643, P0652, or P0653

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 P0642

5V Reference 1 Circuit Low Voltage

DTC P0643

5V Reference 1 Circuit High Voltage

DTC P0652

5V Reference 2 Circuit Low Voltage

DTC P0653

5V Reference 2 Circuit High Voltage

Circuit/System Description

The engine control module (ECM) has two 5V reference circuits. The ECM provides the 5V reference to various sensors. A short to ground or voltage on one of the 5V reference circuits will affect all components connected to that 5V reference circuit. The ECM monitors the voltage on the 5V reference circuits.

Conditions for Running the DTC

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

Conditions for Setting the DTC

The ECM detects the 5V reference is out of range for 0.1â€‰s.

Action Taken When the DTC Sets

DTC P0642, P0643, P0652, and P0653 are Type A DTCs.

Conditions for Clearing the DTC

DTC P0642, P0643, P0652, and P0653 are Type A DTCs.

Diagnostic Aids

If a shared 5V reference circuit is shorted to ground or shorted to a voltage, other 5V reference circuits may be affected.

P0642 and P0643

The 5V reference 1 circuit provides 5V to the following sensors:

- The exhaust gas recirculation (EGR) position sensor
- The accelerator pedal position sensor 2

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- The throttle position sensor 1 and 2
- The crankshaft position sensor

P0652 and P0653

The 5V reference 2 circuit provides 5V to the following sensors:

- The camshaft position sensor
- The manifold absolute pressure sensor
- The accelerator pedal position sensor 1

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, observe the DTC information with a scan tool. DTCs P0642, P0643, P0652, and P0653 should not set.
2. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Circuit/System Testing

Note:

Additional DTCs will set when disconnecting components.

1. Ignition OFF, disconnect the harness connector at all appropriate sensors for the applicable DTC. Refer to Diagnostic Aids.
2. Ignition ON, test for 4.8â€“5.2V between each of the 5V reference circuits listed below and ground:
3.
    - Q38 Throttle Body circuit terminal 5
    - B74 Manifold Absolute Pressure Sensor circuit terminal 1
    - B107 Accelerator Pedal Position Sensor 2 circuit terminal 1
    - B107 Accelerator Pedal Position Sensor 1 circuit terminal 6
    - Q14 Exhaust Gas Recirculation (EGR) Valve circuit terminal D

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- B23 Camshaft Position Sensor circuit terminal 3
- B26 Crankshaft Position Sensor circuit terminal 1

4.
   - If less than the specified range, test for a short to ground on the 5V reference circuit. If all circuits test normal, replace the K20â€‰Engine Control Module.
   - If greater than the specified range, test for a short to voltage on the 5V reference circuit. If all circuits test normal, replace the K20â€‰Engine Control Module.
5. Clear the DTC information with a scan tool.
6. Note**:**

   A short to voltage on the signal circuit of certain components may cause this DTC to set.
7. Connect each component associated with the 5 V reference circuit one at a time while monitoring the DTC information for P0642, P0643, P0652, and P0653. The DTC status should not display failed this ignition.
8.
   - If the DTC status displays failed when a component is connected, test the signal circuit of the component for a short to voltage. If the circuit tests normal, replace the component.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Accelerator Pedal Position Sensor Replacement
- Manifold Absolute Pressure Sensor Replacement
- Exhaust Gas Recirculation Valve Replacement
- Throttle Body Assembly Replacement
- Control Module References for ECM replacement, setup and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0650, P263A, or P263B

Diagnostic Instructions

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

DTC Descriptor

DTC P0650

Malfunction Indicator Lamp (MIL) Control Circuit

DTC P263A

Malfunction Indicator Lamp (MIL) Control Circuit Low Voltage

DTC P263B

Malfunction Indicator Lamp (MIL) Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P263A	P0650	â€”	â€”
Control	P263A/MIL ON	P0650	P263B	â€”

Circuit/System Description

The malfunction indicator lamp (MIL) is located on the instrument panel cluster. Ignition voltage is supplied directly to the MIL. The engine control module (ECM) turns the MIL ON by grounding the MIL control circuit. There should be a steady MIL with the ignition ON and the engine OFF.

The MIL informs the driver that an emission system fault has occurred and that the engine control system requires service. The engine control module (ECM) monitors the MIL control circuit for conditions that are incorrect for the commanded states of the MIL.

Conditions for Running the DTC

- The ignition is ON.
- The ignition voltage is between 10â€“16V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects a short to voltage, a short to ground, or an open/high resistance on the MIL control circuit.

Action Taken When the DTC Sets

DTCs P0650, P263A, and P263B are Type E DTCs.

Conditions for Clearing the DTC

DTCs P0650, P263A, and P263B are Type E DTCs.

Reference Information

Schematic Reference

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Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Verification

1. Ignition ON, command the MIL ON and OFF with a scan tool. The MIL should turn ON and OFF.
2. Verify that the DTCs P0650, P263A, and P263B are not set.
3. Operate the vehicle within the Conditions for Running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data.

Circuit/System Testing

1. Ignition ON, verify that the P16 Instrument Cluster warning indicators are illuminated.
2.
    - If the P16 Instrument Cluster indicators are not illuminated, refer to Symptoms - Displays and Gauges.
3. Ignition OFF, disconnect the harness connector at the K20 ECM.
4. Ignition ON, verify the MIL does not illuminate.
5.
    - If the MIL illuminates, test the MIL control circuit for a short to ground. If the circuit tests normal, replace the P16 Instrument Cluster.
6. Ignition ON, verify the MIL illuminates with a 3A fused jumper wire between the MIL control circuit terminal 26 X2 and ground.
7.
    - If the MIL does not illuminate, test the MIL control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the bulb/P16 Instrument Cluster.
8. If all circuits test normal, replace the K20 ECM.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Instrument Cluster Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0688

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 P0688 91

Main Relay Output Voltage Signal Not Plausible

DTC P0688 92

Main Relay Output Voltage Signal Malfunction

Circuit/System Description

The ECM controls the ignition relay feedback circuit via an internal solid-state device ground engine called a drive. The main function of the drive is to supply ground to the controlled components. Each drive has a fault line monitored by the ECM. When the ECM commands components ON, voltage of the control circuit should be low, about 0 V. When the ECM commands components OFF, voltage of the control circuit should be high, close to battery voltage. DTC sets if the ECM has detected that the actual state of the control circuit mismatches the desired state.

Conditions for Running the DTC

- Ignition ON.
- The system voltage is 9â€“18 V.

Conditions for Setting the DTC

P0688 91

Rationality check failed.

P0688 92

The signal voltage is less than 3 V.

Action Taken when the DTC Sets

DTC P0688 is a C type DTC.

Conditions for Clearing the MIL/DTC

DTC P0688 is a C type DTC.

Reference Information

Schematic Reference

Temperature Versus Resistance

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

- Circuit Testing

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- Circuit Testing
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs
- Charging System Test

Scan Tool Reference

Control Module References

Circuit/System Verification

Ignition ON, use the scan tool to command the relay ON and OFF. Feel or listen to verify that the relay is powered ON and OFF as commanded.

Circuit/System Testing

1. Ignition OFF, disconnect the engine controls ignition relay.
2. Important:

   Test lamp is used in load circuit and may not turn ON.
3. Connect a test lamp between the main relay B + power supply circuit and a known ground.
4. Ignition ON, test for a less than 0.1 V of difference between the actual battery voltage and the main relay B + power supply voltage.
5.
   - **If greater than 0.1 V**
   - Test the main relay B + voltage circuit for short to ground or open/high resistance.
6.
   - **If less than 0.1 V**
7. Ignition ON, connect a test lamp between the control circuit power supply voltage and a known ground.
8.
   - **If the test lamp does not illuminate**
   - Test the control circuit for open/high resistance or short to ground. If all circuits test normal, replace the ECM.
9.
   - **If the test lamp illuminates**
10. Ignition OFF, connect a test lamp between the main relay control circuit at the electrical center under the hood and the relay coil ground circuit.
11. Ignition ON. The test lamp should turn ON when the ignition switch is shifting between ON and OFF.
12.
    - **If the test lamp does not turn ON**
    - Test if the relay coil ground circuit is open/high resistance.
13.
    - **If the test lamp illuminates**
14. If all circuits/connections are tested to be normal, test or replace the main relay.

Repair Instructions

Perform the Diagnostic Repair Verification.

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Repair Verification

Ignition ON, use the scan tool to command the relay ON and OFF. Feel or listen to verify that the relay is powered ON and OFF as commanded.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0685-P0687, P0689, P0690, or P1682 (LKY)

Diagnostic Instructions

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

DTC Descriptor

Engine Controls Ignition Relay Control Circuit

Engine Controls Ignition Relay Control Circuit Low Voltage

Engine Controls Ignition Relay Control Circuit High Voltage

Engine Controls Ignition Relay Feedback Circuit Low Voltage

Engine Controls Ignition Relay Feedback Circuit High Voltage

Ignition 1 Switch Circuit 2

Diagnostic Fault Information

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

Circuit/System Description

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

Components

Component	Description
KR73 Ignition Main Relay	-
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

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

Conditions for Running the DTC

P0685, P0686, P0687

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Ignition Voltage = Greater than 11 V

DTCs run continuously when the above condition is met.

P0689

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

DTC runs continuously when the above conditions are met.

P0690

- DTC P0685Not set
- Engine Controls Ignition Relay Command = Off - For greater than 2> s

DTC runs continuously when the above conditions are met.

P1682

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

DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0685, P0686, P0687

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

P0689

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

P0690

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

P1682

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

- Ignition 1 Signal
- Engine Controls Ignition Relay Feedback Signal

Actions Taken When the DTC Sets

- DTCs P0685, P0686, P0687, P0689, P0690
- DTCs P1682e Type A DTCs.

Conditions for Clearing the DTC

- DTCs P0685, P0686, P0687, P0689, P0690
- DTCs P1682e Type A DTCs.

Diagnostic Aids

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

Reference Information

Schematic Reference

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- Engine Controls Schematics
- Power Distribution Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Electrical Center Identification Views
- Relay Replacement
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify no other DTCs are set.
3.
    - **If other DTCs are set**
    - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
4.
    - **If no other DTCs are set**
5. Ignition/Vehicle >> Cycle On and Off
6. Verify the component produces a clicking sound: KR73 Ignition Main Relay
7.
    - **If the component does not produce a sound**
    - Refer to: Circuit/System Testing
8.
    - **If the component produces a sound**
9. Verify the following parameters are within 3> V of each other:
10.
    - Engine Controls Ignition Relay Feedback Signal
11.
    - **If not within 3> V of each other**
    - Refer to: Circuit/System Testing

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12.

- **If within 3> V of each other**

13. 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.

14.

- **If the DTC sets**
- Refer to: Circuit/System Testing

15.

- **If the DTC does not set**

16. All OK.

Circuit/System Testing

1. Vehicle Off.
2. Remove the component: KR73 Ignition Main Relay
3. Verify a test lamp turns On between the test points:
4.
   - B+ circuit terminal 30 & Ground
   - B+ circuit terminal 85 & Ground
5.
   - **If the test lamp does not turn On**
   - Replace the component: X50A Fuse Block - Underhood
6.
   - **If the test lamp turns On**
7. Ignition >> On / Vehicle >> In Service Mode
8. Connect a test lamp between the test points: Relay Terminal 86 & B+ circuit
9. Perform the scan tool control function: KR73 Ignition Main Relay >> On and Off
10. Verify the test lamp turns On and Off.
11.
    - **If the test lamp is always Off**
12.
    1. Ignition/Vehicle >> Off & Remove >> Test lamp
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Ignition >> On / Vehicle >> In Service Mode
    4. Test for less than 1> V between the test points: Relay Terminal 86 @ Relay Socket & Terminal 64 @ Control module harness
    5.
       - If 1> V or greater >> Repair the short to voltage on the circuit.
    6.
       - If less than 1> V

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7. Ignition/Vehicle >> Off
8. Test for less than 2> Ω between the test points: Relay Terminal 86 @ Relay Socket & Terminal 64 @ Control module harness
9.
    - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
    - If less than 2> Ω >> Replace the component: K20 Engine Control Module

13.
    - **If the test lamp is always On**

14.
    1. Ignition/Vehicle >> Off & Remove >> Test lamp
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Test for infinite resistance between the test points: Relay Terminal 86 @ Relay Socket & Ground
    4.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
        - If infinite resistance >> Replace the component: K20 Engine Control Module

15.
    - **If the test lamp turns On and Off**

16. Verify the fuse is not open:
17.
    - F5UBhinsp;Fuse

18.
    - **If the fuse is open**

19.
    1. Vehicle Off.
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Test for infinite resistance between the test points: Output terminal @ Fuse & Ground
    4.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
        - If infinite resistance >> Replace the component: K20 Engine Control Module

20.
    - **If the fuse is not open**

21. Ignition >> On / Vehicle >> In Service Mode
22. Verify a test lamp does not turn On between the test points: Relay Terminal 87 @ Relay Socket & Ground
23.
    - **If the test lamp turns On**

24. Disconnect the electrical connector: X1 @ K20 Engine Control Module
25. Test for less than 1> V between the test points:

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26.
    - Ignition Relay Feedback Circuit 4> @ Control module harness & Ground
27.
    - If 1> V or greater >> Repair the short to voltage on the circuit.
28.
    - **If the test lamp does not turn On**
29. Vehicle Off.
30. Connect a 30 A fused jumper wire between the test points: Relay Terminal 87 & Relay Terminal 30 @ Relay Socket
31. Ignition >> On / Vehicle >> In Service Mode
32. Verify the scan tool parameter: Engine Controls Ignition Relay Feedback Signal = Within 1> V of the battery voltage
33.
    - **If not within 1> V of the battery voltage**
34.
    1. Ignition/Vehicle >> Off & Remove >> Jumper wire(s)
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Test for less than 2> Ω between the test points:
    4.
        - Relay Terminal 87 @ Relay Socket & Ignition Relay Feedback Circuit 4> @ Control module harness
    5.
        - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
        - If less than 2> Ω >> Replace the component: K20 Engine Control Module
35.
    - **If within 1> V of the battery voltage**
36. Test or replace the component: KR73 Ignition Main Relay

Component Testing

Relay Test

1. Vehicle Off.
2. Remove the component: KR73 Ignition Main Relay
3. Test for 70 to 110thinsp;Ω between the test points: Relay Terminal 85 & 86
4.
    - **If not between 70 and 110thinsp;Ω**
    - Replace the component: KR73 Ignition Main Relay
5.
    - **If between 70 and 110thinsp;Ω**
6. Test for infinite resistance between the test points:
7.

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- Component terminal 30 & 85
- Component terminal 30 & 86
- Component terminal 30 & 87
- Component terminal 85 & 87

8.
   - **If less than infinite resistance**
   - Replace the component: KR73 Ignition Main Relay

9.
   - **If infinite resistance**

10. Connect a 3> A fused jumper wire between the test points: Relay Terminal 86 & B+
11. Connect a jumper wire between the test points: Relay Terminal 85 & Ground
12. Test for less than 2> Ω between the test points: Relay Terminal 30 & 87
13.
   - **If 2> Ω or greater**
   - Replace the component: KR73 Ignition Main Relay

14.
   - **If less than 2> Ω**

15. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Relay Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0685-P0687, P0689, P0690, or P1682 (LC5 or LMU)

Symptoms

Diagnostic Trouble Codes - P0686

Diagnostic Instructions

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

DTC Descriptor

Engine Controls Ignition Relay Control Circuit

Engine Controls Ignition Relay Control Circuit Low Voltage

Engine Controls Ignition Relay Control Circuit High Voltage

Engine Controls Ignition Relay Feedback Circuit Low Voltage

Engine Controls Ignition Relay Feedback Circuit High Voltage

Ignition 1 Switch Circuit 2

Diagnostic Fault Information

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

Circuit/System Description

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

Components

Component	Description
KR73 Ignition Main Relay	-
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.

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

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Conditions for Running the DTC

P0685, P0686, P0687

Ignition Voltage = Greater than 11 V

DTCs run continuously when the above condition is met.

P0689

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

DTC runs continuously when the above conditions are met.

P0690

- DTC P0685Not set
- Engine Controls Ignition Relay Command = Off - For greater than 2> s

DTC runs continuously when the above conditions are met.

P1682

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

DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P0685, P0686, P0687

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

P0689

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

P0690

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

P1682

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

- Ignition 1 Signal
- Engine Controls Ignition Relay Feedback Signal

Actions Taken When the DTC Sets

- DTCs P0685, P0686, P0687, P0689, P0690
- DTCs P1682e Type A DTCs.

Conditions for Clearing the DTC

- DTCs P0685, P0686, P0687, P0689, P0690
- DTCs P1682e Type A DTCs.

Diagnostic Aids

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

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Reference Information

Schematic Reference

- Engine Controls Schematics
- Power Distribution Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Electrical Center Identification Views
- Relay Replacement
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Ignition >> On / Vehicle >> In Service Mode
2. Verify no other DTCs are set.
3.
    - **If other DTCs are set**
    - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
4.
    - **If no other DTCs are set**
5. Ignition/Vehicle >> Cycle On and Off
6. Verify the component produces a clicking sound: KR73 Ignition Main Relay
7.
    - **If the component does not produce a sound**
    - Refer to: Circuit/System Testing
8.
    - **If the component produces a sound**
9. Verify the following parameters are within 3> V of each other:
10.
    - Engine Controls Ignition Relay Feedback Signal
11.

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- **If not within 3> V of each other**
- Refer to: Circuit/System Testing

12.

- **If within 3> V of each other**

13. 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.

14.

- **If the DTC sets**
- Refer to: Circuit/System Testing

15.

- **If the DTC does not set**

16. All OK.

Circuit/System Testing

1. Vehicle Off.
2. Remove the component: KR73 Ignition Main Relay
3. Verify a test lamp turns On between the test points:
4.
   - B+ circuit terminal 30 & Ground
   - B+ circuit terminal 85 & Ground
5.
   - **If the test lamp does not turn On**
   - Replace the component: X50A Fuse Block - Underhood
6.
   - **If the test lamp turns On**
7. Ignition >> On / Vehicle >> In Service Mode
8. Connect a test lamp between the test points: Relay Terminal 86 & B+ circuit
9. Perform the scan tool control function: KR73 Ignition Main Relay >> On and Off
10. Verify the test lamp turns On and Off.
11.
    - **If the test lamp is always Off**
12.
    1. Ignition/Vehicle >> Off & Remove >> Test lamp
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Ignition >> On / Vehicle >> In Service Mode
    4. Test for less than 1> V between the test points: Relay Terminal 86 @ Relay Socket & Terminal 7> @ Control module harness
    5.

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- If 1> V or greater >> Repair the short to voltage on the circuit.

6.

- If less than 1> V

7. Ignition/Vehicle >> Off
8. Test for less than 2> Ω between the test points: Relay Terminal 86 @ Relay Socket & Terminal 7> @ Control module harness
9.

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

13.

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

14.

1. Ignition/Vehicle >> Off & Remove >> Test lamp
2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
3. Test for infinite resistance between the test points: Relay Terminal 86 @ Relay Socket & Ground
4.

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

15.

- **If the test lamp turns On and Off**

16. Verify the fuse is not open:
17.

- F5UBhinsp;Fuse

18.

- **If the fuse is open**

19.

1. Vehicle Off.
2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
3. Test for infinite resistance between the test points: Output terminal @ Fuse & Ground
4.

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

20.

- **If the fuse is not open**

21. Ignition >> On / Vehicle >> In Service Mode
22. Verify a test lamp does not turn On between the test points: Relay Terminal 87 @ Relay Socket & Ground
23.

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- **If the test lamp turns On**

24. Disconnect the electrical connector: X1 @ K20 Engine Control Module
25. Test for less than 1> V between the test points:
26.
    - Ignition Relay Feedback Circuit 66 @ Control module harness & Ground
27.
    - If 1> V or greater >> Repair the short to voltage on the circuit.
28.
    - **If the test lamp does not turn On**
29. Vehicle Off.
30. Connect a 30 A fused jumper wire between the test points: Relay Terminal 87 & Relay Terminal 30 @ Relay Socket
31. Ignition >> On / Vehicle >> In Service Mode
32. Verify the scan tool parameter: Engine Controls Ignition Relay Feedback Signal = Within 1> V of the battery voltage
33.
    - **If not within 1> V of the battery voltage**
34.
    1. Ignition/Vehicle >> Off & Remove >> Jumper wire(s)
    2. Disconnect the electrical connector: X1 @ K20 Engine Control Module
    3. Test for less than 2> Ω between the test points:
    4.
        - Relay Terminal 87 @ Relay Socket & Ignition Relay Feedback Circuit 66 @ Control module harness
    5.
        - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
        - If less than 2> Ω >> Replace the component: K20 Engine Control Module
35.
    - **If within 1> V of the battery voltage**
36. Test or replace the component: KR73 Ignition Main Relay

Component Testing

Relay Test

1. Vehicle Off.
2. Remove the component: KR73 Ignition Main Relay
3. Test for 70 to 110thinsp;Ω between the test points: Relay Terminal 85 & 86
4.
    - **If not between 70 and 110thinsp;Ω**
    - Replace the component: KR73 Ignition Main Relay
5.

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- **If between 70 and 110thinsp;Ω**

6. Test for infinite resistance between the test points:
7.
    - Component terminal 30 & 85
    - Component terminal 30 & 86
    - Component terminal 30 & 87
    - Component terminal 85 & 87
8.
    - **If less than infinite resistance**
    - Replace the component: KR73 Ignition Main Relay
9.
    - **If infinite resistance**
10. Connect a 3> A fused jumper wire between the test points: Relay Terminal 86 & B+
11. Connect a jumper wire between the test points: Relay Terminal 85 & Ground
12. Test for less than 2> Ω between the test points: Relay Terminal 30 & 87
13.
    - **If 2> Ω or greater**
    - Replace the component: KR73 Ignition Main Relay
14.
    - **If less than 2> Ω**
15. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Relay Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P06EC

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

DTCâ€‰P06EC

Kâ€‰103 Fuel Pump Control Module requested MIL Illumination

Circuit/System Description

DTC P06EC is an alarm code when transmission DTCâ€™s related to vehicle emissions are stored in the K103 Fuel Injector Control Module. The K20 Engine Control Module receives the K103 Fuel Injector Control Module information through the serial data circuit. The K103 Fuel Injector Control Module then sends a serial data message to the K20 Engine Control Module requesting malfunction indicator lamp (MIL) illumination. When the K20 Engine Control Module receives the message from the K103 Fuel Injector Control Module, DTCâ€‰P06EC will set in the K20 Engine Control Module.

Conditions for Running the DTC

- Ignition is ON, or the engine is running.
- DTCâ€‰P06EC will continue to be current or active as long as the K103 Fuel Injector Control Module is requesting MIL illumination.

Conditions for Setting the DTC

The K103 Fuel Injector Control Module requests to illuminate the MIL.

DTCâ€‰P06EC is a Typeâ€‰A DTC.

Action Taken When the DTC Sets

- DTCâ€‰P06EC is a Typeâ€‰A DTC.
- DTCâ€‰P06EC will continue to be current or active as long as the K103 Fuel Injector Control Module is requesting MIL illumination.

Conditions for Clearing the DTC

DTCâ€‰P06EC is a Typeâ€‰A DTC.

Diagnostic Aids

Communication codes, U-codes, as well as powertrain codes, P-codes, set in the K103 Fuel Injector Control Module will cause the K103 Fuel Injector Control Module to request DTCâ€‰P06EC to be set in the Kâ€‰20 Engine Control Module.

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

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1. Note**:**

   Correct any engine controls and communication DTCs before diagnosing K103 Fuel Injector Control Module DTCs.

2. DTCâ€‰P06EC is an informational DTC. If there are no engine controls or communication DTCs, refer to Diagnostic Trouble Code (DTC) List - Vehicle for diagnosis of K103 Fuel Injector Control Module DTCs.

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

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P0700

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

DTCâ€‰P0700

Transmission Control Module Requested MIL Illumination

Circuit/System Description

Diagnostic trouble code (DTC)â€‰P0700 is an informational DTC that indicates that an emission related transmission DTC has set in the transmission control module (TCM). The engine control module (ECM) turns ON the malfunction indicator lamp (MIL) when the TCM sends a message over the serial data circuit requesting MIL illumination. The DTC information for the ECM will only display DTCâ€‰P0700, and the ECM Freeze Frame/Failure Records data will display the engine operating conditions that were present when the transmission DTC was set. The TCM Freeze Frame/Failure records data is available from the DTC that was set in the TCM.

Conditions for Running the DTC

- The ignition is ON or the engine is operating.
- DTCâ€‰P0700 runs continuously.

Conditions for Setting the DTC

The ECM receives a serial data message from the TCM requesting the ECM to turn ON the MIL.

Action Taken When the DTC Sets

DTCâ€‰P0700 is a Typeâ€‰A DTC.

Conditions for Clearing the MIL/DTC

DTCâ€‰P0700 is a Typeâ€‰A DTC.

Diagnostic Aids

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

Reference Information

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Note:
    - Do not replace the engine control module for this DTC. DTC P0700 is an informational DTC.

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- Correct any engine control and communication DTCs before diagnosing transmission control module DTCs.

2. Verify there are no engine control or communication DTCs set.
3.
   - **If a DTC is set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle.
4.
   - **If a DTC is not set**
5. Verify there are no transmission control module DTCs set.
6.
   - **If a DTC is set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle.
7.
   - **If a DTC is not set**
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.
10.
    - **If the DTC sets**
    - Refer to Diagnostic Trouble Code (DTC) List - Vehicle.
11.
    - **If the DTC does not set**
12. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P1325

Diagnostic Instructions

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

DTC Descriptor

Crankshaft Position Reluctor Ring Performance

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
5> V Reference	Regulated voltage supplied by the control module.
Signal	The control module input circuit has an internal resistance connected to 5> V.
Low Reference	Grounded through the control module.

Component	Description
B26 Crankshaft Position Sensor	The sensor contains a hall-effect sensor and additional electronics that processes the signal. It detects the change of strength of the magnetic field caused by the reluctor ring. When the strength changes, the sensor changes the amount of current it consumes. This results in a square wave signal of the current, while the voltage stays constant. The control module detects the frequency in which the current changes, which is proportional to the rotational speed.
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
Reluctor Ring	There are 58 teeth or invisible magnetic segments on the edge of the crankshaft position reluctor ring mounted on the crankshaft. Each tooth or magnetic segment on the ring is spaced at a 60 segment spacing with 2> missing segments for a reference gap.

The ECM uses information from the crankshaft position sensor and the camshaft position sensor(s) for sequencing and timing of the spark events.

Conditions for Running the DTC

Engine = Running

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

Conditions for Setting the DTC

Crankshaft Position Sensor = No Signal - During 1> engine revolution(s)

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type C> DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type C> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

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Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Circuit/System Verification

1. Verify there are no other DTCs set, except for DTC P1325
2.
   - **If other DTCs are set**
   - Refer to: Diagnostic Trouble Code (DTC) List - Vehicle
3.
   - **If no other DTCs are set**
4. Perform the following action:
5.
   - Wiggle the harness and connector: B26 Crankshaft Position Sensor
   - Wiggle the harness and connector: K20 Engine Control Module
   - - The engine should not stumble/stall.
6.
   - **If a condition exists**
   - Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)
7.
   - **If no condition exists**
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.
10.
    - **If the DTC sets**
    - Refer to: Circuit/System Testing
11.
    - **If the DTC is not set**
12. All OK.

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Circuit/System Testing

1. Verify the following conditions do not exist:
2.
    - B26 Crankshaft Position Sensor & Reluctor Ring - Excessive play / Foreign material passing between the components / Incorrect air gap / Incorrect installation / Loose / Visible Damage
    - Crankshaft Sprocket - Visible Damage / Worn
    - Engine Oil - Contaminated / Dirty
    - Timing Chain or Timing Belt - Visible Damage / Worn
    - Timing Chain Tensioner or Timing Belt Tensioner - Visible Damage / Worn
3.
    - **If a condition exists >> Repair or replace as necessary**
4.
    - **If no condition exists**
5. Test or replace the component: B26 Crankshaft Position Sensor

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Crankshaft Position Sensor Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2009 or P2010 (LKY)

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 P2009

Intake Manifold Runner Control (IMRC) Solenoid Control Circuit Low Voltage

DTC P2010

Intake Manifold Runner Control (IMRC) Solenoid Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2009*	P2009	â€”	â€”
Control	P2009	P2009	P2010	â€”
*Opens the fuse that supplies voltage to the IMT/IMRC solenoid.				

CircuitSystem Description

Ignition voltage is supplied directly to the IMRC solenoid. The engine control module (ECM) controls the solenoid 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

- DTC P0562 or P0563 is not set.
- The ignition is ON.
- The ignition voltage is between 8â€“16V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2009

The ECM detects a short to ground or an open on the IMRC solenoid control circuit.

P2010

The ECM detects a short to voltage on the IMRC solenoid control circuit.

Action Taken When the DTC Sets

DTC P2009 and P2010 are Type E DTCs.

Conditions for Clearing the DTC

DTC P2009 and P2010 are Type E DTCs.

Reference Information

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Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Air Intake 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

CircuitSystem Verification

1. Ignition ON, verify that the DTC P2009 or P2010 is not set.
2.
    - If a DTC is set, perform the CircuitSystem Testing.
3. Observe the intake manifold runner control valve control circuit test status parameters. Each of the intake manifold runner control valve control circuit test status parameters should display OK or Not Run.
4. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that are captured in the Freeze FrameFailure Records Data List.

CircuitSystem Testing

1. Ignition OFF, disconnect the harness connector at the Q21 intake manifold runner control solenoid valve.
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 1 and ground.
3.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an openhigh resistance. If the circuit tests normal and the ignition circuit fuse is open, test all the components connected to the ignition circuit and replace as necessary.
4. Ignition OFF, connect a test lamp between the control circuit terminal 2 and the ignition circuit terminal 1.
5. Ignition ON, command the Intake Manifold Tuning Control Valve Open and Closed with a scan tool. The test lamp should turn ON and OFF.
6.
    - If the test lamp remains ON all the time, test the control circuit for a short to ground. If the circuit tests normal, replace the ECM.
    - If the test lamp remains OFF all the time, test the control circuit for a short to voltage or an openhigh resistance. If the circuit tests normal, replace the ECM.
7. Test for 3â€“4 volts between the control circuit terminal 2 and ground.
8.
    - If the voltage is not within the specified range, replace the ECM.

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    - If the voltage is not within the specified range, replace the ECM.
9. If all circuits test normal, test or replace the Q21 intake manifold runner control solenoid valve.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Intake Manifold Tuning Valve Replacement
- Control Module References for ECM replacement, setup and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2009 or P2010 (LC5 and LMU)

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 P2009

Intake Manifold Runner Control (IMRC) Solenoid Control Circuit Low Voltage

DTC P2010

Intake Manifold Runner Control (IMRC) Solenoid Control Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2009*	P2009	â€”	â€”
Control	P2009	P2009	P2010	â€”
*Opens the fuse that supplies voltage to the IMT/IMRC solenoid.				

CircuitSystem Description

Ignition voltage is supplied directly to the IMRC solenoid. The engine control module (ECM) controls the solenoid 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 is ON.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2009

The ECM detects a short to ground or an openhigh resistance on the intake manifold runner control (IMRC) solenoid control circuit.

P2010

The ECM detects a short to voltage on the intake manifold runner control (IMRC) solenoid control circuit.

Action Taken When the DTC Sets

DTC P2009 and P2010 are Type E DTCs.

Conditions for Clearing the DTC

DTC P2009 and P2010 are Type E DTCs.

Reference Information

Schematic Reference

Engine Controls Schematics

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Connector End View Reference

Master Electrical Component List

Description and Operation

Air Intake System Description

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON, verify that the DTC P2009 or P2010 is not set.
2.
    - If a DTC is set, perform the Circuit/System Testing.
3. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that are captured in the Freeze Frame/Failure Records data list.

CircuitSystem Testing

1. Ignition OFF, disconnect the harness connector at the Q21 intake manifold runner control solenoid valve.
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit terminal 1 and ground.
3.
    - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an openhigh resistance. If the circuit tests normal and the ignition circuit fuse is open, test all the components connected to the ignition circuit and replace as necessary.
4. Ignition ON, test for less than 5V between the control circuit terminal 2 and ground.
5.
    - If greater than the specified range, test the control circuit for a short to voltage. If the circuit tests normal, replace the K20 ECM.
6. Ignition OFF, test for greater than 10Î© between the control circuit terminal 2 and ground.
7.
    - If less than the specified range, test the control circuit for a short to ground. If the circuit tests normal, replace the K20 ECM.
8. Ignition ON, test for greater than 10V between the control circuit terminal 2 and the B.
9.
    - If less than the specified range, test the control circuit for an openhigh resistance. If the circuit tests normal, replace the K20 ECM.
10. If all circuits test normal, test or replace the Q21 intake manifold runner control solenoid valve.

Repair Instructions

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Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Intake Manifold Tuning Valve Replacement
- Control Module References for ECM replacement, setup, and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2104-P2106 or P2110

Symptoms

Diagnostic Trouble Codes - P2105

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 P2104

Throttle Actuator Control (TAC) System â€“ Forced Engine Idle Speed

DTC P2105

Throttle Actuator Control (TAC) System â€“ Forced Engine Shutdown

DTC P2106

Throttle Actuator Control (TAC) System â€“ Throttle Limitation Active

DTC P2110

Throttle Actuator Control (TAC) System â€“ Forced Limited Engine Speed

Circuit/System Description

DTC P2104, P2105, P2106, and P2110 indicate that a throttle actuator control (TAC) DTC is set that causes the engine control module (ECM) to command one of the following reduced power modes:

- Forced engine idle
- Forced engine shutdown
- Throttle limitation
- Limited engine speed

Conditions for Running the DTC

The ignition is ON or the engine is running.

Conditions for Setting the DTC

A failure with the TAC system is present.

Action Taken When the DTC Sets

DTC P2104, P2105, P2106, and P2110 are Type A DTCs.

Conditions for Clearing the DTC

DTC P2104, P2105, P2106, and P2110 are Type A DTCs.

Reference Information

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Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

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

Note:

- A low battery condition while cranking the engine may cause DTC P2106 to set. Refer to Symptoms - Engine Electrical.
- In extreme cold weather conditions ice may form in the vacuum source to the MAP sensor and may set a DTC. Inspect the MAP sensor and the vacuum source for ice, moisture, or other restrictions.

1. Ignition ON, observe the scan tool MAP Sensor data parameter. Engine running, verify the scan tool MAP Sensor data parameter changes.
2.
    - If the MAP data parameter does not change, refer to DTC P0107 or P0108 for further diagnosis.
3. Verify no vacuum leak exists.
4.
    - If a vacuum leak does exist, repair as necessary.
5. DTCs P2104, P2105, P2106, and P2110 are informational DTCs. Correct the throttle actuator control (TAC) system DTCs that are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
6. Operate the vehicle within the conditions for running the DTC to verify the DTC does not reset. You may also operate the vehicle within the conditions that you observed from the freeze frame/failure records data.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for ECM replacement, setup and programming

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2122, P2123, P2127, P2128, or P2138

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

DTCâ€‰P2122

Accelerator Pedal Position (APP) Sensorâ€‰1 Circuit Low Voltage

DTCâ€‰P2123

Accelerator Pedal Position (APP) Sensorâ€‰1 Circuit High Voltage

DTCâ€‰P2127

Accelerator Pedal Position (APP) Sensorâ€‰2 Circuit Low Voltage

DTCâ€‰P2128

Accelerator Pedal Position (APP) Sensorâ€‰2 Circuit High Voltage

DTCâ€‰P2138

Accelerator Pedal Position (APP) Sensorsâ€‰1-2 Not Plausible

Diagnostic Fault Information

Circuit	Short to Ground	High Resistance	Open	Short to Voltage	Signal Performance
APP Sensorâ€‰1 5â€‰V Reference	P06A3	P2138	P2122	P06A3	P2138
APP Sensorâ€‰2 5â€‰V Reference	P0107, P0697	P2138	P2127	P0106, P0108, P0697	P2138
APP Sensorâ€‰1 Signal	P2122	P2138	P2122	P2123	P2138
APP Sensorâ€‰2 Signal	P2127	P2138	P2127	P2128	P2138
APP Sensorâ€‰1 Low Reference	â€”	P2138	P2123	â€”	P2138
APP Sensorâ€‰2 Low Reference	â€”	P2138	P2128	â€”	P2138

Typical Scan Tool Data

APP Sensorâ€‰1

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating at idle. **Parameter Normal Range:** APP Sensorâ€‰1 0.88â€“1.08â€‰V			
APP Sensorâ€‰1 5â€‰V Reference	0.00â€‰V	0.00â€‰V	2â€“4â€‰V
APP Sensorâ€‰1 Signal	0.00â€‰V	0.00â€‰V	4â€“5â€‰V
APP Sensorâ€‰1 Low Reference	â€”	4â€“5â€‰V	â€”

APP Sensorâ€‰2

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: The engine is operating at idle. **Parameter Normal Range:** APP Sensorâ€‰2 0.39â€“0.59â€‰V			
APP Sensorâ€‰2 5â€‰V Reference	0.00â€‰V	0.00â€‰V	1â€“3â€‰V
APP Sensorâ€‰2 Signal	0.00â€‰V	0.00â€‰V	2â€“5â€‰V

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Circuit	Short to Ground	Open	Short to Voltage
APP Sensorâ€‰2 Low Reference	â€”	4â€“5â€‰V	â€”

Circuit/System Description

The accelerator pedal assembly contains 2â€‰accelerator pedal positionâ€‰(APP) sensors. The APP sensors are mounted to the accelerator pedal assembly and are not serviceable. The APP sensors provide a signal voltage that changes relative to pedal position. The engine control moduleâ€‰(ECM) supplies each APP sensor with a 5â€‰V reference circuit, a low reference circuit, and a signal circuit.

Conditions for Running the DTC

P2122, P2123, P2127, P2128

- DTCâ€‰P0697 and P06A3 are not set.
- The ignition is ON or the engine is running.
- The run/crank or powertrain relay voltage is greater than 6.0â€‰V and reduced power is not active.
- DTCâ€‰P2122, P2123, P2127, P2128 run continuously when the above conditions are met.

P2138

- DTCâ€‰P0697, P06A3, P2122, P2123, P2127, and P2128 are not set.
- The ignition is ON or the engine is running.
- The run/crank or powertrain relay voltage is greater than 6.0â€‰V and reduced power is not active.
- DTCâ€‰P2138 runs continuously when the above conditions are met.

Conditions for Setting the DTC

P2122

The ECM detects the APP sensorâ€‰1 voltage is less than 0.46â€‰V for greater than 1â€‰s.

P2123

The ECM detects the APP sensorâ€‰1 voltage is greater than 4.75â€‰V for greater than 1â€‰s.

P2127

The ECM detects the APP sensorâ€‰2 voltage is less than 0.32â€‰V for greater than 1â€‰s.

P2128

The ECM detects the APP sensorâ€‰2 voltage is greater than 2.6â€‰V for greater than 1â€‰s.

P2138

The ECM detects the voltage difference between APP sensorâ€‰1 and APP sensorâ€‰2 exceeds a predetermined value for greater than 1â€‰s.

Action Taken When the DTC Sets

- DTCsâ€‰P2122, P2123, P2127, P2128, and P2138 are Typeâ€‰A DTCs.
- 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

DTCsâ€‰P2122, P2123, P2127, P2128, and P2138 are Typeâ€‰A DTCs.

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Diagnostic Aids

A high resistance condition on the accelerator pedal sensor circuits could cause a DTC to set.

Ensure that the in-line harness connector seals are installed correctly. Improper installation could result in water intrusion into the connector and cause a DTC to set.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

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 DTCâ€‰P0642, P0643, P0652 or P0653 is not set.
3.
    - **If a DTC is set**
    - Refer to DTC P0642, P0643, P0652, or P0653 for further diagnosis.
4.
    - **If no DTC is set**
5. Verify the scan tool APP Sensorâ€‰1 Circuit Status and APP Sensorâ€‰2 Circuit Status parameters display OK.
6.
    - **If OK is not displayed**
    - Refer to Circuit/System Testing.
7.
    - **If OK is displayed**
8. Verify the scan tool APP Sensorâ€‰1 and 2 Agree/Disagree parameter displays Agree while performing the tests listed below:
9.
    - Rapidly depress the accelerator pedal from the rest position to the wide open throttle position (WOT) and release pedal. Repeat the

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- 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.

10.
    - **If Disagree**
    - Refer to Circuit/System Testing
11.
    - **If Agree**
12. Verify that DTCâ€‰P2122, P2123, 2127, P2128, or P2138 is not set.
13.
    - **If a DTC is set**
    - Refer to Circuit/System Testing
14.
    - **If no DTC is set**
15. 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.
16. Verify the DTC does not set.
17.
    - **If the DTC sets**
    - Refer to Circuit/System Testing
18.
    - **If the DTC does not set**
19. All OK

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B107â€‰Accelerator Pedal Position Sensor. It may take up to 2â€‰minutes for all vehicle systems to power down.
2. Test for less than 5â€‰â„¦ between the appropriate low reference circuit terminal listed below and ground.
3.
    - APP sensorâ€‰1 low reference circuit terminalâ€‰4
    - APP sensorâ€‰2 low reference circuit terminalâ€‰3
4.
    - **If 5â€‰â„¦ or greater**
5.
    1. Ignition OFF, disconnect the harness connector at the K20â€‰â€‰Engine Control Module.
    2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.

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- If less than 2â€‰â„¦, replace the K20â€‰â€‰Engine Control Module.

6.

- **If less than 5â€‰â„¦**

7. Ignition ON.
8. Test for 4.8â€“5.2â€‰V between the appropriate 5â€‰V reference circuit terminal listed below and ground.
9.

- APP sensorâ€‰1 5â€‰V reference circuit terminalâ€‰6
- APP sensorâ€‰2 5â€‰V reference circuit terminalâ€‰1

10.

- **If less than 4.8â€‰V**

11.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the 5â€‰V reference circuit and ground.
3.

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

4.

- If infinite resistance

5. Test for less than 2â€‰â„¦ in the 5â€‰V reference circuit end to end.
6.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

12.

- **If greater than 5.2â€‰V**

13.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for less than 1â€‰V between the 5â€‰V reference circuit and ground.
3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

14.

- **If between 4.8â€“5.2â€‰V**

15. Verify the scan tool APP sensorâ€‰1 and APP sensorâ€‰2 voltage parameters are less than 0.3â€‰V.
16.

- **If 0.3â€‰V or greater**

17.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.

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2. Test for less than 1â€‰V between the signal circuit terminal listed below and ground.

18.

- APP sensorâ€‰1 signal circuit terminalâ€‰5
- APP sensorâ€‰2 signal circuit terminalâ€‰2

19.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V, replace the K20â€‰Engine Control Module.

20.

- **If less than 0.3â€‰V**

21. Install a 3â€‰A fused jumper wire between the appropriate signal circuit terminal listed below and the 5â€‰V reference circuit terminalâ€‰6 or 1.

22.

- APP sensorâ€‰1 signal circuit terminalâ€‰5
- APP sensorâ€‰2 signal circuit terminalâ€‰2

23. Verify the scan tool APP sensorâ€‰1 or APP sensorâ€‰2 voltage parameter is greater than 4.8â€‰V.

24.

- **If 4.8â€‰V or less**

25.

1. Ignition OFF, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the signal circuit terminal and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 2â€‰â,¦ in the signal circuit end to end.
6.
   - If 2â€‰â,¦ or greater, repair the open/high resistance in the circuit.
   - If less than 2â€‰â,¦, replace the K20â€‰Engine Control Module.

26.

- **If greater than 4.8â€‰V**

27. Test or replace the B107â€‰â€‰Accelerator Pedal Position Sensor.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Accelerator Pedal Position Sensor Replacement
- Control Module References for engine control module replacement, programming, and setup

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2183-P2185

Symptoms

Diagnostic Trouble Codes - P2184

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

DTCâ€‰P2183

Engine Coolant Temperature (ECT) Output Circuit High Temperature

DTCâ€‰P2184

Engine Coolant Temperature (ECT) Output Circuit Short to Ground

DTCâ€‰P2185

Engine Coolant Temperature (ECT) Output Circuit Short to Battery

DTCâ€‰P0117â€‰00

Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

DTCâ€‰P0118â€‰00

Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	P2184	P2185	P2185	P2183
Low Reference	â€”	P2185	â€”	â€”

Typical Scan Tool Data

ECT Sensor

Circuit	Short to Ground	Open	Short to Voltage
Operating Conditions: Engine operating in Closed Loop. **Parameter Normal Range:** â^’39 to +139Â°C (â^’38 to +282Â°F) Varies with coolant temperature.			
Signal	139Â°C (282Â°F)	â^’40Â°C (â^’40Â°F)	â^’40Â°C (â^’40Â°F)
Low Reference	â€”	â^’40Â°C (â^’40Â°F)	â^’40Â°C (â^’40Â°F)

Circuit/System Description

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

The following table illustrates the difference between temperature, resistance, and voltage:

ECT	ECT Resistance	ECT Signal Voltage
Cold	High	High

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ECT	ECT Resistance	ECT Signal Voltage
Warm	Low	Low

Conditions for Running the DTC

- The ignition is ON.
- The engine speed is greater than 1â€‰000â€‰RPM.

Conditions for Setting the DTC

DTCâ€‰P2183

The ECM detects large step changes or sensor stuck in mid range of the ECT signal.

DTCâ€‰P2184

The ECM detects the ECT voltage is below the threshold.

DTCâ€‰P2185

The ECM detects the ECT voltage is above the threshold.

Action Taken When the DTC Sets

DTCsâ€‰P2183, P2184 and P2185 are Type B DTCs.

Conditions for Clearing the DTC

DTCsâ€‰P2183, P2184 and P2185 are Type B DTCs.

Diagnostic Aids

- Test the ECT sensor at various temperature levels in order to evaluate the possibility of a skewed sensor. A skewed sensor can result in a DTC or a driveability condition. Refer to Temperature Versus Resistance.
- If the engine has sat overnight, the intake air temperature (IAT) sensor and the ECT sensor values should display within 3Â°C (5Â°F).
- After starting a cold engine, the ECT sensor temperature should rise steadily, then stabilize after the thermostat opens.
- High resistance in the circuits of either the ECT or IAT sensor may set a DTC.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

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Circuit/System Verification

1. Ignition ON, verify that no other DTCs are set.
2.
   - **If any other DTCs are set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle.
3.
   - **If none DTC is set**
4. Engine running for 60â€‰s, verify the DTC information. DTCsâ€‰P2184 or P2185 should not set.
5.
   - **If the DTCsâ€‰P2184 or P2185 are set**
   - Refer to Circuit/System Testing.
6.
   - **If the DTCsâ€‰P2184 or P2185 are not set**
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 the DTC do not set.
9.
   - **If the DTCsâ€‰P2184 or P2185 are set**
   - Refer to Circuit/System Testing
10.
    - **If the DTCsâ€‰P2184 or P2185 are not set**
11. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the B34â€‰Engine Coolant Temperature Sensor.
2. Ignition OFF, test for less than 10â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
3.
   - **If 10â€‰â„¦ or greater**
4.
   1. Disconnect the X2â€‰harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 2â€‰â„¦ in the low reference circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
5.
   - **If less than 10â€‰â„¦**
6. Ignition ON, verify the scan tool ECT Sensor is at â°’40Â°C (â°’40Â°F).

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7.

- **If greater than â^'40Â°C (â^'40Â°F)**

8.

1. Disconnect the X2â€‰harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the signal circuit terminalâ€‰1 and ground.
3.

- If less than infinite resistance, repair the short to ground on the circuit.
- If infinite resistance, replace the K20â€‰Engine Control Module.

9.

- **If less than â^'40Â°C (â^'40Â°F)**

10. Note**:**

    If the fuse in the jumper wire opens, the signal circuit is shorted to a voltage and the sensor may be damaged.

11. Ignition ON, connect a 3â€‰A fused jumper wire between the signal circuit terminalâ€‰1 and ground. Verify the scan tool ECT Sensor parameter is greater than 136Â°C (277Â°F).

12.

- **If less than 136Â°C (277Â°F)**

13.

1. Disconnect the X2â€‰harness connector at the K20â€‰Engine Control Module.
2. Test for less than 1â€‰V between the signal circuit terminalâ€‰1 and ground.
3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.

4.

- If less than 1â€‰V

5. Test for less than 2â€‰â„¦ in the signal circuit end to end.
6.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

14.

- **If greater than 136Â°C (277Â°F)**

15. Test or replace the B34â€‰Engine Coolant Temperature Sensor.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the B34â€‰Engine Coolant Temperature Sensor.
2. Test and record the resistance between the signal circuit terminalâ€‰1 and the low reference circuit terminalâ€‰2 at various ambient temperatures. Compare those measurements to the Temperature Versus Resistance table and verify that the resistance is within 5% of the specification.

3.

- **If not within the 5% of resistance**

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- Replace the B34â€‰Engine Coolant Temperature Sensor.

4.
   - **If within the 5% of resistance**
5. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for ECM replacement, programming and setup.

Related Part Information

Part Name	Catalog Name	Part Code

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2186

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

DTCâ€‰P2186

Engine Coolant Temperature (ECT) Sensor 2 Circuit Erratic

Circuit/System Description

The engine coolant temperature (ECT) Sensor 2, located at the radiator is a variable resistor that measures the temperature of the engine coolant. The ECM supplies 5 V to the ECT sensor signal circuit and a ground for the low reference circuit. The ECM compares the temperature values from the ECT Sensor 2 with stored values. The purpose of this diagnostic is to analyze the performance of the thermostat.

Conditions for Running the DTC

- The ignition is ON.
- The battery voltage is between 10â€“16â€‰V.
- The DTC runs continuously when the above conditions are met.

Conditions for Setting the DTC

The ECM detects the radiator coolant temperature is greater than 5.25Â°C (41.45Â°F).

Action Taken When the DTC Sets

DTCâ€‰P2186 is a Type Bâ€‰DTC.

Conditions for Clearing the DTC

DTCâ€‰P2186 is a Type Bâ€‰DTC.

Diagnostic Aids

- If the condition is intermittent, allowing the vehicle to sit for greater than 8 hours with the ignition OFF, may help isolate the condition. Compare the scan tool ECT sensor 1, ECT sensor 2, and IAT sensor temperature values at Ignition ON. The ECT sensor 1, ECT sensor 2 and IAT sensor values should display within 3Â°C (37Â°F).
- A resistance condition in the ECT sensor circuits may cause this DTC. 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

Connector End View Reference

Component Connector End Views

Description and Operation

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Cooling System 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. Verify the cooling system is filled to the correct coolant level. Refer to Cooling System Leak Testing and Cooling System Draining and Filling.
2.
   - **If the coolant level is not correct**
   - Repair as necessary
3.
   - **If the coolant level is correct**
4. Ignition ON
5. Verify DTC P0117, P0118, P2184, or P2185 are not set.
6.
   - **If any of the DTCs are set**
   - Refer to Diagnostic Trouble Code (DTC) List - Vehicle
7.
   - **If none of the DTCs are set**
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.
10.
    - **If the DTC sets**
    - Refer to Component Testing.
11.
    - **If the DTC does not set**
12. All OK.

Component Testing

Static Test

1. Ignition OFF, disconnect the harness connector at the B34Bâ€‰Engine Coolant Temperature Sensor 2.
2. Note**:**

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

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3. Test the B34Bâ€‰Engine Coolant Temperature Sensor 2 by varying the sensor temperature while monitoring the sensor resistance. Compare the readings with the Temperature Versus Resistance - Engine Coolant Temperature Sensor table and verify that the resistance is within 5% of the specification.
4.
    - If not within the specified range, replace the B34Bâ€‰Engine Coolant Temperature Sensor 2.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Engine Coolant Temperature Sensor Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

DTC P2300, P2301, P2303, P2304, P2306, P2307, P2309, or P2310

Diagnostic Instructions

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

DTC Descriptor

Ignition Coil 1 Control Circuit Low Voltage

Ignition Coil 1 Control Circuit High Voltage

Ignition Coil 2 Control Circuit Low Voltage

Ignition Coil 2 Control Circuit High Voltage

Ignition Coil 3 Control Circuit Low Voltage

Ignition Coil 3 Control Circuit High Voltage

Ignition Coil 4 Control Circuit Low Voltage

Ignition Coil 4 Control Circuit High Voltage

Diagnostic Fault Information

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

Circuit/System Description

For an overview of the component/system, refer to: Electronic Ignition System Description

Circuit	Description
Control	The output circuit is switched to ground to activate the component.
Ground	Chassis Ground

Component	Description
K20 Engine Control Module	The control module controls a series of actuators to ensure optimal engine performance. The control module does this by reading values from a variety of sensors, interprets the data and adjusts the engine actuators accordingly.
T8 Ignition Coil	The ignition system on this engine uses ignition coils with integrated power transistors.

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

Conditions for Running the DTC

- Engine = Cranking or Running
- Ignition Voltage = Greater than 11 V

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

Conditions for Setting the DTC

Control Circuit = Commanded state does not match the actual state

Actions Taken When the DTC Sets

DTCs listed in the DTC Descriptor Category = Type A> DTC

Conditions for Clearing the DTC

DTCs listed in the DTC Descriptor Category = Type A> DTC

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References

Special Tools

<sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>

Equivalent regional tools: Special Tools

Circuit/System Verification

1. Engine >> Running
2. Verify the scan tool parameter:
3.
    - Ignition Coil 1â€“4ntrol Circuit High Voltage Test Status = OK or Not Run
    - Ignition Coil 1â€“4ntrol Circuit Low Voltage Test Status = OK or Not Run
    - Ignition Coil 1â€“4ntrol Circuit Open Test Status = OK or Not Run
4.
    - **If not the specified state**

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- Refer to: Circuit/System Testing

5.

- **If the specified state**

6. Verify the scan tool parameter:

7.

- Ignition Coil 1â€“4ntrol Circuit High Voltage Test Status = OK or Not Run
- Ignition Coil 1â€“4ntrol Circuit Low Voltage Test Status = OK or Not Run
- Ignition Coil 1â€“4ntrol Circuit Open Test Status = OK or Not Run

8.

- Perform the action while monitoring the parameter:

9.

- Wiggle the harness and connector: T8 Ignition Coil
- Wiggle the harness and connector: K20 Engine Control Module

10.

- **If not the specified state**
- Repair as necessary >> Wiring / Terminal(s) / Electrical Connector(s)

11.

- **If the specified state**

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.
14.

- **If the DTC sets**
- Refer to: Circuit/System Testing

15.

- **If the DTC is not set**

16. All OK.

Circuit/System Testing

1. Note **:**

   It may take up to 2> min for all vehicle systems to power down before an accurate ground or low reference circuit continuity test can be performed.

2. Ignition/Vehicle & All vehicle systems >> Off
3. Disconnect the appropriate electrical connector: T8 Ignition Coil
4. Test for less than 10 Ω between the test points: Ground circuit terminal 1/A & Ground
5.

- **If 10 Ω or greater**

6.

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1. Disconnect the ground connection: Ground terminal
2. Test for less than 2> Ω between the test points: Ground circuit terminal 1/A @ Component harness & The other end of the circuit @ Ground terminal
3.
    - 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.

7.
    - **If less than 10 Ω**

8. Ignition >> On / Vehicle >> In Service Mode
9. Verify a test lamp does not turn On between the test points: Control circuit terminal 3/C & B+
10.
    - **If the test lamp turns On**

11.
    1. Ignition/Vehicle >> Off & Remove >> Test lamp
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for infinite resistance between the test points: Control circuit terminal 3/C @ Component harness & Ground
    4.
        - If less than infinite resistance >> Repair the short to ground on the circuit.
        - If infinite resistance >> Replace the component: K20 Engine Control Module

12.
    - **If the test lamp does not turn On**

13. Remove >> Test Lamp
14. Engine >> Running
15. Verify the scan tool parameter: Ignition Coil 1â€“6ntrol Circuit High Voltage Test Status = OK or Not Run
16.
    - **If not the specified state**

17.
    1. Ignition/Vehicle >> Off
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for less than 1> V between the test points:Control circuit terminal 3/C @ Component harness & Ground
    4.
        - If 1> V or greater >> Repair the short to voltage on the circuit.
        - If less than 1> V >> Replace the component: K20 Engine Control Module

18.
    - **If the specified state**

19. Ignition/Vehicle >> Off

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20. Connect a 3> A fused jumper wire between the test points:Control circuit terminal 3/C & Ignition circuit terminal 4/D
21. Engine >> Running
22. Verify the scan tool parameter: Ignition Coil 1â€“6ntrol Circuit High Voltage Test Status = OK or Not Run
23.
    - **If not the specified state**
24.
    1. Ignition/Vehicle >> Off & Remove >> Jumper wire(s)
    2. Disconnect the electrical connector: K20 Engine Control Module
    3. Test for less than 2> Ω between the test points:Control circuit terminal 3/C @ Component harness & The other end of the circuit @ Control module harness
    4.
        - If 2> Ω or greater >> Repair the open/high resistance in the circuit.
        - If less than 2> Ω >> Replace the component: K20 Engine Control Module
25.
    - **If the specified state**
26. Test or replace the component: T8 Ignition Coil

Component Testing

1. Note **:**

   Circuit/System Testing must be performed before proceeding with Component Testing.
2. Ignition/Vehicle >> Off
3. Remove the appropriate component: T8 Ignition Coil - Leave the electrical connector connected.
4. Install the special tool: <sptool><sptool-no>J-26792</sptool-no><sptool-desc>Ignition Spark Tester</sptool-desc></sptool>
5. Engine >> Running
6. Note **:**

   An erratic or weak spark is considered a no spark condition.
7. Verify there is spark at the tool.
8.
    - **If there is no spark**
    - Replace the component: T8 Ignition Coil
9.
    - **If there is spark**
10. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

- Ignition Coil Replacement
- For control module replacement, programming, and setup refer to: Control Module References

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 covers 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

The 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 1,500â€‰RPM or 48â€‰km/h (30â€‰mph). The exhaust has a steady spitting sound at idle or at low speed.

Detonation/Spark Knock

A mild to severe ping which usually occurs worse while under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

Dieseling, Run-On

The engine continues to run after the key is turned OFF, but runs very rough.

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.

Fuel Odor

A noticeable smell of unburned fuel.

Hard Start

The engine cranks OK, but does not start for a long time. The vehicle does eventually run, or may start but immediately stall.

Hesitation, Sag, Stumble

A 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 vehicle 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

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The engine runs unevenly at idle. If severe, the engine or the vehicle may shake. Engine idle speed may vary. Either condition may be severe enough to stall the engine.

Surges/Chuggles

An 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 resistanceâ€”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.

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- Inspect the air intake ducts for the following conditions:
-
    - Collapsed
    - Damaged areas
    - Looseness
    - Incorrect installation
    - Leaking
- 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 the fuel system for the following:
-
    - The fuel system for correct operation and pressureâ€”Refer to Fuel System Diagnosis.
    - Improperly operating fuel injectorsâ€”Refer to Fuel Injector Diagnosis.
    - Improper fuel quality conditionâ€”Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
- Test the ignition system for the following:
-
    - Spark plugs with incorrect heat range or an abnormal conditionâ€”Refer to Spark Plug Inspection and Ignition System Specifications.
    - Coolant or oil fouled spark plugs.
    - 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 *J 26792* Spark Testerâ€”Refer to Electronic Ignition System Diagnosis.
- Inspect for the following conditions:
-
    - Improper operation of the transmission torque converter clutch (TCC) â€” The scan tool should indicate an engine speed drop when the TCC is commanded ON.
    - Improper operation of the A/C compressor
    - An engine that runs lean or richâ€”Observe the Fuel Trim parameters with a scan tool. Refer to DTC P0171 or P0172.
    - Slow responding heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions.
    - Caution:

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Refer to Heated Oxygen and Oxygen Sensor Caution.

- Water intrusion in the HO2S connector
- Engine oil contaminated by fuel
- Split or kinked vacuum hosesâ€”Verify that the routing and connections are as shown on the Vehicle Emission Control Information label.
- Excessive knock sensor system spark retard activityâ€”Observe the Knock Retard parameter on the scan tool for activity more than 0Â°.
- Electromagnetic interference (EMI) on the reference circuit, which may cause a misfire condition. You can usually detect EMI 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 EMI is present. Inspect the high voltage components near the ignition control circuit if a condition exists.
- A stuck open evaporative emission (EVAP) canister purge solenoid.
- A crankshaft position sensor with an intermittent conditionâ€”Observe the scan tool Crankshaft Position Resync Counter parameter. The Resync Counter parameter should remain at 0 during all operating conditions, and when moving the related harnesses and connectors between the crankshaft position sensor and the ECM.

- Inspect the exhaust system components for the following:
-
  - Physical damage or possible internal failure
  - Restricted three-way catalytic converters
  - For more information, refer to Symptoms - Engine Exhaust.
- Inspect the engine cooling system for the following conditions:
-
  - A thermostat with incorrect heat range. Refer to Thermostat Diagnosis.
  - Improper engine coolant levelâ€”If the level is low, refer to Loss of Coolant.
- Inspect the engine for the following mechanical failures:
- Refer to Symptoms - Engine Mechanical.
-
  - Excessive oil in the combustion chamber or leaking valve seals
  - Oil Consumption
  - Incorrect cylinder compression
  - Sticking or leaking valves
  - Worn camshaft lobes
  - Incorrect valve timing
  - Worn rocker arms
  - Broken valve springs
  - Excessive carbon buildup in the combustion chambersâ€”Clean the chambers with top engine cleaner, if necessary. Follow the instructions on the can.
  - Incorrect engine parts
- If the above conditions do not address the symptom, refer to the additional symptoms tests.

Additional Symptoms Tests

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Detonation/Spark Knock

- Test for an engine overheating condition. Refer to Engine Overheating.
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the reading to that parameter listed on the Engine Control Module Scan Tool Information list. If the reading is not in the range specified in the list, 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. Refer to Engine Coolant Temperature Sensor Replacement If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- 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. If equipped with the driver information center feature, a reduced engine power message may be displayed as well. A DTC may not be set.

A repair may not be necessary. Observe the scan tool Reduced Engine Power History parameter or refer to K20 Engine Control Module: Scan Tool Information to determine the reason for the reduced engine power event.

Verify or inspect for the following:

- Vehicle being operated at sustained high engine speeds, or, towing heavy loads up an incline for an extended period of time, which may cause the engine oil or coolant to overheat. Inspect the airflow passageways in front of the engine for obstructions and clear away any debris or foreign material that is found. If no obstructions are found, review approved driving habits with the customer. The customer may need to operate the vehicle at a higher engine speed to improve cooling system performance, or, at a slower engine speed to reduce engine load.
- A cooling fan condition which may cause the engine control module to reduce engine power. Refer to Cooling Fan Description and Operation and Cooling System Description and Operation to verify correct operation of the cooling fan.
- High pressure fuel system condition. Refer to Fuel System Diagnosis and Fuel System Description to verify high pressure fuel system operation and pressure.
- Fuel temperature out of range too high.
- If equipped with manual transmission, reduced engine power caused by transmission oil temperature that is out of range too high. Allow the transmission and transmission oil to cool down.

Fuel Odor

- Inspect for a saturated EVAP canisterâ€”Refer to Evaporative Emission Control System Description.
- Inspect for leaking, damaged, or deteriorated fuel lines.
- Inspect for a condition with the internal components of the fuel tank assemblyâ€”Refer to Fuel System Description.

Hard Start

- Verify that the fuel system has adequate pressure for engine start-up. Refer to Fuel System Description and Fuel System Diagnosis.
- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value of 90â€‰% may indicate an excessive accumulation of carbon deposits in the throttle bore. Inspect the throttle body and bore and clean, if necessary.
- 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 3Â°C (5Â°F). If the ECT sensor is out of range with the IAT sensor, test the resistance of the ECT sensor. Refer to Temperature Versus Resistance - Engine Coolant Temperature Sensor for resistance specifications. Replace the ECT sensor if the resistance is not within specification. Refer to Engine Coolant Temperature Sensor ReplacementIf the sensor is within the specifications, test the ECT sensor circuits for high resistance.
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor.

Hesitation, Sag, Stumble

- Test the fuel pressure. Refer to Fuel System Diagnosis.

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- Test the generator. Refer to Symptoms - Engine Electrical. Repair the charging system if the generator output voltage is less than 9â€‰V or more than 16â€‰V.
- Inspect for excessive crankshaft endplay that will cause the crankshaft position sensor reluctor wheel to move out of alignment with the crankshaft position sensor.
- Test the manifold absolute pressure (MAP) sensor. Refer to DTC P0106.
- 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 0â€‰degrees to 20â€‰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 2â€‰degrees in each of the commanded states.
-
  - If any of the parameters is greater than 2â€‰degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage.

  Lack of Power, Sluggishness, or Sponginess
- Inspect the engine electrical system for correct operation. Refer to Symptoms - Engine Electrical.
- Verify that each injector harness is connected to the correct injector.
- 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 0â€‰degrees to 20â€‰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 2â€‰degrees in each of the commanded states.
-
  - If any of the parameters is greater than 2â€‰degrees, inspect the suspect camshaft actuator and camshaft actuator solenoid valve and valve bore for contamination, obstruction, and damage.

  Poor Fuel Economy
- Inspect for heavy loads being carried or towed
- Inspect for acceleration rate too much or too often
- Inspect the brake system for brake drag.
- Inspect for incorrect operation of the speedometer.
- Verify that the engine coolant temperature (ECT) has not shifted in value. Allow the engine to run and reach operating temperature. Observe the ECT Sensor parameter with a scan tool and compare the reading to that parameter listed on the Engine Control Module Scan Tool Information list. If the reading is not in the range specified in the list, 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. Refer to Engine Coolant Temperature Sensor Replacement If the sensor is within the specification, test the ECT sensor circuits for high resistance.
- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value of 90â€‰% may indicate an excessive accumulation of carbon deposits in the throttle bore. Inspect the throttle body and bore and clean, if necessary.

  Rough, Unstable, or Incorrect Idle and Stalling
- Observe the Throttle Body Idle Airflow Compensation parameter with a scan tool. A value of 90â€‰% may indicate an excessive accumulation of carbon deposits in the throttle bore. Inspect the throttle body and bore and clean, if necessary.
- Inspect for loose, worn engine mounts.
- Inspect the intake and exhaust manifolds for casting flash.
- An excessively high idle may be due to the floor mat interfering with the accelerator pedal. With this condition present, it may not be

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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.

Surges/Chuggles

- Verify that each injector harness is connected to the correct injector.
- Inspect for slow responding heated oxygen sensors (HO2S). The HO2S should respond quickly to a change in throttle position. If the HO2S do not respond to different throttle positions, inspect for contamination from fuel, silicon, or the incorrect use of RTV 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 PCM reduces the amount of fuel delivered to the engine, causing a driveability condition.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Malfunction Indicator Lamp (MIL) Diagnosis

Diagnostic Instructions

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

Circuit/System Description

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

Diagnostic Aids

If the condition is intermittent, move the related harnesses and connectors while monitoring the scan tool MIL control circuit status parameters. Perform this test with the ignition ON and the engine OFF, and with the engine running. The MIL control circuit status parameters change from OK or Not Run to Malfunction if there is a condition with a circuit or a connection.

Reference Information

Schematic Reference

- Engine Controls Schematics
- Instrument Cluster Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

Note:

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

1. Ignition ON.
2. Verify the parameters listed below do not display Malfunction when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
3.
    - The MIL Control Circuit Low Voltage Test Status

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- The MIL Control Circuit Open Test Status
- The MIL Control Circuit High Voltage Test Status

4.
   - **If Malfunction is displayed**
   - Refer to Circuit/System Testing
5.
   - **If Malfunction is not displayed**
6. Engine running.
7. Verify the parameters listed below do not display Malfunction when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
8.
   - The MIL Control Circuit Low Voltage Test Status
   - The MIL Control Circuit Open Test Status
   - The MIL Control Circuit High Voltage Test Status
9.
   - **If Malfunction is displayed**
   - Refer to Circuit/System Testing
10.
    - **If Malfunction is not displayed**
11. Verify the malfunction indicator lamp turns ON and OFF when commanding the Malfunction Indicator Lamp On and Off with a scan tool.
12.
    - **If the malfunction indicator lamp does not turn ON and OFF**
    - Refer to Circuit/System Testing
13.
    - **If the malfunction indicator lamp turns ON and OFF**
14. All OK.

Circuit/System Testing

1. Ignition OFF.
2. Disconnect the X1 harness connector at the K20â€‰Engine Control Module.
3. Ignition ON, verify the malfunction indicator lamp does not illuminate.
4.
   - **If the malfunction indicator lamp illuminates**
5.
   1. Test for infinite resistance between the control circuit terminalâ€‰X1â€‰1 and ground.
   2.
      - If less than infinite resistance, repair the short to ground in the circuit.
      - If infinite resistance, replace the P16â€‰Instrument Cluster.

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6.

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

7. Connect a 3â€‰A fused jumper wire between the control circuit terminalâ€‰X1â€‰1 and ground.
8. Verify the malfunction indicator lamp illuminates.
9.

- **If the malfunction indicator lamp illuminates**
- Replace the K20â€‰Engine Control Module.
- **If the malfunction indicator lamp does not illuminate**

10.

1. Test for less than 1â€‰V between the control circuit terminalâ€‰X1â€‰1 and ground.
2.

- If 1â€‰V or greater, repair the short to voltage on the circuit.

3.

- If less than 1â€‰V

4. Ignition OFF.
5. Test for less than 2â€‰â„¦ in the control circuit end to end.
6.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.

7.

- If less than 2â€‰â„¦.

11. Ignition OFF, disconnect the harness connector at the instrument cluster.
12. Ignition ON, verify a test lamp illuminates between the ignition voltage circuit terminalâ€‰31 and ground.
13.

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

14.

1. Ignition OFF.
2. Test for infinite resistance between the ignition voltage circuit and ground.
3.

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

15.

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

16.

1. Ignition OFF.
2. Test for less than 2â€‰â„¦ in the ignition voltage circuit end to end.
3.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.

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17.

- **If the test lamp illuminates**

18. Replace the P16â€‰Instrument Cluster.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Instrument Cluster Replacement
- Control Module References for control module replacement, programming, and setup

Related Part Information

Part Name	Catalog Name	Part Code
Malfunction Indicator Lamp	LAMP,MALFUNCTION IND	1575A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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.

This diagnostic assumes the system voltage levels are adequate for starter motor operation. Fuel level and fuel quality must be determined for correct diagnosis.

Diagnostic Aids

Inspect for any of the following conditions:

- Insufficient fuel can cause a no start condition. Thoroughly inspect the fuel delivery system for sufficient fuel volume to the fuel injectors. Inspect the fuel supply components for partial blockage or restrictions.
- Fuel injectors with partially blocked and restricted nozzles, or a malfunctioning solenoid, can cause a no start condition. Refer to Fuel Injector Diagnosis.
- There may be fuel spray at the fuel injectors and the indicated fuel pressure may be correct, yet there may not be enough fuel to start the engine. If the fuel injectors and the injector circuit are OK, and fuel spray is detected, the fuel injector ON time may be inadequate. If the engine control module (ECM) receives incorrect inputs from the various information sensors, the fuel delivered by the fuel injectors may be inadequate to start the engine. Check all the engine data parameters with a scan tool and compare the values indicated with the expected values or the values from a known vehicle in good condition.
- Check the crankshaft position sensor engine reference signal with a scan tool. Observe the engine speed parameter while cranking the engine. The scan tool should indicate a steady 200â€“300â€‰RPM while cranking. If erratic values, such as sudden spikes in the engine speed, are displayed, the engine reference signal is not stable enough for the engine to start and run properly.
- Inspect the engine for good secure electrical grounds.
- If the engine almost starts and then stalls, check for an open in the ground circuits of the crankshaft position sensor and the camshaft position sensor.
- Water or foreign material in the fuel can cause a no start or engine will not stay running condition. During freezing weather water can freeze inside the fuel system. The engine may start after 30â€‰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.
- A vehicle that starts and runs after being brought to the repair shop for a no start condition, may have an ignition system that is susceptible to moisture. Spray water on the ignition system components and the wiring in order to check for an engine starting or will not stay running concern.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Electrical Information Reference

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- 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
- *EL 26792* HEI Spark Tester
- *J 34730-405* Injector Test Lamp

For equivalent regional tools, refer to Special Tools.

Circuit/System Verification

Attempt to start the engine. The engine should start and run.

Circuit/System Testing

1. Crank the engine for up to 15â€‰s.
2. Verify that other DTCs are not set.
3.
    - If any other DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle.
4. Ignition ON, verify that the theft deterrent LED located in the instrument cluster is OFF.
5.
    - If the LED is ON, or blinking, refer to Symptoms - Theft Deterrent.
6. Ignition OFF for 90â€‰s, determine the current vehicle testing altitude. Ignition ON, verify that the scan tool manifold absolute pressure (MAP) sensor parameter is within the specified range indicated in the Altitude Versus Barometric Pressure table.
7.
    - If not within the specified range, test the B74 manifold absolute pressure sensor. Refer to DTC P0107 or P0108.
8. Ignition OFF, disconnect the harness connector at the fuel injector.
9. Engine cranking, verify the *J 34730-405* injector test lamp flashes between the control circuit and the ignition circuit.
10.
    - If the *J 34730-405* injector test lamp does not flash, refer to DTC P0261, P0262, P0264, P0265, P0267, P0268, P0270, or P0271.
11. Verify the engine speed parameter indicates current engine speed while cranking the engine.
12.
    - If engine speed is not indicated, refer to DTC P0335-P0337.
13. Install the *EL 26792* hei spark tester.
14. Crank the engine for 15â€‰s, verify that spark is observed from the *EL 26792* hei spark tester.
15.
    - If spark is not observed, refer to Electronic Ignition System Diagnosis.

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16. Command the fuel pump ON and OFF. Fuel pump should energize when commanded ON and de-energize when commanded OFF.
17.
    - If the fuel pump does not respond, refer to Fuel Pump Electrical Circuit Diagnosis.
18. Turn OFF the ignition.
19. Install the *CH 48027* digital pressure gauge or equivalent. Verify the fuel pressure is 384â€“425â€‰kPa (56â€“62â€‰psi) while commanding the fuel pump ON with a scan tool.
20.
    - If not within the specified range, refer to Fuel System Diagnosis.
21. Inspect for the following conditions:
22.
    - Compare the actual engine coolant temperature to the ECT parameter.
    - Air filter and air intake system for restrictions and obstructions
    - Test the fuel for contamination. Refer to Alcohol/Contaminants-in-Fuel Diagnosis.
    - Inspect the spark plug. Refer to Spark Plug Inspection.

Repair Verification

Perform the Diagnostic Repair Verification after completing the repair.

Spark Plug Replacement

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 2â€‰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 2â€‰seconds if ignition reference pulses cease to be detected and the ignition remains ON.

The fuel system is a returnless on â€“ 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 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

Scan Tool Reference

Control Module References for scan tool information

Special Tools

- *CHâ€‰41769* Fuel Line Quick Disconnect Tool
- *CHâ€‰48027* Digital Pressure Gauge
- *ENâ€‰37287* Fuel Line Shut-off Adapter
- *Jâ€‰42982* Fuel Pressure Gauge Adapter

For equivalent regional tools, refer to Special Tools.

Circuit/System Verification

Note:

- Inspect the fuel system for damage or external leaks before proceeding.

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- 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 CHâ€‰48027â€“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.
3.
    - **If the fuel pump does not turn ON and OFF**
    - Refer to Fuel Pump Electrical Circuit Diagnosis.
4.
    - **If the fuel pump does turn ON and OFF**
5. Ignition OFF, all accessories OFF, install a *Jâ€‰42982* Fuel Pressure Gauge Adapter and a *CHâ€‰48027* Gauge.
6. Ignition ON, engine OFF.
7. Command the Fuel Pump Relay On several times with a scan tool.
8. Verify the fuel pressure is between 276â€“345â€‰kPa (40â€“50â€‰psi) with the fuel pump running.
9.
    - **If less than 276â€‰kPa (40â€‰psi)**
    - Refer to Circuit/System Testing - Fuel Pressure Low.
10.
    - **If greater than 345â€‰kPa (50â€‰psi)**
    - Replace the G12 Fuel Pump.
11.
    - **If between 276â€“345â€‰kPa (40â€“50â€‰psi)**
12. Verify that the fuel pressure does not decrease more than 34â€‰kPa (5â€‰psi) in 1â€‰minute.
13.
    - **If greater than 34â€‰kPa (5â€‰psi)**
    - Refer to Circuit/System Testing - Fuel Pressure Leaks Down.
14.
    - **If less than 34â€‰kPa (5â€‰psi)**
15. Relieve the fuel pressure to 69â€‰kPa (10â€‰psi).
16. Verify that the fuel pressure does not decrease more than 14â€‰kPa (2â€‰psi) in 5â€‰min.
17.
    - **If greater than 14â€‰kPa (2â€‰psi)**
    - Replace the G12 Fuel Pump.
18.
    - **If less than 14â€‰kPa (2â€‰psi)**
19. Operate the vehicle within the conditions of the customer's concern while monitoring the fuel pressure with the *CHâ€‰48027* Gauge.

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20. Verify the fuel pressure does not drop off during acceleration, cruise or hard cornering.
21.
    - **If the fuel pressure drops off**
    - Refer to Circuit/System Testing - Fuel Pressure Drops Off.
22.
    - **If the fuel pressure does not drop off**
23. 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:
2.
    - Restricted fuel feed pipe
    - Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.
3.
    - **If a condition exists**
    - Repair as necessary.
4.
    - **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 *ENâ€‰37287* Adapter between the chassis fuel feed hose and the engine compartment fuel feed pipe.
3. Open the valve on the *ENâ€‰37287* Adapter.
4. Ignition ON, command the Fuel Pump Relay On with a scan tool and bleed the air from the *CHâ€‰48027* Gauge.
5. Command the Fuel Pump Relay On and then Off with a scan tool.
6. Close the valve on the *ENâ€‰37287* Adapter.
7. Verify that the fuel pressure does not decrease more than 34â€‰kPa (5â€‰psi) in 1â€‰min.
8.
    - **If greater than 34â€‰kPa (5â€‰psi)**
    - Locate and replace the leaking Q17 Fuel Injector.
9.
    - **If less than 34â€‰kPa (5â€‰psi)**
    - Replace the G12 Fuel Pump.

Fuel Pressure Drops Off

1. Verify none of the conditions listed below exist:
2.
    - Restricted fuel feed pipe

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- Restricted fuel feed pipe
- Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.

3.

- **If a condition exists**
- Repair as necessary.

4.

- **If none of the conditions exist**
- Replace the G12 Fuel Pump.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Injector Replacement
- Fuel Tank Fuel Pump Module Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Fuel Pump Electrical Circuit Diagnosis (LKY)

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Switch B+	*	**	â€”	â€”
Relay Coil Ground	P0628	P0627	â€”	â€”
Output Control	*	**	***	â€”
Relay Coil Control	P0628	P0627	P0629	â€”
Component Ground	â€”	**	â€”	â€”
* The fuel pump fuse opens and the engine cranks but does not run. ** The engine cranks but does not run. *** The fuel pump operates continuously and the battery will discharge.				

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.

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 fuel pump relay output control circuit.
- The fuel pump has an intermittent internal condition.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Fuel System Description

Electrical Information Reference

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

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Control Module References

Circuit/System Verification

1. Ignition ON.
2. Verify the KR23Aâ€‰Fuel Pump Relay turns on and off/clicks when commanding the Fuel Pump Relay On and Off with a scan tool.
3.
   - **If the Fuel Pump Relay does not turn on and off/clicks**
   - Refer to Circuit/System Testing.
4.
   - **If the Fuel Pump Relay turns on and off/clicks**
5. All OK.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the KR23Aâ€‰Fuel Pump Relay. It may take up to 2â€‰minutes for all vehicle systems to power down.
2. Test for less than 10â€‰â„¦ between the ground circuit terminalâ€‰86 and ground.
3.
   - **If 10â€‰â„¦ or greater**
4.
   1. Ignition OFF.
   2. Test for less than 2â€‰â„¦ in the ground circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, repair the open/high resistance in the ground connection.
5.
   - **If less than 10â€‰â„¦**
6. Ignition ON.
7. Verify a test lamp illuminates between the B+ circuit terminalâ€‰30 and ground.
8.
   - **If the test lamp does not illuminate and the circuit fuse is OK**
9.
   1. Ignition OFF, remove the test lamp.
   2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, verify the fuse is OK and there is voltage at the fuse.
10.
    - **If the test lamp does not illuminate and the circuit fuse is open**

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

11.

1. Ignition OFF, remove the test lamp.
2. Test for infinite resistance between the ignition circuit and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Disconnect the harness connector at the G16â€‰Fuel Pump.
6. Test for infinite resistance between the output control circuit terminalâ€‰87 and ground.
7.
   - If less than infinite resistance, repair the short to ground on the circuit.
8.
   - If infinite resistance
9. Connect the KR23Aâ€‰Fuel Pump Relay and install a new fuse.
10. Connect a test lamp between the output control circuit terminalâ€‰87 and ground, ignition ON.
11. Verify the test lamp turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.
12.
    - If the test lamp does not turn ON and OFF, replace the KR23Aâ€‰Fuel Pump Relay.
    - If the test lamp turns ON and OFF, test or replace the G16â€‰Fuel Pump.

12.

- **If the test lamp illuminates**

13. Connect a test lamp between the control circuit terminalâ€‰85 and the ground circuit terminalâ€‰86.
14. Verify the test lamp turns ON and OFF when commanding the Fuel Pump Relay On and Off with a scan tool.
15.

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

16.

1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module.
2. Test for infinite resistance between the control circuit and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Test for less than 2â€‰â„¦ in the control circuit end to end.
6.
   - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
   - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

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17.

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

18.

1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for less than 1â€‰V between the control circuit and ground.
3.

- If 1â€‰V or greater, repair the short to voltage on the circuit.
- If less than 1â€‰V , replace the K20â€‰Engine Control Module.

19.

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

20. Verify that a test lamp does not illuminate between the output control circuit terminalâ€‰87 and ground.

21.

- **If the test lamp illuminates**
- Repair the short to voltage on the output control circuit.

22.

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

23. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the G16â€‰Fuel Pump. It may take up to 2 minutes for all vehicle systems to power down.

24. Test for less than 10â€‰â„¦ between the G16â€‰Fuel Pump ground circuit terminalâ€‰2 and ground.

25.

- **If 10â€‰â„¦ or greater**

26.

1. Ignition OFF.
2. Test for less than 2â€‰â„¦ in the ground circuit end to end.
3.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, repair the open/high resistance in the ground connection.

27.

- **If less than 10â€‰â„¦**

28. Connect the harness connector at the G16â€‰Fuel Pump.

29. Ignition ON, connect a 15â€‰A fused jumper wire between the B+ circuit terminalâ€‰30 and the output control circuit terminalâ€‰87.

30. Verify the G16â€‰Fuel Pump is activated.

31.

- **If the G16â€‰Fuel Pump does not activate**

32.

1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the G16â€‰Fuel Pump.
2. Test for less than 2â€‰â„¦ in the output control circuit end to end.

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3.

- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, replace the G16â€‰Fuel Pump.

33.

- **If the G16â€‰Fuel Pump activates**

34. Replace the KR23Aâ€‰Fuel Pump Relay.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Fuel Tank Fuel Pump Module Replacement
- Relay Replacement.
- Control Module References for K20 Engine Control Module replacement, setup, and programming.

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Pump	PUMP,FUEL	SS129
Fuel Pump	PUMP KIT,FUEL	4790A
Fuel Pump	PUMP,FUEL	4795A
Fuel Pump	PUMP,FUEL	4800A
Fuel Pump	PUMP KIT,FUEL (ELEC)	4825Z
Fuel Pump	PUMP,FUEL (ELEC)	4826A
Fuel Pump	PUMP,FUEL (W/ FUEL HTR)	4838A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Fuel Pump Electrical Circuit Diagnosis (LC5, LMU)

Diagnostic Instructions

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

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Relay Switch B+	*	**	â€”	â€”
Relay Coil Ignition	P0628	P0628	P0563	â€”
Relay Switch Control	*	**	***	â€”
Relay Coil Control	P0628	P0628	P0629	â€”
Component Ground	â€”	**	â€”	â€”

* The fuel pump fuse opens and the engine cranks but does not run.

** The engine cranks but does not run.

*** The fuel pump operates continuously and the battery will discharge.

Circuit/System Description

The engine control module (ECM) provides a ground to the coil side of the fuel pump relay. When the ignition switch is first turned ON, the ECM energizes the fuel pump relay, which applies power to the fuel pump. The ECM enables the fuel pump relay as long as the engine is cranking or running, and crankshaft reference pulses are received. If no crankshaft reference pulses are received, the ECM de-energizes the fuel pump relay after about 3â€‰seconds.

Reference Information

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Master Electrical Component List

Description and Operation

Fuel System Description

Electrical Information Reference

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

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Ignition ON.

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2. Verify the KR23Aâ€‰Fuel Pump Relay turns on and off/clicks when commanding the Fuel Pump Relay On and Off with a scan tool.
3.
    - **If the fuel pump relay does not turn on and off/clicks**
    - Refer to Circuit/System Testing.
4.
    - **If the fuel pump relay turns on and off/clicks**
5. All OK.

Circuit/System Testing

1. Ignition OFF, disconnect the KR23Aâ€‰Fuel Pump Relay, ignition ON.
2. Verify a test lamp illuminates between the ignition circuit terminalâ€‰86 and ground.
3.
    - **If the test lamp does not illuminate and the circuit fuse is OK**
4.
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, verify the fuse is OK and there is voltage at the fuse
5.
    - **If the test lamp does not illuminate and the circuit fuse is open**
6.
    1. Ignition OFF, remove the test lamp.
    2. Test for infinite resistance between the ignition circuit and ground.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
    4.
        - If infinite resistance, replace the KR23Aâ€‰Fuel Pump Relay.
7.
    - **If the test lamp illuminates**
8. Verify a test lamp illuminates between the B+ circuit terminalâ€‰30 and ground.
9.
    - **If the test lamp does not illuminate and the circuit fuse is OK**
10.
    1. Ignition OFF, remove the test lamp.
    2. Test for less than 2â€‰â„¦ in the B+ circuit end to end.
    3.

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- If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
- If less than 2â€‰â„¦, verify the fuse is OK and there is voltage at the fuse

11.

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

12.

1. Ignition OFF, remove the test lamp.
2. Test for infinite resistance between the B+ circuit and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.
   - If infinite resistance
5. Disconnect the harness connector at the G12â€‰Fuel Pump.
6. Test for infinite resistance between the component control circuit terminalâ€‰87 and ground.
7.
   - If less than infinite resistance, repair the short to ground on the circuit.
8.
   - If infinite resistance
9. Connect the KR23Aâ€‰Fuel Pump Relay and install a new fuse.
10. Connect a test lamp between the component control circuit terminalâ€‰87 and ground, ignition ON.
11. Verify the test lamp turns On and Off when commanding the KR23Aâ€‰Fuel Pump Relay On and Off with a scan tool.
12.
    - If the test lamp does not turn On and Off, replace the relay.
13.
    - If the test lamp turns On and Off, test or replace the G12â€‰Fuel Pump.

13.

- **If the test lamp illuminates**

14. Connect a test lamp between the ignition circuit terminalâ€‰86 and the control circuit terminalâ€‰85.
15. Verify the test lamp turns ON and OFF when commanding the KR23Aâ€‰Fuel Pump Relay On and Off with a scan tool.
16.

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

17.

1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module, ignition ON.
2. Test for infinite resistance between the control circuit and ground.
3.
   - If less than infinite resistance, repair the short to ground on the circuit.
4.

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- If infinite resistance

5. Test for less than 2â€‰â„¦ in the control circuit end to end.
6.
   - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
   - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.

18.
   - **If the test lamp is always ON**

19.
   1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K20â€‰Engine Control Module.
   2. Test for less than 1â€‰V between the control circuit and ground.
   3.
      - If 1â€‰V or greater, repair the short to voltage on the circuit.
   4.
      - If less than 1â€‰V, replace the K20â€‰Engine Control Module.

20.
   - **If the test lamp turns ON and OFF**

21. Verify that a test lamp does not illuminate between the component control circuit terminalâ€‰87 and ground.
22.
   - **If the test lamp illuminates**
   - Repair the short to voltage on the control circuit.

23.
   - **If the test lamp does not illuminate**

24. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the G12â€‰Fuel Pump. It may take up to 2 minutes for all vehicle systems to power down.
25. Test for less than 10â€‰â„¦ between the G12â€‰Fuel Pump ground circuit terminalâ€‰2 and ground.
26.
   - **If 10â€‰â„¦ or greater**

27.
   1. Ignition OFF.
   2. Test for less than 2â€‰â„¦ in the ground circuit end to end.
   3.
      - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
      - If less than 2â€‰â„¦, repair the open/high resistance in the ground connection.

28.
   - **If less than 10â€‰â„¦**

29. Connect the harness connector at the G12â€‰Fuel Pump.
30. Ignition ON, connect a 15â€‰A fused jumper wire between the ignition circuit terminalâ€‰86 and the component control circuit

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terminalâ€‰87.

31. Verify the G12â€‰Fuel Pump is activated.
32.
    - **If the G12â€‰Fuel Pump does not activate**
33.
    1. Ignition OFF, remove the jumper wire, disconnect the harness connector at the G12â€‰Fuel Pump.
    2. Test for less than 2â€‰â„¦ in the component control circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the G12â€‰Fuel Pump.
34.
    - **If the G12â€‰Fuel Pump activates**
35. Replace the KR23Aâ€‰Fuel Pump Relay.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Fuel Tank Fuel Pump Module Replacement
- Relay Replacement
- Control Module References for ECM replacement, programming, and setup.

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Pump	PUMP,FUEL	SS129
Fuel Pump	PUMP KIT,FUEL	4790A
Fuel Pump	PUMP,FUEL	4795A
Fuel Pump	PUMP,FUEL	4800A
Fuel Pump	PUMP KIT,FUEL (ELEC)	4825Z
Fuel Pump	PUMP,FUEL (ELEC)	4826A
Fuel Pump	PUMP,FUEL (W/ FUEL HTR)	4838A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Fuel Injector Diagnosis (LC5, LMU)

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 K20 Engine Control Moduleâ€‰ enables the appropriate fuel injector pulse for each cylinder. The ignition voltage is supplied directly to the fuel injectors. The K20 Engine Control Module 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

Connector End View Reference

Master Electrical Component List

Description and Operation

Fuel System Description

Electrical Information Reference

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

Special Tools

- *CHâ€‰48027* Digital Pressure Gauge
- *CHâ€‰51064* Fuel Pressure Gauge Adapter
- *ELâ€‰39021* Fuel Injector Coil and Balance Tester

For equivalent regional tools, refer to Special Tools.

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Fuel Injector Coil Test

1. Ignition ON, verify the scan tool ECT Sensor is between 10â€“32Â°C (50â€“90Â°F).
2.
   - **If not within the specified range**
3.
   1. Measure and record the resistance of each Q17â€‰Fuel Injector with a DMM.
   2. Subtract the lowest resistance value from the highest resistance value.
   3. Verify the difference between the lowest value and the highest value is 3â€‰â„¦ or less.
   4.
      - If not within the specified range
   5.
      1. Add all of the Q17â€‰Fuel Injector resistance values to obtain a total resistance value.
      2. Divide the total resistance value by the number of fuel injectors to obtain an average resistance value.
      3. Subtract the lowest individual fuel injector resistance value from the average resistance value.
      4. Subtract the average resistance value from the highest individual resistance value.
      5. Replace the Q17â€‰Fuel Injector that displays the greatest difference above or below the average value.
   6.
      - If within the specified range, perform the Fuel Injector Balance Test.
4.
   - **If within the specified range**
5. Test for 11â€“14â€‰â„¦ between terminalâ€‰1 and terminalâ€‰2 of each Q17â€‰Fuel Injector.
6.
   - **If not between 11â€“14â€‰â„¦**
   - Replace the Q17â€‰Fuel Injector.
7.
   - **If between 11â€“14â€‰â„¦**
8. Verify infinite resistance between each terminal at the Q17â€‰Fuel Injector and the fuel injector housing/case.
9.
   - **If less than infinite resistance**
   - Replace the Q17â€‰Fuel Injector
10.
    - **If infinite resistance**
11. All OK, perform the Fuel Injector Balance Test.

Fuel Injector Balance Test with Special Tool

1. Note**:**
   - DO NOT perform this test if the engine coolant temperature (ECT) is above 94Â°C (201Â°F). Irregular fuel pressure readings may result due to hot soak fuel boiling.

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- Verify that adequate fuel is in the fuel tank before proceeding with this diagnostic.
- Before proceeding with this test review the User Manual CHâ€‰48027-5 for Safety Information and Instructions.

2. Verify the correct fuel system pressure. Refer to Fuel System Diagnosis.
3. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5â€“2.5â€‰A position.
4. Connect the *ELâ€‰39021* fuel injector coil and balance testerâ€‰to a Q17â€‰Fuel Injector.
5. Command the Fuel Pump Relay On 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 34â€‰kPa (5â€‰psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each Q17â€‰Fuel Injector.
6. Command the Fuel Pump Relay On one more time and energize the fuel injector by depressing the Push to Start Test button on the *ELâ€‰39021* fuel injector coil and balance testerâ€‰at the previously selected pressure.
7. After the Q17â€‰Fuel Injector stops pulsing, select Min from the Display Mode on the *CH-48027* gauge and record the Min pressure.
8. Note**:**

   New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.
9. Clear the Min/Max results on the *CHâ€‰48027* gauge.
10. Select Normal from the Display Mode on the *CH-48027* gauge.
11. Repeat stepsâ€‰3 and 5 through 8 for each Q17â€‰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 Q17â€‰Fuel Injector.
14. Add all of the individual pressure drop values except for the fuel 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.
16. Verify the difference of any individual fuel injector pressure drop is 20â€‰kPa (3â€‰psi) or less than the calculated average pressure drop.
17.
    - **If not within the specified range**
    - Replace the appropriate Q17â€‰Fuel Injector(s).
18.
    - **If within the specified range**
19. All OK.

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 34â€‰kPa (5â€‰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 function within the Control 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 Enable button on the scan tool at the previously selected pressure.
7. After the injector stops pulsing, select Min from the Display Mode on the *CHâ€‰48027* gaugeâ€‰and record the Min pressure.
8. Note**:**

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

9. Clear the Min/Max results on the *CHâ€‰48027* gauge.
10. Select Normal from the Display Mode on the *CHâ€‰48027* gauge.
11. Press Enter on the scan tool to bring you back to the Select Injector screen.
12. Repeat stepsâ€‰4 through 10 for each fuel injector.
13. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
14. Obtain a pressure drop value for each Q17â€‰Fuel Injector.
15. Add all of the individual pressure drop values except for the fuel injector suspected of being faulty. This is the total pressure drop.
16. Divide the total pressure drop by the number of fuel injectors that were added together. This is the average pressure drop.
17. Verify the difference of any individual fuel injector pressure drop is 20â€‰kPa (3â€‰psi) or less than the calculated average pressure drop.
18.
    - **If not within the specified range**
    - Replace the appropriate Q17â€‰Fuel Injector(s).
19.
    - **If within the specified range**
20. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Fuel Injector Replacement

Related Part Information

Part Name	Catalog Name	Part Code
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0203
Fuel Injector	INJECTOR KIT,FUEL(MARINE)	0150A
Fuel Injector	INJECTOR,FUEL	X0006
Fuel Injector	INJECTOR,FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0011
Fuel Injector	INJECTOR,FUEL(W/FUEL RL)	X0012
Fuel Injector	INJECTOR KIT,FUEL	X0018
Central Multiport Fuel Injector	INJECTOR,CTL M/PORT FUEL	X0026
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0028
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0031
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL	X0033
Direct Fuel Injector	INJECTOR,DIR FUEL	X0034
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0035
Multiport Fuel Injector	INJECTOR,M/PORT FUEL	X0036
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	X0037
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL & FEED & RTN PIPE)	X0038
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0039
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0040
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0041
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0042
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL)	X0043
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL)	X0044

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Part Name	Catalog Name	Part Code
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL)	X0045
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL)	X0046
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL)	X0047
Continuous Fuel Injector	INJECTOR KIT,CONTINUOUS FUEL	X0048
Direct Fuel Injector	INJECTOR KIT,DIR FUEL	X0049
Indirect Fuel Injector	INJECTOR KIT,INDIRECT FUEL	X0050
Multiport Fuel Injector	INJECTOR KIT,M/PORT FUEL	X0051
Sequential Multiport Fuel Injector	INJECTOR KIT,SEQ M/PORT FUEL	X0052
Central Multiport Fuel Injector	INJECTOR KIT,CTL M/PORT FUEL	X0053
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0054
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0084
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0091
Central Sequential Multiport Fuel Injector	INJECTOR,CTL SEQ M/PORT FUEL	X0151
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0152
Central Sequential Multiport Fuel Injector	INJECTOR KIT,CTL SEQ M/PORT FUEL	X0213
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/DISTR)	X0285
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/ FUEL FEED TUBE)	X0286
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ WRG HARN)	X0315
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ FUEL RL & WRG HARN)	X0327
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/DISTR)	X0019
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	SJ075
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	SJ186
Fuel Injector	INJECTOR,FUEL	X0824

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Fuel Injector Diagnosis (LKY)

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 moduleâ€‰(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

Connector End View Reference

Master Electrical Component List

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-47976* Active Fuel Injector Tester
- *CHâ€‰48027* Digital Pressure Gauge
- *CHâ€‰51064* Fuel Pressure Gauge Adapter
- *ELâ€‰39021* Fuel Injector Coil and Balance Tester

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- *ENâ€‰44602* Injector Test Adapter

For equivalent regional tools, refer to Special Tools.

Fuel Injector Coil Test

Verify the resistance of each Q17â€‰Fuel Injector with one of the following methods:

- If the engine coolant temperature (ECT) sensor is between 10â€“32Â°C (50â€“90Â°F), the resistance of each fuel injector should be 11â€“14â€‰â„¦. If the injectors measure OK, perform the Fuel Injector Balance Test.
-
    - If not within the specified range, replace the Q17â€‰Fuel Injector.
- If the ECT sensor is not between 10â€“32Â°C (50â€“90Â°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 3â€‰â„¦. 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 Q17â€‰Fuel Injector that displays the greatest difference above or below the average.

Fuel Injector Balance Test with Special Tool

1. Note:
    - DO NOT perform this test if the engine coolant temperature (ECT) is above 94Â°C (201Â°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 CHâ€‰48027-5 for Safety Information and Instructions.
2. Verify the correct fuel system pressure. Refer to Fuel System Diagnosis.
3. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5â€“2.5â€‰A position.
4. Connect the *ELâ€‰39021* fuel injector coil and balance testerâ€‰to a Q17â€‰Fuel Injector using the *ENâ€‰44602* Injector Test Adapter.
5. 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 34â€‰kPa (5â€‰psi) of the maximum pump pressure. Record this fuel pressure. This is the starting pressure at which you will pulse each injector.
6. Command the Fuel Pump Relay On one more time and energize the fuel injector by depressing the Push to Start Test button on the *ELâ€‰39021* fuel injector coil and balance testerâ€‰at the previously selected pressure.
7. After the injector stops pulsing, select Min from the Display Mode on the *CHâ€‰48027* gaugeâ€‰and record the Min pressure.
8. Note:

    New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.
9. Clear the Min/Max results on the *CHâ€‰48027* gauge.
10. Select Normal from the Display Mode on the *CHâ€‰48027* gauge.
11. Repeat stepsâ€‰3 and 5 through 8 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.

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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 20â€‰kPa (3â€‰psi).
16.
    - If the difference between any individual pressure drop and the average pressure drop is more than 20â€‰kPa (3â€‰psi), replace the Q17â€‰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 34â€‰kPa (5â€‰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 *CHâ€‰48027* gaugeâ€‰and record the Min pressure.
8. Note**:**

   New test results will not be recorded if the Min/Max results are not cleared after each injector is tested.
9. Clear the Min/Max results on the *CHâ€‰48027* gauge.
10. Select Normal from the Display Mode on the *CHâ€‰48027* gauge.
11. Press Enter on the scan tool to bring you back to the Select Injector screen.
12. Repeat stepsâ€‰4 through 10 for each fuel injector.
13. Subtract the minimum pressure from the starting pressure for one fuel injector. The result is the pressure drop value.
14. Obtain a pressure drop value for each fuel injector.
15. Add all of the individual pressure drop values except for the injector suspected of being faulty. This is the total pressure drop.
16. 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 20â€‰kPa (3â€‰psi).
17.
    - If the difference between any individual pressure drop and the average pressure drop is more than 20â€‰kPa (3â€‰psi), replace the Q17â€‰Fuel Injector.

Fuel Injector Balance Test with Active Fuel Injector Tester

1. Note**:**
   - DO NOT perform this test if the engine coolant temperature (ECT) is above 94Â°C (201Â°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.
2. Verify the battery is fully charged and all accessories are OFF.
3. Ignition OFF, all vehicle systems OFF. Install the *CH-47976* Active Fuel Injector Tester, refer to the Active Fuel Injector Tester User Guide. It may take up to 2â€‰minutes for all vehicle systems to power down.
4. Turn ON the Active Fuel Injector Tester and select the vehicle.
5. Ignition ON, perform the Injector Test with the Active Fuel Injector Tester.

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6.
   - **If the Active Fuel Injector Tester aborts testing due to fuel pressure or fuel leak down**
   - Refer to Fuel System Diagnosis.
7.
   - **If the Active Fuel Injector Tester does not abort testing**
8. Compare the test results with the appropriate recommended tolerance.
9.
   - **If any fuel injector exceeds the recommended tolerance**
   - Replace the appropriate Q17â€‰Fuel Injector(s).
10.
   - **If all fuel injectors are within the recommended tolerance**
11. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Fuel Injector Replacement

Related Part Information

Part Name	Catalog Name	Part Code
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0203
Fuel Injector	INJECTOR KIT,FUEL(MARINE)	0150A
Fuel Injector	INJECTOR,FUEL	X0006
Fuel Injector	INJECTOR,FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0011
Fuel Injector	INJECTOR,FUEL(W/FUEL RL)	X0012
Fuel Injector	INJECTOR KIT,FUEL	X0018
Central Multiport Fuel Injector	INJECTOR,CTL M/PORT FUEL	X0026
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0028
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0031
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL	X0033
Direct Fuel Injector	INJECTOR,DIR FUEL	X0034
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0035
Multiport Fuel Injector	INJECTOR,M/PORT FUEL	X0036
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	X0037
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL & FEED & RTN PIPE)	X0038
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0039
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0040
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0041
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0042
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL)	X0043
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL)	X0044
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL)	X0045
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL)	X0046
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL)	X0047
Continuous Fuel Injector	INJECTOR KIT,CONTINUOUS FUEL	X0048
Direct Fuel Injector	INJECTOR KIT,DIR FUEL	X0049
Indirect Fuel Injector	INJECTOR KIT,INDIRECT FUEL	X0050
Multiport Fuel Injector	INJECTOR KIT,M/PORT FUEL	X0051

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Part Name	Catalog Name	Part Code
Sequential Multiport Fuel Injector	INJECTOR KIT,SEQ M/PORT FUEL	X0052
Central Multiport Fuel Injector	INJECTOR KIT,CTL M/PORT FUEL	X0053
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0054
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0084
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0091
Central Sequential Multiport Fuel Injector	INJECTOR,CTL SEQ M/PORT FUEL	X0151
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0152
Central Sequential Multiport Fuel Injector	INJECTOR KIT,CTL SEQ M/PORT FUEL	X0213
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/DISTR)	X0285
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/ FUEL FEED TUBE)	X0286
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ WRG HARN)	X0315
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ FUEL RL & WRG HARN)	X0327
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/DISTR)	X0019
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	SJ075
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	SJ186
Fuel Injector	INJECTOR,FUEL	X0824

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 10â€‰percent can cause driveability conditions and fuel system deterioration. Fuel with more than 10â€‰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

CHâ€‰44175-A Alcohol Tester Kit, if available

For equivalent regional tools, refer to Special Tools.

Circuit/System Verification

1. Remove a sample of fuel from the bottom of the fuel tank and place in a clean, clear container.
2. Place the sample on a level surface for 2 minutes.
3. Verify the sample is clear and bright in color.
4.
    - **If the sample appears cloudy, or contaminated with water, as indicated by a water layer at the bottom of the sample**
    - Refer to Circuit/System Testing â€" Particulate Contaminants in Fuel.
    - **If alcohol contamination is suspected**
    - Refer to Circuit/System Testing â€" Alcohol in Fuel Testing.
5.
    - **If the sample remains clear and bright**
6. All OK.

Circuit/System Testing

Alcohol in Fuel Testing with Special Tool

1. Test the fuel composition using *CHâ€‰44175â€"A* Alcohol Tester Kit and Instruction Manual.
2. Verify no water appears in the fuel sample.
3.
    - **If water appears in the fuel sample**

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- Clean the fuel system.

4.

- **If no water appears in the fuel sample**

5. Subtractâ€‰50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
6. Verify the fuel sample does not measure greater than 15%.
7.

- **If not within the specified range**

8.

1. Add fresh regular gasoline to the vehicle's fuel tank.
2. Remove a new sample of fuel from the tank.
3. Test the fuel composition using *CHâ€‰44175â€“A* Alcohol Tester Kit and Instruction Manual.
4. Subtractâ€‰50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
5. Verify the fuel sample does not measure greater than 15%.
6.

- If not within the specified range, drain and replace the vehicle's fuel.

9.

- **If within the specified range**

10. All OK.

Alcohol in Fuel Testing without Special Tool

1. Using a 100â€‰ml (3.38â€‰oz) specified cylinder with 1â€‰ml (0.034â€‰oz) graduation marks, fill the cylinder with fuel to the 90â€‰ml (3.04â€‰oz) mark.
2. Add 10â€‰ml (0.34â€‰oz) of water in order to bring the total fluid volume to 100â€‰ml (3.38â€‰oz) and install a stopper.
3. Shake the cylinder vigorously for 10â€“15â€‰seconds.
4. Carefully loosen the stopper in order to release the pressure.
5. Re-install the stopper and shake the cylinder vigorously again for 10â€“15â€‰seconds.
6. Put the cylinder on a level surface for approximately 5â€‰minutes 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 10â€‰ml (0.34â€‰oz). For example, if the volume of the lower layer is increased to 15â€‰ml (0.51â€‰oz), this indicates at least 5% alcohol in the fuel. The actual amount of alcohol may be somewhat more because this procedure does not extract all of the alcohol from the fuel.
7. Verify the fuel sample does not measure greater than 15%.
8.

- **If not within the specified range**

9.

1. Add fresh regular gasoline to the vehicle's fuel tank.
2. Remove a new sample of fuel from the tank.
3. Test the fuel composition of the new sample.
4. Verify the fuel sample does not measure greater than 15% .
5.

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- If not within the specified range, drain and replace the vehicle's fuel.
- If within the specified range, all OK.

10.
    - **If within the specified range**
11. All OK.

Particulate Contaminants in Fuel

1. Using an approved fuel container, draw approximately 0.5â€‰liter (0.53â€‰qt) of fuel from the bottom of the fuel tank.
2. Place the container on a level surface for approximately 5â€‰minutes 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 white or light brown crystals. Rubber will appear as black and irregular particles.
3. Verify there are no physical contaminants or water present in the fuel sample.
4.
    - **If any physical contaminants or water are present**
    - Clean the fuel system.
5.
    - **If no physical contaminants or water are present**
6. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Fuel Tank Draining

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Evaporative Emission System Diagnosis (LC5, LMU)

Special Tools

ENâ€‰41413â€“200 Evaporative Emissions System Tester

Operating Instructions for the Evaporative Emission System Tester

Vehicle Setup

1. Note:

   A large difference between the vehicle temperature and shop temperature will seriously affect the accuracy of the tests. Always allow enough time, at least 15â€‰min, for the vehicle temperature to adjust to the shop temperature.

2. Engine OFF, open the hood. Position a large fan to blow air under the vehicle onto the fuel tank area.
3. Connect the red battery clip from the tester to the positive battery terminal.
4. Note:

   The vehicle battery must be fully charged for optimal tester performance

5. Connect the black battery clip of the tester to chassis ground.

Flowmeter Test â€“ Leak Detection

1. Open the nitrogen tank valve and turn the nitrogen/smoke valve on the front control panel to nitrogen.
2. Connect the hose to the correct test orifice on the bottom front of the *ENâ€‰41413â€–200* Evaporative Emissions System Tester. For orifice size, refer to the GM service manual for the vehicle being tested. The vehicle specific information can be found in service procedures for DTCs that relate to evaporative emission (EVAP) system leaks.
3. Press and release the remote switch to activate the tester.
4. Position the sliding red flag on the flowmeter to align with the floating indicator. When the red flag is set, press and release the remote switch to deactivate the tester.
5. Remove the hose from the test orifice and install the hose onto the vehicle. For proper connection location, and the special tool numbers for any adapters that may be required, refer to the service manual for the vehicle being tested. The vehicle specific information can be found in service procedures for DTCs that relate to EVAP system leaks.
6. Seal the EVAP system per instructions in the service manual. Most systems can be sealed using a scan tool output control for the evaporative emission (EVAP) canister vent solenoid valve. Other systems require that the system be plugged. Refer to the service manual for the vehicle being tested for specific instructions.
7. Note:
   - Larger volume fuel tanks, and/or those with lower fuel levels, may require several minutes to fill with nitrogen.
   - Static buildup may cause the float indicator to stick. It may be necessary to tap on the flowmeter to free the float.
8. Press and release the remote switch to activate the nitrogen flow and fill the system.
9. Compare the stable floating indicator position to the red flag.
10.
    - Above the red flag, the result is unacceptable, fail-go to smoke procedure
    - Below the red flag, the result is unacceptable, pass-test complete
11. Press and release the remote switch to deactivate the tester.

Smoke Procedure â€“ Locate the Leak

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1. Note:

   It is not recommended to use the tester in an outside repair bay area because wind and sunlight may affect temperature and your ability to see the smoke.

2. Turn OFF any fans that may cause air movement around or near the vehicle.

3. Note:

   Completely unwind the nitrogen/smoke hose from the bracket to optimize the testers performance.

4. Connect the nitrogen/smoke hose to the vehicle as directed in the service manual. Some vehicles require that the nitrogen/smoke hose be connected at the front of the EVAP system at the EVAP service port. An adapter may be necessary. Other vehicles require the connection be made at the rear of the system using an adapter at the fuel fill cap. Consult the service manual for vehicle specific instructions regarding connection location and adapters.

5. Open the nitrogen tank valve and turn the nitrogen/smoke valve on the control panel to smoke.

6. Note:

   The remote switch operates in a push ON, push OFF fashion.

7. Press and release the remote switch to activate the tester and inject smoke into the EVAP system.

8. Note:

   Inject smoke in less than 2â€‰min cycles for optimal tester performance.

9. Press and release the remote switch to deactivate the tester.

10. Note:

    For optimal visual smoke performance, deactivate the smoke flow and allow the system pressure to drop. Allowing the smoke to exit through small holes at a low flow rate greatly enhances visibility.

11. Introduce smoke into the system for an additional 60â€‰s. Continue introducing smoke at 15â€‰s intervals, as necessary.

12. Using a high-intensity white light , inspect the entire EVAP system path, and look for the source of the leak indicated by the exiting smoke. Introduce smoke at 15â€‰s intervals, as needed, until the source of the leak is identified.

Temperature Variation Instructions

The Concern

Ideal circumstances for conducting the EVAP flowmeter test require equal temperatures between the nitrogen gas and the vehicle EVAP system. Significant differences in temperature between them can result in a flow or pressure change during testing, causing misleading results. Typically, the evaporative emissions system tester is stored indoors, approximately 21Â°C (70Â°F). Vehicles brought in for diagnosis may have an EVAP system at significantly different temperatures â˜’40 to +43Â°C (â˜’40 to +110Â°F).

For Example
Note:

With no temperature difference between the nitrogen gas and EVAP system, the resulting vehicle EVAP system pressure will remain stable at 13â€‰in H20 once pressurized, providing no leaks are present.

When the EVAP Flowmeter Tests are performed with significant differences in temperature between the nitrogen gas and the vehicle EVAP system, the following results can occur:

- An increase in flow during the flowmeter test can be caused by a vehicles warm EVAP system cooling down.
- A decrease in flow during the flowmeter test can be caused by a vehicles cool EVAP system warming up.

The Solution

When working on a vehicle with significant differences in temperature between the vehicle EVAP system and the nitrogen gas, allow the vehicle EVAP system temperature to stabilize as close as possible to the temperature of the nitrogen gas before conducting the Flowmeter Test.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 individual ignition coil assemblies for each cylinder. The engine control module (ECM) controls the spark events by transmitting the timing pulses on the ignition control (IC) circuits to the individual ignition module/coil assemblies 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

Connector End View Reference

Master Electrical Component List

Description and Operation

Electronic Ignition System Description

Electrical Information Reference

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

Scan Tool Reference

Control Module References

Special Tools

EL 26792 HEI Spark Tester

For equivalent regional tools, refer to Special Tools.

Circuit/System Testing

Note**:**

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

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the appropriate T8â€‰Ignition Coil. It may take up to 2â€‰â€‰min for all vehicle systems to power down.

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2. Test for less than 5â€‰â„¦ between the ground circuit terminalâ€‰1 and ground.
3.
    - **If 5â€‰â„¦ or greater**
4.
    1. Ignition OFF.
    2. Test for less than 2â€‰â€‰â„¦ in the ground circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, repair the open/high resistance in the ground connection.
5.
    - **If less than 5â€‰â„¦**
6. Test for less than 5â€‰â„¦ between the low reference circuit terminalâ€‰2 and ground.
7.
    - **If 5â€‰â„¦ or greater**
8.
    1. Ignition OFF, disconnect the X2â€‰harness connector at the K20â€‰Engine Control Module.
    2. Test for less than 2â€‰â€‰â„¦ in the low reference circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, replace the K20â€‰Engine Control Module.
9.
    - **If less than 5â€‰â„¦**
10. Ignition ON.
11. Verify a test lamp illuminates between the ignition circuit terminalâ€‰4 and ground.
12.
    - **If the test lamp does not illuminate and the circuit fuse is good**
13.
    1. Ignition OFF.
    2. Test for less than 2â€‰â„¦ in the ignition circuit end to end.
    3.
        - If 2â€‰â„¦ or greater, repair the open/high resistance in the circuit.
        - If less than 2â€‰â„¦, verify the fuse is not open and there is voltage at the fuse.
14.
    - **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.

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15.

    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.
    3.
        - If less than infinite resistance, repair the short to ground on the circuit.
    4.
        - If infinite resistance
    5. Replace the fuse, ignition ON.
    6. Verify the fuse is good after connecting each of the components one at a time.
    7.
        - If the fuse opens, replace the component that opens the fuse when connected.
        - If the fuse is good, all OK.

16.

    - **If the test lamp illuminates**

17. Ignition OFF, exchange the suspect T8â€‰Ignition Coil with the T8â€‰Ignition Coil of a known functioning cylinder.
18. Engine Running.
19. Verify the scan tool Cylinder 1â€“4â€‰Current Misfire Counter does not increment for the same cylinder that the suspect T8â€‰Ignition Coil was removed from.
20.

    - **If increments**
    - Replace the K20â€‰Engine Control Module.

21.

    - **If does not increment**

22. Test or replace the T8â€‰Ignition Coil.

Component Test

Note**:**

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

1. Ignition OFF, connect the *EL 26792* HEI Spark Tester to the appropriate T8â€‰Ignition Coil.
2. Engine Running.
3. Verify the spark output of the T8â€‰Ignition Coil.
4.

    - **If no output or the output is weak**
    - Replace the T8â€‰Ignition Coil.

5.

    - **If the output is normal**

6. All OK.

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Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair.

- Ignition Coil Replacement
- Control Module References for engine control module replacement, programming, and setup.

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Repair Instructions

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Body Idle Air Flow Compensation Reset

Diagnostic Instructions

- Perform the Diagnostic System Check prior to using this diagnostic procedure: Diagnostic System Check - Vehicle
- Review the description of Strategy Based Diagnosis: Strategy Based Diagnosis

Description

For an overview of the component/system, refer to: Throttle Actuator Control (TAC) System Description

This procedure triggers the control module to learn the values of the component: Q38 Throttle Body - Airflow Adaptive Values

When to Perform the Procedure

Note **:**

Failure to perform this procedure may result in poor system performance, DTCs being set, or customer dissatisfaction.

Perform this procedure when the following component has been serviced:

- Q38 Throttle Body - Cleaned / Replaced
- K20 Engine Control Module - Replaced

Conditions for Running the Procedure

- DTC P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0120, P0122, P0123, P0128, P0171, P0172, P0174, P0175, P0201â€“P0208, P0220, P0222, P0223, P0261, P0262, P0264, P0265, P0267, P0268, P0270, P0271, P0273, P0274, P0276, P0277, P0279, P0280, P0282, P0283, P0300â€“P0308, P0351â€–P0358, P0496, P0601, P0604, P0606, P060D, P0641, P0651, P0697, P06A3, P06D2, P1248, P1249, P124A, P124B, P1516, P16A0â€–P16A2, P2101, P2119, P2120, P2122, P2123, P2125, P2127, P2128, P2135, P2138, P2147, P2148, P2150, P2151, P2153, P2154, P2156, P2157, P216B, P216C, P216E, P216F, P217B, P217C, P217E, P217F, P2176, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310, P2312, P2313, P2315, P2316, P2318, P2319, P2321, P2322
- Ignition = On
- Vehicle Speed Sensor = 0> km/h (0> MPH)

Reference Information

Scan Tool Reference

Control Module References

With Scan Tool

1. Ignition >> On / Vehicle >> In Service Mode
2. Select: Module Diagnostics
3. Select: Engine Control Module
4. Select: Configuration/Reset Functions
5. Select: Reset Functions
6. Select: Throttle Body Idle Air Flow Compensation Reset
7. Follow the instructions on the scan tool.
8. Verify the scan tool parameter: Throttle Body Idle Air Flow Compensation = 0>%

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9.
    - **If greater than 0>**
    - Repeat step 1>
10.
    - **If 0>**
11. Engine >> Idling - At normal operating temperature
12. Verify the scan tool parameter: Engine Speed = 100to +200hinsp;RPM of the Desired Idle Speed
13.
    - **{ Test failed 1> time(s) } If not in the specified range**
14.
    1. Engine idling. - For greater than 3> min
    2. Ignition/Vehicle >> Off - For greater than 1> min
    3. Engine idling. - For greater than 3> min
    4. Repeat step 9>
15.
    - **{ Test failed 2> time(s) } If not in the specified range**
16.
    1. Perform the following action: Road test the vehicle.
    2. Vehicle Speed - Greater than 70 km/h (44 MPH)
    3. Decelerate - For 2> s
    4. Repeat step 10.2 - 3> times
    5. Engine idling. - For greater than 3> min
    6. Repeat step 9>
17.
    - **{ Test failed 3> time(s) } If not in the specified range**
    - Refer to: Diagnostic System Check - Vehicle
18.
    - **If in the specified range**
19. All OK.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the repair: Diagnostic Repair Verification

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Engine Control Module Replacement

Pre-Removal Procedure

Caution**:**

- Turn the ignition OFF when installing or removing the control module connectors and disconnecting or reconnecting the power to the control module (battery cable, powertrain control module (PCM)/engine control module (ECM)/transaxle control module (TCM) pigtail, control module fuse, jumper cables, etc.) in order to prevent internal control module damage.
- Control module damage may result when the metal case contacts battery voltage. DO NOT contact the control module metal case with battery voltage when servicing a control module, using battery booster cables, or when charging the vehicle battery.
- In order to prevent any possible electrostatic discharge damage to the control module, do no touch the connector pins or the soldered components on the circuit board.
- Remove any debris from around the control module connector surfaces before servicing the control module. Inspect the control module connector gaskets when diagnosing or replacing the control module. Ensure that the gaskets are installed correctly. The gaskets prevent contaminant intrusion into the control module.
- The replacement control module must be programmed.

Removal Procedure

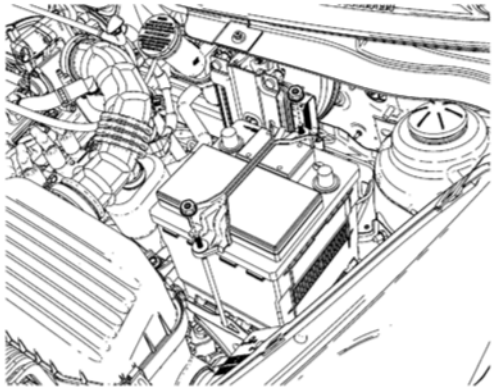
Warning**:**

Unless directed otherwise, the ignition must be OFF with the key removed, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable to prevent an electrical spark should a tool or equipment come in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

For Vehicles equipped with OnStarÂ® (UE1) with Back Up Battery:

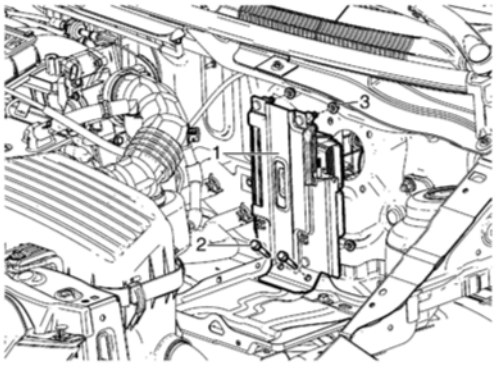
The Back Up Battery is a redundant power supply to allow limited OnStarÂ® functionality in the event of a main vehicle battery power disruption to the VCIM (OnStarÂ®module). Do not disconnect the main vehicle battery or remove the OnStarÂ® fuse with the ignition key in any position other than OFF. Retained accessory power should be allowed to time out or be disabled (simply opening the driver door should disable retained accessory power) before disconnecting power. Disconnecting power to the OnStarÂ® module in any way while the ignition is On or with retained accessory power activated may cause activation of the OnStarÂ® Back-Up Battery system and will discharge and permanently damage the back-up battery. Once the Back-Up Battery is activated it will stay on until it has completely discharged. The back-up battery is not rechargeable and once activated the back-up battery must be replaced.

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1. Click here for full size
2. Turn the ignition OFF.
3. Remove the battery. Refer to Battery Replacement.

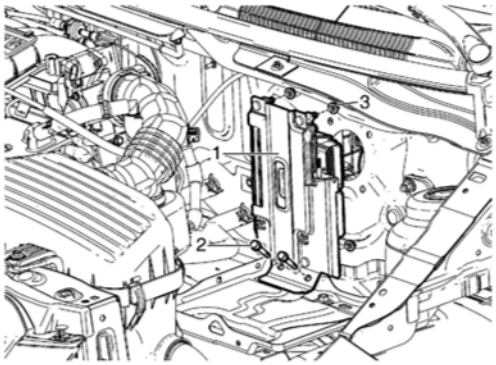
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4. Click here for full size
5. Remove the engine control module (ECM) bracket retaining boltâ€‰â€‰(2).
6. Release the ECM connector locking lever and disconnect the ECM connector.
7. Remove the ECM retaining nutâ€‰â€‰(3) from the ECM bracketâ€‰â€‰(1) and remove the ECM.

Installation Procedure



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1. Click here for full size
2. Caution:

   Refer to Fastener Caution.

3. Install the ECM retaining nutâ€‰(3) and tighten to 10â€‰N-m (89â€‰lbâ€‰in).

4. Note:

   Connect the front electrical connector to the ECM first.

5. Connect the ECM connector and lock the ECM connector locking lever.
6. Install the ECM bracketâ€‰â€‰(1) to the battery tray and tighten the ECM bracket retaining boltâ€‰(2) to 10â€‰N-m (89â€‰lbâ€‰in).
7. Install the battery. Refer to Battery Replacement.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Body Inspection and Cleaning

Note:

Over extended time and mileage, deposits may accumulate on the back of the throttle valve plate. The source of the deposit is exhaust gas. Typically these deposits pose no problem. Occasionally the deposit may accumulate to a point where perceived pedal effort or throttle valve movement is affected. This procedure should not be performed on vehicles with mileage under 80,450â€‰km (50,000â€‰mi).

1. Remove the air cleaner outlet duct. Refer to Air Cleaner Assembly Replacement.
2. Warning:

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

   Do not insert any tools into the throttle body bore in order to avoid damage to the throttle valve plate.
4. Inspect the throttle body bore and the throttle valve plate for deposits. You will need to open the throttle valve in order to inspect all surfaces.
5. Caution:

   Do not use any solvent that contains Methyl Ethyl Ketone (MEK). This solvent may damage fuel system components.
6. Clean the throttle body bore and the throttle valve plate using a clean shop towel with an appropriate cleaner.
7. Install the air cleaner outlet duct. Refer to Air Cleaner Assembly Replacement.
8. Perform the throttle/idle learn procedure. Refer to Throttle or Idle Learn.

Related Part Information

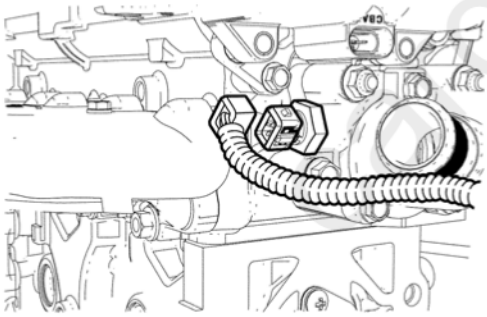
Part Name	Catalog Name	Part Code
Throttle Body	BODY,THROT (W/ THERM BYPASS PIPE)	1767A
Throttle Body	BODY,THROT(W/MASS AIR FLOW SEN)	1768A
Throttle Body	BODY,THROT(W/MASS AIR FLOW SEN)	1769A
Throttle Body	BODY,THROT	1770A
Throttle Body	BODY,THROT	1770B
Throttle Body	BODY,THROT (CSTG)	1770C
Throttle Body	BODY,THROT (W/SEN)	1777A
Throttle Body	BODY,THROT(W/TBI)	X0213
Throttle Body	BODY KIT,THROT	X0277
Throttle Body	BODY KIT,THROT(W/TBI)	X0301
Throttle Body	BODY KIT,THROT(W/THROT POSN SEN)	X0320
Throttle Body	BODY,THROT(W/THROT ACTR)	X0474
Throttle Body	BODY KIT,THROT (W/ THROT ACTR)	X0483
Throttle Body	BODY,THROTTLE	SJ035

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Engine Coolant Temperature Sensor Replacement (Thermostat)

Removal Procedure



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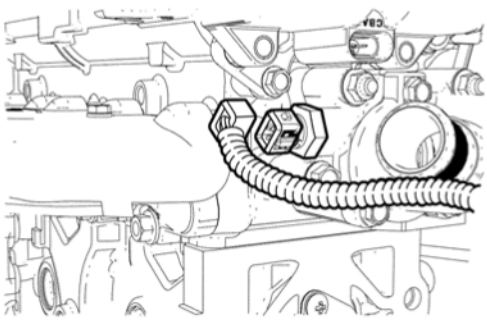
1. Click here for full size
2. Warning**:**

   Allow sufficient time for the engine to cool before removing the ECT sensor. A hot engine may cause an excessive coolant loss or a personal injury.

3. Drain the engine coolant. Refer to Cooling System Draining and Filling.
4. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
5. Remove the air cleaner assembly. Refer to Air Cleaner Assembly Replacement.
6. Disconnect the engine coolant temperature sensor connector.
7. Remove the engine coolant temperature sensor.

Installation Procedure

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1. Click here for full size
2. Caution:

   Refer to Component Fastener Tightening Caution.

3. Install the engine coolant temperature sensor and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).
4. Connect the engine coolant temperature sensor connector.
5. Install the air cleaner assembly. Refer to Air Cleaner Assembly Replacement.
6. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
7. Refill the engine coolant. Refer to Cooling System Draining and Filling.

Related Part Information

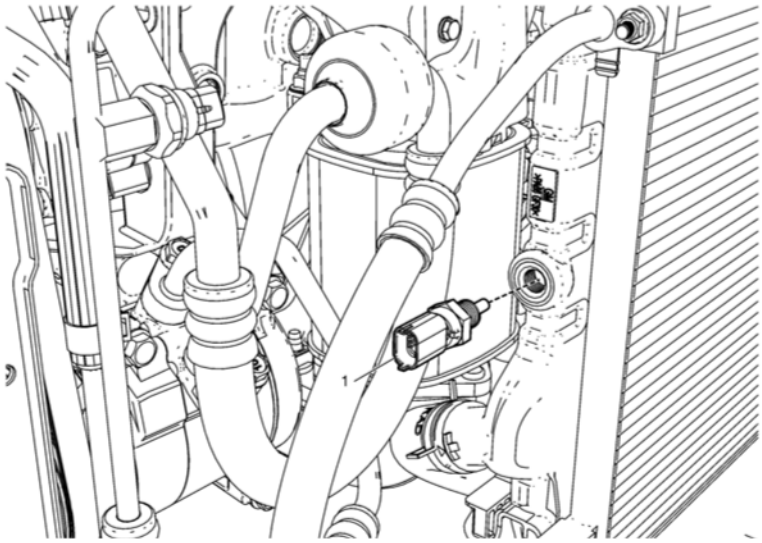
Part Name	Catalog Name	Part Code
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP	4000A
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP	4000B
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP(W/ENG COOL TEMP IND SW)	4000G
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP(W/ENG COOL T/GA SEN)	4000K
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP(W/ENG COOL T/GA SEN & TEMP IND SW)	4000N
Engine Coolant Temperature Sensor	SENSOR PKG,ENG COOL TEMP	4001A
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP (POSN 2)	4007A
Engine Coolant Temperature Gauge Sensor	SENSOR,ENG COOL T/GA	2250A
Engine Coolant Temperature Sensor	SENSOR,ENG COOL TEMP	SJ244

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Engine Coolant Temperature Sensor Replacement (Radiator)

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Callout	Component Name
Warning: Allow sufficient time for the engine to cool before removing the ECT sensor. A hot engine may cause an excessive coolant loss or a personal injury. Preliminary Procedures 1. Drain the cooling system. Refer to Cooling System Draining and Filling. 2. Disconnect the connector plug.	

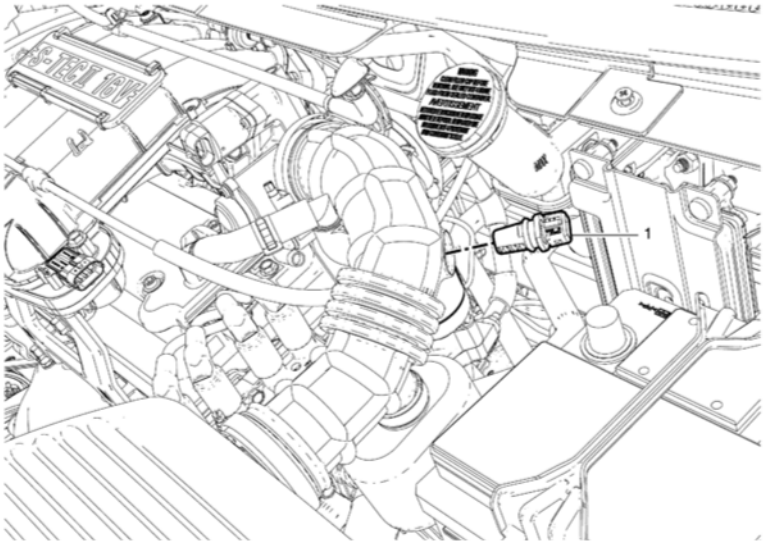
Callout	Component Name
1	Engine Coolant Temperature Sensor Caution: Refer to Fastener Caution. Procedure Remove the coolant temperature sensorâ€‰(1). Tighten 12â€‰N-m (9â€‰lbâ€‰ft)

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Intake Air Temperature Sensor Replacement

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Callout	Component Name
Caution: Any time service is being performed which requires removal of the air cleaner assembly, always cover the throttle body opening. This will prevent any foreign material from entering the engine. Preliminary Procedure Disconnect the electric plug.	
1	Remove the intake air temperature (IAT) sensorâ€‰(1).

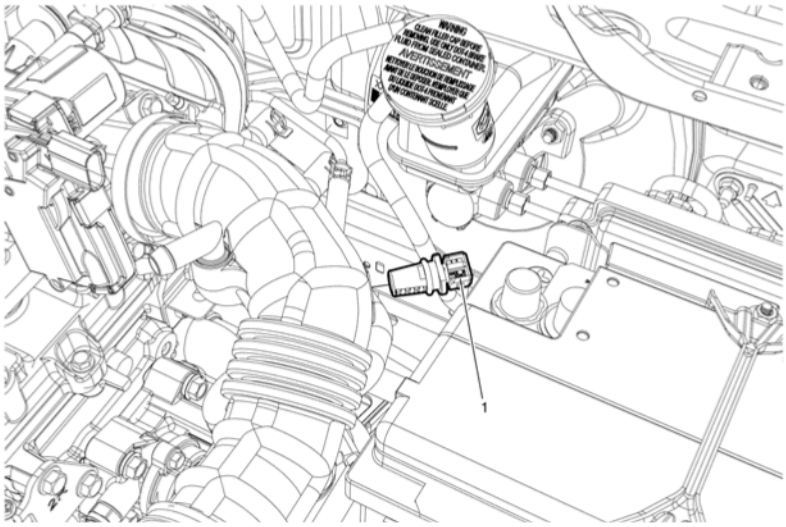
Related Part Information

Part Name	Catalog Name	Part Code
Intake Air Temperature Sensor	SENSOR PKG,INT AIR TEMP	5099A
Intake Air Temperature Sensor	SENSOR,INT AIR TEMP	5100A
Intake Air Temperature Sensor	SENSOR,INT AIR TEMP	5100B
Intake Air Temperature Sensor	SENSOR,INT AIR TEMP	SJ247

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Intake Air Temperature Sensor Replacement (LKY)

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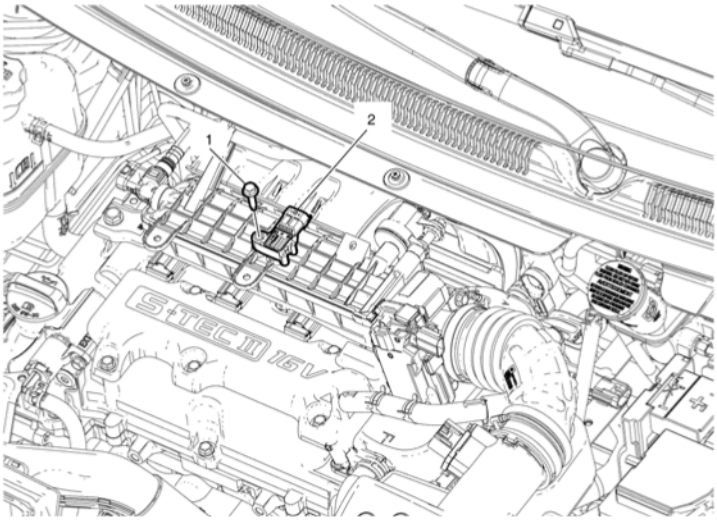
Click here for full size

Callout	Component Name
Caution: Any time service is being performed which requires removal of the air cleaner assembly, always cover the throttle body opening. This will prevent any foreign material from entering the engine. Preliminary Procedure Disconnect the electric plug.	
1	Intake Air Temperature Sensor Procedure Remove the intake air temperature (IAT) sensor.

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Manifold Absolute Pressure Sensor Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Disconnect the manifold absolute pressure sensor connector.
1	Manifold Absolute Pressure Sensor Bolt Caution: Refer to Fastener Caution. Procedure Remove the manifold absolute pressure sensor bolt Tighten 10â€‰N-m (89â€‰lbâ€‰in)
2	Manifold Absolute Pressure Sensor

Related Part Information

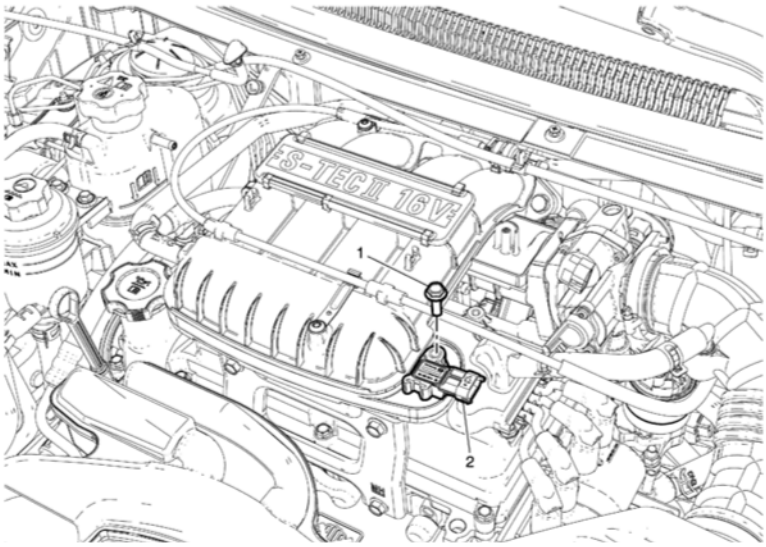
Part Name	Catalog Name	Part Code
Manifold Absolute Pressure Sensor	SENSOR PKG,MAP	4999Y
Manifold Absolute Pressure Sensor	SENSOR KIT,MAP	4999Z
Manifold Absolute Pressure Sensor	SENSOR,MAP	5000A
Manifold Absolute Pressure Sensor	SENSOR,MAP(DA)	5000C
Manifold Absolute Pressure Sensor	SENSOR,MAP(ENG)	5000E
Manifold Absolute Pressure Sensor	SENSOR,MAP	SJ248

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Manifold Absolute Pressure Sensor Replacement

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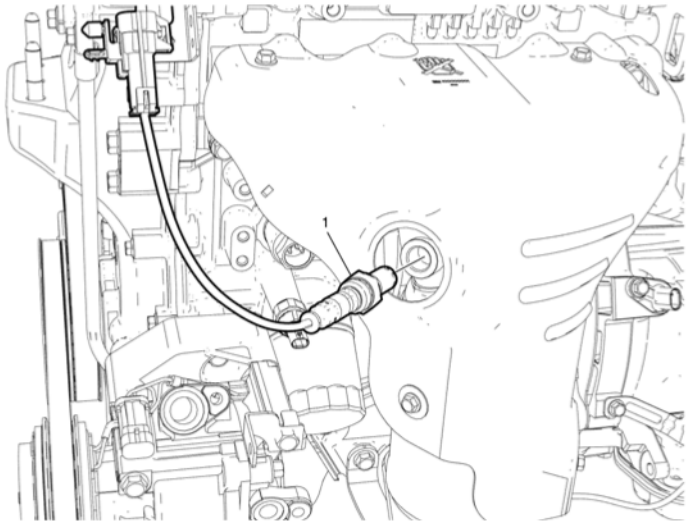
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Callout	Component Name
Preliminary Procedure Disconnect manifold absolute pressure sensor electric plug.	
1	Remove the manifold absolute pressure sensor bolt. Caution: Refer to Fastener Caution. Tighten 8â€‰N-m (70.8â€‰lbâ€‰in)
2	Remove the manifold absolute pressure sensor.

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Heated Oxygen Sensor Replacement - Sensor 1 (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Raise the vehicle by its full height. Refer to Lifting and Jacking the Vehicle. 3. Disconnect the heated oxygen sensor-1 connector.

Callout	Component Name
1	Heated Oxygen Sensor-1 Caution: Refer to Fastener Caution. Procedure Remove the heated oxygen sensor-1. Tighten 42â€‰N-m (31â€‰lbâ€‰ft) Special Tools *EN-48259* Installer/Remover For equivalent regional tools, refer to Special Tools.

Related Part Information

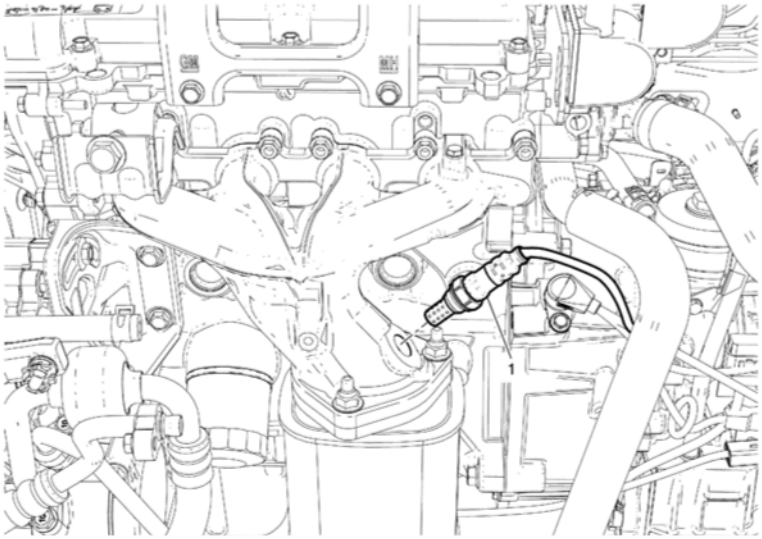
Part Name	Catalog Name	Part Code
Heated Oxygen Sensor	SENSOR,HTD OXY (PRE-CATALYST BANK 1 SEN 1)	4015A
Heated Oxygen Sensor	SENSOR,HTD OXY (PRE-CATALYST BANK 2 SEN 1)	4016A
Heated Oxygen Sensor	SENSOR,HTD OXY (POST-CATALYST BANK 1 SEN 2)	4017A
Heated Oxygen Sensor	SENSOR,HTD OXY (POST-CATALYST BANK 2 SEN 2)	4018A
Heated Oxygen Sensor	SENSOR,HTD OXY	4491A
Heated Oxygen Sensor	SENSOR,HTD OXY(POSN 1)	4494A
Heated Oxygen Sensor	SENSOR,HTD OXY(POSN 2)	4496A
Heated Oxygen Sensor	SENSOR,HTD OXY(POSN 3)	4498A
Heated Oxygen Sensor	SENSOR,HTD OXY	SJ246

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Heated Oxygen Sensor Replacement - Sensor 1

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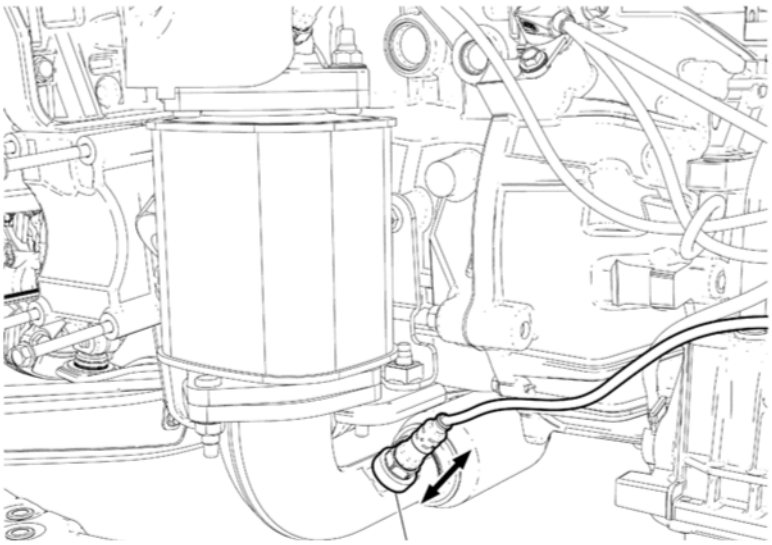
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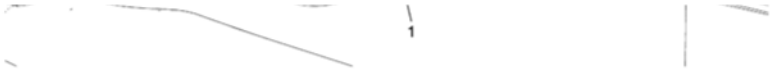
Callout	Component Name
	Preliminary Procedures 1. Remove the exhaust manifold heat shield. Refer to Exhaust Manifold Heat Shield Replacement. 2. Disconnect the heated oxygen sensorâ€‰1 wiring harness connector.
1	Heated Oxygen Sensor 1 Caution: Refer to Component Fastener Tightening Caution. Tighten 41â€‰N·m (30.2â€‰lbâ€‰ft)

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Heated Oxygen Sensor Replacement - Sensor 2

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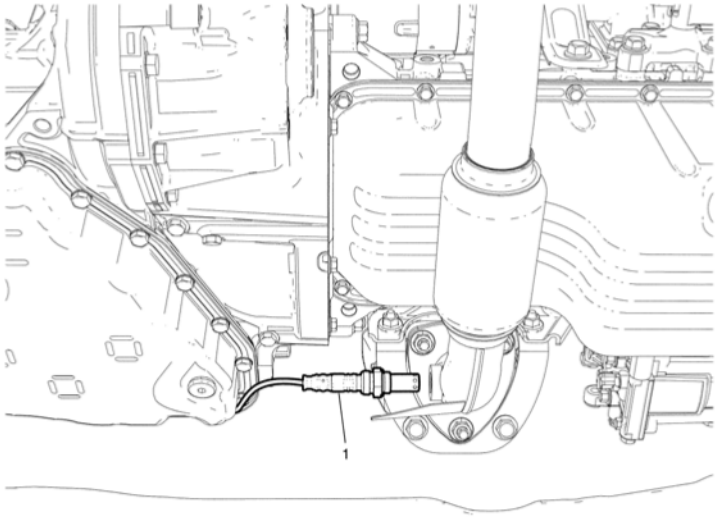
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Callout	Component Name
	Preliminary Procedures 1. Remove the exhaust manifold heat shield. Refer to Exhaust Manifold Heat Shield Replacement. 2. Disconnect the heated oxygen sensorâ€‰2 wiring harness connector.
1	Heated Oxygen Sensor 2 Caution: Refer to Component Fastener Tightening Caution. Tighten 41â€‰N·m (30.2â€‰lbâ€‰ft)

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Heated Oxygen Sensor Replacement - Sensor 2 (LKY)

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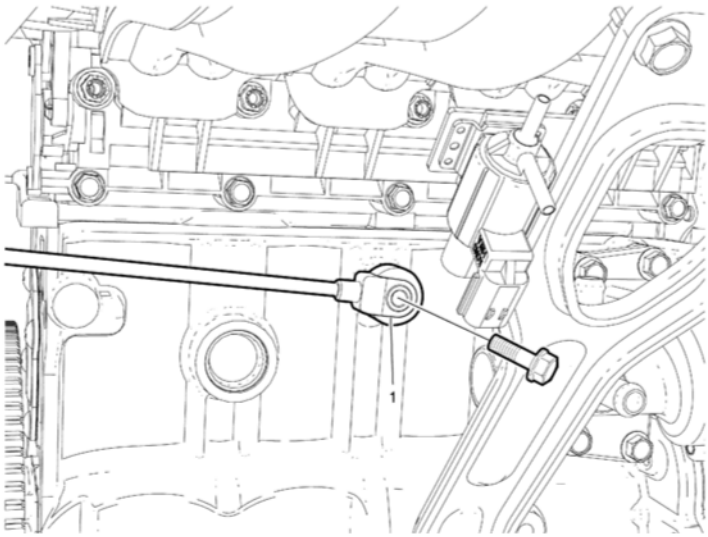
Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Raise the vehicle by its full height. Refer to Lifting and Jacking the Vehicle. 3. Disconnect the heated oxygen sensor-2 connector.
1	Heated Oxygen Sensor-2 Caution: Refer to Fastener Caution. Procedure Remove the heated oxygen sensor-2. Tighten 42â€‰N-m (31â€‰lbâ€‰ft)

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Knock Sensor Replacement

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Callout	Component Name
Preliminary Procedure Disconnect the knock sensor wiring harness connector.	
1	Remove the knock sensor. Caution: Refer to Fastener Caution. Tighten 20â€‰N-m (14.8â€‰lbâ€‰ft)

Related Part Information

Part Name	Catalog Name	Part Code
Knock Sensor	SENSOR,KNOCK	0650A
Knock Sensor	SENSOR,KNOCK	0650B

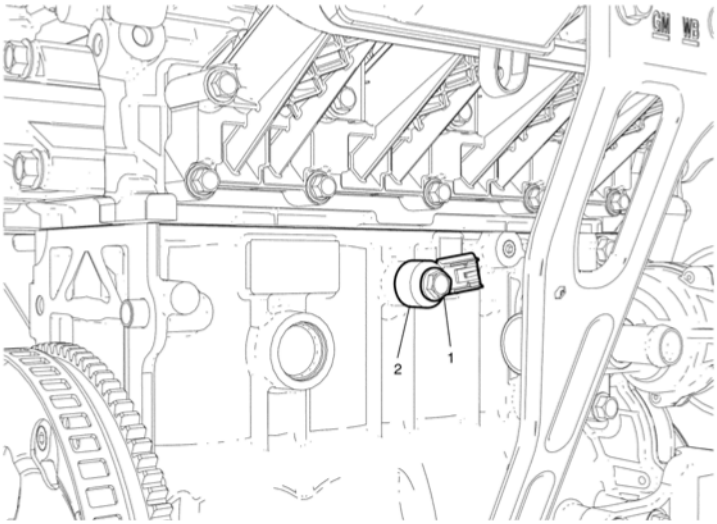
Part Name	Catalog Name	Part Code
Knock Sensor	SENSOR,KNOCK (POSN 1)	0650C
Knock Sensor	SENSOR,KNOCK (POSN 2)	0650D
Knock Sensor	SENSOR,KNOCK	SJ242

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Knock Sensor Replacement (LKY)

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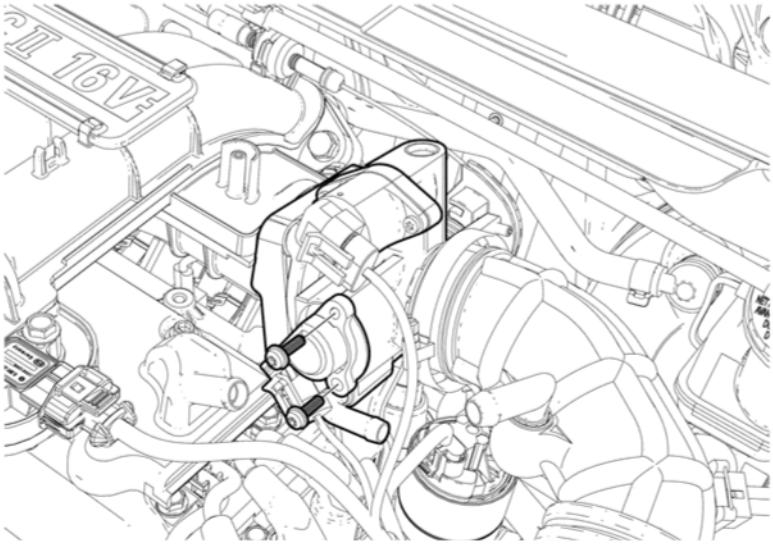
Click here for full size

Callout	Component Name
	Preliminary Procedures 1. Remove the starter. Refer to Starter Replacement. 2. Disconnect the knock sensor wiring harness connector.
1	Knock Sensor Retaining Bolt Caution: Refer to Fastener Caution. Procedure Remove the knock sensor retaining bolt. Tighten 25â€‰N·m (18â€‰lbâ€‰ft)
2	Knock Sensor

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Position Sensor Replacement

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Callout	Component Name
1	Throttle Position Sensor Procedure Disconnect the throttle position sensor wiring harness plug.
2	Throttle Position Sensor Mounting Bolt Caution: Refer to Fastener Caution. Tighten 2.7â€‰N-m (23.9â€‰lbâ€‰in)

Related Part Information

Part Name	Catalog Name	Part Code

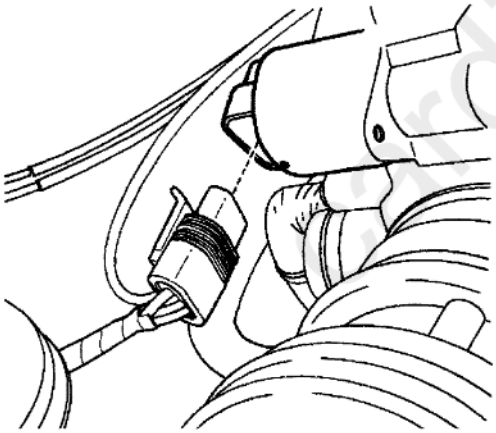
Part Name	Catalog Name	Part Code
Throttle Position Sensor	SENSOR KIT,THROT POSN	X0024
Throttle Position Sensor	SENSOR,THROT POSN	X0085
Throttle Position Sensor	SENSOR PKG,THROT POSN	X0133
Throttle Position Sensor	SENSOR,THROT POSN	SJ249

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

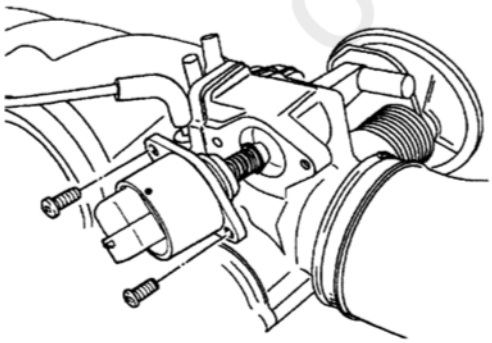
Idle Air Control Valve Replacement

Removal Procedure



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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the idle air control valve (IACV) wiring harness connector.



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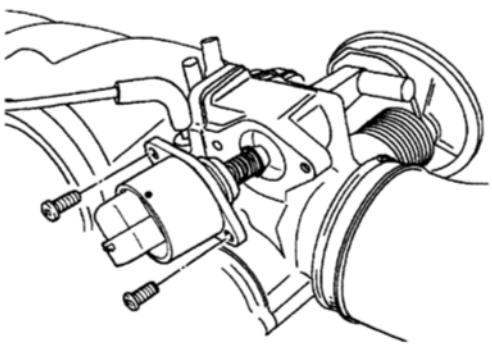
4. Click here for full size
5. Note**:**

   Clean the IAC valve O-ring seal area, the pintle valve seat and the air passage with a suitable fuel system cleaner. Do not use methyl ethyl ketone.

6. Remove the IACV retaining bolts.
7. Remove the IACV.

Installation Procedure

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1. Click here for full size
2. Note:

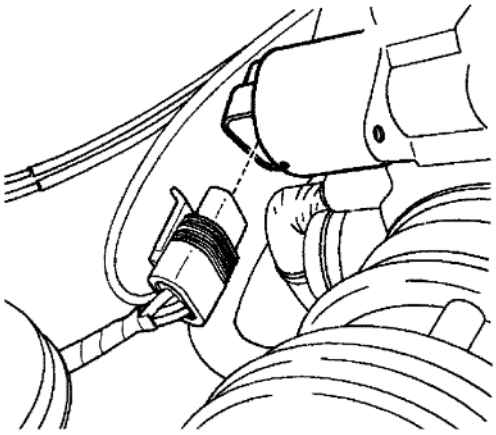
   If installing a new IAC valve, be sure to replace it with an identical part. On IACV that have been in service, do not push on the valve pintle. The force required to move the pintle may damage the threads on the worm drive.

3. Install the new O-ring seal with the IACV.
4. Caution:

   Refer to Fastener Caution.

5. Install the IACV retaining bolts and tighten to 3.1â€‰N-m (27.4â€‰lbâ€‰in).

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6. Click here for full size
7. Connect the IACV connector.
8. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

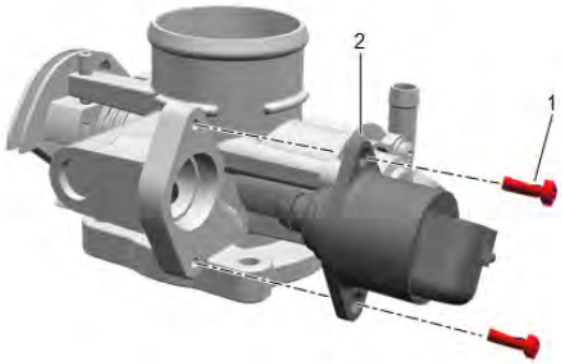
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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

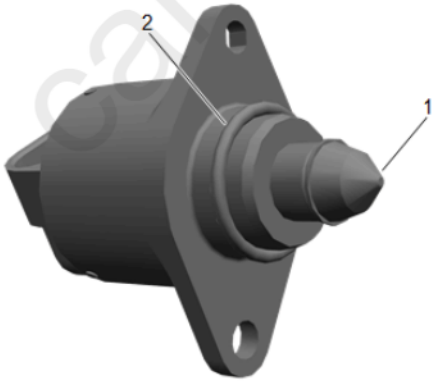
Idle Air Control Valve Cleaning

Removal Procedure

1. Throttle Body Assembly >> Remove - Throttle Body Assembly Replacement



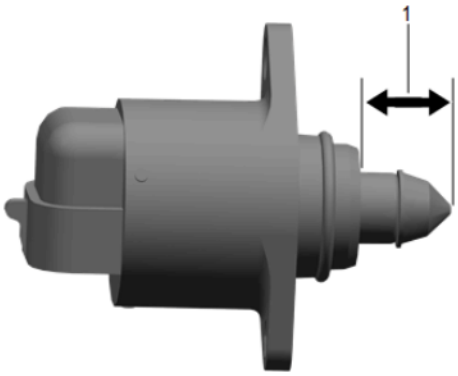
2. Click here for full size
3. Idle Air Control Valve Boltâ€‰(1>) >> Remove [2>x]
4. Idle Air Control Valveâ€‰(2>) @ Throttle Body >> Remove



5. Click here for full size
6. Note:

   DO NOT pull or push or rotate the pintleâ€‰(1>). DO NOT soak the IACV in any liquid cleaner or solvent, as internal damage may result
7. Idle Air Control Valve O-ringâ€‰(2>) >> Remove
8. Inspect the O-ring for cuts, cracks or distortion and replace if damaged.

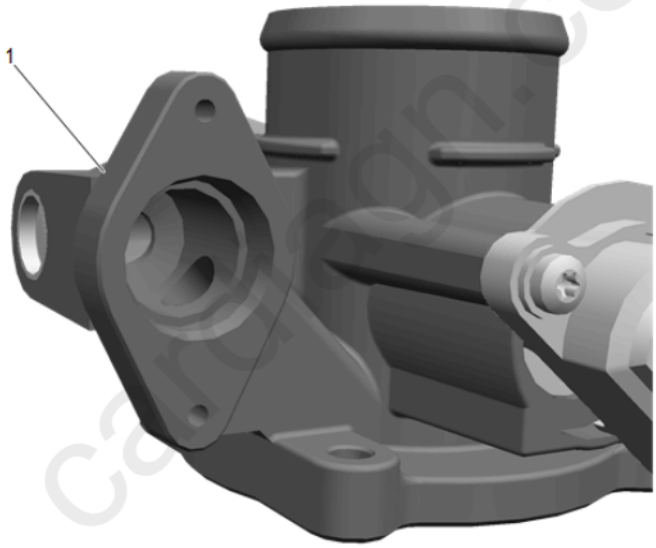
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9. [Click here for full size]
10. Note**:**

    Do not use methyl ethyl ketone

11. Clean the pintle surfacesâ€‰(1>) using suitable fuel system cleaner. And clean the residues using soft, clean and dry cloth.



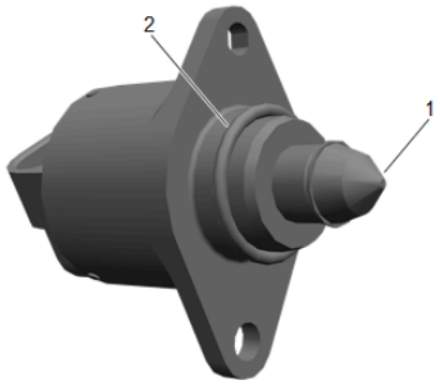
12. [Click here for full size]
13. Note**:**

    Do not use methyl ethyl ketone

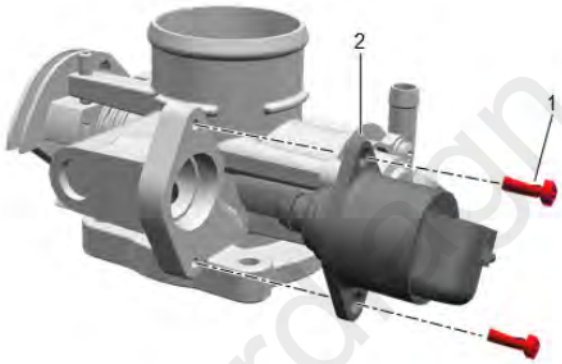
14. Clean the throttle body valve seat and air passage inside surfaces using suitable fuel system cleaner. And clean the residues using soft, clean and dry cloth

Installation Procedure

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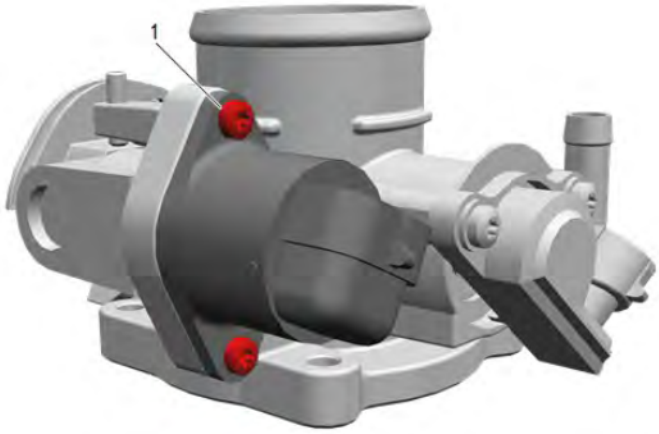


1. Click here for full size
2. Install the O-ringâ€‰(2>) and lubricate it with clean engine oil



3. Click here for full size
4. Apply thread locking compound (any Loctite compound) on Idle Air Control Valve Boltâ€‰(1>)[2>x]
5. Idle Air Control Valveâ€‰(2>) @ Throttle Body >> Install

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6. [Click here for full size]
7. Caution:

   Refer to Fastener Caution.

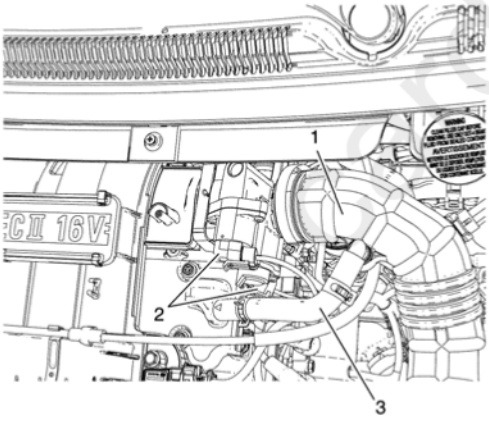
8. Idle Air Control Valve Boltâ€‰(1>) >> Install and tighten 3>N-m (27 lb in).[2>x]
9. Throttle Body Assembly >> Install - Throttle Body Assembly Replacement

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Body Assembly Replacement (Without FX3)

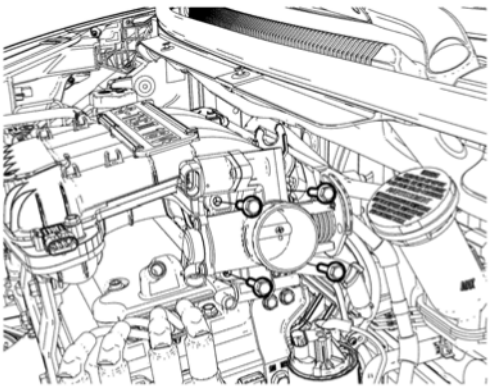
Removal Procedure



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1. Click here for full size
2. Ignition OFF, open the hood.
3. Remove the air cleaner outlet ductâ€‰(1).
4. Disconnect the PCV pipeâ€‰(3).
5. Disconnect the throttle cable and wiring harness plugâ€‰(2).

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6. Click here for full size
7. Note:

   Be careful to be poured when removing the throttle body. Close the coolant inlet and outlet hose using a adequate tool.

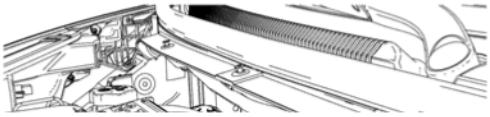
8. Note:

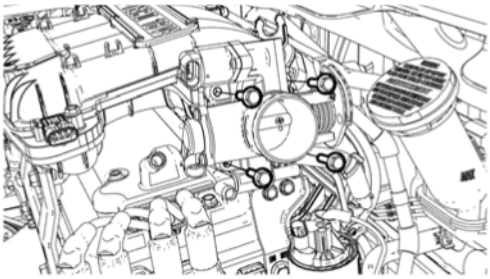
   Close the entrance of the intake manifold after removing the throttle body and any dirt should not be entered.

9. Disconnect the engine coolant inlet and outlet hose.
10. Remove the throttle body assembly retaining bolt.
11. Remove the throttle body with the gasket.

Installation Procedure

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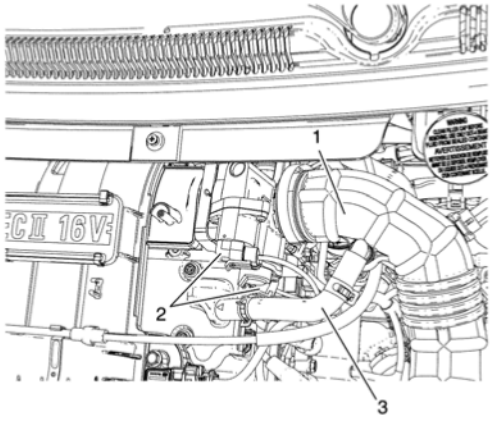




1. Click here for full size
2. Install the throttle body with the new throttle body gasket.
3. Caution:

   Refer to Fastener Caution.
4. Tighten the throttle body retaining bolt to 10.5â€‰N-m (93â€‰lbâ€‰ft).

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5. Click here for full size
6. Note**:**

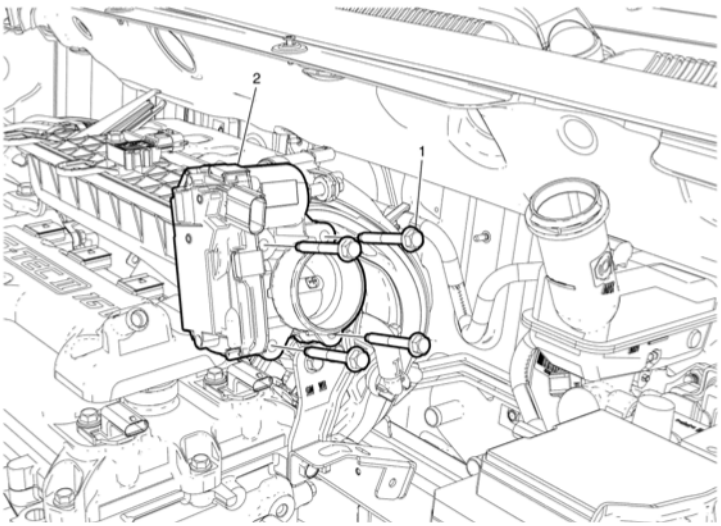
   After connecting the throttle cable, check the throttle valve is closed fully. Check if there is a contact to the accelerator pedal when stopping the engine.

7. Connect the throttle cable and wiring harness plugâ€‰(2).
8. Connect the engine coolant inlet and outlet hose.
9. Connect the PCV pipeâ€‰(3).
10. Install the air cleaner outlet ductâ€‰(1).
11. Perform the throttle body idle air flow compensation reset. Throttle Body Idle Air Flow Compensation Reset
12. Perform the throttle or idle learn. Throttle or Idle Learn

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Body Assembly Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Remove the air cleaner assembly. Refer to Air Cleaner Assembly Replacement. 2. Disconnect the throttle body connector. 3. Perform the throttle body idle air flow compensation reset. Throttle Body Idle Air Flow Compensation Reset 4. Perform the throttle or idle learn. Throttle or Idle Learn

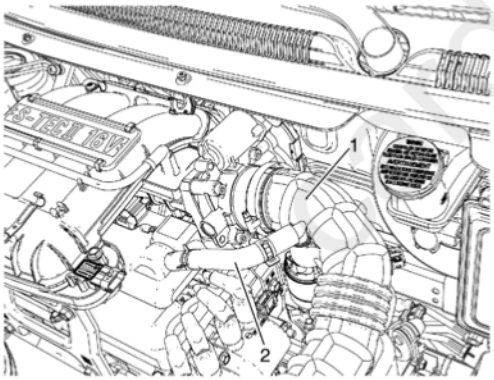
Callout	Component Name
1	Throttle Body Retaining Bolt (Qtyâ€‰4) Caution: Refer to Fastener Caution. Procedure Remove the throttle body retaining bolts. Tighten 10â€‰N-m (89â€‰lbâ€‰in)
2	Throttle Body Assembly

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Throttle Body Assembly Replacement (FX3)

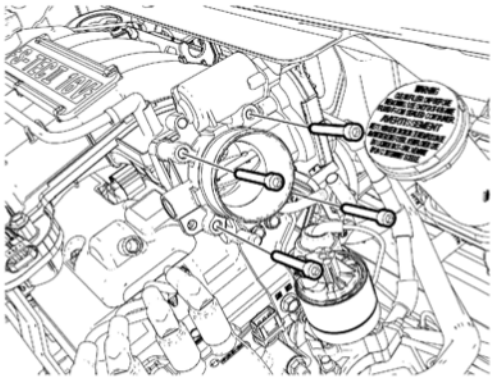
Removal Procedure



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1. Click here for full size
2. Ignition OFF, open the hood.
3. Remove the air cleaner outlet ductâ€‰(1).
4. Disconnect the PCV pipeâ€‰(2).

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5. Click here for full size
6. Note:

   Be careful to be poured when removing the throttle body. Close the coolant inlet outlet hose using a adequate tool.

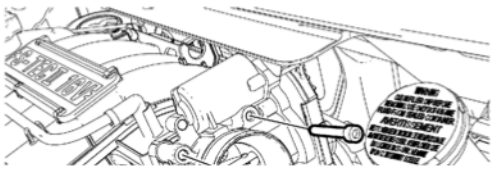
7. Disconnect the engine coolant inlet and outlet hose.
8. Note:

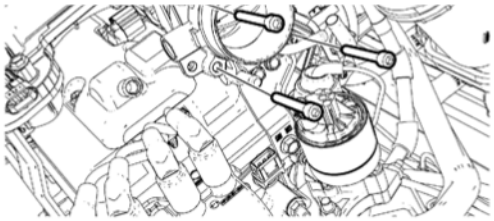
   Close the entrance of the intake manifold after removing the throttle body and any dirt should not be entered.

9. Remove the throttle body assembly retaining bolt.
10. Remove the throttle body with the gasket.

Installation Procedure

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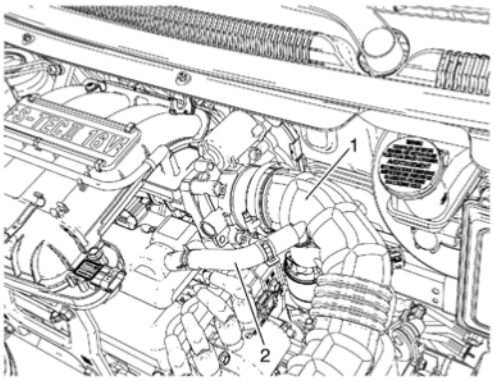




1. Click here for full size
2. Install the throttle body with the NEW throttle body gasket.
3. Caution:

   Refer to Fastener Caution.
4. Tighten the throttle body retaining bolt to 10.5â€‰N-m (93â€‰lbâ€‰in).

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5. Click here for full size
6. Note**:**

   After connecting the throttle cable, check the throttle valve is closed fully. And check if there is a contact to the accelerator pedal when stopping the engine.

7. Connect the engine coolant inlet and outlet hose.
8. Connect the PCV pipeâ€‰(2).
9. Install the air cleaner outlet ductâ€‰(1).
10. Perform the throttle body idle air flow compensation reset. Throttle Body Idle Air Flow Compensation Reset
11. Perform the throttle or idle learn. Throttle or Idle Learn

1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Pressure Relief

Warning**:**

Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.

After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

1. Open the fuel cap.
2. Remove the fuel pump fuse from the engine room fuse box.
3. Ignition on and allow the engine to idle until the engine stops.
4. After ignition OFF, crank the engine for 10â€‰seconds to verify that there is no fuel.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Pressure Gauge Installation and Removal

Special Tools

DW100-010 Fuel Pressure Gauge

For equivalent regional tools, refer to Special Tools.

Installation Procedure

Warning**:**

Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

Warning**:**

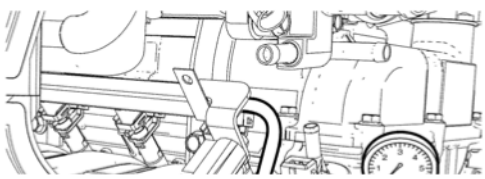
Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

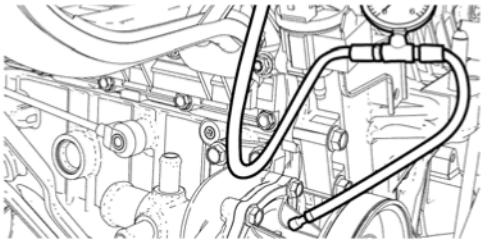
Caution**:**

Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

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1. Click here for full size
2. Relieve the fuel pressure. Refer to Fuel Pressure Relief.
3. Attach the *DW100-010* gauge to the test connection.
4. Start the engine.
5. Read the fuel pressure from the pressure gauge.
6. Nominal value: 380â€‰kPa (3.8â€‰bar)

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Pressure Gauge Installation and Removal (LKY)

Special Tools

EN-49495 Fuel Pressure Gauge

For equivalent regional tools, refer to Special Tools.

Installation Procedure

Warning:

Fuel/gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

Warning:

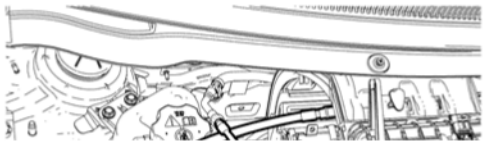
Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

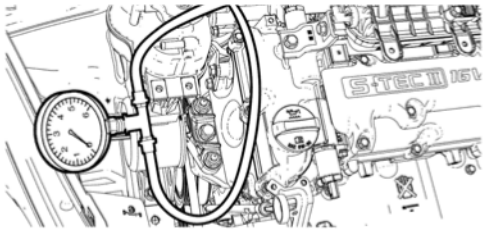
Caution:

Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

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1. Click here for full size
2. Relieve the fuel pressure. Refer to Fuel Pressure Relief.
3. Attach the *EN-49495* fuel pressure gauge to the fuel feed pipe and fuel rail.
4. Start the engine
5. Read the fuel pressure from the pressure gauge.
6. Nominal value

   380â€‰kPa (3.8â€‰bar)

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

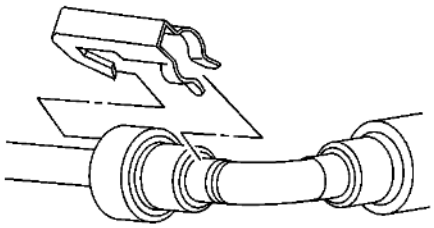
Metal Collar Quick Connect Fitting Service (LKY)

Special Tools

EN-47831 Fuel Line Disconnect Tool

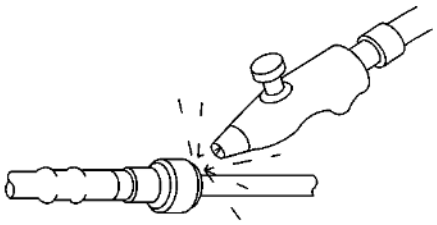
For equivalent regional tools, refer to Special Tools.

Removal Procedure



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1. Click here for full size
2. Relieve the fuel system pressure before servicing any fuel system connection. Refer to Fuel Pressure Relief.
3. Remove the retainer from the quick connect fitting.

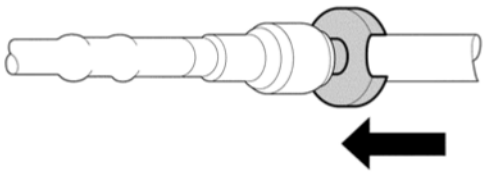


4. [Click here for full size]
5. Warning**:**

   Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

6. Blow dirt out of the fitting using compressed air.

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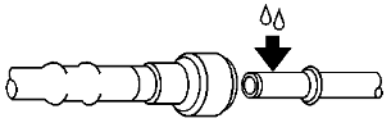


7. Click here for full size
8. Insert the *EN-47831* tool into the male connector, then push inward in order to release the locking tabs.
9. Pull the connection apart.
10. Caution**:**

    If necessary, remove rust or burrs from the fuel pipes with an emery cloth. Use a radial motion with the fuel pipe end in order to prevent damage to the O-ring sealing surface. Use a clean shop towel in order to wipe off the male tube ends. Inspect all the connections for dirt and burrs. Clean or replace the components and assemblies as required.
11. Use a clean shop towel in order to wipe off the male pipe end.
12. Inspect both ends of the fitting for dirt and burrs. Clean or replace the components as required.

Installation Procedure

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1. Click here for full size
2. Warning**:**

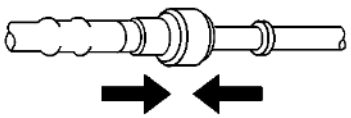
   In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.

   This will ensure proper reconnection and prevent a possible fuel leak.

   During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

3. Apply a few drops of clean engine oil to the male pipe end.

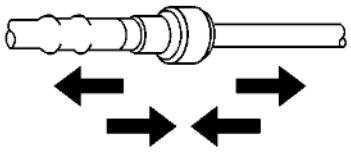
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4. [Click here for full size]

5. Push both sides of the fitting together in order to snap the retaining tabs into place.

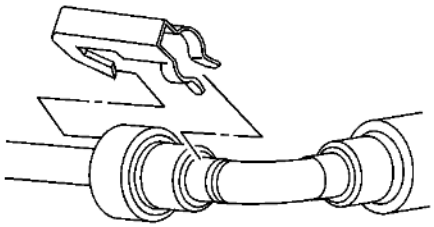
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6. [Click here for full size]

7. Once installed, pull on both sides of the fitting in order to make sure the connection is secure.

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8. Click here for full size
9. Install the retainer to the quick connect fitting.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Draining

Warning**:**

Refer to Diesel/Gasoline Vapors Warning.

Warning**:**

Refer to Safety Goggles and Fuel Warning.

Warning**:**

Refer to Fuel Vapors in Evaporative Emission Components Warning.

1. Note**:**

   The fuel tank must be drained with a suitable, commercially-available fuel removal unit and suction hose - follow safety regulations and national legislation. The fuel tank is fitted with a refill limit float valve. This is located on the filler neck in the fuel tank. To prevent damaging the refill limit float valve, a suitable suction hose must be used. In the presence of fuel vapors or escaping fuel - observe safety regulations and national legislation. Store drained fuel in a suitable, sealable container.

2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the fuel tank filler cap.
4. Insert a suitable suction hose into the fuel tank filler pipe.
5. Attach a suitable suction hose to the hose used with the hand or air operated pump devise.
6. Using a hand or air operated pump drain as much fuel from the tank as possible.

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Tank	TANK KIT,FUEL	0023Z
Fuel Tank	TANK,FUEL(W/SDR)	0024A
Fuel Tank	TANK,FUEL (W/SDR & FIL PIPE)	0024B
Fuel Tank	TANK,FUEL	0025A
Fuel Tank	TANK,FUEL (LH PROC)	0025R
Fuel Tank	TANK,FUEL (RH PROC)	0025T
Fuel Tank	TANK,FUEL (PRIMARY)	0028A
Fuel Tank	TANK,FUEL	0034A
Fuel Tank	TANK,FUEL(TMPRY)	0050A
Fuel Tank	TANK,FUEL(TMPRY)	0050B

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

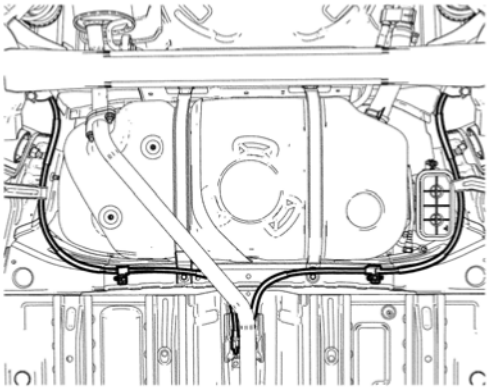
Fuel Tank Replacement (LMT, LMU, LC5)

Removal Procedure

1. Open the hood.
2. Warning**:**

   Refer to Battery Disconnect Warning.
3. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
4. Drain the fuel tank. Refer to Fuel Tank Draining.

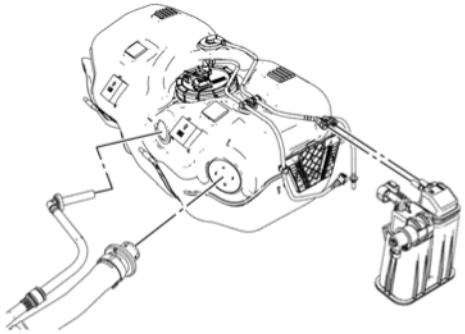
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5.
Click here for full size

6. If needed, remove the parking brake cable retaining clamp and set it away from the path.

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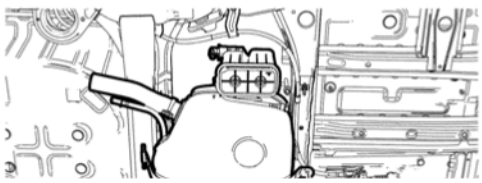


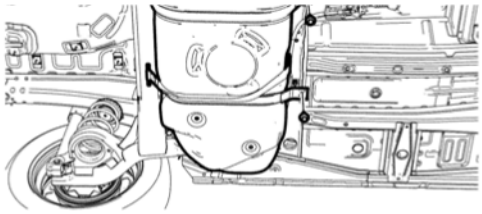
7. Click here for full size
8. Warning:

   Refer to Fuel Vapors in Evaporative Emission Components Warning.

9. Disconnect the fuel tank filler tube, EVAP bent tube and EVAP line from the fuel tank.
10. Disconnect the fuel supply line and wiring harness connector from the fuel pump. Refer to Fuel Tank Fuel Pump Module Replacement.
11. If needed, disconnect the fuel supply line and wiring harness in the right side of the fuel tank.

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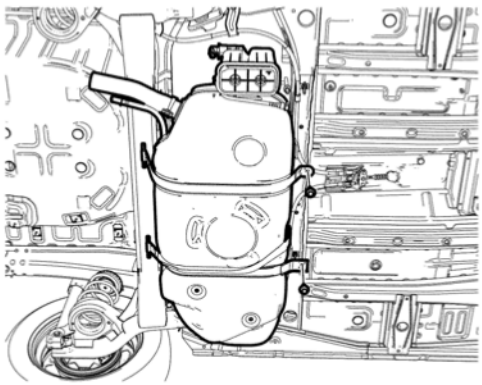




12. Click here for full size
13. Remove the exhaust pipe. Refer to Exhaust Pipe Replacement.
14. Place a suitable jack under the fuel tank.
15. Remove the 2â€‰fuel tank strap bolts.
16. Remove the 2â€‰fuel tank straps.
17. Lower the vehicle. Refer to Lifting and Jacking the Vehicle.

Installation Procedure

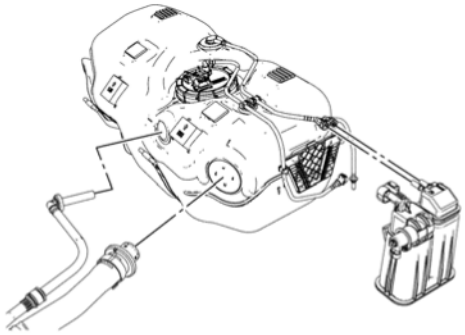
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1. Click here for full size
2. Raise the jack.
3. Install the fuel tank.
4. Install the 2â€‰fuel tank straps.
5. Caution:

   Refer to Fastener Caution.
6. Install the 2â€‰fuel tank strap bolts and tighten to 20â€‰N-m (14.8â€‰lbâ€‰ft).



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7. Click here for full size
8. Connect the fuel supply line.
9. Connect the fuel filler tube to the fuel tank.

10. Connect the EVAP bent tube and EVAP line.
11. Install the parking brake cable retainer.
12. Install the exhaust pipe. Refer to Exhaust Pipe Replacement.
13. Connect the fuel supply line and wiring harness connector to the fuel pump. Refer to Fuel Tank Fuel Pump Module Replacement.
14. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
15. Fill the fuel and check the fuel leakage of the fuel connection line.
16. Close the hood.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

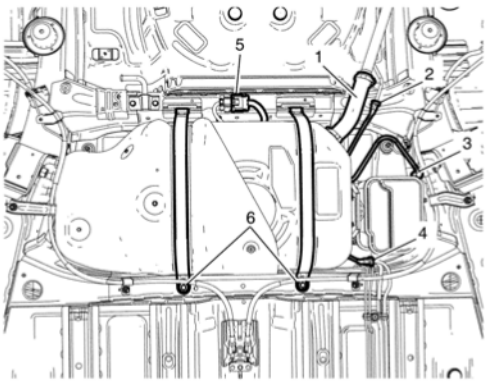
Fuel Tank Replacement (LKY)

Removal Procedure

1. Open the hood.
2. Warning**:**

   Refer to Battery Disconnect Warning.
3. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
4. Relieve the fuel pressure. Refer to Fuel Pressure Relief.
5. Ensure that the fuel level in the tank is less than 1/4 full. If necessary, drain the fuel tank to at least this level. Refer to Fuel Tank Draining.
6. Raise and suitably support the vehicle. Refer to Lifting and Jacking the Vehicle.
7. Remove the front exhaust muffler assembly. Refer to Exhaust Muffler Replacement - Front.

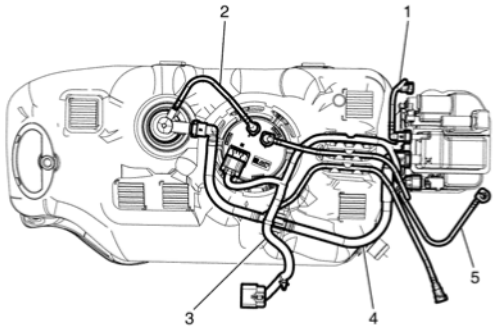
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8. Click here for full size
9. Disconnect the fuel tank filler hoseâ€‰(1) and clamp.
10. Disconnect the fuel tank vent pipe connectorâ€‰(2).
11. Disconnect the fuel feed pipe connectorâ€‰(3).
12. Disconnect the evaporative emission canister purge pipe connectorâ€‰(4).
13. Disconnect the fuel tank electrical extension connectorâ€‰(5).
14. Place a suitable jack under the fuel tank.
15. Remove the fuel tank strap boltsâ€‰(6) and straps.
16. If needed, remove the parking brake cable retaining clamp and set it away from the path.
17. Remove the fuel tank.

Disassembly Procedure

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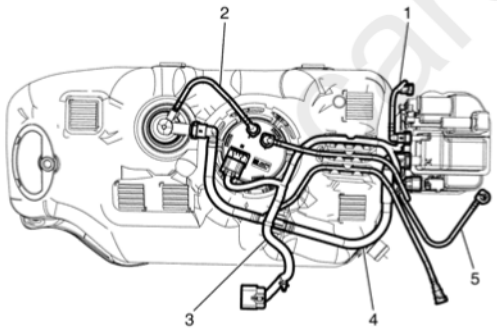
1. Click here for full size
2. Remove the evaporative emission canister purge pipeâ€‰(1).
3. Disconnect the fuel tank recirculation pipe connectorâ€‰(2).
4. Disconnect the fuel tank wiring harnessâ€‰(3) electrical connectors from the following:
5.
    - Fuel tank pump
    - Fuel tank pressure sensor
    - Evaporative emission canister solenoid valve
6. Remove the fuel tank vent pipeâ€‰(4).
7. Remove the fuel feed pipeâ€‰(5).
8. Remove the evaporative emission canister. Refer to Evaporative Emission Canister Replacement.

9. Remove the fuel tank fuel pump module. Refer to Fuel Tank Fuel Pump Module Replacement.
10. Remove the fuel tank heat shield. Refer to Fuel Tank Heat Shield Replacement.

Assembly Procedure

1. Install the fuel tank heat shield. Refer to Fuel Tank Heat Shield Replacement.
2. Install the fuel tank fuel pump module. Refer to Fuel Tank Fuel Pump Module Replacement.
3. Install the evaporative emission canister. Refer to Evaporative Emission Canister Replacement.

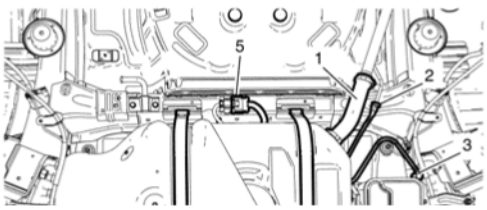
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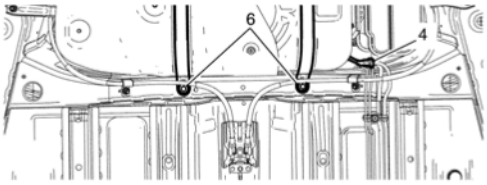


4. Click here for full size
5. Install the fuel tank vent pipeâ€‰(4).
6. Install the fuel feed pipeâ€‰(5).
7. Install the evaporative emission canister purge pipeâ€‰(1).
8. Connect the fuel tank recirculation pipe connectorâ€‰(2).
9. Connect the fuel tank wiring harnessâ€‰(3) electrical connectors to the following:
10.
    - Fuel tank pump
    - Fuel tank pressure sensor
    - Evaporative emission canister solenoid valve

Installation Procedure

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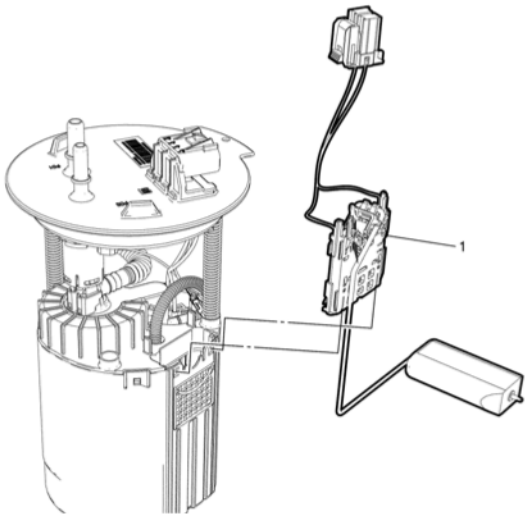
1. Click here for full size
2. Using the adjustable jack, slowly raise and reposition the fuel tank in order to install the tank to the vehicle.
3. Install the fuel tank strap and strap boltsâ€‰(6) and tighten to 20â€‰N-m (15â€‰lbâ€‰ft).
4. Remove the adjustable jack from under the fuel tank.
5. Connect the fuel tank filler hoseâ€‰(1) and clamp.
6. Connect the fuel tank vent pipe connectorâ€‰(2).
7. Connect the fuel feed pipe connectorâ€‰(3).
8. Connect the evaporative emission canister purge pipe connectorâ€‰(4).
9. Connect the fuel tank electrical extension connectorâ€‰(5).
10. Install the front exhaust muffler assembly. Refer to Exhaust Muffler Replacement - Front.
11. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
12. Perform the following procedure in order to inspect for leaks:
13.
    1. Turn the ignition ON, with the engine OFF, for 2â€‰seconds.
    2. Turn the ignition OFF for 10â€‰seconds.
    3. Turn the ignition ON, with the engine OFF.
    4. Inspect for fuel leaks.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Level Sensor Replacement (LKY)

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Callout	Component Name
Preliminary Procedures Remove the fuel pump. Refer to Fuel Tank Fuel Pump Module Replacement.	
1	Fuel Level Sensor Procedure 1. Disconnect the fuel level sensor electrical connector. 2. Remove the fuel level sensor.

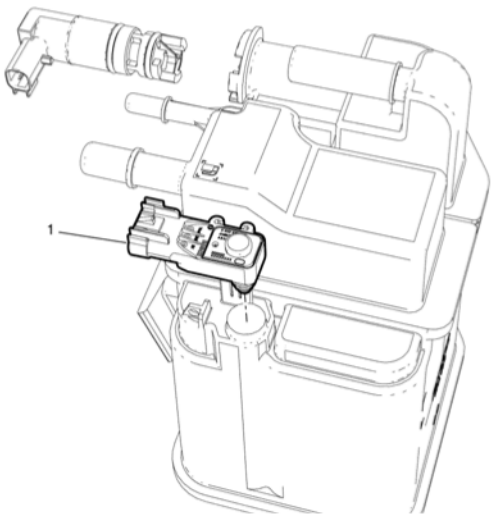
Related Part Information

Part Name	Catalog Name	Part Code
Fuel Level Sensor	SENSOR KIT,FUEL LVL	3164A
Fuel Level Sensor	SENSOR,FUEL LVL	3165A
Fuel Level Sensor	SENSOR,FUEL LVL	3165B

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Pressure Sensor Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
1	Fuel Tank Pressure Sensor Procedure 1. Disconnect the fuel tank pressure sensor electrical connector. 2. Remove the fuel tank pressure sensor.

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Tank Pressure Sensor	SENSOR KIT,F/TNK PRESS	4589Z

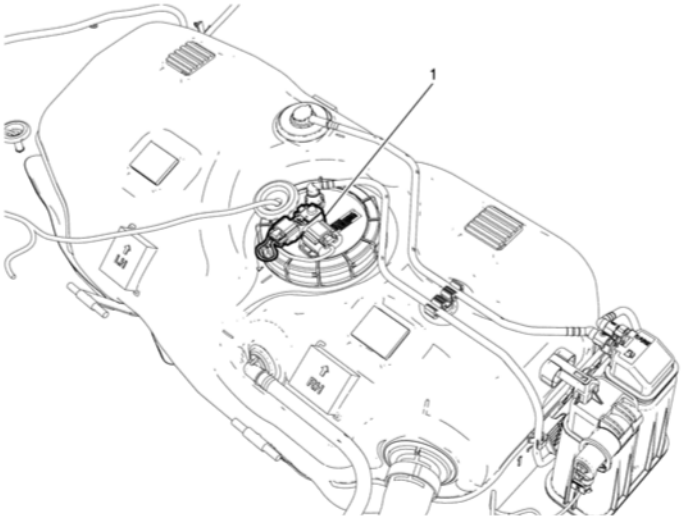
Part Name	Catalog Name	Part Code
Fuel Tank Pressure Sensor	SENSOR,F/TNK PRESS	4590A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Pressure Sensor Replacement

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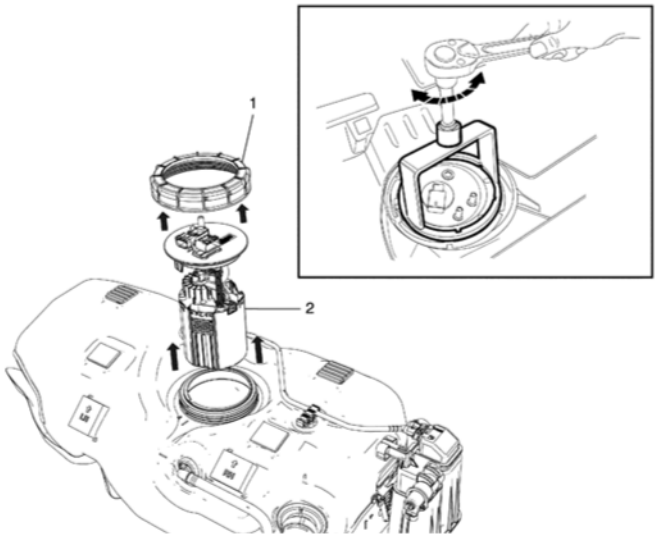
Click here for full size

Callout	Component Name
Preliminary Procedures 1. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Fold the rear seat, remove the fuel pump cover. 3. Disconnect the fuel tank pressure sensor connector.	
1	Remove the fuel tank pressure sensor.

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Fuel Pump Module Replacement (LMT, LMU, LC5)

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Callout	Component Name
	Preliminary Procedures 1. Relieve the fuel pressure. Refer to Fuel Pressure Relief. 2. Disconnect battery negative cable. Refer to Battery Negative Cable Disconnection and Connection. 3. Fold rear seat, remove fuel pump cover, and disconnect fuel line and wiring harness.
1	Fuel Pump Lock Ring Procedure Remove fuel pump lock ring using *EN-50167* ring. Special Tools *EN-50167* Fuel Pump Lock Ring Remover/Installer For equivalent regional tools, refer to Special Tools.

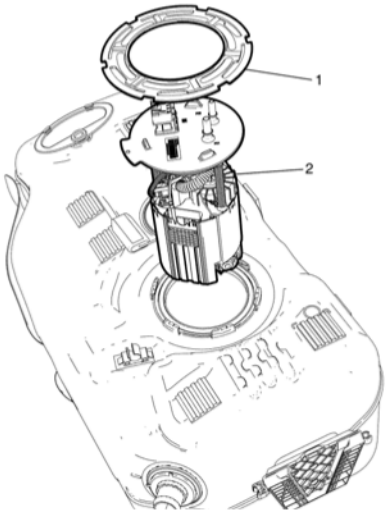
Callout	Component Name
2	Fuel Pump Procedure Remove fuel pump assemble above.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Fuel Pump Module Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Remove the fuel tank. Refer to Fuel Tank Replacement. 2. Disconnect the evaporative emission vent pipe connector and fuel feed connector.
1	Fuel Pump Lock Ring Caution: Refer to Fastener Caution. Procedure Remove the fuel pump lock ring using *J-45747* fuel sending unit wrench. Special Tools *J-45747* Fuel Sending Unit Wrench For equivalent regional tools, refer to Special Tools.

Callout	Component Name
2	Fuel Pump

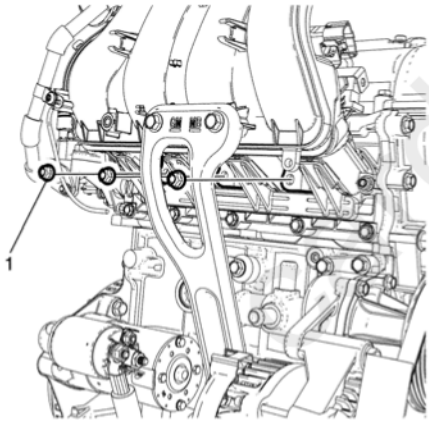
Related Part Information

Part Name	Catalog Name	Part Code
Fuel Tank Fuel Pump Module	MODULE KIT,F/TNK F/PMP	SJ073
Fuel Tank Fuel Pump Module	MODULE KIT,F/TNK F/PMP	1223Z
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP(SENDER & PUMP)	1224A
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP (SENDER & PUMP & REG)	1224B
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP (SENDER & PUMP & REG & FUEL LINE)	1224C
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP (SENDER & PUMP & FIL HOSE)	1224D
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP	1224E
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP (W/O FUEL LVL SEN)	1224F
Fuel Tank Fuel Pump Module	MODULE KIT,F/TNK F/PMP (W/O FUEL LVL SEN)	1224G
Fuel Tank Fuel Pump Module	MODULE,F/TNK F/PMP (W/O FUEL LVL SEN & F/TNK PRESS SEN)	1224H

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

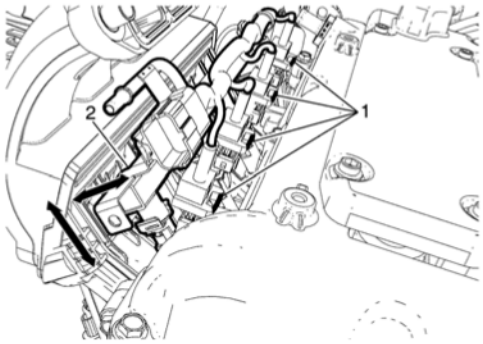
Fuel Injection Fuel Rail Assembly Replacement



diagn.com

1. Click here for full size
2. Relieve the fuel pressure. Refer to Fuel Pressure Relief.
3. Remove the upper intake manifold housing. Refer to Upper Intake Manifold Replacement.
4. Remove the fuel rail retaining nutâ€‰(1).
5. If needed, remove engine coolant surge tank retaining bolt and put it away from the path for easy access, and also remove air cleaner assembly.

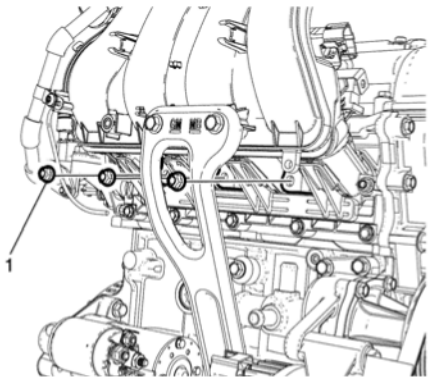
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6. Click here for full size
7. Disconnect the fuel hose from the fuel railâ€‰(2).
8. Disconnect the fuel rail and fuel injector connector.
9. Relieve fuel Injector clipâ€‰(1) and remove the fuel railâ€‰(2) with the fuel injector.

Installation Procedure

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1. Click here for full size
2. Install the fuel rail with the fuel injector.
3. Connect the fuel rail and fuel injector connector.
4. Connect the fuel hose to the fuel rail.
5. Caution:

   Refer to Fastener Caution.
6. Install the fuel rail retaining nutâ€‰(1) and tighten to 10â€‰N-m (88.5â€‰lbâ€‰in).

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Injection Fuel Rail	RAIL KIT,F/INJN FUEL	0090A
Continuous Fuel Injection Fuel Rail	RAIL KIT,CONTINUOUS F/INJN FUEL	0090B
Direct Fuel Injection Fuel Rail	RAIL KIT,DIR F/INJN FUEL	0090C
Indirect Fuel Injection Fuel Rail	RAIL KIT,INDIRECT F/INJN FUEL	0090D
Multiport Fuel Injection Fuel Rail	RAIL KIT,M/PORT F/INJN FUEL	0090E
Sequential Multiport Fuel Injection Fuel Rail	RAIL KIT,SEQ M/PORT F/INJN FUEL	0090F
Fuel Injection Fuel Rail	RAIL,F/INJN FUEL	0100A
Continuous Fuel Injection Fuel Rail	RAIL,CONTINUOUS F/INJN FUEL	0100B
Direct Fuel Injection Fuel Rail	RAIL,DIR F/INJN FUEL	0100C
Indirect Fuel Injection Fuel Rail	RAIL,INDIRECT F/INJN FUEL	0100D
Multiport Fuel Injection Fuel Rail	RAIL,M/PORT F/INJN FUEL	0100E
Sequential Multiport Fuel Injection Fuel Rail	RAIL,SEQ M/PORT F/INJN FUEL	0100F
Multiport Fuel Injection Fuel Rail	RAIL,M/PORT F/INJN FUEL	0101B
Multiport Fuel Injection Fuel Rail	RAIL,M/PORT F/INJN FUEL(CSTG)	0101C
Central Sequential Multiport Fuel Injection Fuel Rail	RAIL,CTL SEQ M/PORT F/INJN FUEL	0102B
Fuel Injection Front Fuel Rail	RAIL,F/INJN FRT FUEL	0105A

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Part Name	Catalog Name	Part Code
Fuel Injection Front Fuel Rail	RAIL,F/INJN FRT FUEL	0105B
Fuel Injection Front Fuel Rail	RAIL,F/INJN FRT FUEL(EXTR)	0105J
Fuel Injection Fuel Rail	RAIL,F/INJN FUEL(EXTR)	0105K
Fuel Injection Fuel Rail	RAIL,F/INJN FUEL	0105L
Fuel Injection Rear Fuel Rail	RAIL,F/INJN RR FUEL	0106A
Fuel Injection Rear Fuel Rail	RAIL,F/INJN RR FUEL	0106B
Fuel Injection Rear Fuel Rail	RAIL,F/INJN RR FUEL(EXTR)	0106J
Multiport Fuel Injection Fuel Rail	RAIL,M/PORT F/INJN FUEL	SJ221

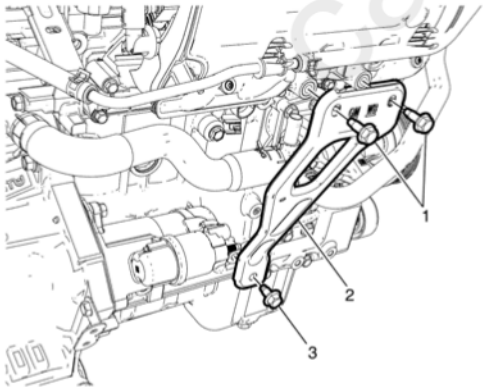
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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Injection Fuel Rail Assembly Replacement (LKY)

Removal Procedure

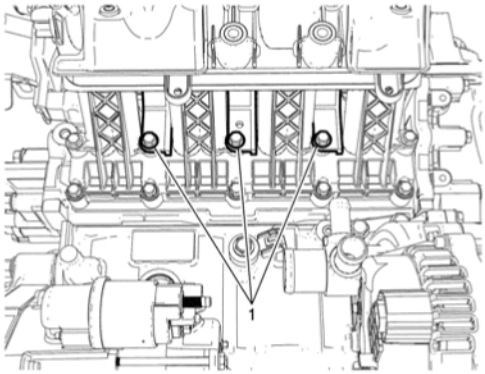
1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
2. Relieve the fuel pressure. Refer to Fuel Pressure Relief.
3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.



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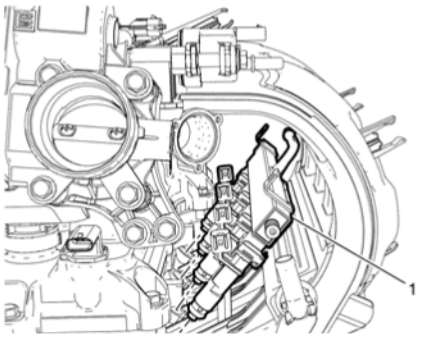
4. Click here for full size
5. Remove the 2 intake manifold bracket boltsâ€‰(1).
6. Remove the intake manifold bracket boltsâ€‰(3).
7. Remove the intake manifold bracketâ€‰(2).

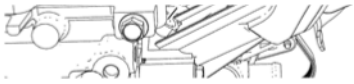
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8. Click here for full size
9. Remove the fuel rail retaining boltsâ€‰(1).
10. Lower the vehicle.

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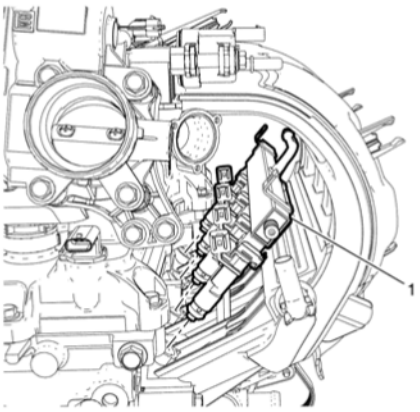




11. Click here for full size
12. Remove the positive crankcase ventilation hose. Refer to Positive Crankcase Ventilation Hose/Pipe/Tube Replacement.
13. Disconnect the fuel feed line â€‰quick connect fitting from the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.
14. Disconnect the fuel rail and fuel injector connector.
15. Remove the fuel rail and fuel injectorâ€‰(1).
16. Transfer parts as necessary.

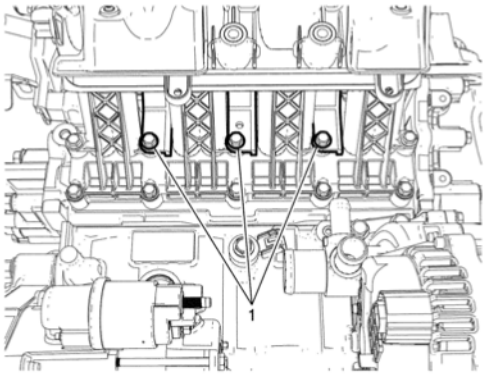
Installation Procedure

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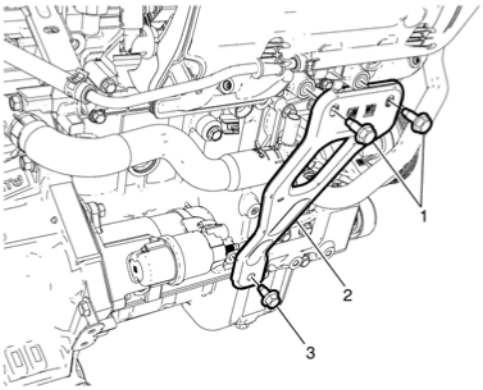
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1. Click here for full size
2. Install the fuel rail and fuel injectorâ€‰(1).
3. Connect the fuel rail and fuel injector connector.
4. Connect the fuel feed lineâ€‰quick connect fitting to the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.
5. Install the positive crankcase ventilation hose. Refer to Positive Crankcase Ventilation Hose/Pipe/Tube Replacement.



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6. Click here for full size
7. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
8. Install the fuel rail retaining boltsâ€‰(1) and tighten to 10â€‰N-m (89â€‰lbâ€‰in).



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9. Click here for full size
10. Install the intake manifold bracketâ€‰(2).
11. Install the 2 intake manifold bracket boltsâ€‰(1) and tighten to 25â€‰N-m (18â€‰lbâ€‰ft).
12. Install the intake manifold bracket boltâ€‰(3) and tighten to 46â€‰N-m (34â€‰lbâ€‰ft).

13. Lower the vehicle.
14. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Injector Cleaning

Special Tools

- *J 35800-A* Fuel Injector Cleaner
- *J 37287* Fuel Line Shut-Off Adapters
- *J 42873-1* 3/8 Fuel Line Shut-Off Valve
- *J 42873-2* 5/16 Return Pipe Shut-Off Valve
- *J 42964-1* 3/8 Fuel Pipe Shut-Off Valve
- *J 42964-2* 5/16 Fuel Pipe Shut-Off Valve

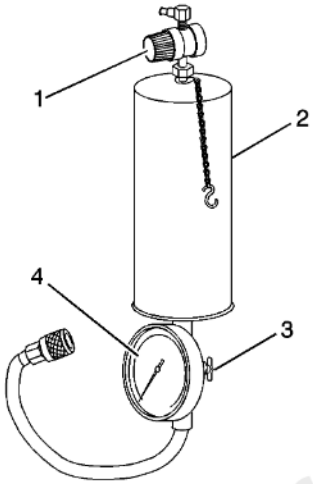
Caution**:**

- GM Upper Engine and Fuel Injector Cleaner is the only injector cleaning agent recommended. DO NOT USE OTHER CLEANING AGENTS AS THEY MAY CONTAIN METHANOL, WHICH CAN DAMAGE FUEL SYSTEM COMPONENTS.
- Under NO circumstances should the GM Upper Engine and Fuel Injector Cleaner be added to the vehicle fuel tank, as it may damage the fuel pump and other system components.
- Do not exceed the recommended cleaning solution concentration. Higher concentrations may damage fuel system components. Testing has demonstrated that exceeding the recommended cleaning solution concentration does not improve the effectiveness of this procedure.

Note**:**

Vehicles with less than 160â€‰km (100â€‰mi) on the odometer should not have the injectors cleaned. These vehicles should have the injectors replaced.

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1. Click here for full size

2. Obtain *J 35800-A* fuel injector cleaner (2).

3. Note:

   Make sure the valve at the bottom of the canisterâ€‰(3) is closed.

4. Forâ€‰4,â€‰5, and 6â€‰cylinder engines, empty two of the 30â€‰ml (1â€‰oz) reservoirs of the GM Upper Engine and Fuel Injector Cleaner twin reservoir container into the *J 35800-A* fuel injector cleaner , injector cleaning tank, then add 420â€‰ml (14â€‰oz) of regular unleaded gasoline. If you are using any other brand of cleaning tank, you will need a total of 60â€‰ml (2â€‰oz) of GM Upper Engine and Fuel Injector Cleaner mixed with 420â€‰ml (14â€‰oz) of regular unleaded gasoline.

5. For 8â€‰cylinder engines, empty two of the 30â€‰ml (1â€‰oz) reservoirs of the GM Upper Engine and Fuel Injector Cleaner twin reservoir container into the *J 35800-A* fuel injector cleaner , injector cleaning tank, then add 420â€‰ml (14â€‰oz) of regular unleaded gasoline. If you are using any other brand of cleaning tank, you will need a total of 60â€‰ml (2â€‰oz) of GM Upper Engine and Fuel Injector Cleaner mixed with 420â€‰ml (14â€‰oz) of regular unleaded gasoline.

6. This procedure will need to be repeated for an 8â€‰cylinder engine. The 8â€‰cylinder engines receive 960â€‰ml total fluidâ€”120â€‰ml (4â€‰oz) of GM Upper Engine and Fuel Injector Cleaner and 840â€‰ml (28â€‰oz) of gasoline.

7. Fill the injector cleaning tank with regular unleaded gasoline. Be sure to follow all additional instructions provided with the tool.

8. Electrically disable the vehicle fuel pump by performing one of the following depending on how the vehicle is equipped:

9.

   1. Remove the fuel pump relay and disconnect the oil pressure switch.
   2. Remove the fuel pump fuse.
   3. Remove the fuel system control module (FSCM) fuse.

10. Disconnect the fuel feed and return line, if equipped, at the fuel rail. Plug the fuel feed and return line, if equipped, coming off the fuel rail with *J 37287* fuel line shut-off adapters , or *J 42964-1* 3/8 fuel pipe shut-off valve , and *J 42964-2* 5/16 fuel pipe shut-off valve or *J 42873-1* 3/8 fuel line shut-off valve , and *J 42873-2* 5/16 return pipe shut-off valve as appropriate for the fuel system.

11. Connect the *J 35800-A* fuel injector cleaner to the vehicle fuel rail.

12. Pressurize the *J 35800-A* fuel injector cleaner to 510â€‰kPaâ€‰(75â€‰psi).

13. Start and idle the engine until it stalls due to lack of fuel. This should take approximately 15â€“20â€‰minutes.

14. Turn the ignition to the OFF position.

15. Injectors should be flow-tested at this point. If further cleaning is needed, a repeat of the above procedure should be done.

16. When the injector restriction returns to zero, proceed to stepâ€‰12.

17. Disconnect the *J 35800-A* fuel injector cleaner from the fuel rail.

18. If equipped, reconnect the vehicle fuel pump relay and oil pressure switch connector, fuel pump fuse, or fuel system control module.

19. Remove the *J 37287* fuel line shut-off adapters , or *J 42964-1* 3/8 fuel pipe shut-off valve and *J 42964-2* 5/16 fuel pipe shut-off valve , or *J 42873-1* 3/8 fuel line shut-off valve *J 42873-1* 3/8 fuel line shut-off valve and reconnect the vehicle fuel feed and return lines.

20. Start and idle the vehicle for an additional two minutes to ensure residual injector cleaner is flushed from the fuel rail and fuel lines.

21. Pour the entire contents of GM Fuel System Treatment Plus, GMâ€‰P/Nâ€‰19367028 into a nearly empty tank and advise the customer to refuel with up to 76â€‰L (20â€‰gal) of fuel.

22. Advise the customer to use only a Top Tier Detergent gasoline and to add a bottle of GM Fuel System Treatment Plus to the fuel tank at every oil change.

23. Regular use of GM Fuel System Treatment Plus should keep the customer from having to repeat the injector cleaning procedure.

24. Road test the vehicle to verify that the customer concern has been corrected.

Related Part Information

Part Name	Catalog Name	Part Code
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0203
Fuel Injector	INJECTOR KIT,FUEL(MARINE)	0150A

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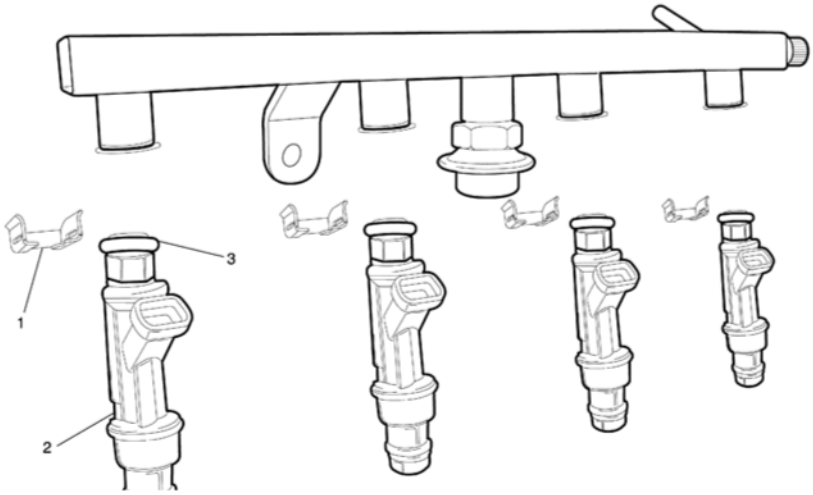
Part Name	Catalog Name	Part Code
Fuel Injector	INJECTOR,FUEL	X0006
Fuel Injector	INJECTOR,FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0011
Fuel Injector	INJECTOR,FUEL(W/FUEL RL)	X0012
Fuel Injector	INJECTOR KIT,FUEL	X0018
Central Multiport Fuel Injector	INJECTOR,CTL M/PORT FUEL	X0026
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0028
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0031
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL	X0033
Direct Fuel Injector	INJECTOR,DIR FUEL	X0034
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0035
Multiport Fuel Injector	INJECTOR,M/PORT FUEL	X0036
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	X0037
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL & FEED & RTN PIPE)	X0038
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0039
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0040
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0041
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0042
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL)	X0043
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL)	X0044
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL)	X0045
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL)	X0046
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL)	X0047
Continuous Fuel Injector	INJECTOR KIT,CONTINUOUS FUEL	X0048
Direct Fuel Injector	INJECTOR KIT,DIR FUEL	X0049
Indirect Fuel Injector	INJECTOR KIT,INDIRECT FUEL	X0050
Multiport Fuel Injector	INJECTOR KIT,M/PORT FUEL	X0051
Sequential Multiport Fuel Injector	INJECTOR KIT,SEQ M/PORT FUEL	X0052
Central Multiport Fuel Injector	INJECTOR KIT,CTL M/PORT FUEL	X0053
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0054
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0084
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0091
Central Sequential Multiport Fuel Injector	INJECTOR,CTL SEQ M/PORT FUEL	X0151
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0152
Central Sequential Multiport Fuel Injector	INJECTOR KIT,CTL SEQ M/PORT FUEL	X0213
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/DISTR)	X0285
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/ FUEL FEED TUBE)	X0286
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ WRG HARN)	X0315
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ FUEL RL & WRG HARN)	X0327
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/DISTR)	X0019
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	SJ075
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	SJ186
Fuel Injector	INJECTOR,FUEL	X0824

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Injector Replacement

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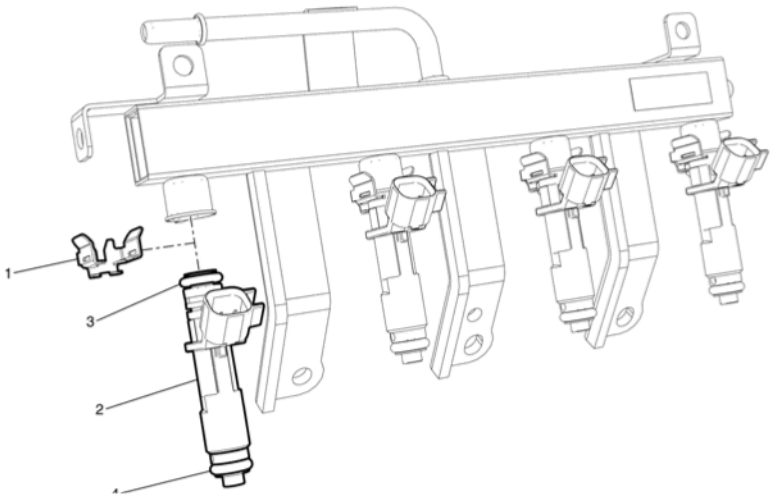
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Callout	Component Name
Preliminary Procedure Remove the fuel rail. Refer to Fuel Injection Fuel Rail Assembly Replacement.	
1	Remove the fuel injector retainer clip.
2	Disconnect the fuel injector pulling down.
3	Replace the fuel injector with the O-ring.

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Injector Replacement (LKY)

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Callout	Component Name
Preliminary Procedure Remove the fuel rail. Refer to Fuel Injection Fuel Rail Assembly Replacement.	
1	Fuel Injector Retainer Clip (Qty:â€‰4) Procedure Remove the fuel injector retainer clip.
2	Fuel Injector (Qty:â€‰4) Procedure Disconnect the fuel injector pulling down.
3	Fuel Injector Upper O-ring (Qty:â€‰4) Procedure Replace the fuel injector with the New O-ring.

Callout	Component Name
4	Fuel Injector Lower O-ring (Qty:â€‰4) Procedure Replace the fuel injector with the New O-ring.

Related Part Information

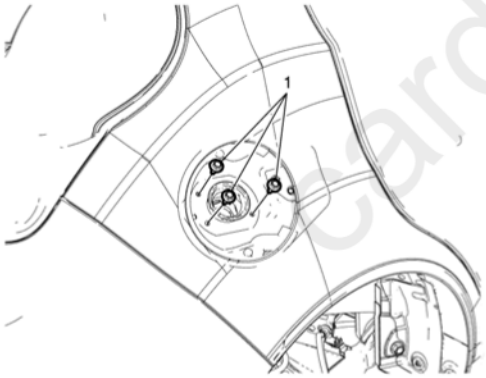
Part Name	Catalog Name	Part Code
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0203
Fuel Injector	INJECTOR KIT,FUEL(MARINE)	0150A
Fuel Injector	INJECTOR,FUEL	X0006
Fuel Injector	INJECTOR,FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0011
Fuel Injector	INJECTOR,FUEL(W/FUEL RL)	X0012
Fuel Injector	INJECTOR KIT,FUEL	X0018
Central Multiport Fuel Injector	INJECTOR,CTL M/PORT FUEL	X0026
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0028
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0031
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL	X0033
Direct Fuel Injector	INJECTOR,DIR FUEL	X0034
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0035
Multiport Fuel Injector	INJECTOR,M/PORT FUEL	X0036
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	X0037
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL & FEED & RTN PIPE)	X0038
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL & FUEL FEED & RTN PIPE)	X0039
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0040
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0041
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL & FEED & RTN PIPE)	X0042
Continuous Fuel Injector	INJECTOR,CONTINUOUS FUEL(W/FUEL RL)	X0043
Direct Fuel Injector	INJECTOR,DIR FUEL(W/FUEL RL)	X0044
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL(W/FUEL RL)	X0045
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/FUEL RL)	X0046
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL(W/FUEL RL)	X0047
Continuous Fuel Injector	INJECTOR KIT,CONTINUOUS FUEL	X0048
Direct Fuel Injector	INJECTOR KIT,DIR FUEL	X0049
Indirect Fuel Injector	INJECTOR KIT,INDIRECT FUEL	X0050
Multiport Fuel Injector	INJECTOR KIT,M/PORT FUEL	X0051
Sequential Multiport Fuel Injector	INJECTOR KIT,SEQ M/PORT FUEL	X0052
Central Multiport Fuel Injector	INJECTOR KIT,CTL M/PORT FUEL	X0053
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	X0054
Throttle Body Fuel Injector	INJECTOR KIT,THROT BODY FUEL	X0084
Indirect Fuel Injector	INJECTOR,INDIRECT FUEL	X0091
Central Sequential Multiport Fuel Injector	INJECTOR,CTL SEQ M/PORT FUEL	X0151
Throttle Body Fuel Injector	INJECTOR,THROT BODY FUEL	X0152
Central Sequential Multiport Fuel Injector	INJECTOR KIT,CTL SEQ M/PORT FUEL	X0213
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/DISTR)	X0285
Multiport Fuel Injector	INJECTOR,M/PORT FUEL (W/ FUEL FEED TUBE)	X0286
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ WRG HARN)	X0315
Direct Fuel Injector	INJECTOR,DIR FUEL (W/ FUEL RL & WRG HARN)	X0327
Multiport Fuel Injector	INJECTOR,M/PORT FUEL(W/DISTR)	X0019
Sequential Multiport Fuel Injector	INJECTOR,SEQ M/PORT FUEL	SJ075
Throttle Body Fuel Injection Fuel Injector	INJECTOR,TBI FUEL	SJ186
Fuel Injector	INJECTOR,FUEL	X0824

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Fuel Tank Filler Pipe Replacement

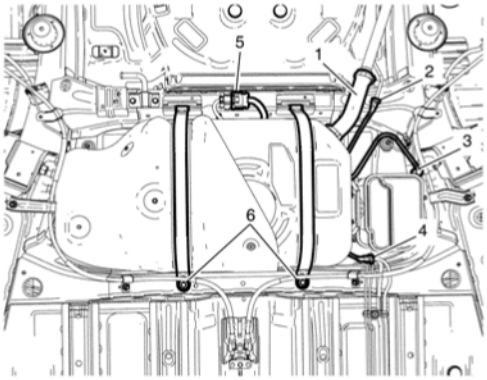
Removal Procedure



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1. Click here for full size
2. Open the fuel filler door and filler cap.
3. Remove the fuel filler pipe upper boltsâ€‰(1).
4. Lift and support the vehicle. Refer to Lifting and Jacking the Vehicle.

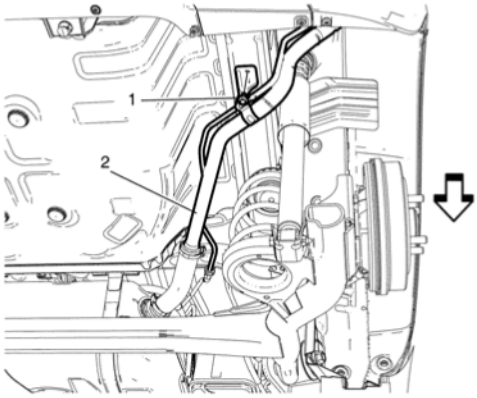
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5.
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6. Disconnect the fuel tank filler hoseâ€‰(1) and clamp.
7. Disconnect the fuel tank vent pipe connectorâ€‰(2).

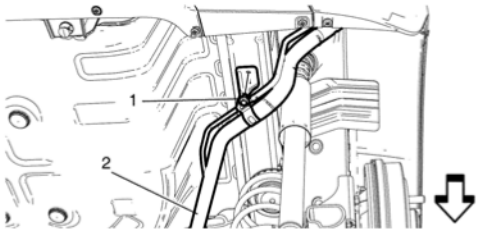
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8. Click here for full size
9. Remove the fuel tank filler pipe lower boltâ€‰(1).
10. Remove the fuel tank filler pipe assemblyâ€‰(2).

Installation Procedure

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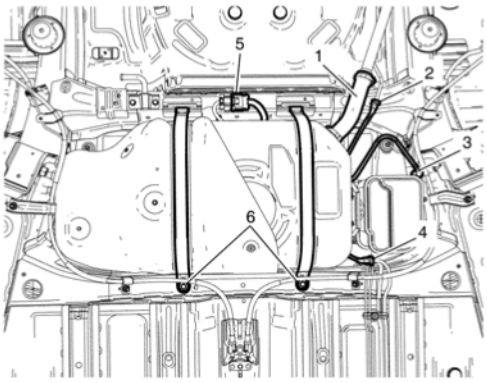




1. Click here for full size
2. Install the fuel tank filler pipe assemblyâ€‰(2).
3. Caution:

   Refer to Fastener Caution.
4. Install the fuel tank filler pipe lower boltâ€‰(1) and tighten to 6â€‰N-m (53â€‰lbâ€‰in).

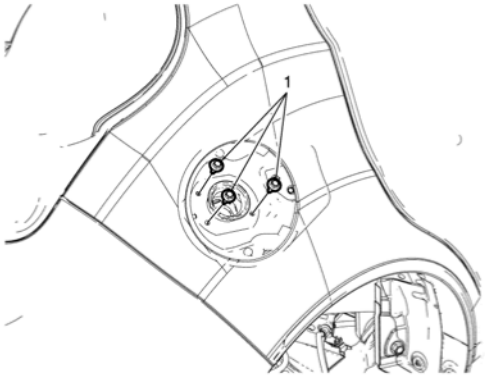
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5. [Click here for full size]

6. Connect the fuel tank filler hoseâ€‰(1) and clamp,
7. Tighten fuel tank filler hose clamp to 6â€‰N-m (53â€‰lbâ€‰in).
8. Connect the fuel tank vent pipe connectorâ€‰(2).
9. Lower the vehicle. Refer to Lifting and Jacking the Vehicle.

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10. Click here for full size
11. Install the fuel filler pipe upper boltsâ€‰(1) and tighten to 6â€‰N-m (53â€‰lbâ€‰in).
12. Close the fuel filler door and filler cap.

Related Part Information

Part Name	Catalog Name	Part Code
Fuel Tank Filler Pipe	PIPE,F/TNK FIL	1525A
Fuel Tank Filler Pipe	PIPE,F/TNK FIL(W/FIL HOSE)	1526A
Fuel Tank Filler Pipe	PIPE,F/TNK FIL(TEMP)	1530A
Fuel Tank Filler Pipe	PIPE,F/TNK FIL (W/ FUEL SURGE TK)	1535A

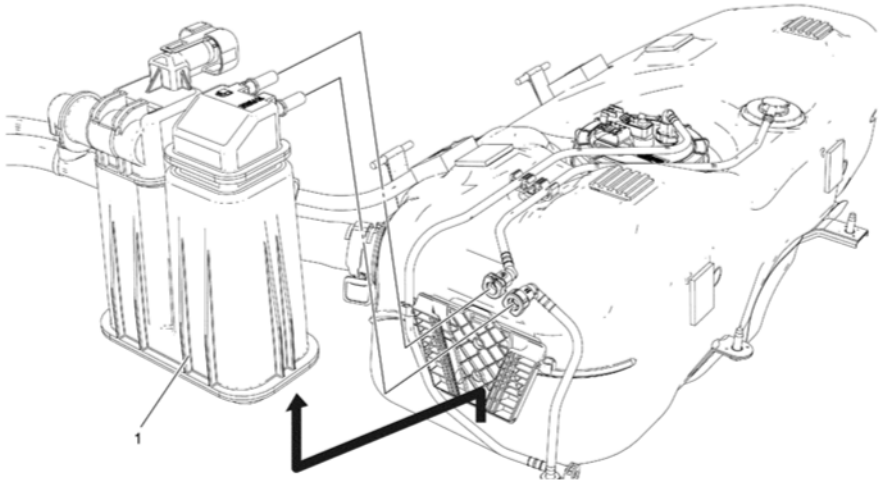
Part Name	Catalog Name	Part Code
Fuel Tank Filler Pipe	PIPE,F/TNK FIL	1550A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Evaporative Emission Canister Replacement

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Callout	Component Name
	Preliminary Procedures 1. Remove the fuel tank. Refer to Fuel Tank Replacement 2. Disconnect the fuel line and purge line.
1	Evaporative Emission Canister Procedure Remove the canister pushing up from the canister bracket.

Related Part Information

Part Name	Catalog Name	Part Code
Evaporative Emission Canister	CANISTER KIT,EVAP EMIS	0045A
Evaporative Emission Canister	CANISTER,EVAP EMIS	0050A
Evaporative Emission Canister	CANISTER,EVAP EMIS (W/O VENT VLV SOL)	0050B

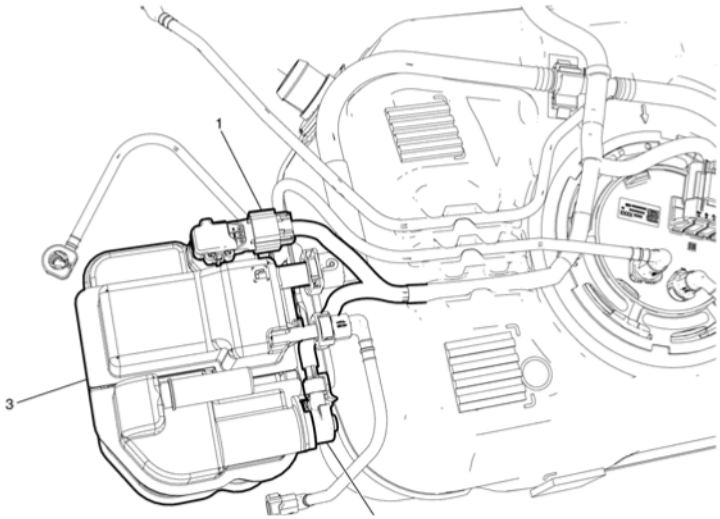
Part Name	Catalog Name	Part Code
Evaporative Emission Canister	CANISTER,EVAP EMIS	0050C

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Evaporative Emission Canister Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Remove the fuel tank. Refer to Fuel Tank Replacement. 2. Disconnect the vent pipe connector and evaporative purge connector.
1	Fuel Tank Pressure Sensor Procedure 1. Disconnect the fuel tank pressure sensor electrical connector. 2. Remove the fuel tank pressure sensor.

Callout	Component Name
2	Evaporative Emission Canister Solenoid Valve Procedure 1. Disconnect the evaporative emission canister solenoid valve electrical connector. 2. Remove the evaporative emission canister solenoid valve.
3	Evaporative Emission Canister Procedure Remove the evaporative emission canister pushing up from the evaporative emission canister bracket.

Related Part Information

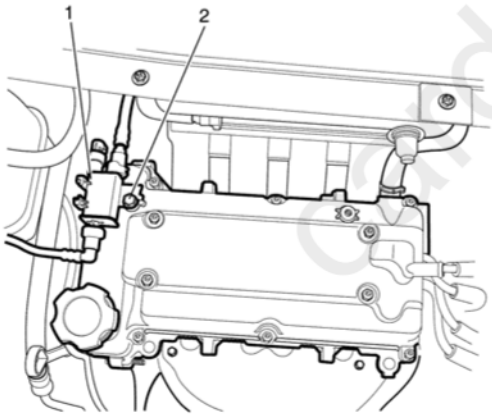
Part Name	Catalog Name	Part Code
Evaporative Emission Canister	CANISTER KIT,EVAP EMIS	0045A
Evaporative Emission Canister	CANISTER,EVAP EMIS	0050A
Evaporative Emission Canister	CANISTER,EVAP EMIS (W/O VENT VLV SOL)	0050B
Evaporative Emission Canister	CANISTER,EVAP EMIS	0050C

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Evaporative Emission Canister Purge Solenoid Valve Replacement

Removal Procedure

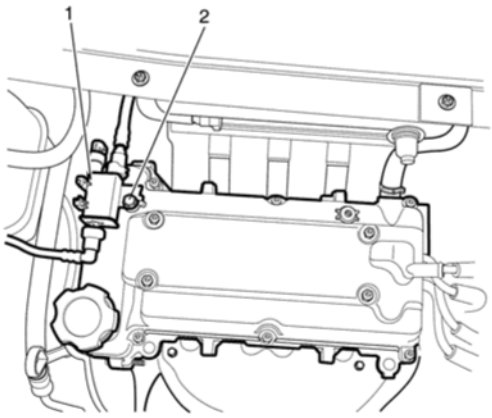


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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the evaporative emission canister purge solenoid valve wiring harness connector.
4. Disconnect the evaporative emission canister purge solenoid valve inlet and outlet hose.
5. Remove the evaporative emission canister purge solenoid valveâ€‰(1) from the bracket.

Installation Procedure

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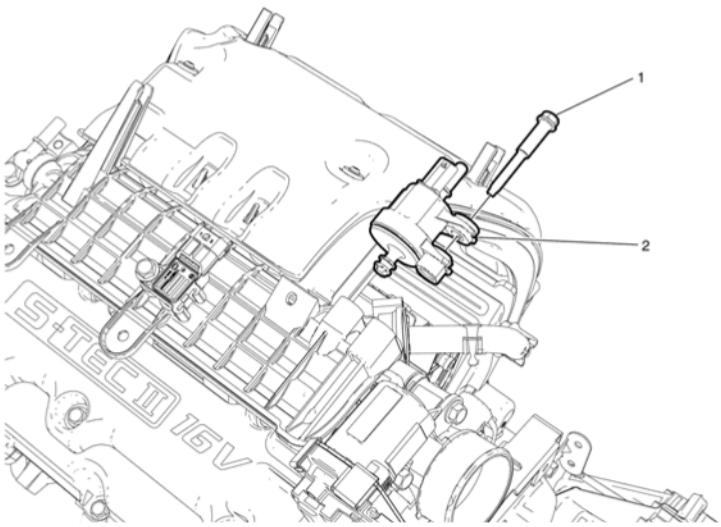
1. Click here for full size
2. Install the evaporative emission canister purge solenoid valveâ€‰(1) to the bracket.
3. Connect the evaporative emission canister purge solenoid valve inlet and outlet hose.
4. Connect the evaporative emission canister purge solenoid valve wiring harness connector.
5. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Evaporative Emission Canister Purge Solenoid Valve Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Disconnect the evaporative emission canister purge solenoid valve electrical connector. 3. Disconnect the evaporative emission pipe connecter.
1	Evaporative Emission Canister Purge Solenoid Valve Bolt Caution: Refer to Fastener Caution. Procedure Remove the evaporative emission canister purge solenoid valve bolt. Tighten 10â€‰N-m (89â€‰lbâ€‰in)

Callout	Component Name
2	Evaporative Emission Canister Purge Solenoid Valve

Related Part Information

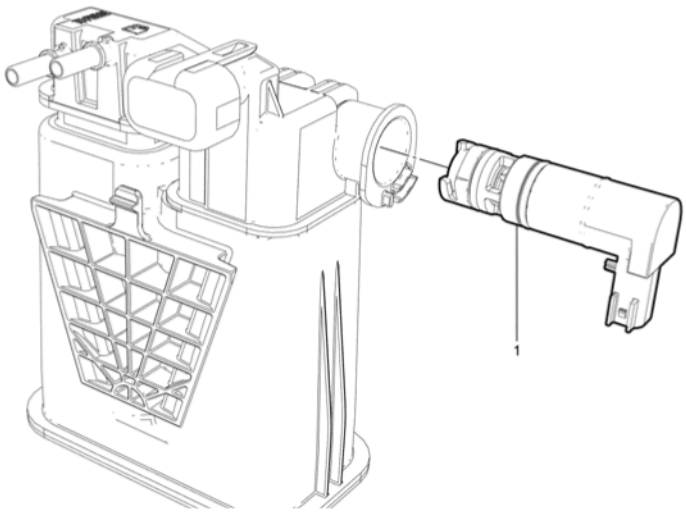
Part Name	Catalog Name	Part Code
Evaporative Emission Canister Purge Solenoid Valve	VALVE,EVAP EMIS CNSTR PURGE SOL(W/BRKT)	0659Z
Evaporative Emission Canister Purge Solenoid Valve	VALVE,EVAP EMIS CNSTR PURGE SOL	0660A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Evaporative Emission Canister Vent Solenoid Valve Replacement (Korea with LMT)

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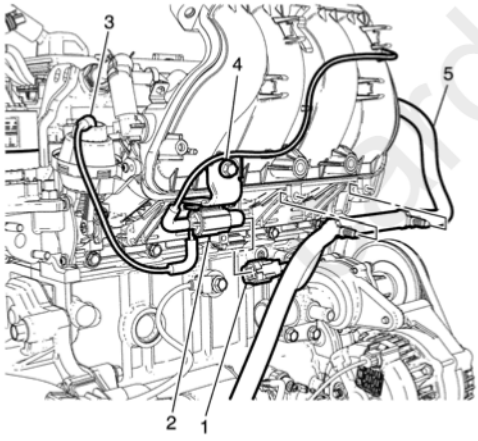
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Callout	Component Name
Preliminary Procedure Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.	
1	Evaporative Emission Canister Vent Solenoid Valve Procedure 1. Disconnect the evaporative emission canister vent solenoid valve electrical connector. 2. Remove the evaporative emission canister vent solenoid valve.

1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Intake Manifold Tuning Valve Replacement

Removal Procedure

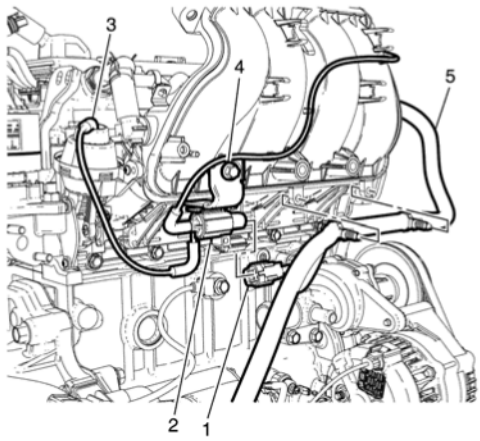


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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the wiring harness and IMRC valve solenoid inlet and outlet hose.
4. Remove the IMRC valve solenoid retaining bolt.
5. Remove the IMRC valve solenoid.

Installation Procedure

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1. Click here for full size
2. Caution:

   Refer to Fastener Caution.

3. Install the IMRC valve solenoid retaining bolt and tighten to 6.5â€‰N-m (57.5â€‰lbâ€‰in).
4. Connect the wiring harness and IMRC valve solenoid inlet and outlet hose.
5. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

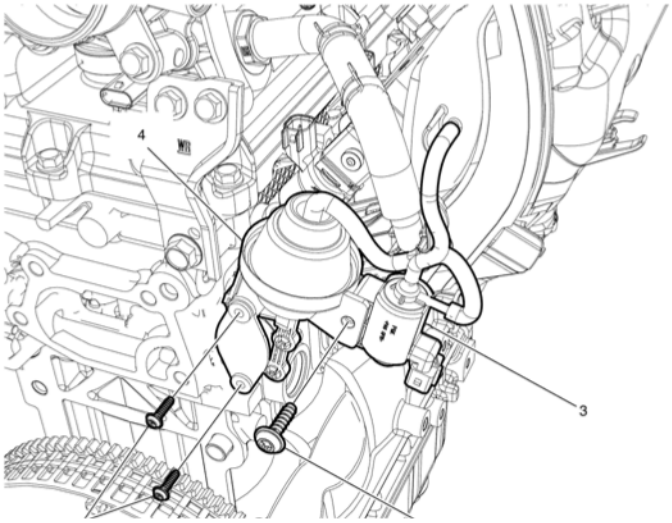
Part Name	Catalog Name	Part Code
Intake Manifold Tuning Valve	VALVE,INT MANIF TUNING	X0062
Intake Manifold Tuning Valve	VALVE,INT MANIF TUNING	X0063
Intake Manifold Tuning Valve	VALVE KIT,INT MANIF TUNING	X0123
Intake Manifold Tuning Valve	VALVE,INT MANIF TUNING (W/ACTR)	X0268

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Intake Manifold Tuning Valve Replacement (LKY)

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Callout	Component Name
Preliminary Procedure Remove the intake manifold. Refer to Engine Coolant Thermostat Housing Replacement.	
1	Intake Manifold Tuning Valve Actuator Cover Fastener (Qty:â€‰2) Caution: Refer to Fastener Caution. Tighten 9â€‰N-m (80â€‰lbâ€‰in)
2	Intake Manifold Tuning Valve Solenoid Fastener Tighten 9â€‰N-m (80â€‰lbâ€‰in)

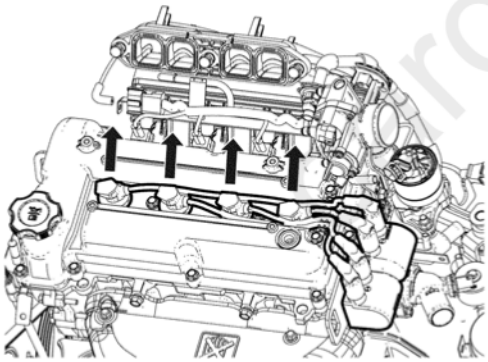
Callout	Component Name
3	Intake Manifold Tuning Valve Solenoid Procedure 1. Disconnect the vacuum line from the intake manifold and intake manifold tuning valve. 2. Disconnect the electrical wiring harness connector from the intake manifold tuning valve solenoid.
4	Intake Manifold Tuning Valve Procedure Disconnect the shift lever from intake manifold.

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

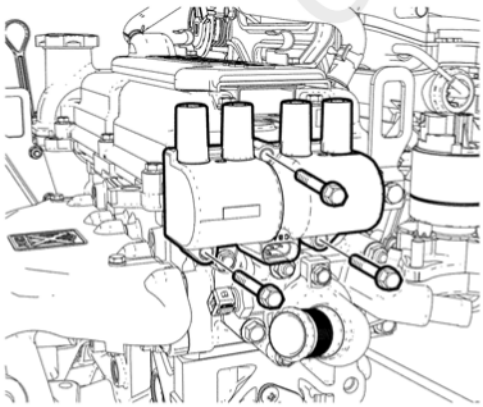
Ignition Coil Replacement

Removal Procedure



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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the ignition cable.
4. Disconnect the ignition coil connector.

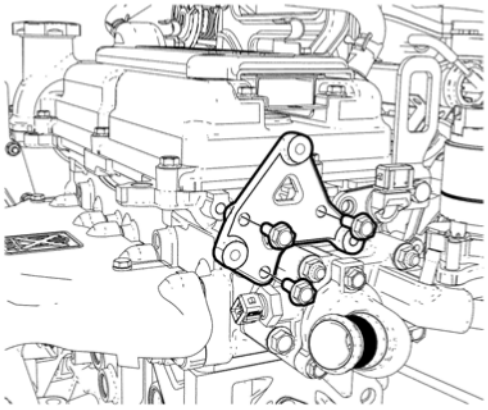


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5.
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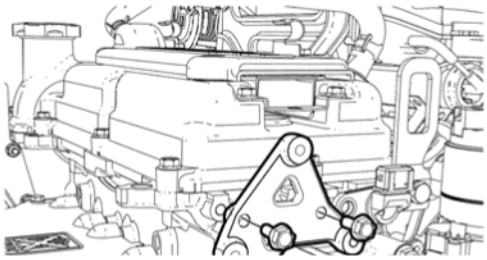
6. Remove the ignition coil retaining bolt.
7. Remove the ignition coil.

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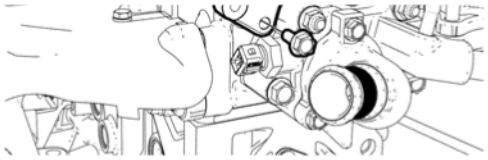


8. Click here for full size
9. Remove the ignition coil bracket retaining bolt.
10. Remove the ignition coil bracket.

Installation Procedure



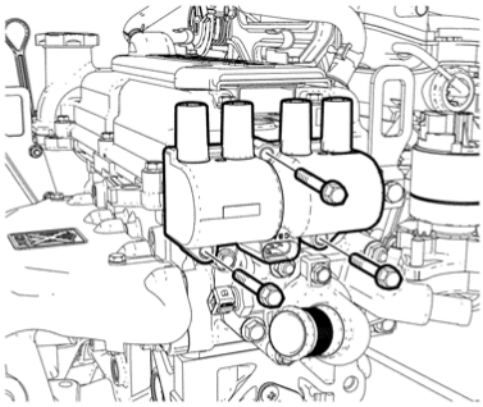
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1. Click here for full size
2. Install the ignition coil bracket.
3. Caution:

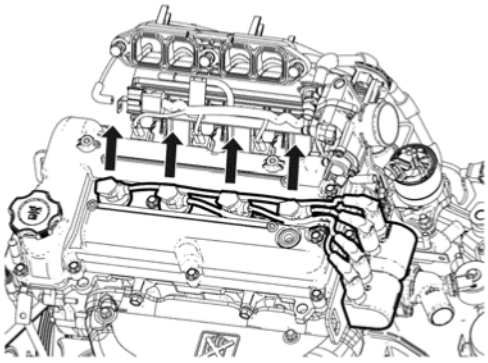
   Refer to Fastener Caution.
4. Install the ignition coil bracket retaining bolt and tighten to 10â€‰N-m (88.5â€‰lbâ€‰in).

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5. Click here for full size
6. Install the ignition coil.
7. Install the ignition coil retaining bolt and tighten to 10â€‰N-m (88.5â€‰lbâ€‰in).

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8. Click here for full size
9. Connect the ignition coil connector.
10. Connect the ignition coil.
11. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

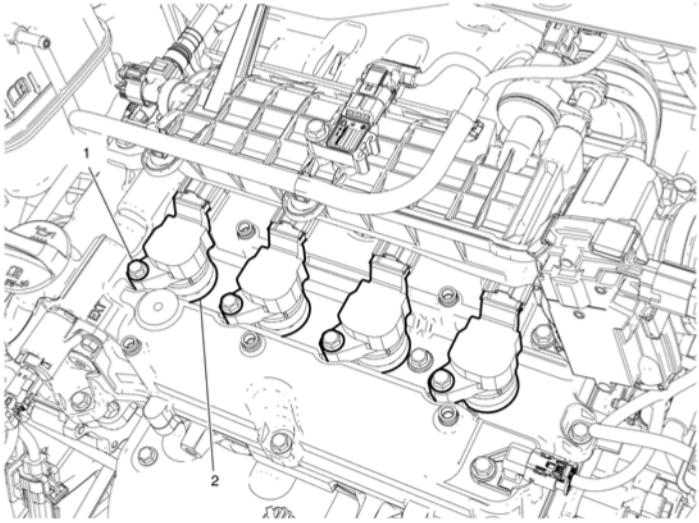
Part Name Catalog Name	Part Code
Ignition Coil COIL KIT,IGN	2699A
Ignition Coil COIL,IGN	2700A
Ignition Coil COIL,IGN (W/ BRKT)	2702A
Ignition Coil COIL KIT,IGN	SJ139
Ignition Coil COIL,IGN	SJ140

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Ignition Coil Replacement

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Remove the ignition coil cover. Refer to Ignition Coil Cover Replacement. 3. Disconnect the 4 ignition coil connectors.
1	Ignition Coil Cover Bolt (Qty:â€‰4) Caution: Refer to Fastener Caution. Procedure Remove the ignition coil boltsâ€‰(1). Tighten 10â€‰N-m (89â€‰lbâ€‰in)

Callout	Component Name
2	Ignition Coil (Qty:â€‰4) Procedure Transfer parts as necessary.

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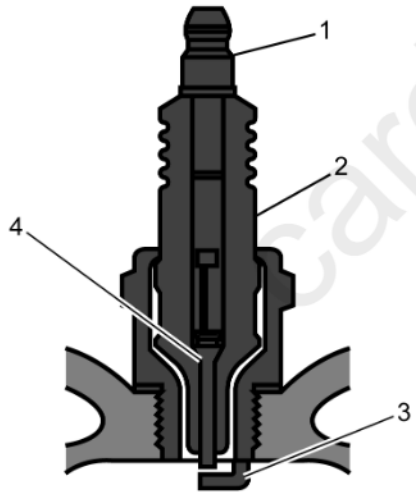
1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Spark Plug Inspection

Spark Plug Usage

1. Ensure that the correct spark plug is installed. Refer to Ignition System Specifications.
2. Ensure that the spark plug has the correct heat range. An incorrect heat range causes the following conditions:
3.
    - Spark plug fouling-colder plug
    - Pre-ignition causing spark plug and/or engine damageâ€“hotter plug

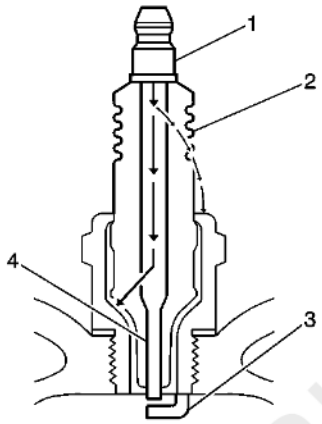
Spark Plug Inspection



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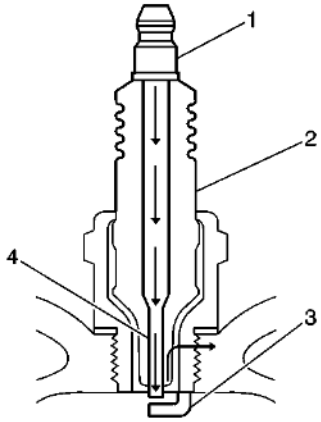
1.
Click here for full size

2. Inspect the terminal postâ€‰(1) for damage.
3.
    - Inspect for a bent or broken terminal postâ€‰(1).
    - Test for a loose terminal postâ€‰(1) by twisting and pulling the post. The terminal postâ€‰(1) should not move.
4. Inspect the insulatorâ€‰â€‰(2) for flashover or carbon tracking, soot. This is caused by the electrical charge traveling across the insulatorâ€‰(2) between the terminal postâ€‰â€‰(1) and ground. Inspect for the following conditions:
5.
    - Inspect the spark plug boot for damage.
    - Inspect the spark plug recess area of the cylinder head for moisture, such as oil, coolant, or water.
    - A spark plug boot that is saturated causes arcing to ground.



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6. Click here for full size
7. Inspect the insulatorâ€‰â€‰(2) for cracks. All or part of the electrical charge may arc through the crack instead of the electrodesâ€‰â€‰(3, 4).



8. Click here for full size
9. Inspect for evidence of improper arcing.
10.
    - Measure the gap between the center electrodeâ€‰â€‰(4) and the side electrodeâ€‰â€‰(3) terminals. Refer to an excessively wide electrode gap can prevent correct spark plug operation.
    - Inspect for the correct spark plug torque. Refer to insufficient torque can prevent correct spark plug operation. An over torqued spark plug, causes the insulatorâ€‰â€‰(2) to crack.
    - Inspect for signs of tracking that occurred near the insulator tip instead of the center electrodeâ€‰â€‰(4).
    - Inspect for a broken or worn side electrodeâ€‰â€‰(3).
    - Inspect for a broken, worn, or loose center electrodeâ€‰â€‰(4) by shaking the spark plug.
11. A rattling sound indicates internal damage.
12. A loose center electrodeâ€‰â€‰(4) reduces the spark intensity.
13.
    - Inspect for bridged electrodesâ€‰â€‰(3, 4). Deposits on the electrodesâ€‰â€‰(3, 4) reduce or eliminates the gap.
    - Inspect for worn or missing platinum pads on the electrodesâ€‰â€‰(3, 4) If equipped.
    - Inspect for excessive fouling.
    - Inspect the spark plug recess area of the cylinder head for debris. Dirty or damaged threads can cause the spark plug not to seat correctly during installation.

Spark Plug Visual Inspection

1. Normal operation: brown to grayish-tan with small amounts of white powdery deposits are normal combustion by-products from fuels with

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additives.

2. Carbon fouled-dry, fluffy black carbon, or soot caused by the following conditions:
3.
    - Rich fuel mixtures
    - Leaking fuel injectors
    - Excessive fuel pressure
    - Restricted air filter element
    - Incorrect combustion
    - Reduced ignition system voltage output
    - Weak coils
    - Worn ignition wires
    - Incorrect spark plug gap
    - Excessive idling or slow speeds under light loads can keep spark plug temperatures so low that normal combustion deposits may not burn off.
    - Deposit fouling-oil, coolant, or additives that include substances such as silicone, very white coating, reduces the spark intensity. Most powdery deposits will not effect spark intensity unless they form into a glazing over the electrode.

Related Part Information

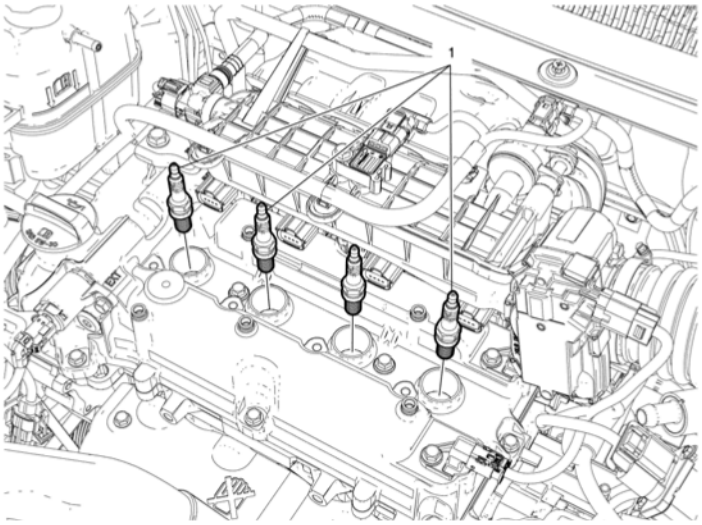
Part Name	Catalog Name	Part Code
Spark Plug	SPARK PLUG, 0021A	

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Spark Plug Replacement (LKY)

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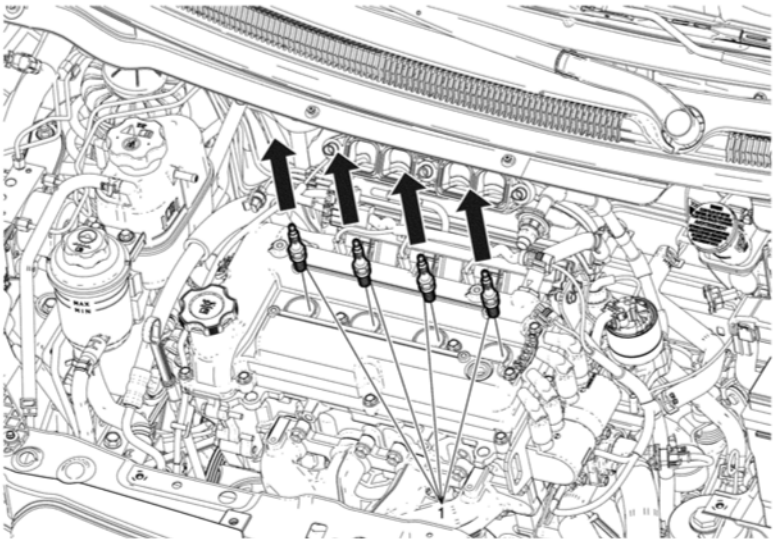
Click here for full size

Callout	Component Name
Preliminary Procedure Remove the ignition coil. Refer to Ignition Coil Replacement.	
1	Spark Plug Caution: Refer to Fastener Caution. Procedure Remove the spark plugâ€‰(1). Tighten 20â€‰N-m (15â€‰lbâ€‰ft)

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Spark Plug Replacement

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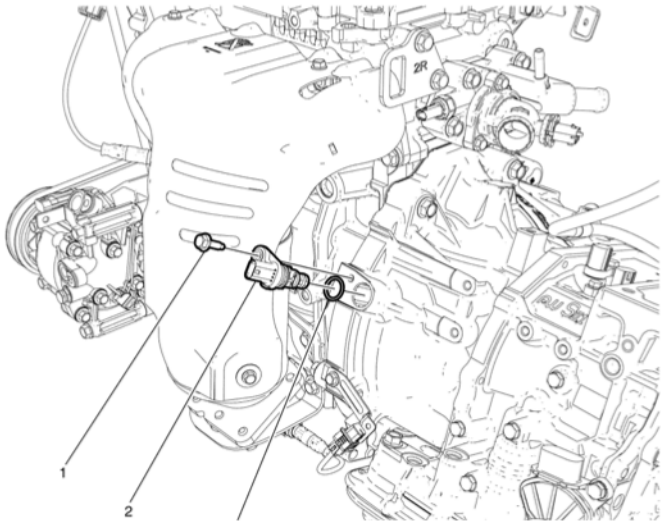
Click here for full size

Callout	Component Name
Preliminary Procedure Remove the ignition coil. Refer to Ignition Coil Replacement.	
1	Remove the spark plugâ€‰(1). Caution: Refer to Fastener Caution. Tighten 20â€‰N-m (14.8â€‰lbâ€‰ft)

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Crankshaft Position Sensor Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Remove the air cleaner assembly. Refer to Air Cleaner Assembly Replacement. 3. Disconnect the crankshaft position sensor connector.
1	Crankshaft Position Sensor Bolt Caution: Refer to Fastener Caution. Procedure Remove the crankshaft position sensor bolt. Tighten 9â€‰N-m (80â€‰lbâ€‰in)

Callout	Component Name
2	Crankshaft Position Sensor
3	Crankshaft Position Sensor O-ring Seal

Related Part Information

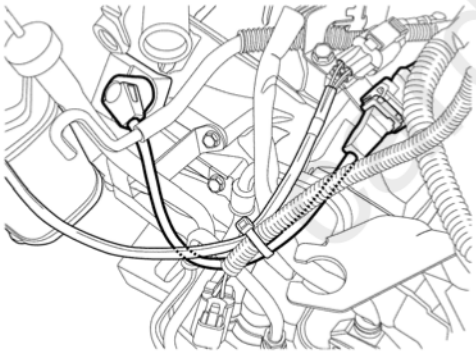
Part Name	Catalog Name	Part Code
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	3700A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN (POSN 1)	3705A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN (POSN 2)	3710A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	X0044
Crankshaft Position Sensor	SENSOR KIT,CR/SHF POSN	X0220
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	X0344
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	SJ243

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Crankshaft Position Sensor Replacement

Removal Procedure

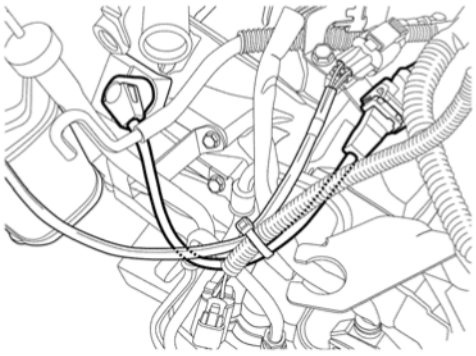


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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the crankshaft position sensor connector.
4. Remove the crankshaft position sensor retaining bolt.
5. Remove the crankshaft position sensor.

Installation Procedure

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1.
   Click here for full size
2. Install the crankshaft position sensor.
3. Caution:

   Refer to Fastener Caution.
4. Install the crankshaft position sensor retaining bolt and tighten to 6.5â€‰N-m (7.5â€‰lbâ€‰in).
5. Connect the crankshaft position sensor connector.
6. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

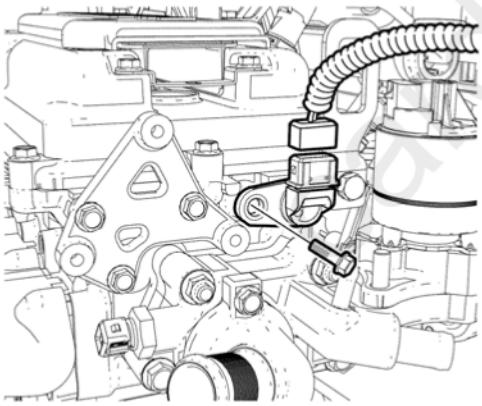
Part Name	Catalog Name	Part Code
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	3700A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN (POSN 1)	3705A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN (POSN 2)	3710A
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	X0044
Crankshaft Position Sensor	SENSOR KIT,CR/SHF POSN	X0220
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	X0344
Crankshaft Position Sensor	SENSOR,CR/SHF POSN	SJ243

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Camshaft Position Sensor Replacement

Removal Procedure



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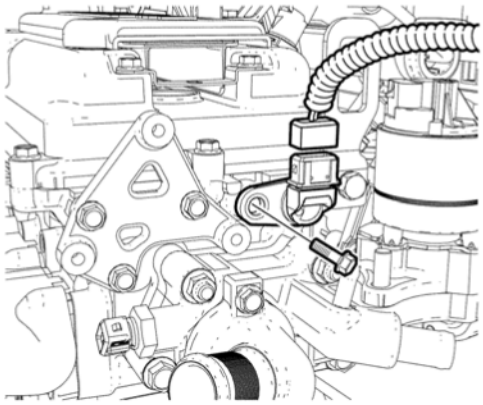
1. Click here for full size
2. Note**:**

   Be careful pouring engine oil after removing the CMP sensor.

3. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
4. Disconnect the camshaft position sensor connector.
5. Remove the camshaft position sensor retaining bolt.
6. Remove the camshaft position sensor.

Installation Procedure

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1. Click here for full size
2. Install the camshaft position sensor.
3. Caution:

   Refer to Fastener Caution.
4. Install the crankshaft position sensor retaining bolt and tighten to 6.5â€‰N-m (7.5â€‰lbâ€‰in).
5. Connect the crankshaft position sensor connector.
6. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

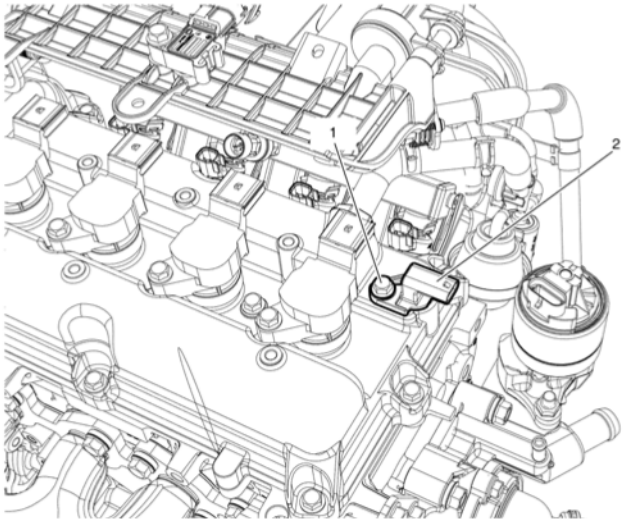
Part Name	Catalog Name	Part Code
Camshaft Position Sensor	SENSOR,CM/SHF POSN	3600A
Camshaft Position Sensor	SENSOR,CM/SHF POSN	X0042
Camshaft Position Sensor	SENSOR,CM/SHF POSN	X0339
Camshaft Position Sensor	SENSOR KIT,CM/SHF POSN	X0363

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Camshaft Position Sensor Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Remove the ignition coil cover. Refer to Ignition Coil Cover Replacement. 3. Disconnect the camshaft position sensor connector.
1	Camshaft Position Sensor Bolt (Qty:â€‰1) Caution: Refer to Fastener Caution. Procedure Remove the camshaft position sensor bolt. Tighten 10â€‰N-m (89â€‰lbâ€‰in)

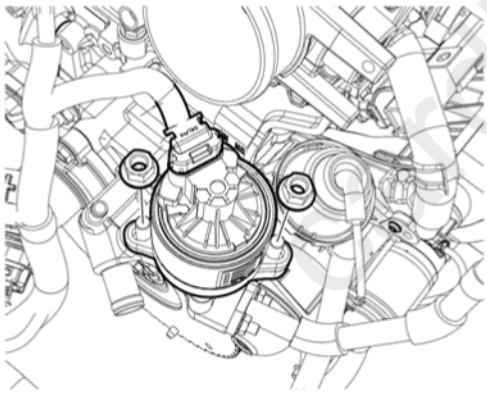
Callout	Component Name
2	Camshaft Position Sensor (Qty:â€‰1)

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Exhaust Gas Recirculation Valve Replacement (LKY)

Removal Procedure

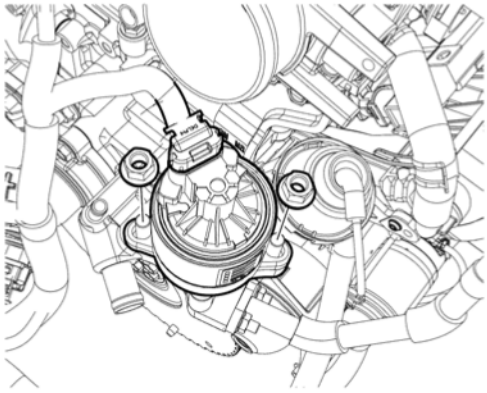


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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the exhaust gas recirculation (EGR) valve connector.
4. Remove the EGR valve mounting nuts.
5. Remove the EGR valve.

Installation Procedure

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1. Click here for full size
2. Install the EGR valve.
3. Caution:

   Refer to Fastener Caution.
4. Install the EGR valve mounting nuts and tighten to 25â€‰N-m (18â€‰lbâ€‰ft).
5. Connect the EGR valve connector.
6. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

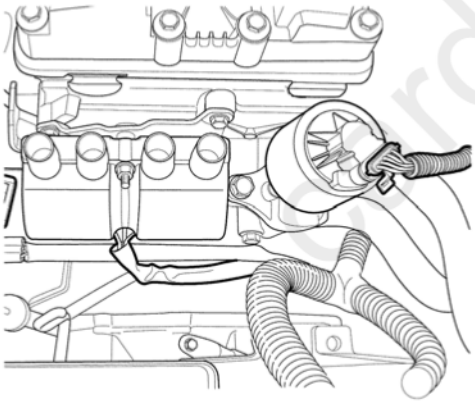
Part Name	Catalog Name	Part Code
Exhaust Gas Recirculation Valve	VALVE KIT,EGR	0045A
Exhaust Gas Recirculation Valve	VALVE,EGR	0050A
Exhaust Gas Recirculation Valve	VALVE,EGR	0050B

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Exhaust Gas Recirculation Valve Replacement

Removal Procedure

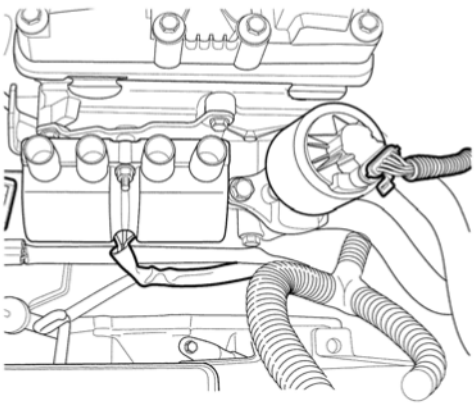


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1. Click here for full size
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Disconnect the exhaust gas recirculation (EGR) valve connector.
4. Remove the EGR valve mounting bolt.
5. Remove the EGR valve.

Installation Procedure

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1. Click here for full size
2. Install the EGR valve.
3. Caution:

   Refer to Fastener Caution.
4. Install the EGR valve mounting bolt and tighten to 30â€‰N-m (22.1â€‰lbâ€‰ft).
5. Connect the EGR valve connector.
6. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Related Part Information

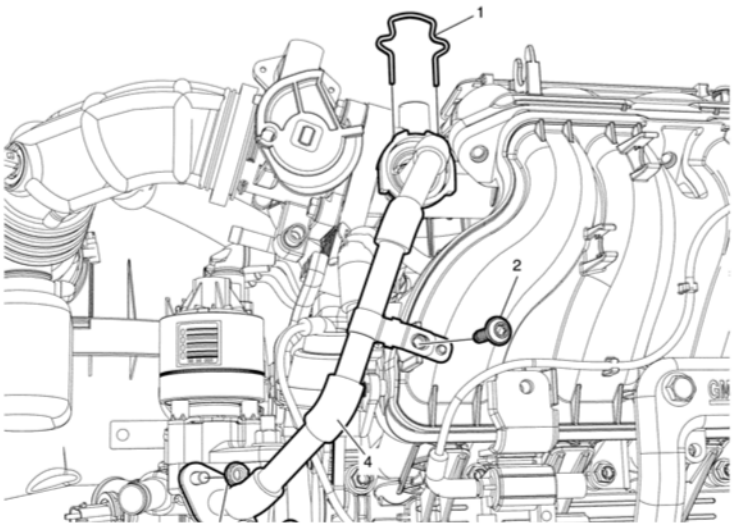
Part Name	Catalog Name	Part Code
Exhaust Gas Recirculation Valve	VALVE KIT,EGR	0045A
Exhaust Gas Recirculation Valve	VALVE,EGR	0050A
Exhaust Gas Recirculation Valve	VALVE,EGR	0050B

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Exhaust Gas Recirculation Valve Pipe Replacement

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Callout	Component Name
1	EGR Pipe Retaining Clip
2	EGR Pipe Retaining Bolt Caution: Refer to Fastener Caution. Tighten 8â€‰N-m (70.8â€‰lbâ€‰in)
3	EGR Pipe Retaining Nut Tighten 10â€‰N-m (88.5â€‰lbâ€‰in)
4	EGR Pipe

Related Part Information

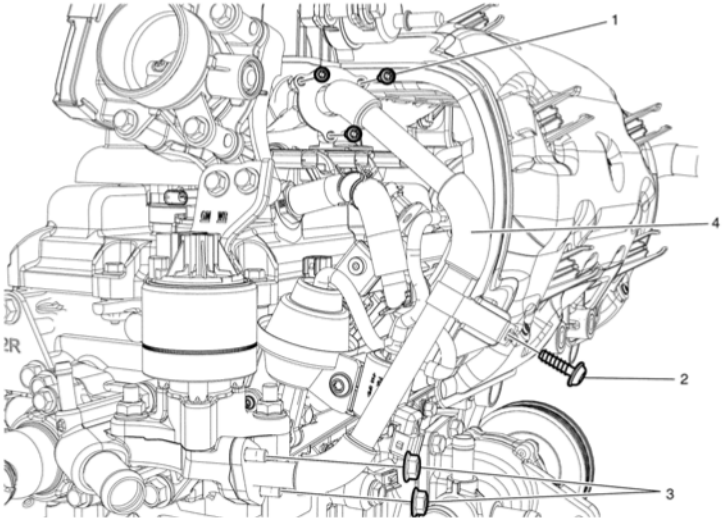
Part Name	Catalog Name	Part Code
Exhaust Gas Recirculation Valve Pipe	PIPE,EGR VLV	0650A
Exhaust Gas Recirculation Valve Pipe	PIPE,EGR VLV	0650B
Exhaust Gas Recirculation Pipe	PIPE,EGR	0698B

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Exhaust Gas Recirculation Valve Pipe Replacement (LKY)

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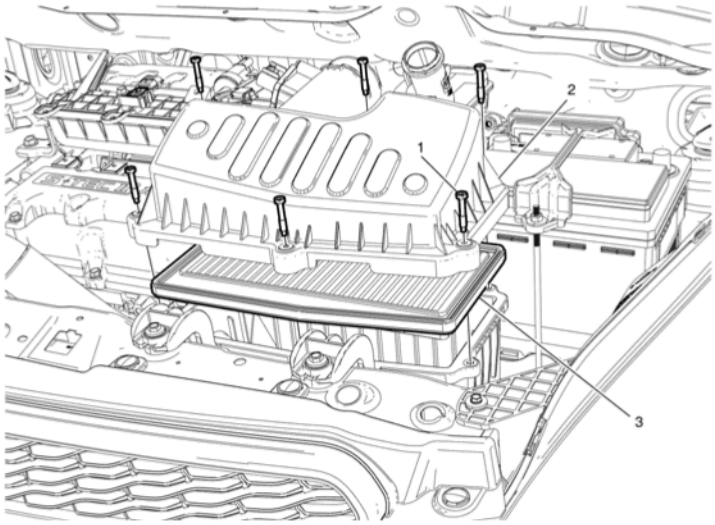
Callout	Component Name
1	EGR Pipe Retaining Fastener Caution: Refer to Fastener Caution. Tighten 2.5â€‰N-m (22â€‰lbâ€‰in)
2	EGR Pipe Retaining Bracket Fastener Tighten 8â€‰N-m (71â€‰lbâ€‰in)
3	EGR Pipe Retaining Nut Tighten 10â€‰N-m (89â€‰lbâ€‰in)
4	EGR Pipe

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Air Cleaner Element Replacement (LKY)

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Callout	Component Name
Preliminary Procedure Open the hood.	
1	Air Cleaner Housing Bolt (Qtyâ€‰6) Caution: Refer to Fastener Caution. Procedure Remove the air cleaner housing bolts Tighten 2â€‰N-m (17â€‰lbâ€‰in)

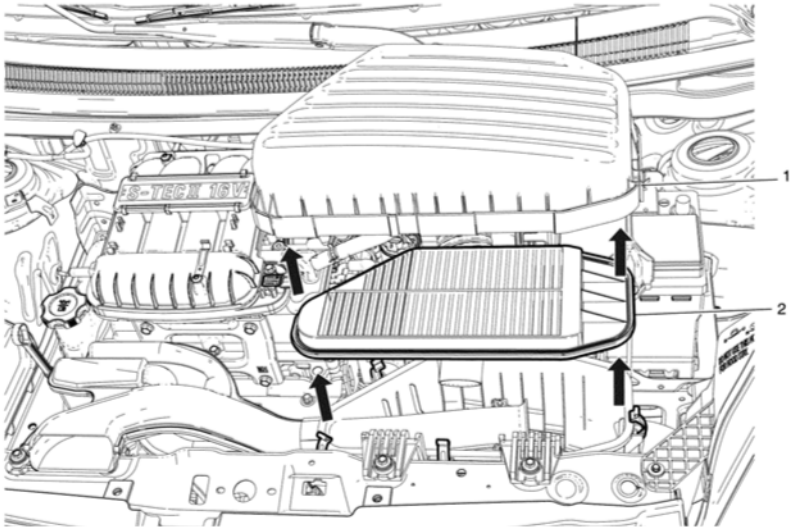
Callout	Component Name
2	Air Cleaner Upper Housing Procedure Release clip and remove air cleaner upper housingâ€‰(2).
3	Air Cleaner Element Procedure Replace air cleaner elementâ€‰â€‰(3).

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
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Air Cleaner Element Replacement

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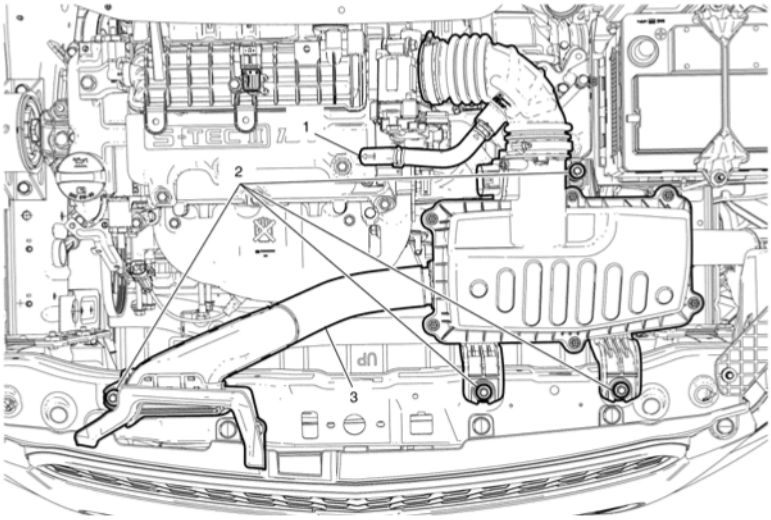
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Callout	Component Name
Preliminary Procedure Open the hood.	
1	Release clip and remove air cleaner upper housingâ€‰(1).
2	Replace air cleaner elementâ€‰(2). Note: Inspect or replace the air cleaner element (Filter).

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Air Cleaner Assembly Replacement (LKY)

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Callout	Component Name
	Preliminary Procedures 1. Open the hood and disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection. 2. Disconnect the air flow sensor connector.
1	Breather Hose Procedure Disconnect the breather hoseâ€‰(1) and clamp from the air cleaner outlet duct.

Callout	Component Name
2	Air Cleaner Assembly Retaining Bolt (Qty:â€‰4) Caution: Refer to Fastener Caution. Procedure Remove the air cleaner assembly retaining boltâ€‰â€‰(3). Tighten 6â€‰N-m (53â€‰lbâ€‰in)
3	Air Cleaner Assembly Procedure Disconnect the resonator duct from the air cleaner assembly.

Related Part Information

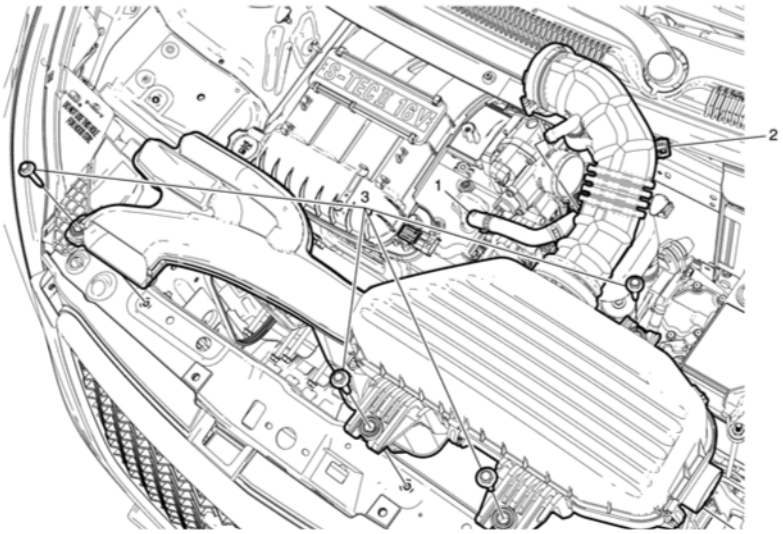
Part Name	Catalog Name	Part Code
Air Cleaner	CLEANER,AIR (W/ ADSORBER & MASS AIRFLOW SEN)	0045A
Air Cleaner	CLEANER,AIR (W/ RESO & MASS AIRFLOW SEN)	0046A
Air Cleaner	CLEANER,AIR (W/ RESO & MASS AIRFLOW SEN)	0046B
Air Cleaner	CLEANER PKG,AIR	0047A
Air Cleaner	CLEANER KIT,AIR	0048A
Air Cleaner	CLEANER,AIR(W/MASS AIR FLOW SEN)	0049A
Air Cleaner	CLEANER,AIR	0050A
Air Cleaner	CLEANER,AIR	0050B
Air Cleaner	CLEANER,AIR (W/ MASS AIRFLOW SEN & DRN HOSE)	0073A
Air Cleaner	CLEANER,AIR (W/ INT AIR TEMP SEN)	1060A
Air Cleaner	CLEANER PKG,AIR	SJ542
Air Cleaner	CLEANER KIT,AIR	SS145

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Air Cleaner Assembly Replacement

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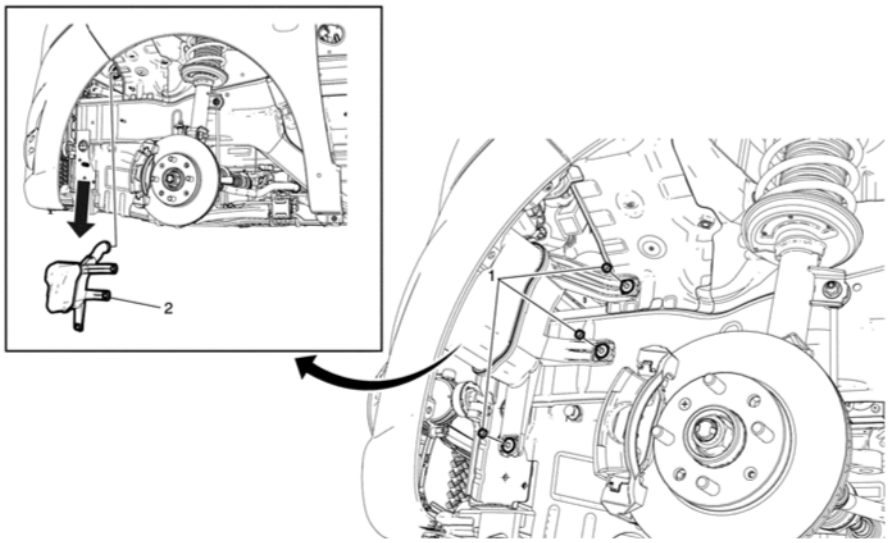
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Callout	Component Name
Preliminary Procedure Open the hood and disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.	
1	Disconnect the breather hoseâ€‰(1) from the air cleaner outlet duct.
2	Disconnect the connector from the intake air temperature sensorâ€‰(2).
3	Remove the air cleaner assembly retaining boltâ€‰(3) (Qty:â€‰4). Caution: Refer to Fastener Caution. Tighten 6â€‰N-m (53.1â€‰lbâ€‰in)
4	Disconnect the resonator duct from the air cleaner assembly.

1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Air Cleaner Resonator Replacement

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Callout	Component Name
	Preliminary Procedures 1. Remove the front (LH) tire and wheel. Refer to Tire and Wheel Removal and Installation. 2. Remove the front (LH) wheel house liner. Refer to Front Wheelhouse Liner Replacement.
1	Air Cleaner Resonator Assembly Retaining Nut Caution: Refer to Fastener Caution. Procedure Remove the air cleaner resonator assembly retaining nutâ€‰(1). Tighten 6â€‰N-m (53â€‰lbâ€‰in)
2	Air Cleaner Resonator Assembly

Related Part Information

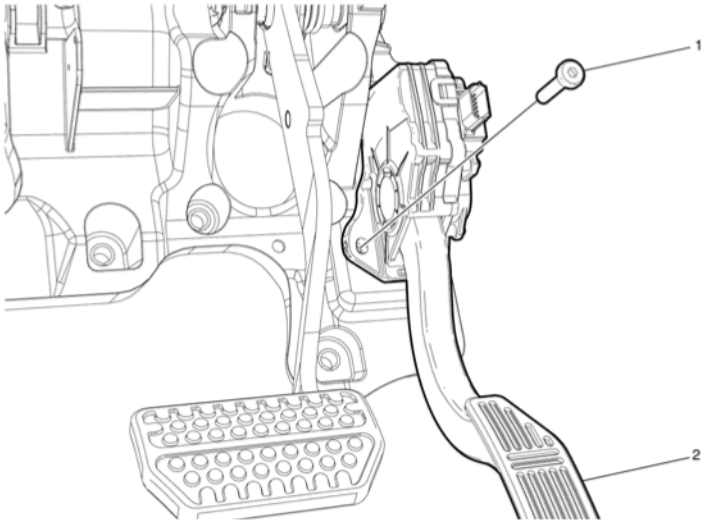
Part Name	Catalog Name	Part Code
Air Cleaner Resonator	RESONATOR,A/CL	2399Y
Air Cleaner Resonator	RESONATOR,A/CL	2400A
Air Cleaner Resonator	RESONATOR,A/CL	2401A

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. REPAIR INSTRUCTIONS
4.

Accelerator Pedal Position Sensor Replacement (LKY)

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Callout	Component Name
Preliminary Procedure Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.	
1	Accelerator Pedal Position Sensor Fastener Caution: Refer to Fastener Caution. Tighten 7â€‰N-m (62â€‰lbâ€‰in)
2	Accelerator Pedal Position Sensor Procedure Disconnect the electrical wiring harness connector from accelerator pedal position sensor.

Related Part Information

Part Name	Catalog Name	Part Code
Accelerator Pedal Position Sensor	SENSOR,ACCEL PED POSN	2990A
Accelerator Pedal Position Sensor	SENSOR,ACCEL PED POSN	0145A

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Specifications

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Temperature Versus Resistance - Intake Air Temperature Sensor

Temperature	Resistance
140Â°C (284Â°F)	76 to 81 Ω
120Â°C (248Â°F)	119to 125thinsp;Ω
100Â°C (212Â°F)	193to 201thinsp;Ω
80Â°C (176Â°F)	328to 345thinsp;Ω
60Â°C (140Â°F)	587to 625thinsp;Ω
40Â°C (104Â°F)	1,122 1,210insp;Ω
25Â°C (77Â°F)	1,913 2,088insp;Ω
20Â°C (68Â°F)	2,309 2,530insp;Ω
0>Â°C (32Â°F)	5,191 5,789insp;Ω
â^'10 (14Â°F)	8,082 9,105insp;Ω
â^'20 (â^'4F)	12,94714,744nsp;Ω
â^'40 (â^'40)	36,59542,717nsp;Ω

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1. ENGINE/PROPULSION
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Temperature Versus Resistance - Engine Coolant Temperature Sensor

Temperature	Resistance
150Â°C (302Â°F)	42 to 44 Ω
140Â°C (284Â°F)	53 to 57 Ω
130Â°C (266Â°F)	68 to 72 Ω
120Â°C (248Â°F)	88 to 92 Ω
110Â°C (230Â°F)	114to 120thinsp;Ω
100Â°C (212Â°F)	151to 159thinsp;Ω
90Â°C (194Â°F)	203to 215thinsp;Ω
80Â°C (176Â°F)	275to 293thinsp;Ω
70Â°C (158Â°F)	379to 405thinsp;Ω
60Â°C (140Â°F)	532to 572thinsp;Ω
50Â°C (122Â°F)	762to 824thinsp;Ω
45Â°C (113Â°F)	921to 997thinsp;Ω
40Â°C (104Â°F)	1118o 1212hinsp;Ω
35Â°C (95Â°F)	1366o 1484hinsp;Ω
30Â°C (86Â°F)	1683o 1829hinsp;Ω
25Â°C (77Â°F)	2088o 2266hinsp;Ω
20Â°C (68Â°F)	2608o 2828hinsp;Ω
15Â°C (59Â°F)	3289o 3567hinsp;Ω
10Â°C (50Â°F)	4182o 4532hinsp;Ω
5>Â°C (41Â°F)	5356o 5800hinsp;Ω
0>Â°C (32Â°F)	6914o 7484hinsp;Ω
-5Â°C (23Â°F)	8994o 9732hinsp;Ω
-10Â°C (14Â°F)	11796 12762insp;Ω
-15Â°C (5>Â°F)	15589 16871insp;Ω
-20Â°C (-4Â°F)	20791 22517insp;Ω
-30Â°C (-22Â°F)	37991 41273insp;Ω
-40Â°C (-40Â°F)	72230 78834insp;Ω

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Altitude Versus Barometric Pressure

Altitude Measured in Meters (m)	Altitude Measured in Feet (ft)	Barometric Pressure Measured in Kilopascals (kPa)	Barometric Pressure Measured in Pounds Per Square Inch (PSI)
Determine your altitude by contacting a local weather station or by using another reference source.			
4,267	14,000	56â€“64	8.1â€“9.3
3,962	13,000	58â€“66	8.4â€“9.6
3,658	12,000	61â€“69	8.8â€“10.0
3,353	11,000	64â€“72	9.3â€“10.4
3,048	10,000	66â€“74	9.6â€“10.7
2,743	9,000	69â€“77	10.0â€“11.2
2,438	8,000	71â€“79	10.3â€“11.5
2,134	7,000	74â€“82	10.7â€“11.9
1,829	6,000	77â€“85	11.2â€“12.3
1,524	5,000	80â€“88	11.6â€“12.8
1,219	4,000	83â€“91	12.0â€“13.2
914	3,000	87â€“95	12.6â€“13.8
610	2,000	90â€“98	13.1â€“14.2
305	1,000	94â€“102	13.6â€“14.8
0	0 Sea Level	96â€“104	13.9â€“15.1
â^'305	â^'1,000	101â€“105	14.6â€“15.2

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Ignition System Specifications

Application	Specification
Ignition Type	Individual Ignition Coils
Firing Order	1â€“3â€“4â€“2
Spark Plug Torque	Refer to Fastener Specifications.
Spark Plug Gap	0.8â€“0.9â€‰mm (0.031â€“0.035â€‰in)
Spark Plug Type	Refer to Electronic Parts Catalogue

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Fastener Specifications

Single Use Non-Threaded Fasteners/Components

Application
Note: All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.
Fuel Injector Lower O-ring
Fuel Injector Upper O-ring
Fuel Pump O-ring
Idle Air Control Valve O-ring
Throttle Body Gasket

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
Note: All fasteners listed in this table can be reused after removal.	
Accelerator Pedal Position Sensor Bolt	6>N-m (53 lb in)
Air Cleaner Assembly Retaining Bolt	6>N-m (53 lb in)
Air Cleaner Housing Bolts	2>N-m (18 lb in)
Air Cleaner Resonator Assembly Retaining Nut	6>N-m (53 lb in)
Camshaft Position Actuator Solenoid Valve Bolts	10N-m (89 lb in)
Camshaft Position Sensor Bolt	10N-m (89 lb in)
Crankshaft Position Sensor Bolt	10N-m (89 lb in)
ECM Bracket Retaining Bolt	10N-m (89 lb in)
Engine Coolant Temperature Sensor (Radiator)	12N-m (106thinsp;lb in)
Engine Coolant Temperature Sensor (Thermostat)	18N-m (13 lb ft)
Evaporative Emission Canister Purge Solenoid Valve Bolt	10N-m (89 lb in)
Fuel Tank Filler Hose Clamp	6>N-m (53 lb in)
Fuel Tank Filler Pipe Lower Bolt	6>N-m (53 lb in)
Fuel Tank Filler Pipe Upper Bolt	6>N-m (53 lb in)
Fuel Tank Strap Bolt	20N-m (15 lb ft)
Fuel Rail Retaining Bolt	10N-m (89 lb in)
Heated Oxygen Sensor â€“ Sensor 1	44N-m (32 lb ft)
Heated Oxygen Sensor â€“ Sensor 2	44N-m (32 lb ft)
Ignition Coil Retaining Bolt	10N-m (89 lb in)
Intake Manifold Bracket Bolt - Lower	46N-m (34 lb ft)
Intake Manifold Bracket Bolt - Upper	25N-m (18 lb ft)
Knock Sensor Retaining Bolt	25N-m (18 lb ft)
Manifold Absolute Pressure Sensor Bolt	10N-m (89 lb in)
Mass Airflow Sensor Bolt	2>N-m (18 lb in)
Oil Pressure Indicator Switch	35N-m (26 lb ft)
Spark Plug	12N-m (106thinsp;lb in)
Throttle Body Retaining Bolt	10N-m (89 lb in)

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Fastener Specifications (LKY)

Single Use Non-Threaded Fasteners/Components

Application
Note: All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.
Fuel Injector Lower O-ring
Fuel Injector Upper O-ring
Fuel Pump O-ring
Idle Air Control Valve O-ring
Throttle Body Gasket

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
Note: All fasteners listed in this table can be reused after removal.	
Accelerator Pedal Position Sensor Bolt	6>N-m (53 lb in)
Air Cleaner Assembly Retaining Bolt	6>N-m (53 lb in)
Air Cleaner Housing Bolts	2>N-m (18 lb in)
Air Cleaner Resonator Assembly Retaining Nut	6>N-m (53 lb in)
Camshaft Position Sensor Bolt	10N-m (89 lb in)
Crankshaft Position Sensor Bolt	10N-m (89 lb in)
ECM Bracket Retaining Bolt	10N-m (89 lb in)
EGR Pipe Retaining Bracket Screw	8>N-m (71 lb in)
EGR Pipe Retaining Nut	10N-m (89 lb in)
EGR Pipe Retaining Screw	2.5N-m (22 lb in)
EGR Valve Mounting Nut	25N-m (18 lb ft)
Engine Coolant Temperature Sensor (Radiator)	12N-m (106thinsp;lb in)
Engine Coolant Temperature Sensor (Thermostat)	18N-m (13 lb ft)
Evaporative Emission Canister Purge Solenoid Valve Bolt	10N-m (89 lb in)
Fuel Rail Retaining Bolt	10N-m (89 lb in)
Fuel Tank Filler Hose Clamp	6>N-m (53 lb in)
Fuel Tank Filler Pipe Lower Bolt	6>N-m (53 lb in)
Fuel Tank Filler Pipe Upper Bolt	6>N-m (53 lb in)
Fuel Tank Strap Bolt	20N-m (15 lb ft)
Heated Oxygen Sensor â€“ Sensor 1	44N-m (32 lb ft)
Heated Oxygen Sensor â€“ Sensor 2	44N-m (32 lb ft)
Ignition Coil Retaining Bolt	10N-m (89 lb in)
Intake Manifold Bracket Bolt â€“ Lower	46N-m (34 lb ft)
Intake Manifold Bracket Bolt â€“ Upper	25N-m (18 lb ft)
Intake Manifold Tuning Valve Actuator Cover Screw	9>N-m (80 lb in)
Intake Manifold Tuning Valve Solenoid Screw	9>N-m (80 lb in)
Knock Sensor Retaining Bolt	25N-m (18 lb ft)
Manifold Absolute Pressure Sensor Bolt	10N-m (89 lb in)
Mass Airflow Sensor Bolt	2>N-m (18 lb in)
Oil Pressure Indicator Switch	35N-m (26 lb ft)
Spark Plug	12N-m (106thinsp;lb in)
Throttle Body Retaining Bolt	10N-m (89 lb in)

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1. **ENGINE/PROPULSION**
2. ENGINE CONTROLS AND FUEL - 1.0L, 1.19L, OR 1.2L
3. SPECIFICATIONS
4.

Approximate Fluid Capacities

Application	Specification	
	Metric	English
Fuel Tank Capacity	35.0â€‰liters	9.0â€‰gallons

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Schematic and Routing Diagrams

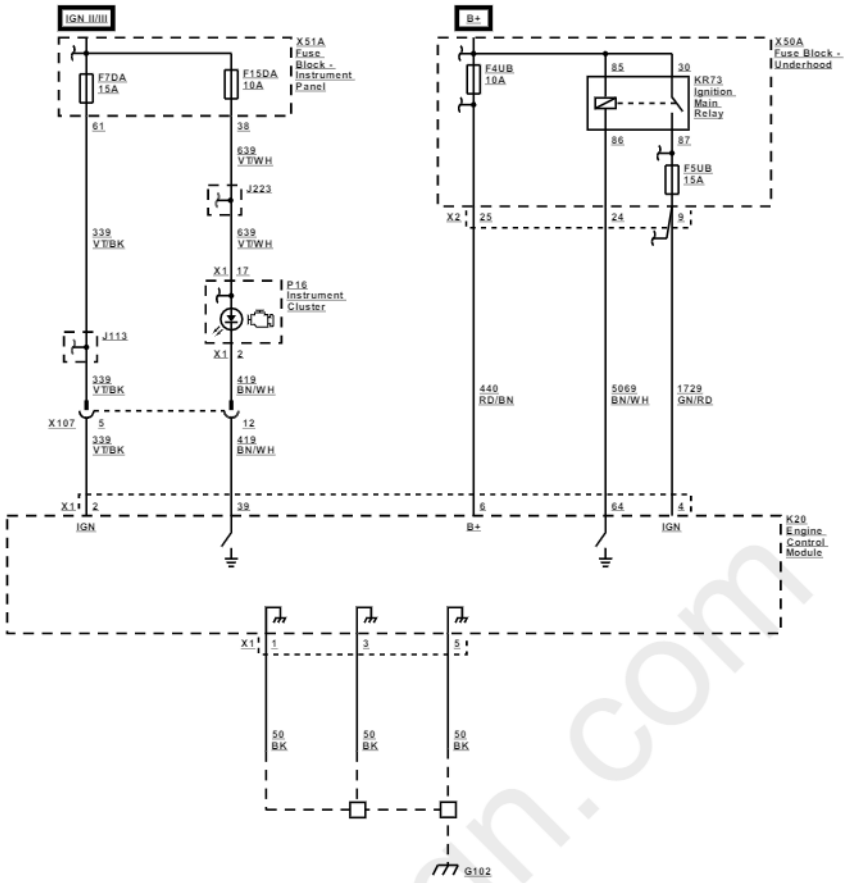
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Engine Controls Schematics (LMU with FX3)

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Module Power, Ground, Serial Data, and MIL

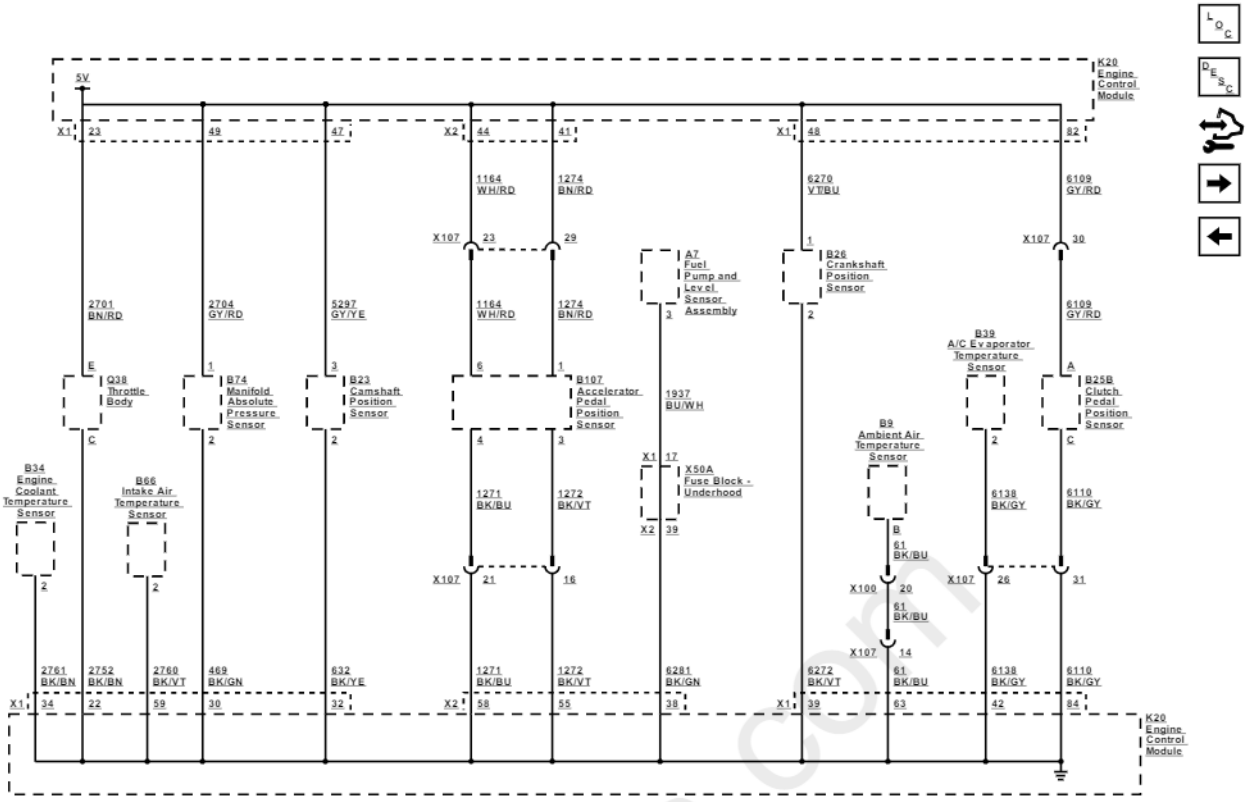
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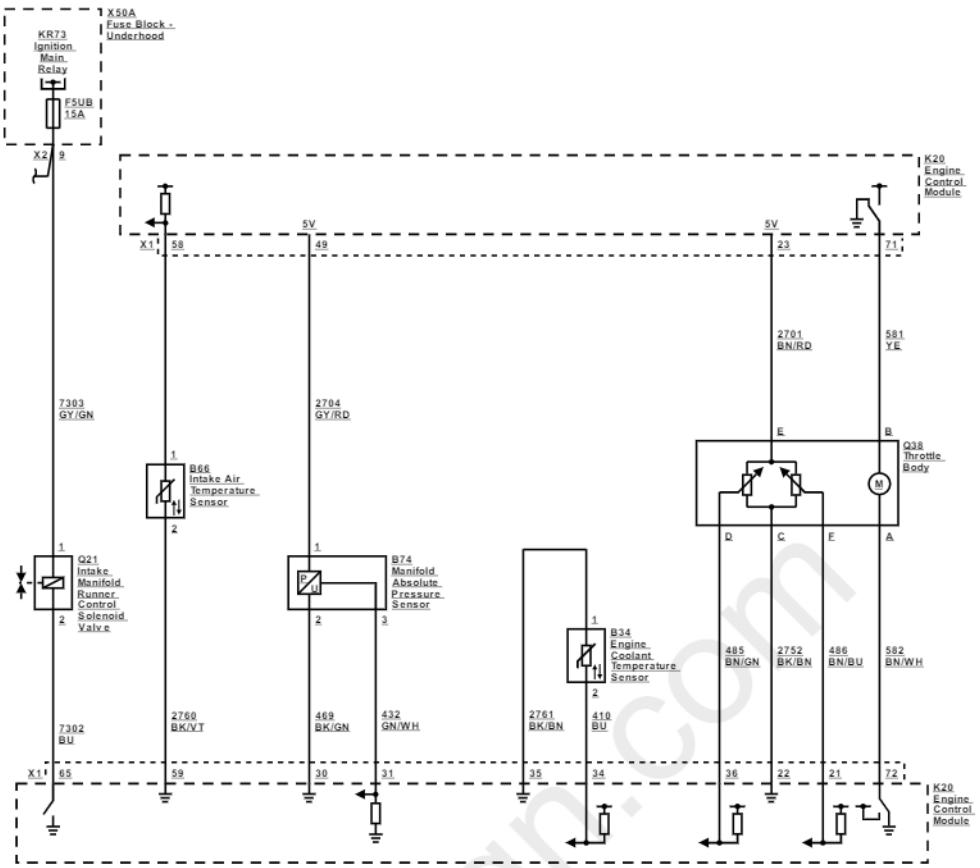
5-Volt and Low Reference Bus



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Engine Data Sensors - Pressure, Temperature, and Throttle Controls

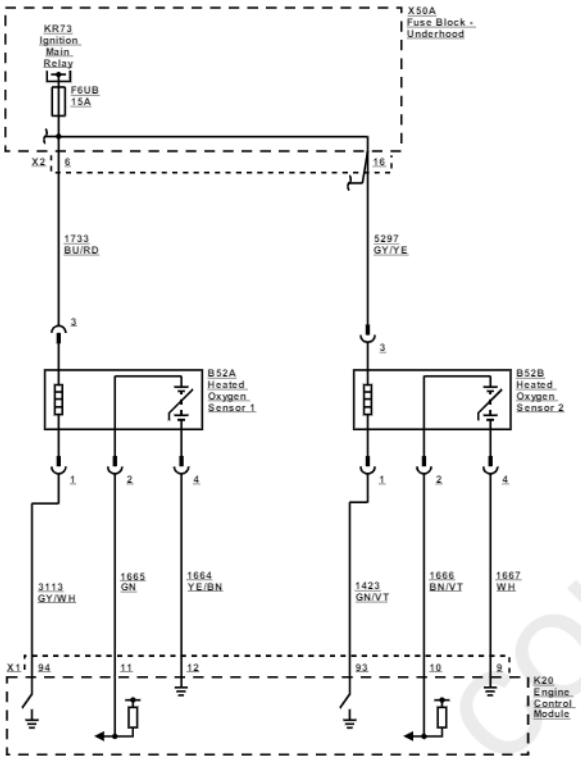


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Engine Data Sensors - Oxygen Sensors

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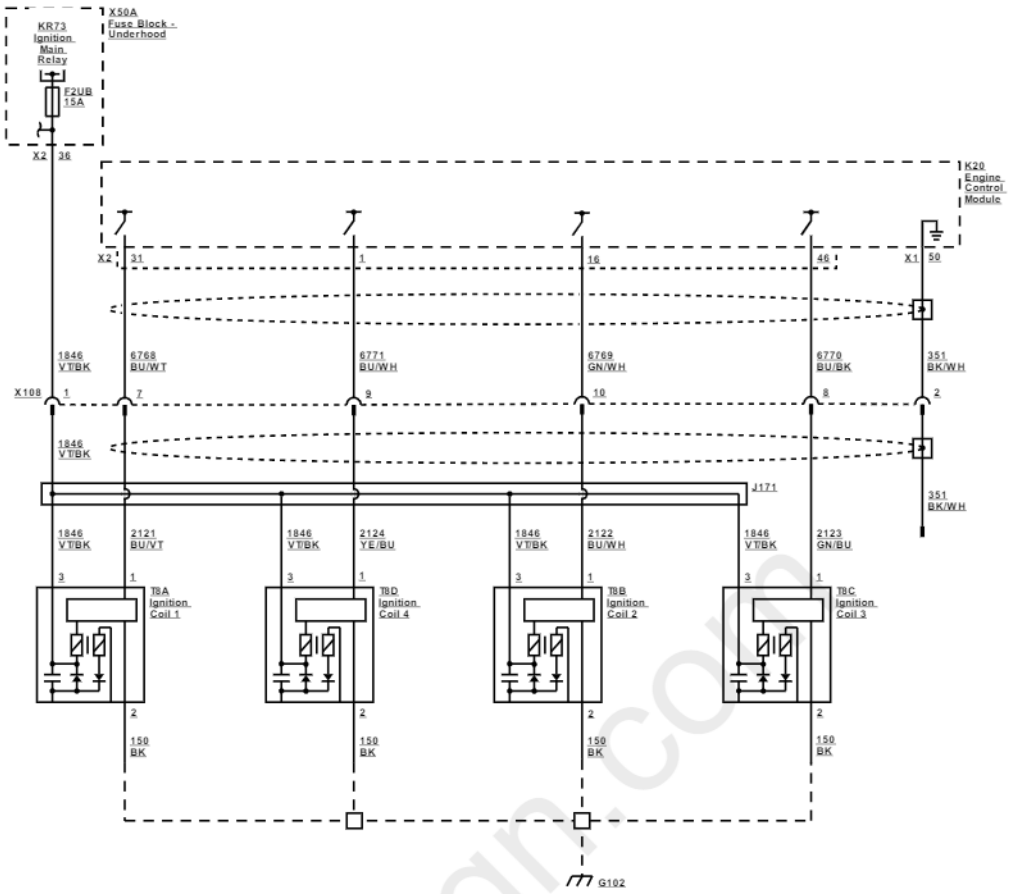


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Ignition Controls - Ignition System

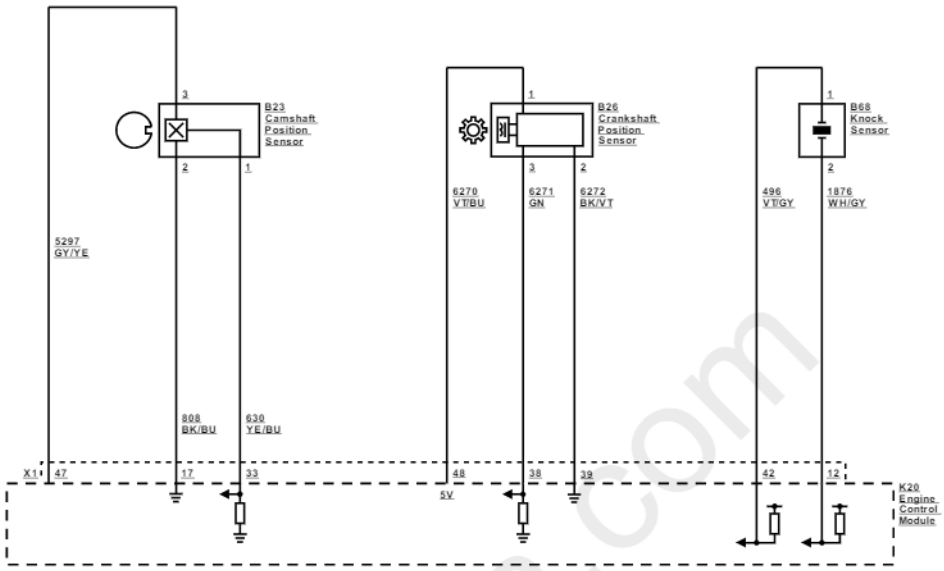
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Ignition Controls - Camshaft, Crankshaft, Knock, and Rough Road Sensors

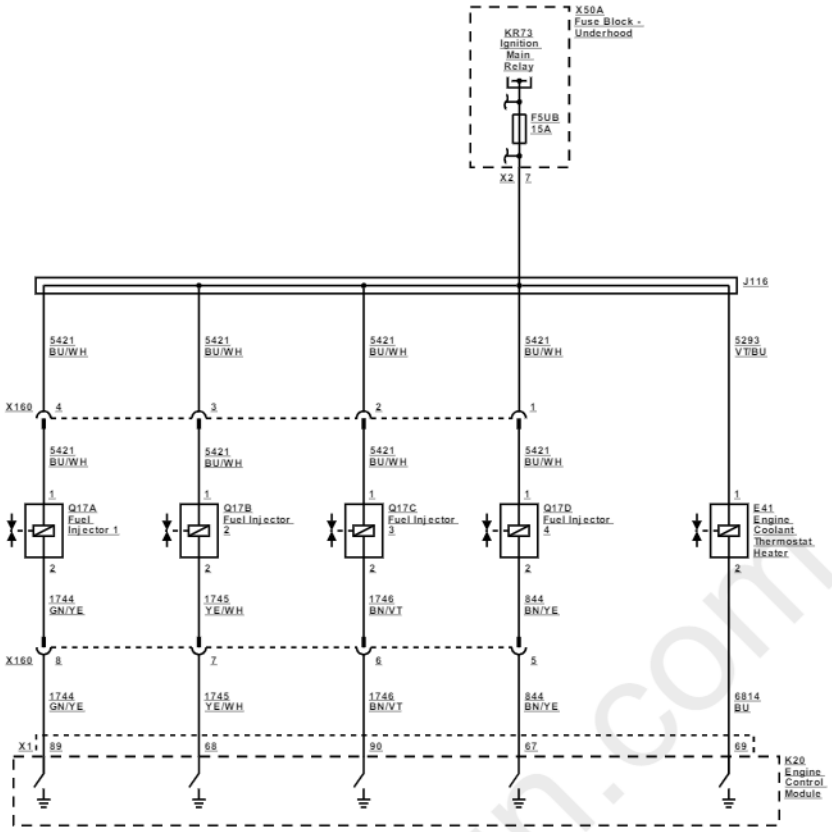


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Fuel Controls - Fuel Injectors

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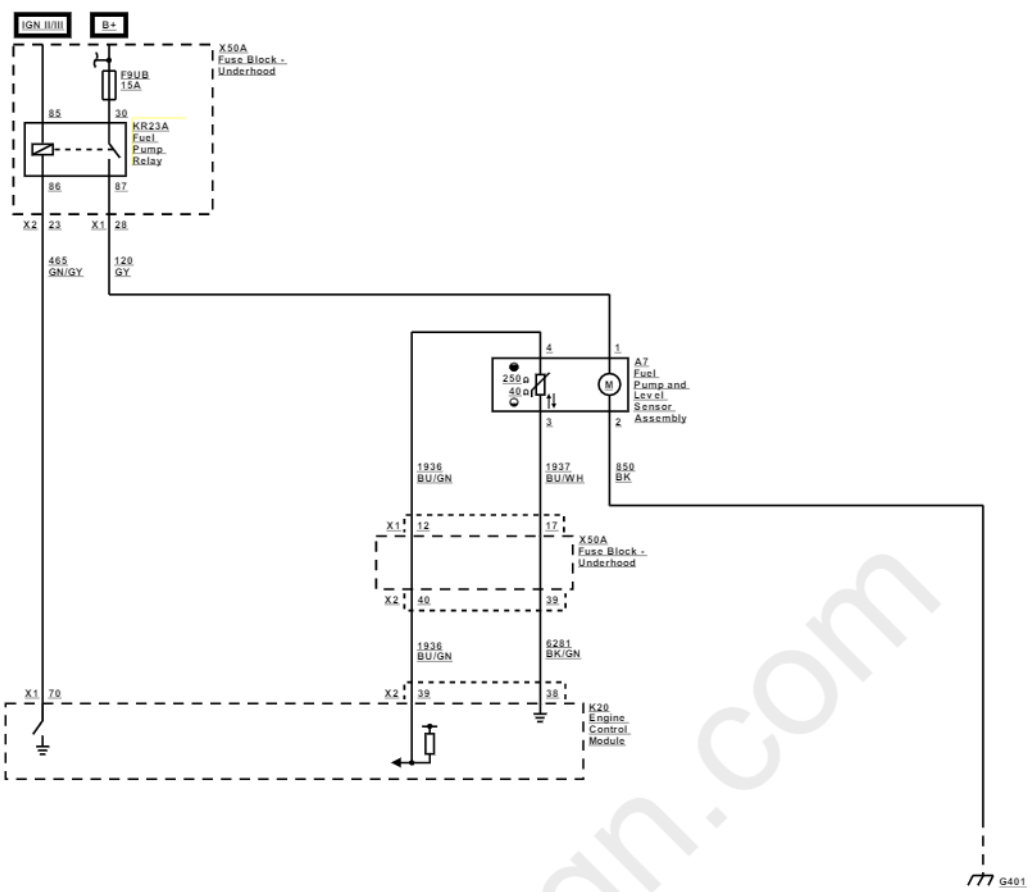


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Fuel Controls - Fuel Pump and Fuel Pressure

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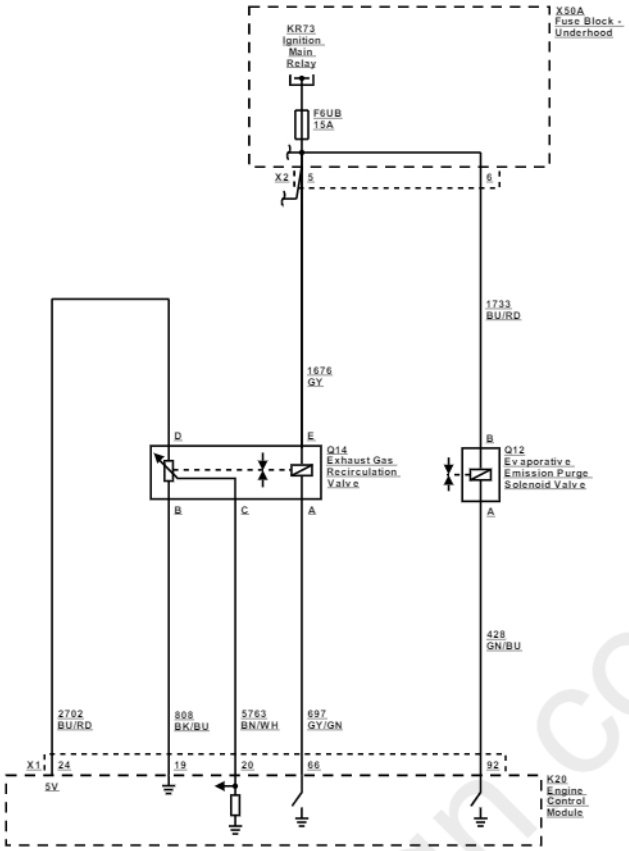


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Fuel Controls - Evaporative Emission Controls

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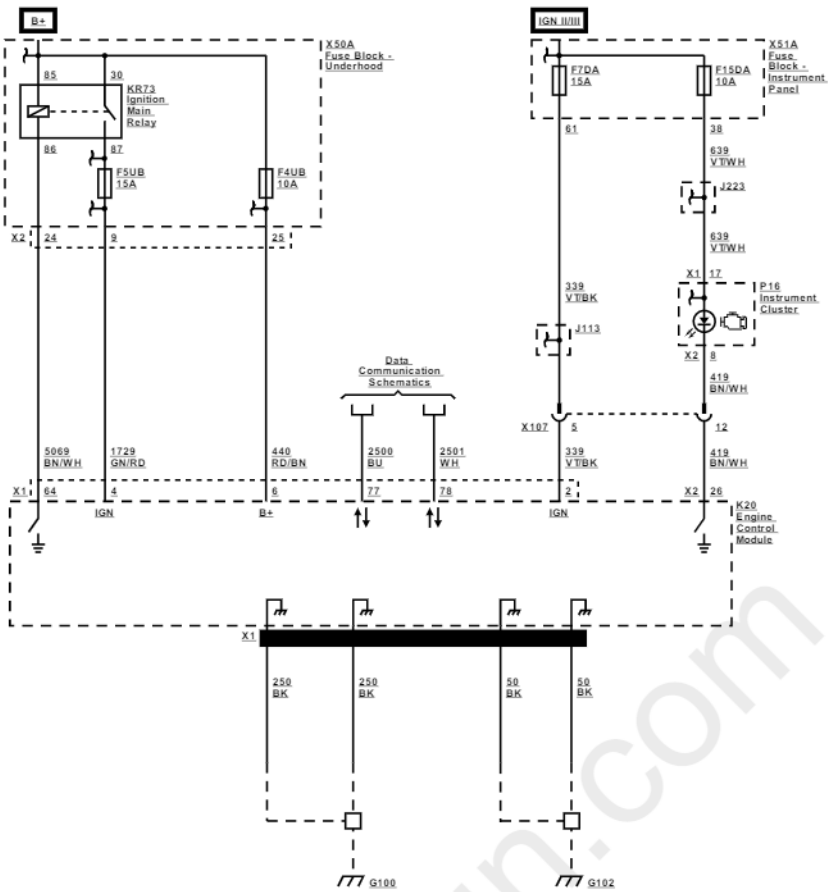
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Engine Controls Schematics (LKY)

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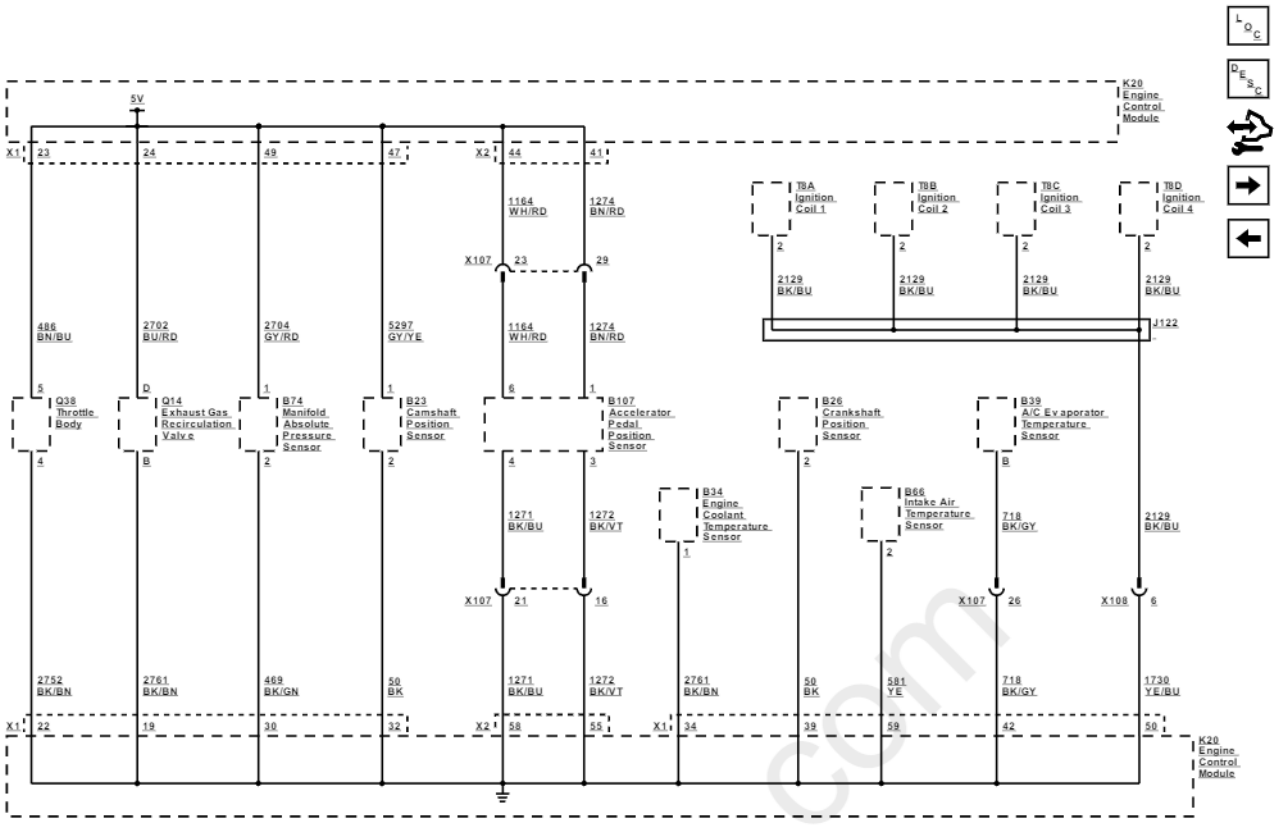
Module Power, Ground, Serial Data, and MIL



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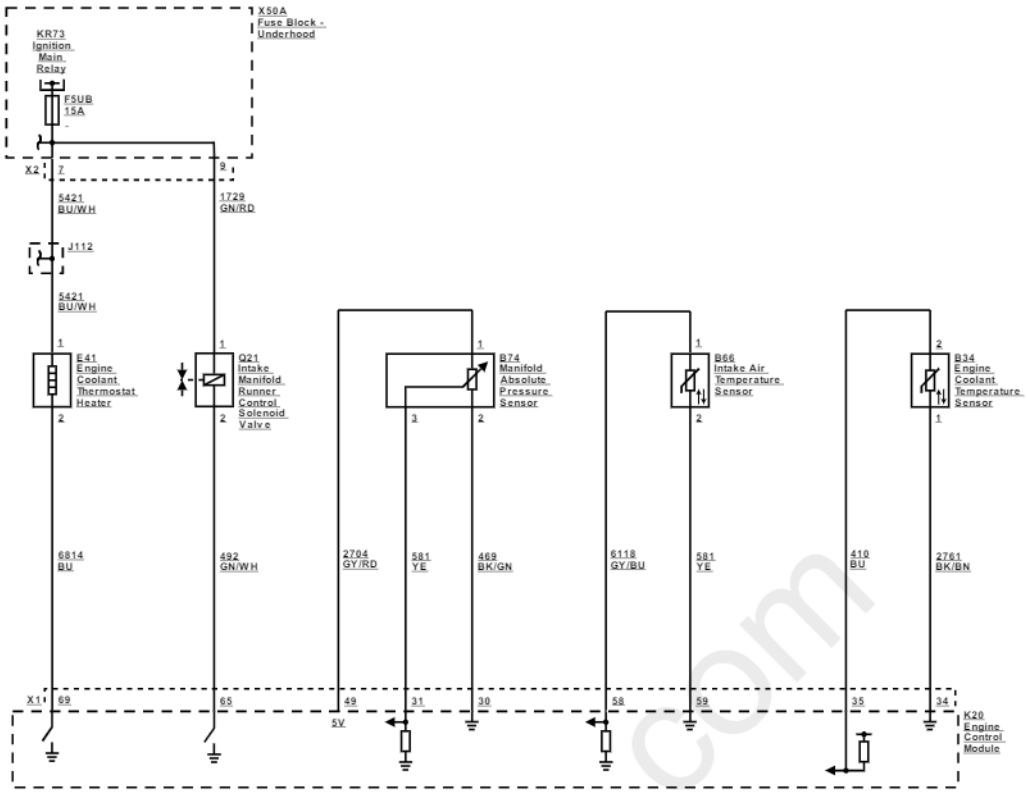
5V and Low Reference Bus



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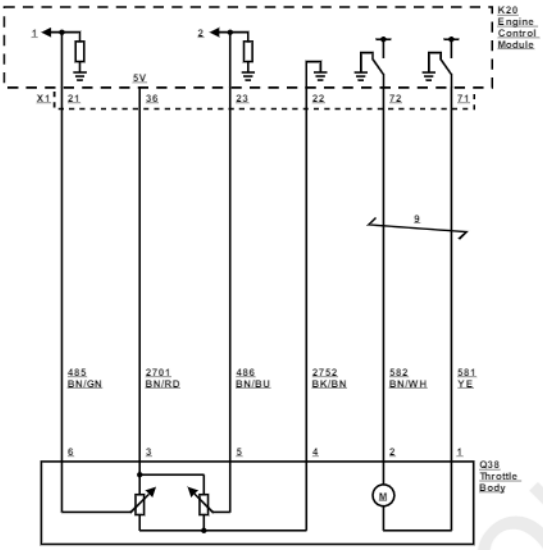
Engine Data Sensors - Pressure and Temperature Controls



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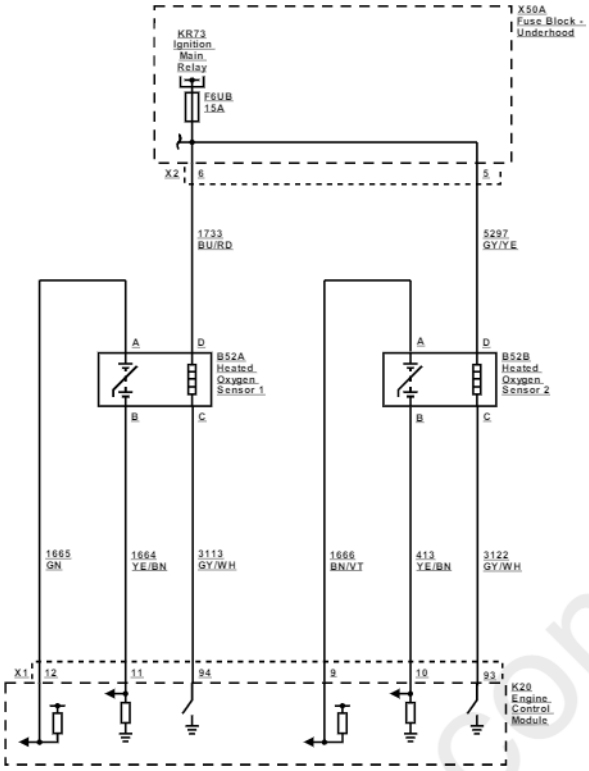
Engine Data Sensors - Throttle Controls



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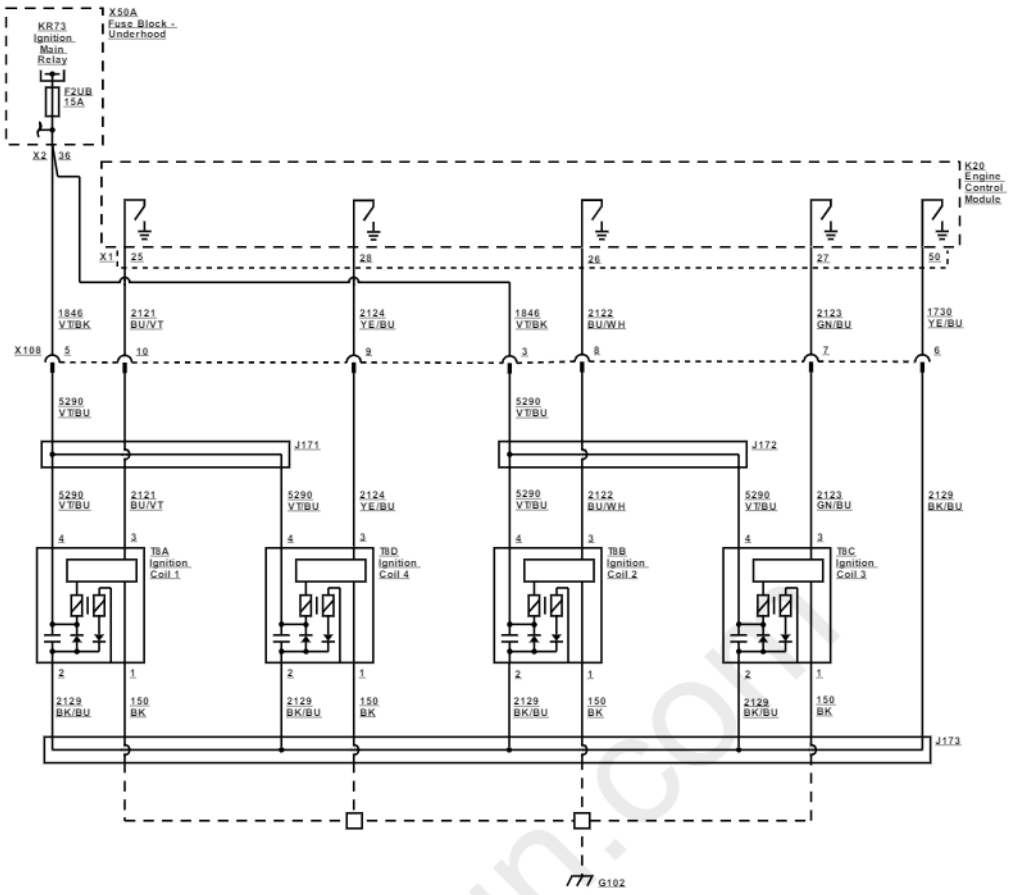
Engine Data Sensors - Oxygen Sensors



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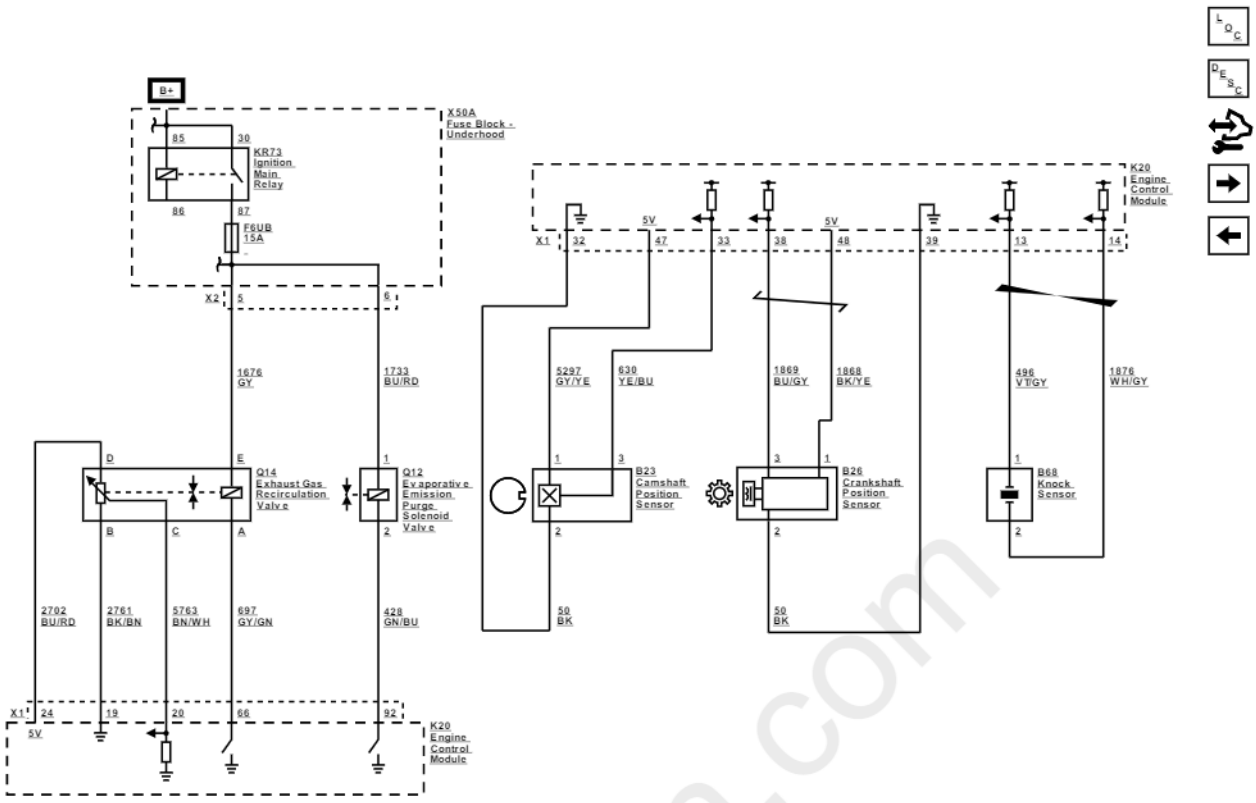
Ignition Controls - Ignition System



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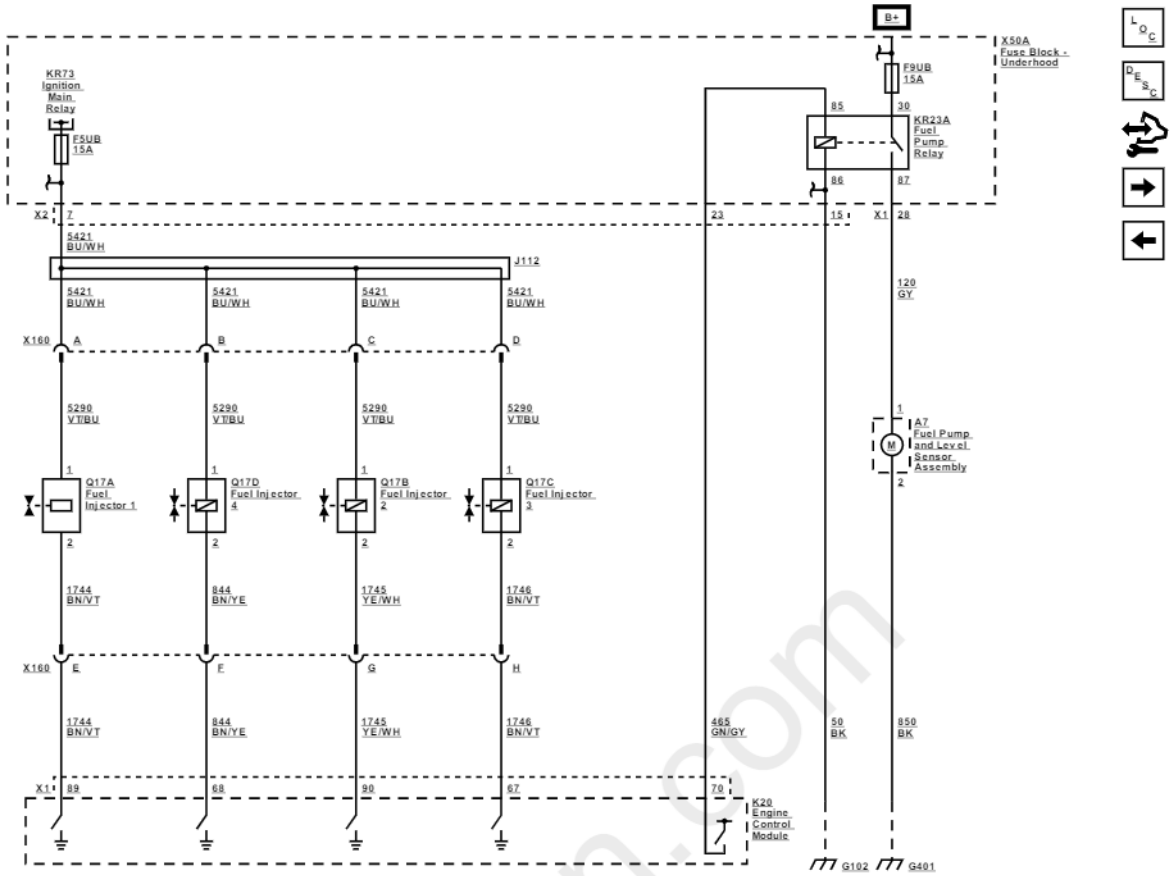
Ignition and Fuel Controls - Camshaft, Crankshaft, and Knock Sensors, Exhaust and Evaporative Emission Controls



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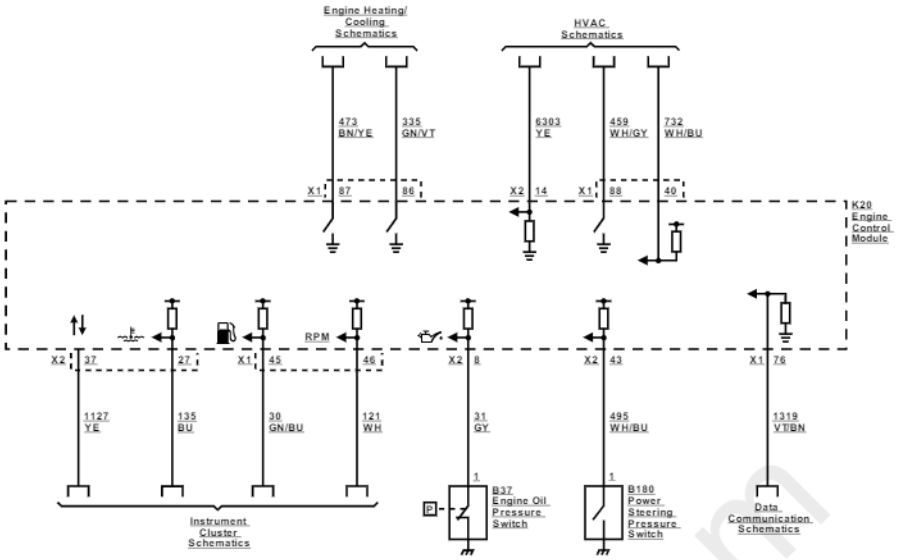
Fuel Controls - Fuel Pump and Fuel Injectors



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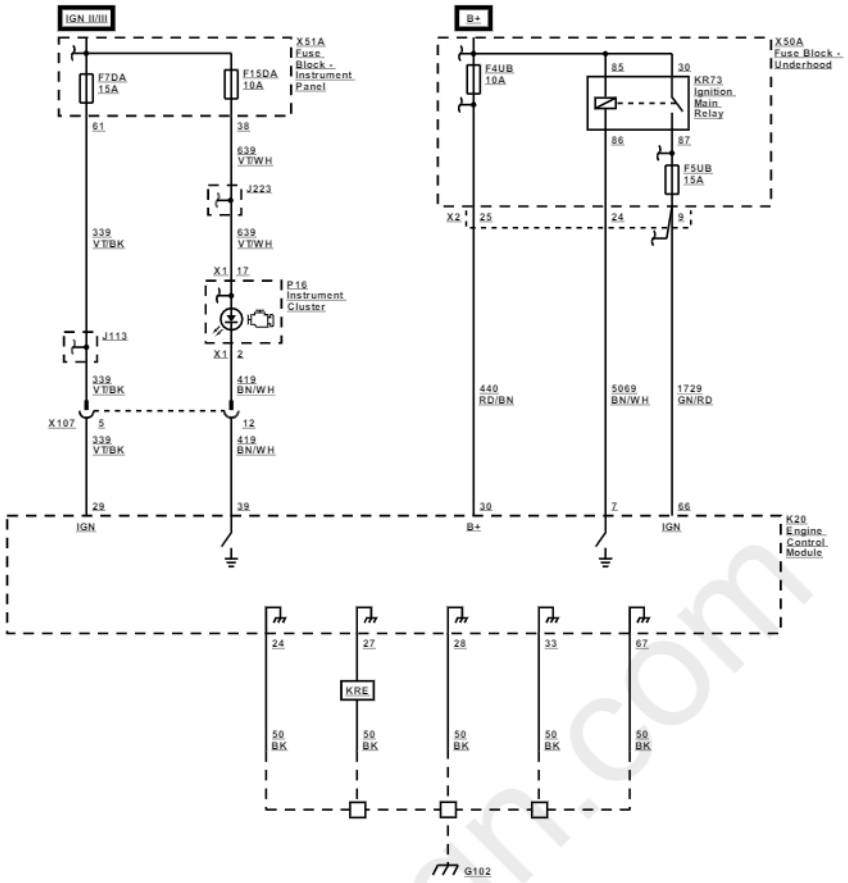
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Engine Controls Schematics (LMU without FX3)

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Module Power, Ground, Serial Data, and MIL

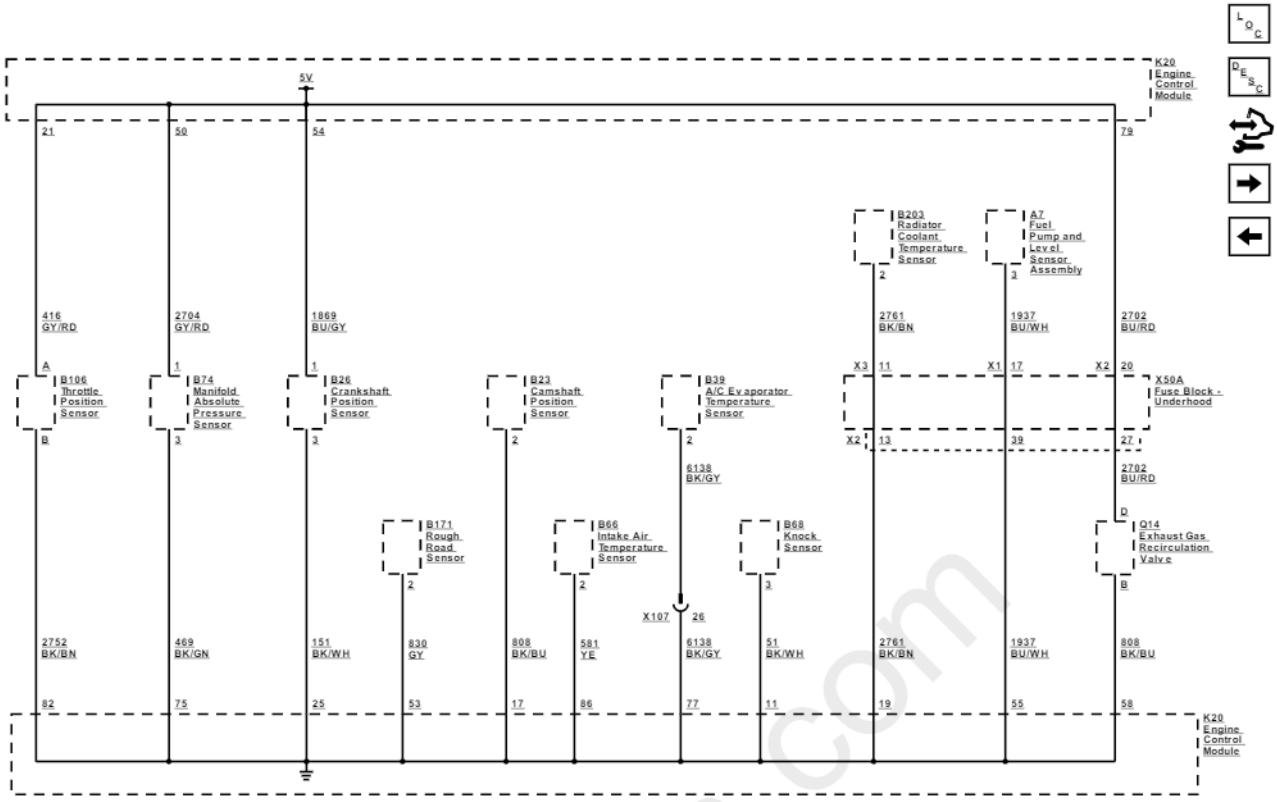
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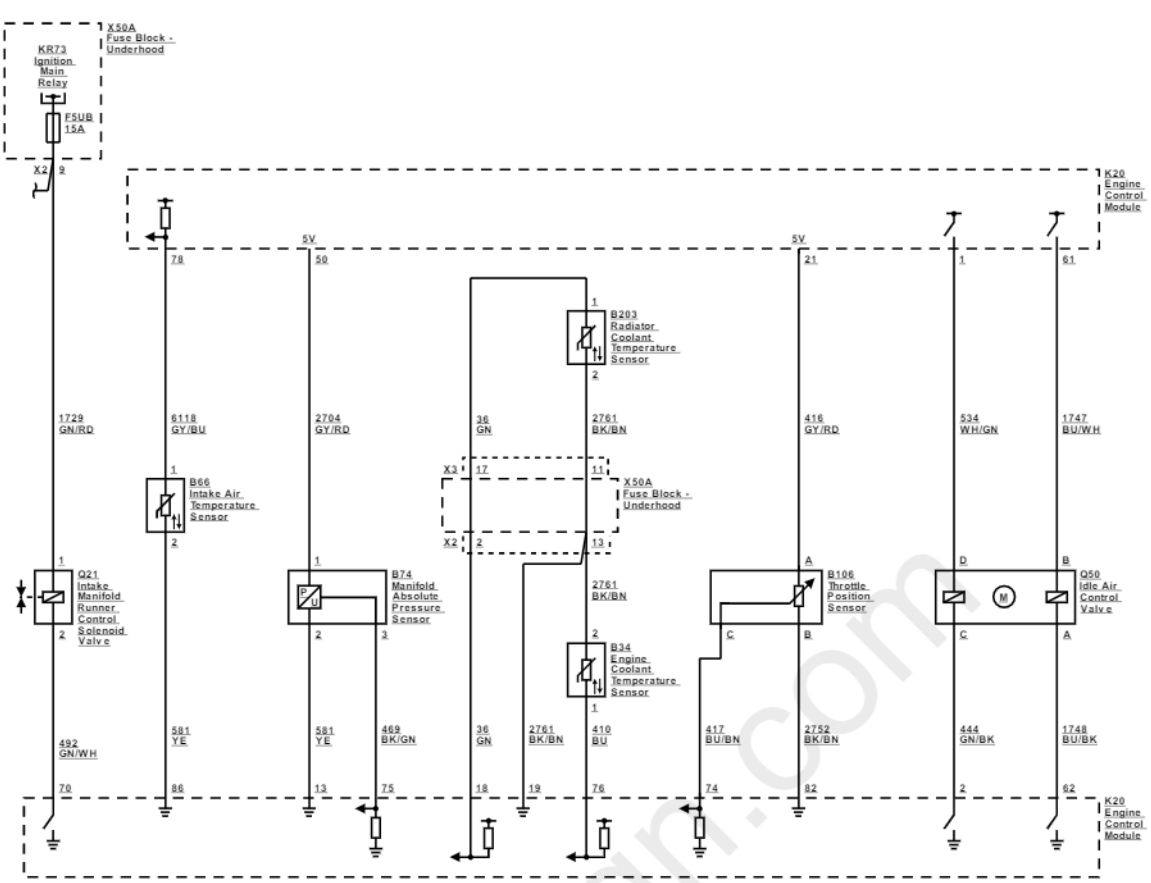
5-Volt and Low Reference Bus



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Engine Data Sensors - Pressure, Temperature, and Throttle Controls

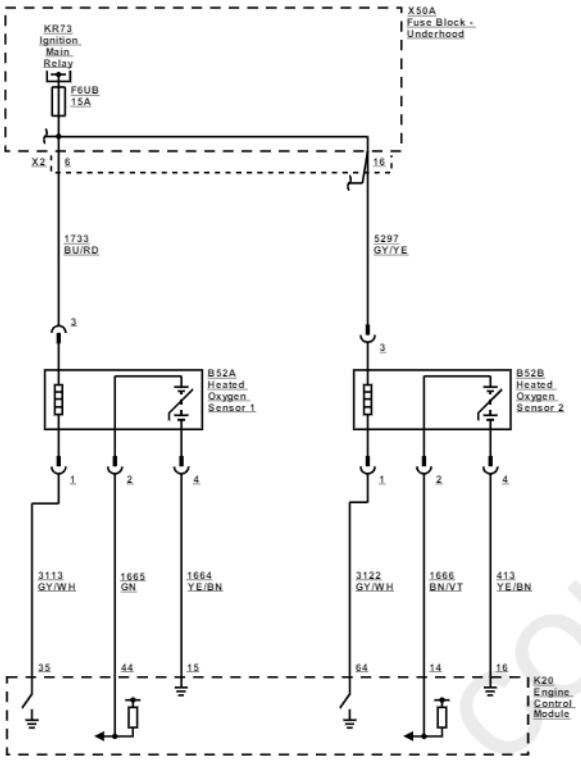


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Engine Data Sensors - Oxygen Sensors

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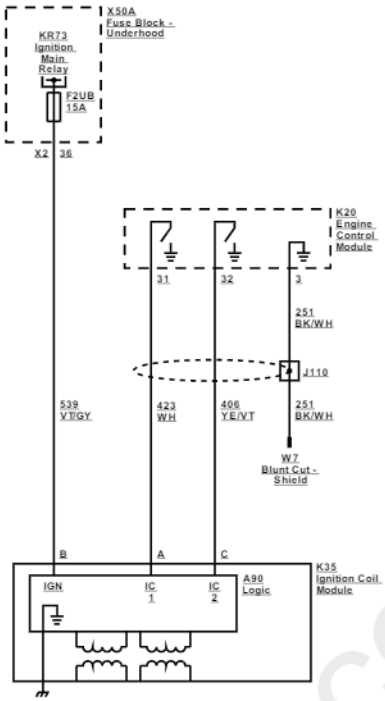


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Ignition Controls - Ignition System

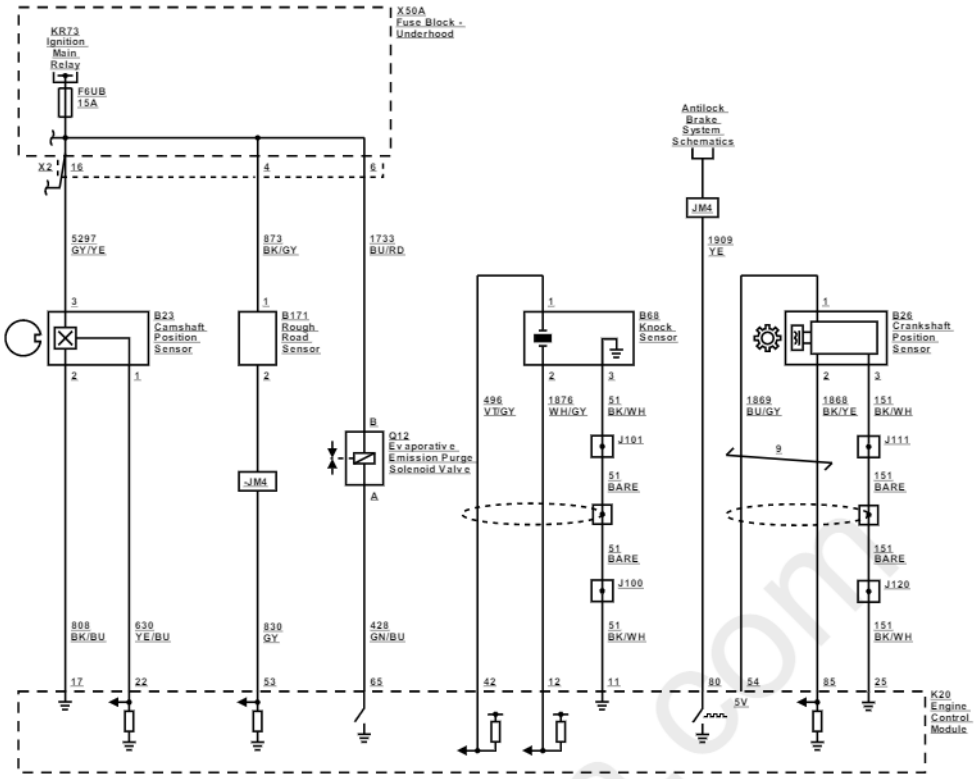
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Ignition Controls - Camshaft, Crankshaft, Knock, and Rough Road Sensors

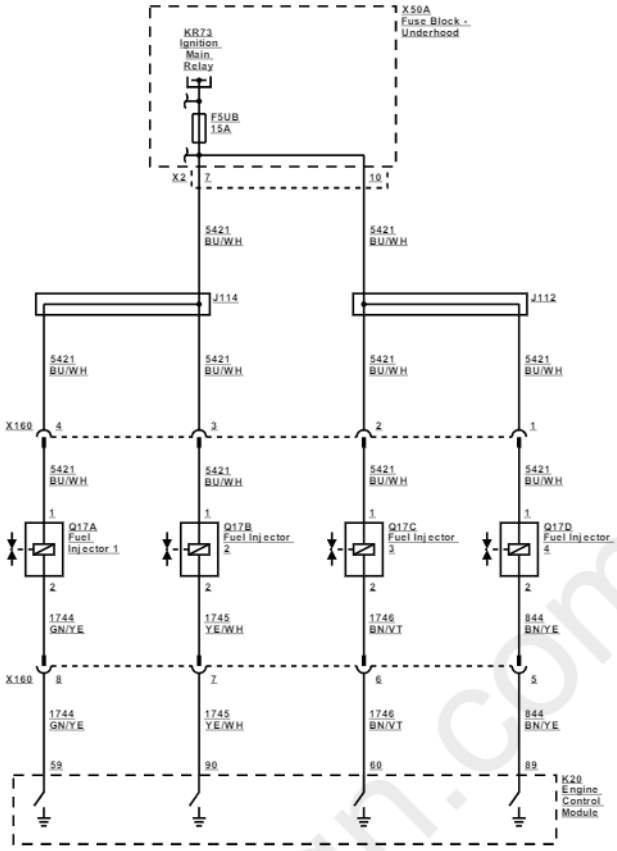


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Fuel Controls - Fuel Injectors

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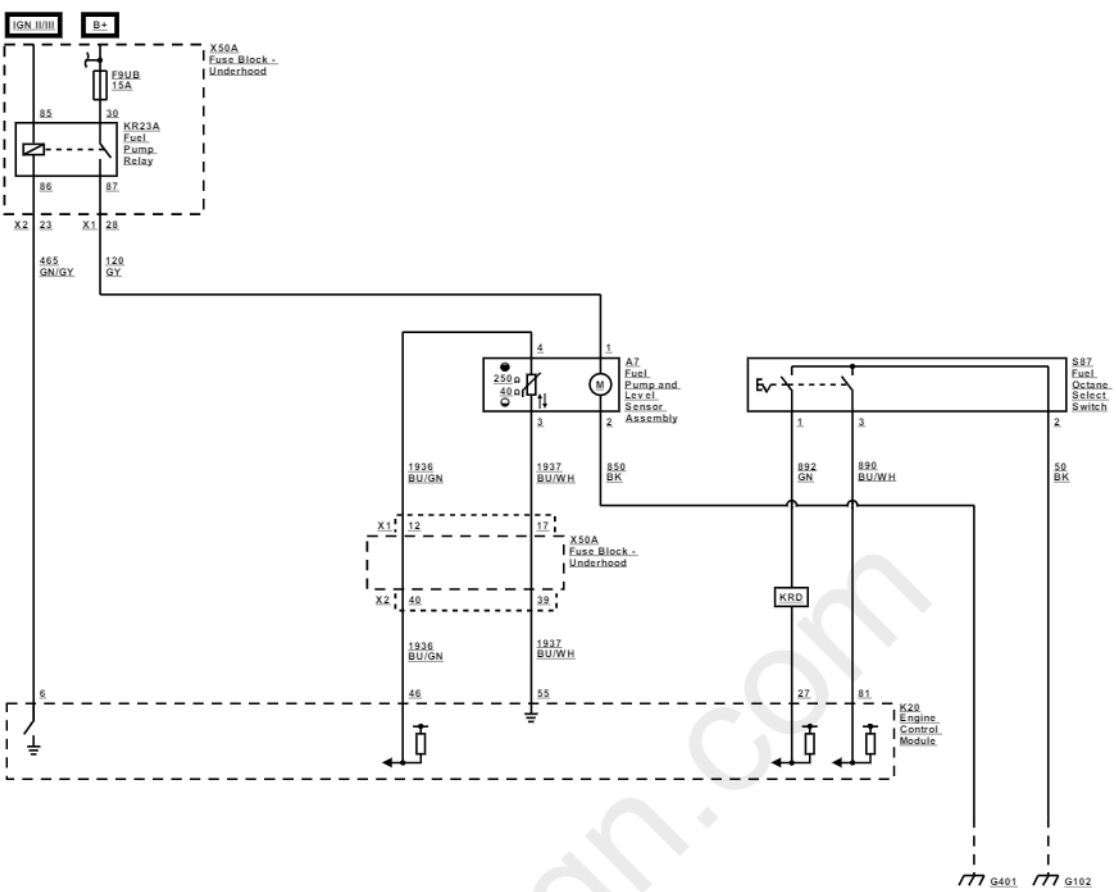


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Fuel Controls - Fuel Pump, Fuel Pressure, and Octane Selection

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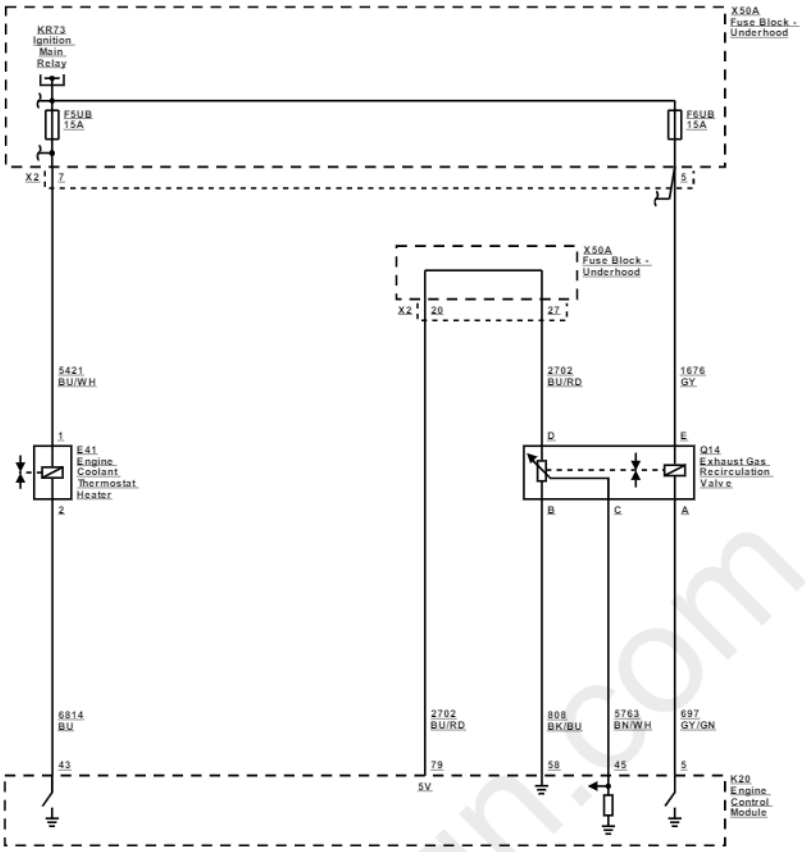


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Fuel Controls - Evaporative Emission Controls

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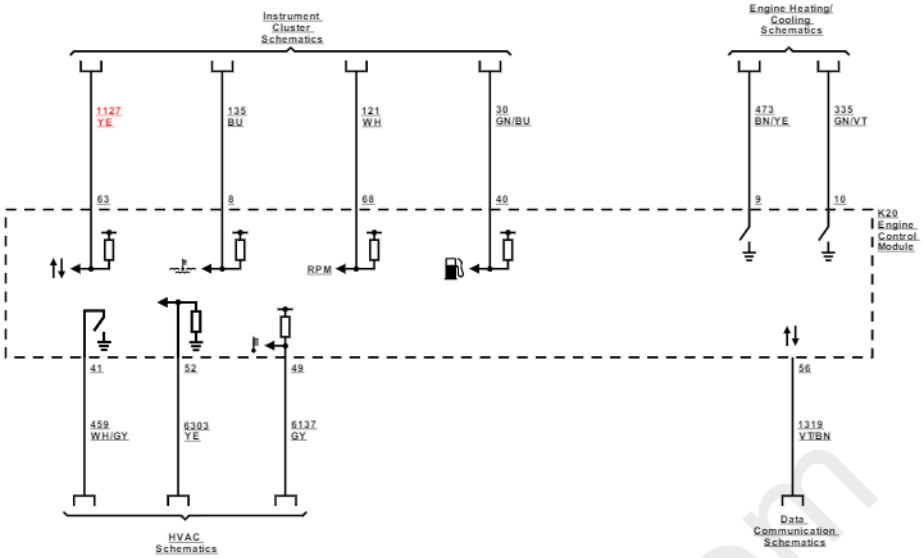


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