2007 ENGINE PERFORMANCE

Engine Controls and Fuel - 6.0L - TrailBlazer

SYMPTOMS - ENGINE CONTROLS

SYMPTOMS DESCRIPTION

Symptoms cover conditions that are not covered DTCs. Certain conditions can cause multiple symptoms. These conditions are listed together under Symptoms Testing. Conditions that may only cause certain symptoms are listed separately under Additional Symptoms Test. Perform the Symptoms Testing before using the Additional Symptoms Tests. Poor Fuel Fill Quality test may be performed separately from the Symptoms Testing and Additional Symptoms Tests procedures.

DIAGNOSTIC FAULT INFORMATION

Perform the **Diagnostic System Check - Vehicle** before using the symptoms procedures.

SYMPTOMS DEFINITION

Backfire

Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.

Cuts Out, Misses

A steady pulsation or jerking that follows engine speed, which is usually more pronounced as the engine load increases. This condition is not normally felt above 1500 RPM or 48 km/h (30 mph). The exhaust has a steady spitting sound at idle or at low speed.

Detonation/Spark Knock

A mild to severe ping which usually 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.

Hard Start

Engine cranks OK, but does not start for a long time. The vehicle does eventually run or may start but immediately stalls.

Hesitation, Sag, Stumble

Momentary lack of response as the accelerator is pushed down. This condition can occur at any vehicle speed. This condition is usually more pronounced when first trying to make the vehicle move, as from a stop. This condition may cause the engine to stall in severe conditions.

Lack of Power, Sluggishness or Sponginess

The engine delivers less than expected power. Little or no increase in speed when the accelerator pedal is pushed down part way.

Poor Fuel Economy

Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, the fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Poor Fuel Fill Quality

Difficulty when refueling the vehicle.

Rough, Unstable or Incorrect Idle and Stalling

The engine runs unevenly at idle. If severe, the engine or the vehicle may shake. Engine idle may vary in speed. Either condition may be severe enough to stall the engine.

Surges/Chuggles

Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

SYMPTOMS VERIFICATION

Before using the Symptom tables, perform the following inspections:

- Ensure that the engine control module (ECM) and malfunction indicator lamp (MIL) are operating correctly.
- Ensure that there are no diagnostic trouble codes (DTCs) that are stored.
- Ensure that the scan tool data is within a normal operating range.
- Verify the customer concern.
- Perform the Visual/Physical Inspection in this section. The visual/physical inspection is extremely important and can lead to correcting a condition without additional testing. It may also help reveal the cause of an intermittent condition.

Identifying Intermittent Conditions

Many intermittent conditions occur with harness or connector movement due to engine torque, rough pavement, vibration or physical movements of a component. Refer to the following for a list of issues that may cause an

intermittent condition:

- Moisture and water intrusion in connectors, terminals and components
- Incomplete connector mating
- Poor terminal contact
- High circuit or component resistance-High resistance can include any resistance, regardless of the amount, which can interrupt the operation of the component.
- Harness that is too short or tight.
- Wire insulation that is chaffed or cut.
- High or low ambient temperature
- High or low engine coolant temperatures
- High underhood temperatures
- Heat build up in component or circuit due to circuit resistance, poor terminal contact or high electrical load
- High or low system voltage
- High vehicle load conditions
- Rough road surfaces
- Electro-magnetic interference (EMI)/circuit interference from relays, solenoids or other electrical surge
- Incorrect installation of aftermarket, add on accessories

Visual/Physical Check

- Ensure that the control module grounds are clean, tight and correctly located. Refer to **Wiring Repairs** .
- Ensure that the vacuum hoses are not split, kinked and properly connected, as shown on the Vehicle Emission Control Information label. Refer to **Emission Hose Routing Diagram** .
- Ensure that the air filter is clean and free from restrictions.
- Ensure that there is no water intrusion in connectors terminals and components.
- Inspect the air intake ducts for the following conditions:
  - Collapsed
  - Damaged areas
  - Looseness
  - Incorrect installation
  - Leaking
- Inspect for air leaks at the throttle body mounting area, the mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Inspect the wiring harness for the following conditions:
  - Poor connections
  - Pinches
  - Cuts

- Inspect for loose, damaged, unseated or missing sensors/components.
- Inspect the terminals for corrosion and correct contact.

SYMPTOMS TESTING

Backfire, Cuts Out/Misses, Detonation/Spark Knock, Dieseling/Run-On, Hard Start, Hesitation/Sag/Stumble, Lack of Power/Sluggishness/Sponginess, Poor Fuel Economy, Rough, Unstable or Incorrect Idle and Stalling or Surges/Chuggles

1. Test for the following conditions:
   - The fuel system for the following:
     - Correct fuel pressure-Refer to **Fuel System Diagnosis**
     - Fuel injectors that are leaking or improper operation-Refer to **Fuel Injector Diagnosis**.
     - Contaminated or a poor fuel quality condition-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis**.
   - The ignition system for the following:
     - Spark plugs for incorrect heat range or an abnormal condition-Refer to **Spark Plug Inspection** .
     - For diagnosis of coolant or oil fouled spark plugs, refer to **Loss of Coolant** or **Symptoms - Engine Mechanical** .
     - Wet down the secondary ignition system with water from a spray bottle. Wetting down the secondary ignition system may help locate damaged or deteriorated components. Look/listen for arcing or misfiring as the water is applied.
     - Weak spark using the **J 26792** Spark Tester-Refer to **Electronic Ignition (EI) System Diagnosis**.
   - The operation of the A/C compressor
   - Items that can cause an engine to run rich or lean-Refer to **DTC P0171, P0172, P0174 or P0175** .
   - Inspect the heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions.

     NOTE: Refer to Heated Oxygen and Oxygen Sensor Notice .

   - Water intrusion in the HO2S connector

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

   - Inspect the MAF sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Install the MAF in the proper direction. Refer to **Mass Airflow Sensor/Intake Air Temperature Sensor Replacement** .
   - Inspect the mass air flow (MAF) sensor connections.

- Engine oil contaminated by fuel
- The engine for the following mechanical failures-Refer to **Symptoms - Engine Mechanical** :
  - Excessive oil in the combustion chamber or leaking valve seals
  - 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 chambers-Clean the chambers with top engine cleaner. Follow the instructions on the can.
  - Incorrect engine parts
- Vacuum hoses for splits or kinks-Verify that the routing and connections are as shown on the Vehicle Emission Control Information label. Refer to **Emission Hose Routing Diagram** .
- Knock sensor (KS) system for excessive spark retard activity-Refer to **Knock Sensor (KS) System Description** and**DTC P0324, P0325, P0326, P0327, P0328, P0330, P0332 or P0333** .
- The exhaust system components for the following:
  - Physical damage or possible internal failure
  - The three-way catalytic converters for a restriction

    For more information, refer to **Symptoms - Engine Exhaust** .

- Electromagnetic interference (EMI) on the reference circuit can 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.
- The crankcase ventilation valve for proper operation-Refer to **Crankcase Ventilation System Inspection/Diagnosis** .
- Evaporative emission (EVAP) canister purge solenoid that is stuck open
- The engine cooling system for the following conditions:
  - The thermostat is the correct heat range. Refer to **Thermostat Diagnosis** .
  - Proper engine coolant level-Refer to **Draining and Filling Cooling System (LH6, LS2)** or **Draining and Filling Cooling System (LL8)** .

2. If the above conditions do not address the symptom, refer to **Additional Symptoms Tests**.

ADDITIONAL SYMPTOMS TESTS

Detonation/Spark Knock

Test the engine for an overheating condition. Refer to **Symptoms - Engine Cooling** .

Poor Fuel Economy

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

Rough, Unstable or Incorrect Idle and Stalling

Inspect the engine mounts.

Surges/Chuggles

Test the 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 ECM reduces the amount of fuel delivered to the engine, causing a driveability condition.

Hard Start

- 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 ± 3°C (5°F). If the ECT sensor is out of range with the IAT sensor, test the resistance of the ECT sensor. Refer to **Temperature Versus Resistance** 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 circuits for a high resistance.
- Test the idle air control (IAC) system.
- Test the fuel pump relay operation. The fuel pump should turn ON for 2 seconds when the ignition is turned ON. Refer to **Fuel Pump Electrical Circuit Diagnosis**.

Hesitation, Sag, Stumble

- Test the manifold absolute pressure (MAP) sensor. Refer to **DTC P0106** .
- Test the generator. Refer to **Symptoms - Engine Electrical** . Repair the charging system if the generator output voltage is less than 9 volts or more than 16 volts.

Poor Fuel Economy

- Heavy loads being carried or towed.
- Acceleration rate too much or too often.
- Inspect for foreign material accumulation in the throttle bore and for carbon deposits on the throttle plate and shaft. Also inspect for throttle body tampering.

POOR FUEL FILL QUALITY

Test for the following conditions that is applicable to the current symptom.

Difficult to Fill

- Restricted vent lines
- The evaporative emission (EVAP) vent valve is stuck closed
- High fuel temperature
- A condition with the internal components of the fuel tank assembly.

For more information, refer to:

- **Fuel Hose/Pipes Routing Diagram**
- **Evaporative Emissions Hose Routing Diagram**
- **Fuel System Description**
- **Evaporative Emission Control System Description**

Fuel Odor

- Saturated EVAP canister-Refer to **Evaporative Emission Control System Description** .
- A condition with the internal components of the fuel tank assembly-Refer to **Fuel System Description** .

MALFUNCTION INDICATOR LAMP (MIL) DIAGNOSIS

DIAGNOSTIC FAULT INFORMATION

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

CIRCUIT/SYSTEM DESCRIPTION

Ignition voltage is supplied to the malfunction indicator lamp (MIL). The engine control module (ECM) turns the MIL ON by grounding the MIL control circuit.

REFERENCE INFORMATION

Schematic Reference

- **Instrument Cluster Schematics**
- **Engine Controls Schematics**

Connector End View Reference

- **Displays and Gages Connector End Views**
- **Engine Control Module Connector End Views**

Electrical Information Reference

- **Circuit Testing**

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

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Output Controls**
- **Scan Tool Data Definitions**

CIRCUIT/SYSTEM VERIFICATION

Ignition ON, the MIL should turn ON and OFF when commanded with a scan tool.

CIRCUIT/SYSTEM TESTING

1. Ignition OFF, disconnect the harness connector at the instrument panel cluster (IPC).
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit and ground.
    - 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, replace the IPC.
3. Connect a test lamp between the control circuit and the ignition circuit.
4. Command the MIL ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
    - If the test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the ECM.
    - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
5. If all circuits test normal, replace the IPC.

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

- **Control Module References**
- **Instrument Cluster Replacement**

ENGINE CRANKS BUT DOES NOT RUN

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle**
- **Strategy Based Diagnosis**
- **Diagnostic Procedure Instructions**

CIRCUIT/SYSTEM DESCRIPTION

This Engine Cranks but Does Not Run diagnostic is an organized approach to identify a condition which causes the engine to crank but does not continue to run. This diagnostic directs the service technician to the appropriate system diagnosis. This diagnostic assumes the vehicle system voltage levels are adequate for starter motor operation. Refer to **Battery Inspection/Test** and **Engine Cranks Slowly** . The fuel level supply must be adequate and the fuel quality must be able to sustain the combustion process.

DIAGNOSTIC AIDS

- When disconnecting electrical connectors or removing fuses and relays from a fuse block, always inspect both mating electrical terminals for corrosion and terminal tightness.
- Use the **J 35616** Connector Test Adapter Kit for any test that requires probing the underhood fuse block terminals, component wire harness terminals or the ECM wire harness terminals.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics

Connector End View Reference

- **Engine Control Module Connector End Views**
- **Engine Controls Connector End Views**
- **Electrical Center Identification Views**

Electrical Information Reference

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

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Output Controls**
- **Scan Tool Data Definitions**

Special Tools Required

J 34730-1A Fuel Pressure Gage

CIRCUIT/SYSTEM VERIFICATION

Attempt to start the engine. The engine should start and run.

- If the vehicle passes the Circuit/System Verification test, then refer to **Testing for Intermittent Conditions and Poor Connections** .

CIRCUIT/SYSTEM TESTING

1. Crank the engine for 15 seconds.
2. Observe the vehicle DTC information with a scan tool.
    - If any DTCs are set, then repair those DTCs first. Refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
3. With the ignition ON and the engine OFF, test the fuses that are supplied ignition 1 voltage by the powertrain relay. The test lamp should illuminate ON for each test point of the fuses.
    - If the test lamp does not illuminate on, for at least one test point of each fuse, refer to **DTC P0685, P0689 or P0690** .
4. Crank the engine for 15 seconds. Observe the engine speed parameter with a scan tool.
    - If engine RPM is not indicated, refer to **DTC P0335 or P0336** .
5. Install a spark plug tester onto one ignition module/coil assembly, on each bank of the engine.
6. Observe both spark plug testers.

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

7. Crank the engine for 15 seconds. The ignition coil secondary voltage should be observed across the gap of both spark plug testers.
    - If the ignition coil secondary voltage is not observed, is inconsistent or weak on either spark plug tester, refer to **Electronic Ignition (EI) System Diagnosis**.
8. With the ignition ON and the engine OFF, command the fuel pump ON and OFF with the scan tool. The fuel pump should energize when commanded ON and de-energize when commanded OFF.
    - If the fuel pump does not turn ON and OFF, refer to **Fuel Pump Electrical Circuit Diagnosis**.
9. Turn OFF the ignition.
10. Install the **J 34730-1A** . With the ignition ON and the engine OFF, command the fuel pump ON several times with the scan tool. Refer to **Fuel System Diagnosis** for the fuel pressure specification.
11. Inspect for the following conditions:
    - Compare the actual engine coolant temperature to the ECT parameter
    - Filter and air intake system for restrictions and obstructions
    - Test the fuel for contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis**.
    - Inspect the spark plugs-Refer to **Spark Plug Inspection** .
    - Test the exhaust system for restrictions-Refer to **Restricted Exhaust** .
    - Engine mechanical conditions, such as worn timing chain, sprocket gears, low compression, etc-Refer to **Engine Compression Test** .

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

POWERTRAIN RELAY DIAGNOSIS

DIAGNOSTIC FAULT INFORMATION

IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

TYPICAL SCAN TOOL DATA

EC Ignition Relay

Display Parameters	Normal Range	Short to Ground	Open/High Resistance	Short to Voltage
Operating Conditions: Ignition ON, engine OFF				
EC Ignition Relay Circuit Status	OK/Incomplete	Short to GRN/Open	Short to GRN/Open	Short to B+
EC Ignition Relay Command	ON	ON	ON	ON
EC Ignition Relay Feedback Signal	12-12.9 V	0.0 V	0.0 V	12-12.9 V

CIRCUIT/SYSTEM DESCRIPTION

The powertrain relay is a normally open relay. The relay armature is held in the open position by spring tension. Battery positive voltage is supplied directly to the relay coil and the armature contact at all times. The engine control module (ECM) supplies the ground path to the relay coil control circuit via an internal integrated circuit called an output driver module (ODM). The ODM output control is configured to operate as a low side driver for the powertrain relay. The ODM for the powertrain relay also incorporates a fault detection circuit, which is continuously monitored by the ECM. When the ECM commands the powertrain relay ON, ignition 1 voltage is supplied to the ECM and to several additional circuits.

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

Schematic Reference

Engine Controls Schematics

Connector End View Reference

- **Engine Control Module Connector End Views**
- **Engine Controls Connector End Views**
- **Electrical Center Identification Views**

Electrical Information Reference

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

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Special Tools Required

- **J 35616** Connector Test Adapter Kit
- **J 43244** Relay Puller Pliers

CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON, engine OFF, command the powertrain relay ON and OFF several times using the scan tool output control function. You should either hear or feel the relay click with each command.
2. Ignition ON, engine OFF, with a test lamp, probe both test points of all the fuses that are powered by the powertrain relay. The test lamp should illuminate on at least one test point of each fuse.
    - If the vehicle passes the Circuit/System Verification test, then operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that are captured in the Freeze Frame/Failure Records Data list.

CIRCUIT/SYSTEM TESTING

1. Ignition OFF, disconnect the powertrain relay.
2. Ignition ON, verify that a test lamp does not illuminate between the relay coil control circuit and ground.
    - If the test lamp illuminates, test the relay coil control circuit for a short to voltage. If the circuit tests normal, replace the ECM.
3. Verify that a test lamp does not illuminate between the relay ignition 1 voltage circuit and ground.
    - If the test lamp illuminates, test the relay ignition 1 voltage circuit for a short to voltage. If the circuit tests normal, replace the ECM.
4. Verify that a test lamp illuminates between the relay coil B+ and ground.
    - If the test lamp does not illuminate, test the relay coil B+ circuit for a short to ground or an

open/high resistance.

5. Verify that a test lamp illuminates between the relay switch B+ and ground.
    - If the test lamp does not illuminate, test the relay switch B+ circuit for a short to ground or an open/high resistance. If the circuits test normal and the fuse for the ignition 1 voltage circuit is open, test the ignition 1 voltage circuit to the ECM for a short to ground. If the circuit tests normal, replace the ECM.
6. Connect a test lamp between the relay coil B+ and the relay coil control circuit.
7. Ignition ON, command the powertrain relay ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
    - If the test lamp is always ON, test the relay coil control circuit for a short to ground. If the circuit tests normal, replace the ECM.
    - If the test lamp is always OFF, test the relay coil control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
8. Connect a 20-amp fused jumper wire between the relay switch B+ and the relay ignition 1 voltage circuit.
9. Ignition ON, engine OFF, monitor the EC Ignition Relay Feedback parameter with a scan tool. The parameter should display B+.
    - If the parameter does not display B+, test the ignition 1 voltage circuit for an open/high resistance. If the circuit tests normal, replace the ECM.
10. If all circuits test normal, test or replace the relay.

COMPONENT TESTING

1. Ignition OFF, disconnect the powertrain relay.
2. Test for 65-110 ohms of resistance between terminals 85 and 86 of the relay.
    - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between following terminals:
    - Terminal 30 and 86
    - Terminal 30 and 87
    - Terminal 30 and 85
    - Terminal 85 and 87
    - If not the specified value, replace the relay.
4. Install a 20-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 1 ohm of resistance between terminals 30 and 87.
    - If greater than the specified range, replace the relay.

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**
- **Underhood Electrical Center or Junction Block Replacement**

- **Control Module References** for ECM replacement, setup and programming.

FUEL INJECTOR DIAGNOSIS

DIAGNOSTIC FAULT INFORMATION

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

CIRCUIT/SYSTEM DESCRIPTION

The control module enables the appropriate fuel injector pulse for each cylinder. The ignition voltage is supplied directly to the fuel injectors. The 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, the scan tool is first used to energize the fuel pump relay. 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 the 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

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

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics

Connector End View Reference

Engine Controls Connector End Views

Electrical Information Reference

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

- **Wiring Repairs**

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Special Tools Required

- **J 34730-1A** Fuel Pressure Gage
- **J 39021** Fuel Injector Coil and Balance Tester
- **J 44602** Injector Test Adapter

COMPONENT TESTING

Fuel Injector Coil Test

1. Observe the ECT Sensor parameter with a scan tool. The ECT sensor should be 10-32°C (50-90°F).
   - If the ECT Sensor parameter is not within 10-32°C (50-90°F), go to **Step 3** .
2. Measure the resistance of each fuel injector with a DMM. The resistance of each fuel injector should be 11-14 ohms.
   - If the resistance of any fuel injector is not 11-14 ohms, replace the fuel injector.
3. Measure and record the resistance of each fuel injector with a DMM. Subtract the lowest resistance value from the highest resistance value. The difference between the lowest value and the highest value should be equal to or less than 3 ohms.
   - If the difference is equal to or less than 3 ohms, perform the Fuel Injector Balance Test-Fuel Pressure Test.
   - If the difference is more than 3 ohms, continue with the Fuel Injector Coil Test.
4. 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 fuel injector that displays the greatest resistance difference above or below the average.
5. Perform the Fuel Injector Balance Test-Fuel Pressure Test.

Fuel Injector Balance Test-Fuel Pressure Test

IMPORTANT: DO NOT perform this test if the engine coolant temperature (ECT) is above 94°C (201°F). Irregular fuel pressure readings may result due to hot soak fuel boiling.

IMPORTANT: Verify that adequate fuel is in the fuel tank before proceeding with this diagnostic.

1. Install a fuel pressure gage. Refer to **Fuel Pressure Gage Installation and Removal** .
2. Turn ON the ignition, with the engine OFF.

IMPORTANT:
- **The fuel pump relay may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.**
- **DO NOT start the engine.**

3. Command the fuel pump relay ON with a scan tool.
4. Observe the fuel pressure gage with the fuel pump commanded ON. The fuel pressure should be 345-414 kPa (50-60 psi).
   - If the fuel pressure is not 345-414 kPa (50-60 psi), refer to **Fuel System Diagnosis**.

IMPORTANT: The fuel pressure may vary slightly when the fuel pump stops operating. After the fuel pump stops operating, the fuel pressure should stabilize and remain constant.

5. Monitor the fuel pressure gage for one minute. The fuel pressure should not decrease more than 34 kPa (5 psi).
   - If the fuel pressure decreases more than 34 kPa (5 psi), refer to **Fuel System Diagnosis**.
6. Perform the Fuel Injector Balance Test with Special Tool or the Fuel Injector Balance Test with Tech 2.

Fuel Injector Balance Test with Special Tool

1. Set the amperage supply selector switch on the fuel injector tester to the Balance Test 0.5-2.5 amp position.
2. Connect the **J 39021** to a fuel injector with a **J 44602** .
3. Command the fuel pump relay ON and then OFF with a scan tool.
4. Record the fuel pressure indicated by the fuel pressure gage after the fuel pressure stabilizes. This is the first pressure reading.

IMPORTANT: The fuel pressure may rise after the fuel injector stops pulsing. Record the fuel pressure value immediately after the fuel injector stops pulsing. DO NOT record the higher fuel pressure value.

5. Energize the fuel injector by depressing the Push to Start Test button on the fuel injector tester.
6. Record the fuel pressure indicated by the fuel pressure gage after the fuel injector has stopped pulsing. This is the second pressure reading.
7. Repeat steps 2-6 for each fuel injector.
8. Perform the Pressure Drop Calculation.

Fuel Injector Balance Test with Tech 2

1. With a scan tool, select the Fuel Injector Balance Test function within the Special Functions menu.
2. Select an injector to be tested.
3. Press Enter to prime the fuel system.
4. Record the fuel pressure indicated by the fuel pressure gage after the fuel pressure stabilizes. This is the first pressure reading.

IMPORTANT: Record the fuel pressure value immediately after the fuel injector stops pulsing. The fuel pressure may rise after the fuel injector stops pulsing. DO NOT record the higher fuel pressure value.

5. Energize the fuel injector by depressing the Pulse Injector button on the scan tool. This will energize the injector and decrease the fuel pressure.
6. Record the fuel pressure indicated by the fuel pressure gage after the fuel injector has stopped pulsing. This is the second pressure reading.
7. Press Enter again to bring you back to the Select Injector screen.
8. Repeat steps 2-7 for each fuel injector.
9. Perform the Pressure Drop Calculation.

Pressure Drop Calculation

1. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value.
2. Obtain a pressure drop value for each fuel injector.
3. Add all of the individual pressure drop values. This is the total pressure drop.
4. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. The difference between any individual pressure drop and the average pressure drop should not be more than 20 kPa (3 psi).
    - If the difference between any individual pressure drop and the average pressure drop is more than 20 kPa (3 psi), perform the **Fuel Injector Cleaning** .

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

FUEL PUMP ELECTRICAL CIRCUIT DIAGNOSIS

DIAGNOSTIC FAULT INFORMATION

Always perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

Fuel Pump Electrical Circuit Diagnosis

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

Battery Voltage - Relay Switch Side	1	2	-	-
Fuel Pump Supply Voltage	1	2	3	-
Fuel Pump Relay Control	P0230	P0230	P0230	-
Fuel Pump Relay Ground	-	P0230	-	-
Fuel Pump Ground	-	2	-	-

[1] Open fuel pump fuse, cranks no start
[2] Cranks no start
[3] Fuel pump operates continuously, then discharged battery

CIRCUIT/SYSTEM DESCRIPTION

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

DIAGNOSTIC AIDS

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

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

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics

Connector End View Reference

- **Engine Control Module Connector End Views**
- **Engine Controls Connector End Views**
- **Electrical Center Identification Views**

Electrical Information Reference

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

- **Wiring Repairs**

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Special Tools Required

J 43244 Relay Puller Pliers

CIRCUIT/SYSTEM VERIFICATION

1. With the ignition ON, engine OFF, command the fuel pump relay ON and OFF several times using the scan tool output control function. You should either hear or feel the relay click and the fuel pump should turn ON and OFF with each command.
    - If the fuel pump operates continuously, test for a faulty relay or a short to voltage in the supply voltage circuit of the fuel pump.

CIRCUIT/SYSTEM TESTING

1. With the ignition OFF, remove the fuel pump relay from the underhood electrical center.
2. With the ignition ON, engine OFF, probe the control circuit of the fuel pump relay with a test lamp that is connected to a good ground. Command the fuel pump relay ON and OFF with a scan tool. The test lamp should turn ON and OFF with each command.
    - If the test lamp does not turn ON and OFF, test for an open, high resistance or a short to ground in the fuel pump relay control circuit, an intermittent or a poor connection at the engine control module (ECM). If the circuit tests normal, replace the control module.
    - If the test lamp remains illuminated with each command, test for a short to voltage in the control circuit of the fuel pump relay, an intermittent or a poor connection at the ECM. If the circuit tests normal, replace the control module.
3. Connect a test lamp between the control circuit of the fuel pump relay and the ground circuit of the fuel pump relay. Command the fuel pump relay ON and OFF with a scan tool.
    - If the test lamp does not turn ON and OFF, repair the open or the high resistance in the ground circuit of the fuel pump relay.
    - If the test lamp does turn ON and OFF, test for an intermittent and for a poor connection at the fuel pump relay or a faulty fuel pump relay.
4. Inspect the fuel pump fuse.
    - If the fuel pump fuse is open, test for a short to ground in the supply voltage circuit of the fuel pump or a faulty fuel pump module.
5. With the ignition ON, engine OFF, probe the battery positive voltage circuit of the fuel pump relay with a test lamp that is connected to a good ground.
    - If the test lamp does not illuminate, repair the open in the battery positive voltage circuit.

6. Connect a 15-amp fused jumper wire between the battery positive voltage circuit of the fuel pump relay and the supply voltage circuit of the fuel pump.
    - If the fuel pump operates, test for an intermittent or poor connection at the fuel pump relay or a faulty fuel pump relay.
    - If the fuel pump does not operate, test for an open or high resistance in the supply voltage circuit of the fuel pump, an open or high resistance in the ground circuit of the fuel pump, an intermittent or poor connection at the fuel pump module cover or a faulty fuel pump module.

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

- **Control Module References** for ECM replacement, setup and programming.
- **Fuel Sender Assembly Replacement**
- **Relay Replacement (Attached to Wire Harness)** or **Relay Replacement (Within an Electrical Center)**

FUEL SYSTEM DIAGNOSIS

DIAGNOSTIC FAULT INFORMATION

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

CIRCUIT/SYSTEM DESCRIPTION

When the ignition is turned ON, the engine control module (ECM) supplies power to the in-tank fuel pump, by energizing the fuel pump relay. The in-tank fuel pump remains ON as long as the engine is cranking or running and the ECM receives crankshaft reference pulses. If there are no reference pulses, the ECM turns the in-tank fuel pump OFF, 2 seconds after the ignition switch is turned ON or 2 seconds after the engine stops running. The electric fuel pump is incorporated into the modular fuel pump and sender assembly and is located inside the fuel tank. The fuel pump supplies fuel through a fuel filter, also located in the modular fuel pump and sender assembly, through the fuel feed pipes, to the fuel rail assembly. The fuel pump provides fuel at a pressure above the pressure needed by the fuel injectors. The fuel pressure regulator, located in the modular fuel pump and sender assembly, keeps the fuel available to the fuel injectors at a regulated pressure. When the fuel pressure rises above the pressure regulator calibration, the pressure is relieved, with excess fuel exhausted into the modular fuel pump and sender assembly reservoir.

REFERENCE INFORMATION

Electrical Information Reference

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

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

Special Tools Required

- **J 34730-1A** Fuel Pressure Gage
- **J 37287** Fuel Line Shut-Off Adapters

CIRCUIT/SYSTEM VERIFICATION

IMPORTANT:

- **Inspect the fuel system for damage or external leaks before proceeding.**
- **Verify that adequate fuel is in the fuel tank before proceeding.**
- **The fuel pump relay may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.**

1. Ignition ON, command the fuel pump relay ON with a scan tool. You should hear the fuel pump turn ON and OFF.
   - If the fuel pump does not operate, refer to **Fuel Pump Electrical Circuit Diagnosis**.
2. Ignition OFF, all accessories OFF, install the **J 34730-1A** . Refer to **Fuel Pressure Gage Installation and Removal** .
3. Ignition ON, command the fuel pump relay ON with a scan tool. Verify the fuel pressure is between 345-414 kPa (50-60 psi) and remains steady for 5 minutes.

CIRCUIT/SYSTEM TESTING

IMPORTANT:

- **The fuel pump relay may need to be commanded ON a few times in order to obtain the highest possible fuel pressure.**
- **DO NOT start the engine.**

1. Ignition ON, command the fuel pump relay ON with a scan tool and observe the fuel pressure gage while the fuel pump is operating. Verify the fuel pressure is between 345-414 kPa (50-60 psi).
   - If the fuel pressure is greater than the specified range, replace the fuel pump.
   - If the fuel pressure is less than the specified range, remove the fuel tank and test, inspect and repair the items listed below. If all items test normal, replace the fuel pump.
     - Restricted fuel feed pipe
     - Restricted or plugged fuel filter
     - Restricted or plugged strainer
     - Stuck or binding fuel level float

- Inspect the harness connectors and the ground circuits of the fuel pump for poor connections.

IMPORTANT: The fuel pressure may vary slightly when the fuel pump stops operating. After the fuel pump stops operating, the fuel pressure should stabilize and remain constant.

2. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 minute.
    - If the fuel pressure decreases more than the specified value, perform the following procedure:
        1. Ignition OFF, relieve the fuel pressure. Refer to **Fuel Pressure Relief** .
        2. Install the **J 37287** between the fuel feed pipe and the fuel rail.
        3. Open the valve on the **J 37287** .
        4. Ignition ON, command the fuel pump relay ON with a scan tool and bleed the air from the fuel pressure gage.
        5. Close the valve on the **J 37287** .
        6. Verify that the fuel pressure does not decrease more than 34 kPa (5 psi) in 1 minute.
            - If the fuel pressure drops, locate and replace the leaking fuel injector.
        7. If the fuel system test normal, replace the fuel pump.
3. Relieve the fuel pressure to 69 kPa (10 psi). Verify that the fuel pressure does not decrease more than 14 kPa (2 psi) in 5 minutes.
    - If the fuel pressure decreases more than the specified value, replace the fuel pump.
4. Remove the **J 37287** and **J 34730-1A** . Refer to **Fuel Pressure Gage Installation and Removal** .
5. Operate the vehicle within the conditions of the customers concern while monitoring the fuel trim and O2 parameters with a scan tool. The scan tool parameters should not indicate a lean condition.
    - If the scan tool parameters indicate a lean condition, test for a restricted fuel feed pipe, restricted fuel filter or poor connections at the harness connectors and ground circuits of the fuel pump. If all test normal, replace the fuel pump.
6. If the fuel system components test normal, refer to **Symptoms - Engine Controls**.

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

- **Fuel Injector Replacement**
- **Fuel Sender Assembly Replacement**

ALCOHOL/CONTAMINANTS-IN-FUEL DIAGNOSIS

TEST DESCRIPTION

Water contamination in the fuel system may cause driveability conditions such as hesitation, stalling, no start or misfires in one or more cylinders. Water may collect near a single fuel injector at the lowest point in the fuel injection system and cause a misfire in that cylinder. If the fuel system is contaminated with water, inspect the

fuel system components for rust or deterioration.

Ethanol concentrations of greater than 10 percent can cause driveability conditions and fuel system deterioration. Fuel with more than 10 percent ethanol could result in driveability conditions such as hesitation, lack of power, stalling or no start. Excessive concentrations of ethanol used in vehicles not designed for it may cause fuel system corrosion, deterioration of rubber components and fuel filter restriction.

REFERENCE INFORMATION

Special Tool

J 44175 Fuel Composition Tester

SYSTEM VERIFICATION

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

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

ALCOHOL IN FUEL TESTING WITH SPECIAL TOOL

1. Test the fuel composition using **J 44175** and Instruction Manual.
2. If water appears in the fuel sample, clean the fuel system.
3. Subtract 50 from the reading on the DMM in order to obtain the percentage of alcohol in the fuel sample.
4. If the fuel sample contains more than 15 percent ethanol, add fresh, regular gasoline to the vehicle's fuel tank.
5. Test the fuel composition.
6. If testing shows the ethanol percentage is still more than 15 percent, replace the fuel in the vehicle.

ALCOHOL IN FUEL TESTING WITHOUT SPECIAL TOOL

1. Using a 100 ml (3.38 oz.) specified cylinder with 1 ml (0.034 oz.) graduation marks, fill the cylinder with fuel to the 90 ml (3.04 oz.) mark.
2. Add 10 ml (0.34 oz.) of water in order to bring the total fluid volume to 100 ml (3.38 oz.) and install a stopper.
3. Shake the cylinder vigorously for 10-15 seconds.
4. Carefully loosen the stopper in order to release the pressure.
5. Re-install the stopper and shake the cylinder vigorously again for 10-15 seconds.
6. Put the cylinder on a level surface for approximately 5 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 10 ml (0.34 oz.). For example, if the volume of the lower layer is

increased to 15 ml (0.51 oz.), this indicates at least 5 percent alcohol in the fuel. The actual amount of alcohol may be somewhat more because this procedure does not extract all of the alcohol from the fuel.

PARTICULATE CONTAMINANTS IN FUEL TESTING PROCEDURE

1. Using an approved fuel container, draw approximately 0.5 liter (0.53 qt) of fuel.
2. Place the container on a level surface for approximately 5 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 a white or light brown crystals. Rubber will appear as black and irregular particles.
3. Observe the fuel sample. If any physical contaminants or water are present, clean the fuel system.

REPAIR PROCEDURES

IMPORTANT: Perform the DIAGNOSTIC REPAIR VERIFICATION after completing the diagnostic procedure.

Fuel System Cleaning

ELECTRONIC IGNITION (EI) SYSTEM DIAGNOSIS

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle**
- **Strategy Based Diagnosis**
- **Diagnostic Procedure Instructions**

CIRCUIT/SYSTEM DESCRIPTION

This ignition system uses individual ignition module/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. Each ignition module/coil has the following circuits:

- An ignition 1 voltage circuit
- A ground circuit
- An IC circuit
- A low reference circuit

DIAGNOSTIC AIDS

- This test procedure requires that the vehicle battery has passed a load test and is completely charged.
- There is an adequate supply of fuel in the fuel tank.
- When disconnecting electrical connectors or removing fuses and relays from a fuse block, always inspect

both mating electrical terminals for corrosion and terminal tightness.

- Use the **J 35616** for any test that requires probing the underhood fuse block terminals, component wire harness terminals or the ECM wire harness terminals.

REFERENCE INFORMATION

Schematic Reference

Engine Controls Schematics

Connector End View Reference

- **Engine Control Module Connector End Views**
- **Engine Controls Connector End Views**

Electrical Information Reference

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

Scan Tool Reference

- **Scan Tool Data List**
- **Scan Tool Output Controls**
- **Scan Tool Data Definitions**

Special Tools Required

- **J 26792** Spark Plug Tester
- **J 35616** Connector Test Adapter Kit

CIRCUIT/SYSTEM VERIFICATION

Observe the Engine Controls Schematic for the ignition module/coils and review the Ignition System Specifications to verify the following concerns:

- The ignition modules/coils are correctly wired and connected
- The proper spark plug type
- The proper spark plug gap and torque
- The proper ohm values for the spark plug wires

Refer to **Ignition System Specifications** .

CIRCUIT/SYSTEM TESTING

1. Turn OFF the ignition.

IMPORTANT: This engine application uses 2 fuses, one for each bank, to supply ignition 1 voltage to the ignition module/coil assemblies and also to the fuel injectors. A good indication that a fuse is open is that all 4 misfire counters are incrementing on one side of the engine

2. Inspect both fuse that supplies ignition voltage to the ignition module/coils.
    - If a fuse is open, test all 8 ignition voltage circuits to the ignition module/coils or the fuel injectors on the engine bank, for a short to ground.
3. Disconnect the 4 ignition module/coil and the 4 fuel injector electrical connectors, for the engine bank that has the open fuse.
4. Replace the open fuse with a new fuse.
5. Ignition ON, engine OFF.
6. Reconnect each ignition module/coil and fuel injector electrical connectors, one at a time.
    - If the fuse opens when connecting an ignition module/coil or fuel injector electrical connector, then replace the component that caused the fuse to open.
7. Ignition OFF, disconnect the appropriate ignition module/coil electrical connector.
8. Ignition ON, verify that a test lamp illuminates between the ignition voltage circuit and ground.
    - If the test lamp does not illuminate test the ignition voltage circuit for an open/high resistance.
9. Verify that a test lamp illuminates between the ignition module/coil ground circuit and B+.
    - If the test lamp does not illuminate, test the ignition module/coil ground circuit for an open/high resistance.
10. Inspect and measure the resistance of the spark plug wire. Refer to **Spark Plug Wire Inspection** and **Ignition System Specifications** .
    - If the resistance value is not within the specified range or does not pass the inspection, replace the spark plug wire.
11. Exchange the misfiring cylinder, ignition module/coil assembly with the ignition module/coil assembly from a non-misfiring cylinder.
12. Start and idle the engine. Observe the misfire counters on the scan tool.
    - If the misfire transfers with the suspect ignition module/coil, then replace the ignition module/coil assembly.
    - If the misfire does not transfer with the suspect ignition module/coil, then measure the resistance of the IC circuit. The IC circuit should measure less than 5 ohms. If the circuit tests normal, replace the ECM.

COMPONENT TESTING

- Use the Spark Plug Inspection procedure to verify the integrity of the spark plugs. Refer to **Spark Plug Inspection** . Replace the spark plug if necessary.

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

- Use the **J 26792** to verify the output of each ignition module/coil. If no spark is detected across the gap of the spark plug tester, then replace the ignition module/coil assembly.

REPAIR PROCEDURES

Perform the **DIAGNOSTIC REPAIR VERIFICATION** after completing the diagnostic procedure.

- **Control Module References** for replacement, setup and programming.
- **Ignition Coil Replacement**
- **Spark Plug Replacement**

INSPECTION/MAINTENANCE (I/M) SYSTEM CHECK

DESCRIPTION

Several states require that a vehicle pass on-board diagnostic (OBD) system tests and the inspection/maintenance (I/M) emission inspection in order to renew license plates. This is accomplished by viewing the I/M System Status display on a scan tool. Using a scan tool, the technician can observe the I/M System Status in order to verify that the vehicle meets the criteria that comply with the local area requirements.

CONDITIONS FOR UPDATING THE I/M SYSTEM STATUS

Each system monitor requires at least one and sometimes several diagnostic tests. The result of each test is reported by a diagnostic trouble code (DTC). A system monitor is complete when either all of the DTCs comprising the monitor have Run and Passed or when any one of the DTCs comprising the monitor has illuminated the malfunction indicator lamp (MIL). Once the system monitor is complete, the I/M System Status display will indicate YES in the Completed column.

For example, when the HO2S Heater Status indicates YES, either all of the oxygen sensor heater tests have passed or one of the tests has illuminated the MIL. If the vehicle has 4 heated oxygen sensors, either all 4 heater circuit tests have passed or one of the heater circuit tests has illuminated the MIL. The I/M System Status will indicate NO under the Completed column when any of the required tests for that system have not run. The following is a list of conditions that would set the I/M System Status indicator to NO:

- The vehicle is new from the factory and has not yet been driven through the necessary drive conditions to complete the tests.
- The battery has been disconnected or discharged below operating voltage.
- The control module power or ground has been interrupted.
- The control module has been reprogrammed.
- The control module DTCs have been cleared.

MONITORED EMISSION CONTROL SYSTEMS

The OBD II System monitors all emission control systems that are on-board. Not all vehicles have a full complement of emission control systems. For example, a vehicle may not be equipped with secondary air injection (AIR) or exhaust gas recirculation (EGR). The OBD II regulations require monitoring of the following:

- The air conditioning system
- The catalytic converter efficiency
- Comprehensive component monitoring-Emission related inputs and outputs
- The evaporative emissions (EVAP) system
- The EGR System
- The fuel delivery system
- Heated catalyst monitoring
- Misfire monitoring
- The oxygen sensor system (O2S or HO2S)
- The oxygen sensor heater system (HO2S heater)
- The AIR system

For the specific DTCs required for each system, refer to **Inspection/Maintenance (I/M) System DTC Table**. Systems such as fuel delivery, misfire and comprehensive components may not be listed in a system status list. These tests run continuously and do not require an I/M System Status indicator.

Inspection/Maintenance (I/M) System Check

Step	Action	Value(s)	Yes	No
1	1. Perform the **Diagnostic System Check - Vehicle** . **IMPORTANT:** **Many DTC related repairs will instruct the technician to clear the DTC information. This procedure will reset ALL of the I/M System Status indicators to NO and require performing the I/M Complete System Set Procedure.** 2. Repair any DTCs or driveability concerns that would prevent the I/M System Status tests from completing. Did you find and repair a DTC or	-		

	driveability concern?		Go to **Step 3**	Go to **Step 2**
2	1. Review any service bulletins for software updates that may prevent inspection/maintenance (I/M) readiness. 2. Perform any reprogramming or repairs indicated by the service bulletins. Was a reprogramming or repair service required?	-	Go to **Inspection/Maintenance (I/M) Complete System Set Procedure**	Go to **Step 3**
3	Observe the I/M System Status display with a scan tool. Is more than one test indicating a NO status?	-	Go to **Inspection/Maintenance (I/M) Complete System Set Procedure**	Go to the I/M System Set Procedure for the indicated systems that have not updated

INSPECTION/MAINTENANCE (I/M) COMPLETE SYSTEM SET PROCEDURE

DIAGNOSTIC FAULT INFORMATION

IMPORTANT: Always perform the Inspection/Maintenance (I/M) System Check prior to using this diagnostic procedure.

DESCRIPTION

The purpose of the Inspection/Maintenance (I/M) complete system set procedure is to satisfy the enable criteria necessary to execute all of the I/M readiness diagnostics and complete the drive cycles for those particular diagnostics. When all I/M monitored diagnostic tests are completed, the I/M System Status indicators are set to YES. Perform the Inspection/Maintenance (I/M) Complete System Set Procedure if any I/M System Status indicators are set to NO.

CONDITIONS FOR MEETING A COLD START

- The ignition voltage between 11-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The start-up engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The start-up intake air temperature (IAT) is between 4-30°C (39-86°F).
- The difference between the IAT and the ECT is 6°C (10.8°F)
- The ambient air temperature is between 4-30°C (39-86°F).
- Fuel level is between 15 - 85 percent

CIRCUIT/SYSTEM VERIFICATION

Review the Inspection/Maintenance (I/M) System Status indicators with a scan tool. All I/M System Status indicators should report YES.

INSPECTION/MAINTENANCE (I/M) SYSTEM SET PROCEDURE

IMPORTANT: Whenever the ignition is turned ON, ignition positive voltage is supplied to the heated oxygen sensor (HO2S) heaters. After verifying the enable criteria, turn OFF the ignition for approximately 5 minutes to allow the sensors to cool before continuing with the test. Once the engine is started, do NOT turn the engine OFF for the remaining portion of the set procedure.

1. Ensure that the vehicle meets the conditions for a cold start listed above.
    - If the EVAP I/M System Status indicator displays NO, perform the EVAP Service bay test if applicable.
    - If the EVAP Service bay test is NOT available, ensure that 17 hours has elapsed since the last cold start.

      The EVAP I/M System Status indicator requires several drive and 17 hour key OFF cycles to complete before the indicator will transition.

    - If the O2S Heater System Status indicator displays NO, ensure that the ignition has been turned OFF for at least 10 hours.
2. Set the vehicle parking brake and ensure the vehicle is in Park for automatic transmission or Neutral for manual transmission.
3. Turn OFF all accessories; HVAC system, other electrical loads, including aftermarket/add-on equipment, etc.
4. Start and idle the engine for 2 minutes, until 65°C (149°F) is achieved.
5. Run the engine for 6.5 minutes within the following conditions:
    - MAF parameter between 4-30 g/s
    - Engine speed steady between 1000-3000 RPM
6. Return the engine to idle for 1 minute.
7. Apply and hold brake pedal and shift to Drive for automatic or apply clutch pedal for manual and operate the vehicle within the following conditions for 2 minutes:
    - Depress the accelerator pedal until TP Sensor angle is more than 2 percent.
    - Mass air flow (MAF) signal between 15-30 g/s
    - RPM steady between 1200-2000 RPM
8. Release the accelerator pedal and shift the vehicle to Park for automatic or Neutral and release clutch pedal for manual and allow the engine to idle for 2 minutes.
9. Quickly depress the accelerator pedal until TP Sensor Angle is more than 8 percent and return to idle, repeat 3 times.

10. Allow engine to idle for at least 2 minutes.
11. Close the hood, release the parking brake and drive vehicle at 24 km/h (15 mph) or slower for 2 minutes.

CAUTION: Refer to Road Test Caution .

12. Continue to drive the vehicle for at least 5.5 miles between 45-112 km/h (28-70 mph) with the vehicle reaching at least 80 km/h (50 mph).
13. Release the accelerator pedal for at least 2 seconds. This will allow the vehicle to enter decel fuel cut-off.
14. Depress the accelerator pedal until the TP Sensor angle is increased 3-20 percent and maintain a safe speed for 1 minute.
15. Safely stop the vehicle, with the engine in drive for automatic or in neutral with the clutch pedal depressed and parking brake applied for manual, idle for 2 minutes.
16. Shift to Park for automatic and apply the parking brake or Neutral and release clutch pedal for manual.

IMPORTANT: Do NOT disturb the vehicle or turn ON the ignition, until told to do so. Disturbing the vehicle may invalidate this portion of the test.

17. Turn OFF the ignition and exit the vehicle. Do NOT disturb the vehicle for 45 minutes.
18. Observe the Inspection/Maintenance (I/M) System Status with a scan tool. All of the I/M System Status indicators should display YES.
    - If the EVAP I/M System Status indicator displays NO turn OFF the ignition for 17 hours, ensure that the vehicle meets the conditions for a cold start and repeat steps 13-16 three more times or until the EVAP I/M System Status indicator transitions to YES. If the indicator continues to display NO, refer to the **Inspection/Maintenance (I/M) System DTC Table** to identify the DTCs that did not run. Follow the Conditions for Running the DTC in order to set the EVAP I/M System Status indicator

- If any of the I/M System Status indicators display NO, refer to the **Inspection/Maintenance (I/M) System DTC Table** for the indicator which did not display YES. The I/M System DTC Table identifies the DTCs associated with each I/M System Status Indicator. Follow the Conditions for Running the DTC in order to set the associated status indicator.

INSPECTION/MAINTENANCE (I/M) SYSTEM DTC TABLE

Inspection/Maintenance (I/M) System DTC Table

System	DTCs Required to Set System Status to YES
Catalyst	**DTC P0420 or P0430**
EVAP	**DTC P0442** **DTC P0446** **DTC P0451, P0452, P0453 or P0454** **DTC P0496** **DTC P0461**

	DTC P0464
Oxygen Sensor	**DTC P0131, P0132, P0137 or P0138** **DTC P0133, P0134, P0140, P1133, P2A00 or P2A01** **DTC P0151, P0152, P0157 or P0158** **DTC P0153, P0154, P0160, P1153, P2A03 or P2A04**
Oxygen Sensor Heater	**DTC P0030, P0036, P0053, P0054, P0135 or P0141** **DTC P0050, P0056, P0059, P0060, P0155 or P0161**

SERVICE BAY TEST

DIAGNOSTIC INSTRUCTIONS

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- **Strategy Based Diagnosis**
- **Diagnostic Procedure Instructions**

DESCRIPTION

The purpose of the evaporative emission (EVAP) Service Bay Test is to aid in resetting the EVAP inspection/maintenance (I/M) system status. For this vehicle that is equipped with the engine off natural vacuum (EONV) diagnostic, the Service Bay Test uses the scan tool to initiate the control module's regular sequence of EVAP system DTC tests, but with different enable criteria. By using the Service Bay Test the I/M indicator can be set without the need for multiple cold soaks.

The scan tool displays for the Service Bay Test are based on the events that occur within the following three categories:

- The engine running portion of the tests-The vehicle must remain at rest, in Park or in Neutral, during this portion of the test. This test inspects for large leaks, a leaking purge valve and/or vent system restrictions. The scan tool will display test progress or the reason for an abort or failure.
- Drive cycle-The scan tool will display time and distance needed to warm the fuel.
- Ignition OFF-During this portion of the test, the engine controller will remain active for up to 45 minutes when the ignition is turned OFF to allow control of the EVAP vent valve and run the EONV test. The engine controller inspects for small leaks during this period by monitoring fuel tank pressure or vacuum. If the system is sealed, there will be a pressure or vacuum change. Pressure or vacuum changes that are less than the calibrated values indicate a leak.

When the EVAP diagnostics are initiated by the Service Bay Test, the scan tool will indicate if the enable conditions listed below are not met or will display a specific reason if the test aborts. When complete, the display will indicate that the tests passed or failed.

CONDITIONS FOR RUNNING THE TEST

The following conditions must be met in order to enable the Service Bay Test:

- The battery voltage is between 11-18 volts.
- The engine coolant temperature (ECT) is less than 70°C (158°F) at start-up.
- The EVAP I/M system status indicator is set to NO.
- The fuel level is 15-85 percent capacity and cannot be refueled during the tests.
- There are no DTCs displayed.
- The vehicle must be driven for the time and distance specified on the scan tool.
- The ambient air temperature is between 0-40°C (32-104°F)
- The ignition must remain OFF during the engine OFF portion of the test and the vehicle must remain at rest.

TEST PROCEDURE

IMPORTANT: If the Service Bay Test aborts or fails a DTC will NOT be set.

1. Install a scan tool.
2. Select the Service Bay Test with the scan tool.

CAUTION: Refer to Road Test Caution .

3. Follow the instructions on the scan tool.
    - If the test aborts, correct the condition for running the test and then retest.
    - If the test fails, repair the vehicle for the condition indicated by the failure message on the scan tool.
4. Verify that the EVAP I/M system status is set to YES.