SELF-DIAGNOSTICS - 3.8L

2001 Chevrolet Camaro

2001 ENGINE PERFORMANCE
Self-Diagnostics

3.8L Camaro & Firebird

INTRODUCTION

Most engine control problems are the result of mechanical breakdowns, poor electrical connections or damaged vacuum hoses. Before considering the computer system as a possible cause of problems, perform basic diagnostic procedures in appropriate BASIC DIAGNOSTIC PROCEDURES article. Failure to do so may result in lost diagnostic time.

If no faults were found while performing basic diagnostic procedures, go to DIAGNOSTIC PROCEDURE under SELF-DIAGNOSTIC SYSTEM. If no fault codes are present and driveability problems exist, go to appropriate TROUBLE SHOOTING - NO CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.). If only intermittent codes are present, see INTERMITTENTS in appropriate TROUBLE SHOOTING - NO CODES article. For diagnosing an individual component or system, go to appropriate SYSTEM & COMPONENT TESTING article.

SELF-DIAGNOSTIC SYSTEM

DESCRIPTION

Powertrain Control Module (PCM) is equipped with a self-diagnostic system, which detects system Diagnostic Trouble Codes (DTCs) or abnormalities. When a malfunction occurs, PCM will store a DTC. Malfunctions are recorded as history/intermittent failures or as current failures. Current DTCs indicate PCM has detected a fault which is currently present. A history DTC indicates that PCM has previously detected a malfunction that is not currently present as it is either an intermittent condition or the system is not being currently operated.

Instrument Panel Cluster (IPC) can be used to retrieve and clear DTCs. A scan tool can be used to retrieve and clear DTCs. See RETRIEVING DIAGNOSTIC TROUBLE CODES. The scan tool also has several features that can be used to help locate an intermittent condition. When scan tool is used for system tests, it will display values actually seen or commanded by various systems (i.e., BCM, PCM). This will usually include the following types of information:

* Analog Data Input - Displays analog input seen by system.
* Inputs/Outputs - Displays digital values as seen by system, and provides indication of whether input or output has cycled.
* Special Functions (Output Controls) - Allows for outputs of system to be set at a desired value (ON or OFF). This will only indicate if IPC is sending the appropriate commands, not what action was actually taken.
* Clear Codes - Will erase DTCs for system currently selected (if problem still exists in system, DTC may immediately reset).

Code Types
There are 3 types of DTC categories:

* Type "A" - Emissions related. Illuminates MIL the first time DTC sets. Freeze frame data will be stored.
* Type "B" - Emissions related. Illuminates MIL if fault is active for 2 consecutive driving cycles. Freeze frame data will be stored for second failure.
* Type "C" - Non-emissions related. Does not illuminate MIL, but a message may be displayed in the Driver's Information Center (DIC). Fault data will be stored in the failure records.

Freeze Frame

NOTE: Freeze frame may also be referred to as snapshot.

PCM stores one freeze frame record for the first failed test that sets a type "A" DTC. PCM stores one freeze frame record for the second failed test that sets a type "B" DTC. Recorded freeze frame data can be retrieved using a Tech 2 scan tool and selecting POWERTRAIN, DTC and CAPTURE INFO.

Most scan tools can manually record freeze frame data by technician specified triggering points. Triggering points can include a manual trigger, trigger when any DTC sets, or trigger when a specific DTC sets. See scan tool manufacturer's instructions for specific operating information.

Failure Records

Failure records are stored when any DTC is set. PCM can store up to 5 failure records. Failure records will be stored for all DTCs, whether or not the Malfunction Indicator Light (MIL) is illuminated.

DIAGNOSTIC PROCEDURE

Diagnosis of computerized engine control system should be performed in the following order:

1) Ensure all engine systems not related to computer system are operating properly. DO NOT proceed with testing unless all other problems have been repaired. Powertrain diagnostic system check must be performed before using specific DTC testing procedure. See POWERTRAIN DIAGNOSTIC SYSTEM CHECK.

2) If DTCs were displayed, determine whether codes are hard or intermittent. Hard codes will cause MIL to illuminate continuously while engine is running. See INTERMITTENT TROUBLE CODE DETERMINATION. For diagnosing hard codes, proceed to appropriate DTC test. See DIAGNOSTIC TESTS. For diagnosing intermittent codes, see appropriate TROUBLE SHOOTING - NO CODES article.

3) If no DTCs are present and a driveability problem exists, refer to SYMPTOMS in appropriate TROUBLE SHOOTING - NO CODES article. Doing so will help identify proper system or component to check in appropriate SYSTEM & COMPONENT TESTING article.

4) After necessary repairs are made, clear DTCs, verify vehicle will enter "closed-loop" operation and ensure DTC does not reset.

SCAN TOOL

NOTE: Before connecting scan tool to vehicle, diagnostic system should be checked to determine if system is operating properly and if information received will be accurate. See POWERTRAIN DIAGNOSTIC SYSTEM CHECK.
If vehicle does not pass OBD system check, information

received may be invalid.

Scan tool is a specialized tester which, when connected to DLC, can be used to diagnose on-board computer control systems by providing instant access to circuit voltage information without need to crawl under dash or hood to backprobe sensors and connectors.

Scan tool reduces diagnostic time dramatically by furnishing input data (voltage signals) which can be compared to specification parameters. They may also furnish information on output device (solenoids and motors) status. However, status parameters only indicate output signals have been sent to devices by PCM; they do not indicate whether devices have responded properly to signal. Verify proper response at output device using a voltmeter or test light.

A problem may exist even if DTCs are not present. About 80 percent of driveability problems occur without setting DTCs. Sensors that are out of calibration will not set a DTC but will cause driveability problems.

Using a scan tool is the easiest method of checking sensor specifications and other data parameters. Scan tool is also useful in finding intermittent wiring problems by wiggling wiring harnesses and connections (key on, engine off) while observing data parameters.

NOTE: If erroneous voltage signals are suspected, verify tester information using a digital voltmeter and wiring schematic. If non-existent codes are displayed, DO NOT use scan tool for diagnosis. Contact tester manufacturer for additional information.

Scan Tool Display (OEM)

NOTE: OBD II vehicles have options available in the scan tool DTC mode to display enhanced information available. However, to fully utilize information and procedures requires the use of a Tech 2 scan tool. See scan tool operator's manual for additional information.

The following are Tech 2 scan tool sub-menus in the DTC INFO and SPECIFIC DTC modes:

DTC SET THIS IGNITION - This parameter indicates if a Diagnostic Trouble Code (DTC) set during the current ignition cycle. The scan tool displays Yes or No.

ENGINE RUN TIME - Scan tool displays hours, minutes and seconds. This displays the amount of engine run time for current ignition cycle. When you cycle ignition off, timer resets to zero.

FAIL COUNTER - Scan tool displays the amount of times a DTC fails. This parameter is located in the Failure Records list.

FAILURES SINCE FIRST FAIL - Scan tool displays the number of times a DTC failed since the first failure.

LOOP STATUS - Scan tool displays Open or Closed. Closed Loop indicates PCM is controlling fuel delivery according to Oxygen (O2) sensor voltage. In Open Loop, PCM ignores the oxygen sensor voltage and bases amount of fuel to be delivered on Throttle Position (TP) sensor, engine coolant, and Mass Airflow (MAF) sensor inputs only.

MILEAGE SINCE DTC CLEARED - This parameter indicates mileage accumulated since an emission DTC cleared. PCM stores this mileage in the Freeze Frame/Failure Records buffers. Scan tool displays Kilometers or Miles.

MILEAGE SINCE FIRST FAILURE - This parameter indicates mileage accumulated since an emission DTC first failed. PCM stores

this mileage in the Freeze Frame/Failure Records buffers. Scan tool displays Kilometers or Miles.

MILEAGE SINCE LAST FAILURE - This parameter indicates mileage accumulated since an emission DTC last failed. PCM stores this mileage in the Freeze Frame/Failure Records buffers. Scan tool displays Kilometers or Miles.

MILEAGE SINCE MIL REQUEST - This parameter indicates mileage accumulated since PCM requested MIL to illuminate. PCM stores this mileage in the Freeze Frame/Failure Records buffers. Scan tool displays Kilometers or Miles.

NOT RUN COUNTER - Scan tool displays number of times a DTC has not reached the failure parameters in order to run since the first failure.

PASS COUNTER - Scan tool displays number of times a DTC has passed, since the first failure. Scan tool displays 0-65,535 counts.

PCM RESET - This parameter indicates when the internal PCM resets. Scan tool displays YES when an internal PCM reset occurred. Scan tool displays NO under the normal operating conditions.

WARM-UPS W/O EMISSION FAULTS - This parameter counts the number of warm up cycles without an emission fault present. The counter increases to 255 and rolls back to 0 unless a fault occurs. If a fault occurs, the counter changes back to 0 until the fault is corrected. Manually clearing fault with a scan tool or disconnecting power to the PCM also resets the counter to 0.

WARM-UPS W/O NON-EMISSION FAULTS - This parameter counts the number of warm up cycles without a non-emission fault present. The counter increases to 255 and rolls back to 0 unless a fault occurs. If a fault occurs, the counter changes back to 0 until the fault is corrected. Manually clearing fault with a scan tool or disconnecting power to the PCM also resets the counter to 0.

Scan Tool Data

Typical scan data values table contains all parameters included in the following data lists arranged in alphabetical order. For complete list of scan tool data, see PID VALUE CHARTS - CARS article.

* Engine Data 1 (ENG 1) - Contains general information regarding fuel delivery and basic engine operating conditions.
* Engine Data 2 (ENG 2) - Contains general information regarding Air Conditioning (A/C), Crankshaft Position (CKP), Camshaft Position (CMP), Knock Sensor (KS), and basic engine operating conditions.
* Evaporative Emission (EVAP) Data (EE) - Contains information specific to Evaporative (EVAP) emissions control system. Also displays parameters required to verify proper EVAP system operation.
* Freeze Frame/Failure Records (FF/FR) - Contains specific information regarding operating conditions when failure occurred.
* Fuel Trim Data (FT) - Contains specific information regarding fuel trim.
* Misfire Data (MF) - Contains specific information regarding misfire diagnostics and parameters required to verify proper operation with regard to misfire.

Use typical scan data values only after the following conditions are met:

* Diagnostic system check has been completed.
* Engine is idling unless checking a value at a specified RPM.
* Throttle is closed unless checking a value at a specified

RPM.
* Vehicle is in Park or Neutral.
* Vehicle is operating in closed loop.
* Vehicle accessories are turned off.

SPECIAL TOOLS (DIAGNOSTIC)

NOTE: For scan tool data values, refer to scan tool manufacturer owner's manual or compare values with a known-good component or vehicle.

NOTE: A scan tool connected to DLC is used to read DTCs and check voltages in system on serial data line. A scan tool is required to retrieve vehicle information.

Computerized engine control system is most easily diagnosed using scan tool; however, other tools may aid in diagnosing problems. These tools are a tachometer, test light, ohmmeter, digital voltmeter with a 10-megohm input impedance (minimum), vacuum pump, vacuum gauge, fuel injector test light, and jumper wires with appropriate terminal ends and length. A test light, rather than a voltmeter, must be used when indicated by a diagnostic test. In addition, special jumper harnesses or testers may be required by manufacturer to facilitate diagnosis.

RETRIEVING DIAGNOSTIC TROUBLE CODES

DTCs are retrieved using a Tech 2 scan tool, or other OBD-II compatible scan tool connected to OBD-II 16-pin Data Link Connector (DLC). See Fig. 1. DLC is located below left side of dash to left of steering column.

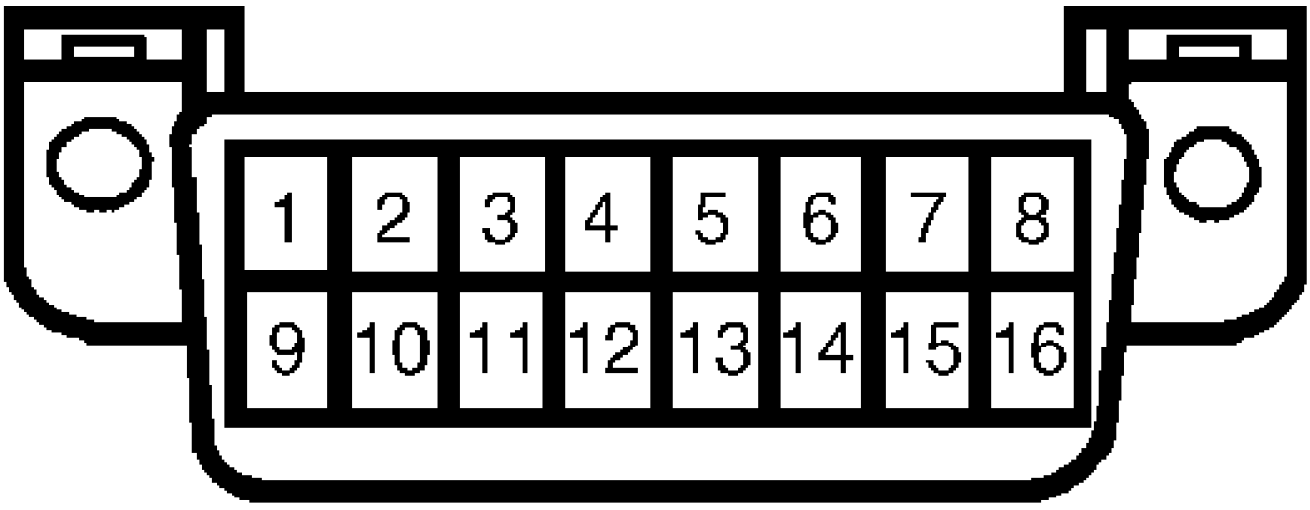

Fig. 1: Identifying OBD-II Data Link Connector (DLC)
Courtesy of General Motors Corp.

CLEARING DIAGNOSTIC TROUBLE CODES

To clear DTCs from memory, use scan tool, following scan tool manufacturer's instructions. Codes may also be cleared by disconnecting power supply to PCM for at least 30 seconds.

INTERMITTENT TROUBLE CODE DETERMINATION

NOTE: Intermittent is a DTC or symptom, with a condition that cannot be duplicated. Before attempting to diagnose an intermittent condition, ensure powertrain diagnostic system check has been performed.
See POWERTRAIN DIAGNOSTIC SYSTEM CHECK under SYSTEM CHECKS.

Duplicating Failure Conditions

Freeze frame and failure records data contain the conditions present when DTC set. Review and record freeze frame and failure records data. Clear DTCs using scan tool. Turn ignition off and wait 15 seconds. Operate the vehicle under the same conditions noted in freeze frame and failure records data, as closely as possible. Vehicle must also be operating within conditions for running the DTC. See description under appropriate DTC test description. Monitor DTC Status for the DTC being tested. The scan tool will indicate Ran, when the enabling conditions have been satisfied long enough for the DTC to run. The scan tool will also indicate whether the DTC passed or failed. An alternate method is to drive the vehicle with the DVOM connected to a suspected circuit. An abnormal reading on the DVOM when the problem occurs, may help you locate the problem.

Wiring Harness & Electrical Connectors

Many intermittent open or shorted circuits come and go with harness or connector movement caused by the following conditions:

* Vibration
* Engine Torque
* Bumps Or Rough Pavement

Test for intermittents by moving related connectors and wiring while monitoring appropriate scan tool data. With engine running, move related connectors and wiring while monitoring engine operation. Verify if harness or connector movement affects scan tool data display, component or system operation or engine operation. Repair condition as necessary.

Intermittents caused by electrical connectors are usually caused by one or more of the following conditions:

* Poor electrical connections
* Terminal tension
* Wiring problems

Check for poor mating of connector halves, terminals backed out or not fully seated in connector body, improperly formed or damaged terminals or poor terminal tension. Also check for poor terminal to wire connections including terminals crimped over insulation, swollen and stiff sections of wire in suspect circuits, wires that are broken inside the insulation, pinched, cut or rubbed through wiring or wiring that is in contact with hot exhaust components. Repair condition as necessary.

Control Module & Component Power & Grounds

Many vehicles have multiple circuits supplying power to control modules. Other components may have separate power circuits that may also need to be tested. Check connections at module or component connectors, fuses, and any intermediate connections between power source and the module or component. Ensure that the circuit can carry the current necessary to operate the component. Test all control module ground and system ground circuits. Control module may have

multiple ground circuits. Other components may have separate grounds that may also need to be tested. Check grounds for clean and tight connections at the ground connection. Check the connections at the component and in splice packs, where applicable. Ensure that the circuit can carry the current necessary to operate the component.

Temperature Sensitivity

An intermittent condition may occur when a component or connection reaches normal operating temperature. Condition may occur only when component or connection is cold, or hot. Use freeze frame and failure records, scan tool snapshot or vehicle data recorder to help diagnose this type of intermittent. If intermittent is related to heat, check for high ambient temperatures, underhood or engine generated heat, circuit generated heat due to a poor connection, or high electrical load. If intermittent is related to cold, check for low ambient temperatures or water intrusion.

Electromagnetic Interference & Electrical Noise

Some electrical components or circuits are sensitive to Electromagnetic Interference (EMI) or other types of electrical noise. Check for misrouted wiring that is too close to high voltage or high current devices. Check for wires that are too close to secondary ignition components, electrical motors or the generator. Check for non-factory or aftermarket add-on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, or cell phones. Test for open diode across AC compressor. Some relays may contain a clamping diode. Check that generator is operating properly.

DIAGNOSTIC MATERIALS

Diagnostic Aids

Diagnostic aids are additional tips used to help diagnose trouble codes when inspected circuit is okay. Diagnostic aids may help lead to a definitive solution to trouble code problem.

PCM LOCATION

PCM is located on right rear of engine compartment, on rear of wheelwell.

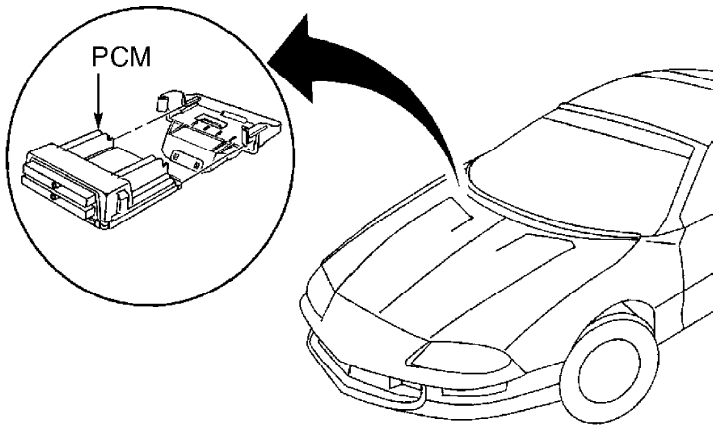

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Fig. 2: Locating Powertrain Control Module
Courtesy of General Motors Corp.

DIAGNOSTIC SYSTEM CHECKS

POWERTRAIN DIAGNOSTIC SYSTEM CHECK

After performing procedures in PRELIMINARY INSPECTION & ADJUSTMENTS, BASIC FUEL SYSTEM CHECKS and BASIC IGNITION SYSTEM CHECKS in appropriate BASIC DIAGNOSTIC PROCEDURES article, this is the starting point for utilizing the self-diagnostic system for determining computer-related problems. After performing necessary tests as described in the OBD system check, if no codes are indicated and driveability problems still exist, see appropriate TROUBLE SHOOTING - NO CODES article and SCAN TOOL.

CAUTION: DO NOT perform diagnostic system check if there is not a driveability concern, unless another procedure directs you to this diagnostic procedure. Check for applicable Technical Service Bulletins (TSBs) before proceeding. Unless a diagnostic procedure instructs you, DO NOT clear DTCs. Ensure battery is fully charged before proceeding.

NOTE: DO NOT turn ignition off during the following procedure unless instructed to do so.

1) Connect scan tool. Turn ignition on, with engine off. If scan tool powers up, go to next step. If scan tool does not power up, go to SCAN TOOL DOES NOT POWER UP under SELF-DIAGNOSTIC SYSTEM in appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

2) If scan tool displays Powertrain Control Module (PCM) data, go to next step. If scan tool does not display PCM data, go to SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE under SELF-DIAGNOSTIC SYSTEM in appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

3) Attempt to start engine. If engine starts and continues to run, go to next step. If engine does not start or starts and then stalls, go to NO START DIAGNOSIS in appropriate BASIC DIAGNOSTIC PROCEDURES article.

4) Select DTC display function for PCM, Vehicle Theft Deterrent (VTD), Instrument Panel (IP) cluster, Electronic Brake Control Module (EBCM) and Heating, Ventilation and Air Conditioning (HVAC) controller. If DTCs are stored in any module, go to next step. If no DTCs are stored in any module, go to step 9).

5) Using scan tool, select CAPTURE INFO to store the powertrain DTC information. After scan tool captures DTC information, go to next step.

6) If scan tool does not display any DTCs that begin with "U", go to next step. If scan tool displays any DTCs that begin with "U", go to SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE in appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

7) If scan tool displays DTC P0601, P0602, P0604 or P0606, go to DTC P0601, P0602, P0604 or P0606 under DIAGNOSTIC TESTS. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not display DTC P0601, P0602, P0604 or P0606, go to next step.

8) If scan tool displays DTC P0560, P0562, P0563, P0615 or P0620, go to SELF-DIAGNOSTIC SYSTEM in appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS. If scan tool does not display DTC P0560, P0562, P0563, P0615 or P0620, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS to identify and repair DTCs set in PCM.

9) If driveability concern is with automatic transmission, go to diagnostic system check in appropriate ELECTRONIC CONTROLS article in AUTOMATIC TRANSMISSIONS. If driveability concern is not with automatic transmission, go to next step.

10) If concern is with Inspection and Maintenance (I/M) testing, go to INSPECTION/MAINTENANCE SYSTEM CHECK If concern is not

with I/M testing, go to next step.

11) Check for driveability symptoms such as hard to start, surges, lack of power, etc. If driveability symptom is identified, perform appropriate test in appropriate TROUBLE SHOOTING - NO CODES article. If no driveability symptoms are present, diagnostic system check is complete.

PROGRAMMING

CRANKSHAFT POSITION SENSOR VARIATION LEARN PROCEDURE

Description

Crankshaft Position (CKP) system variation compensating values are stored in Powertrain Control Module (PCM) non-volatile memory after learn procedure has been performed. If actual crankshaft position system variation is not within crankshaft position system variation compensating values stored in PCM, DTC P0300 may set. CKP system variation learn procedure should be performed if any of the following conditions are true:

* DTC P1336 is set.
* PCM has been replaced.
* Engine has been replaced.
* Crankshaft has been replaced.
* Crankshaft harmonic balancer has been replaced.
* Crankshaft Position (CKP) sensor has been replaced.

Set vehicle parking brake and block drive wheels when performing CKP system variation learn procedure to prevent personal injury. Release throttle when engine reaches the SECOND fuel cut off. Leaving throttle open during the fuel cut-off will allow engine to decel at an even rate. Once learn procedure is completed, PCM will return the engine control to the operator and engine will respond to throttle position.

Scan tool crankshaft position system variation learn function cannot be performed if Engine Coolant Temperature (ECT) is less than 158°F (70°C). Scan tool crankshaft position system variation learn function will be inhibited if any powertrain DTCs other than DTC P1336 are set before or during CKP system variation learn procedure. Diagnose and repair any DTCs if set.

CKP system variation learn function will be inhibited if PCM detects a malfunction in camshaft position signal circuit, 3X reference circuit, or 18X reference circuit. If scan tool indicates a problem with cam signal, go to DTC P0341: CAMSHAFT POSITION SENSOR MISMATCH. If scan tool indicates a problem with 3X crank signal, go to DTC P1374: CRANKSHAFT POSITION SENSOR 3X REFERENCE CIRCUIT MALFUNCTION. If scan tool indicates a problem with 18X crank signal, go to DTC P0336: CRANKSHAFT POSITION SENSOR 18X REFERENCE CIRCUIT MALFUNCTION.

Learn Procedure

1) Connect scan tool to data link connector located under driver's side of instrument panel, left of steering column. Apply parking brake and block drive wheels. Close hood if necessary. Place transmission in Park (A/T), or Neutral (M/T).

2) Start engine and allow to idle until engine coolant temperature reaches 158°F (70°C). Turn off all accessories. Depress brake pedal for duration of the procedure.

3) Use scan tool to enable crankshaft position system

variation learn procedure. Slowly raise engine speed to 5150 RPM. Immediately release throttle when engine speed decreases. Turn ignition off for 15 seconds after learn procedure is completed successfully.

4) If crankshaft position sensor variation learn procedure cannot be completed successfully, go to DTC P1336: CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED under DIAGNOSTIC TESTS for additional diagnostic information.

OIL LIFE INDEX RESET

NOTE: Oil life index will need to be reset when powertrain control module is replaced.

Turn ignition on. Press TRIP/OIL RESET button on instrument panel for 12 seconds. OIL CHANGE light will flash to confirm system is resetting. Reset is complete when OIL CHANGE light goes out. Turn ignition off.

POWERTRAIN CONTROL MODULE PROGRAMMING

NOTE: DO NOT program Powertrain Control Module (PCM) unless directed by a service procedure or technical service bulletin. Programming PCM at any other time may not permanently correct fault condition.

Programming Precautions

Ensure the following conditions are met before attempting to program Powertrain Control Module (PCM).

* Battery is fully charged. Battery charger is NOT connected.
* Charging system concerns are not present. Repair as necessary.
* All vehicle accessories are off.
* No components are connected that can put excessive load on electrical system.

Incorrect system voltage or voltage fluctuations from a battery charger can cause programming failure or can cause control module damage. Ensure ignition switch is in proper position specified. Scan tool will prompt to turn ignition on with engine off. During programming procedure, DO NOT change position of ignition switch unless instructed. When programming, DO NOT disturb scan tool connection. If an interruption occurs during programming, programming failure or PCM damage may occur.

Programming

After replacing Powertrain Control Module (PCM) or if program needs to be updated, refer to latest Techline information on PCM reprogramming. On all models, after reprogramming, perform INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE under DRIVE CYCLES, CRANKSHAFT POSITION SENSOR VARIATION LEARN PROCEDURE and OIL LIFE INDEX RESET.

INSPECTION/MAINTENANCE PROCEDURES

NOTE: Drive cycles may also be referred to as On-Board Diagnostic (OBD) drive cycles.

INSPECTION/MAINTENANCE SYSTEM CHECK

Description

Several states require vehicles pass On-Board Diagnostic (OBD II) system tests and Inspection Maintenance (I/M) emission inspection to renew registration. This is accomplished by viewing I/M System Status display on scan tool. Using scan tool, the technician can observe I/M System Status to verify that vehicle meets the criteria that comply with local area requirements.

Conditions for Updating the I/M System Status

Each system requires at least one, and sometimes several, diagnostic tests. Results of these tests are reported by a Diagnostic Trouble Code (DTC). A system monitor is complete when either all DTCs comprising the monitor have run and passed, or when any one of the DTCs comprising the monitor has illuminated the Malfunction Indicator Light (MIL). Once all tests are completed, I/M System Status display will indicate YES. Example: when HO2S Heater Test indicates YES, all oxygen sensor heaters have been diagnosed. I/M System Status will indicate NO when any of the required tests for that system have not run. The following conditions will set I/M system status indicator to NO:

* Vehicle is new from factory and has not yet been driven through necessary drive conditions to complete tests.
* Battery has been disconnected or discharged below operating voltage.
* PCM power or ground has been interrupted.
* PCM has been reprogrammed.
* PCM DTCs have been cleared as part of a service procedure.

Monitored Emission Control Systems

OBD II System monitors all emission control systems. OBD II regulations require monitoring of the following:

* Air conditioning system.
* Catalytic converter efficiency.
* Evaporative Emissions (EVAP) system.
* Exhaust Gas Recirculation (EGR) system.
* Fuel delivery system.
* Heated catalyst monitoring.
* Misfire monitoring.
* Oxygen sensor system (O2S or HO2S).
* Oxygen sensor heater system (HO2S heater).
* Secondary air injection (AIR) system.

For specific DTCs required for each system, see INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Systems such as fuel delivery, misfire, and comprehensive components may not be listed in a system status list. These tests run continuously on some vehicles, and may not require an indicator.

INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES

I/M System	(1) DTC
AIR	P0410, P1415, P1416
Catalyst	P0420
EGR	P0401, P0404, P0405, P1404
EVAP	P0440, P0442, P0446, P1441
Oxygen Sensor	P0133, P0140, P0153, P1133, P1134, P1153, P1154
Oxygen Sensor Heater	P0135, P0141, P0155, P0161

(1) - For DTC description, see DIAGNOSTIC TROUBLE CODE (DTC) DEFINITIONS.

Diagnostic Procedures

1) Perform POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. If DTC or driveability concerns were repaired using powertrain diagnostic system check, go to step 3). If no DTC or driveability concerns were repaired using powertrain diagnostic system check, go to next step.

2) Check for applicable Technical Service Bulletins (TSB) for software updates that may prevent I/M readiness. Perform any reprogramming or repairs indicated by TSBs. If reprogramming or repair service is required, go to INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE. If reprogramming or repair service is not required, go to next step.

3) Using scan tool, observe I/M SYSTEM STATUS display. If more than one test indicates a NO status, go to INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE. If only one test indicates a NO status, go to appropriate I/M system set procedure for the indicated system.

Diagnostic Aids

I/M System Status display provides an indication of when PCM has completed required tests. This does not mean test has passed, only that a decision was made. If diagnostic fails, a DTC will indicate failure. If failure indication is present for a DTC associated with one of the I/M regulated systems, failure may prevent other required tests from running. Example: a DTC for control circuit of the relay controlling an AIR pump may not be listed in INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table because DTC is a continuous test. If this DTC is set, active tests for AIR system may not run. The I/M System Status information may be useful for a technician to determine if diagnostics have run when verifying repairs.

INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE

NOTE: Inspection/maintenance complete system set procedure will need to be performed when powertrain control module is replaced.

Description

The purpose of Inspection Maintenance (I/M) complete system set procedure is to satisfy enable criteria necessary to execute all I/M readiness diagnostics, and to complete the trips (drive cycles) for those particular diagnostics. When all diagnostic tests are completed, I/M system status indicators are set to YES. Perform this test when more than one or all of the I/M system status indicators are set to NO.

Conditions For Running

* Barometric Pressure (BARO) more than 74 kPa.
* Engine Coolant Temperature (ECT) less than 95°F (35°C).
* Intake Air Temperature (IAT) less than 95°F (35°C).
* Difference between IAT and ECT must be 11°F (6°C) or less.
* Battery voltage 9-18 volts.
* Fuel level between 1/4 and 3/4.

Test Procedure

NOTE: If the vehicle has recently run, start this procedure at step 3). This will allow the tests that require the engine at operating temperature to run.

1) If Inspection/Maintenance (I/M) system check has been performed, go to next step. If I/M system check has not been performed, go to INSPECTION/MAINTENANCE SYSTEM CHECK.

NOTE: Whenever ignition is on, ignition positive voltage is supplied to HO2S heaters. After verifying enable criteria, turn ignition off for approximately 5 minutes to allow sensors to cool before continuing test. Once engine is started, DO NOT turn engine off for remaining portion of procedure.

2) Program scan tool with vehicle information before ignition is turned on. Turn off all accessories, including A/C and blower fan. Set vehicle parking brake. Ensure transmission is in Park (A/T) or Neutral (M/T). Start engine and allow to idle. Allow engine to idle for 2 minutes. Go to next step.

3) Test drive vehicle and ensure vehicle is accelerated at part throttle to 55 MPH. Drive vehicle at this speed until engine reaches operating temperature. Continue test driving vehicle under these conditions for 6 minutes. Go to next step.

4) Reduce vehicle speed to 45 MPH. Maintain this speed for one additional minute. Perform 4 decelerations of 25 seconds each from 45 MPH while the throttle is closed, brakes are NOT applied, clutch is not actuated, transmission is not manually downshifted and vehicle speed remains above 25 MPH. After each deceleration period, return vehicle speed to 45 MPH under part throttle acceleration maintain for 15 seconds. Go to next step.

5) Accelerate at part throttle to 45-55 MPH. Drive vehicle at this speed for 2 minutes. Decelerate to 0 MPH. After coming to a stop, ensure engine is idling with brake pedal depressed, automatic transmission in Drive and clutch pedal depressed (M/T) for 2 minutes. Go to next step.

6) Using scan tool, observe I/M SYSTEM STATUS display. If all I/M system status indicators update to yes, go to next step. If all I/M system status indicators do not update to yes, go to appropriate I/M system set procedure for the indicated system in appropriate SYSTEM & COMPONENT TESTING article.

7) Using scan tool, observe emission related DTC portion of the I/M system status display. If any DTCs are set, repair as necessary. Go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, system is okay and test is complete.

Diagnostic Aids

Rough road conditions may prevent some tests from running. Extreme high or low ambient temperatures may prevent tests such as heated oxygen sensor heater and evaporative emission system from initiating. If step is interrupted before completion, perform remaining portion of test procedures. Any portion of test procedure that requires the engine at operating temperature may be repeated. This allows most diagnostics to run and the remaining tests can be performed using individual system set procedures.

If vehicle has recently run, start this procedure at step 3. This will allow the tests that require engine at operating temperature to run. Using this method allows shorter cool down periods if the tests requiring a cold start do not initiate.

Scan tool can be used to monitor each I/M system status indicator. When all indicators for a test step have updated to YES, testing can move on to next step even if remaining portion of the test is not complete. For example, step 3 is designed to run EVAP, AIR, and HO2S tests. The procedure instructs technician to operate the vehicle in enable conditions for 6 minutes. If all 3 tests have updated to YES

within 4 minutes, you do not need to continue with the enable conditions and testing can advance to the next step.

INSPECTION/MAINTENANCE AIR SYSTEM SET PROCEDURE

Description

This test is performed to satisfy enable criteria necessary to execute Inspection Maintenance (I/M) readiness diagnostics for secondary air injection (AIR) system. Test may be used to set I/M System Status to YES. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING before performing this test. Failure to meet necessary requirements may produce inaccurate test results.

Conditions for Running

* Engine Coolant Temperature (ECT) is 40-230°F (4.5-110°C).
* Intake Air Temperature (IAT) is more than 40°F (4.5°C).
* Engine is operating in closed loop fuel control.
* Battery voltage is more than 10 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Start engine and allow to idle for 2 minutes. Road test vehicle. Accelerate at part throttle to 45 MPH. Maintain this speed for 3 minutes or until I/M system status indicator updates to YES. Using scan tool, monitor I/M system status display. If I/M system status display updates to YES, go to step 5). If I/M system status display does not update to YES, go to next step.

3) Using scan tool, monitor DTCs. If any DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, go to next step.

4) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If I/M system status display updates to YES, go to next step. If I/M system status display does not update to YES, go to DIAGNOSTIC AIDS.

5) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

AIR pump generally operates upon initial start up before engine goes into closed loop fuel control. Some systems perform a passive diagnostic test at this time. See CONDITIONS FOR RUNNING. Active diagnostic test is performed after the engine goes into closed loop.

On vehicles that perform a passive test, the active test will only run if passive test fails or is indeterminate. If diagnostic test does not run, observe fuel trim correction. If fuel trim correction is more than +/- 4 percent, AIR system test may not run. If status does not update, test can be repeated until I/M system status updates to YES. See DIAGNOSTIC PROCEDURES.

I/M System Status does not indicate whether test has passed or failed, only that a decision was made. When all diagnostics for a specific system have run and passed, I/M system status will update to YES. If test for a specific system has failed, I/M system status will update to YES, indicating a determination was made, even if all required tests have not run. When a failure occurs, emission related DTC portion of I/M system status display will indicate Malfunction Indicator Light (MIL) is requested.

I/M system status also registers the number of DTCs. First failure of a type "B" DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES. A second trip is required, and all conditions to run must be met for test to run again. These conditions may include a partial to complete engine cool down.

I/M system status will update only when an emission related DTC fails for a second time, or when all tests pass. If an impending failure exists, system may require more time to run diagnostic than in set procedure. If test does not run after numerous attempts and no DTCs are set, review scan tool data list and service information for an indication of why test does not complete. See INSPECTION/MAINTENANCE SYSTEM CHECK.

Some tests may abort due to changes in conditions while test is running. Example: changes in engine load, such as cooling fan or A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

INSPECTION/MAINTENANCE CATALYST SYSTEM SET PROCEDURE

Description

This test is to satisfy enable criteria necessary to execute Inspection Maintenance (I/M) readiness diagnostics for catalyst system. Test may be used to set I/M system status indicators to YES. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING before performing this test. Failure to meet necessary requirements may produce inaccurate test results.

Conditions For Running

* Barometric pressure is more than 74 kPa.
* Engine coolant is 176-248°F (80-120°C).
* Intake Air Temperature (IAT) is 5-167°F (-15 to +75°C).
* Engine is in closed loop fuel control.
* Engine has run for 6-8 minutes off idle to initiate test.
* Battery voltage is 9-16 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Start engine and allow to idle. Road test vehicle. Accelerate at part throttle to 55 MPH. Maintain this speed for 5 minutes. Decelerate to 0 MPH. Idling engine for 2 minutes with brake pedal depressed, automatic transmission in Drive or manual transmission in Neutral with clutch pedal depressed. Using scan tool, observe the I/M system status display. If Catalyst System Status updates to YES, go to step 5). If Catalyst System Status does not update to YES, go to next step.

3) Using scan tool, monitor DTCs. If any DTCs are set, go to

DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, go to next step.

4) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If Catalyst System Status display updates to YES, go to next step. If Catalyst System Status display does not update to YES, go to DIAGNOSTIC AIDS.

5) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

PCM runs a maximum of 6 tests per trip until Catalyst System Status updates to YES. If status does not update, test outlined in this procedure can be repeated until I/M system status updates to YES. I/M system status does not indicate whether the test has passed or failed, only that a decision was made. When all diagnostics for a specific system have run and passed, the I/M system status will update to YES. If a test for a specific system has failed, I/M system status will update to YES, indicating a determination was made, even if all required tests have not run.

When a failure occurs, emission related DTC portion of I/M system status display will indicate Malfunction Indicator Light (MIL) is requested. I/M system status also registers the number of Diagnostic Trouble Codes (DTCs). The first failure of a type B DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES, a second trip is required. All conditions to run must be met for test to run again. These conditions may include a partial to complete engine cool down.

I/M system status will update only when an emission related DTC fails a second time, or when all tests pass. If there is an impending failure, system may require more time to run diagnostics than allowed in set procedure. If test does not run after numerous attempts and no DTCs are set, review scan tool data list and service information for an indication of why test does not complete. See INSPECTION/MAINTENANCE SYSTEM CHECK.

Some tests may abort due to changes in conditions while test is running. Example: changes in engine load, such as cooling fan or A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

INSPECTION/MAINTENANCE EXHAUST GAS RECIRCULATION SYSTEM SET PROCEDURE

Description

Purpose of this test is to satisfy enable criteria necessary to execute I/M readiness diagnostics for Exhaust Gas Recirculation (EGR) system. Test may be used to set I/M System Status indicators to YES. Ensure vehicle meets the requirements listed in CONDITIONS FOR RUNNING before performing this test. Failure to meet necessary

requirements may produce inaccurate test results.

Conditions For Running

* Barometric Pressure (BARO) is more than 70 kPa.
* Engine Coolant Temperature (ECT) more than 167°F (75°C).
* System voltage is 10-18 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Start engine and allow to idle. Road test vehicle. Accelerate at part throttle to 45 MPH. Maintain this speed for one minute. Perform 4 decelerations of 25 seconds each from 45 MPH while the throttle is closed, brakes are NOT applied, clutch is not actuated, transmission is not manually downshifted and vehicle speed remains above 25 MPH. After each deceleration period, return vehicle speed to 45 MPH under part throttle acceleration maintain for 15 seconds. If EGR System Status updates to YES, go to step 5). If EGR System Status does not update to YES, go to next step.

3) Using scan tool, monitor DTCs. If any DTCs are set, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. If no DTCs are set, go to next step.

4) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If EGR System Status display updates to YES, go to next step. If EGR System Status display does not update to YES, go to DIAGNOSTIC AIDS.

5) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

Powertrain Control Module (PCM) only runs EGR active tests during a gradual deceleration with closed throttle and vehicle speed more than 25 MPH. Several deceleration cycles may be necessary to accumulate a sufficient number of EGR flow samples. Procedure is designed for a clear, flat road. If procedure is performed on a road with a slight down hill grade, test may acquire necessary sample counters in one or two decel trips. If test is interrupted during the procedure, it may take more than three deceleration cycles to complete the test. If status does not update, test can be repeated until I/M system status updates to YES.

I/M system status does not indicate if test has passed or failed, only that a decision was made. When all of diagnostics for specific system have run and passed, I/M system status will update to YES. If a test for a specific system has failed, the I/M system status will update to YES, indicating a determination was made, even if all of the required tests have not run. When a failure occurs, emission related DTC portion of I/M system status display will indicate the Malfunction Indicator Light (MIL) is requested. I/M system status also registers the number of DTCs. The first failure of a type "B" DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES. A second trip is required, and all

conditions to run must be met for test to run again. See CONDITIONS FOR RUNNING. These conditions may include a partial to complete engine cool down.

The I/M system status will update only when an emission related DTC fails the second time, or when all tests pass. If there is an impending failure, system may require more time to run diagnostic than was allotted in set procedure. If test does not run after numerous attempts and no DTC is set, review appropriate scan tool data list and service information for an indication of why test does not complete. Some tests may abort due to changes in conditions while test is running. For example, changes in engine load, such as a cooling fan or an A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

INSPECTION/MAINTENANCE EVAPORATIVE EMISSION SYSTEM SET

PROCEDURE

Description

This test is to satisfy enable criteria necessary to execute Inspection Maintenance (I/M) readiness diagnostics for Evaporative Emission (EVAP) System. Test may be used to set I/M System Status indicators to YES. Service bay tests are included on scan tool for some systems. Test is designed to allow EVAP diagnostic tests to run in service bay conditions. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING before performing either EVAP system test. Failure to meet necessary requirements may produce inaccurate test results.

Conditions for Running

Non-scan tool service bay test equipped vehicles:

* Barometric pressure is more than 75 kPa.
* Fuel level is between 1/4 and 3/4 full.
* Battery voltage is 10-18 volts.
* Test will only initiate after a cold start. PCM considers engine cold if Engine Coolant Temperature (ECT) is 39-86°F (3.75-30°C), Intake Air Temperature (IAT) is 39-86°F (3.75-30°C) and difference between ECT and IAT is less than 14°F (8°C).

Scan tool service bay test equipped vehicles:

* Barometric pressure is more than 75 kPa.
* Engine Coolant Temperature (ECT) is less than 176°F (80°C).
* Fuel level is between 1/4 and 3/4.
* Battery voltage is 10-18 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) Using scan tool, select SPECIAL FUNCTIONS. Determine if vehicle is equipped with SERVICE BAY TEST for the EVAP System. If vehicle is equipped with EVAP service bay test, go to next step. If vehicle is not equipped with EVAP service bay test, go to step 5).

3) Ensure the vehicle is within the Conditions for Running specified in the supporting text. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Using scan tool, follow directions to perform EVAP service bay test. If EVAP system passes service bay test, go to step 8). If EVAP system passes

service bay test, go to next step.

4) Check scan tool for reason why test did not pass. Example: failed DTC or aborted test. Repair as necessary. After repairs, go to INSPECTION/MAINTENANCE COMPLETE SYSTEM SET PROCEDURE.

5) Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Start engine and allow to idle. Once engine is started, DO NOT turn engine OFF for remainder of procedure until test is complete. Road test vehicle. For this test to run, accelerate at part throttle to 45 MPH. Maintain this speed until engine reaches operating temperature. This may take up to 10 minutes, depending on the start up coolant temperature. Continue operating vehicle an additional 3 minutes after engine reaches operating temperature or until I/M system status indicator updates to YES. If EVAP system status updates to YES, go to step 8). If EVAP system status does not update to YES, go to next step.

6) Using scan tool, monitor DTCs. If any DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, go to next step.

7) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If EVAP system status display updates to YES, go to next step. If EVAP system status display does not update to YES, go to DIAGNOSTIC AIDS.

8) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

Extreme high or low ambient temperatures may prevent EVAP system tests from initiating. Performing visual inspection before running EVAP service bay test may prevent having to repeat the test. Loose fuel cap may cause service bay test to abort or fail and prevent I/M system status from updating. Failed or aborted test will require vehicle to cool down to meet enable criteria for running another test.

I/M system status does not indicate whether the test has passed or failed, only that a decision was made. When all diagnostics for a specific system have run and passed, I/M system status will update to YES. If test for a specific system has failed, I/M System Status will update to YES, indicating a determination was made, even if all required tests have not run. When failure occurs, emission related DTC portion of the I/M system status display will indicate Malfunction Indicator Light (MIL) is requested. I/M system status also registers the number of DTCs.

First failure of a type B DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES, a second trip is required. All conditions to run must be met for test to run again. These conditions may include a partial to complete engine cool down.

I/M system status will update only when an emission related DTC fails a second time, or when all tests pass. If there is an impending failure, system may require more time to run diagnostics than allowed in set procedure. If test does not run after numerous attempts and no DTCs are set, review scan tool data list and service

information for an indication of why test does not complete. See INSPECTION/MAINTENANCE SYSTEM CHECK.

Some tests may abort due to changes in conditions while test is running. Example: changes in engine load, such as cooling fan or A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

INSPECTION/MAINTENANCE HEATED OXYGEN SENSOR SYSTEM SET PROCEDURE

Description

This test is to satisfy enable criteria necessary to execute Inspection Maintenance (I/M) readiness diagnostics for Oxygen Sensor (O2S) Heated Oxygen Sensor (HO2S) system. Test may be used to set the I/M system status to YES. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING before performing this test. Failure to meet necessary requirements may produce inaccurate test results.

Conditions for Running

* Engine Coolant Temperature (ECT) is more than 165°F (75°C).
* Engine is running in closed loop fuel control.
* Engine has been running for more than 4 minutes.
* Battery voltage is 9-18 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Start engine and allow to idle. Road test vehicle. For test to run, accelerate at part throttle to 45-55 MPH. Maintain this speed for 6 minutes or until I/M system status updates to YES. Manual transmission models may require operation in 5th gear for this test to run. Using scan tool, review I/M system status display. If HO2S/O2S system status updates to YES, go to step 5). If HO2S/O2S system status does not update to YES, go to next step.

3) Using scan tool, monitor DTCs. If any DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, go to next step.

4) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If HO2S/O2S system status display updates to YES, go to next step. If HO2S/O2S system status display does not update to YES, go to DIAGNOSTIC AIDS.

5) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

If status does not update, this procedure can be repeated until I/M system status updates to YES. I/M system status does not indicate whether the test has passed or failed, only that a decision

was made. When all diagnostics for a specific system have run and passed, I/M system status will update to YES. If test for a specific system has failed, I/M System Status will update to YES, indicating a determination was made, even if all required tests have not run. When failure occurs, emission related DTC portion of the I/M system status display will indicate Malfunction Indicator Light (MIL) is requested. I/M system status also registers the number of DTCs.

First failure of a type B DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES, a second trip is required. All conditions to run must be met for test to run again. These conditions may include a partial to complete engine cool down.

I/M system status will update only when an emission related DTC fails a second time, or when all tests pass. If there is an impending failure, system may require more time to run diagnostics than allowed in set procedure. If test does not run after numerous attempts and no DTCs are set, review scan tool data list and service information for an indication of why test does not complete. See INSPECTION/MAINTENANCE SYSTEM CHECK.

Some tests may abort due to changes in conditions while test is running. Example: changes in engine load, such as cooling fan or A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

INSPECTION/MAINTENANCE HEATED OXYGEN SENSOR HEATER SYSTEM SET PROCEDURE

Description

This test is to satisfy enable criteria necessary to execute Inspection Maintenance (I/M) readiness diagnostics for Heated Oxygen Sensor (HO2S) system. Test may be used to set I/M system status to YES. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING before performing this test. Failure to meet necessary requirements may produce inaccurate test results.

Conditions for Running

* Start up Engine Coolant Temperature (ECT) is less than 95°F (35°C).
* Start up Intake Air Temperature (IAT) is less than 95°F (35°C).
* Difference between IAT and ECT is less than 11°F (6°C).
* Battery voltage is 9-18 volts.

Diagnostic Procedures

1) Perform Inspection/Maintenance (I/M) system check. See INSPECTION/MAINTENANCE SYSTEM CHECK. After performing Inspection/Maintenance (I/M) system check, go to next step.

2) When ignition is turned ON, ignition positive voltage is supplied to HO2S heaters. After verifying enable criteria, turn ignition off for approximately 5 minutes to allow sensors to cool before continuing with test. Preprogram scan tool with vehicle information before ignition is turned on. Ensure vehicle meets requirements listed in CONDITIONS FOR RUNNING. Turn all accessories off. Set parking brake and verify transmission is in Park for automatic transmissions and Neutral for manual transmissions. Start engine and allow to idle for 2 minutes or until I/M system status indicator updates to YES. If HO2S heater system status updates to YES, go to step 5). If HO2S heater system status does not update to YES, go

to next step.

3) Using scan tool, monitor DTCs. If any DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTCs are set, go to next step.

4) Using scan tool, monitor NOT RAN SINCE CODE CLEARED display. Determine which DTCs required for YES status have not run. See INSPECTION/MAINTENANCE SYSTEM DIAGNOSTIC TROUBLE CODES table. Enter DTC number in SPECIFIC DTC menu of scan tool. Operate vehicle within conditions for running DTC located in FREEZE FRAME/FAILURE RECORDS for DTC. Repeat procedure until scan tool indicates diagnostic test has run. Repeat step for any additional required DTCs that have not run. Using scan tool, observe I/M system status display. If HO2S heater system status display updates to YES, go to next step. If HO2S heater system status display does not update to YES, go to DIAGNOSTIC AIDS.

5) Using scan tool, observe emission related DTC portion of I/M system status display. If scan tool indicates any emission related DTCs are set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool does not indicate any emission related DTCs are set, system is okay at this time.

Diagnostic Aids

HO2S heater tests will normally run within 2 minutes allotted in procedure. If there is an indeterminate condition, test may take up to 8 minutes before a decision of pass or fail is made. If test does not update within allotted period of time, continue operation within enable conditions until test updates to YES. If test does not update to YES, test may have failed or aborted due to loss of enabling conditions. Extremely high ambient temperatures may prevent HO2S heater test from initiating.

I/M system status does not indicate whether the test has passed or failed, only that a decision was made. When all diagnostics for a specific system have run and passed, I/M system status will update to YES. If test for a specific system has failed, I/M System Status will update to YES, indicating a determination was made, even if all required tests have not run. When failure occurs, emission related DTC portion of the I/M system status display will indicate Malfunction Indicator Light (MIL) is requested. I/M system status also registers the number of DTCs.

First failure of a type B DTC does not constitute a final determination of pass or fail, and will not update I/M system status to YES, a second trip is required. All conditions to run must be met for test to run again. These conditions may include a partial to complete engine cool down.

I/M system status will update only when an emission related DTC fails a second time, or when all tests pass. If there is an impending failure, system may require more time to run diagnostics than allowed in set procedure. If test does not run after numerous attempts and no DTCs are set, review scan tool data list and service information for an indication of why test does not complete. See INSPECTION/MAINTENANCE SYSTEM CHECK.

Some tests may abort due to changes in conditions while test is running. Example: changes in engine load, such as cooling fan or A/C compressor clutch turning ON, may cause test to abort. If a diagnostic test is difficult to run, observe I/M system status display while maintaining necessary enable conditions until system status updates to YES.

SUMMARY

If no hard fault codes are present, driveability symptoms exist or intermittent DTC(s) exist, proceed to appropriate TROUBLE SHOOTING - NO CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

NOTE: Use of Tech 2 scan tool is required to retrieve DTCs. Refer to user reference manual supplied with scan tool.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DTC	(1) Definition	(2) Type
BXXXX (3)	Body Control DTC	N/A
CXXXX (4)	Brake/Chassis DTC	N/A
P0101	Mass Airflow Sensor Performance	B
P0102	Mass Airflow Sensor Circuit Low Frequency	B
P0103	Mass Airflow Sensor Circuit High Frequency	B
P0107	Manifold Absolute Pressure Sensor Circuit Low Voltage	B
P0108	Manifold Absolute Pressure Sensor Circuit High Voltage	B
P0112	Intake Air Temperature Sensor Circuit Low Voltage	B
P0113	Intake Air Temperature Sensor Circuit High Voltage	B
P0117	Engine Coolant Temperature Sensor Circuit Low Voltage	B
P0118	Engine Coolant Temperature Sensor Circuit High Voltage	B
P0125	Engine Coolant Temperature Excessive Time To Enter Closed Loop Fuel Control	B
P0128	Engine Coolant Temperature Excessive Time To Reach Operating Temperature	B
P0130	HO2S Circuit Malfunction -Bank 1, Sensor 1	B
P0131	HO2S Circuit Voltage Low - Bank 1, Sensor 1	B
P0132	HO2S Circuit Voltage High - Bank 1, Sensor 1	B
P0133	HO2S Slow Response - Bank 1, Sensor 1	B
P0134	HO2S Circuit Insufficient Activity - Bank 1, Sensor 1	B
P0135	HO2S Heater Performance - Bank 1, Sensor 1	B

P0137	HO2S Circuit Low Voltage – Bank 1, Sensor 2	B
P0138	HO2S Circuit High Voltage – Bank 1, Sensor 2	B
P0140	HO2S Circuit Insufficient Activity – Bank 1, Sensor 2	B
P0141	HO2S Heater Performance – Bank 1, Sensor 2	B
P0150	HO2S Circuit Malfunction – Bank 2, Sensor 1	B
P0151	HO2S Circuit Voltage Low – Bank 2, Sensor 1	B
P0152	HO2S Circuit Voltage High – Bank 2, Sensor 1	B
P0153	HO2S Slow Response – Bank 2, Sensor 1	B
P0154	HO2S Circuit Insufficient Activity – Bank 2, Sensor 1	B
P0155	HO2S Heater Performance – Bank 2, Sensor 1	B
P0171	Fuel Trim System Lean – Bank 1	B
P0172	Fuel Trim System Rich – Bank 1	B
P0174	Fuel Trim System Lean – Bank 2	B
P0175	Fuel Trim System Rich – Bank 2	B
P0201–P0206	Injector Control Circuit	B
P0218 (5)	Transmission Fluid Overtemperature	C
P0230	Fuel Pump Relay Control Circuit	B
P0241 (4)	Pulse Width Modulated Signal Circuit Malfunction	C
P0300	Engine Misfire Detected	B
P0325	Knock Sensor Module Performance	B
P0327	Knock Sensor No. 1 Circuit	B
P0332	Knock Sensor No. 2 Circuit	B
P0336	Crankshaft Position Sensor 18X Reference Circuit Malfunction	B
P0341	Camshaft Position Sensor Out Of Range	B
P0401	Insufficient EGR Flow	A
P0403	EGR Control Circuit Malfunction	A
P0404	EGR Valve Desired Position Not Met	A
P0405	EGR Position Sensor Signal Voltage Excessively Low	A
P0420	Catalyst System Low Efficiency	A
P0440	Evaporative Emission (EVAP) System	A

P0442	Evaporative Emission (EVAP) System Small Leak Detected	A
P0443	Evaporative Emission (EVAP) Purge Solenoid Control Circuit	B
P0446	Evaporative Emission (EVAP) Vent System Performance	A
P0449	EVAP Canister Vent Solenoid Valve Control Circuit	B
P0452	Fuel Tank Pressure Sensor Circuit Low Voltage	B
P0453	Fuel Tank Pressure Sensor Circuit High Voltage	B
P0462 (6)	Fuel Level Sensor Circuit Low Voltage	C
P0463 (6)	Fuel Level Sensor Circuit High Voltage	C
P0480	Cooling Fan Relay No. 1 Control Circuit	B
P0481	Cooling Fan Relays No. 2 & 3 Control Circuit	B
P0500 (5)	Vehicle Speed Sensor Circuit	B
P0502 (5)	Vehicle Speed Sensor Signal Out Of Range	B
P0503 (5)	Vehicle Speed Sensor Malfunction	B
P0506	Idle Speed Low	B
P0507	Idle Speed High	B
P0530	A/C Refrigerant Pressure Sensor Circuit	C
P0560 (7)	System Voltage Out Of Range	C
P0562 (7)	System Voltage Low	C
P0563 (7)	System Voltage High	C
P0567 (8)	Resume/Accel Switch Signal Malfunction	C
P0568 (8)	Set/Coast Switch Signal Malfunction	C
P0571 (8)	Cruise Control Release Switch Circuit Failure	C
P0601	PCM Internal Malfunction	A
P0602	PCM Internal Malfunction	A
P0604	PCM Internal Malfunction	A
P0606	PCM Internal Malfunction	A
P0615 (7)	Starter Enable Circuit Malfunction	C
P0620 (7)	Fault Detection Circuit Malfunction	C
P0650	Malfunction Indicator Light (MIL) Control Circuit	B
P0704	Clutch Switch Circuit	B

(8)(9)		
P0711 (5)	Transmission Fluid Temperature Sensor Malfunction	C
P0712 (5)	Transmission Fluid Temperature Sensor Circuit Low Input	C
P0713 (5)	Transmission Fluid Temperature Sensor Circuit High Input	C
P0719 (5)	TCC Brake Switch Signal Low	C
P0724 (5)	TCC Brake Switch Signal High	C
P0740 (5)	TCC Solenoid Valve Circuit Malfunction	B
P0742 (5)	TCC Malfunction	B
P0748 (5)	Pressure Control Solenoid Circuit Malfunction	C
P0751 (5)	2-2-3-3 Shift Pattern Detected	B
P0752 (5)	1-1-4-4 Shift Pattern Detected	B
P0753 (5)	1-2 Shift Solenoid Circuit Malfunction	B
P0756 (5)	4-3-3-4 Shift Pattern Detected	A
P0757 (5)	1-2-2-1 Shift Pattern Detected	A
P0758 (5)	2-3 Shift Solenoid Circuit Malfunction	A
P0785 (5)	3-2 Shift Solenoid Circuit Malfunction	B
P0801 (5)	Reverse Inhibit Solenoid Control Circuit	C
P0803 (5)	Skip Shift Solenoid Control Circuit	B
P1106	Manifold Absolute Pressure Sensor Circuit High Voltage	C
P1107	Manifold Absolute Pressure Sensor Circuit Low Voltage	C
P1112	Intake Air Temperature Sensor Circuit Intermittent Low Voltage	C
P1114	Engine Coolant Temperature Sensor Circuit Intermittent Low Voltage	C
P1115	Engine Coolant Temperature Sensor Circuit Intermittent High Voltage	C
P1120	Throttle Position Sensor Voltage Out Of Range	A
P1125	Accelerator Pedal Position Sensors Out Of Range	A
P1133	HO2S Insufficient Switching - Bank 1, Sensor 1	B
P1134	HO2S Transition Time Ratio - Bank 1, Sensor 1	B
P1153	HO2S Insufficient Switching - Bank 2, Sensor 1	B

P1154	HO2S Transition Time Ratio - Bank 2, Sensor 1	B
P1220	Throttle Position Sensor Voltage Out Of Range	A
P1221	Throttle Position Sensor 1 & 2 Disagree	A
P1271	Accelerator Pedal Position Sensor 1 & 2 Signals Shorted Together	C
P1272	Accelerator Pedal Position Sensor 1 & 3 Signals Shorted Together	C
P1273	Accelerator Pedal Position Sensor 2 & 3 Signals Shorted Together	C
P1275	Accelerator Pedal Position Sensor 1 Signal Out Of Range	C
P1276	Accelerator Pedal Position Sensor 1 Disagrees With Sensors 2 & 3	C
P1280	Accelerator Pedal Position Sensor 2 Signal Out Of Range	C
P1281	Accelerator Pedal Position Sensor 2 Disagrees With Sensors 1 & 3	C
P1285	Accelerator Pedal Position Sensor 3 Signal Out Of Range	C
P1286	Accelerator Pedal Position Sensor 3 Disagrees With Sensors 1 & 2	C
P1336	Crankshaft Position System Variation Not Learned	A
P1351	PCM Detects Open In Ignition Control Circuit	B
P1352	PCM Detects Open In Ignition Control Circuit	B
P1361	PCM Does Not Monitor Ignition Control Pulses	B
P1362	PCM Detects Short To Voltage In Ignition Control Timing Signal Circuit	B
P1374	Crankshaft Position Sensor 3X Reference Circuit Malfunction	B
P1380	Misfire Detected - Rough Road Data Not Available	C
P1381	Misfire Detected - No Communication With Brake Control Module	C
P1441	EVAP System Flow During Non-Purge	B
P1514	Actual MAF & Speed Density Is Greater Than Expected	A
P1515	Commanded & Actual Throttle Position Mismatch	A
P1516	Commanded & Actual Throttle Position Malfunction	A
P1517	Throttle Actuator Control Module Internal Malfunction	A

P1518	Loss Of Communication Between PCM & TAC Module	A
P1519	Throttle Position Sensor 1 Out Of Range	C
P1523	Commanded & Actual Throttle Position Mismatch	C
P1546	A/C Clutch Feedback Circuit Low Voltage	C
P1571 (4)	Pulse Width Modulated Signal Circuit Malfunction	C
P1574 (8)	Sudden Decrease In Vehicle Speed On Non-Drive Wheel	C
P1586 (8)	Cruise Inhibit Signal Circuit Malfunction	C
P1626 (10)	Theft Deterrent System Fuel Enable Circuit Lost	C
P1629 (10)	Theft Deterrent System Fuel Enable Circuit Malfunction	C
P1635	5-Volt Reference 1 Circuit	B
P1639	5-Volt Reference 2 Circuit	B
P1810 (5)	Invalid TFP Manual Valve Position Switch State	B
P1860 (5)	TCC PWM Solenoid Valve Circuit Malfunction	B
P1870 (5)	Excessive TCC Slip When Engaged	B
UXXXX (3)	Scan Tool Does Not Communicate With Class 2 Device	

(1) - DTC definitions may vary depending on vehicle and/or engine configuration.
(2) - For code type definitions, see CODE TYPES under SELF-DIAGNOSTIC SYSTEM.
(3) - See appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.
(4) - See appropriate ANTI-LOCK article in BRAKES.
(5) - See appropriate ELECTRONIC CONTROLS article in TRANSMISSIONS.
(6) - See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT.
(7) - See appropriate GENERATORS & REGULATORS article in STARTING & CHARGING SYSTEMS.
(8) - See appropriate CRUISE CONTROL SYSTEMS article in ACCESSORIES & EQUIPMENT.
(9) - See BORG-WARNER T56 6-SPEED ELECTRONIC CONTROLS article in MANUAL TRANSMISSIONS.
(10) - See appropriate ANTI-THEFT SYSTEMS article in ACCESSORIES & EQUIPMENT.
(11) - This procedure applies to A/T vehicles only.

SYSTEM TESTS

MALFUNCTION INDICATOR LIGHT INOPERATIVE

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.

2) Check GAUGES fuse No. 9 (10-amp) located in instrument panel fuse block. If fuse is okay, go to next step. If fuse is blown, go to step 10).

3) Turn ignition off. Disconnect Powertrain Control Module (PCM) connectors. PCM is located on right rear of engine compartment. Turn ignition on. Connect a 3-amp fused jumper between ground and PCM connector C2 terminal No. 46 (Brown/White wire). See Fig. 3. Observe Malfunction Indicator Light (MIL). If MIL does not illuminate, go to next step. If MIL illuminates, go to step 9).

4) If fused jumper wire blows, go to step 11). If fused jumper wire does not blow, go to next step.

5) Turn ignition off. Remove the Instrument Panel Cluster (IPC). See REMOVAL & INSTALLATION in appropriate ANALOG INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. Using DVOM, measure resistance of Brown/White wire between IPC connector terminal A8 and PCM connector C2 terminal No. 46. See Fig. 4. If resistance is 5 ohms or less, go to next step. If resistance is more than 5 ohms, repair open in Brown/White wire. After repairs, go to step 14).

6) Using a test light connected to ground, probe IPC connector terminal A3 (Pink wire). Turn ignition on. If test light does not illuminate, go to next step. If test light illuminates, go to step 8).

7) Repair open in Pink wire between GAUGES fuse in instrument panel fuse block and IPC. After repairs, go to step 14).

8) Check for faulty connections at IPC connector. If faulty connections are found, repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

9) Check for faulty connections at PCM connector. If faulty connections are found, repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).

10) Repair the short to ground in Pink wire between GAUGES fuse in instrument panel fuse block and IPC. Replace GAUGES fuse. After repairs, go to step 14).

11) Repair the short to voltage in Brown/White wire between IPC connector terminal A8 and PCM connector C2 terminal No. 46. After repairs, go to step 14).

12) Replace IPC. After repairs, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

14) Recheck operation on MIL. If MIL operates properly, repair is complete. If MIL does not operate properly, go to step 2).

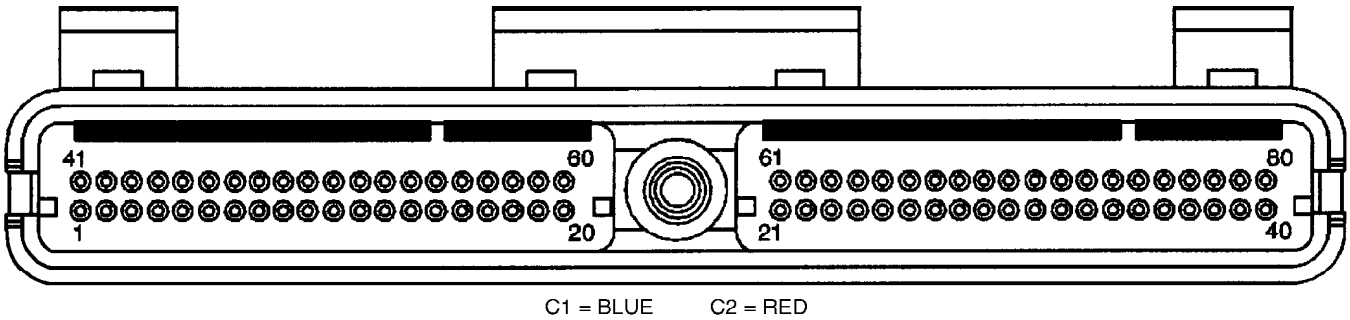

Fig. 3: Identifying Powertrain Control Module Connectors & Terminals
Courtesy of General Motors Corp.

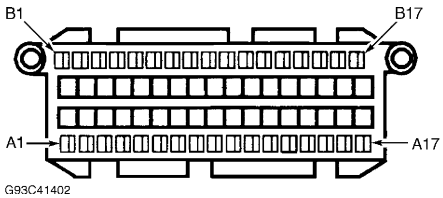

Fig. 4: Identifying Instrument Cluster Connector Terminals
Courtesy of General Motors Corp.

MALFUNCTION INDICATOR LIGHT ALWAYS ON

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.
2) Turn ignition off. Disconnect Powertrain Control Module (PCM) connectors. PCM is located on right rear of engine compartment. Turn ignition on. Observe Malfunction Indicator Light (MIL). If MIL illuminates, go to next step. If MIL does not illuminate, go to step 5).
3) Turn ignition off. Remove the Instrument Panel Cluster (IPC). See REMOVAL & INSTALLATION in appropriate ANALOG INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. Using DVOM, measure resistance between ground and IPC connector terminal A8 (Brown/White wire). See Fig. 4. If resistance is more than 5 ohms, go to next step. If resistance is 5 ohms or less, repair short to ground in Brown/White wire. After repairs, go to step 6)
4) Replace IPC. After repairs, go to step 6).
5) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.
6) Recheck operation on MIL. If MIL operates properly, repair is complete. If MIL does not operate properly, go to step 2).

DIAGNOSTIC TESTS

NOTE: Before clearing DTCs, perform powertrain diagnostic system check. See POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. Record FREEZE FRAME and FAILURE RECORDS for reference during testing. Data will be erased when DTCs are cleared.

NOTE: If PCM is replaced, NEW PCM must be programmed using special manufacturer's equipment.

NOTE: For component locations and PCM connector terminal identification, see appropriate SYSTEM & COMPONENT TESTING article.

DTC P0101: MASS AIRFLOW SENSOR PERFORMANCE

NOTE: For circuit identification, see WIRING DIAGRAMS article.

Description
Mass Airflow (MAF) sensor is an airflow meter that measures amount of air that enters engine. Powertrain Control Module (PCM) uses MAF sensor signal in order to provide correct fuel delivery for a wide range of engine speeds and loads. A small quantity of air entering the engine indicates deceleration or idle condition. A large quantity of air entering the engine indicates an acceleration or a high load situation. MAF sensor has an ignition 1 voltage circuit, a ground circuit, and a signal circuit. PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage in order to produce a frequency that is based on inlet airflow through the sensor bore. PCM uses Barometric Pressure (BARO), Throttle Position (TP), Intake Air Temperature (IAT), and engine RPM in order to calculate a predicted MAF value. PCM compares actual MAF sensor signal to predicted MAF value. This comparison determines the following conditions: signal is stuck based on a lack of variation, or signal is too low or too high for a given operating condition. DTC P0101 will set if actual MAF sensor signal is not within a predetermined range of the calculated value.

Code Enable Criteria

For DTC to run, the following conditions must be met for more than 2 seconds:

* DTCs P0102, P0103, P0107, P0108, P0401, P0404, P0405, P0440, P0442, P0446, P0606, P1404, P1441, P1514, P1515, P1516, or P1517 are not set.
* DTCs P1120 and P1220 as a combination are not set.
* DTC P1518 is not set in combination with any of the following DTCs: P1120, P1125, P1220, P1221, P1271, P1272, P1273, P1275, P1276, P1280, P1281, P1285, P1286.
* Engine is running.
* Ignition 1 signal is 9-18 volts.
* TP sensor angle is less than 30 percent.
* TP sensor angle is steady within a range of less than 5 percent.
* MAP sensor is more than 20 kPa.
* MAP sensor is steady within a range of 5.2 kPa.

DTC will set if actual MAF sensor signal is not within a predetermined range of calculated value. Condition is present for more than 40 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Install a scan tool. Start engine. Monitor Diagnostic Trouble Code (DTC) information using scan tool. If scan tool displays any other DTCs set, see DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no other DTCs are displayed, go to next step.

3) Observe and record Freeze Frame/Failure Records for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within conditions for running DTC in code enable criteria or within parameters observed in Freeze Frame/Failure Records. If DTC fails this ignition, go to next step. If DTC does not fail this ignition, go to DIAGNOSTIC AIDS.

4) Let engine idle at normal operating temperature. Using scan tool, observe MAP sensor voltage parameter. If scan tool indicates that voltage is 0.8-4.0 volts, go to next step. If scan tool indicates that voltage is not 0.8-4.0 volts, check Manifold Absolute Pressure (MAP) sensor. See appropriate SYSTEM & COMPONENT TESTING article.

5) Any unmetered air that enters the engine may cause this DTC to set. This step eliminates any conditions which can cause a DTC to set with a MAF sensor that is operating correctly. Turn ignition off. Inspect for the following conditions: objects that are blocking the MAF sensor air inlet screen, a dirty air filter element, or an obstructed or collapsed intake air duct. Inspect for vacuum leaks in the following components: intake manifold, throttle body, EGR valve flange and pipe, MAF sensor seal, MAP sensor seal, seal on the evaporative emission (EVAP) canister purge valve, crankcase ventilation system, brake booster system, and air induction system, If problem was found and corrected, go to 22). If problem was not found and corrected, go to next step.

6) Remove MAP sensor from engine vacuum source. Leave MAP sensor electrical harness connected. Connect a hand operated vacuum pump to MAP sensor. Turn ignition on, with engine off. Using scan tool, observe and record kPa parameter display of MAP sensor while slowly applying 20 in. Hg, one in. Hg at a time. Each one in. Hg of vacuum applied should result in a 3-4 kPa drop in MAP sensor value on scan tool. Value should change smoothly with each one in. Hg increase

in vacuum. If scan tool indicates MAP sensor value changed smoothly through entire range, go to next step. If scan tool does not indicate MAP sensor value changed smoothly through entire range, check Manifold Absolute Pressure (MAP) sensor. See appropriate SYSTEM & COMPONENT TESTING article.

7) Apply 20 in. Hg vacuum to MAP sensor. If scan tool indicates MAP sensor value is 34 kPa or less, go to next step. If scan tool does not indicate MAP sensor value is 34 kPa or less, check Manifold Absolute Pressure (MAP) sensor. See appropriate SYSTEM & COMPONENT TESTING article.

8) Disconnect the vacuum source from the MAP sensor. If scan tool indicates MAP sensor value returned to original value observed in step 6), go to next step. If scan tool does not indicate MAP sensor value returned to original value observed in step 6), check Manifold Absolute Pressure (MAP) sensor. See appropriate SYSTEM & COMPONENT TESTING article.

9) This step checks signal circuit from the MAF sensor to the PCM. Voltage reading of less than 4 volts or more than 6 volts, indicates a poor connection or a wiring problem. Turn ignition off. Disconnect MAF sensor connector. Turn ignition on, with engine off. Measure voltage between MAF sensor signal circuit and a good ground. If voltage reading is about 5.0 volts, go to next step. If voltage reading is not about 5.0 volts, go to step 11).

10) Connect test light between MAF sensor ignition 1 voltage circuit and ground circuit. If test light illuminates, go to step 18). If test light does not illuminate, go to step 13).

11) If voltage is less than 4.5 volts, go to step 14). If voltage is 4.5 volts or more, go to next step.

12) Turn ignition off. Disconnect PCM. Disconnecting PCM may eliminate short to voltage if signal circuit is shorted to another PCM circuit. Turn ignition on, with engine off. Measure voltage between MAF sensor signal circuit and a good ground. If voltage is about zero volts, go to step 19). If voltage is not about zero volts, go to step 17).

13) Connect test light between MAF sensor ignition 1 voltage circuit and good ground. If test light illuminates, go to step 15). If test light does not illuminate, go to step 16).

14) Turn ignition off. Disconnect PCM. Check MAF sensor signal circuit between MAF sensor and PCM for high resistance, open, short to ground, or short to MAF sensor ground circuit. If problem was found and corrected, go to step 22). If problem was not found and corrected, go to step 19).

15) Repair high resistance or open in MAF sensor ground circuit and go to step 22).

16) Repair short to ground or open in MAF sensor ignition 1 voltage circuit. MAF sensor ignition 1 voltage circuit is spliced to other components on the vehicle. Replace the fuse as necessary. If problem was found and repaired, go to step 22). If problem was not found and repaired, go to step 20).

17) Repair short to voltage in MAF sensor signal circuit and go to step 22).

18) Inspect for poor connections at MAF sensor connector. If problem was found and repaired, go to step 22). If problem was not found and repaired, go to step 20).

19) Inspect for poor connections at PCM connector. If problem was found and repaired, go to step 22). If problem was not found and repaired, go to step 21).

20) Replace MAF sensor and go to step 22).

21) Replace PCM. Program replacement PCM. See PROGRAMMING. After replacing PCM, go to next step.

22) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine. Operate vehicle within conditions for running DTC in code enable criteria. If DTC runs and passes, go to next step.

If DTC does not run and pass, return to step 2)

23) Using scan tool, observe stored information in CAPTURE INFO. If scan tool displays any DTCs that you have not diagnosed, see DIAGNOSTIC TROUBLE CODE DEFINITIONS. If scan tool displays any DTCs that you have not diagnosed, system is okay at this time.

Diagnostic Aids

Check for following conditions: A misrouted harness. Inspect MAF sensor harness to ensure harness is not routed too close to secondary ignition wires or coils, solenoids, relays or motors. Deposits on throttle plate or in throttle bore. Unmetered air (any unmetered air entering the engine may cause this DTC to set). Verify oil dipstick is completely seated and oil filler cap is tight. MAF display should increase from 4-7 grams/second at idle to 130 grams/second or more at 1-2 shift during a Wide Open Throttle (WOT) acceleration. If not, inspect for a restriction. Barometric pressure is used in order to calculate predicted mass airflow value, based on MAP sensor reading at key ON. A skewed MAP sensor will cause calculated mass airflow value to be inaccurate. Value shown for MAP sensor display varies with altitude. With ignition on and engine off, approximate value displayed should be about 103 kPa at or near sea level. Value decreases by approximately 3 kPa for every 1000 feet of altitude. Inspect for an unresponsive MAP sensor due to the following conditions: poor vacuum connections, damaged vacuum source, defective vacuum hoses or any unmetered air leaks into the manifold.

If problem is related to aftermarket accessories, check and repair installed equipment. If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

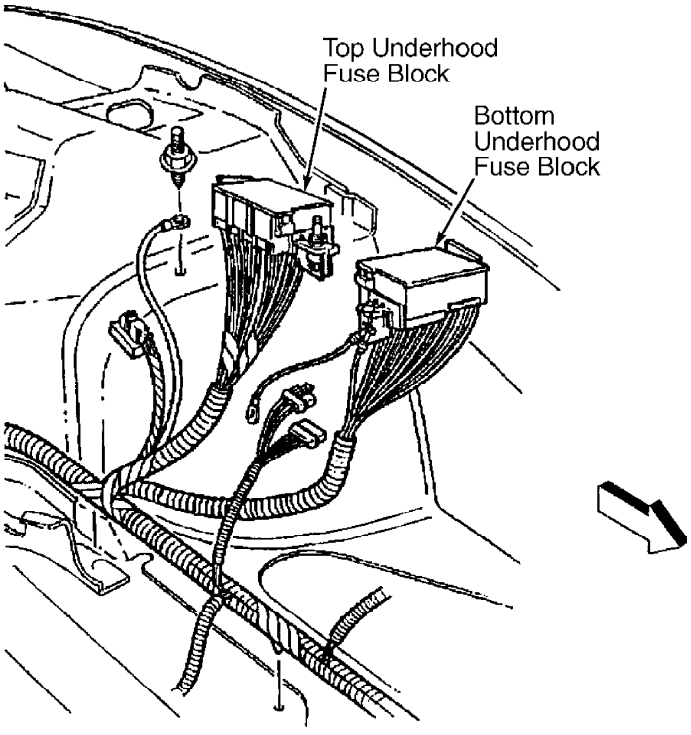

Fig. 5: Locating Underhood Fuse Blocks
Courtesy of General Motors Corp.

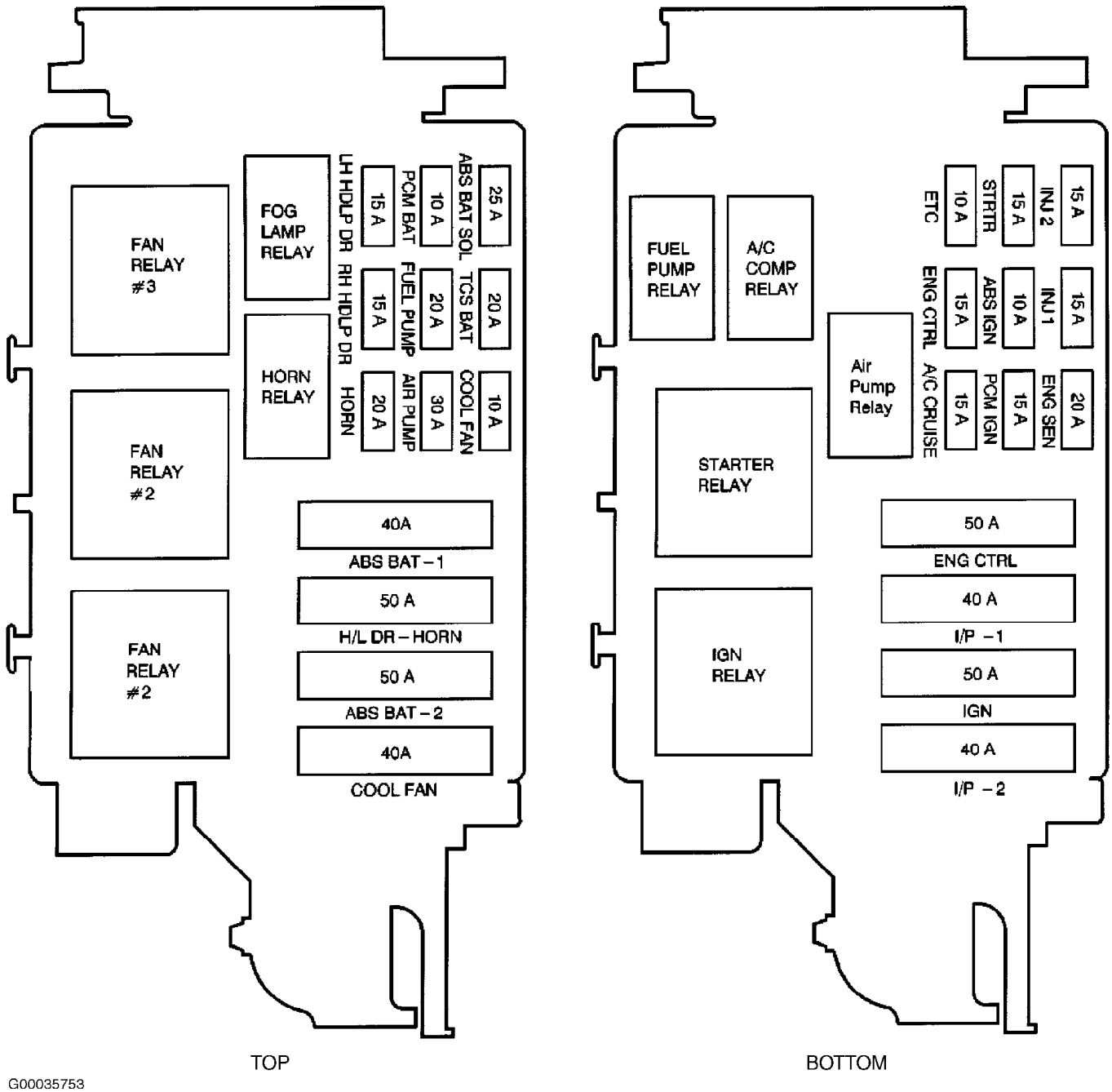

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Fig. 6: Identifying Top & Bottom Underhood Fuse Blocks & Components
Courtesy of General Motors Corp.

DTC P0102: MASS AIRFLOW SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit identification, see WIRING DIAGRAMS article.

Description

Mass Airflow (MAF) sensor is an airflow meter that measures the amount of air entering the engine. Powertrain Control Module (PCM) uses MAF sensor signal in order to provide correct fuel delivery for a wide range of engine speeds and loads. A small quantity of air entering the engine indicates deceleration or idle. A large quantity

of air entering the engine indicates an acceleration or high load situation. MAF sensor has an ignition 1 voltage circuit, a ground circuit and a signal circuit. PCM applies a voltage to MAF sensor on signal circuit. MAF sensor uses the voltage in order to produce a frequency based on inlet airflow through sensor bore. Frequency will vary within a range of around 2000 Hz at idle to about 10,000 Hz at maximum engine load. DTC P0102 will set if the PCM detects a frequency signal lower than possible range of a normally operating MAF sensor.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Engine is cranking or running.
* Throttle Position (TP) indicated angle is more than 1.5 percent.
* Ignition 1 signal is more than 8 volts.

DTC will set when MAF sensor frequency signal is less than 800 Hz for more than .5 second.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Start and operate engine at idle. Using scan tool, monitor MAF sensor frequency display. If MAF sensor value is less than 800 Hz, go to step 4). If MAF sensor value 800 Hz or more, go to next step.
3) Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for 30 seconds. Start engine and operate vehicle within conditions required for this DTC to run in code enable criteria, or as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that DTC failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
4) Check ENG SEN fuse (20-amp) located in bottom underhood fuse block. See Figs. 5 and 6. If fuse is open, go to step 14). If fuse is okay, go to next step.
5) Turn ignition off. Disconnect MAF sensor connector. Turn ignition on. Using DVOM, measure voltage between MAF sensor terminal "A" (Yellow wire) circuit and ground. If voltage reading is about 5 volts, go to next step. If voltage reading is not about 5 volts, go to step 8).
6) Turn ignition off. Connect a 3-amp fused jumper wire between ground and MAF sensor terminal "A" (Yellow wire). Start engine. Check for DTCs. If additional DTCs set, go to step 16). If no additional DTCs set, go to next step.
7) Turn ignition off. Connect test light between MAF sensor terminal "C" (Pink wire) and terminal "B" (Black/White wire). Turn ignition on. If test light illuminates, go to step 18). If test light does not illuminate, go to step 11).
8) If voltage is less than 4.5 volts, go to step 10). If voltage is 4.5 volts or more, go to next step.
9) Turn ignition off. Disconnect PCM connectors. Turn ignition on. Using DVOM, measure voltage between ground and MAF sensor terminal "A" (Yellow wire). If voltage is about zero volts, go to step 12). If voltage is not about zero volts, go to step 15).
10) Turn ignition off. Disconnect PCM connectors. Using DVOM, check for open, high resistance, short to ground or short to voltage in MAF sensor signal circuit between MAF sensor and PCM. Repair as necessary. After repairs, go to step 22). If circuit is okay, go to step 12).

11) Connect test light between ground and MAF sensor terminal "C" (Pink wire). If test light illuminates, go to step 13). If test light does not illuminate, go to step 14).

12) With DVOM lead connected to PCM connector C1, terminal No. 69 (Yellow wire), check for continuity at all other circuits in both PCM connectors. If continuity exists between any circuit(s), go to step 17). If continuity does not exist between any circuit(s), go to step 19).

13) Repair open or high resistance in MAF sensor ground circuit (Black/White wire). After repairs, go to step 22).

14) Repair open or short to ground in MAF sensor ignition 1 voltage circuit (Pink wire). See WIRING DIAGRAMS article. Replace fuse if necessary. After repairs, go to step 22). If circuit is okay, go to step 20).

15) Repair short to voltage in signal circuit (Yellow wire) between MAF sensor and PCM. After repairs, go to step 22).

16) Repair short between MAF sensor connector terminal "A" (Yellow wire) and circuit that set DTC. After repairs, go to step 22).

17) Repair circuits that are shorted together. After repairs, go to step 22).

18) Check for poor connections at MAF sensor connector. Repair as necessary. After repairs, go to step 22). If connections are okay, go to step 20).

19) Check for poor connections at PCM connectors. Repair as necessary. After repairs, go to step 22). If connections are okay, go to step 21).

20) Replace MAF sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 22).

21) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. Program replacement PCM. See PROGRAMMING. After replacing PCM, go to next step.

22) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

23) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for the following conditions: A misrouted harness. Inspect MAF sensor harness to ensure it is not routed too close to secondary ignition wires or coils, solenoids, relays or motors. Low minimum air rate. A low minimum air rate may cause this DTC to set during deceleration. Check for a plugged or collapsed intake air duct, dirty air filter element, blocked MAF sensor air inlet screen or throttle bore, and throttle plate coking. Any unmetered air entering engine may cause this DTC to set. Inspect for vacuum leaks anywhere downstream of MAF sensor. Check for vacuum or PCV system leaks, incorrect PCV valve, engine oil dipstick not fully seated or engine oil filler cap loose or missing. A Wide Open Throttle (WOT) acceleration from a stop should cause mass airflow display on a scan tool to increase from about 4-7 grams/second at idle to about 130 grams/second or more at time of 1-2 shift. If not, inspect for a restriction. If vehicle condition may be related to aftermarket accessories, check accessory installation.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0103: MASS AIRFLOW SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Mass Airflow (MAF) sensor is an airflow meter that measures the amount of air entering the engine. Powertrain Control Module (PCM) uses MAF sensor frequency signal in order to provide correct fuel delivery for a wide range of engine speeds and loads. A small quantity of air entering the engine indicates deceleration or idle. A large quantity of air entering the engine indicates an acceleration or high load situation. MAF sensor has an ignition 1 voltage circuit, a ground circuit and a signal circuit. The PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage in order to produce a frequency based on inlet airflow through sensor bore. Frequency will vary within a range of about 2000 Hz at idle to about 10,000 Hz at maximum engine load. DTC P0103 will set if the PCM detects a frequency signal higher than the possible range of a normally operating sensor.

PCM monitors MAF sensor frequency and can determine if sensor is stuck low, stuck high, not providing airflow value expected for a given operating condition, or that signal variation expected during normal operation is not present.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* Engine is cranking or running.
* Throttle position indicated angle is more than 1.5 percent.
* Ignition 1 signal is at least 8 volts.

DTC will set when MAF sensor frequency signal is more than 11500 Hz for more than .5 second.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect MAF sensor connector. Start engine. Using scan tool, monitor MAF sensor frequency. If MAF sensor frequency is zero Hz, go to step 5). If a MAF sensor frequency is not zero Hz, go to next step.

4) Check MAF sensor harness for incorrect routing near secondary ignition wires or coils, solenoids, relays or motors. Correct problem as necessary. After repairs, go to step 9). If routing is okay, go to step 6).

5) Check for poor connection at MAF sensor connectors. Repair or replace as necessary. After repairs, go to step 9). If connector terminals are okay, go to step 7).

6) Check for poor connections at PCM connectors. Repair as necessary. After repairs, go to step 9). If connections are okay, go to step 8).

7) Replace MAF sensor. See REMOVAL, OVERHAUL & INSTALLATION -

CARS article. After replacing sensor, go to step 9).
8) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.
9) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
10) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
Water entering air intake and reaching MAF sensor can cause DTC P0103 to set. Water rapidly cools MAF sensor element causing PCM to receive an excessive airflow signal. Check air induction and secondary air injection systems for evidence of water intrusion. Poor connection at MAF sensor connector terminal "C" (Pink wire) may cause DTC P0103 to set.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0107: MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Manifold Absolute Pressure (MAP) sensor responds to pressure changes in intake manifold. Pressure changes occur based on engine load. MAP sensor has following circuits: 5-volt reference circuit, low reference circuit and signal circuit. Powertrain Control Module (PCM) supplies 5 volts to MAP sensor on 5-volt reference circuit. PCM also provides a ground on low reference circuit. MAP sensor provides a signal to PCM on signal circuit which is relative to pressure changes in intake manifold. PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. PCM should detect a high signal voltage at a high MAP, such as ignition on, engine off, or at Wide Open Throttle (WOT).

Certain vehicle models also use MAP sensor in order to determine barometric pressure (BARO). This occurs when ignition is turned on, with engine off. BARO reading may also be updated whenever engine is operated at WOT. PCM monitors MAP sensor signal for voltage outside of normal range. If PCM detects MAP sensor signal voltage that is excessively low, DTC P0107 will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Ignition is on.
* DTCs P0606, P1120, P1125, P1220, P1221, P1271, P1272, P1273, P1275, P1276, P1280, P1281, P1285, P1286, P1514, P1515, P1516, P1517, or P1518 are not set.
* Throttle angle is more than zero percent when the engine speed is less than 1000 RPM.
* Throttle angle is more than 10 percent when engine speed is more than 1000 RPM.

MAP sensor signal voltage is less than 0.1 volt for more than

7 seconds. Engine must be running.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle. Using scan tool, monitor DTC Information. If DTC P1635 fails in this ignition cycle, go to DTC P1635: 5-VOLT REFERENCE 1 CIRCUIT. If DTC P1635 did not fail in this ignition cycle, go to next step.

3) Using scan tool, monitor MAP sensor voltage. If MAP sensor voltage is less than .10 volt, go to step 5). If MAP sensor voltage is .10 volt or more, go to next step.

4) Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that DTC failed this ignition, go to next step. If scan tool does not indicate that DTC failed this ignition, see DIAGNOSTIC AIDS.

5) Turn ignition off. Disconnect MAP sensor connector. Turn ignition on. Using DVOM, measure voltage between MAP sensor connector terminal "C" (Gray wire) and ground. If voltage is approximately 5 volts, go to next step. If voltage is not approximately 5 volts, go to step 7).

6) Connect a 3-amp fused jumper wire between MAP sensor connector terminals "B" (Light Green wire) and "C" (Gray wire). Monitor MAP voltage display on scan tool. If MAP sensor voltage is approximately 5 volts, go to step 9). If MAP voltage is not approximately 5 volts, go to step 8).

7) Check for an open or short to ground in Gray wire between MAP sensor connector "C" and PCM connector C1 terminal No. 33. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).

8) Check for an open or short to ground in Light Green wire between MAP sensor connector "B" and PCM connector C2 terminal No. 25. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).

9) Check for poor connections at MAP sensor. Repair as necessary. After repairs, go to step 13). If connection is okay, go to step 11).

10) Check for poor connection at PCM connectors. Repair as necessary. After repairs, go to step 13). If terminals are okay, replace MAP sensor. After repairs, go to step 12).

11) Replace MAP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 13).

12) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

13) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for damaged, disconnected, improperly routed or

restricted MAP sensor vacuum source lines/hoses.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0108: MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Manifold Absolute Pressure (MAP) sensor responds to pressure changes in intake manifold. Pressure changes occur based on engine load. MAP sensor has the following circuits: 5-volt reference circuit, low reference circuit and signal circuit. Powertrain Control Module (PCM) supplies 5 volts to MAP sensor on 5-volt reference circuit. PCM also provides a ground on low reference circuit. MAP sensor provides a signal to PCM on signal circuit which is relative to pressure changes in intake manifold. PCM should detect a low signal voltage at a low MAP, such as during idle or deceleration. PCM should detect a high signal voltage at a high MAP, such as ignition on, engine off, or at Wide Open Throttle (WOT). Certain models also use MAP sensor in order to determine Barometric Pressure (BARO). This occurs when ignition is on, with engine off. BARO reading may also be updated whenever engine is operated at WOT. PCM monitors MAP sensor signal for voltage outside of normal range. If PCM detects a MAP sensor signal voltage that is excessively high, DTC P0108 will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1120, P1125, P1220, P1221, P1271, P1272, P1273, P1275, P1276, P1280, P1281, P1285, P1286, P1514, P1515, P1516 and P1517 are not set.
* DTCs P0121, P0122, and P0123 are not set.
* Engine has been running for a length of time that is determined by start-up coolant temperature. Length of time ranges from 2 minutes at less than -22°F (-30°C) to one second at more than 86°F (30°C).
* The throttle angle is less than 0.5 percent when engine speed is less than 900 RPM.

Code will set when MAP sensor signal voltage is more than 4.3 volts for 7 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle. Using scan tool, monitor Failed This Ignition option under DTC information option. If DTC P1635 fails this ignition cycle, go to DTC P1635: 5-VOLT REFERENCE 1 CIRCUIT . If DTC P1635 did not fail this ignition cycle, go to next step.

3) Using scan tool, monitor MAP sensor voltage. If MAP sensor voltage is more than 4.2 volts, go to step 5). If sensor voltage is 4. 2 volts or less, go to next step.

4) Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run within code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool

indicates that this DTC failed this ignition, go to next step. If scan tool does not indicate that this DTC failed this ignition, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

5) Turn ignition off. Check MAP sensor vacuum hoses for leaks, restrictions and faulty connections. After repairs, go to step 16). If vacuum supply hoses are okay, go to next step.

6) Turn ignition off. Disconnect MAP sensor connector. Monitor MAP voltage display on scan tool. Turn ignition on. If MAP sensor voltage is less than 0.1 volt, go to next step. If MAP voltage is 0.1 volt or more, go to step 9).

7) Using a DVOM, measure voltage between MAP sensor connector terminals "A" (Orange/Black wire) and "C" (Gray wire). If voltage is 4.7-5.2 volts, go to step 12). If voltage is not 4.7-5.2 volts, go to next step.

8) If voltage is more than 5.2 volts, go to step 11). If voltage is less than 5.2 volts, go to step 10).

9) Check for short to voltage in Light Green wire between MAP sensor connector "B" and PCM connector C2 terminal No. 25. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 13).

10) Check for open in Orange/Black wire between MAP sensor connector "A" and PCM connector C1 terminal No. 13. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 13).

11) Check for short to voltage in Gray wire between MAP sensor connector "C" and PCM connector C1 terminal No. 33. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 13).

12) Check for poor connections at MAP sensor. Repair as necessary. After repairs, go to step 16). If connection is okay, go to step 14).

13) Check for poor connection at PCM connectors. Repair as necessary. After repairs, go to step 16). If terminals are okay, go to step 15).

14) Replace MAP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 16).

15) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

16) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this DTC ran and passed, go to next step. If scan tool does not indicate that this DTC ran and passed, go to step 2).

17) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

DTC P0112: INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Intake Air Temperature (IAT) sensor is a thermistor which measures temperature of air entering engine. Powertrain Control Module (PCM) applies 5 volts through a pull up resistor. When intake air is cold, sensor resistance is high and PCM will monitor a high signal voltage on IAT sensor signal circuit. As intake air warms, sensor resistance becomes lower, causing PCM to monitor a lower voltage. If PCM detects an excessively low IAT sensor signal voltage, which indicates a high temperature, DTC P0112 will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0117, P0118, P0125, P0128, P0501, P0502, P1114, or P1115 are not set.
* Engine run time is more than 10 seconds.
* Vehicle speed is at least 25 MPH.

DTC will set when intake air temperature is more than 275°F (135°C) for 20 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Turn ignition on. Using scan tool, monitor IAT display. If IAT reading is more than 275°F (135°C), go to step 4). If IAT reading is 275°F (135°C) or less, go to next step.
3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 15 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
4) Turn ignition off. Disconnect IAT sensor connector. Note IAT sensor value on scan tool. IAT sensor value should be -34°F (-37°C). If IAT value is as specified, go to step 6). If IAT value is not as specified, go to next step.
5) Turn ignition off. Disconnect IAT sensor and PCM connectors. Check for short to ground in Tan wire between IAT sensor connector terminal "B" and PCM connector C2 terminal No. 50. Repair as necessary. After repairs, go to step 8). If circuit is okay, go to step 7).
6) Replace IAT sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 8).
7) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.
8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0113: INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Intake Air Temperature (IAT) sensor is a thermistor which measures temperature of air entering engine. Powertrain Control Module

(PCM) applies 5 volts through a pull up resistor. When intake air is cold, sensor resistance is high and PCM will monitor a high signal voltage on IAT sensor signal circuit. As intake air warms, sensor resistance becomes lower causing PCM to monitor a lower voltage. If PCM detects an excessively high IAT sensor signal voltage, which indicates a low temperature, DTC P0113 will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0117, P0118, P0125, P0128, P0501, P0502, P1114 or P1115 are not set.
* Engine Coolant Temperature (ECT) is more than 60°F (140°C).
* Vehicle speed is less than 5 MPH.
* Mass Airflow (MAF) is less than 8 grams/second.
* Engine run time is more than 3 minutes.

DTC will set when intake air temperature is less than -36°F (-38°C) for more than 20 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Turn ignition on. Using scan tool, monitor IAT display. If IAT reading is not less than -34°F (-37°C), go to next step. If IAT reading is -34°F (-37°C) or less, go to step 4).
3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 15 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. If DTC resets, go to next step. If code does not reset, see DIAGNOSTIC AIDS.
4) Turn ignition off. Disconnect IAT sensor connector. Connect a 3-amp fused jumper wire between IAT sensor connector terminals. Turn ignition on. Note IAT sensor value on scan tool. If IAT sensor value is more than 135°F (275°C), go to step 6). If IAT value is 135°F (275°C) or less, go to next step.
5) Connect a jumper wire between ground and IAT sensor connector terminal "B" (Tan wire). If IAT sensor value is more than 135°F (275°C), go to step 7). If IAT sensor value is 135°F (275°C) or less, go to step 8).
6) Turn ignition off. Disconnect PCM connector C2. Check for short to voltage in Tan wire between IAT sensor connector terminal "B" and PCM connector C2 terminal No. 50. Repair circuit as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).
7) Check Purple wire between IAT sensor terminal "A" and PCM connector C1 terminal No. 17 for an open or high resistance. Repair wiring as necessary. After repairs, go to step 13). If circuit is okay, go to step 9).
8) Using DVOM, check Tan wire between PCM connector C2 terminal No. 50 and IAT sensor terminal "B" for an open circuit. Repair wiring as necessary. After repairs, go to step 13). If circuit is okay, go to next step.
9) Turn ignition off. Disconnect PCM connectors. Check for faulty connections at PCM connectors. Repair connectors as necessary. After repairs, go to step 13). If connectors are okay, go to step 12).
10) Check for faulty connections at IAT sensor. Repair connectors as necessary. After repairs, go to step 13). If connectors are okay, go to next step.
11) Replace IAT sensor. See REMOVAL, OVERHAUL & INSTALLATION

- CARS article. After replacing sensor, go to step 13).
12) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.
13) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If a short to a separate 5-volt source occurs, this DTC may set. If short to separate 5-volt source exists, continuity test to all other PCM circuits will be necessary to diagnose specific circuit.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0117: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Engine Coolant Temperature (ECT) sensor is a thermistor that measures temperature of engine coolant. Powertrain Control Module (PCM) supplies 5 volts to ECT signal circuit. When ECT is cold, sensor resistance is high. When ECT increases, sensor resistance lowers. With high sensor resistance, PCM detects a high voltage on ECT signal circuit. With lower sensor resistance, PCM detects a lower voltage on ECT signal circuit. If PCM detects an excessively low ECT signal voltage, which is a high temperature indication, this DTC will set.

Code Enable Criteria
* Engine run time is more than 15 seconds.

For DTC to run, ECT sensor must indicate coolant temperature more than 282°F (139°C) for more than 10 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Turn ignition on. Using scan tool, monitor ECT sensor display. If scan tool indicates more than 280°F (138°C), go to step 4). If scan tool indicates less than 280°F (138°C), go to next step.
3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
4) Turn ignition off. Disconnect ECT sensor. Turn ignition on. Monitor ECT sensor display. If scan tool indicates less than -36°F (-38°C), go to step 6). If scan tool does not indicate less than -36°F

(-38°C), go to next step.
5) Turn ignition off. Disconnect PCM connectors. Check for short to ground in Yellow wire between ECT sensor connector terminal "B" and PCM connector C1 terminal No. 26. See Fig. 3. Also check for short between Yellow wire for ECT sensor and any low reference circuit. Repair as necessary. After repairs, go to step 8). If circuit is okay, go to step 7).
6) Replace ECT sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 8).
7) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.
8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
DTC may be set because of an engine overheating condition. After starting engine, ECT sensor temperature should rise steadily to about 194°F (90°C), then stabilize after thermostat opens. A skewed sensor could result in poor driveability concerns. Check ECT at different temperatures in order to evaluate the possibility of a skewed sensor. See appropriate SENSOR OPERATING RANGE CHARTS article.

If malfunction is not present at this time, go to DTC P1114: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0118: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Engine Coolant Temperature (ECT) sensor is a thermistor that measures temperature of engine coolant. Powertrain Control Module (PCM) supplies 5 volts to ECT signal circuit. When ECT is cold, sensor resistance is high. When ECT increases, sensor resistance lowers. With high sensor resistance, PCM detects a high voltage on ECT signal circuit. With lower sensor resistance, PCM detects a lower voltage on ECT signal circuit. If PCM detects an excessively high ECT signal voltage, which is a low temperature indication, this DTC will set.

Code Enable Criteria
For DTC to run, engine run time must be more than 15 seconds. DTC will set when ECT sensor temperature is less than -36°F (-38°C) for more than 24 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Turn ignition on. Using scan tool, monitor ECT display. If

ECT reading is -36°F (-38°C) or more, go to next step. If ECT reading is less than -36°F (-38°C), go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect ECT sensor connector. Connect a 3-amp fused jumper wire between ECT sensor connector terminals. Turn ignition on. If fuse in jumper wire blows, go to step 7). If fuse in jumper wire does not blow, go to next step.

5) Note ECT sensor value displayed on scan tool. If ECT value is more than 280°F (138°C), go to step 9). If ECT value is 280°F (138°C) or less, go to next step.

6) Turn ignition off. Connect a 3-amp fused jumper wire between ECT sensor connector terminal "B" (Yellow wire) and ground. Turn ignition on. Note ECT sensor value displayed on scan tool. If ECT value is more than 280°F (138°C), go to step 8). If ECT value is 280°F (138°C) or less, go to next step.

7) Check for open, high resistance, short to voltage or short to separate 5-volt reference circuit in Yellow wire between ECT connector terminal "B" and PCM connector C2 terminal No. 26. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to next step.

8) Check for open or high resistance in Black wire between ECT connector terminal "A" and PCM connector C1 terminal No. 12. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).

9) Check for poor connections at ECT connector. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 11).

10) Check for poor connections at PCM connectors and terminals. Repair as necessary. After repairs, go to step 13). If connections are okay, go to step 12).

11) Replace ECT sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 13).

12) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to next step.

13) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If a short to a separate 5-volt source occurs, this DTC may set. If short is present, a continuity test to all other PCM circuits will be necessary to diagnose the specific circuit. After starting engine, ECT should rise steadily to about 194°F (90°C) then stabilize after the thermostat opens. Test ECT at different temperatures to in order to evaluate possibility of a skewed sensor. A skewed sensor could result in poor driveability. See appropriate SENSOR OPERATING RANGE CHARTS article.

If malfunction is not present at this time, go to DTC P1115: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0125: ENGINE COOLANT TEMPERATURE EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

An Engine Coolant Temperature (ECT) sensor monitors coolant temperature. This input is used by Powertrain Control Module (PCM) for engine control and as an enabling criteria for some diagnostics. Airflow coming into engine is accumulated and used to determine if engine has been driven within conditions that would allow engine coolant to heat up normally to thermostat regulating temperature. If coolant temperature does not increase normally or does not reach regulating temperature of thermostat, diagnostics that use engine coolant temperature as enabling criteria, may not run when expected. This DTC will only run once per ignition cycle within enabling condition. This DTC will set when there has been excessive time to reach a minimum coolant temperature required for closed loop fuel control.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0112, P0113, P0117, P0118, P0125, P1111, P1112, P1114, or P1115 are not set.
* Minimum air temperature is 19°F (-7°C) or more.
* Start-up coolant temperature is less than 104°F (40°C) on M/T models and 20°F (68°C) on A/T models.
* Region 1 - Air temperature is more than 50°F (10°C) and the start-up coolant temperature is more than 50°F (10°C).
* Region 2 - Air temperature is more than 19°F (-7°C) and the start-up coolant temperature is between 19°F (-7°C) and 50°F (10°C).
* Region 3 - Air temperature is more than 19°F (-7°C) and the start-up coolant temperature is between -40°F (-40°C) and 19°F (-7°C).

DTC will set when:

Region 1-On A/T models, engine run time is more than 139 seconds to achieve a closed loop temperature of 68°F (20°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 104 seconds. On M/T models, engine run time is more than 325 seconds to achieve a closed loop temperature of 104°F (40°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 250 seconds.

Region 2-On A/T models, engine run time is more than 251 seconds to achieve closed loop temperature of 68°F (20°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 188 seconds. On M/T models, engine run time is more than 400 seconds to achieve closed loop temperature of 104°F (40°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 300 seconds.

Region 3-On A/T models, engine run time is more than 324

seconds to achieve closed loop temperature of 68°F (20°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 243 seconds. On M/T models, engine run time is more than 475 seconds to achieve closed loop temperature of 104°F (40°C). Calibrated minimum amount of airflow has been exceeded. Maximum idle time has been less than 375 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check coolant level. If coolant level is low, repair any cooling system leaks and fill coolant to proper level. If coolant level is okay, go to next step.

3) Turn ignition off. Disconnect ECT sensor. Connect a 3-amp fused jumper wire between ECT sensor connector terminals. Turn ignition on. Monitor ECT sensor temperature on scan tool. If scan tool indicates ECT value is more than 280°F (138°C), go to step 7). If scan tool indicates ECT value 280°F (138°C) or less, go to next step.

4) Turn ignition off. Connect a 3-amp fused jumper wire between ECT sensor connector terminal "B" (Yellow wire) and ground. Turn ignition on. Monitor ECT sensor temperature on scan tool. If scan tool indicates ECT value is more than 280°F (138°C), go to next step. If scan tool indicates ECT value is 280°F (138°C) or less, go to step 6).

5) Check for open or high resistance in Brown wire between ECT sensor connector terminal "A" and PCM connector C1 terminal No. 12. Repair wiring as necessary. After repairs, go to step 10).

6) Check for open or high resistance in Yellow wire between ECT sensor connector terminal "B" and PCM connector C2 terminal No. 26. Repair wiring as necessary. After repairs, go to step 10).

7) Remove ECT sensor. Using a pan of hot water, check ECT sensor temperature/resistance. See appropriate SENSOR OPERATING RANGE CHARTS article. If ECT sensor closely matches sensor operating range chart, go to next step. If ECT sensor does not closely match sensor operating range chart, go to step 9).

8) Reinstall ECT sensor and diagnose thermostat. See appropriate article in ENGINE COOLING.

9) Replace ECT sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing ECT sensor, go to next step.

10) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

11) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

DTC P0125 is designed to detect a skewed ECT sensor. On M/T models, if DTC P0125 and DTC P0128 are set, a faulty thermostat may be the cause.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0128: ENGINE COOLANT TEMPERATURE EXCESSIVE TIME TO REACH OPERATING TEMPERATURE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Engine Coolant Temperature (ECT) sensor monitors coolant temperature. This input is used by Powertrain Control Module (PCM) for engine control and as an enabling criteria for some diagnostics. Airflow coming into engine is accumulated and used to determine if engine has been driven within conditions that would allow engine coolant to heat up normally to thermostat regulating temperature. If coolant temperature does not increase normally or does not reach regulating temperature of thermostat, diagnostics that use engine coolant temperature as enabling criteria, may not run when expected. If engine coolant fails to reach a preset target temperature before a calculated airflow is accumulated DTC P0128 will set. This DTC will only run once per ignition cycle within enabling condition.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0112, P0113, P0117, P0118, P0125, P1111, P1112, P1114, or P1115 are not set.
* Coolant temperature is more than -40°FC (-40°C).
* Air temperature is 19°F (-7°C) or more.
* Engine is running for more than 4 minutes.
* Vehicle speed average is more than 15 MPH over the key cycle.
* Mass airflow average reading is more than 23 grams/second.
* Vehicle has been driven more than 3 miles.

DTC will set when allowed time for engine coolant to reach a preset temperature has been exceeded.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check coolant level. If coolant level is low, diagnose for coolant leak. See appropriate article in ENGINE COOLING. If coolant level is okay, go to next step.

3) Turn ignition off. Disconnect ECT sensor. Connect a 3-amp fused jumper wire between ECT sensor connector terminals. Turn ignition on. Monitor ECT sensor temperature on scan tool. If scan tool indicates ECT value is more than 280°F (138°C), go to step 7). If scan tool indicates ECT value is 280°F (138°C) or less, go to next step.

4) Turn ignition off. Connect a fused jumper wire between ECT sensor connector terminal "B" (Yellow wire) and ground. Turn ignition on. Monitor ECT sensor temperature on scan tool. If scan tool indicates ECT value is more than 280°F (138°C), go to next step. If scan tool indicates ECT value less than 280°F (138°C), go to step 6).

5) Repair open or high resistance in Brown wire between ECT sensor connector terminal "A" and PCM connector C1 terminal No. 12. After repairs, go to step 10).

6) Repair open or high resistance in Yellow wire between ECT sensor connector terminal "B" and PCM connector C1 terminal No. 74. After repairs, go to step 10).

7) Remove ECT sensor. Using a pan of hot water, check ECT sensor temperature/resistance. See appropriate SENSOR OPERATING RANGE CHARTS article. If ECT sensor closely matches sensor operating range chart, go to next step. If ECT sensor does not closely match sensor operating range chart, go to step 9).

8) Reinstall ECT sensor and diagnose engine failing to reach operating temperature condition. See appropriate article in ENGINE

COOLING.

9) Replace ECT sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to next step.

10) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

11) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

DTC P0128 will set if diagnostic does not pass within 25 minutes after start up. DTC is designed to detect a faulty thermostat. A skewed ECT sensor to can cause DTC P0128 to set. A skewed IAT sensor may cause this DTC to set. IAT sensor should read near ambient temperature.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0130: HO2S CIRCUIT MALFUNCTION - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies bias voltage of about 450 millivolts (mV) between HO2S high and low signal circuits. The HO2S voltage ranges from about 1000 mV when exhaust is rich to about 100 mV when exhaust is lean. PCM monitors and stores sensor voltage information and evaluates voltage samples to determine amount of time sensor voltage is out of range. If signal amplitude of HO2S bank 1 sensor exceeds lack of activity thresholds but will not allow closed loop operation, DTC P0130 will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine has been running for at least 4 minutes.
* Engine coolant temperature is at least 122°F (50°C).
* Engine RPM is 1000-3000 RPM.
* Accelerator Pedal Position (APP) indicated angle is 5-40 percent.
* Ignition voltage is 9-18 volts.

DTC will set when PCM detects an active sensor with an improper HO2S voltage amplitude.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, clear DTCs. Reset fuel trim values. Start engine and run to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor appropriate HO2S voltage with

engine at idle. Voltage should swing rapidly from more than to less than 300-600 mV range. If HO2S voltage is fixed between 300-600 mV, go to step 4). If HO2S voltage is not fixed between 300-600 mV, go to next step.

3) Condition that set this DTC is not present. DTC may have been set by one of the following conditions: HO2S connector water intrusion, intermittently open HO2S high signal circuit, intermittently open HO2S low signal circuit, HO2S low signal circuit with high resistance to ground, PCM ground circuits with high resistance to ground, inoperative HO2S heater, poor HO2S or PCM connector terminal contact, exhaust system leak (typically within 12" upstream of HO2S or defective HO2S. Repair as necessary. If problem was found and repaired, go to step 17) If problem was not found and corrected, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Turn ignition off. Disconnect suspect HO2S connector for corresponding DTC. Connect a jumper wire between ground and suspect HO2S connector terminal "A" (Tan/White wire for Bank 1, Sensor 1; Tan wire for Bank 2, Sensor 1; Gray wire for Bank 1, Sensor 2). Monitor HO2S voltage using scan tool. If voltage reading is less than 20 mV, go to step 7). If voltage reading is 20 mV or more, go to next step.

5) Turn ignition off. Remove jumper wire from the HO2S terminal. Disconnect PCM connectors. Using DVOM, measure continuity of suspect HO2S high signal circuit (Purple/White wire for Bank 1, Sensor 1; Purple wire for Bank 2, Sensor 1; Dark Blue wire for Bank 1, Sensor 2) and then HO2S low signal circuit (Tan/White wire for Bank 1, Sensor 1; Tan wire for Bank 2, Sensor 1; Gray wire for Bank 1, Sensor 2) between PCM connectors and suspect HO2S connector. If resistance of both circuits is less than 5 ohms, go to next step. If resistance of both circuits is 5 ohms or more, go to step 9).

6) Inspect for poor connections at PCM connectors. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 16).

7) Remove jumper wire from HO2S terminals. Connect test light between appropriate HO2S terminals "C" (Black wire) and "D" (Pink wire). Turn ignition on. If test light illuminates, go to next step. If test light does not illuminate, go to step 10).

8) Turn ignition off. Reconnect HO2S connector. Disconnect PCM connectors. Using DVOM, measure resistance between appropriate HO2S low signal terminal (Tan/White wire for Bank 1, Sensor 1; Tan wire for Bank 2, Sensor 1; Gray wire for Bank 1, Sensor 2) and a PCM ground circuit terminal. If resistance is less than 500 ohms, go to step 12). If resistance is 500 ohms or more, go to step 11).

9) Repair high resistance in appropriate circuit as necessary. After repairs, go to step 17).

10) Repair wiring to appropriate HO2S terminal "C" (Black wire) or "D" (Pink wire). Probable causes include: open or high resistance circuit, poor ground connection or an open heater fuse (which can also set other DTCs). After repairs, go to step 17).

11) Repair high resistance between HO2S terminal "B" (Tan/White wire for Bank 1, Sensor 1; Tan wire for Bank 2, Sensor 1; Gray wire for Bank 1, Sensor 2) and a PCM ground circuit terminal. Probable causes include: poor HO2S connector terminal contact, open HO2S circuit (which will require HO2S replacement), poor PCM ground connection, high PCM ground circuit resistance or ungrounded exhaust system. After repairs, go to step 17).

12) Inspect for exhaust system leaks upstream of suspect HO2S. Leak may be very small and will typically be within 12" of suspect HO2S. Repair exhaust system as necessary. After repairs, go to step 17). If exhaust system is okay, go to next step.

NOTE: Although 500 ohms resistance is allowed, typical resistance should be less than 50 ohms.

13) Allow engine to cool to ambient temperature. Using DVOM, re-measure resistance between appropriate HO2S terminal "A" and PCM ground circuit terminal. If resistance is less than 500 ohms, go to step 15). If resistance is 500 ohms or more, go to next step.

14) Remove HO2S from exhaust. Clean HO2S mounting threads. Apply anti-seize compound to sensor threads. Tighten HO2S to specification. See REMOVAL, OVERHAUL & INSTALLATION article. Using DVOM, re-measure resistance between appropriate HO2S terminal "A" and a PCM ground circuit terminal. If resistance is less than 500 ohms, go to step 17). If resistance is 500 ohms or more, go to next step.

15) Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 17).

16) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

DTC P0131: HO2S CIRCUIT VOLTAGE LOW - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies bias voltage of about 450 millivolts (mV) between HO2S high and low signal circuits. HO2S voltage ranges from about 1000 mV when exhaust is rich to about 100 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains excessively low for an extended period of time, this DTC will be set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Vehicle is in closed loop.
* Air/fuel ratio is 14.5-14.8.
* Accelerator Pedal Position (APP) indicated angle is 5-40 percent.
* Engine has been running for more than 4 minutes.
* Engine coolant temperature is more than 122°F (50°C).

DTC will set when HO2S signal voltage remains less than 175 mV during normal closed loop operation or 600 mV during power enrichment.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and operate vehicle within conditions for

setting DTC parameters in code enable criteria. Using scan tool, observe HO2S voltage parameter. If HO2S voltage remains less than 175 mV, go to step 4). If HO2S voltage does not remain less than 175 mV, go to next step.

3) Operate vehicle within failure records conditions. If scan tool indicates DTC failed this ignition, go to next step. If scan tool does not indicate DTC failed this ignition, condition that set this DTC is not present. See INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Turn ignition off. Disconnect suspect HO2S connector. Turn ignition on. If voltage reading on scan tool is less than 400 mV, go to next step. If voltage reading on scan tool is 400 mV or more, go to step7).

5) Turn ignition off. Remove jumper wire from the HO2S terminal. Disconnect PCM connectors. Using DVOM, check HO2S high signal circuit (Purple/White wire for Bank 1, Sensor 1; Purple wire for Bank 2, Sensor 1; Dark Blue wire for Bank 1, Sensor 2) for a short to ground or to HO2S low signal circuit (Tan/White wire for Bank 1, Sensor 1; Tan wire for Bank 2, Sensor 1; Gray wire for Bank 1, Sensor 2) between PCM connectors and suspect HO2S connector. If resistance of both circuits is less than 5 ohms, go to next step. If resistance of both circuits is 5 ohms or more, go to step 8).

6) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 8).

7) Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

DTC P0132: HO2S CIRCUIT VOLTAGE HIGH - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal and low signal circuits. When measured with DVOM, this may display as low as 320 mV. Oxygen sensor varies voltage within a range of about 1000 mV when exhaust is rich, down to about 10 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains excessively high for an extended period of time, this DTC will be set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Ignition 1 signal is 9-18 volts.
* Vehicle is in closed loop.
* Air/fuel ratio is 14.5-14.8.
* Accelerator Pedal Position (APP) indicated angle is

5-40 percent.

DTC will set when HO2S signal voltage remains more than 975 mV during normal closed loop operation or more than 200 mV during decel fuel cut-off.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: In the following step, observe all HO2S data parameters. If all parameters remain more than 975 mV, go to DIAGNOSTIC AIDS.

2) Start engine and run to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor appropriate HO2S voltage with engine at idle. Operate vehicle withing conditions for setting DTC in code enable criteria. If HO2S voltage is less than 775 mV, go to next step. If HO2S voltage is more than 775 mV, go to step 5).

3) Operate vehicle in decel fuel mode, with vehicle speed more than 25 MPH and TP angle less than 3 percent, while observing HO2S voltage parameter on scan tool. If HO2S voltage remains more than 110 mV while in decel fuel mode, go to step 5). If HO2S voltage does not remain more than 110 mV while in decel fuel mode, go to next step.

4) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters for suspect DTC. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, SPECIFIC, and then suspect DTC. If scan tool indicates that DTC failed this ignition, go to next step. If scan tool does not indicate that DTC failed this ignition, see DIAGNOSTIC AIDS.

5) Turn ignition off. Disconnect suspect HO2S connector. Monitor HO2S voltage using scan tool. If voltage reading is more than 550 mV, go to next step. If voltage reading 550 mV or less, go to step 8).

6) Check for a short to voltage in wiring to HO2S terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). After repairs, go to step 9)If wiring is okay, go to next step.

7) Replace PCM. After repairs, go to step 9).

8) Replace HO2S. After repairs, go to step 9).

9) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC in code enable criteria. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

10) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Inspect for the following conditions:

* Check for high fuel pressure. System will go rich if pressure is too high. PCM can compensate for some increase. However, if fuel pressure is too high, a HO2S DTC may set.

* Check for leaking fuel injectors.
* Check Evaporative Emission (EVAP) canister for fuel saturation. If EVAP canister is full of fuel, inspect canister control and hoses.
* Disconnect Mass Airflow (MAF) sensor and see if rich condition is corrected. If condition is corrected, replace MAF sensor.
* Check for a leaking fuel pressure regulator diaphragm. Disconnect vacuum line to fuel pressure regulator and check for presence of fuel.
* Check for an intermittent Throttle Position (TP) sensor problem. A faulty sensor output may cause system to go rich due to a false indication of engine acceleration.
* Check for a shorted HO2S. If HO2S is internally shorted, HO2S voltage displayed on scan tool will be more than one volt. Disconnect affected HO2S and jumper HO2S low circuit to ground with ignition on. If displayed HO2S voltage changes from more than 1000 mV to around 450 mV, replace HO2S. Silicone contamination of HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery White deposit on portion of HO2S exposed to exhaust stream. If contamination is present, replace affected HO2S.
* Check for an open HO2S high or low signal circuit or poor HO2S connection. A poor connection or open in HO2S high or low signal circuit can cause DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between rich and lean thresholds can also cause this condition. Operate vehicle while monitoring HO2S voltage with a scan tool. If HO2S voltage is limited within a range of 300-600 mV, inspect HO2S high and low signal circuit wiring and associated terminal connections. If wiring and connections are okay, replace HO2S.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0133: HO2S SLOW RESPONSE - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM continuously monitors HO2S activity for 100 seconds. During this period, PCM counts number of times HO2S responds from rich to lean and from lean to rich, and adds amount of time it took to complete transition for 100-second test period. With this information, an average time for all transitions can be determined.

A lean to rich transition is determined when HO2S voltage changes from less than 300 mV to more than 600 mV. A rich to lean transition is determined when HO2S voltage changes from more than 600 mV to less than 300 mV. If average response time is too slow, this DTC will set. A sensor that responds too slowly is most likely defective and should be replaced.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0300, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.

* Engine run time is more than 4 minutes.
* Engine Coolant Temperature (ECT) is more than 122°F (50°C).
* Engine speed is 1000-3000 RPM.
* Mass Airflow (MAF) is 13-30 grams/second.
* Engine is running in closed loop.

DTC will set when HO2S lean-to-rich average transition response time was longer than 63 milliseconds or rich-to-lean average transition response time was longer than 190 milliseconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any DTCs except HO2S are present, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Raise engine speed to 1200 RPM for 2 minutes and observe parameters on scan tool display. If voltage is varying outside 400-500 mV range, go to next step. If voltage is not varying outside 400-500 mV range, go to step 4).

3) Operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, SPECIFIC, and then suspect DTC. If scan tool indicates that DTC failed this ignition, go to next step. If scan tool does not indicate that DTC failed this ignition, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Check exhaust system for leaks. Repair as necessary. After repairs, go to step 15). If exhaust is okay, go to next step.

5) Turn ignition off. Disconnect suspect HO2S. Turn ignition on. Connect a fused jumper wire between ground and suspect HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage. If HO2S voltage is 400 mV, go to next step. If HO2S voltage is not 400 mV, go to step 10).

6) Remove jumper wire. Using DVOM, measure voltage between ground and suspect HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). If voltage is about 4.5 volts, go to next step. If voltage is not about 4.5 volts, go to step 9)

7) Using a DVOM connected to ground and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2), check for voltage. If voltage is about 5 volts, go to step 11). If voltage is not about 5 volts, go to next step.

8) Check for open or high resistance in wiring to HO2S sensor terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair wiring as necessary. After repairs, go to step 15). If wiring is okay, go to step 13).

9) Check for open or high resistance to HO2S sensor terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Repair wiring as necessary. After repairs, go to step 15). If wiring is okay, go to step 13).

10) Check for short to ground to HO2S sensor terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair wiring as necessary. After repairs, go to step 15). If wiring is okay, go to step 14).

11) Check for poor connections at HO2S. Repair connections as necessary. After repairs, go to step 15). If connections are okay, go to next step.

12) Determine cause of HO2S sensor contamination. Check for oil or coolant consumption, use of improper RTV sealant, or alcohol/contaminated fuel. Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 15)

13) Check for poor connections at PCM. After repairs, go to step 15). If connections are okay, go to next step.

14) Replace PCM. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0134: HO2S CIRCUIT INSUFFICIENT ACTIVITY - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Powertrain Control Module (PCM) supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal and low signal circuits. When measured with a DVOM, this may display as low as 320 mV. Oxygen sensor varies voltage within a range of about 1000 mV when exhaust is rich, down to about 10 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains at or near 450 mV bias for an extended period of time, this DTC will set, indicating an open sensor signal or sensor low circuit.

Code Enable Criteria

For DTC to run, DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set. DTC will set when HO2S signal voltage remains at 400-500 mV.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Before performing next test step, ensure all HO2S are secure in exhaust pipe. A loose sensor can cause DTC to set.

NOTE: If any DTCs except HO2S DTCs are present, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Increase engine speed to 1200 RPM for 2 minutes. Using scan tool, select ENGINE 1 and note suspect HO2S voltage. If voltage varies from

less than 400 mV to more than 500 mV, go to next step. If voltage does not vary from less than 400 mV to more than 500 mV, go to step 4).

3) Turn engine off if necessary. Turn ignition on. Using scan tool, read and record FAILURE RECORDS data. Turn ignition off for 30 seconds. Start engine and operate vehicle within conditions noted in FAILURE RECORDS data. Using scan tool, read SPECIFIC DTC. If scan tool indicates DTC failed this ignition, go to next step. If scan tool does not indicate DTC failed this ignition, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Check for an exhaust leak, an incorrectly installed HO2S or damaged wiring. After repairs, go to step 15). If no problems were found, go to next step.

5) Disconnect suspect HO2S. Turn ignition on. Connect jumper wire between HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and ground. Using scan tool, observe HO2S voltage parameter. If scan tool indicates HO2S voltage is more than 400 mV, go to next step. If voltage is 400 mV or less, go to step 10).

6) Remove jumper wire. Using DVOM connected to ground, measure voltage to HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). If voltage is about 4.5 volts, go to next step. If voltage is not about 4.5 volts, go to step 9).

7) Using a DVOM, measure voltage between ground and terminal "A" of HO2S (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). If voltage reading is about 5 volts, go to step 11). If voltage reading is not about 5 volts, go to next step.

8) Check wiring to HO2S terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for an open or high resistance. Repair as necessary. After repairs, go to step 15). If connections are okay, go to step 13).

9) Check wiring to HO2S terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for an open or high resistance. Repair as necessary. After repairs, go to step 15). If connections are okay, go to step 13).

10) Check wiring to HO2S terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for a short to ground. Repair as necessary. After repairs, go to step 15). If connections are okay, go to step 14).

11) Check HO2S sensor for poor connections. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

12) Determine cause of HO2S sensor contamination. Check for oil or coolant consumption, use of improper RTV sealant, or alcohol/contaminated fuel. Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 15).

13) Check PCM connectors for poor connections. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0135: HO2S HEATER PERFORMANCE - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Heated Oxygen Sensors (HO2S) are used in order to minimize amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. HO2S heater greatly decreases amount of time required for fuel control sensors to become active. HO2S heater is also required by catalyst monitor sensor to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from engine. PCM will run heater test only after a cold start, and only once during an ignition cycle. A cold start is determined by Engine Coolant Temperature (ECT) and Intake Air Temperature (IAT) at time of start-up.

When engine is started, PCM monitors HO2S voltage. When HO2S voltage indicates a sufficiently active sensor, PCM looks at how much time has elapsed since start-up. If PCM determines that too much time was required for HO2S to become active, this DTC will set. Time for HO2S to reach operating temperature is based on ECT at start-up and average Mass Airflow (MAF) since start-up. Higher average airflow or higher start-up ECT equals a shorter time to HO2S activity.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449 or P1441 are not set.
* Intake Air Temperature (IAT) and Engine Coolant Temperature (ECT) are less than 95°F (122°C) and within 11°F (6°C) of each other at engine start-up.
* Average Mass Airflow (MAF) for sample period is less than 20 grams/second.
* System voltage is 9-18 volts.

DTC will set when HO2S voltage remains within 150 mV of bias voltage (about 450 mV) for a longer time than normal. Amount of time ranges between 42 seconds and 2 minutes.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If engine has been operating, allow engine to cool for about 1/2 hour before proceeding with test.

2) Turn ignition off. Install scan tool. Turn ignition on. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage parameter. If suspect HO2S voltage changes from bias voltage to less than 300 mV or more than 600 mV, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM. If HO2S voltage does not change from bias voltage to less than 300 mV or more than 700 mV, go to next step.

3) Check ENG SEN fuse (20-amp) located in bottom underhood fuse block. If fuse is blown, go to step 13). If fuse is okay, go to next step.

4) Ensure ignition is on. Raise and support vehicle. Disconnect suspect HO2S connector. Connect a test light between ground and suspect HO2S connector terminal "D" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

5) Connect test light between HO2S connector terminals "C" (Black wire) and "D" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

6) Allow HO2S to cool for at least 10 minutes. Using DVOM, measure resistance between HO2S connector terminals "C" (Black wire) and "D" (Pink wire). If resistance is 5-10 ohms, go to step 9). If resistance is not 5-10 ohms, go to step 12).

7) Repair open in Pink wire between suspect HO2S connector terminal "D" and splice S104 located in engine harness approximately 6" from PCM harness breakout. After repairs, go to step 14).

8) Repair open in Black wire between suspect HO2S connector terminal "C" and splice S108 located in main engine harness approximately 2" from transmission harness breakout (A/T) or approximately 5" from VSS harness breakout (M/T). After repairs, go to step 14).

9) Check for poor connection at HO2S. If a problem is found, repair as necessary. After repairs, go to step 14). If problem was not found, go to next step.

10) Check wiring to HO2S terminals "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for an open. If problem was found and corrected, go to 14). If no problem was found, go to next step.

11) Check for poor connection at suspect HO2S connector terminals "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2), and at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to next step.

12) Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 14).

13) Locate and repair short to ground in Pink wire between suspect HO2S and splice S104 located in engine harness approximately 6" (15 cm) from PCM harness breakout. After repairs, replace fuse and go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0137: HO2S CIRCUIT LOW VOLTAGE - BANK 1, SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

In order to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a 3-way catalytic converter is used. Catalyst within the converter promotes a chemical reaction which oxidizes HC and CO present in exhaust gas, converting them into harmless water vapor and carbon dioxide. Catalyst also reduces NOx, converting NOx to nitrogen. PCM has the ability to monitor this process using the post-catalyst heated oxygen sensor (HO2S). This HO2S produces an output signal which indicates oxygen storage capacity of catalyst. This in turn indicates the catalysts ability to convert exhaust gases efficiently. If post HO2S signal voltage remains excessively low for an extended period of time, this DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine is running in closed loop.
* Accelerator Pedal Position (APP) indicated angle is 5-40 percent.
* Air/fuel ratio is 14.5-14.8.
* Engine Coolant Temperature (ECT) is more than 165°F (75°C).

DTC will set when post-HO2S signal voltage remains less than 60 mV during normal closed loop operation or less than 600 mV during power enrichment mode.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and run to normal operating temperature. Operate vehicle within parameters for setting DTC. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage display. If voltage reading remains less than 60 mV, go to step 4). If voltage reading does not remain less than 60 mV, go to next step.

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Raise and support vehicle. Locate and disconnect suspect HO2S connector. Connect a jumper wire between ground and suspect HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2 Sensor 2; Gray wire on Bank 1, Sensor 2). Turn ignition on. Monitor HO2S voltage with scan tool. If voltage reading is about 450 mV, go to DIAGNOSTIC AIDS. If voltage reading is not about 450 mV, go to next step.

5) Check wiring to HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for a short to ground or short to sensor ground circuit. If problem was found and corrected, go to next step. If problem was not found, go to step 7).

6) Replace suspect HO2S. See REMOVAL, OVERHAUL & INSTALLATION

- CARS article. After repairs, go to step 8).
7) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.
8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
Check for low fuel pressure, fuel injector leaks, vacuum leaks, exhaust leaks, faulty MAF sensor and fuel contamination.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0138: HO2S CIRCUIT HIGH VOLTAGE - BANK 1, SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. Catalyst within the converter promotes a chemical reaction which oxidizes HC and CO present in exhaust gas, converting them into harmless water vapor and carbon dioxide. Catalyst also reduces NOx, converting NOx to nitrogen. PCM has the ability to monitor this process using post-catalyst Heated Oxygen Sensor (HO2S). This sensor produces an output signal which indicates oxygen storage capacity of catalyst, this in turn indicates catalysts ability to convert exhaust gases efficiently. If post HO2S voltage remains excessively high for an extended period of time, this DTC will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201, P0202, P0203, P0204, P0205, P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine is running in closed loop.
* Air/fuel ratio is 14.5-14.8.
* Accelerator Pedal Position (APP) indicated angle is 5-40 percent.

DTC will set when post-HO2S signal voltage remains more than 999 mV during normal closed loop operation or more than 200 mV during deceleration fuel mode operation.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Observe pre-catalyst HO2S voltage parameters. If pre-catalyst HO2S voltage parameters remain more than 600 mV, see DIAGNOSTIC AIDS.

2) Start engine and run to normal operating temperature. Operate vehicle within conditions for setting parameters in code enable criteria. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S display. If voltage is more than 999 mV, go to step 4). If voltage is 999 mV or less, go to next step.

3) Turn engine off. Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter DTC. If scan tool indicates that test failed this ignition, go to next step. If scan tool does not indicate that test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Raise and support vehicle. Disconnect suspect HO2S connector. Connect a jumper wire between ground and suspect HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Turn ignition on. Monitor HO2S voltage with scan tool. If voltage reading is about 450 mV, go to DIAGNOSTIC AIDS. If voltage reading is not about 450 mV, go to next step.

5) Turn ignition off. Disconnect PCM connectors. Turn ignition on. Using a DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). If voltages is more than 999 mV, go to next step. If voltage is 999 mV or less, go to step 7).

6) Repair short to voltage in wiring to HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). After repairs, go to step 8).

7) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for high fuel pressure, faulty fuel injectors, fuel saturated EVAP canister, EVAP canister control and hoses, MAF sensor, leaking fuel pressure regulator diaphragm or intermittent TP sensor output.

Check for a shorted HO2S. If HO2S is internally shorted, HO2S voltage displayed on scan tool will be more than one volt. Disconnect affected HO2S and jumper HO2S terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) to ground with ignition on. If displayed HO2S voltage changes from more than 1000 mV to about 450 mV, replace faulty HO2S.

Silicone contamination of HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery White deposit on HO2S. A poor connection or open in HO2S high signal or low signal circuit can cause DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing

between rich and lean thresholds can also cause this condition. Operate vehicle while monitoring HO2S voltage with a scan tool. If HO2S voltage is limited within a range of 300-600 mV, inspect HO2S high and low signal circuit wiring and connections. If wiring and connections are okay, replace faulty HO2S.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0140: HO2S CIRCUIT INSUFFICIENT ACTIVITY - BANK 1, SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a 3-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes HC and CO present in exhaust gas, converting these chemicals into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting NOx to nitrogen. PCM has the ability to monitor this process using post-catalyst Heated Oxygen Sensor (HO2S). This sensor produces an output signal which indicates oxygen storage capacity of the catalyst. This in turn indicates the catalyst's ability to convert exhaust gases efficiently. If post HO2S signal voltage remains at or near 450 mV bias for an extended period of time, this DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine has been running for more than 4 minutes.

DTC will set when post-catalst HO2S signal voltage remains at 412-490 mV during normal closed loop operation and Accelerator Pedal Position (APP) sensor indicated angle change is more than 1.5 percent at least 6 times.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any DTCs except HO2S DTCs are present, repair those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Increase engine speed to more than 1200 RPM for 2 minutes. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage parameter. If voltage reading is 412-490 mV, go to next step. If voltage reading is not 412-490 mV, go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, and then enter DTC. If scan tool indicates that test failed this ignition, go to next step. If

scan tool does not indicate that test failed this ignition, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Check for exhaust leaks, incorrectly installed HO2S and damaged wiring. If problem was found and corrected, go to step 15). If no problems were found, go to next step.

5) Turn ignition on. Disconnect HO2S. Jumper HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) to a good ground. Using scan tool, observe HO2S voltage parameter. If scan tool indicates HO2S voltage is more than 400 mV, go to next step. If scan tool indicates HO2S voltage is 400 mV or less, go to step 10).

6) Remove jumper wire. Using a DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). If voltage is about 4.5 volts, go to next step. If voltage is not about 4.5 volts, go to step 9).

7) Turn ignition on. Measure voltage at HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). If voltage is about 5 volts, go to step 11). If voltage is not about 5 volts, go to next step.

8) Check for open or high resistance in wiring between PCM and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

9) Check for open or high resistance in wiring between PCM and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

10) Check for short to ground in wiring between PCM and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).

11) Check for poor connection at HO2S connector. Repair as necessary. After repairs, go to step 15). If connection is okay, go to next step.

12) Determine cause of contamination before replacing HO2S. Check for alcohol/contaminants in fuel, excessive engine oil or coolant consumption, or use of improper RTV sealant. Remove HO2S and visually inspect sensor to check for contamination. If contaminated, portion of sensor exposed to exhaust stream will have a White powdery coating. Silicone contamination causes a high but false HO2S signal voltage (rich exhaust indication). PCM will then reduce amount of fuel delivered to engine, causing a severe driveability problem. Eliminate source of contamination before replacing oxygen sensor. Replace defective HO2S sensor. After repairs, go to step 15).

13) Check for poor connection from HO2S wiring at PCM connector. Repair as necessary. After repairs, go to step 15). If connection is okay, go to next step.

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0141: HO2S HEATER PERFORMANCE - BANK 1, SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Heated Oxygen Sensors (HO2S) are used to minimize amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. Oxygen Sensor (O2S) heater greatly decreases amount of time required for pre-catalyst oxygen sensors to become active. An O2S heater is required by catalyst monitor sensor to maintain a sufficiently high temperature, which allows accurate exhaust oxygen content readings further from engine.

PCM will run heater test only after a cold start, and only once during an ignition cycle. Cold start is determined by Engine Coolant Temperature (ECT) and Intake Air Temperature (IAT) at time of start-up. When engine is started, PCM will monitor HO2S voltage. When post-HO2S voltage indicates a sufficiently active sensor, PCM looks at how much time has elapsed since start-up. If PCM determines that too much time was required for post-HO2S to become active, this DTC will set. Amount of time HO2S should reach operating temperature is based on ECT at start-up and average Mass Airflow (MAF) since start-up. The higher average airflow, or higher start-up ECT equals a shorter time to HO2S activity.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* System voltage is 9-18 volts.
* Intake Air Temperature (IAT) is less than 95°F (35°C) at start-up.
* Engine Coolant Temperature (ECT) is less than 95°F (35°C) at start-up.
* ECT and IAT are withing 11°F of each other.
* Average Mass Airflow (MAF) for sample period is less than 22.7 grams/second.

DTC will set when post-HO2S voltage remains within 150 mV of bias voltage (about 450 mV). Amount of time depends on engine coolant temperature at start-up, and on average airflow since start-up.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If engine has just been operating, allow engine to cool for about 1/2 hour before proceeding.

2) Turn ignition on. Using scan tool, observe HO2S voltage parameter. If HO2S voltage varies from bias voltage to more than 600 mV or less than 300 mV, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM. If HO2S voltage does not vary from bias

voltage to more than 600 mV or less than 300 mV, go to next step.
3) Check ENG SEN fuse (20-amp). If fuse open, go to step 15). If fuse is okay, go to next step.
4) Disconnect HO2S. Using a test light connected to a good ground, probe HO2S connector terminal "D" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
5) Connect a test light between Pink and Black wires at HO2S connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6) Allow HO2S to cool for at least 10 minutes. Measure resistance between Pink and Black wires at HO2S pigtail using a DVOM. If resistance is 5-10 ohms, go to step 9). If resistance is not 5-10 ohms, go to step 14).
7) Repair open in Pink wire between ENG SEN fuse (20-amp) ground and HO2S terminal "C". After repairs, go to step 16).
8) Repair open in Black wire between ground and HO2S terminal "C". After repairs, go to step 16).
9) Check for poor connection at HO2S connector. Repair as necessary. If problem was found and corrected, go to step 16). If problem was not found, go to next step.
10) Check for continuity of wiring between PCM and HO2S connector terminals "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Repair as necessary. If problem was found and corrected, go to step 16). If problem was not found, go to next step.
11) Check for poor connection at HO2S connector terminals "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Repair as necessary. If problem was found and corrected, go to step 16). If problem was not found, go to next step.
12) Check for poor connection at PCM to HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 2; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair as necessary. If problem was found and corrected, go to step 16). If problem was not found, go to next step.
13) Check for poor connection at PCM to HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 2; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). Repair as necessary. If problem was found and corrected, go to step 16). If problem was not found, go to next step.
14) Replace HO2S. After repairs, go to step 16).
15) Repair short to ground in wiring between ENG SEN fuse (20-amp) and HO2S connector terminal "D" (Pink wire) and replace faulty fuse. After repairs, go to next step.
16) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
17) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0150: HO2S CIRCUIT MALFUNCTION - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal circuit and HO2S low signal circuit. When measured with a 10-megohm DVOM, this may display as low as 350 mV. Oxygen sensor signal varies from about 1000 mV when exhaust is rich, to about 100 mV when exhaust is lean. If HO2S 1 voltage remains at or near 450 mV bias for an extended period of time, DTC P0154 is set. If signal amplitude of HO2S bank 1 sensor exceeds lack of activity thresholds, such as DTC P0134, but will not allow closed loop operation, DTC P0150 will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine has been running for at least 4 minutes.
* Engine Coolant Temperature (ECT) is at least 122°F (50°C).
* Engine RPM is 1000-3000 RPM.
* Airflow is 13-30 grams/second.
* Accelerator Pedal Position (APP) indicated angle is 5-40 percent.
* Ignition voltage is 9-18 volts.

DTC will set when PCM detects an active sensor with an improper HO2S voltage amplitude.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Clear DTCs using scan tool. Reset fuel trim values. Start and idle engine until normal operating temperature is reached. Using scan tool, observe HO2S voltage for suspect sensor. If HO2S voltage is fixed within 300-600 mV, go to step 4). If HO2S voltage is not fixed within 300-600 mV, go to next step.

3) Condition that set this DTC is not present. DTC may have been set by HO2S connector water intrusion, intermittent open in HO2S high signal circuit, intermittent open in HO2S low signal circuit, HO2S low signal circuit with high resistance to ground, PCM ground circuits with high resistance to ground, inoperative HO2S heater, poor HO2S or PCM connector terminal connection, exhaust system leak or defective HO2S. Repair problem as necessary. After repairs, go to step 17). If problem was not found, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Turn ignition off. Disconnect suspect HO2S connector. Jumper HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) to a known good ground. Jumper HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) to a known good ground. Turn ignition on. Using a scan tool, observe HO2S voltage for suspect sensor. If voltage measures less than 20 mV, go to step 7). If voltage is 20 mV or more, go to next step.

5) Turn ignition off. Remove jumper wires from HO2S terminals. Disconnect PCM connectors C1 and C2. Using a DVOM, measure

continuity of wiring between PCM and HO2S connector terminals "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2). If resistance in both circuits is less than 5 ohms, go to next step. If resistance in either circuit is 5 ohms or more, go to step 9).

6) Check for poor connections at PCM connector. Repair wiring as necessary. After repairs, go to step 17). If connections are okay, go to step 16).

7) Remove jumper wires from HO2S terminals. Connect test light between HO2S connector terminals "C" (Black wire) and "D" (Pink wire). Turn ignition on. If test light illuminates, go to next step. If test light does not illuminate, go to step 10).

8) Turn ignition off. Reconnect HO2S connector. Disconnect PCM connector C1. Using DVOM, measure resistance between appropriate PCM connector C1 terminal (No. 12 on Bank 1, Sensor 1; No. 29 on Bank 2, Sensor 1; No. 28 on Bank 1, Sensor 2) and one of the PCM ground circuit terminals. If resistance is less than 500 ohms, go to step 12). If resistance is 500 ohms or more, go to step 11).

9) Repair wiring that measured high resistance. After repairs, go to step 17).

10) Repair wiring to HO2S connector terminals "C" (Black wire) and "D" (Pink wire) for open or high resistance, poor ground connection, or open ENG SEN fuse (20-amp). After repairs, go to step 17).

11) Repair high resistance in wiring between HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and PCM ground circuit. Probable causes include the following:

* Poor HO2S connector terminal connection.
* Open sensor harness low signal circuit, this requires HO2S replacement.
* Sensor harness low signal circuit with high resistance, this requires HO2S replacement
* Poor PCM ground connection.
* High PCM ground circuit resistance.
* Ungrounded exhaust system.

After repairs, go to step 17).

12) Inspect for exhaust system leaks upstream of suspect HO2S. Leak may be very small and will typically be within 12" of suspect HO2S. Repair exhaust as necessary. After repairs, go to step 17). If no problem was found, go to next step.

13) Allow engine to cool to ambient temperature. Using a DVOM, measure resistance between HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and a PCM ground circuit terminal. If resistance is less than 500 ohms, go to step 15). Of resistance is 500 ohms or more, go to next step.

14) Remove suspect HO2S from exhaust. Clean HO2S mounting threads. Apply anti-seize sensor threads. Tighten HO2S to specification. Using a DVOM, measure resistance between HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) and a PCM ground circuit terminal. If resistance is less than 500 ohms, go to step 17). Of resistance is 500 ohms or more, go to next step.

15) Replace HO2S. After repairs, go to step 17).

16) Replace PCM. After repairs, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC.

If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0151: HO2S CIRCUIT LOW VOLTAGE - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal and low signal circuits. When measured with a DVOM, this may display as low as 350 mV. Oxygen sensor (O2S) varies voltage within a range of about 1000 mV when exhaust is rich, down through about 100 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains excessively low for an extended period of time, this DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Vehicle is in closed loop.
* Air/fuel ratio is 14.5-14.8.
* Accelerator Pedal Position (APP) sensor indicated angle is 5-40 percent.

DTC will set when HO2S signal voltage remains less than 175 mV during normal closed loop operation or HO2S signal voltage remains less than 600 mV during power enrichment.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Observe all HO2S voltage parameters. If all parameters remain less than 400 mV, see DIAGNOSTIC AIDS.

2) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Using scan tool, observe HO2S parameter. If voltage remains less than 400 mV, go to step 4). If HO2S voltage does not remain less than 400 mV, go to next step.

3) Operate vehicle within Failure Records conditions. If scan tool indicates that test failed this ignition, go to next step. If scan tool does not indicate that test failed this ignition, see DIAGNOSTIC AIDS.

4) Disconnect suspect HO2S. Turn ignition on. If scan tool indicates HO2S voltage is less than 400 mV, go to next step. If scan tool indicates HO2S voltage is 400 mV or more, go to step 7).

5) Check wiring to HO2S terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for a short to ground or sensor ground circuit. Repair wiring as necessary. After repairs, go to step 8). If no problems were found, go to next step.

6) Replace PCM. After repairs, go to step 8).

7) Replace HO2S. After repairs, go to next step.

8) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for throttle body inlet screen blockage, faulty fuel injectors, low fuel pressure, exhaust leaks, faulty Mass Airflow (MAF) sensor, and water/alcohol contaminated fuel.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0152: HO2S CIRCUIT HIGH VOLTAGE - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal and low signal circuits. When measured with a DVOM, this may display as low as 320 mV. Oxygen sensor (O2S) varies voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains excessively high for an extended period of time, this DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Vehicle is in closed loop.
* Air/fuel ratio is 14.5-14.8.
* Accelerator Pedal Position (APP) sensor indicated angle is 5-40 percent.

DTC will set when HO2S signal voltage remains more than 975 mV during normal closed loop operation or HO2S signal voltage remains more than 200 mV during decel fuel cutoff.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Observe all HO2S voltage parameters. If all parameters remain more than 600 mV, see DIAGNOSTIC AIDS.

2) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for diagnostic to run in code enable criteria, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Using scan tool, observe HO2S parameter. If voltage remains more than 600 mV, go to step 5). If HO2S voltage does not remain more than 600 mV, go to next step.

3) Operate vehicle in Decel fuel mode (vehicle speed more than 25 MPH and TP angle less than 3 percent) while observing HO2S voltage parameter on scan tool. If HO2S voltage remains more than 110 mV while in Decel fuel mode, go to step 5). If HO2S voltage remains 110 mV or less while in Decel fuel mode, go to next step.

4) Operate vehicle within Failure Records conditions. If scan tool indicates that test failed this ignition, go to next step. If scan tool does not indicate that test failed this ignition, see DIAGNOSTIC AIDS.

5) Disconnect suspect HO2S. If scan tool indicates HO2S voltage is more than 500 mV, go to next step. If scan tool indicates HO2S voltage is 500 mV or less, go to step 8).

6) Check wiring to HO2S terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for a short to voltage. Repair wiring as necessary. After repairs, go to step 9). If no problems were found, go to next step.

7) Replace PCM. After repairs, go to step 9).

8) Replace HO2S. After repairs, go to next step.

9) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

10) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for high fuel pressure, faulty fuel injectors, fuel saturation of Evaporative (EVAP) canister, defective canister control and hoses, faulty Mass Airflow (MAF) sensor, leaking fuel pressure regulator diaphragm, intermittent Throttle Position (TP) sensor output, internally shorted HO2S, silicone contaminated HO2S, open HO2S high or low signal circuit or faulty HO2S.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0153: HO2S SLOW RESPONSE - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM continuously monitors Heated Oxygen Sensor (HO2S) activity. PCM counts number of times that a rich-to-lean and a lean-to-rich response is indicated. Then, the PCM adds the amount of time taken to complete all transitions for a 100 second test period. With this information, an average time for each transition can be

determined. If average response time is too slow, a DTC P0133 will be set. A lean-to-rich transition is indicated when HO2S voltage changes from less than 300 mV to more than 600 mV. A rich-to-lean transition is indicated when HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0300, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set.
* Engine Coolant Temperature (ECT) is more than 122°F (50°C).
* Engine speed is 1000-3000 RPM.
* Mass Airflow (MAF) is 10-30 grams/second.

DTC will set when HO2S lean-to-rich average transition response time was longer than 63 milliseconds or rich-to-lean average transition response time was longer than 190 milliseconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any DTCs except HO2S DTCs are present, repair those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Increase engine speed to more than 1200 RPM for 2 minutes. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage parameter. If voltage reading is varying outside 400-500 mV, go to next step. If voltage reading is not varying outside 400-500 mV, go to step 4).
3) Operate vehicle within conditions of FREEZE FRAME/FAILURE RECORDS. If scan tool indicates DTC failed this ignition, go to next step. If scan tool does not indicate DTC failed this ignition, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.
4) Check for an exhaust leak, incorrectly installed HO2S or damaged wiring. Repair as necessary. After repairs, go to step 15). If no problems were found, go to next step.
5) Turn ignition on. Disconnect HO2S. Connect jumper wire between ground and PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2). Using a scan tool, observe HO2S voltage parameter. If scan tool indicates HO2S voltage is more than 400 mV, go to next step. If scan tool indicates HO2S voltage is 400 mV or less, go to step 10).
6) Remove jumper wire. Using a DVOM, measure voltage between ground and PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2). If voltage reading is about 4.5 volts, go to next step. If voltage reading is not about 4.5 volts, go to step 9).
7) Using a DVOM, measure voltage between ground and PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2). If voltage reading is about 5 volts, go to step 11). If voltage reading is not about 5 volts, go to next step.
8) Using a DVOM, check wiring between PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2) and HO2S connector

terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for an open or high resistance. After repairs, go to step 15). If no problem is found, go to step 13).

9) Using a DVOM, check wiring between PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2) and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for an open or high resistance. After repairs, go to step 15). If no problem is found, go to step 13).

10) Using a DVOM, check wiring to HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for a short to ground. After repairs, go to step 15). If no problem is found, go to step 14).

11) Check for poor connections at HO2S. After repairs, go to step 15). If no problem is found, go to next step.

12) Determine cause of HO2S contamination before replacing sensor. Check for fuel contamination, excessive engine oil or coolant consumption, use of an inappropriate RTV sealant (not oxygen sensor safe). Remove HO2S and visually inspect portion of HO2S exposed to exhaust stream in order to check for contamination. If contaminated, portion of HO2S exposed to exhaust stream will have a White powdery coating. Silicone contamination causes a high but false HO2S signal voltage (rich exhaust indication). PCM will then reduce amount of fuel delivered to engine, causing a severe driveability problem. Eliminate source of contamination before replacing the oxygen sensor. Replace affected HO2S sensor. After repairs, go to step 15).

13) Inspect for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If no problems were found, go to next step.

14) Replace PCM. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0154: HO2S CIRCUIT INSUFFICIENT ACTIVITY - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM supplies a bias voltage of about 450 mV between Heated Oxygen Sensor (HO2S) high signal and low signal circuits. When measured with a DVOM, this may display as low as 320 mV. Oxygen Sensor (O2S) varies voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. PCM constantly monitors HO2S signal during closed loop operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If HO2S voltage remains at or near 450 mV bias for an extended period of time, this DTC will set, indicating an open HO2S high signal or HO2S low signal circuit.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, DTC P0201-P0206, P0410, P0440, P0442, P0443, P0446, P0449 or P1441 are not set.
* Engine has been running for more than 4 minutes. DTC will set when HO2S signal voltage remains at 400-500 mV.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any DTCs except HO2S DTCs are present, repair those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Increase engine speed to more than 1200 RPM for 2 minutes. Using scan tool, select ENGINE 1 DATA LIST and monitor suspect HO2S voltage parameter. If voltage reading is varying outside 400-500 mV, go to next step. If voltage reading is not varying outside 400-500 mV, go to step 4).

3) Operate vehicle within conditions of FREEZE FRAME/FAILURE RECORDS. If scan tool indicates DTC failed this ignition, go to next step. If scan tool does not indicate DTC failed this ignition, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

4) Check for an exhaust leak, incorrectly installed HO2S or damaged wiring. Repair as necessary. After repairs, go to step 15). If no problems were found, go to next step.

5) Turn ignition on. Disconnect HO2S. Connect jumper wire between ground and PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2). Using a scan tool, observe HO2S voltage parameter. If scan tool indicates HO2S voltage is more than 400 mV, go to next step. If scan tool indicates HO2S voltage is 400 mV or less, go to step 10).

6) Remove jumper wire. Using a DVOM, measure voltage between ground and PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2). If voltage reading is about 4.5 volts, go to next step. If voltage reading is not about 4.5 volts, go to step 9).

7) Using a DVOM, measure voltage between ground and PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2). If voltage reading is about 5 volts, go to step 11). If voltage reading is not about 5 volts, go to next step.

8) Using a DVOM, check wiring between PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2) and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for an open or high resistance. After repairs, go to step 15). If no problem is found, go to step 13).

9) Using a DVOM, check wiring between PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2) and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) for an open or high resistance. After repairs, go to step 15). If no problem is found, go to step 13).

10) Using a DVOM, check wiring to HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for a short to ground. After repairs, go to step 15). If no problem is found, go to step 14).

11) Check for poor connections at HO2S. After repairs, go to step 15). If no problem is found, go to next step.

12) Determine cause of HO2S contamination before replacing sensor. Check for fuel contamination, excessive engine oil or coolant consumption, use of an inappropriate RTV sealant (not oxygen sensor safe). Remove HO2S and visually inspect portion of HO2S exposed to exhaust stream in order to check for contamination. If contaminated, portion of HO2S exposed to exhaust stream will have a White powdery coating. Silicone contamination causes a high but false HO2S signal voltage (rich exhaust indication). PCM will then reduce amount of fuel delivered to engine, causing a severe driveability problem. Eliminate source of contamination before replacing the oxygen sensor. Replace affected HO2S sensor. After repairs, go to step 15).

13) Inspect for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If no problems were found, go to next step.

14) Replace PCM. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

DTC P0155: HO2S HEATER CIRCUIT - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Code Enable Criteria
Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If engine has just been operating, allow engine to cool for about 1/2 hour before proceeding.

2) Turn ignition on. Using scan tool, observe HO2S voltage parameter. If HO2S voltage varies from bias voltage to more than 600 mV or less than 300 mV, go to INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM. If HO2S voltage does not vary from bias voltage to more than 600 mV or less than 300 mV, go to next step.

3) Check ENG SEN fuse (20-amp). If fuse is open, go to step 13). If fuse is okay, go to next step.

4) Disconnect HO2S. Using a test light connected to a good ground, probe HO2S connector terminal "D" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 7).

5) Connect a test light between Pink and Black wires at HO2S connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

6) Allow HO2S to cool for at least 10 minutes. Measure resistance between Pink and Black wires at HO2S pigtail using a DVOM.

If resistance is 5-10 ohms, go to step 9). If resistance is not 5-10 ohms, go to step 12).

7) Repair open in Pink wire between suspect HO2S connector terminal "D" and splice S104 located in engine harness approximately 6" from PCM harness breakout. After repairs, go to step 14).

8) Repair open in Black wire between ground and HO2S connector terminal "C". After repairs, go to step 14).

9) Check for poor connection at HO2S connector. Repair as necessary. After repairs, go to step 14). If no problem was found, go to next step.

10) Using a DVOM, check wiring between PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2) and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2) and between PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2) and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2) for an open or high resistance. Repair as necessary. After repairs, go to step 14). If no problem is found, go to next step.

11) Check connections at PCM connector C2 (terminal No. 12 on Bank 1, Sensor 1; terminal No. 10 on Bank 2, Sensor 1; terminal No. 11 on Bank 1, Sensor 2) and HO2S connector terminal "B" (Purple/White wire on Bank 1, Sensor 1; Purple wire on Bank 2, Sensor 1; Dark Blue wire on Bank 1, Sensor 2), and at PCM connector C1 (terminal No. 27 on Bank 1, Sensor 1; terminal No. 29 on Bank 2, Sensor 1; terminal No. 28 on Bank 1, Sensor 2) and HO2S connector terminal "A" (Tan/White wire on Bank 1, Sensor 1; Tan wire on Bank 2, Sensor 1; Gray wire on Bank 1, Sensor 2). Repair as necessary. After repairs, go to step 14). If no problem is found, go to next step.

12) Replace HO2S. After repairs, go to step 14).

13) Repair short to ground in Pink wire between HO2S connector terminal "D" and ENG SEN fuse (20-amp). After repairs, go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

DTC P0171: FUEL TRIM SYSTEM LEAN - BANK 1; P0174: FUEL TRIM SYSTEM LEAN - BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM monitors oxygen sensor signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery is indicated by long and short term fuel trim values.

Short term fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. Long term fuel trim values changes in response to trends in short term fuel trim. Long term fuel trim makes coarse adjustments to fueling in order to re-center and restore control to short term fuel trim. Long term and short term fuel trim can be monitored by use of scan tool.

Ideal fuel trim value is about zero percent. A positive fuel trim indicates that PCM is adding fuel to compensate for a lean condition. A negative fuel trim indicates that PCM is reducing amount of fuel to compensate for rich condition.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0121, P0122, P0123, P0130, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0201, P0202, P0203, P0204, P0205, P0206 P0300, P0401, P0403, P0404, P0404, P0405, P0410, P0440, P0442, P0446, P0506, P0507, P1404, or P1441 are not set.
* Engine Coolant Temperature (ECT) is 68-230°F (20-110°C).
* Intake Air Temperature (IAT) is 64-158°F (18-70°C).
* Manifold Absolute Pressure (MAP) is 2.1-15.2 psi (15-105 kPa).
* Vehicle speed is less than 82 MPH.
* Engine speed is 600-4000 RPM.
* Barometric Pressure (BARO) is more than 70 kPa (10.1 psi).
* Mass Airflow (MAF) is 5-150 g/s.
* Fuel level is more than 10 percent.

DTC will set when average long term fuel trim cell value is above 20 percent for 6 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present, except P0171 or P0174, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Ensure system is in closed-loop. Using scan tool, record long term fuel trim. Turn engine off. Turn ignition on. Review FREEZE FRAME/FAILURE RECORDS for DTC. If long term fuel trim is more than 23 percent, go to next step. If long term fuel trim is less than 23 percent, go to DIAGNOSTIC AIDS.
3) Start engine and allow to idle. Observe suspect HO2S using scan tool. If HO2S reading is fluctuating between 200 and 800 mV, go to next step. If HO2S reading is not fluctuating or not 200-800 mV, go to step 5).
4) Turn engine off. Visually check for damaged or improperly routed/connected vacuum hoses. DTC will set if fuel pressure is too low. Check that fuel tank has adequate fuel to run diagnostics. Check for contaminated fuel. Repair condition as necessary. After repairs, go to step 7). If conditions are not found, go to step 6).
5) Check for proper installation of suspect HO2S. Ensure HO2S harness is not contacting exhaust system. Check for short between HO2S wires. Repair as necessary. After repairs, go to step 7). If conditions are not found, diagnose fuel system. See appropriate SYSTEM & COMPONENT TESTING article.
6) With engine operating at idle, check for the following conditions:

* Missing, loose or leaking exhaust components before HO2S.
* Vacuum leaks at throttle body, injector "O" rings or intake manifold.
* Air leaks in air induction system.

* Leaks in AIR system, improper air delivery to AIR system or malfunctioning shut-off valves.
* Leaking crankcase ventilation system.

Repair as necessary. After repairs, go to next step. If conditions are not found, diagnose engine mechanical condition. Repair engine mechanical condition as necessary.

NOTE: After performing any repairs, use fuel trim reset function on scan tool to reset long term fuel trim.

7) Using scan tool, select FUEL TRIM RESET function to reset long term fuel trim and clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

8) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

System will go lean if and injector is not supplying enough fuel. Engine may go lean during acceleration or under load because of a fuel pump without adequate supply capabilities.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0172: FUEL TRIM SYSTEM RICH - BANK 1; DTC P0175: FUEL TRIM SYSTEM RICH - BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM monitors oxygen sensor signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery is indicated by long and short term fuel trim values.

Short term fuel trim values change rapidly in response to HO2S signal voltages. These changes fine tune engine fueling. Long term fuel trim values changes in response to trends in short term fuel trim. Long term fuel trim makes coarse adjustments to fueling in order to re-center and restore control to short term fuel trim. Long term and short term fuel trim can be monitored by use of scan tool.

Ideal fuel trim value is about zero percent. A positive fuel trim indicates that PCM is adding fuel to compensate for a lean condition. A negative fuel trim indicates that PCM is reducing amount of fuel to compensate for rich condition.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0121, P0122, P0123, P0130, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0201, P0122, P0201-P0206, P0300, P0401, P0403, P0404, P0405, P0410, P0412, P0418, P0440, P0442, P0446, P0506, P0507, P1404, or P1441 are not set.
* Engine Coolant Temperature (ECT) is 68-239°F (20-110°C).
* Intake Air Temperature (IAT) is 64-158°F (18-70°C).
* Manifold Absolute Pressure (MAP) is 15-105 kPa (2.1-15.2

psi).
* Vehicle speed is less than 82 MPH.
* Engine speed is between 600-4000 RPM.
* Barometric Pressure (BARO) is more than 70 kPa (10.1 psi).
* Mass Airflow (MAF) is 5-150 g/s.
* Fuel level is more than 10 percent.

DTC will set when average long term fuel trim value is below -13 percent for 40 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present, except P0172 or P0175, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and run to normal operating temperature. Ensure system is in closed-loop operation. Using scan tool, record long term fuel trim data. Turn engine off. Turn ignition on. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and record displayed data for DTC. If long term fuel trim is more than -13 percent, go to DIAGNOSTIC AIDS. If long term fuel trim is less than -13 percent, go to next step.

3) Start engine and allow to idle. Observe suspect HO2S using scan tool. If HO2S reading is fluctuating between 200 mV and 800 mV, go to next step. If HO2S reading is not fluctuating or not between 200 mV and 800 mV, go to step 5).

4) Turn engine off. Visually check for blocked MAF sensor screen, damaged or improperly routed/connected vacuum hoses. Collapsed or restricted air intake duct or restricted air filter. Repair condition as necessary. After repairs, go to step 7). If conditions are not found, go to step 6).

5) Turn engine off. Check for proper installation of suspect HO2S. Ensure HO2S harness is not contacting exhaust system. Check for short between HO2S wires. Repair as necessary. After repairs, go to step 7). If conditions are not found, diagnose fuel system. See appropriate SYSTEM & COMPONENT TESTING article.

6) Check for the following conditions:

* Excessive fuel contamination of engine oil.
* Malfunctioning EVAP system.
* Malfunctioning fuel pressure regulator.
* Malfunctioning fuel injector(s).

Using scan tool, perform fuel injector balance test. Repair as necessary. After repairs, go to next step. If conditions are not found, diagnose engine mechanical condition. Repair engine mechanical condition as necessary.

7) Using scan tool, select FUEL TRIM RESET function to reset long term fuel trim and clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

8) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for water or alcohol contaminated fuel. Malfunctioning MAF sensor can cause rich condition and set these DTCs. Use DTC P0101 to aid in diagnosis. See DTC P0101: MASS AIRFLOW SENSOR PERFORMANCE.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0201-P0206: INJECTOR CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM enables an injector on intake stroke of each cylinder. Ignition voltage is supplied directly to fuel injectors. PCM controls each injector by grounding control circuit via an internal switch called a driver. The driver supplies ground for component being controlled and is equipped with a fault line which is monitored by the PCM.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* Engine is running.
* Ignition voltage is 9-18 volts.

DTC will set when PCM detects an incorrect voltage on a fuel injector control circuit for 30 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Clear DTCs using scan tool. Start engine and run to operating temperature. Using scan tool, monitor all the MISFIRE CURRENT COUNTERS in MISFIRE DATA LIST. If any of the misfire counters are incrementing, go to step 4). If misfire counters are not incrementing, go to next step.

3) Using scan tool, observe FREEZE FRAME/FAILURE RECORDS for DTC. Turn ignition off for 30 seconds. Start engine and operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect suspect fuel injector connector indicating an incrementing misfire counter. Turn ignition on. Using a test light connected to ground, probe injector connector terminal "A" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 11).

5) Turn ignition off. Connect an Injector Test Light (J-34730-405) to connector of suspect injector. Operate engine at idle. If injector test light blinks, go to step 9). If injector test light does not blink, go to next step.

6) If injector test light is illuminated steady, go to step 8). If injector test light is not illuminated steady, go to next step.

7) Check for open or short to voltage in circuit between PCM connector C1 or C2 and suspect fuel injector. For terminal and wire color identification, see FUEL INJECTOR CONTROL CIRCUIT IDENTIFICATION table. Repair as necessary. After repairs, go to step 14). If circuits is okay, go to step 10).

8) Check for short to ground in circuit between PCM connector C1 or C2 and suspect fuel injector. For terminal and wire color identification, see FUEL INJECTOR CONTROL CIRCUIT IDENTIFICATION table. Repair as necessary. After repairs, go to step 14). If circuits

is okay, go to step 13).

9) Check for poor connections at suspect fuel injector connector. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

10) Check for poor connections at PCM connector C1 or C2. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).

11) Check INJ 1 fuse (15-amp) supplying suspect fuel injector. Fuses are located in bottom underhood fuse block. See Figs. 5 and 6. If fuse is blown, repair short to ground in Pink wire between suspect fuel injector connector terminal "A" and INJ fuse. If fuse is okay, repair open in Pink wire. After repairs, go to step 14).

12) Replace suspect fuel injector. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

FUEL INJECTOR CONTROL CIRCUIT IDENTIFICATION

Cylinder	PCM Connector Terminal No. (1)(2)	Wire Color
1	79	(3) Black
2	73	(3) Light Green/Black
3	42	(4) Pink/Black
4	46	(3) Light Blue/Black
5	47	(3) Black/White
6	43	(3) Yellow/Black

(1) - See Fig. 3.
(2) - Fuel injector connector terminal "B" for all circuits.
(3) - Connector C1.
(4) - Connector C2.

Diagnostic Aids

Perform fuel injector coil test. See appropriate SYSTEM & COMPONENT TESTING article. If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0230: FUEL PUMP RELAY CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Powertrain Control Module (PCM) provides ignition positive voltage to coil side of fuel pump relay. When ignition switch is first turned ON, PCM energizes fuel pump relay, which applies power to fuel pump. PCM enables fuel pump relay as long as engine is cranking or running, and crankshaft reference pulses are received. If no crankshaft reference pulses are received, PCM de-energizes fuel pump relay after 2 seconds. PCM monitors voltage on the fuel pump relay control circuit.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Ignition must be on.
* Ignition voltage is 9-18 volts.

DTC will set when PCM detects an incorrect voltage on control circuit of fuel pump relay for less than 1 second.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Install scan tool. Turn ignition on, with engine off. Using scan tool, command fuel pump relay on and off. If fuel pump relay turns on and off as commanded, go to next step. If fuel pump relay does not turn on and off as commanded, go to step 4).

3) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for setting this DTC. If DTC resets, go to next step. If DTC does not reset, see DIAGNOSTIC AIDS

4) Turn ignition off. Locate and remove fuel pump relay. Fuel pump relay is located in bottom underhood fuse block. See Figs. 5 and 6. Turn ignition on. Using a test light connected to battery voltage, probe fuel pump relay connector terminal B10. See WIRING DIAGRAMS article for terminal reference. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).

5) Connect a test light between fuel pump relay connector terminals A8 and B10. Using scan tool, command fuel pump relay on and off. If test light turns on and off as commanded, go to step 9). If test light does not turn on and off as commanded, go to step 11).

6) If test light remains illuminated, go to step 8). If test light does not remain illuminated, go to next step.

7) Check for open or short to ground in Dark Green/White wire between fuel pump relay connector terminal A8 and PCM connector C2 terminal No. 3. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 10).

8) Check for short to voltage in Dark Green/White wire between fuel pump relay connector terminal A8 and PCM connector C2 terminal No. 3. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 13).

9) Check for poor connections at fuel pump relay. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

10) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).

11) Repair open in Black/White wire between fuel pump relay and ground connection located on front of engine bolted to pulley above A/C clutch connector. After repairs, go to step 14).

12) Replace fuel pump relay. After replacing relay, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After system is okay, go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0300: ENGINE MISFIRE DETECTED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Crankshaft Position (CKP) sensor reluctor (4X) is located on side of engine block behind starter assembly. CKP sensor will send a pulse on every falling edge of 4X reluctor wheel. A misfire will cause a change in crankshaft speed. PCM times interval between each pulse and compares each new interval with previous one to determine when an excessive change in crankshaft speed has occurred. A certain amount of acceleration/deceleration is expected between each firing stroke, but if crankshaft speed changes are more than expected amount, PCM will interpret this as a misfire. PCM continuously calculates crankshaft position from low and high resolution signals. This information is used to determine which cylinder is misfiring so that PCM can increment appropriate misfire counter.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0125, P0336, P0341, P0502, P0503, P1106, P1107, P1114, P1115, P1121, P1122, P1336, or P1374 are not set.
* Engine speed is 550-5850 RPM.
* System voltage is 9-18 volts.
* Engine coolant temperature is 21-248°F (-6 to +120°C).
* Throttle angle is steady.

DTC will set when PCM is detecting a crankshaft RPM variation indicating a misfire sufficient to cause 3-way catalytic converter damage or emissions levels to exceed the mandated standard.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) If any DTCs other than P0135 and P0155 are set, repair those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no additional DTCs are set, go to next step.

3) Start and operate engine at idle. Operate vehicle within parameters to set DTC as recorded in FREEZE FRAME/FAILURE RECORDS. Using scan tool, select MISFIRE DATA LIST function and monitor MISFIRE CUR. COUNTERS (one counter per cylinder). If any misfire counter is incrementing, go to next step. If misfire counter is not incrementing, go to DIAGNOSTIC AIDS.

4) Select MISFIRE HISTORY CYL # on scan tool. If misfire history displays a large value for more than one cylinder, go to next step. If misfire history does not display a large value for more than one cylinder, go to step 13).

5) Check for split, damaged or misrouted vacuum hoses. Repair as necessary. After repairs, go to step 25). If vacuum hoses are okay,

go to next step.

6) Check for damaged or improperly installed crankcase ventilation system. Repair as necessary. After repairs, go to step 25). If vacuum hoses are okay, go to next step.

7) Check for blockage or damage of throttle body inlet screen. Repair as necessary. After repairs, go to step 25). If vacuum hoses are okay, go to next step.

8) Test fuel pressure. See appropriate BASIC DIAGNOSTIC PROCEDURES article. If fuel pressure tests okay, go to next step. If fuel pressure is not as specified, repair as necessary. After repairs, go to step 25).

9) Check for contamination of fuel by water, alcohol or other foreign matter. Repair as necessary. After repairs, go to step 25). If fuel is okay, go to next step.

10) Visually check for poor PCM or engine ground connections. See Fig. 7. Repair as necessary. After repairs, go to step 25). If ground connections are okay, go to next step.

11) Check for vacuum leaks at intake manifold, EGR adapter, EGR valve, EGR feed pipes or fuel injector "O" rings. Repair as necessary. After repairs, go to step 25). If no vacuum leaks are found, go to next step.

12) Remove EGR valve. Check that EGR valve pintle is not sticking in closed or open position. Check for excessive carbon deposits or burrs that may be preventing EGR valve from closing completely. Repair or replace EGR valve as necessary. After repairs, go to step 25). If EGR valve is okay, go to next step.

13) Perform fuel injector coil test on suspect cylinder. See appropriate SYSTEM & COMPONENT TESTING article. Replace injectors as necessary. After repairs, go to step 25). If fuel injector is okay, go to next step.

14) Check spark plug wire on suspect cylinder for damage. Replace plug wire as necessary. After repairs, go to step 25). If spark plug wire is okay, go to next step.

15) Install Spark Tester (J 26792) to spark plug end of spark plug wire on suspect cylinder. Jumper companion cylinder spark plug end of spark plug wire to ground. Companion cylinder is spark plug wire that shares the same ignition coil (1/4, 2/5 and 3/6). Crank engine while observing spark tester. If spark is present, go to step 20). If spark is not present, go to next step.

16) Remove spark plug wires from ignition coils and check for carbon tracking. If carbon tracking is present, replace ignition coil and spark plug wire. After repairs, go to step 25). If carbon tracking is not present, check spark plug wire on suspect cylinder for damage. Replace plug wire as necessary. After repairs, go to step 25). If spark plug wire is okay, go to next step.

17) Using DVOM, measure resistance of suspect spark plug wire. Specification is 3000 ohms per ft, 250 ohms per INCH of spark plug wire. Measure length of spark plug wire. If resistance is as specified for length of wire, go to next step. If resistance is not as specified for length of spark plug wire, replace plug wire as necessary. After repairs, go to step 25).

18) Inspect suspect ignition coil for cracks, carbon tracking or damage. Replace as necessary. After repairs, go to step 25). If ignition coils are okay, go to next step.

19) Using DVOM, measure ignition coil secondary resistance. If resistance is 5-8 K/ohms, go to step 24). If resistance is not 5-8 K/ohms, replace suspect ignition coil. After repairs, go to step 25).

20) Remove and inspect spark plug(s) for suspect cylinder for excessive fouling. If spark plug is excessively fouled, diagnose and repair engine mechanical condition. See appropriate article in ENGINES. If spark plug(s) is okay, go to next step.

21) Check suspect spark plug(s) insulators for cracks or carbon fouling. Check that electrode gap is 0.060" (1.52 mm). Repair

or replace spark plug(s) as necessary. After repairs, go to step 25). If spark plugs are okay, go to next step.

22) Check for engine mechanical condition. See appropriate article in ENGINES. Repair as necessary. After repairs, go to step 25). If engine mechanical condition is okay, go to next step.

23) Check for malfunctioning transmission Torque Converter Clutch (TCC). Repair as necessary. After repairs, go to step 25). If TCC is okay, go to DIAGNOSTIC AIDS.

24) Replace ignition control module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 25).

25) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

26) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Scan tool provides information that can be useful in identifying misfiring cylinder. If DTC P0300 is currently stored as DTC status FAILED SINCE CODE CLEAR, misfire history counters (MISFIRE HIST #1-#6) will still contain a value that represents level of misfire detected on each cylinder.

A misfire DTC may set if components that affect Crankshaft Position (CKP) sensor have recently been replaced, and crankshaft position sensor variation learn procedure has not been performed. If diagnostic test does not identify a condition, perform CRANKSHAFT POSITION SENSOR VARIATION LEARN PROCEDURE under PROGRAMMING. Crankshaft position sensor variation learn procedure should be performed if any of the following conditions are true:

* PCM has been replaced.
* DTC P1336 is set.
* Engine has been replaced.
* Crankshaft has been replaced.
* Crankshaft harmonic balancer has been replaced.
* Crankshaft Position (CKP) sensor has been replaced.

Scan tool displayed misfire counter values (MISFIRE HIST. #1-#6) can be useful to determine whether misfire affects a single cylinder, a cylinder pair (cylinders that share an ignition coil), or random. Switch ignition coils and retest. If misfire follows coil, replace suspect ignition coil. If largest amount of activity is isolated to a cylinder pair, check for following conditions:

* Secondary Ignition Wires - Check secondary wires for with suspect cylinder pair for disconnected ignition wires or excessive resistance. Specification is 3000 ohms per ft, 250 ohms per INCH of spark plug wire.
* Damaged Or Malfunctioning Ignition Coil - Check for cracks, carbon tracking or other damage. Also check coil secondary resistance. Secondary resistance should be 5-8 K/ohms.

If misfire is random, check the following:

* System grounds - Ensure all ground connections are clean and properly tightened. See Fig. 7.
* Mass Air Flow (MAF) sensor - MAF sensor output that causes

PCM to sense a lower than normal air flow will cause a lean condition. Attempt to operate vehicle within failure records conditions with MAF sensor disconnected. If lean or misfiring condition is not present with MAF sensor disconnected, replace MAF sensor.

* Damaged accessory drive belt or driven accessory - A damaged serpentine belt or belt driven accessory can cause engine load variations sufficient to set a misfire DTC.
* Air induction system - Vacuum leaks that cause intake air to bypass MAF sensor will cause a lean condition. Check for disconnected or damaged vacuum hoses, incorrectly installed or malfunctioning crankcase ventilation valve or vacuum leaks at throttle body, EGR valve and intake manifold mounting surfaces.
* Fuel pressure - Perform a fuel system pressure test. See appropriate BASIC DIAGNOSTIC PROCEDURES article. A malfunctioning fuel pump, plugged filter or malfunctioning fuel pressure regulator will contribute to a lean condition.
* Fuel injectors - Perform fuel injector coil test. See appropriate SYSTEM & COMPONENT TESTING article.
* Water contamination in fuel system can cause a single cylinder to misfire as well as random misfire.
* Check for leaking EGR valve, adapter or feed pipes which will contribute to a lean condition or excessive EGR flow.
* Excessive Open Loop operation caused by extended idling or short trip driving may leave deposits on Heated Oxygen Sensors (HO2S). Deposits cause HO2S to respond slowly to exhaust oxygen content, affecting fuel control and causing a misfire to be indicated at idle. This condition is not permanent. To determine if this condition is causing DTC P0300 to set, review FREEZE FRAME/FAILURE RECORDS for DTC P0300. If DTC P0300 occurs at high engine speeds, deposits did not cause DTC to set. If DTC P0300 occurs at idle or very low engine speeds and at engine coolant temperatures below 176°F (80°C), deposits are very likely cause of DTC. Deposits on HO2S can be eliminated by running vehicle at operating temperature with MAF sensor above 15 g/s.

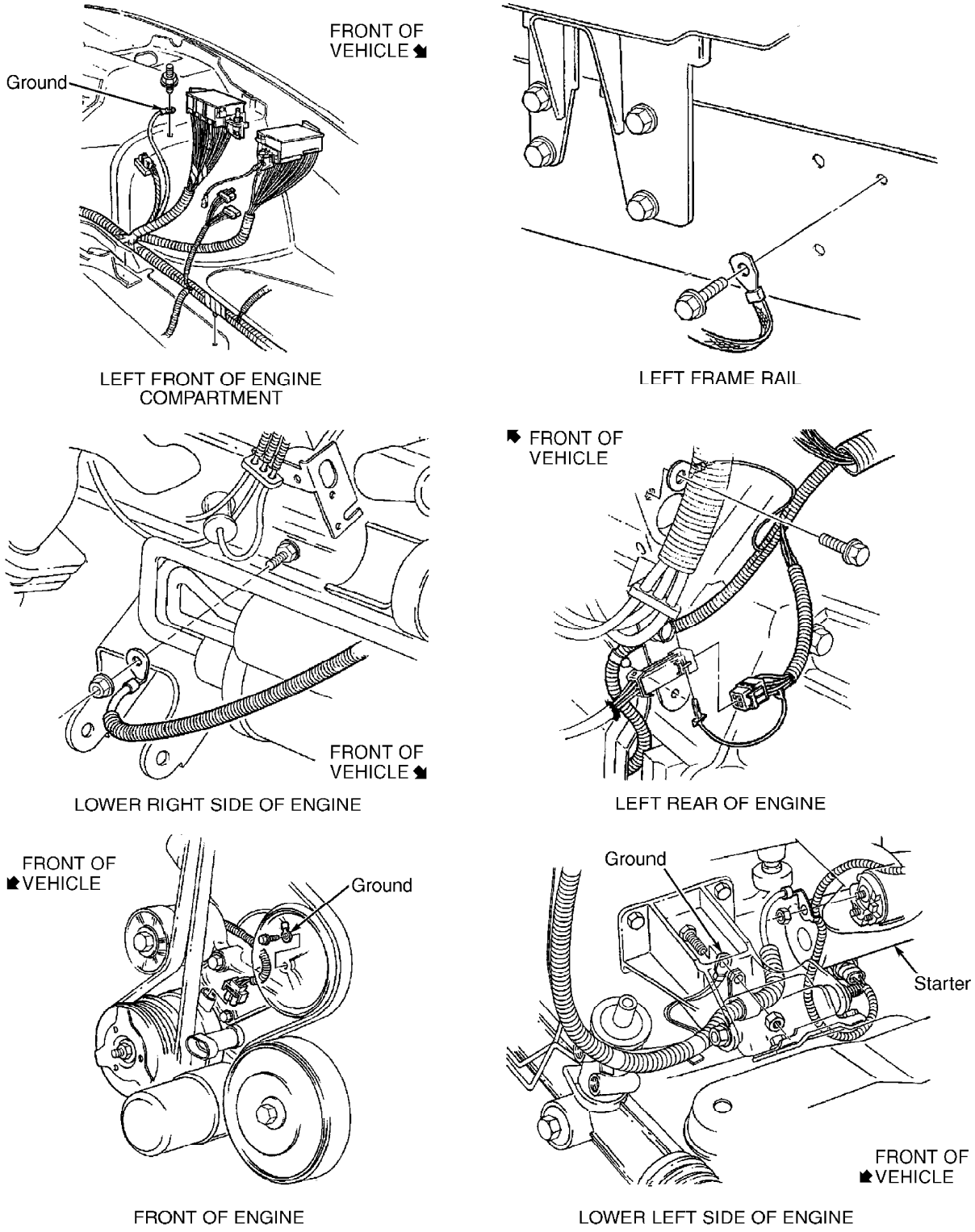

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Fig. 7: Locating Ground Connections
Courtesy of General Motors Corp.

DTC P0325: KNOCK SENSOR MODULE PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Knock Sensor (KS) module is located in PCM. KS module monitors both knock sensors to determine if detonation is present. If excessive knock is present, PCM will retard timing until knock goes away. When KS module is missing or malfunctioning, KS circuit voltage going to PCM will go low. PCM interprets this low signal as spark knock.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0117, P0118, P0121, P0122, P0123, P0125, P0336, P0341, P0502, P0503, P1114, P1115, or P1121 are not set.
* Engine speed is 1000-2500 RPM.
* Throttle angle is more than 10 percent.
* Engine load is more than 45 percent.
* Engine Coolant Temperature (ECT) is more than 140°F (60°C).
* Maximum spark retard is less than 15 degrees.
* System voltage is more than 9 volts.
* Engine run time is more than 30 seconds.

DTC will set when PCM detects a malfunction in integrated KS diagnostic circuitry which will not allow proper diagnosis of KS system.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on, engine off. Review FREEZE FRAME and/or FAILURE RECORDS data for this DTC and observe parameters. Turn ignition on for 30 seconds. Start engine. Operate vehicle within conditions required to set this DTC. Using scan tool select DTC option and SPECIFIC DTC option, then enter this DTC. If scan tool indicates this DTC failed this ignition, go to next step. If scan tool does not indicate this DTC failed this ignition, go to DIAGNOSTIC AIDS.

3) Replace PCM. Se REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.

4) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0327: KNOCK SENSOR NO. 1 CIRCUIT; P0332: KNOCK SENSOR NO. 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Knock Sensor (KS) system is used to detect engine detonation. PCM will retard spark timing based on signals from KS module. KS produces an AC signal voltage that is sent to KS module. The amount of AC voltage produced is proportional to amount of knock.

When engine is operating, PCM will learn minimum and maximum frequency of noise engine produces.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0117, P0118, P0121, P0122, P0123, P0125, P0336, P0341, P0502, P0503, P1114, P1115, or P1121 are not set.
* Engine speed is 1000-2500 RPM.
* Throttle angle is more than 10 percent.
* Engine load is more than 45 percent.
* Engine coolant temperature (ECT) is more than 140°F (60°C).
* Maximum spark retard is less than 15 degrees.
* System voltage is more than 9 volts.
* Engine run time is more than 30 seconds.

DTC will set when PCM detects a KS 1 or a KS 2 voltage within calculated average voltage range.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Ensure engine mechanical problem is not causing knock. If engine knock is heard, repair engine mechanical condition as necessary. Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect suspect KS. KS are located on lower left and right of engine block. Using DVOM, measure voltage between suspect KS terminal and engine block. Turn ignition on. Voltage should be zero volts. If voltage is as specified, go to step 5). If voltage is not as specified, go to next step.

4) For bank 1 KS, repair short to voltage in Dark Blue wire between KS connector and PCM connector C1 terminal No. 33. See Fig. 3. For bank 2 KS, repair short to voltage in Light Blue wire between KS connector and PCM connector C1 terminal No. 34. After repairs, go to step 9).

5) Locate PCM and disconnect connector C1. See Fig. 2. Turn ignition on, with engine off. For bank 1 KS, check for open or short to ground in Dark Blue wire between KS connector and PCM connector C1 terminal No. 33. See Fig. 3. For bank 2 KS, check for open or short to ground in Light Blue wire between KS connector and PCM connector C1 terminal No. 34. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to next step.

6) Check for poor connections at suspect KS connector. Repair as necessary. After repairs, go to step 9). If connections are okay, go to next step.

7) Check for poor connections at KS terminals of PCM connector. Repair as necessary. After repairs, go to step 9). If terminal connections are okay, go to next step.

8) Replace KS. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to next step.

9) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

10) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0336: CRANKSHAFT POSITION SENSOR 18X REFERENCE CIRCUIT MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Crankshaft Position (CKP) sensor is connected directly to Ignition Control Module (ICM). CKP sensor is located behind harmonic balancer on front of engine. CKP sensor consists of 10-volt reference circuit, low reference circuit, CKP sensor 1 signal circuit, and CKP sensor 2 signal circuit. CKP sensor shares power supply and low reference circuits with the Camshaft Position (CMP) sensor.

Code Enable Criteria

For DTC to run, engine must be running and 3X reference pulses are being received. DTC will set when 18X reference pulses are not received in one engine cycle (720° of crankshaft rotation).

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Attempt to start engine. If engine starts, go to next step. If engine does start, go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Check for open, short to voltage or short to ground in Light Blue/Black wire between ICM connector terminal "C" and PCM connector C1 terminal No. 9. See Figs. 3 and 8. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to next step.

5) Turn ignition off. Locate PCM and disconnect connector C1. See Fig. 2. Disconnect CKP sensor connector. Using DVOM, measure voltage between PCM connector terminal No. 9 (Light Blue/Black wire) and ground. Using a test light connected to ground, repeatedly touch CKP sensor connector terminal "B" (Yellow wire) while monitoring DVOM reading. If voltage fluctuates on DVOM, go to step 7). If voltage does not fluctuate on DVOM, go to next step.

6) Check for short to voltage or poor connections at ICM. Repair as necessary. After repairs, go to step 11). If connections are

okay, go to step 9).

7) Visually inspect CKP sensor circuits for routing too close to secondary ignition components, after-market components, solenoids, relays and motors. Repair as necessary. After repairs, go step 11). If routing is okay, go to next step.

8) Check for poor CKP sensor terminal connections at PCM connector. Repair as necessary. After repairs, go to step 11). If connection or terminal tension is okay, go to step 10).

9) Replace ICM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 11).

10) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

11) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

12) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for incorrect harness routing near secondary ignition components, faulty ignition coil secondary circuit arcing to ICM or to ICM wiring harness, secondary ignition wires arcing to wiring harness or poor connections.

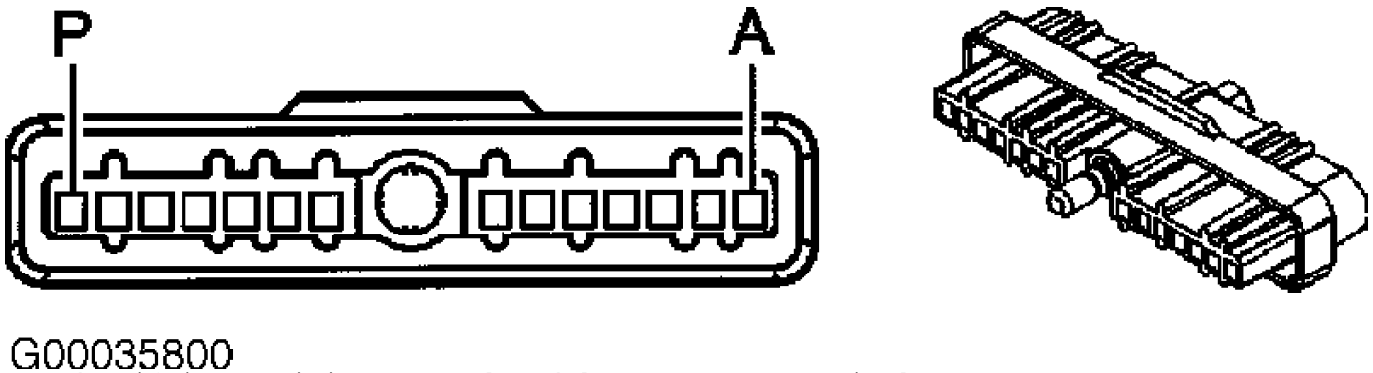


Fig. 8: Identifying Ignition Control Module Connector Terminals
Courtesy of General Motors Corp.

DTC P0341: CAMSHAFT POSITION SENSOR MISMATCH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Camshaft Position (CMP) sensor is a hall-effect type sensor. Sensor produces one signal for each revolution of camshaft to control sequential fuel injection. PCM compares CMP sensor signal to number of 3X, low-resolution, engine speed signals generated by Ignition Control Module (ICM). Normal ratio of 3X signals is 6-to-1.

Code Enable Criteria

For DTC to run, engine is running and 3X reference pulses are being received. DTC will set when PCM does not receive CMP sensor reference pulses during one rotation of camshaft.

Diagnostic Procedures

NOTE: If engine will crank but will not run, go to appropriate TROUBLE SHOOTING - NO CODES article.

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start and operate engine at idle for 2 minutes. Using scan tool, monitor CMP sensor input signal. If CMP sensor input signal is present, go to next step. If CMP sensor input signal is not present, go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Locate PCM and disconnect connector C1. See Fig. 2. Using DVOM, measure voltage between ground and PCM connector C1 terminal No. 7 (Black wire). See Fig. 3. Turn ignition on. If voltage is approximately 5 volts, go to next step. If voltage is zero, attempt to use ignition switch to rotate engine 1/4 turn or so until voltage in indicated. If voltage is not approximately 5 volts, go to step 6).

NOTE: For next step, a horse shoe magnet must be used.

5) Locate CMP sensor in engine front cover between crank shaft and water pump pulleys. Without disconnecting CMP sensor connector, remove CMP sensor. Turn ignition on. Monitor CMP sensor input signal on scan tool. Place one end of magnet on CMP sensor. If voltage changes from 5 volts to zero volts when magnet is placed in CMP sensor, go to step 17). If voltage does not change from 5 volts to zero volts, go to step 9). If voltage remains at 5 volts, retest CMP sensor using other end of magnet.

6) If voltage is more than 5 volts, go to step 8). If voltage is much less than 5 volts, go to next step.

7) Turn ignition off. Disconnect Ignition Control Module (ICM). Ignition coils are mounted to ICM. Turn ignition on. Using a test light connected to battery voltage, probe ICM connector terminal "J" (Brown/White wire). See Fig. 8. If test light illuminates, repair short to ground in Brown/White wire between CMP sensor and ICM. After repairs, go to step 25). If test light does not illuminate, go to step 14).

8) Turn ignition off. Disconnect Ignition Control Module (ICM). Ignition coils are mounted to ICM. Turn ignition on. Connect a test light between ground and ICM connector terminal "J" (Brown/White wire). See Fig. 8. If test light illuminates, repair short to voltage in Brown/White wire between CMP sensor and ICM. After repairs, go to step 25). If test light does not illuminate, go to step 19).

9) Disconnect CMP sensor connector. Using DVOM, measure voltage between CMP sensor connector terminals "B" (Red/Black wire) and "C" (White/Black wire). If battery voltage is indicated, go to next step. If battery voltage is not indicated, go to step 13).

10) Using DVOM, measure voltage between CMP sensor connector terminals "A" (Brown/White wire) and "B" (Red/Black wire). If voltage is 5-7 volts, go to next step. If voltage is not 5-7 volts, go to step 12).

11) Using DVOM, measure voltage between ground and PCM connector C1 terminal No. 7 (Black wire). Using a test light connected

to ground, repeatedly touch CMP sensor connector terminal "A" (Brown/White wire) while observing DVOM. If DVOM switches from zero to 5 volts when touching test light to CMP sensor connector, go to step 16). If DVOM does not switch from zero to 5 volts when touching test light to CMP sensor connector, go to step 15).

12) Check for open, short to ground or short to voltage in Brown/White wire between CMP sensor and ICM connector terminal "J". See Fig. 8. Check for open, short to ground or short to voltage in Black wire between ICM connector terminal "F" and PCM connector C1 terminal No. 7. Repair as necessary. After repairs, go to step 25). If circuits are okay, go to step 15).

13) Check for open in Red/Black wire between CMP sensor and ICM connector terminal "M". See Fig. 8. Check for open in White/Black wire between CMP sensor and ICM connector terminal "N". Repair as necessary. After repairs, go to step 25). If circuits are okay, go to step 15).

14) Check for open in Brown/White wire between CMP sensor and ICM connector terminal "J". See Fig. 8. Repair as necessary. After repairs, go to step 25). If circuit is okay, go to next step.

15) Check for poor connections at ICM. Repair as necessary. After repairs, go to step 25). If circuit is okay, go to step 18).

16) Check for poor connections at CMP sensor. Repair as necessary. After repairs, go to step 25). If circuit is okay, go to step 20).

17) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 25). If circuit is okay, go to step 21).

18) Visually inspect CMP sensor circuits for routing too close to secondary ignition components, after-market components, solenoids, relays and motors. Check for carbon tracking or arcing to ignition wires at ignition coil terminals. Repair or replace any components as necessary. After repairs, go to step 25). If routing and components are okay, go to next step.

19) Replace ICM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 25).

20) Replace CMP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 25).

21) Visually inspect CMP sensor circuits for routing too close to secondary ignition components, after-market components, solenoids, relays and motors. Check for carbon tracking or arcing to ignition wires at ignition coil terminals. Repair or replace any components as necessary. After repairs, go to step 25). If routing and components are okay, go to next step.

22) Reinstall CMP sensor to engine front cover. Disconnect CMP sensor connector. Using DVOM, measure voltage between CMP sensor terminal "A" (component side). Use ignition switch to rotate engine 1/4 turn or so while observing DVOM reading. If voltage switches back and forth from zero to 5 volts, go to next step. If voltage does not switch back and forth from zero to 5 volts, go to step 24).

23) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 25).

24) Replace CMP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

25) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

26) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Visually inspect CMP sensor circuits for routing too close to secondary ignition components. Check for carbon tracking or arcing to ignition wires at ignition coil terminals.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0401: INSUFFICIENT EGR FLOW

Description

Powertrain Control Module (PCM) tests Exhaust Gas Recirculation (EGR) system during deceleration by momentarily commanding EGR valve to open while monitoring Manifold Absolute Pressure (MAP) sensor signal. When EGR valve is opened, PCM should see an increase in MAP. If expected increase in MAP is not seen, PCM notes amount of error detected and adjusts an internal fail counter towards a fail threshold level. When fail counter exceeds fail threshold level, PCM will set DTC.

The number of test samples required to accomplish this may vary according the amount of detected flow error. Normally, PCM will only allow 1 EGR flow test sample to be taken during an ignition cycle. PCM allows 12 test samples during first ignition cycle following a scan tool CLEAR INFO command or when battery is disconnected and reconnected. Between 9-12 samples should be sufficient for PCM to determine adequate EGR flow and pass EGR test.

Code Enable Criteria

Vehicle will need to be driven more than 50 MPH, and then allowed to decelerate. When vehicle is decelerating while meeting all criteria listed below, PCM will enable test to run. As test is running, you will see desired EGR parameter and EGR position sensor on scan tool change from 0 to a calibrated value above 0. For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0201-P0206, P0300, P0336, P0403, P0404, P0405, P0502, P0503, P0506, P0507, P0604, P0606, P1106, P1107, P1112, P1114, P1115, P1120, P1121, P1122, P1125, P1220, P1221, P1374, P1404, P1514, P1515, P1516, P1517, or P1518 are not set.
* System voltage is 11-18 volts.
* AC status does not change.
* Transaxle range does not change.
* Throttle Position (TP) angle is less than 1 percent during deceleration.
* Intake Air Temperature (IAT) is less than 176°F (80°C).
* Engine Coolant Temperature (ECT) is more than 167°F (75°C).
* Engine speed is 900-1400 RPM.
* Idle Air Control (IAC) position is steady.
* Vehicle speed is more than 25 MPH during deceleration.
* Barometric Pressure (BARO) sensor more than 70 kPa.

DTC will set when MAP changes monitored during EGR flow test indicate insufficient EGR flow.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) If any MAP sensor DTCs are set, diagnose those DTCs first.

See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no MAP DTCs are set, go to next step.

3) Check exhaust system for modifications or leaks. Replace or repair as necessary. After repairs, go to step 7). If exhaust is okay, go to next step.

4) Check for leaks at EGR pipe and gasket at EGR valve. Repair or replace as necessary. After repairs, go to step 7). If EGR valve gasket and pipe are okay, go to next step.

5) Remove EGR valve. Check for restrictions or blockage of EGR ports or pintle. Repair or replace as necessary. After repairs, go to step 7). If no restrictions are found, go to next step.

6) Remove EGR valve. Check for restrictions or blockage of EGR intake manifold port or exhaust pipe. Repair or replace as necessary. After repairs, go to next step. If no restrictions are found, go to DIAGNOSTIC AIDS.

7) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

8) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for an EGR valve that shows signs of excessive heat caused by exhaust system blockage or plugged catalytic converter. Check for vacuum restriction to MAP sensor. Restrictions can cause EGR flow test to fail due to insufficient MAP changes. Check for engine that is running poorly. Check for poor connection or damaged harness. If harness appears okay, observe EGR position sensor display on scan tool while moving connectors and wiring related to EGR valve.

To verify repair, clear info using scan tool and run EGR flow test keeping in mind:

* PCM will only run EGR flow test during a gradual deceleration.
* PCM will only run EGR test during closed throttle condition.
* PCM will only run EGR test at vehicle speeds above 25 MPH.

Several deceleration cycles, typically 9-12, will be necessary to run a sufficient number of EGR flow test samples. EGR test counter displayed on scan tool can be useful to ensure EGR flow test is running and to track number of test samples taken. Counter will increment each time a sample is taken.

DTC P0403: EGR CONTROL CIRCUIT MALFUNCTION

Description

Powertrain Control Module (PCM) monitors Exhaust Gas Recirculation (EGR) valve pintle position input to ensure valve responds properly to commands from PCM. Linear EGR valve is controlled using ignition positive driver and ground circuit within PCM. Driver can detect an electrical malfunction in ignition positive or ground circuit.

Code Enable Criteria

For DTC to run, engine must be running or cranking with system voltage 10-16 volts. DTC will set when PCM detects an

electrical malfunction in control circuit for EGR valve for more than 20 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on. Using scan tool, command EGR valve from zero to 100 percent. If EGR position sensor is close to desired EGR position at all commanded positions, go to next step. If EGR position sensor is not close to desired EGR position at all commanded positions, go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect EGR valve electrical connector. Turn ignition on. Connect test light between ground and EGR valve connector terminal "E" (Light Blue wire). Using scan tool, command EGR valve from zero to 100 percent. If test light turns on and off with each command, go to next step. If test light does not turn on and off with each command, go to step 6).

5) Connect test light between EGR valve connector terminals "A" (Gray wire) and "E" (Light Blue wire). Using scan tool, command EGR valve from zero to 100 percent. If test light turns on and off with each command, go to step 10). If test light does not turn on and off with each command, go to step 9).

6) If test light remains illuminated with each command, go to step 8). If test light does not remain illuminated with each command, go to next step.

7) Check for short to ground or open in Light Blue wire between EGR valve connector terminal "E" and PCM connector C2 terminal No. 4. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 11).

8) Check for short to voltage in Light Blue wire between EGR valve connector terminal "E" and PCM connector C2 terminal No. 4. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 11).

9) Check for open or high resistance in Gray wire between EGR valve connector terminal "A" and PCM connector C1 terminal No. 32. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 11).

10) Check for poor connections at EGR valve connector. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 12).

11) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 13).

12) Replace EGR valve. After repairs, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC

test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0404: EGR VALVE DESIRED POSITION NOT MET

Description

Powertrain Control Module (PCM) monitors Exhaust Gas Recirculation (EGR) valve pintle position input to ensure valve responds properly to commands from PCM. PCM compares EGR position sensor with desired EGR position when valve is commanded open.

Code Enable Criteria

For DTC to run, system voltage must be more than 10 volts with EGR valve enabled. DTC will set when difference between EGR position sensor and desired EGR position is more than 15 percent for more than 25 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC P0403 or P0405 are also set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on. Using scan tool, command EGR valve from zero to 100 percent. If EGR position sensor remain within 15 percent of desired EGR position at all commanded positions, go to next step. If EGR position sensor does not remain within 15 percent of desired EGR position at all commanded positions, go to step 4).

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect EGR valve connector. Using scan tool, monitor EGR valve position sensor. If EGR valve position sensor is zero percent, go to next step. If EGR valve position sensor is not zero percent, go to step 8).

5) Using DVOM, measure voltage between ground and EGR valve connector terminals "B" (Black wire) and "D" (Gray wire). If voltage is approximately 5 volts, go to next step. If voltage is not approximately 5 volts, go to step 7).

6) Connect a fused jumper between EGR valve connector terminals "C" (Brown wire) and "D" (Gray wire). Monitor EGR valve position sensor. If EGR valve position sensor is 100 percent, go to step 12). If EGR valve position sensor is not 100 percent, go to step 10). If fused jumper blows, repair short to ground in Brown wire between EGR valve connector terminal "C" and PCM connector C1 terminal No. 28. See Fig. 3.

7) Using DVOM, measure voltage between ground and EGR valve connector terminal "D" (Gray wire). If voltage is approximately 5 volts, go to step 9). If voltage is not approximately 5 volts, go to step 11).

8) Check for short to voltage in Brown wire between EGR valve

connector terminal "C" and PCM connector C1 terminal No. 28. See Fig. 3. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 13).

9) Check for open or high resistance in Black wire between EGR valve connector terminal "B" and PCM connector C1 terminal No. 31. See Fig. 3. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 13).

10) Check for open or high resistance in Brown wire between EGR valve connector terminal "C" and PCM connector C1 terminal No. 28. See Fig. 3. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 14).

11) Check for open short to ground or short to voltage in Gray wire between EGR valve connector terminal "D" and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 14).

12) Check for poor connections at EGR valve connector. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 14).

13) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 15).

14) Replace EGR valve. After repairs, go to step 16).

15) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

16) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

17) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for excessive deposits on EGR pintle or seat. If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0405: EGR POSITION SENSOR SIGNAL VOLTAGE EXCESSIVELY LOW

Description

Powertrain Control Module (PCM) monitors Exhaust Gas Recirculation (EGR) valve pintle position input to ensure that valve responds properly to commands from PCM and to detect a fault if pintle position sensor circuit is open or shorted.

Code Enable Criteria

For DTC to run, system voltage must be more than 10 volts. DTC will set when EGR position sensor is less than 0.14 volts at any time for more than 20 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC P1635 is also set, diagnose that DTCs first. See DTC P1635: 5-VOLT REFERENCE 1 CIRCUIT.

2) Turn ignition on. Using scan tool, monitor EGR valve position sensor voltage. If voltage is less than 0.14 volt, go to step

4). If voltage is more than 0.14 volt, go to next step.

3) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect EGR valve connector. Connect a fused jumper wire between EGR valve connector terminal "C" (Brown wire) and "D" (Gray wire). Turn ignition on. Using scan tool, observe EGR position sensor parameter. If EGR position sensor is 100 percent, go to step 10). If EGR position sensor is not 100 percent, go to next step.

5) Remove fused jumper wire. Connect a test light between ground and EGR valve connector terminal "D" (Gray wire). If test light illuminates, go to step 9). If test light does not illuminate, go to next step.

6) Check for open or high resistance in Gray wire between EGR valve connector terminal "D" and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to next step.

7) Check for short to ground in Gray wire between EGR valve connector terminal "D" and PCM connector C2 terminal No. 33. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to next step.

8) Connect DVOM between EGR valve connector terminals "B" (Black wire) and "D" (Gray wire). Ensure ignition is on. Disconnect all other components using 5-volt signal from PCM. See WIRING DIAGRAMS article for reference. A change in voltage will isolate a defective component. If a change in voltage is displayed, repair or replace as necessary. After repairs, go to step 15). If no change in voltage is observed, go to step 11).

9) Check for open, short to ground or high resistance in Brown wire between EGR valve connector terminal "C" and PCM connector C1 terminal No. 28. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 11).

10) Check for short between Light Blue and Brown wires for EGR valve. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 12).

11) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If connections are okay, go to step 14).

12) Check for poor connections at EGR valve connector. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

13) Replace EGR valve. After repairs, go to step 15).

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see

INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0420: CATALYST SYSTEM LOW EFFICIENCY

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

To control emissions of Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), a 3-way catalytic converter is used. Catalyst within converter promotes a chemical reaction to oxidize HC and CO present in exhaust gas, converting chemicals into harmless water vapor and carbon dioxide. Catalyst also reduces NOx, converting NOx to nitrogen. Converter also has ability to store excess oxygen and release stored oxygen to promote these reactions. This Oxygen Storage Capacity (OSC) is a measurement of catalysts ability to control emissions. Powertrain Control Module (PCM) monitors this process using a Heated Oxygen Sensor (HO2S) located in exhaust stream past 3-way converter. When catalyst is functioning properly, HO2S 2 (downstream) is slow to respond to a large change in HO2S 1 (upstream) signal. When HO2S 2 responds quickly to a large change in HO2S 1 signal, OSC and efficiency of catalyst is considered to be bad.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101-P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0130-P0135, P0137, P0138, P0140, P0141, P0150-P0155, P0171, P0172, P0174, P0175, P0201-P0206, P0300, P0325, P0336, P0341, P0401, P0403-P0405, P0440, P0442, P0443, P0446, P0449, P0502, P0503, P0506, P0507, P1120, P1125, P1133, P1134, P1153, P1154, P1220, P1221, P1336, P1352, P1361, P1362, P1441, or P1523 are not set.
* Engine has been running longer than 10 minutes.
* Engine Coolant Temperature (ECT) is more than 158°F (70°C), and less than 255°F (124°C).
* Barometric Pressure (BARO) is more than 75 kPa.
* Vehicle is in closed loop.
* Intake Air Temperature (IAT) is more than -4°F (-20°C), and less than 212°F (100°C).
* Battery voltage more than 10.7 volts.
* Warm the catalyst - Fully open hood. Place transmission in Park (automatic transmission), or Neutral (manual transmission). Set parking brake. Press and hold brake pedal. Each time engine is started, diagnostic can run up to 18 times. After 10 minute run time, and before diagnostic runs first time, engine must run an additional 5 minutes at 1500-2000 RPM. For any additional tests on same key cycle, RPM must be 1500-2000 RPM for 1 minute. To activate diagnostic, return engine to idle and put vehicle in Drive or depress clutch.
* Test the catalyst - Place transmission in Drive (automatic transmission), or Neutral and depress clutch (manual transmission). Within 60 seconds, air/fuel ratio will go rich (below 14.0) for up to 5 seconds, then air/fuel ratio may go lean (above 15.3) for up to 8 seconds. Use scan tool to check if DTC P0420 has passed or failed this key cycle.

DTC will set when PCM determines catalyst's oxygen storage capacity is less than an acceptable threshold.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to

next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

NOTE: If A/C is left on, diagnostic may not run.

3) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn A/C off. Open hood. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. Up to 6 tests may need to be completed for test to pas or fail. If test does not pass or fail after 6 tests have ran, go to DIAGNOSTIC AIDS. If scan tool indicates that this test failed this ignition, system is okay at this time. If scan tool does not indicate that this test failed this ignition, go to next step.

4) Check that three-way catalytic converter is original equipment. Check for converter damage and rattle inside converter. If damage to converter is obvious, go to step 9). If damage to converter is not obvious, go to next step.

5) Check for exhaust leaks. If leaks are found, go to step 7). If exhaust is okay, go to next step.

6) Check for damage to HO2S or related harnesses. If damage is found, go to step 8). If HO2S are okay, go to step 9).

7) Repair exhaust system as necessary. After repairs, go to step 10).

8) Replace suspect HO2S or harness as necessary. After repairs, go to step 10).

9) Replace 3-way catalytic converter. After repairs, go to next step.

NOTE: If A/C is left on, diagnostic may not run.

10) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn A/C off. Open hood. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. Up to 6 tests may need to be completed for test to pas or fail. If test does not pass or fail after 6 tests have ran, go to DIAGNOSTIC AIDS. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, go to next step.

11) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

PCM will NOT enable catalyst test until engine speed is 150 RPM +/- from desired idle, Throttle Position (TP) is less than 0.5 percent and short term integrator is -20 to +20 percent. Catalyst test will abort if above conditions are not met. Catalyst test may abort due to a change in engine load due to A/C, coolant fan, or other components. If this condition occurs, use scan tool to force cooling fans on. Return to step 3), then repeat the test.

When using scan tool to force cooling fans on, use list and use previous list soft keys to enter catalyst data list. If the catalyst data list is not entered this way, cooling fan control will

be canceled.

- The number of attempted tests is limited to 18 per key cycle.
- You may need to attempt more than 6 tests to complete 6 tests. An aborted test counts as an attempted test.
- If 18 tests have been attempted and a decision has not been made during this key cycle, turn ignition off for 30 seconds. Start engine, and perform items under CODE ENABLE CRITERIA, including 10-minute run time.
- After returning to idle, HO2S 1 signal may stay rich or lean for several seconds causing test to be delayed.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0440: EVAPORATIVE EMISSION SYSTEM

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Evaporative Emission (EVAP) system large leak test applies vacuum to EVAP system and monitors the rate of vacuum decay. Powertrain Control Module (PCM) monitors Fuel Tank Pressure (FTP) sensor to determine rate of vacuum decay. At an appropriate time, PCM turns EVAP canister purge valve on (open) and EVAP canister vent valve on (closed). This allows engine to draw a vacuum on the system. At a calibrated time or vacuum level, PCM turns purge valve off (closed), and tests the system vacuum.

Code Enable Criteria

For DTC to run, the following conditions must be met:

- DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0443, P0449, P0452, P0453, P1106, P1107, P1112, P1114, P1120, P1220, or P1221 are not set.
- Ignition voltage is 10-18 volts.
- Barometric Pressure (BARO) is more than 75 kPa.
- Fuel level is 15-85 percent.
- Engine Coolant Temperature (ECT) is 39-86°F (4-30°C).
- Intake Air Temperature (IAT) is 39-86°F (4-30°C).
- Start-up ECT and IAT are within 16°F (9°C).
- Vehicle Speed Sensor (VSS) is less than 75 MPH.

DTC will set when EVAP system is not able to achieve or maintain vacuum during diagnostic test.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If DTC P0443 or DTC P0449 are also set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

3) Check EVAP system for loose, incorrect, defective or missing fuel tank filler cap. Check for improperly routed, kinked or damaged EVAP system purge lines or damaged EVAP system component. Repair or replace as necessary. After repairs, go to step 18). If no problem is found, go to next step.

NOTE: The following steps require EVAP Pressure/Purge Diagnostic

Station (J 41413) and Fuel Fill Cap Adaptor (J 41415). Always zero EVAP pressure and vacuum in H2O gages on EVAP pressure diagnostic station before proceeding with diagnosis.

4) Connect EVAP pressure/purge diagnostic station and fuel fill cap adapter. Turn ignition on. Using scan tool, seal EVAP system. Pressurize system to 5 in. H2O using EVAP pressure/purge diagnostic station. Rotate EVAP pressure/purge diagnostic station rotary switch to OFF/HOLD position. Monitor pressure gage for 1 minute. If gauge holds steady at 5 in. H2O, go to next step. If gauge does not hold steady at 5 in. H2O, go to step 7).

5) Compare EVAP pressure/purge diagnostic station value Fuel Tank Pressure (FTP) sensor value on scan tool. If EVAP pressure/purge diagnostic station value is near the scan tool value, go to next step. If EVAP pressure/purge diagnostic station value is not near the scan tool value, go to step 11).

6) Monitor pressure gage on EVAP pressure/purge diagnostic station. Disconnect EVAP purge pipe from the EVAP purge solenoid. EVAP purge solenoid is located on left side of engine next to cylinder No. 3 fuel injector. If EVAP system pressure decreases, go to step 8). If EVAP system pressure does not decrease, go to step 9).

7) Using EVAP pressure/purge diagnostic station, continuously pressurize EVAP system. It may be necessary to partially lower fuel tank to inspect components located in upper portion of tank. Using Ultrasonic Leak Detector (J 41416), inspect for leaks in EVAP system purge pipe, vapor pipe, canister, vent hose/pipe, fuel fill pipe/hose and fuel fill cap, canister vent valve, canister purge valve, fuel sender assembly and/or seal, Fuel Tank Pressure (FTP) sensor seal, fill limiter vent valve, pressure relief valve, rollover valve, or fuel tank. See Fig. 9. Repair as necessary. After repairs, go to step 18). If components are okay and no leak is found, go to DIAGNOSTIC AIDS.

8) Attach a vacuum gauge to purge pipe port of EVAP purge solenoid. Start engine and allow to idle. Using scan tool, command EVAP purge solenoid to 50 percent. If vacuum gauge indicates more than 10 in. H2O vacuum, go to DIAGNOSTIC AIDS. If vacuum gauge indicates less than 10 in. H2O vacuum, go to step 12).

9) Monitor pressure gauge on EVAP pressure/purge diagnostic station. Disconnect EVAP purge pipe from EVAP canister. If EVAP system pressure decreases, go to step 14). If EVAP system pressure does not decrease, go to next step.

10) Monitor pressure gauge on EVAP pressure/purge diagnostic station. Disconnect EVAP vapor line from EVAP canister. If EVAP system pressure decreases, go to step 17). If EVAP system pressure does not decrease, go to step 13).

11) Monitor FTP sensor voltage on scan tool. If voltage is more than 4.3 volts, go to DTC P0453: FUEL TANK PRESSURE SENSOR CIRCUIT HIGH VOLTAGE. If voltage is less than 4.3 volts, go to step 15).

12) Check vacuum source to EVAP purge solenoid for blockage, damage or disconnections. Repair as necessary. After repairs, go to step 18). If vacuum source is okay, go to step 16).

13) Repair EVAP vapor pipe restriction. After repairs, go to step 18).

14) Repair EVAP purge pipe restriction. After repairs, go to step 18).

15) Replace FTP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 18).

16) Repair EVAP purge solenoid. After repairs, go to step 18).

17) Repair EVAP canister. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

18) Turn ignition on. Using scan tool, command EVAP vent

solenoid on. Pressurize system to 5 in. H2O using EVAP pressure/purge diagnostic station. Rotate EVAP pressure/purge diagnostic station rotary switch to OFF/HOLD position. Monitor pressure gage for 5 minutes. If scan tool indicates SERVICE BAY TEST PASSED, go to next step. If service bay test fails, go to step 7).

19) While monitoring EVAP pressure/purge diagnostic station pressure gauge, command EVAP purge solenoid to 50 percent. If EVAP system pressure decreases, go to next step. If EVAP system pressure does not decrease, go to step 9).

20) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Use EVAP pressure/purge diagnostic station to pressurize EVAP system to aid in locating intermittent leaks. Move all EVAP components while testing using ultrasonic leak detector. A temporary blockage in EVAP purge solenoid, purge pipe or EVAP canister could cause an intermittent condition.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

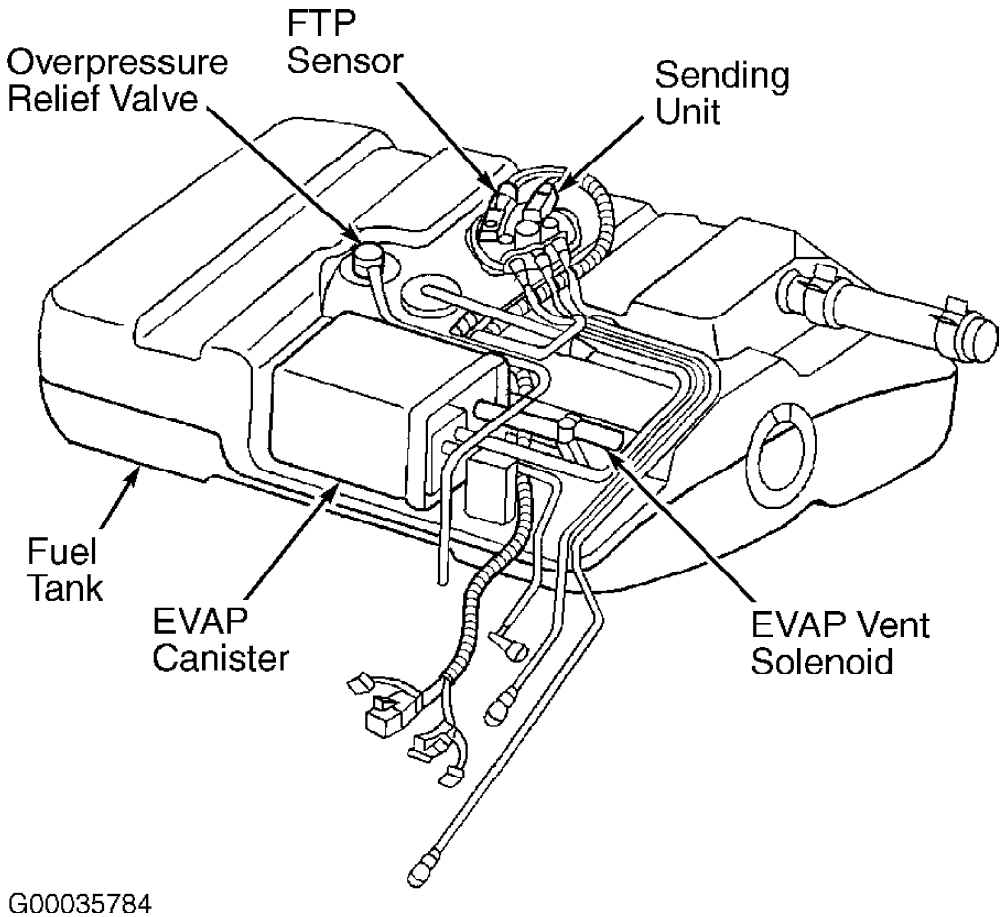


Fig. 9: Identifying Fuel Tank Components
Courtesy of General Motors Corp.

DTC P0442: EVAPORATIVE EMISSION SYSTEM SMALL LEAK DETECTED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

This DTC tests Evaporative Emission (EVAP) system for a small leak. Powertrain Control Module monitors Fuel Tank Pressure (FTP) sensor signal to determine vacuum decay rate. At an appropriate time, PCM turns EVAP purge solenoid and vent solenoid on. This allows engine to draw a vacuum on EVAP system. At a calibrated time, or vacuum level, PCM turns EVAP purge solenoid off, sealing system. PCM then monitors FTP sensor input to determine EVAP system vacuum decay. If PCM detects a leak larger than a calibrated amount, this DTC sets.

Code Enable Criteria

PCM commands EVAP purge solenoid off once system has reached a predetermined level of vacuum. This test checks if vacuum can be achieved in EVAP system. Failure to develop a vacuum may be caused by a large leak or restriction. This DTC sets after twice failing this test.

For DTC to run, the following conditions must be met:

* DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0440, P0443, P0449, P0452, P0453, P1106, P1107, P1112, P1114, P1120, P1220, or P1221 are not set.
* Ignition voltage is 10-18 volts.
* Barometric pressure (BARO) is more than 75 kPa.
* Fuel level is 15-85 percent.
* Engine Coolant Temperature (ECT) is 39-86°F (4-30°C).
* Intake Air Temperature (IAT) is 39-86°F (4-30°C).
* Start-up ECT and IAT are within 16°F (9°C) of each other.

DTC will set when EVAP system can achieve vacuum, but a vacuum decay is detected during diagnostic test.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If DTCs P0443, P0446, P0449, P0452, P0453, P0461, P0462, P0463, or P1441 are also set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

3) Check EVAP system for loose, incorrect, defective or missing fuel tank filler cap. Check for improperly routed, kinked or damaged EVAP system purge lines or damaged EVAP system component. Repair or replace as necessary. After repairs, go to step 5). If no problem is found, go to next step.

NOTE: The following steps require EVAP Pressure/Purge Diagnostic Station (J 41413) and Fuel Fill Cap Adaptor (J 41415). Always zero EVAP pressure and vacuum in H2O gages on EVAP pressure diagnostic station before proceeding with diagnosis.

4) Connect EVAP pressure/purge diagnostic station and fuel fill cap adapter. Turn ignition on. Using scan tool, seal EVAP system. Pressurize system to 15 in. H2O using EVAP pressure/purge diagnostic station. Using Ultrasonic Leak Detector (J 41416), inspect for leaks in EVAP system purge pipe, vapor pipe, canister, vent hose/pipe, fuel fill pipe/hose and fuel fill cap, canister vent valve, canister purge valve, fuel sender assembly and/or seal, Fuel Tank Pressure (FTP) sensor seal, fill limiter vent valve, pressure relief valve, rollover valve, or fuel tank. See Fig. 9. Repair or replace as necessary. After

repairs, go to next step. If components are okay and no leak is found, go to DIAGNOSTIC AIDS.

5) Remove and then reinstall fuel filler cap to relieve fuel tank pressure. Turn ignition on. Using scan tool, command the EVAP vent solenoid on. Pressurize the EVAP system to 5 in. H2O using EVAP pressure/purge diagnostic station. Place control knob to OFF/HOLD position. Monitor EVAP system pressure for 5 minutes. If EVAP system pressure holds, go to next step. If EVAP system pressure does not hold, go to step 4).

6) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

To aid in locating intermittent leaks, use the EVAP pressure/purge diagnostic station to pressurize the EVAP system. Move all EVAP components while using the ultrasonic leak detector to locate possible leaks.

DTC P0443: EVAPORATIVE EMISSION PURGE SOLENOID CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Ignition voltage is supplied directly to Evaporative Emission (EVAP) purge solenoid. The EVAP purge solenoid is Pulse Width Modulated (PWM). Powertrain Control Module (PCM) controls EVAP purge solenoid on time by grounding control circuit via an internal switch called a driver. Scan tool displays amount of on time as a percentage. PCM monitors status of the driver.

Code Enable Criteria

For DTC to run, engine speed must be more than 400 RPM with system voltage 6-18 volts. DTC will set when PCM detects commanded state of driver and actual state of control circuit DO NOT match for a minimum of 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Warm engine to normal operating temperature. Operate engine at idle. Using scan tool, command EVAP purge solenoid to 50 percent and then to zero percent. If solenoid responds as commanded, go to next step. If solenoid does not respond as commanded, go to step 4).

3) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for setting this DTC. Check DTCs. If this DTC resets, go to next step. If DTC does not reset, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect EVAP purge solenoid. EVAP purge solenoid is located on left side of engine next to cylinder No. 3 fuel injector. Turn ignition on, with engine off. Connect test light between ground and EVAP purge solenoid connector terminal "A" (Pink wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 11).

5) Connect test light between EVAP purge solenoid connector terminals "A" (Pink wire) and "B" (Dark Green/White wire). Using scan tool, command EVAP purge solenoid to 50 percent and then to zero

percent. If test light responds to each command, go to step 9). If test light does not respond to each command, go to next step.

6) If test light remains illuminated with each command, go to step 8). If test light does not remain illuminated with each command, go to next step.

7) Check for short to voltage or open in Dark Green/White wire between EVAP purge solenoid and PCM connector C1 terminal No. 76. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 10).

8) Check for short to ground in Dark Green/White wire between EVAP purge solenoid and PCM connector C1 terminal No. 76. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 13).

9) Check for poor connections at EVAP purge solenoid. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

10) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).

11) Repair open or short to ground in Pink wire between EVAP purge solenoid and ENG CTRL fuse (15-amp) located in bottom underhood fuse block. See Figs. 5 and 6. After repairs, go to step 14).

12) Replace EVAP purge solenoid. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing solenoid, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.

14) Using scan tool, clear DTCs. Turn ignition off for 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0446: EVAPORATIVE EMISSION VENT SYSTEM PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

This DTC tests Evaporative Emission (EVAP) system for a restricted or blocked EVAP vent path. Powertrain Control Module (PCM) commands EVAP purge solenoid and vent solenoid on. This allows a vacuum to be applied to EVAP system. Once a calibrated vacuum level has been reached, PCM commands EVAP purge solenoid and vent solenoid off. PCM monitors Fuel Tank Pressure (FTP) sensor for a decrease in vacuum.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0443, P0449, P0452, P0453, P1106, P1107, P1112, P1114, P1120, P1220, or P1221 are not set.
* Ignition voltage is 10-18 volts.
* Barometric Pressure (BARO) is more than 75 kPa.
* Fuel level is between 15-85 percent.

* Engine Coolant Temperature (ECT) is 39-86°F (4-30°C).
* Intake Air Temperature (IAT) is 39-86°F (4-30°C).
* Start-up ECT and IAT are within 16°F (9°C).
* Vehicle Speed Sensor (VSS) is less than 75 MPH.

DTC will set when vacuum does not decrease to near zero in. H2O in a calibrated time.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If DTC P0443, P0449, P0452, or P0453 are also set, go to DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

3) Check for loose, kinked or damaged EVAP purge and tank vent lines. Check for damaged EVAP system components. Repair as necessary. After repairs, go to step 13). If no problems were found, go to next step.

4) Disconnect purge line from EVAP purge solenoid. EVAP purge solenoid is located on left side of engine next to cylinder No. 3 fuel injector. Turn ignition on and monitor FTP sensor parameter. If FTP sensor is approximately zero in. H2O, go to next step. If FTP sensor is not approximately zero in. H2O, go to step 8).

NOTE: The following steps require EVAP Pressure/Purge Diagnostic Station (J 41413) and Fuel Fill Cap Adaptor (J 41415). Always zero EVAP pressure and vacuum in H2O gages on EVAP pressure diagnostic station before proceeding with diagnosis.

5) Turn ignition off. Reconnect all previously disconnected components. Connect EVAP pressure/purge diagnostic station and fuel fill cap adapter. Turn ignition on. Using scan tool, command EVAP vent solenoid on. Pressurize system to 5 in. H2O using EVAP pressure/purge diagnostic station. Rotate rotary switch to OFF/HOLD position. Using scan tool, command EVAP vent solenoid off. If EVAP pressure drops to approximately zero in. H2O, go to DIAGNOSTIC AIDS. If EVAP pressure does not drop to approximately zero in. H2O, go to next step.

6) Monitor FTP sensor pressure on scan tool. Disconnect EVAP vent hose from EVAP vent solenoid. See Fig. 9. If FTP sensor pressure is -0.5 to +0.5 in. H2O, go to step 10). If FTP sensor pressure is not -0.5 to +0.5 in. H2O, go to next step.

7) Monitor FTP sensor pressure on scan tool. Disconnect EVAP vent hose from EVAP canister. If FTP sensor pressure is approximately zero in. H2O, go to step 13). If FTP sensor pressure is not approximately zero in. H2O, go to step 11).

8) Monitor FTP sensor voltage on scan tool. If voltage is more than 4.3 volts, go to DTC P0453: FUEL TANK PRESSURE SENSOR CIRCUIT HIGH VOLTAGE. If voltage is less than 4.3 volts, go to next step.

9) Check for poor connections at FTP sensor. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

10) Replace EVAP vent solenoid. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 14).

11) Replace EVAP canister. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 14).

12) Replace FTP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing sensor, go to step 14).

13) Repair blocked EVAP vent hose. After repairs, go to next step.

14) Turn ignition on. Using scan tool, command EVAP vent

solenoid on. Pressurize system to 5 in. H2O using EVAP pressure/purge diagnostic station. Rotate rotary switch to OFF/HOLD position. Using scan tool, command EVAP vent solenoid off. If EVAP pressure decreases, go to next step. If EVAP pressure does not decrease, go to step 3).

15) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

An intermittent condition can be caused by damaged EVAP vent housing, temporary blockage at EVAP vent solenoid inlet or pinched vent hose. Blockage in vent system will also cause a poor fuel fill problem.

DTC P0449: EVAP CANISTER VENT SOLENOID VALVE CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Ignition voltage is supplied directly to Evaporative Emissions (EVAP) vent valve. Powertrain Control Module controls EVAP vent solenoid by grounding control circuit via an internal switch called a driver. Primary function of the driver is to supply ground for controlled component. PCM monitors status of the driver.

Code Enable Criteria

For DTC to run, engine speed must be more than 400 RPM with system voltage 6-18 volts. DTC will set when PCM detects that state of driver and actual state of control circuit DO NOT match for a minimum of 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Warm engine to normal operating temperature. Operate engine at idle. Using scan tool, command EVAP vent solenoid on and off. If solenoid responds as commanded, go to next step. If solenoid does not respond as commanded, go to step 5).

3) Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for setting this DTC. Check DTCs. If this DTC resets, go to next step. If DTC does not reset, see DIAGNOSTIC AIDS.

4) Turn engine off. Turn ignition on. Raise and support vehicle. Disconnect fuel tank connector C405 "D" at body pass-through connector C405 "B". Connector C405 is located in front of rear axle. Connect test light between ground and C405 "B" connector terminal 2A (Pink wire). See Fig. 10. If test light illuminates, go to next step. If test light does not illuminate, go to step 13).

5) Connect test light between C405 "B" connector terminal 2A (Pink wire) and 2B (White wire). Using scan tool, command EVAP canister vent solenoid on and off. If test light turns on and off with each command, go to step 9). If test light does not turn on and off with each command, go to next step.

6) If test light remains illuminated with each command, go to step 8). If test light does remain illuminated with each command, go to next step.

7) Check for short to voltage or open in Pink wire between connector C405 located in front of rear axle and splice S182 located in headlight harness approximately 5" from harness breakout to bottom

underhood fuse block. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 12).

8) Check for short to ground in Pink wire between connector C405 located in front of rear axle and splice S182 located in headlight harness approximately 5" from harness breakout to bottom underhood fuse block. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 12).

9) Check for poor connections at C405 "B" and C405 "D" connectors. Repair as necessary. After repairs, go to step 16). If connections are okay, go to next step.

10) Remove fuel tank and disconnect EVAP vent solenoid connector. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. Check for damaged EVAP canister vet valve wiring. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to next step.

11) Check for poor connections at EVAP vent solenoid. Repair as necessary. After repairs, go to step 16). If connections are okay, go to step 14).

12) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 16). If connections are okay, go to step 15).

13) Repair open or short to ground in Pink wire between connector C405 located in front of rear axle and splice S182 located in headlight harness approximately 5" from harness breakout to bottom underhood fuse block. After repairs, go to step 16).

14) Replace EVAP vent solenoid. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 16).

15) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

16) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

17) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

An intermittent condition can be caused by damaged EVAP vent housing, temporary blockage at EVAP vent solenoid inlet or pinched vent hose. Blockage in vent system will also cause a poor fuel fill problem.

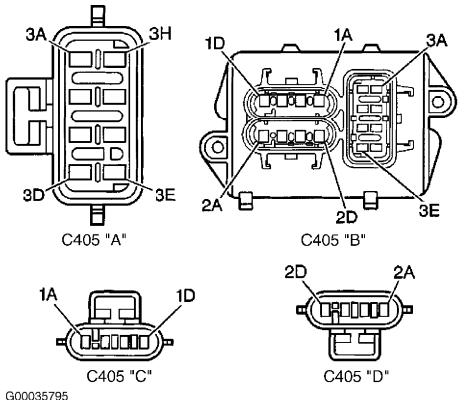


Fig. 10: Identifying In-Line Connector C405 Connectors & Terminals
Courtesy of General Motors Corp.

DTC P0452: FUEL TANK PRESSURE SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Powertrain Control Module (PCM) monitors Fuel Tank Pressure (FTP) sensor signal to detect vacuum decay and excess vacuum during enhanced Evaporative Emission (EVAP) diagnostic. PCM supplies 5-volt reference and ground to FTP sensor. FTP sensor signal voltage increases as the fuel tank pressure decreases. Negative pressure or vacuum equals high voltage. FTP sensor signal voltage decreases as fuel tank pressure increases. Positive pressure equals low voltage.

Code Enable Criteria

For DTC to run, ignition must be on. DTC will set when FTP sensor voltage is less than 0.1 volt for more than 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle for one minute. Using scan tool, monitor FAILED THIS IGNITION option under DTC INFO option. If DTC P1639 failed this ignition cycle, diagnose that DTC first. See DTC P1639: 5-VOLT REFERENCE 2 CIRCUIT. If DTC P1639 did not fail this ignition cycle, go to next step.

3) Monitor fuel tank pressure sensor voltage on scan tool. If scan tool reading is less than 0.10 volt, go to step 5). If scan tool reading is not less than 0.10 volt, go to next step.

4) Turn ignition on, engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data for this DTC and observe parameters. Turn ignition off for 30 seconds. Start and operate vehicle within conditions required for this DTC to run. Using scan tool, select DTC option, SPECIFIC DTC option, then enter this DTC. If scan tool indicates that this diagnostic failed this ignition cycle, go to next step. If scan tool does not indicate that this diagnostic failed this ignition cycle, see DIAGNOSTIC AIDS.

5) Turn ignition off. Raise and support vehicle. Disconnect fuel tank connector C405 "A" at body pass-through connector C405 "B". See Fig. 10. Connector C405 is located in front of rear axle. Connect a fused jumper wire between connector C405 "B" terminals 3D (Gray wire) and 3H (Dark Green wire). Turn ignition on. Using scan tool, monitor FTP voltage. If voltage is 5 volts, go to step 8). If voltage is not 5 volts, go to next step.

6) Check for open in Light Blue/Black wire between connector C405 "B" terminal 3D and PCM connector C2 terminal No. 34. See Fig. 3. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to next step.

7) Check for open or short to ground in Dark Green wire between connector C405 "B" terminal 3H and PCM connector C2 terminal No. 55. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to next step.

8) Remove fuel tank. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. Check for damaged wiring and poor connections. Repair as necessary. After repairs, go to step 12). If circuits are okay, go to step 10).

9) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 12). If circuits are okay, go to step 11).

10) Replace FTP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 12).

11) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

12) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

13) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0453: FUEL TANK PRESSURE SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Powertrain Control Module (PCM) monitors Fuel Tank Pressure (FTP) sensor signal to detect vacuum decay and excess vacuum during enhanced Evaporative Emission (EVAP) diagnostic. PCM supplies 5-volt reference and ground to FTP sensor. FTP sensor signal voltage increases as the fuel tank pressure decreases. Negative pressure or vacuum equals high voltage. FTP sensor signal voltage decreases as fuel tank pressure increases. Positive pressure equals low voltage.

Code Enable Criteria

For DTC to run, ignition must be on. DTC will set when FTP sensor voltage is more than 4.9 volts for more than 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle for one minute. Using scan tool, monitor FAILED THIS IGNITION option under DTC INFO option. If DTC P1639 failed this ignition cycle, diagnose that DTC first. See DTC P1639: 5-VOLT REFERENCE 2 CIRCUIT. If DTC P1639 did not fail this ignition cycle, go to next step.

3) Turn engine off. Turn ignition on. Using scan tool, monitor FTP sensor voltage. If voltage is more than 4.3 volts, go to step 5). If voltage is less than 4.3 volts, go to next step.

4) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data for this DTC and observe parameters. Turn ignition off for 30 seconds. Start and operate vehicle within conditions required for this DTC to run. Using scan tool, select DTC option, SPECIFIC DTC option, then enter this DTC. If scan tool indicates that this diagnostic failed this ignition cycle, go to next step. If scan tool does not indicate that this diagnostic failed this ignition cycle, see DIAGNOSTIC AIDS.

5) Turn ignition off. Raise and support vehicle. Disconnect fuel tank connector C405 "A" at body pass-through connector C405 "B". See Fig. 10. Connector C405 is located in front of rear axle. Using scan tool, monitor FTP sensor voltage. If voltage is more than zero volts, go to next step. If voltage is zero volts, go to step 7).

6) Check for short to voltage in Dark Green wire between connector C405 "B" terminal 3H and PCM connector C2 terminal No. 55. See Fig. 3. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).

7) Using a test light connected to battery voltage, probe

connector C405 "B" terminal 3G (Gray wire). If test light illuminates, go to step 9). If test light does not illuminate, go to next step.

8) Check for open in Gray wire between connector C405 "B" terminal 3G and PCM connector C2 terminal No. 35. See Fig. 3. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).

9) Remove fuel tank. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. Check for damaged wiring and poor connections. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to step 11).

10) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to step 12).

11) Replace FTP sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 13).

12) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

13) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0480: COOLING FAN RELAY NO. 1 CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Battery positive voltage is supplied to cooling fan No. 1 relay from cool fan fuse. Powertrain Control Module (PCM) controls cooling fan No. 1 relay by grounding low speed control circuit via an internal driver. The primary function of the driver is to supply ground for component being controlled. Each driver has a fault line which is monitored by the PCM. When PCM is commanding a component on, the voltage potential of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component off, voltage potential of the circuit should be high (near battery voltage).

PCM will monitor control circuit for the following: Short to ground, short to voltage, open circuit, open relay coil and internally shorted or excessively low resistance in relay coil.

Code Enable Criteria

For DTC to run, ignition must be on with ignition voltage 9-18 volts. DTC will set when improper voltage level has been detected on low speed cooling fan relay control circuit for at least 5 seconds. When DTC is set, the affected driver will be disabled.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on, with engine off. Using scan tool,

command cooling fan relay No. 1 (low speed) on and off. If relay turns on and off as commanded, go to DIAGNOSTIC AIDS. If relay does not turn on or off when commanded, go to next step.

3) Turn ignition off. Locate and disconnect cooling fan No. 1 relay. See Figs. 5 and 6. Turn ignition on. Connect a test light between ground and cooling fan No. 1 relay connector terminal C3 (Orange wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

4) Turn ignition off. Connect test light between cooling fan No. 1 relay connector terminals B1 (Dark Green wire) and C3 (Orange wire). Turn ignition on. Using scan tool, command cooling fan low speed on and off. If test light turns on and off with each command, go to step 10). If test light does not turn on and off with each command, go to next step.

5) If test light remains illuminated with each command, go to step 7). If test light does not remain illuminated with each command, go to next step.

6) Check for short to voltage or open in Dark Green wire between cooling fan No. 1 relay connector terminal B1 and PCM connector C1 terminal No. 6. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 9).

7) Check for short to ground in Dark Green wire between cooling fan No. 1 relay connector terminal B1 and PCM connector C1 terminal No. 42. See Fig. 3. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 9).

8) Check for short to ground or open in Orange wire between cooling fan No. 1 relay connector terminal C3 and splice S179. S179 is located in headlight harness approximately 9.8" from harness breakout to bottom underhood fuse block. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 11).

9) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).

10) Check for poor connections at cooling fan No. 1 relay. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).

11) Repair short to ground in Light Blue wire between cooling fan No. 1 relay connector terminal C1 and left cooling fan motor connector terminal "B". After repairs, go to step 14).

12) Replace cooling fan No. 1 relay. After repairs, go to step 14).

13) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

14) Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, system is okay at this time. If scan tool does not indicate that this test ran and passed, repeat step 2).

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0481: COOLING FAN RELAYS NO. 2 & 3 CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Battery positive voltage is supplied to cooling fan No. 2 and 3 relay from cool fan fuse. Powertrain Control Module (PCM) controls relays by grounding high speed cooling fan relay control circuit via a driver. The primary function of the driver is to supply ground for

component being controlled. Each driver has a fault line which is monitored by PCM. When PCM is commanding a component on, voltage potential of the control circuit should be low (near zero volts). When PCM is commanding the control circuit to a component off, voltage potential of circuit should be high (near battery voltage). PCM will monitor control circuit for short to ground, short to voltage or an open.

Code Enable Criteria

For DTC to run, the ignition must be on with ignition voltage 9-18 volts. DTC will set when improper voltage level has been detected on high speed cooling fan relay control circuit for at least 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Locate cooling fan No.2 and 3 relays. See Figs. 5 and 6. Turn ignition on. Using scan tool, command fans high speed on and off. If cooling fan No.2 and 3 relays turn on and off with each command, go to DIAGNOSTIC AIDS. If cooling fan No.2 and 3 relays do not turn on and off with each command, go to next step.

3) Turn ignition off. Remove cooling fan No. 3 relay from top underhood fuse block. Turn ignition on. Using test light connected to ground, probe cooling fan No. 3 relay connector terminal B8 (Orange wire). If test light illuminates, go to next step. If test light does not illuminate, go to step 8).

4) Connect test light between cooling fan No. 3 relay connector terminals B8 (Orange wire) and C10 (Dark blue wire). Using scan tool, command fans high speed on and off. If test light turns on and off with each command, go to step 9). If test light does not turn on and off with each command, go to next step.

5) If test light remains illuminated with each command, go to step 7). If test light does not remain illuminated with each command, go to next step.

6) Check for open or short to voltage in Dark Blue wire between cooling fan No. 2 relay connector terminal B4, cooling fan No. 3 relay connector terminal C10 and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to step 9).

7) Check for short to ground in Dark Blue wire between cooling fan No. 2 relay connector terminal B4, cooling fan No. 3 relay connector terminal C10 and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to step 9).

8) Check for open or short to ground in Orange wire between cooling fan No. 2 relay connector terminal C6, cooling fan No. 3 relay connector terminal B8 and COOL FAN fuse (10-amp) located in top underhood fuse block. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to step 10).

9) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 12). If connections are okay, go to step 11).

10) Repair open in White wire between right cooling fan motor and cooling fan No. 2 relay connector terminal B6 or cooling fan No. 3 relay connector terminal B9. If circuit is okay, repair short to ground in Red wire between cooling fan No. 2 relay connector terminal C4 and splice S169. S169 is located in headlight harness approximately 2.4" from main branch of engine harness to bottom underhood fuse block breakout. After repairs, go to step 12).

11) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS

article. After replacing PCM, go to next step.
12) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If DTC does not reset, system is okay. If DTC resets, go to step 2).

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0506: IDLE SPEED LOW

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
Throttle Actuator (TAC) motor is controlled by TAC module, using various inputs from Powertrain Control Module (PCM) which are communicated across serial data. DC motor located on throttle body drives throttle plate. To decrease idle speed, TAC module commands throttle closed, reducing air flow into engine. To increase idle speed, TAC module commands throttle plate open allowing more air to bypass throttle plate.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0171, P0172, P0174, P0175, P0200-P0206, P0300, P0336, P0401, P0403, P0404, P0405, P0502, P0503, P1112, P1114, P1115, P1120, P1220, P1221, P1374, P1380, or P1381 are not set.
* Engine is operating for at least 2 minutes.
* Engine Coolant Temperature (ECT) is more than -40°F (-40°C).
* Intake Air Temperature (IAT) is more than -40°F (-40°C).
* Barometric Pressure (BARO) is more than 65 kPa.
* System voltage is 9-18 volts.
* Vehicle speed is less than 4.8 km/h (3 MPH).
* Accelerator Pedal Position (APP) indicated angle is less than 0.25 percent.

DTC will set when actual idle speed is approximately 150 RPM lower than desired idle speed for 15 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Start engine. Using scan tool, command engine speed from 500 RPM up to 1500 RPM, then 1500 RPM to 500 RPM. Repeat 2 times and exit from test. If engine speed change responded to within 100 RPM of each command, see DIAGNOSTIC AIDS. If RPM does not respond as commanded, go to next step.
3) If engine speed is more than 100 RPM more than desired engine speed, go to next step. If engine speed is less than 100 RPM more than desired engine speed, go to step 5).
4) Check for excessive deposits on throttle plates or faulty PCV valve. Repair as necessary. After repairs, go to step 6).
5) Check for excessive deposits in throttle body. Check for parasitic load on engine (i.e., transmission problem). Repair as necessary. After repairs, go to next step.
6) Using scan tool, clear DTCs. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this

DTC. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to 2).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0507: IDLE SPEED HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Throttle Actuator (TAC) motor is controlled by TAC module, using various inputs from Powertrain Control Module (PCM) which are communicated across serial data. DC motor located on throttle body drives throttle plate. To decrease idle speed, TAC module commands throttle closed, reducing air flow into engine. To increase idle speed, TAC module commands throttle plate open allowing more air to bypass throttle plate.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0171, P0172, P0174, P0175, P0200-P0206, P0300, P0336, P0401, P0403, P0404, P0405, P0502, P0503, P1112, P1114, P1115, P1120, P1220, P1221, P1374, P1380, or P1381 are not set.
* Engine is operating for at least 2 minutes.
* Engine Coolant Temperature (ECT) is more than -40°F (-40°C).
* Intake Air Temperature (IAT) is more than -40°F (-40°C).
* Barometric Pressure (BARO) is more than 65 kPa.
* System voltage is 9-18 volts.
* Vehicle speed is less than 4.8 km/h (3 MPH).
* Accelerator Pedal Position (APP) indicated angle is less than 0.25 percent.

DTC will set when actual idle speed is approximately 175 RPM higher than desired idle speed for 15 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine. Using scan tool, command engine speed up to 1500 RPM, down to 500 RPM, and then up to 1500 RPM. Exit from test. If engine speed change responded to within 100 RPM of each command, see DIAGNOSTIC AIDS. If engine speed does not respond as commanded, go to next step.

3) If engine speed is more than 100 RPM more than desired engine speed, go to next step. If engine speed is not as specified, go to step 5).

4) Check for vacuum leaks or faulty PCV valve. Repair as necessary. After repairs, go to step 6).

5) Check for excessive deposits in throttle body. Check for parasitic load on engine (i.e., transmission problem). Repair as necessary. After repairs, go to next step.

6) Using scan tool, clear DTCs. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to 2).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P0530: A/C REFRIGERANT PRESSURE SENSOR CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

A/C refrigerant pressure sensor is located on high side of A/C system and is used to monitor refrigerant pressure. Powertrain Control Module (PCM) uses this information to run cooling fans when A/C refrigerant pressure is high. A 5-volt reference voltage is supplied to sensor and is returned to PCM on signal circuit. Sensor resistance changes as refrigerant pressure increases or decreases. PCM monitors A/C refrigerant pressure sensor signal circuit and can determine when A/C pressure is too high or too low.

Code Enable Criteria

For DTC to set. the engine must be running with A/C requested. DTC will set when PCM detects signal circuit is less than 5 counts (0.09 volt) or more than 250 counts (4.90 volts) for 5 seconds. When DTC is set, A/C compressor clutch will be disabled.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Ensure ambient air temperature is more than 38°F (3°C) before performing next step.

2) Turn ignition off. Check that A/C compressor rotates freely. Start engine. Turn A/C system off. If A/C compressor does not operate, go to next step. If A/C compressor continues to operate, go to diagnostics for compressor clutch does not disengage in appropriate article in AIR CONDITIONING & HEATING.

3) Turn engine off. Turn ignition on. Using scan tool, monitor A/C HIGH SIDE PRESSURE parameter in ENGINE DATA 2 list. If A/C high side pressure is 0.09-4.90 volts, go to DIAGNOSTIC AIDS. If A/C high side pressure is not 0.09-4.90 volts, go to next step.

4) Turn ignition off. Locate and disconnect A/C refrigerant pressure sensor connector. See Fig. 11. Turn ignition on. Using scan tool, monitor A/C HIGH SIDE PRESSURE parameter. If A/C high side pressure is less than 0.09 volt, go to next step. If A/C high side pressure is more than 0.09 volt, go to step 11).

5) Turn ignition off. Connect a 3-amp fused jumper wire between A/C refrigerant pressure sensor connector terminals "B" (Gray wire) and "C" (Red/Black wire). Turn ignition on. Monitor A/C HIGH SIDE PRESSURE parameter. If A/C high side pressure is more than 4.9 volts, go to next step. If A/C high side pressure is less than 4.9 volts, go to step 9).

6) Disconnect fused jumper wire. Using DVOM, measure voltage between ground and A/C refrigerant pressure sensor terminal "B" (Gray wire). If voltage is less than 5.1 volts, go to next step. If voltage is more than 5.1 volts, go to step 8).

7) Turn ignition off. Disconnect negative battery cable. Using DVOM, measure resistance between ground and A/C refrigerant pressure sensor terminal "A" (Black wire). If resistance is more than 5 ohms, go to step 11). If resistance is less than 5 ohms, go to step 13).

8) Check for short to voltage in Gray wire between A/C refrigerant pressure sensor terminal "B" and PCM connector C1 terminal No. 45. See Fig. 3. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

9) Check for open, short to ground or high resistance in Gray wire between A/C refrigerant pressure sensor terminal "B" and PCM connector C1 terminal No. 45. See Fig. 3. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to next step.

10) Check for open, short to ground or high resistance in Red/Black wire between A/C refrigerant pressure sensor terminal "C" and PCM connector C2 terminal No. 14. See Fig. 3. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

11) Check for short to voltage in Red/Black wire between A/C refrigerant pressure sensor terminal "C" and PCM connector C2 terminal No. 14. See Fig. 3. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

12) Check for open in Black wire between A/C refrigerant pressure sensor terminal "A" and PCM connector C1 terminal No. 60. See Fig. 3. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

13) Check for poor connections at A/C refrigerant pressure sensor connector. Repair as necessary. After repairs, go to step 17). If connections are okay, go to step 15).

14) Check for poor connections at PCM connectors. Repair as necessary. After repairs, go to step 17). If connections are okay, go to step 16).

15) Replace A/C refrigerant pressure sensor. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 17).

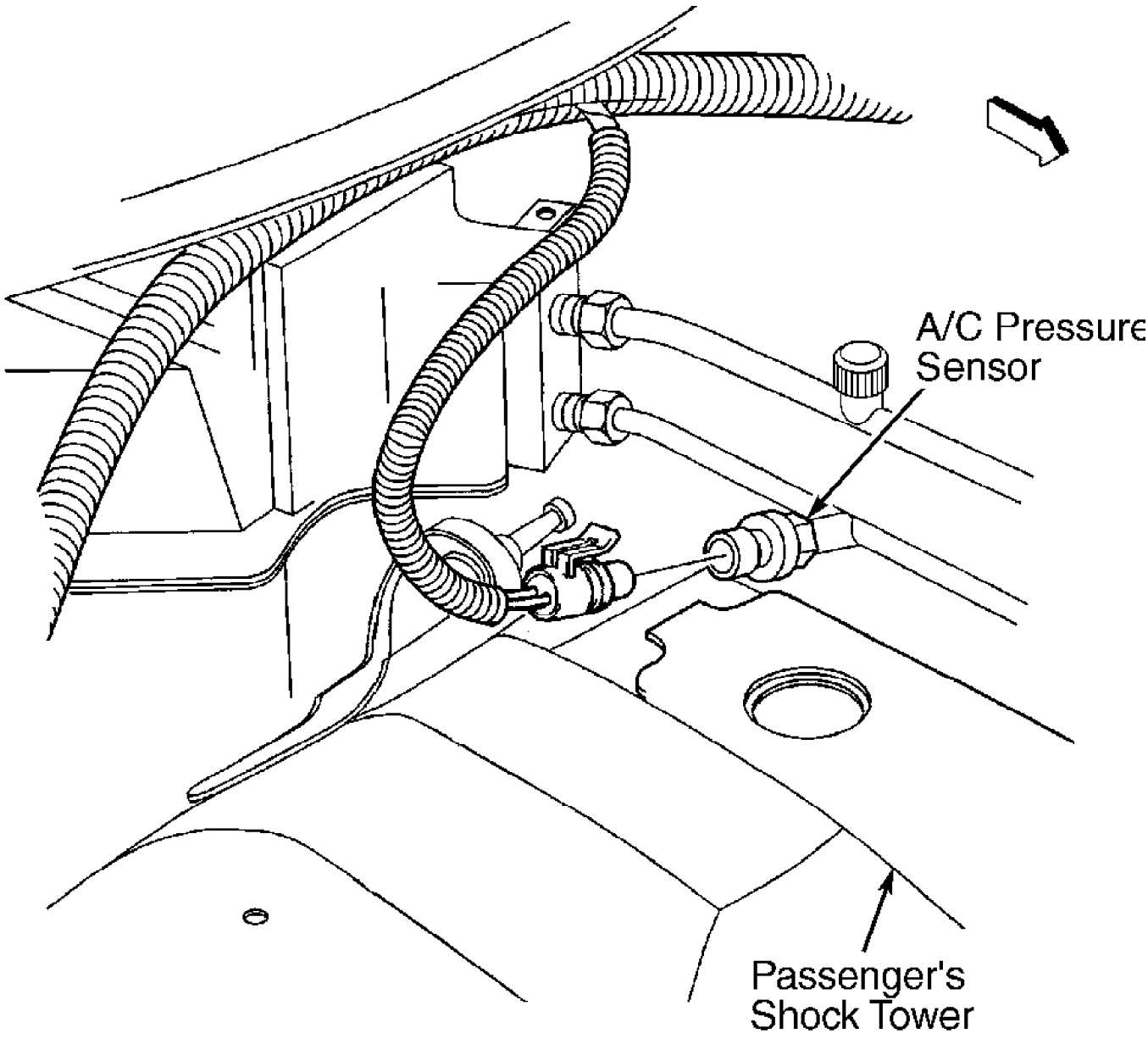
16) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.



G00035797

Fig. 11: Locating A/C Pressure Sensor
Courtesy of General Motors Corp.

DTC P0601: PCM INTERNAL MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Powertrain Control Module (PCM) utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). EEPROM contains program information and calibrations required for powertrain diagnostics operation. Unlike the Programmable Read Only Memory (PROM) used for past applications, the EEPROM is not replaceable. When PCM is replaced or a calibration update is required, PCM must be programmed using approved Techline equipment.

Code Enable Criteria

For DTC to run, ignition must be in crank or run position. DTC will set when PCM does not contain correct program required to operate vehicle.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.

Diagnostic Aids

DTC P0601 indicates that contents of the EEPROM have changed since PCM was programmed. The only possible repair is PCM replacement. Remember to program replacement PCM with correct software and calibration for the vehicle.

DTC P0602: PCM INTERNAL MALFUNCTION

Description

Powertrain Control Module (PCM) utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). EEPROM contains program information and calibrations required for powertrain diagnostics operation. Unlike the Programmable Read Only Memory (PROM) used for past applications, the EEPROM is not replaceable. When PCM is replaced or a calibration update is required, PCM must be programmed using approved Techline equipment.

Code Enable Criteria

For DTC to run, ignition must be in crank or run position. DTC will set when PCM does not contain correct program required to operate vehicle.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Program PCM. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. Recheck for DTC P0602. If DTC resets, go to next step. If DTC does not reset, system is okay at this time.

3) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.

DTC P0604: PCM INTERNAL MALFUNCTION

Description

Powertrain Control Module (PCM) performs an internal self-test on Random Access Memory (RAM) or on read/write memory.

Code Enable Criteria

For DTC to run, ignition switch must be ON for 5 seconds with ignition voltage more than 10 volts.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.

DTC P0606: PCM INTERNAL MALFUNCTION

Description

Diagnostic indicates Powertrain Control Module (PCM) detects an internal microprocessor integrity fault.

Code Enable Criteria

For DTC to run, PCM must be powered up. DTC will set when PCM detects an internal microprocessor integrity fault.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After replacing PCM, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS.

DTC P0650: MALFUNCTION INDICATOR LIGHT (MIL) CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Output Driver Modules (ODM) are used by Powertrain Control Module (PCM) to turn on many current driven devices that are needed to control various engine and transaxle functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to device that PCM is commanding on. Unlike Quad Driver Modules (QDM) used in prior model years, ODM has capability of diagnosing each output circuit individually.

Code Enable Criteria

For DTC to run, ignition must be on. DTC will set when an improper voltage level has been detected on output circuit which controls the Malfunction Indicator Light (MIL) for at least 30 seconds with ignition voltage 9-18 volts.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Locate and check condition of GAUGES fuse No. 9 (10-amp) located in instrument panel fuse block. If fuse is blown, repair short to ground in Pink wire between GAUGES fuse and Instrument Panel Cluster (IPC) connector terminal A3. See Fig. 4. If fuse is okay, go to next step.

3) Turn ignition off. Locate PCM and disconnect connectors. See Fig. 2. Connect a fused jumper wire between ground and PCM connector C2 terminal No. 5 (Brown/White wire). See Fig. 3. Turn ignition on. If MIL is on, go to next step. If MIL is not on, go to step 5).

4) With ignition on, remove fused jumper wire. If MIL remains on, go to step 7). If MIL turns off, go to step 9).

5) Remove IPC. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. Check for open in Brown/White wire between PCM connector C2 terminal No. 5 and IPC connector terminal A3. Repair as necessary. After repairs, go to step 12). If circuit is okay go to

next step.

6) Check for open in Pink wire between IPC connector terminal A3 and GAUGES fuse located in instrument panel fuse block. Repair as necessary. After repairs, go to step 12). If circuit is okay go to step 8).

7) Remove IPC. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. Check for short to ground in Brown/White wire between PCM connector C2 terminal No. 5 and IPC connector terminal A3. Repair as necessary. After repairs, go to step 12). If circuit is okay go to step 10).

8) Check for poor connections at IPC connector. Repair as necessary. After repairs, go to step 12). If connections are okay, go to step 10).

9) Check for poor connections at PCM connector. Repair as necessary. After repairs, go to step 12). If connections are okay, go to step 11).

10) Replace IPC. After repairs, go to step 12).

11) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

12) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

13) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1106: MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH VOLTAGE

Description

Manifold Absolute Pressure (MAP) sensor responds to pressure changes in the intake manifold. Pressure changes occur based on engine load. MAP sensor has a 5-volt reference, low reference and signal circuits.

PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. PCM should detect a high signal voltage at a high MAP, such as ignition on, engine off, or at a Wide Open Throttle (WOT). MAP sensor is also used to determine Barometric Pressure (BARO). This occurs when ignition switch is turned on, with engine off. BARO reading may also be updated whenever engine is operated at WOT. PCM monitors MAP sensor signal for voltage outside of the normal range.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1120, P1125, P1220, P1221, P1271, P1272, P1273, P1275, P1276, P1280, P1281, P1285, P1286, P1514, P1515, P1516, or P1517 are not set.
* Engine has been running for a period of time that is determined by start-up coolant temperature. The time ranges from 2 minutes at less than -22°F (-30°C), to one second at more than 86°F (30°C).
* Throttle angle is less than 0.5 percent when engine

speed is less than 900 RPM.

DTC will set when MAP sensor signal voltage is more than 4.3 volts for 20 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle. Check for additional DTCs. If DTC P0108 or P1635 are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

3) Monitor MAP sensor voltage on scan tool. If MAP voltage is more than 4.3 volts, go to step 4). If MAP voltage is not more than 4.3 volts, go to next step.

4) Monitor MAP sensor voltage on scan tool while moving MAP sensor connector, PCM connectors and MAP sensor harness. See Figs. 12 and 13. If MAP sensor voltage holds steady at more than 4.3 volts, go to next step. If MAP sensor voltage does not hold steady at more than 4.3 volts, go to step 13).

5) Turn ignition off. Locate and disconnect MAP sensor connector. Turn ignition on. If MAP sensor voltage drops to less than 0.1 volt, go to next step. If MAP sensor voltage does not drop to less than 0.1 volt, go to step 8).

6) Using DVOM, measure voltage between MAP sensor connector terminals "A" (Orange/Black wire) and "C" (Gray wire). If voltage is 4.7-5.2 volts, go to step 11). If voltage is not 4.7-5.2 volts, go to next step.

7) If voltage is more than 5.2 volts, go to step 10). If voltage is less than 5.2 volts, go to step 9).

8) Check for short to voltage in Light Green wire between MAP sensor connector terminal "B" and PCM connector C2 terminal No. 25. See Fig. 3. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 12).

9) Check for open in Orange/Black wire between MAP sensor connector terminal "A" and PCM connector C1 terminal No. 13. See Fig. 3. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 12).

10) Check for short to voltage in Gray wire between MAP sensor connector terminal "C" and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 12).

11) Check for poor connections at MAP sensor. Repair as necessary. After repairs, go to step 13). If connections are okay, go to DIAGNOSTIC AIDS.

12) Check for poor connections at PCM. Repair as necessary. After repairs, go to next step. If connections are okay, go to DIAGNOSTIC AIDS.

13) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see

INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

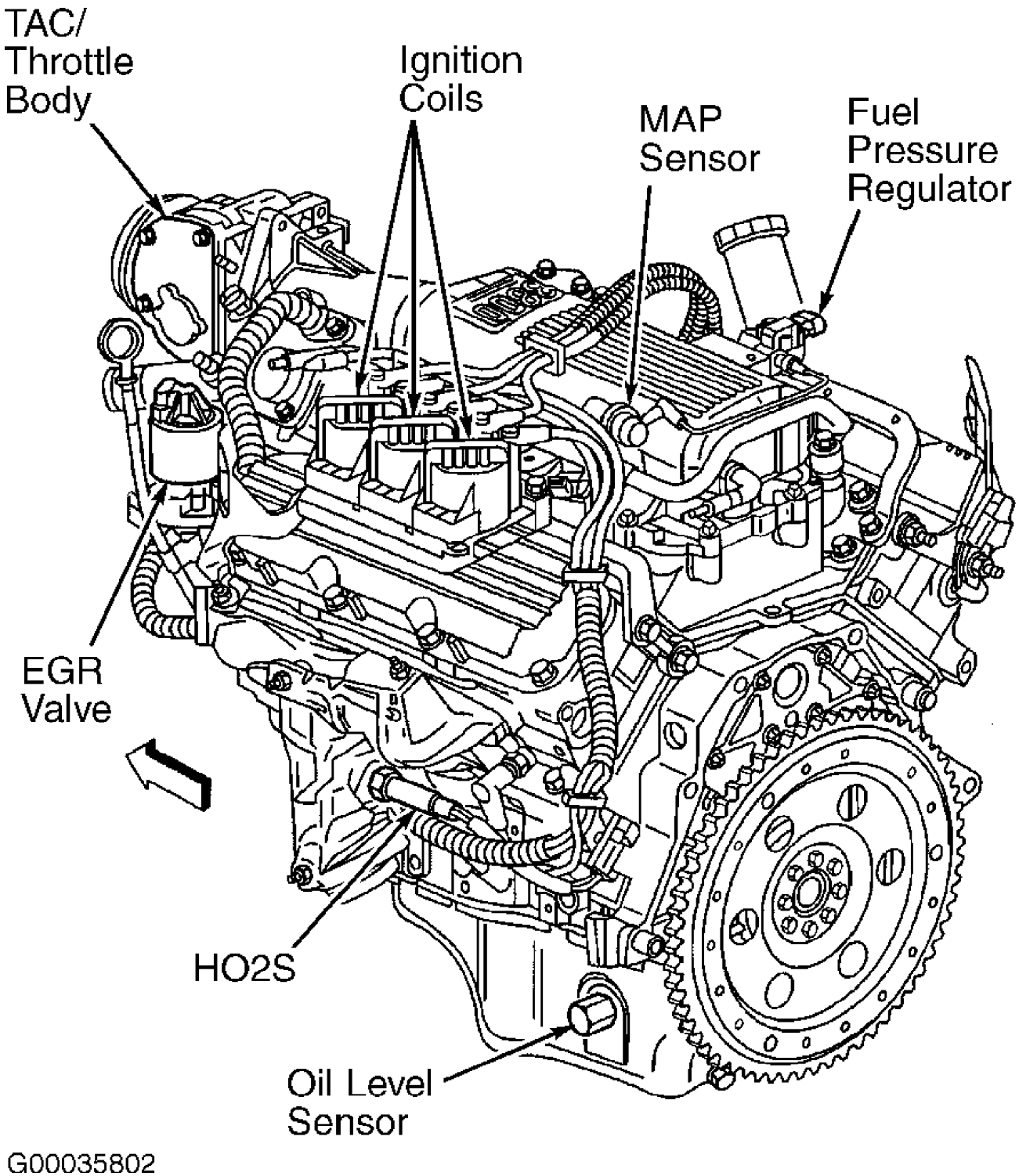


Fig. 12: Identifying Engine Components (1 Of 2)
Courtesy of General Motors Corp.

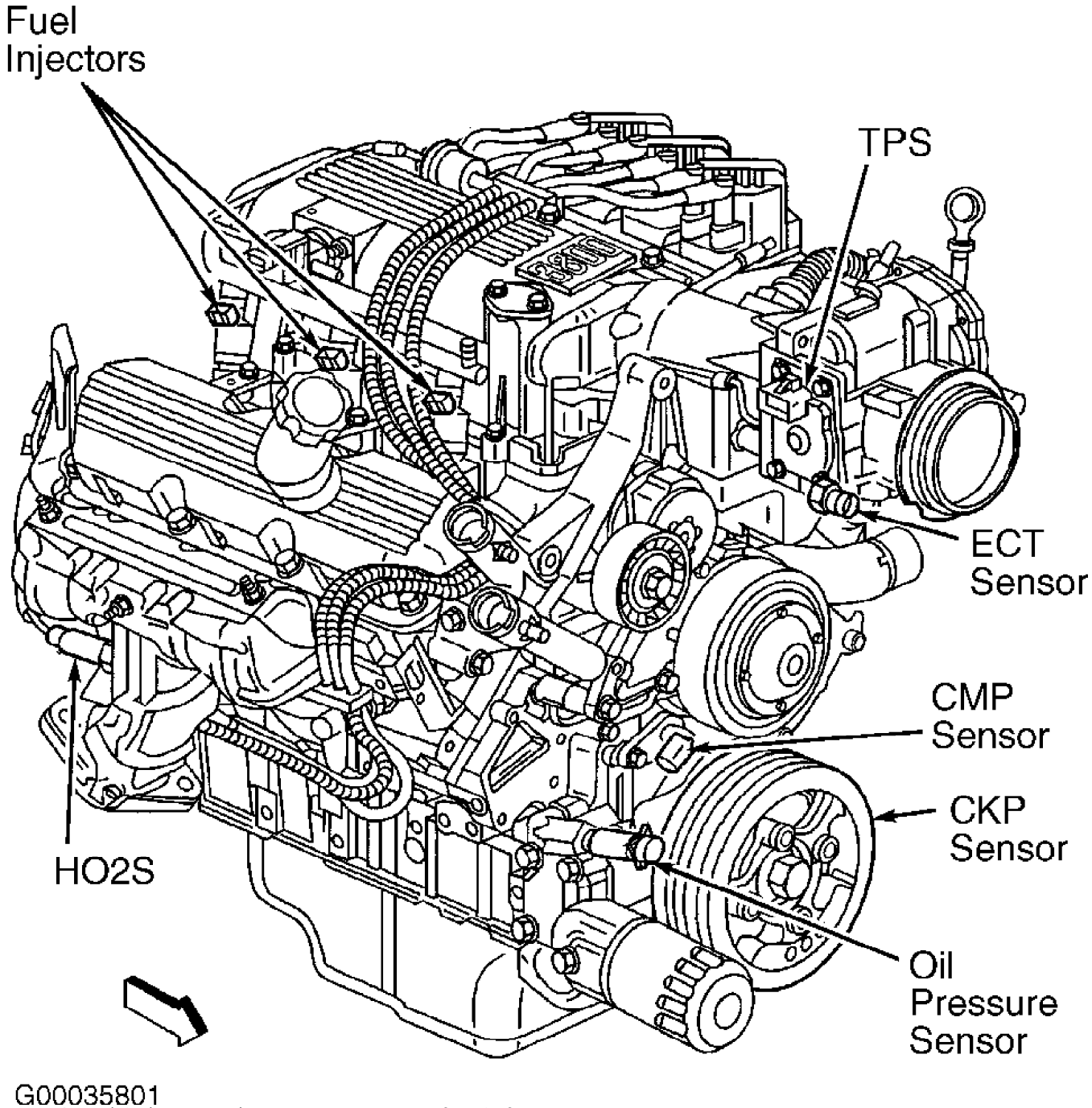


Fig. 13: Identifying Engine Components (2 Of 2)
Courtesy of General Motors Corp.

DTC P1107: MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW VOLTAGE

Description

Manifold Absolute Pressure (MAP) sensor responds to pressure changes in the intake manifold. Pressure changes occur based on engine load. MAP sensor has a 5-volt reference, low reference and signal circuits.

PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. PCM should detect a high signal voltage at a high MAP, such as ignition on, engine off, or at a Wide Open Throttle (WOT). MAP sensor is also used to determine Barometric Pressure (BARO). This occurs when ignition switch is turned on, with engine off. BARO reading may also be updated whenever engine is operated at WOT. PCM monitors MAP sensor signal for voltage outside of the normal range.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1120, P1125, P1220, P1221, P1271, P1272, P1273, P1275, P1276, P1280, P1281, P1285, P1286, P1514, P1515, P1516, P1517, or P1518 are not set.
* Ignition is on.
* Throttle angle is more than 0 percent when engine speed is less than 1000 RPM or throttle angle is more than 10 percent when engine speed is more than 1000 RPM.

DTC will set when MAP sensor signal voltage is less than 0.1 volt for more than 20 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Start engine and allow to idle. Check for additional DTCs. If DTC P0107 or P1635 are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If additional DTCs are not set, go to next step.

3) Monitor MAP sensor voltage on scan tool. If MAP voltage is less than 0.1 volt, go to step 5). If MAP voltage is not less than 0.1 volt, go to next step.

4) Monitor MAP sensor voltage on scan tool while moving MAP sensor connector, PCM connectors and MAP sensor harness. See Figs. 12 and 13. If MAP sensor voltage holds steady at less than 0.1 volt, go to next step. If MAP sensor voltage does not hold steady at less than 0.1 volt, go to step 11).

5) Turn ignition off. Locate and disconnect MAP sensor connector. Turn ignition on. Using DVOM, measure voltage between ground and MAP sensor connector terminal "C" (Gray wire). If voltage is approximately 5 volts, go to next step. If voltage is not approximately 5 volts, go to step 7).

6) Monitor MAP sensor voltage on scan tool. Connect a fused jumper between MAP sensor connector terminals "B" (Light Green wire) and "C" (Gray wire). If voltage is approximately 5 volts, go to step 9). If voltage is not approximately 5 volts, go to step 8).

7) Check for open or short to ground in Gray wire between MAP sensor connector terminal "C" and PCM connector C2 terminal No. 33. See Fig. 3. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to step 10).

8) Check for open or short to ground in Light Green wire between MAP sensor connector terminal "B" and PCM connector C2 terminal No. 25. See Fig. 3. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to step 10).

9) Check for poor connections at MAP sensor. Repair as necessary. After repairs, go to step 11). If connections are okay, go to DIAGNOSTIC AIDS.

10) Check for poor connections at PCM. Repair as necessary. After repairs, go to next step. If connections are okay, go to DIAGNOSTIC AIDS.

11) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

12) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1112: INTAKE AIR TEMPERATURE SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Intake Air Temperature (IAT) sensor is a thermistor which changes resistance based on temperature. IAT is located in air intake passage of engine air induction system. IAT sensor has a signal and ground circuit. PCM applies a voltage (about 5 volts) on signal circuit to sensor and monitors changes in this voltage caused by changes in resistance of sensor to determine intake temperature.

When intake air is cold, sensor resistance is high and PCM signal voltage is only pulled down a small amount through sensor ground. When intake air is warm, sensor resistance is low and PCM signal voltage is pulled down a greater amount. This causes PCM to sense a low signal voltage (high temperature).

Code Enable Criteria

For DTC to run, the following conditions must be met and present for at least 5 seconds:

* DTCs P0101, P0102, P0103, P0117, P0118, P0125, P0128, P0501, P0502, P1114, or P1115 are not set.
* Engine has been running for more than 10 seconds.
* Vehicle speed is more than 25 MPH.

DTC will set when IAT sensor indicates an IAT that is intermittently more than 275°F (135°C) for up to 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If DTC P0112 is also set, diagnose that DTC first. See DTC P0112: INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW VOLTAGE. If additional DTCs are not set, go to next step.

3) Check for intermittent short to ground in Tan wire between IAT sensor connector and PCM connector C2 terminal No. 50. See Fig. 3. Repair as necessary. After repairs, go to next step. If circuit is okay, go to DIAGNOSTIC AIDS.

4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step.

If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1114: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Engine Coolant Temperature (ECT) sensor is a thermistor which changes resistance based on temperature. ECT sensor is mounted on left front of cylinder head. ECT sensor has a signal and ground circuit. PCM applies a voltage (about 5 volts) on signal circuit to sensor and monitors changes in this voltage caused by changes in resistance of sensor to coolant temperature.

When coolant is cold, sensor resistance is high and PCM signal voltage is only pulled down a small amount through sensor ground. When coolant is warm, sensor resistance is low and PCM signal voltage is pulled down a greater amount. This causes PCM to sense a low signal voltage (high temperature).

Code Enable Criteria

For DTC to run, engine must be running for more than 5 seconds. DTC will set when PCM detects an intermittent high ECT sensor temperature while engine is running and run time exceeds 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If DTC P0117 is also set, diagnose that DTC first. See DTC P0117: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW VOLTAGE. If additional DTCs are not set, go to next step.

3) Turn ignition on. Using scan tool, monitor ECT sensor while moving related connectors at sensor and PCM. See Fig. 13. If ECT sensor value changes while moving connectors at component and PCM, go to step 6). If ECT sensor value does not change while moving connectors, go to next step.

4) Using scan tool, observe ECT sensor value while moving related wiring harnesses. If ECT sensor value changes abruptly, go to step 7). If ECT sensor value does not change, go to next step.

5) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to step DIAGNOSTIC AIDS. If scan tool does not indicate that this test failed this ignition, system is okay at this time.

6) Repair damaged connectors or terminals. After repairs, go to step 8).

7) Repair faulty wiring. After repairs, go to next step.
8) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Intermittent short to ground in ECT sensor signal wire can set DTC P0114. ECT sensor or PCM internal shorted, open or skewed is possible, but unlikely. If low voltage and high temperature readings are present, additional ECT sensor codes will set. A skewed sensor may also cause driveability concerns.

Diagnose possible skewed sensor using temperature vs. resistance table. See appropriate SENSOR OPERATING RANGE CHARTS article. If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1115: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Engine Coolant Temperature (ECT) sensor is a thermistor which changes resistance based on temperature. ECT sensor is mounted on left front of cylinder head. ECT sensor has a signal and ground circuit. PCM applies a voltage (about 5 volts) on signal circuit to sensor and monitors changes in this voltage caused by changes in resistance of sensor to coolant temperature.

When coolant is cold, sensor resistance is high and PCM signal voltage is only pulled down a small amount through sensor ground. When coolant is warm, sensor resistance is low and PCM signal voltage is pulled down a greater amount. This causes PCM to sense a low signal voltage (high temperature).

Code Enable Criteria

For DTC to run, engine must be running for more than 5 seconds. DTC will set when PCM detects an intermittent low ECT sensor temperature while engine is running and run time exceeds 5 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Check for additional DTCs. If DTC P0118 is also set, diagnose that DTC first. See DTC P0118: ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH VOLTAGE. If additional DTCs are not set, go to next step.
3) Turn ignition on. Using scan tool, monitor ECT sensor while moving related connectors at sensor and PCM. See Fig. 13. If ECT sensor value changes while moving connectors at component and PCM, go to step 6). If ECT sensor value does not change while moving connectors, go to next step.
4) Using scan tool, observe ECT sensor value while moving

related wiring harnesses. If ECT sensor value changes abruptly, go to step 7). If ECT sensor value does not change, go to next step.

5) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 30 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to step DIAGNOSTIC AIDS. If scan tool does not indicate that this test failed this ignition, system is okay at this time.

6) Repair damaged connectors or terminals. After repairs, go to step 8).

7) Repair faulty wiring. After repairs, go to next step.

8) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

9) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Intermittent short to ground in ECT sensor signal wire can set DTC P0114. ECT sensor or PCM internal shorted, open or skewed is possible, but unlikely. If low voltage and high temperature readings are present, additional ECT sensor codes will set. A skewed sensor may also cause driveability concerns.

Diagnose possible skewed sensor using temperature vs. resistance table. See appropriate SENSOR OPERATING RANGE CHARTS article. If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1120: THROTTLE POSITION SENSOR 1 VOLTAGE OUT OF RANGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

NOTE: Throttle Position (TP) sensors No. 1 and 2 may also be referred to as Throttle Actuator Control (TAC) assembly.

Throttle Position (TP) sensor is part of throttle body of Throttle Actuator Control (TAC) assembly. TP sensor is actually 2 individual TP sensors within 1 housing. Two separate signals, a low-reference and 5-volt reference circuit are used to connect TP sensor assembly to TAC module. TP sensor signal voltage increases as throttle opens. The signal circuit for TP sensor is pulled up to 5-volt reference voltage.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.
* Electronic Throttle Control (ETC) serial data is operational.

DTC will set when TP sensor 1 voltage is less than 0.34 volts or more than 4.4 volts, as observed on the scan tool.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC does not set this ignition cycle, go to DIAGNOSTIC AIDS.

2) Turn ignition on. Using scan tool, monitor AGREE/DISAGREE parameters for TP sensor 1 and 2. If scan tool displays DISAGREE, go to next step. If scan tool displays AGREE, go to step 11).

3) Using scan tool, monitor TP sensor 1 voltage. Depress accelerator pedal to floor and release. If scan tool indicates voltage at or near one volt through entire pedal travel, go to step 21). If scan tool does not indicate voltage at or near one volt through entire pedal travel, go to next step.

4) If voltage is less than one volt, go to next step. If voltage is not less than one volt, go to step 7).

5) While monitoring TP sensor 1 voltage, disconnect TAC assembly throttle body connector. See Fig. 12. If voltage is approximately 5 volts, go to next step. If voltage is not approximately 5 volts, go to step 13).

6) Turn ignition off for 15 seconds. Turn ignition on. Using DVOM, measure voltage between ground and TAC assembly connector terminal "F" (Gray/Black wire). If voltage is 3.9-5.6 volts, go to step 23). If voltage is not 3.9-5.6 volts, go to step 17).

7) Disconnect TAC assembly throttle body connector. See Fig. 12. Turn ignition on. Monitor TP sensor voltage. Connect a test light between TAC assembly connector terminals "G" (Dark Green wire) and "H" (Black wire). If TP voltage is zero volts, go to step 10). If TP voltage is not zero volts, go to next step.

8) Remove test light from Black wire terminal and connect to ground. Monitor TP sensor 1 voltage. If TP sensor voltage is zero volts, go to step 14). If TP sensor voltage is not zero volts, go to next step.

9) If test light illuminates when touched to ground, go to step 15). If test light does not illuminate when touched to ground, go to step 16).

10) Turn ignition off for 15 seconds. Turn ignition back on. Using DVOM, measure voltage between ground and TAC assembly connector terminal "F" (Gray/Black wire). If voltage is 3.9-5.6 volts, go to step 23). If voltage is not 3.9-5.6 volts, go to step 18).

11) Check condition of ETC (10-amp) and TCS BATT (20-amp) fuses located in underhood fuse blocks. See Figs. 5 and 6. If any fuses are blown, go to step 19). If fuses are okay, go to next step.

12) Disconnect TAC module. TAC module is mounted to accelerator pedal bracket. With test light connected to ground, probe TAC module connector terminals No. 3 (Orange wire) and No. 7 (Pink wire). If test light illuminates at both terminals, go to DTC P1515: COMMANDED & ACTUAL THROTTLE POSITION MISMATCH or DTC P1516: COMMANDED & ACTUAL THROTTLE POSITION MALFUNCTION. If test light does not illuminate at both terminals, go to step 20).

13) Check for short to ground in Dark Green wire between TAC assembly connector terminal "G" and TAC module connector terminal No. 10. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

14) Check for open in Black wire between TAC connector terminal "H" and TAC assembly module connector terminal No. 12. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

15) Check for short to voltage in Dark Green wire between TAC

assembly connector terminal "G" and TAC module connector terminal No. 10. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

16) Check for open in Dark Green wire between TAC assembly connector terminal "G" and TAC module connector terminal No. 10. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

17) Check for open or short to ground in Gray/Black wire between TAC assembly connector terminal "F" and TAC module connector terminal No. 11. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

18) Check for short to voltage in Gray/Black wire between TAC assembly connector terminal "F" and TAC module connector terminal No. 11. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

19) Repair short to ground in Pink or Orange wire between blown fuse and TAC module. After repairs, go to step 27).

20) Repair open in Pink or Orange wire between fuse and TAC module. After repairs, go to step 27).

21) Check for short to ground in Gray/Black wire between TAC assembly connector terminal "F" and TAC module connector terminal No. 11. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to next step.

22) Check for short between TAC assembly connector terminals "C" and "F" (component side). If short is found, go to step 24). If short is not found, go to step 26).

23) Check for poor connections at TAC assembly. Repair as necessary. After repairs, go to step 27). If connections are okay, go to next step.

24) Replace TAC assembly. TAC contains both TP sensors. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 27).

25) Check for poor connections at TAC module. Repair as necessary. After repairs, go to step 27). If connections are okay, go to next step.

26) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

27) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

28) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, PCM receives a message across serial data, and more than one ETC system-related DTC may set. This condition is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this condition when you review captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1125: ACCELERATOR PEDAL POSITION SENSORS OUT OF RANGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. Three separate low reference and 5-volt reference circuits are used. If only one APP sensor DTC is set, redundant APP systems allow Electronic Throttle Control (ETC) system to continue operating normally. DTC sets if Powertrain Control Module (PCM) detects a condition with more than one APP sensor. One APP sensor diagnostic trouble code (DTC) will not cause REDUCED ENGINE POWER message to be displayed on Driver's Information Center (DIC). 2 APP sensor DTCs for same sensor also will not cause message to be displayed. However, if 2 or more DTCs are set involving more than one APP sensor, this DTC will set and REDUCED ENGINE POWER message is displayed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition is on.
* Electronic Throttle Control (ETC) serial data is operational.

DTC will set when 2 or more APP sensors are out of range, all 3 APP sensors disagree, or one APP sensor is out of range and the other 2 APP sensors disagree.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) This DTC indicates that 2 or more APP sensor DTCs are also set. Check for additional APP sensor DTCs and diagnose those DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

Diagnostic Aids

If a repair is completed and DTC was cleared using scan tool on same ignition cycle, default action will not clear until an ignition cycle has occurred. When TAC module detects a condition within ETC system, PCM receives a message across serial data and more than one ETC system related DTC may set. This condition is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1133: HO2S INSUFFICIENT SWITCHING - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM monitors Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, PCM counts number of times that HO2S switches from rich-to-lean and lean-to-rich. When PCM determines that HO2S does not switch enough times, DTC will set.

A lean-to-rich switch is determined when HO2S voltages changes from less than 300 mV to more than 600 mV. A rich-to-lean switch is determined when HO2S voltage changes from more than 600 mV to less than 300 mV.

Code Enable Criteria

For DTC to run, DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0300, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set. DTC will set when PCM monitors the following conditions for 2 minutes after closed loop enable.

* Less than 55 lean-to-rich and rich-to-lean switches for this HO2S.
* HO2S voltage remains between 300-600 mV.

When DTC is set, PCM will illuminate Malfunction Indicator Light (MIL) on second consecutive ignition cycle that DTC fails. PCM records operating conditions at the time of failure in FREEZE FRAME and/or FAILURE RECORDS data. MIL will turn off after 3 consecutive ignition cycles that DTC does not fail. Current DTC will clear when DTC runs and passes. History DTC will clear after 40 consecutive no fail cycles by this or any other emission related DTC. DTC can also be cleared manually using scan tool.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present (except HO2S DTCs), diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and allow to idle until operating temperature is reached. Raise engine speed to more than 1200 RPM for 2 minutes. Using scan tool, monitor HO2S voltage. If voltage is 400-500 mV, go to next step. If voltage is not 400-500 mV, go to step 4).

3) Using scan tool, monitor FAIL THIS IGN under DTC info. Operate vehicle within conditions that DTC failed under FAILURE RECORDS. If scan tool indicates that this DTC failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

4) Check exhaust system for leaks. Ensure that HO2S is securely installed. Check for corrosion on terminals and terminal tension at sensor and PCM. Check for damaged wiring. Repair as necessary. After repairs, go to step 15). If exhaust leak is not present, go to next step.

5) Disconnect bank 1 sensor 1 HO2S connector. Connect a fused jumper wire between ground and HO2S connector terminal "B" (Purple/White wire). Using scan tool, monitor HO2S voltage. If HO2S voltage is more than 400 mV, go to next step. If HO2S voltage is less than 400 mV, go to step 10).

6) Remove fused jumper wire. Using DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple/White wire). If voltage is approximately 4.5 volts, go to next step. If voltage is not approximately 4.5 volts, go to step 9).

7) Using DVOM, measure voltage between ground and HO2S connector terminal "A" (Tan/White wire). If voltage is approximately 5 volts, go to step 11). If voltage is not approximately 5 volts, go to next step.

8) Check for open or high resistance in Tan/White wire between HO2S and PCM connector C1 terminal No. 27. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

9) Check for open or high resistance in Purple/White wire between HO2S and PCM connector C2 terminal No. 12. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to

step 13).
10) Check for short to ground in Tan/White wire between HO2S and PCM connector C1 terminal No. 27. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).
11) Check for poor connections at HO2S connector. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.
12) Isolate source of contamination of HO2S. Check for fuel contamination or use of RTV sealant. After isolating and repairing source of contamination, replace HO2S. After replacing oxygen sensor, go to step 15).
13) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.
14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.
15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1134: HO2S TRANSITION TIME RATIO - BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
PCM monitors Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, PCM counts number of times that HO2S switches from rich-to-lean and lean-to-rich and adds amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. PCM then divides rich-to-lean average by lean-to-rich average to obtain a ratio.

Code Enable Criteria
For DTC to run, DTC P0101, DTC P0102, DTC P0103, DTC P0107, DTC P0108, DTC P0112, DTC P0113, DTC P0117, DTC P0118, DTC P0121, DTC P0122, DTC P0123, DTC P0125, DTC P0128, DTC P0201-P0206, DTC P0300, DTC P0410, DTC P0440, DTC P0442, DTC P0443, DTC P0446, DTC P0449, or DTC P1441 are not set. DTC will set when PCM detects HO2S transition time ratio is less than 0.6, or more than 3.3 for 2 minutes after closed loop enable.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present (except HO2S DTCs), diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and allow to idle until operating temperature is reached. Raise engine speed to more than 1200 RPM for 2 minutes.

Using scan tool, monitor HO2S voltage. If voltage is 400-500 mV, go to next step. If voltage is not 400-500 mV, go to step 4).

3) Using scan tool, monitor FAIL THIS IGN under DTC info. Operate vehicle within conditions that DTC failed under FAILURE RECORDS. If scan tool indicates that this DTC failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

4) Check exhaust system for leaks. Ensure that HO2S is securely installed. Check for corrosion on terminals and terminal tension at sensor and PCM. Check for damaged wiring. Repair as necessary. After repairs, go to step 15). If exhaust leak is not present, go to next step.

5) Disconnect bank 1 sensor 1 HO2S connector. Connect a fused jumper wire between ground and HO2S connector terminal "B" (Purple/White wire). Using scan tool, monitor HO2S voltage. If HO2S voltage is more than 400 mV, go to next step. If HO2S voltage is less than 400 mV, go to step 10).

6) Remove fused jumper wire. Using DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple/White wire). If voltage is approximately 4.5 volts, go to next step. If voltage is not approximately 4.5 volts, go to step 9).

7) Using DVOM, measure voltage between ground and HO2S connector terminal "A" (Tan/White wire). If voltage is approximately 5 volts, go to step 11). If voltage is not approximately 5 volts, go to next step.

8) Check for open or high resistance in Tan/White wire between HO2S and PCM connector C1 terminal No. 27. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

9) Check for open or high resistance in Purple/White wire between HO2S and PCM connector C2 terminal No. 12. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

10) Check for short to ground in Tan/White wire between HO2S and PCM connector C1 terminal No. 27. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).

11) Check for poor connections at HO2S connector. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

12) Isolate source of contamination of HO2S. Check for fuel contamination or use of RTV sealant. After isolating and repairing source of contamination, replace HO2S. After replacing oxygen sensor, go to step 15).

13) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1153: HO2S INSUFFICIENT SWITCHING - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM monitors Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, PCM counts number of times that HO2S switches from rich-to-lean and lean-to-rich. When PCM determines that HO2S does not switch enough times, DTC will set.

A lean-to-rich switch is determined when HO2S voltages changes from less than 300 mV to more than 600 mV. A rich-to-lean switch is determined when HO2S voltage changes from more than 600 mV to less than 300 mV.

Code Enable Criteria

For DTC to run, DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0300, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set. DTC will set when PCM monitors the following conditions for 2 minutes after closed loop enable.

* Less than 55 lean-to-rich and rich-to-lean switches for this HO2S.
* HO2S voltage remains between 300-600 mV.

When DTC is set, PCM will illuminate Malfunction Indicator Light (MIL) on second consecutive ignition cycle that DTC fails. PCM records operating conditions at the time of failure in FREEZE FRAME and/or FAILURE RECORDS data. MIL will turn off after 3 consecutive ignition cycles that DTC does not fail. Current DTC will clear when DTC runs and passes. History DTC will clear after 40 consecutive no fail cycles by this or any other emission related DTC. DTC can also be cleared manually using scan tool.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present (except HO2S DTCs), diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and allow to idle until operating temperature is reached. Raise engine speed to more than 1200 RPM for 2 minutes. Using scan tool, monitor HO2S voltage. If voltage is 400-500 mV, go to next step. If voltage is not 400-500 mV, go to step 4).

3) Using scan tool, monitor FAIL THIS IGN under DTC info. Operate vehicle within conditions that DTC failed under FAILURE RECORDS. If scan tool indicates that this DTC failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

4) Check exhaust system for leaks. Ensure that HO2S is securely installed. Check for corrosion on terminals and terminal tension at sensor and PCM. Check for damaged wiring. Repair as necessary. After repairs, go to step 15). If exhaust leak is not present, go to next step.

5) Disconnect bank 2 sensor 1 HO2S connector. Connect a fused jumper wire between ground and HO2S connector terminal "B" (Purple wire). Using scan tool, monitor HO2S voltage. If HO2S voltage is more than 400 mV, go to next step. If HO2S voltage is less than 400 mV, go to step 10).

6) Remove fused jumper wire. Using DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple wire). If voltage is approximately 4.5 volts, go to next step. If voltage is not approximately 4.5 volts, go to step 9).

7) Using DVOM, measure voltage between ground and HO2S connector terminal "A" (Tan wire). If voltage is approximately 5 volts, go to step 11). If voltage is not approximately 5 volts, go to next step.

8) Check for open or high resistance in Tan wire between HO2S and PCM connector C1 terminal No. 29. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

9) Check for open or high resistance in Purple wire between HO2S and PCM connector C2 terminal No. 10. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

10) Check for short to ground in Tan wire between HO2S and PCM connector C1 terminal No. 29. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).

11) Check for poor connections at HO2S connector. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

12) Isolate source of contamination of HO2S. Check for fuel contamination or use of RTV sealant. After isolating and repairing source of contamination, replace HO2S. After replacing oxygen sensor, go to step 15).

13) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1154: HO2S TRANSITION TIME RATIO - BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM monitors Heated Oxygen Sensor (HO2S) activity for 100 seconds. During this period, PCM counts number of times that HO2S switches from rich-to-lean and lean-to-rich and adds amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. PCM then divides rich-to-lean average by lean-to-rich average to obtain a ratio.

Code Enable Criteria

For DTC to run, DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0128, P0201-P0206, P0300, P0410, P0440, P0442, P0443, P0446, P0449, or P1441 are not set. DTC will set when PCM detects HO2S transition time ratio is less than 0.6, or more than 3.3 for 2 minutes after closed loop

enable.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If other DTCs are present (except HO2S DTCs), diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Start engine and allow to idle until operating temperature is reached. Raise engine speed to more than 1200 RPM for 2 minutes. Using scan tool, monitor HO2S voltage. If voltage is 400-500 mV, go to next step. If voltage is not 400-500 mV, go to step 4).

3) Using scan tool, monitor FAIL THIS IGN under DTC info. Operate vehicle within conditions that DTC failed under FAILURE RECORDS. If scan tool indicates that this DTC failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

4) Check exhaust system for leaks. Ensure that HO2S is securely installed. Check for corrosion on terminals and terminal tension at sensor and PCM. Check for damaged wiring. Repair as necessary. After repairs, go to step 15). If exhaust leak is not present, go to next step.

5) Disconnect bank 2 sensor 1 HO2S connector. Connect a fused jumper wire between ground and HO2S connector terminal "B" (Purple/White wire). Using scan tool, monitor HO2S voltage. If HO2S voltage is more than 400 mV, go to next step. If HO2S voltage is less than 400 mV, go to step 10).

6) Remove fused jumper wire. Using DVOM, measure voltage between ground and HO2S connector terminal "B" (Purple wire). If voltage is approximately 4.5 volts, go to next step. If voltage is not approximately 4.5 volts, go to step 9).

7) Using DVOM, measure voltage between ground and HO2S connector terminal "A" (Tan wire). If voltage is approximately 5 volts, go to step 11). If voltage is not approximately 5 volts, go to next step.

8) Check for open or high resistance in Tan wire between HO2S and PCM connector C1 terminal No. 29. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

9) Check for open or high resistance in Purple wire between HO2S and PCM connector C2 terminal No. 10. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).

10) Check for short to ground in Tan wire between HO2S and PCM connector C1 terminal No. 29. See Fig. 3. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).

11) Check for poor connections at HO2S connector. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

12) Isolate source of contamination of HO2S. Check for fuel contamination or use of RTV sealant. After isolating and repairing source of contamination, replace HO2S. After replacing oxygen sensor, go to step 15).

13) Check for poor connections at PCM. Repair as necessary. After repairs, go to step 15). If connections are okay, go to next step.

14) Replace PCM. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC.

If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1220: THROTTLE POSITION SENSOR 2 VOLTAGE OUT OF RANGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

NOTE: Throttle Position (TP) sensors No. 1 and 2 may also be referred to as Throttle Actuator Control (TAC) assembly.

Throttle Position (TP) sensor is part of throttle body of Throttle Actuator Control (TAC) assembly. TP sensor is actually 2 individual TP sensors within 1 housing. Two separate signals, a low-reference and 5-volt reference circuit are used to connect TP sensor assembly to TAC module. TP sensor signal voltage increases as throttle opens. The signal circuit for TP sensor is pulled up to 5-volt reference voltage.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.
* Electronic Throttle Control (ETC) serial data is operational.

DTC will set when TP sensor 2 voltage is less than 0.34 volts or more than 4.4 volts, as observed on the scan tool.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC does not set this ignition cycle, go to DIAGNOSTIC AIDS.

2) Turn ignition on. Using scan tool, monitor AGREE/DISAGREE parameters for TP sensor 1 and 2. If scan tool displays DISAGREE, go to next step. If scan tool displays AGREE, go to step 11).

3) Using scan tool, monitor TP sensor 2 voltage. Depress accelerator pedal to floor and release. If scan tool indicates voltage at or near one volt through entire pedal travel, go to step 21). If scan tool does not indicate voltage at or near one volt through entire pedal travel, go to next step.

4) If voltage is less than one volt, go to next step. If voltage is not less than one volt, go to step 7).

5) While monitoring TP sensor 2 voltage, disconnect TAC assembly throttle body connector. See Fig. 12. If voltage is approximately 5 volts, go to next step. If voltage is not approximately 5 volts, go to step 13).

6) Turn ignition off for 15 seconds. Turn ignition on. Using

DVOM, measure voltage between ground and TAC assembly connector terminal "C" (Gray wire). If voltage is 3.9-5.6 volts, go to step 23). If voltage is not 3.9-5.6 volts, go to step 17).

7) Disconnect TAC assembly throttle body connector. See Fig. 12. Turn ignition on. Monitor TP sensor voltage. Connect a test light between TAC assembly connector terminals "A" (Black wire) and "B" (Purple wire). If TP voltage is zero volts, go to step 10). If TP voltage is not zero volts, go to next step.

8) Remove test light from Black wire terminal and connect to ground. Monitor TP sensor voltage. If TP voltage is zero volts, go to step 14). If TP voltage is not zero volts, go to next step.

9) If test light illuminates when touched to ground, go to step 15). If test light does not illuminate when touched to ground, go to step 16).

10) Turn ignition off for 15 seconds. Turn ignition back on. Using DVOM, measure voltage between ground and TAC assembly connector terminal "C" (Gray wire). If voltage is 3.9-5.6 volts, go to step 23). If voltage is not 3.9-5.6 volts, go to step 18).

11) Check condition of ETC (10-amp) and TCS BATT (20-amp) fuses located in underhood fuse blocks. See Figs. 5 and 6. If any fuses are blown, go to step 19). If fuses are okay, go to next step.

12) Disconnect TAC module. TAC module is mounted to accelerator pedal bracket. With test light connected to ground, probe TAC module connector terminals No. 3 (Orange wire) and No. 7 (Pink wire). If test light illuminates at both terminals, go to DTC P1515: COMMANDED & ACTUAL THROTTLE POSITION MISMATCH or DTC P1516: COMMANDED & ACTUAL THROTTLE POSITION MALFUNCTION. If test light does not illuminate at both terminals, go to step 20).

13) Check for short to ground in Purple wire between TAC assembly connector terminal "B" and TAC module connector terminal No. 22. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

14) Check for short to voltage in Purple wire between TAC connector terminal "A" and TAC assembly module connector terminal No. 24. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

15) Check for short to voltage in Purple wire between TAC assembly connector terminal "B" and TAC module connector terminal No. 22. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

16) Check for open in Purple wire between TAC assembly connector terminal "B" and TAC module connector terminal No. 22. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

17) Check for open or short to ground in Gray wire between TAC assembly connector terminal "C" and TAC module connector terminal No. 23. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 25).

18) Check for short to voltage in Gray wire between TAC assembly connector terminal "C" and TAC module connector terminal No. 23. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to step 26).

19) Repair short to ground in Pink or Orange wire between blown fuse and TAC module. After repairs, go to step 27).

20) Repair open in Pink or Orange wire between fuse and TAC module. After repairs, go to step 27).

21) Check for short to ground in Gray wire between TAC assembly connector terminal "C" and TAC module connector terminal No. 23. Repair as necessary. After repairs, go to step 27). If circuits are okay, go to next step.

22) Check for short between TAC assembly connector terminals "C" and "F" (component side). If short is found, go to step 24). If short is not found, go to step 26).

23) Check for poor connections at TAC assembly. Repair as necessary. After repairs, go to step 27). If connections are okay, go to next step.

24) Replace TAC assembly. TAC contains both TP sensors. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 27).

25) Check for poor connections at TAC module. Repair as necessary. After repairs, go to step 27). If connections are okay, go to next step.

26) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

27) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

28) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, PCM receives a message across serial data, and more than one ETC system-related DTC may set. This condition is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this condition when you review captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1221: THROTTLE POSITION SENSOR 1 & 2 DISAGREE

Description

NOTE: Throttle Position (TP) sensors No. 1 and 2 may also be referred to as Throttle Actuator Control (TAC) assembly.

Throttle Position (TP) sensor is part of throttle body of Throttle Actuator Control (TAC) assembly. TP sensor is actually 2 individual TP sensors within 1 housing. Two separate signals, a low-reference and 5-volt reference circuit are used to connect TP sensor assembly to TAC module. TP sensor signal voltage increases as throttle opens. The signal circuit for TP sensor is pulled up to 5-volt reference voltage.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.
* Electronic Throttle Control (ETC) serial data is operational.

DTC will set when TP sensor 1 and 2 by more than 0.17 volt.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If DTC P1120, P1220 or P1518 are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on. Using scan tool, monitor AGREE/DISAGREE parameters for TP sensor 1 and 2. If scan tool displays AGREE, go to next step. If scan tool displays DISAGREE, go to step 4).

3) Using scan tool, monitor DTC information for this DTC. Move wiring harness and related connectors. If DTC sets this ignition, go to step 10). If DTC does not set this ignition, go to DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect TAC assembly throttle body connector. See Fig. 12. Turn ignition on. Using DVOM, measure voltage between ground and TAC assembly connector terminals "C" (Gray wire) and "F" (Gray/Black wire). If voltage is 3.9-4.6 volts at each terminal, go to next step. If voltage is not 3.9-4.6 volts at each terminal, go to step 11).

5) Using DVOM, measure voltage between ground and TAC assembly connector terminals "B" (Purple wire) and "G" (Dark Green wire). If voltage is 3.9-4.6 volts at each terminal, go to next step. If voltage is not 3.9-4.6 volts at each terminal, go to step 12).

6) Turn ignition off. Using DVOM, check for continuity between TAC assembly connector terminals "C" and "F" (component side). If continuity is indicated, go to step 13). If continuity is not indicated, go to next step.

7) Using DVOM, check for continuity between TAC assembly connector terminals "B" and "G" (component side). If continuity is indicated, go to step 13). If continuity is not indicated, go to next step.

8) Locate and disconnect TAC module connector. TAC module is mounted to accelerator pedal assembly. Using DVOM, check for continuity between TAC assembly connector terminals "C" (Gray wire) and "F" (Gray/Black wire). If continuity is indicated, go to step 15). If continuity is not indicated, go to next step.

9) Using DVOM, check for continuity between ground and TAC assembly connector terminals "B" (Purple wire) and "G" (Dark Green wire). If continuity is indicated, go to step 16). If continuity is not indicated, go to step 14).

10) Repair harness or connections as necessary. After repairs, go to step 17).

11) Check for short to voltage in Gray or Gray/Black wire. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

12) Check for short to voltage in Purple or Dark Green wire. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

13) Replace TAC assembly. TAC contains both TP sensors. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 17).

14) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to step 17).

15) Repair short between Gray and Gray/Black wire. After repairs, go to step 17).

16) Repair short between Purple and Dark Green wire. After repairs, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC

test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, PCM receives a message across serial data, and more than one ETC system-related DTC may set. This condition is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this condition when you review captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1271: ACCELERATOR PEDAL POSITION SENSOR 1 & 2 SIGNALS SHORTED TOGETHER

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, P1518, P1276, or P1281 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent, or APP 1 signal is shorted to APP 2 signal.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no additional DTCs are set, go to next step.

3) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see

INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1272: ACCELERATOR PEDAL POSITION SENSOR 1 & 3 SIGNALS SHORTED TOGETHER

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, P1518, P1281, or P1286 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 1 disagrees with APP sensor 3 by more 10.5 percent, or APP sensor 1 signal is shorted to APP sensor 3 signal.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no additional DTCs are set, go to next step.

3) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1273: ACCELERATOR PEDAL POSITION SENSOR 2 & 3 SIGNALS SHORTED TOGETHER

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, P1518, P1276, or P1286 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 2 disagrees with APP sensor 3 by more than 10.5 percent, or APP sensor 2 signal and APP sensor 3 signal are shorted together.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no additional DTCs are set, go to next step.
3) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.
4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1275: ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL OUT OF RANGE

Description
Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 1 voltage is less than 0.68 volts or more than 4.5 volts.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on, ensuring foot is off accelerator pedal. Using scan tool, observe APP sensor 1 voltage. If voltage is 0.7-1.1 volts, go to next step. If voltage is not 0.7-1.1 volts, go to step 5).

3) Fully depress the accelerator pedal. If voltage changes to 2.7-4.2 volts, go to next step. If voltage does not change to 2.7-4.2 volts, go to step 5).

4) Monitor DTC info for this DTC. Depress accelerator pedal to Wide Open Throttle (WOT) and then return pedal to closed throttle. If DTC fails this ignition, go to next step. If DTC does not fail this ignition, go to DIAGNOSTIC AIDS.

5) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

6) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1276: ACCELERATOR PEDAL POSITION SENSOR 1 DISAGREES WITH SENSORS 2 & 3

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent, and APP sensor 1 disagrees with APP sensor 3 by more than 10.5 percent.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on. Using scan tool, observe APP sensor 1 voltage. If voltage is 0.5-1.3 volts, go to next step. If voltage is not 0.5-1.3 volts, go to step 4).

3) Using scan tool, observe the APP sensor AGREE/DISAGREE parameters. Slowly depress accelerator pedal, stopping briefly at 25, 50 and 75 percent, to Wide Open Throttle (WOT). Then slowly return to a closed position stopping briefly at 75, 50 and 25 percent. If scan tool indicates AGREE for all APP sensor agree/disagree parameters, go to DIAGNOSTIC AIDS. If scan tool does not indicate AGREE for all APP sensor agree/disagree parameters, go to next step.

4) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

5) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

6) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1280: ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL OUT OF RANGE

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0601, P0602, P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 2 voltage is this less than 0.68 volts, or more 4.5 volts.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first.
See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on, ensuring foot is off accelerator pedal. Using scan tool, observe APP sensor 2 voltage. If voltage is 0.7-1.1 volts, go to next step. If voltage is not 0.7-1.1 volts, go to step 5).

3) Fully depress the accelerator pedal. If voltage changes to 2.7-4.2 volts, go to next step. If voltage does not change to 2.7-4.2 volts, go to step 5).

4) Monitor DTC info for this DTC. Depress accelerator pedal to Wide Open Throttle (WOT) and then return pedal to closed throttle. If DTC fails this ignition, go to next step. If DTC does not fail this ignition, go to DIAGNOSTIC AIDS.

5) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

6) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1281: ACCELERATOR PEDAL POSITION SENSOR 2 DISAGREES WITH SENSORS 1 & 3

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 2 disagrees with APP sensor 1 by

more than 10.5 percent, and APP sensor 2 disagrees with APP sensor 3 by more than 10.5 percent.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on. Using scan tool, observe APP sensor 2 voltage. If voltage is 0.5-1.3 volts, go to next step. If voltage is not 0.5-1.3 volts, go to step 4).

3) Using scan tool, observe the APP sensor AGREE/DISAGREE parameters. Slowly depress accelerator pedal, stopping briefly at 25, 50 and 75 percent, to Wide Open Throttle (WOT). Then slowly return to a closed position stopping briefly at 75, 50 and 25 percent. If scan tool indicates AGREE for all APP sensor agree/disagree parameters, go to DIAGNOSTIC AIDS. If scan tool does not indicate AGREE for all APP sensor agree/disagree parameters, go to next step.

4) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

5) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

6) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1285: ACCELERATOR PEDAL POSITION SENSOR 3 SIGNAL OUT OF RANGE

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 3 voltage is this less than 0.68 volts, or more 4.5 volts.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first.
See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on, ensuring foot is off accelerator pedal. Using scan tool, observe APP sensor 3 voltage. If voltage is 0.7-1.1 volts, go to next step. If voltage is not 0.7-1.1 volts, go to step 5).

3) Fully depress the accelerator pedal. If voltage changes to 2.7-4.2 volts, go to next step. If voltage does not change to 2.7-4.2 volts, go to step 5).

4) Monitor DTC info for this DTC. Depress accelerator pedal to Wide Open Throttle (WOT) and then return pedal to closed throttle. If DTC fails this ignition, go to next step. If DTC does not fail this ignition, go to DIAGNOSTIC AIDS.

5) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

6) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1286: ACCELERATOR PEDAL POSITION SENSOR 3 DISAGREES WITH SENSORS 1 & 2

Description

Accelerator Pedal Position (APP) sensors are mounted on accelerator pedal of Throttle Actuator Control (TAC) module assembly. 3 individual APP sensors are contained within one housing. 3 separate low reference and 5-volt reference circuits are used. APP sensor signal voltages increase when accelerator pedal is depressed.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0606, P1517, or P1518 are not set.
* Ignition switch is in the crank or run position.

DTC will set when APP sensor 3 disagrees with APP sensor 1 by more than 10.5 percent, and APP sensor 3 disagrees with APP sensor 2 by more than 10.5 percent.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: Check for additional DTCs. If additional DTCs are set, diagnose those DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Turn ignition on. Using scan tool, observe APP sensor 3 voltage. If voltage is 0.5-1.3 volts, go to next step. If voltage is not 0.5-1.3 volts, go to step 4).

3) Using scan tool, observe the APP sensor AGREE/DISAGREE parameters. Slowly depress accelerator pedal, stopping briefly at 25, 50 and 75 percent, to Wide Open Throttle (WOT). Then slowly return to a closed position stopping briefly at 75, 50 and 25 percent. If scan tool indicates AGREE for all APP sensor agree/disagree parameters, go to DIAGNOSTIC AIDS. If scan tool does not indicate AGREE for all APP sensor agree/disagree parameters, go to next step.

4) Replace TAC module. See REMOVAL, OVERHAUL & INSTALLATION - CARS article. After repairs, go to next step.

5) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

6) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

When TAC module detects a condition within ETC system, Powertrain Control Module (PCM) receives a message across serial data and more than one ETC system related DTC may set. This is due to many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Be aware of this when reviewing captured DTC info.

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1336: CRANKSHAFT POSITION SYSTEM VARIATION NOT LEARNED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Crankshaft Position (CKP) sensor sends pulses to PCM as the reluctor teeth rotate past the CKP sensor. PCM uses the CKP pulses to synchronize ignition and fuel injector operation, and to time interval between each CKP pulse. PCM determines when an excessive change in crankshaft speed occurs by comparing each new time interval with previous interval.

A misfire causes an unexpected change in crankshaft speed. A certain amount of acceleration/deceleration is expected between each

firing stroke, but if crankshaft speed changes more than expected amount, PCM interprets this as a misfire. Interval between CKP sensor pulses is extremely small. At high engine speeds, slight variations in the crankshaft, reluctor and CKP sensor components make misfire detection difficult.

PCM learns variations during CKP system variation learning procedure. PCM compensates for these variations when performing detect misfire calculations. Only a scan tool can command PCM to perform CKP system variation learning procedure again. Perform learning procedure after the following actions:

* PCM replacement.
* Any operation or repair involving crankshaft, CKP sensor or CKP sensor-to-reluctor wheel gap relationship.
* Engine replacement.
* Ignition switch left in ON position until battery is drained.

NOTE: Removing power to PCM with ignition on may clear/erase stored pulse value and set this DTC.

Reprogramming PCM does not require running the CKP system variation learn procedure unless PCM is new or from another vehicle.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* P0336, P0341, or P1374 are not set.
* Engine Coolant Temperature (ECT) is more than 158°F (70°C).

DTC will set when crankshaft position sensor variation values are not stored in the PCM memory.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Perform CKP variation learn procedure. See CRANKSHAFT POSITION SENSOR VARIATION LEARN PROCEDURE under PROGRAMMING.

Diagnostic Aids
Crankshaft position system variation compensating values are stored in PCM non-volatile memory after a learn procedure has been performed. If actual crankshaft position variation is within crankshaft position system variation compensating values stored in PCM, DTC P0300 may set. See DTC P0300: ENGINE MISFIRE DETECTED.

If CKP learn procedure cannot be learned, check for the following conditions:

* If engine coolant temperature is below 158°F (70°C), allow engine to warm to more than 158°F (70°C).
* Scan tool crankshaft position system variation learn function will be disabled if any DTCs other than DTC P1336 are stored.
* Camshaft position signal condition detected. Go to DTC P0341: CAMSHAFT POSITION SENSOR MISMATCH.
* Crankshaft position signal 3X or 18X reference signal condition detected.
  Go to DTC P0336: CRANKSHAFT POSITION SENSOR 18X

REFERENCE CIRCUIT MALFUNCTION.

DTC P1351: PCM DETECTS OPEN IN IGNITION CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Ignition Control Module (ICM) has independent power and ground circuits. The circuits between the ICM and PCM consists of Ignition Control (IC) timing signal, IC timing control, low resolution engine speed signal, medium resolution engine signal, camshaft position signal, and low reference signal.

Both the Camshaft Position (CMP) sensor and Crankshaft Position (CKP) sensor signals are input directly to ICM. The ICM sends 3X signals to PCM and controls the timing advance during engine cranking. The timing advance changes to PCM control after PCM receives the second 3X signal and PCM applies 5 volts to IC timing signal circuit.

Code Enable Criteria

For DTC to run, engine speed must be more than 600 RPM. DTC will set when PCM detects an open in IC control circuit and condition is present for 300 3X reference periods or 100 crankshaft revolutions.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, observe FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. If DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, go to DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a test light connected to battery voltage, probe PCM connector C1 terminal No. 48 (Red/Black wire). See Fig. 3. If test light illuminates, go to step 6). If test light does not illuminate, go to next step.

4) Check for open in Red/Black wire between PCM connector C1 terminal No. 48 and ICM connector terminal "L". Repair as necessary. After repairs, go to step 6). If circuit is okay, go to next step.

5) Check for poor terminal connections at ICM. Repair as necessary. After repairs, go to next step. If connections are okay, go to step 7).

6) Disconnect PCM connector. Connect a DVOM between PCM connector C1 terminals No. 48 (Red/Black wire) and No. 54 (White wire). Turn ignition on. Observe voltage on DVOM. If voltage is 20-40 millivolts, go to step 8). If voltage is not 20-40 millivolts, go to next step.

7) Turn ignition off. Leave PCM connector disconnected. Disconnect ICM connector. Check for open in White wire between ICM and PCM. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to step 9).

8) Check for poor terminal connections at PCM. Repair as necessary. After repairs, go to step 12). If connections are okay, go to step 11).

9) Check for poor terminal connections at ICM. Repair as necessary. After repairs, go to step 12). If connections are okay, go to next step.

10) Replace ICM. After replacing module, go to step 12).

11) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

12) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

13) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1352: PCM DETECTS OPEN IN IGNITION CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Ignition Control Module (ICM) has independent power and ground circuits. The circuits between the ICM and PCM consists of Ignition Control (IC) timing signal, IC timing control, low resolution engine speed signal, medium resolution engine signal, camshaft position signal, and low reference signal.

Both the Camshaft Position (CMP) sensor and Crankshaft Position (CKP) sensor signals are input directly to ICM. The ICM sends 3X signals to PCM and controls the timing advance during engine cranking. The timing advance changes to PCM control after PCM receives the second 3X signal and PCM applies 5 volts to IC timing signal circuit.

Code Enable Criteria

For DTC to run, engine must be running. DTC will set when PCM detects an open in IC signal circuit and condition is present for 300 3X reference periods or 106 crankshaft revolutions.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, observe FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. f DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a test light connected to battery voltage, probe PCM connector C1 terminal No. 48 (Red/Black wire). See Fig. 3. If test light illuminates, go to step 6). If test light does not illuminate, go to next step.

4) Check for open in Red/Black wire between PCM connector C1 terminal No. 48 and ICM connector terminal "L". Repair as necessary. After repairs, go to step 6). If circuit is okay, go to next step.

5) Check for poor terminal connections at ICM. Repair as necessary. After repairs, go to next step. If connections are okay, go to step 7).

6) Turn ignition off. Connect a DVOM between PCM connector C1 terminals No. 8 (Purple/White wire) and No. 53 (Tan/Black wire). See Fig. 3. Turn ignition on. Using a test light connected to battery voltage, probe PCM connector C1 terminal No. 53 (Tan/Black wire). Observe DVOM voltage. If voltage is 150-250 millivolts, go to step 8). If voltage is not 150-250 millivolts, go to next step.

7) Turn ignition off. Leave PCM connector disconnected. Disconnect ICM connector. Check for open Tan/Black wire between ICM and PCM. Repair as necessary. After repairs, go to step 12). If circuit is okay, go to step 9).

8) Check for poor terminal connections at PCM. Repair as necessary. After repairs, go to step 12). If connections are okay, go to step 11).

9) Check for poor terminal connections at ICM. Repair as necessary. After repairs, go to step 12). If connections are okay, go to next step.

10) Replace ICM. After replacing module, go to step 12).

11) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

12) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

13) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1361: PCM DOES NOT MONITOR IGNITION CONTROL PULSES

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Ignition Control Module (ICM) has independent power and ground circuits. The circuits between the ICM and PCM consists of Ignition Control (IC) timing signal, IC timing control, low resolution engine speed signal, medium resolution engine signal, camshaft position signal, and low reference signal.

Both the Camshaft Position (CMP) sensor and Crankshaft Position (CKP) sensor signals are input directly to ICM. The ICM sends 3X signals to PCM and controls the timing advance during engine cranking. The timing advance changes to PCM control after PCM receives the second 3X signal and PCM applies 5 volts to IC timing signal circuit.

Code Enable Criteria

For DTC to run, engine must be running. DTC will set when PCM does not monitor IC pulses while the IC mode spark advance is commanded.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on, with engine off. Using scan tool, monitor the DTC information for DTC 1362. If scan tool indicates that DTC P1362 is current, go to step 6). If scan tool does not indicate that DTC P1362 is current, go to next step.

3) Observe the FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. f this DTC fails this ignition cycle, go to next step. If this DTC does not fail this ignition cycle, go to DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a test light connected to battery voltage, probe PCM connector C1 terminal No. 54 (White wire). See Fig. 3. If test light illuminates, go to next step. If test light does illuminate, go to step 14).

5) Turn ignition off. Leave PCM connector disconnected. Disconnect ICM connector. Turn ignition on. Using test light connected to ground, probe PCM connector C1 terminal No. 54 (White wire). If test light illuminates, go to step 10). If test light does not illuminate, go to step 13).

6) Turn ignition off. Disconnect PCM connector. Disconnect ICM connector. Using test light connected to battery voltage, probe ICM connector terminal "A" (White wire). See Fig. 8. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.

7) Leave ICM and PCM connectors disconnected. Using test light connected to battery voltage, probe ICM connector terminal "A" (White wire). If test light illuminates, go to step 12). If test light does not illuminate, go to next step.

8) Check for short between ICM connector terminals "A" (White wire) and "B" (Tan/Black wire) circuits. Repair as necessary. After repairs, go to step 15). If circuits are okay, go to next step.

9) Reconnect ICM connector. Leave PCM connector disconnected. Turn ignition on. Connect DVOM between a known-good ground and ICM connector terminal "A" (White wire). Connect test light to battery voltage and probe ICM connector terminal "B" (Tan/Black wire). If voltage toggles between 20-40 millivolts to 150-250 millivolts, go to step 14). If voltage does not toggle between 20-40 millivolts to 150-250 millivolts, go to step 13).

10) Repair short to voltage in White wire between ICM and PCM. After repairs, go to step 15).

11) Repair short to ground in White wire between ICM and PCM. After repairs, go to step 15).

12) Repair short to ground in Tan/Black wire between ICM and PCM. After repairs, go to step 15).

13) Replace ICM. After replacing module, go to step 15).

14) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1362: PCM DETECTS SHORT TO VOLTAGE IN IGNITION CONTROL TIMING SIGNAL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Ignition Control Module (ICM) has independent power and ground circuits. The circuits between the ICM and PCM consists of Ignition Control (IC) timing signal, IC timing control, low resolution engine speed signal, medium resolution engine signal, camshaft position signal, and low reference signal.

Both the Camshaft Position (CMP) sensor and Crankshaft Position (CKP) sensor signals are input directly to ICM. The ICM sends 3X signals to PCM and controls the timing advance during engine cranking. The timing advance changes to PCM control after PCM receives the second 3X signal and PCM applies 5 volts to IC timing signal circuit.

Code Enable Criteria

For DTC to run, engine must be running. DTC will set when PCM detects a short to voltage in the IC timing signal circuit.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on, with engine off. Using scan tool, monitor the DTC information for DTC 1361. If scan tool indicates that DTC P1361 is current, go to step 6). If scan tool does not indicate that DTC P1361 is current, go to next step.

3) Observe the FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. If this DTC fails this ignition cycle, go to next step. If this DTC does not fail this ignition cycle, go to DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a test light connected to battery voltage, probe PCM connector C1 terminal No. 53 (Tan/Black wire). See Fig. 3. If test light illuminates, go to next step. If test light does illuminate, go to step 14).

5) Turn ignition off. Leave PCM connector disconnected. Disconnect ICM connector. Turn ignition on. Using test light connected to ground, probe PCM connector C1 terminal No. 53 (Tan/Black wire). If test light illuminates, go to step 10. If test light does not illuminate, go to step 13).

6) Turn ignition off. Disconnect PCM connector. Disconnect ICM connector. Using test light connected to battery voltage, probe ICM connector terminal "A" (White wire). See Fig. 8. If test light illuminates, go to step 11). If test light does not illuminate, go to next step.

7) Leave ICM and PCM connectors disconnected. Using test light connected to battery voltage, probe ICM connector terminal "B" (Tan/Black wire). If test light illuminates, go to step 12). If test light does not illuminate, go to next step.

8) Check for short between ICM connector terminals "A" (White wire) and "B" (Tan/Black wire) circuits. Repair as necessary. After repairs, go to step 15). If circuits are okay, go to next step.

9) Reconnect ICM connector. Leave PCM connector disconnected. Turn ignition on. Connect DVOM between a known-good ground and ICM

connector terminal "A" (White wire). Connect test light to battery voltage and probe ICM connector terminal "B" (Tan/Black wire). If voltage toggles between 20-40 millivolts to 150-250 millivolts, go to step 14). If voltage does not toggle between 20-40 millivolts to 150-250 millivolts, go to step 13).

10) Repair short to voltage in White wire between ICM and PCM. After repairs, go to step 15).

11) Repair short to ground in White wire between ICM and PCM. After repairs, go to step 15).

12) Repair short to ground in Tan/Black wire between ICM and PCM. After repairs, go to step 15).

13) Replace ICM. After replacing module, go to step 15).

14) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

15) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

16) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1374: CRANKSHAFT POSITION SENSOR 3X REFERENCE CIRCUIT

MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The 3X reference signal is produced by Ignition Control Module (ICM). The ICM calculates the 3X reference signal by dividing the Crankshaft Position (CKP) sensor 18X pulses by 3. This calculation is performed while engine is running and while the CKP sync pulses are being received.

PCM uses the 3X reference signal in order to calculate engine RPM and CKP at engine speeds more than 1200 RPM. PCM also uses the pulses on the circuit in order to initiate injector pulses and constantly monitors the number of pulses on the 3X reference circuit and compares it to the number of 3X reference pulses to the number of 18 X reference pulses and CAM signal pulses being received. If PCM receives an incorrect number of pulses on the 3X reference circuit, DTC P1374 will set and PCM will use the 18X reference signal circuit for fuel and ignition control. The engine will continue to start and run using the 18X reference and CMP input signals only.

Code Enable Criteria

For DTC to run, engine must have been running for more than 3 seconds. DTC will set when the following conditions are met for up to 30 seconds:

* Ratio of 18X reference pulses to CAM signal pulses received by PCM equals 36:1.
* Ratio of 18X reference pulses to 3X reference pulses received by PCM does not equal 6:1.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Attempt to start engine. If engine starts and continues to run, go to next step. If engine cranks but does not run, diagnose no-start condition. See NO START DIAGNOSIS in appropriate BASIC DIAGNOSTICS article.

3) Observe the FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. If DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, see DIAGNOSTIC AIDS.

4) Turn ignition off. Disconnect ICM connector. Install Injector Test Light (J 34730-405) to any injector connector. Turn ignition on, with engine off. Connect a test light to battery voltage and repeatedly touch ICM connector terminal "D" (Purple/White wire). See Fig. 8. Observe injector test light. If injector test light blinks, go to step 8). If injector test light does not blink, go to next step.

5) Turn ignition off. Disconnect PCM connector. Turn ignition on, with engine off. Check for open, short to ground or short to voltage in Purple/White wire between ICM and PCM. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to next step.

6) Check for poor terminal connection at PCM connector. Replace loose terminal if necessary. After repairs, go to step 11). If terminals are okay, go to next step.

7) Check for incorrect harness routing near secondary ignition components, carbon tracking on any component, ignition coil arcing to wiring harness or to ICM, ignition coils for cracks, or other signs of damage. Check secondary ignition wires arcing to wiring harness. Repair as necessary. After repairs, go to step 11). If no problem is found, go to step 10).

8) Check for loose terminal connections at ICM. Replace loose terminals if necessary. Repair as necessary. After repairs, go to step 11). If terminal connections are okay, go to next step.

9) Replace ICM. After replacing module, go to next step 11).

10) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

11) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

12) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1380: MISFIRE DETECTED - ROUGH ROAD DATA NOT AVAILABLE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The PCM receives rough road information from the Electronic

Brake Control Module (EBCM) on the serial data circuit. PCM uses the rough road information in order to enhance the misfire diagnostic by distinguishing crankshaft speed variations caused by driving on rough road surfaces from the variations caused by true misfires. The EBCM transmits rough road information based on the inputs from the wheel speed sensors. If EBCM detects a condition which will not allow EBCM to properly identify rough road situations while a misfire condition is being detected by PCM, DTC will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Engine load is less than 87 percent.
* Engine speed is less than 5000 RPM.
* Vehicle speed is more than 10 MPH.
* Misfire DTC is occurring and is requesting the MIL to be illuminated.

DTC will set when PCM has detected an EBCM rough road sensing error.

Diagnostic Procedures
If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, perform ABS system diagnosis. See appropriate ANTI-LOCK article in BRAKES.

DTC P1381: MISFIRE DETECTED - NO COMMUNICATION WITH BRAKE CONTROL MODULE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
The PCM receives rough road information from the Electronic Brake Control Module (EBCM) on the serial data circuit. PCM uses the rough road information to enhance the misfire diagnostic by distinguishing crankshaft speed variations caused by driving on rough road surfaces from variations caused by true misfires. The EBCM transmits rough road information based on inputs from the wheel speed sensors. If a loss of communication occurs which causes PCM not to receive rough road information while DTC P0300 is requesting MIL, DTC P1381 will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Engine load is less than 87 percent.
* Engine speed is less than 5000 RPM.
* Vehicle speed is more than 10 MPH.
* Misfire DTC is occurring and is requesting the MIL to be illuminated.

Conditions for setting DTC:

* PCM is detecting a loss of communication with EBCM for at least 5 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Turn ignition on, with engine off. Using scan tool, attempt to display ABS data. If ABS data is displayed, go to next step. If ABS data is not displayed, go to step 4).

3) Check for open or poor connection in Light Blue wire to EBCM connector C1 terminal No. 25. See WIRING DIAGRAMS. Repair as necessary. After repairs, go to step 7). If circuit is okay, go to next step.

4) Turn ignition off. Disconnect EBCM connector. Turn ignition on, with engine off. Using a DVOM check voltage on EBCM connector C1 terminal No. 25 (Light Blue wire). If voltage reading is 1-5 volts, go to next step. If voltage reading is not 1-5 volts, go to step 6).

5) Check for poor connection at EBCM. Repair as necessary. After repairs, go to step 7). If connections are okay, go to next step.

6) Check for open in Light Blue wire to EBCM. Repair as necessary. After repairs, go to next step. If circuit is okay, diagnose ABS system. See appropriate ANTI-LOCK article in BRAKES.

7) Turn ignition on, with engine off. Using scan tool, attempt to display ABS data. If ABS data can be displayed, system is okay. If ABS data cannot be displayed, perform SCAN TOOL DOES NOT COMMUNICATE WITH CLASS 2 DEVICE in appropriate BODY CONTROL MODULES article in ACCESSORIES & EQUIPMENT.

DTC P1404: EGR CLOSED POSITION PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The PCM monitors the EGR valve pintle position input to ensure that valve responds properly to commands from PCM. When ignition switch is turned on, PCM learns the EGR learned minimum position. PCM compares EGR learned minimum position to EGR position sensor when EGR valve is commanded closed. If EGR position sensor indicates that EGR valve is still open when PCM is commanding EGR valve closed, DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* System voltage is more than 10 volts.
* EGR valve is enabled.

DTC will set when EGR position sensor is 0.2 volt more than the EGR learned minimum position when the desired EGR position is commanded to zero percent for 80 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC P0403 is set, diagnose DTC P0403 first. Go to DTC P0403: EGR CONTROL CIRCUIT MALFUNCTION.

2) Start engine. Using scan tool, observe EGR position sensor parameter. If EGR position sensor parameter is zero percent, go to next step. If EGR position sensor parameter is not zero percent, go to step 5).

3) Turn ignition on, with engine off. Using scan tool, command EGR valve from zero to 100 percent. If desired EGR position remains within 15 percent of EGR position sensor at all commanded

positions, go to next step. If desired EGR position does not remain within 15 percent of EGR position sensor at all commanded positions, go to step 6).

4) Observe the FREEZE FRAME/FAILURE RECORDS for this DTC. Turn ignition off for 30 seconds. Operate vehicle within the conditions for running the DTC or within the parameters observed in FREEZE FRAME/FAILURE RECORDS. If DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, see DIAGNOSTIC AIDS.

5) Turn ignition off. Disconnect EGR valve connector. Turn ignition on, with engine off. Using scan tool, observe EGR position sensor parameter. If EGR position sensor parameter is at zero percent, go to next step. If EGR sensor parameter is not at zero percent, go to step 9).

6) Check voltage between EGR valve connector terminals "B" (Black wire) and "C" (Brown wire). If voltage reading is about 5 volts, go to next step. If voltage reading is not about 5 volts, go to step 8).

7) Connect a fused jumper wire between EGR valve connector terminals "A" (Gray wire) and "C" (Brown wire). If scan tool indicates that EGR position sensor parameter is about 100 percent, go to step 13). If scan tool does not indicate that EGR position sensor parameter is about 100 percent, go to step 11).

8) Check voltage between a known-good ground and EGR valve connector terminal "C" (Brown wire). If voltage reading is about 5 volts, go to step 10). If voltage reading is not about 5 volts, go to step 12).

9) Check for short to voltage in Brown wire between EGR valve and PCM. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

10) Check for open or high resistance in Black wire between EGR valve and PCM. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 14).

11) Check for high resistance or short to ground in Brown wire between EGR valve and PCM. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 15).

12) Check for open, short to ground, or short to voltage in Gray wire between EGR valve and PCM. Repair as necessary. After repairs, go to step 17). If circuit is okay, go to step 15).

13) Check for poor connections at EGR valve connector. Repair as necessary. After repairs, go to step 17), If connections are okay, go to step 15).

14) Check for poor connections at PCM connector. Repair as necessary. After repairs, go to step 17). If connections are okay, go to step 16).

15) Replace EGR valve. After replacing EGR valve, go to next step.

16) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Check for excess deposits on EGR valve pintle or seat. Remove

EGR valve and check for deposits that may interfere with EGR valve pintle extending completely or causing pintle to stick.

DTC P1441: EVAP SYSTEM FLOW DURING NON-PURGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

This DTC tests for undesired intake manifold vacuum flow to the Evaporative Emission (EVAP) system. The control module seals the EVAP system by commanding EVAP canister purge valve off and EVAP canister vent valve on. The control module monitors the Fuel Tank Pressure (FTP) sensor to determine if a vacuum is being drawn on the EVAP system. If vacuum in EVAP system is more than a predetermined value within a predetermined time, DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0440, P0442, P0443, P0446, P0449, P0452, P0453, P1106, P1107, P1112, P1114, P1115, P1120, P1220 or P1221 is not set.
* Ignition voltage is 10-18 volts.
* Barometric pressure is more than 75 kPa.
* Fuel level is 15-85 percent.
* Engine coolant temperature and intake air temperature is 39-86°F (4-30°C).
* Start-up ECT and IAT are within 16°F (9°C).
* Vehicle speed sensor is less than 75 MPH.

DTC will set when PCM detects vacuum during a non-purge condition.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, recheck for DTCs. If DTCs P0443, P0449, P0452 or P0453 is also set, diagnose affected DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If DTCs P0443, P0449, P0452 or P0453 is not set, go to next step.

3) Remove fuel filler cap. Using scan tool, monitor the Fuel Tank Pressure (FTP) sensor. If scan tool indicates FTP sensor is at -0.5 to 0.5 in. H_2O, go to next step. If scan tool does not indicate that FTP sensor is at -0.5 to 0.5 H_2O, go to DTC P0453: FUEL TANK PRESSURE SENSOR CIRCUIT HIGH VOLTAGE.

4) Disconnect purge pipe from EVAP canister purge valve. Install a hand-held vacuum gauge to EVAP canister purge valve purge port. Disconnect EVAP canister purge valve connector. Monitor vacuum on vacuum gauge. Start and operate engine at idle. Increase idle to 1200-1500 RPM. If vacuum gauge indicates an increase in vacuum, go to next step. If vacuum gauge does not indicate an increase in vacuum, see DIAGNOSTIC AIDS.

5) Replace EVAP canister purge valve. After replacing canister purge valve, go to next step.

6) Monitor FTP sensor on scan tool. Start and operate engine at idle for 3 seconds. If scan tool indicates that fuel tank pressure is -0.5 to 0.5 in. H_2O, go to next step. If scan tool does not indicate that fuel tank pressure is -0.5 to 0.5 in. H_2O, go to step 3).

7) Using scan tool, select CAPTURE INFO, REVIEW INFO

function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1514: ACTUAL MAF & SPEED DENSITY IS GREATER THAN EXPECTED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The PCM uses the Throttle Position (TP) sensor, Barometric Pressure (BARO) sensor, Intake Air Temperature (IAT), and engine RPM to calculate an expected Mass Airflow (MAF) rate. The PCM compares this value to MAF value and the speed density calculation in order to verify the proper throttle operation.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* Other electronic throttle control DTCs are not present.
* PCM processor DTCs are not present.
* Engine is running and engine speed is more than 600 RPM.

DTC will set when PCM detects that actual MAF and speed density is much more than the expected or calculated airflow rate.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, recheck for DTCs. If any other DTCs are set, diagnose affected DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no other DTCs are set, go to next step.

3) Turn ignition off. Check throttle body for loose or damaged throttle blade, broken throttle shaft or damaged drive mechanism. If any of these conditions exist, replace throttle body. After repairs, go to next step. If no problem is found, see DIAGNOSTIC AIDS.

4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1515: COMMANDED & ACTUAL THROTTLE POSITION MISMATCH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The commanded throttle position based on Accelerator Pedal Position (APP) and possibly other limiting factors is compared to the actual throttle position. The PCM monitors the commanded and actual throttle position.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* Other electronic throttle control DTCs are not set.
* PCM processor DTCs are not present.
* Ignition switch is crank or run position.
* Ignition voltage is more than 8.5 volts with ignition on, and engine off.
* Electronic throttle control system is not in battery saver mode.

DTC will set when PCM detects that the commanded and actual throttle positions are not within a calibrated range of each other.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, recheck for DTCs. If DTC P1120, P1220 or P1221 is set, diagnose affected DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If DTC P1120, P1220 or P1221 is not set, go to next step.

3) Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, observe TP sensor 1 and 2 angle parameter. Slowly depress the accelerator pedal to Wide Open Throttle (WOT) position and then slowly return pedal to closed throttle. If TP sensor 1 and 2 angle increase to about 100 percent as pedal is depressed and decrease as pedal is released, see DIAGNOSTIC AIDS. If TP sensor 1 and 2 angle does not increase to about 100 percent as pedal is depressed and does not decrease as pedal is released, go to next step.

4) Turn ignition off. Disconnect Throttle Actuator Control (TAC) connector. Turn ignition on, with engine off. Using a DVOM, measure voltage across TAC connector terminals "D" (Brown wire) and "E" (Yellow wire). If voltage reading is 7.5-8.5 volts, go to step 15). If voltage reading is not 7.5-8.5 volts, go to next step.

5) Check voltage between a known-good ground and TAC connector terminals "D" (Brown wire) and "E" (Yellow wire). If any voltage is present at each terminal, go to step 9). If no voltage is present at each terminal, go to next step.

6) Check for open in Brown and Yellow wires between TAC and TAC module. Repair as necessary. After repairs, go to step 10). If circuits are okay, go to next step.

7) Check for short to ground in Brown and Yellow wires between TAC and TAC module. Repair as necessary. After repairs, go to step 11). If circuits are okay, go to next step.

8) Check for continuity between each TAC circuits and all other circuits in the TAC module connector. If continuity exists, go to step 12). If continuity does not exist, go to step 13).

9) Repair short to voltage on affected throttle actuator circuit. After repairs, go to step 17).

10) Repair open or high resistance on affected throttle actuator circuit. After repairs, go to step 17).

11) Repair short to ground on affected throttle actuator circuit. After repairs, go to step 17).

12) Repair circuits that are shorted together. After repairs,

go to step 17).
13) Check for poor connections at TAC module. Repair as necessary. After repairs, go to step 17). If connections are okay, go to next step.
14) Replace TAC module. After replacing module, go to step 17).
15) Check for poor connections at TAC. Repair as necessary. After repairs, go to step 17). If connections are okay, go to next step.
16) Replace throttle body. After replacing throttle body, go to next step.
17) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
Ensure starting and charging systems are operating properly. Low system voltage causes this DTC to set. If starting and charging systems are okay, check for mechanical conditions or binding that may be temperature related. Components may not move freely in extreme heat or cold due to presence of contaminants or ice formation.

DTC P1516: COMMANDED & ACTUAL THROTTLE POSITION MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
The commanded throttle position, based on Accelerator Pedal position (APP) and possibly other limiting factors, is compared to the actual throttle position. The TP values should be within a calibrated range of each other. The Throttle Actuator Control (TAC) module monitors the commanded and actual throttle position. This will DTC set if TAC module detects this condition and sends the message to the PCM across serial data.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* Ignition switch is in crank or run position.
* DTC P1518 is not present.

DTC will set when TAC module detects that the commanded and actual throttle positions are not within a calibrated range of each other or TAC module cannot determine throttle position or both TP sensors are invalid.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Using scan tool, recheck DTCs. If DTC P1120, P1220 or P1221 is set, diagnose affected DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If DTC P1120, P1220 or P1221 is not set, go to next step.
3) Turn ignition off for 15 seconds. Turn ignition on, with

engine off. Using scan tool, observe TP sensor 1 and 2 angle parameter. Slowly depress accelerator pedal to Wide Open Throttle (WOT) position and then slowly return pedal to closed throttle position. If TP sensor 1 and 2 angle increase to about 100 percent as pedal is depressed and decrease as pedal is released, see DIAGNOSTIC AIDS. If TP sensor 1 and 2 angle does not increase to about 100 percent as pedal is depressed and does not decrease as pedal is released, go to next step.

4) Turn ignition off. Disconnect TAC connector. Turn ignition on, with engine off. Using a DVOM, check voltage between TAC connector terminals "D" (Brown wire) and "E" (Yellow wire). If voltage reading is 7.5-8.5 volts, go to step 15). If voltage reading is not 7.5-8.5 volts, go to next step.

5) Check voltage between a known-good ground and TAC connector terminals "D" (Brown wire) and "E" (Yellow wire). If any voltage present on each circuit, go to step 9). If no voltage is present on each circuit, go to next step.

6) Check for open in Brown and Yellow wires between TAC and TAC module. Repair as necessary. After repairs, go to step 10). If circuits are okay, go to next step.

7) Check for short to ground in Brown and Yellow wires between TAC and TAC module. Repair as necessary. After repairs, go to step 11). If circuits are okay, go to next step.

8) Check continuity between each throttle actuator circuits and all other circuits in TAC module connector. If continuity exists, go to step 12). If continuity does not exist, go to step 13).

9) Check for short to voltage on affected throttle actuator circuit. Repair as necessary. After repairs, go to step 17). If circuits are okay, go to step 14).

10) Repair open or high resistance on affected throttle actuator circuit. After repairs, go to step 17).

11) Repair short to ground on affected throttle actuator circuit. After repairs, go to step 17).

12) Repair circuits that are shorted together. After repairs, go to step 17).

13) Check for poor connections at TAC module. Repair as necessary. After repairs, go to step 17). If connections are okay, go to next step.

14) Replace TAC module. After replacing module, go to step 17).

15) Check for poor connections at TAC. Repair as necessary. After repairs, go to step 17). If connections are okay, go to next step.

16) Replace throttle body. After replacing throttle body, go to next step.

17) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

18) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

Ensure starting and charging systems are operating properly. Low system voltage causes this DTC to set. If starting and charging systems are okay, check for mechanical conditions or binding that may be temperature related. Components may not move freely in extreme heat or cold due to presence of contaminants or ice formation.

DTC P1517: THROTTLE ACTUATOR CONTROL MODULE INTERNAL MALFUNCTION

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Throttle Actuator Control (TAC) module contains data which is essential for proper electronic throttle control system operation. The TAC module continuously checks integrity of this data. When TAC module is unable to write or read data to and from Random Access Memory (RAM) or TAC module is unable to correctly read data from the flash memory or an internal TAC module processor fault is detected, this is communicated to the PCM across serial data and DTC will set.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* Ignition is in crank or run position.
* DTC P1518 is not present.

DTC will set when TAC module determines that an internal data test did not pass.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any other DTCs are set, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS .

2) Turn ignition off. Replace TAC module. After replacing module, go to next step.

3) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

4) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1518: LOSS OF COMMUNICATION BETWEEN PCM & TAC MODULE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Throttle Actuator Control (TAC) module and the PCM communicate via a dedicated serial data circuit. This serial data circuit is separate from any other serial data circuit on the vehicle. Accurate transmitting and receiving of serial data requires not only good circuit integrity but also adequate system voltage. This diagnostic monitors the accuracy of serial data transmitted between TAC module and PCM. If PCM or TAC module detects a loss of data or

invalid data, this DTC will set.

Code Enable Criteria

For DTC to run, ignition switch must be in crank or run position. DTC will set when invalid or missing serial data messages are detected for a predetermined period of time.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC P1120, P1220, P1221, P1515 or P1516 is set, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS.

2) Operate vehicle within FAILURE RECORDS conditions. If scan tool indicates that this failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

3) Turn ignition off. Disconnect TAC module connector. Using a DVOM connected to a known-good ground, check voltage on TAC module connector terminal No. 7 (Pink wire). If voltage reading is about zero volts, go to next step. If voltage reading is not about zero volts, go to step 10).

4) Turn ignition on. Check voltage between a known-good ground and TAC module connector terminal No. 7 (Pink wire). If voltage reading is about battery volage, go to next step. If voltage reading is not about battery voltage, go to step 12).

5) Using a test light connected to battery voltage, probe TAC module connector terminals No. 5 (Black/White wire) and No. 17 (Black/White wire). If test light illuminates on both circuits, go to next step. If test light does not illuminate on both circuits, go to step 13).

6) Using a DVOM, check voltage between a known-good ground and TAC module connector terminals No. 16 (Orange/Black wire) and No. 18 (Tan wire). If voltage reading in each circuit is 2-5 volts, go to step 14). If voltage reading in each circuit is not 2-5 volts, go to next step.

7) If voltage reading is more than 5 volts, go to step 11). If voltage reading is not more than 5 volts, go to next step.

8) If voltage reading is less than 5 volts, go to next step.

9) Check for open or short to ground in circuits. Repair as necessary. After repairs, go to step 18). If circuits are okay, go to step 16).

10) Repair short to battery voltage in Pink wire between TAC module and underhood fuse block. After repairs, go to step 18).

11) Check for short to voltage on Orange/Black or Tan wire between TAC module connector and PCM. Repair as necessary. After repairs, go to step 18). If circuits are okay, go to step 17).

12) Repair open or short to ground in Pink wire between TAC module underhood fuse block. After repairs, go to step 18).

13) Repair open in the TAC module ground circuit (Black/White wires). After repairs, go to step 18).

14) Check for faulty connections at TAC module connector terminals No. 16 and 18. Repair as necessary. After repairs, go to step 18). If terminal connections are okay, go to next step.

15) Replace TAC module. After replacing module, go to step 18).

16) Check for faulty connections at PCM. Repair as necessary. After repairs, go to step 18). If connections are okay, go to next step.

17) Replace PCM. Perform PCM relearn procedure. See

POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

18) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

19) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

DTC will set if battery voltage is low or PCM is replaced or reflashed. If problem is slow cranking or if engine is not cranking due to low battery voltage, ignore DTC P1518. Clear any DTCs that may have set from the low battery voltage condition.

DTC P1519: THROTTLE POSITION SENSOR 1 OUT OF RANGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

The Throttle Position (TP) sensor 1 signal is fed into a multiplier (5X) to produce a high resolution calculated TP sensor voltage. This higher resolution TP sensor voltage is used for actuator control in low throttle angle conditions.

Code Enable Criteria

For DTC to run, the following conditions must be met:

* DTC P0606, P1517 or P1518 is not set.
* Ignition switch is in crank or run position.

DTC will set when high resolution TP sensor signal is out of range.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If any other DTCs are set, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS
.

2) Operate vehicle within FAILURE RECORDS conditions. If scan tool indicates this DTC failed this ignition cycle, go to next step. If scan tool does not indicate that this DTC failed this ignition cycle, see DIAGNOSTIC AIDS.

3) Replace TAC module. After replacing module, go to next step.

4) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

5) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs

are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1523: COMMANDED & ACTUAL THROTTLE POSITION MISMATCH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
During battery saver mode the Throttle Actuator Control (TAC) module determines if the throttle plate is returning to the correct de-energized position. If this fault is detected, the TAC module sends a message to the PCM across serial data and this DTC will set.

Code Enable Criteria
For DTC to run, the following conditions must be met:

* DTC P1518 is not set.
* Ignition is on, with engine off.
* Ignition voltage is more than 8.5 volts.
* Battery saver mode is active.

DTC will set when TAC module detects that the commanded and actual throttle positions are not within a calibrated range of each other.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Using scan tool, recheck DTCs. If any other DTCs are set, diagnose affected DTCs first. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no other DTCs are set, go to next step.
3) Turn ignition off for 15 seconds. Turn ignition on, with engine off. Allow accelerator pedal to rest at idle stop for 20 seconds. Using scan tool, observe the indicated throttle position parameter. If throttle position is within 10.8-23.2 percent, go to step 6). If throttle position is not within 10.8-23.2 percent, go to next step.
4) Remove throttle body assembly. Check for any obstructions preventing throttle blade from returning to default position. If an obstruction is found, go to next step. If no obstruction is found, go to step 6).
5) Remove obstruction. After repairs, go to step 7).
6) Replace throttle body assembly. After replacing throttle body, go to next step.
7) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).
8) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1546: A/C CLUTCH FEEDBACK CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

When PCM detects that A/C has been requested, PCM will activate A/C clutch relay. When relay is activated, voltage should be present at both A/C compressor clutch and A/C clutch status terminal at PCM.

Code Enable Criteria

For DTC to set, the following conditions must be met:

* Ignition voltage is 9.0-18.0 volts.
* Engine speed is more than 80 RPM.
* PCM driver is activated.

DTC will set when PCM detects an improper voltage level on output circuit that controls A/C relay for at least 30 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

NOTE: If DTC P0645 is set, diagnose DTC P0645 first. See DTC P0645: A/C CLUTCH RELAY CONTROL CIRCUIT.

2) Start and operate engine at idle with A/C on for 5 minutes. If A/C clutch operates properly, go to next step. If A/C clutch does not operate, go to step 5).

3) Using scan tool, select ENGINE 1 DATA LIST and monitor A/C status display. If scan tool indicates A/C status as ON, go to next step. If scan tool does not indicate that A/C status as ON, go to step 8).

4) Turn ignition on, with engine off. Using scan tool, review FREEZE FRAME and/or FAILURE RECORDS data and note parameters. Turn ignition off for about 15 seconds. Start engine and operate vehicle within conditions required for this diagnostic to run, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter this DTC. If scan tool indicates that this test failed this ignition, go to next step. If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.

5) Turn ignition off. Remove A/C clutch relay. Turn ignition on, with engine off. Using a test light connected to ground, probe ignition feed circuit at A/C relay terminal connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).

6) Connect a fused jumper wire between ignition feed circuit and A/C clutch status circuit on A/C clutch relay harness. If A/C clutch engages, go to next step. If A/C clutch does not engage, go to step 10).

7) Repair A/C clutch relay connection or replace faulty A/C clutch relay. After repairs, go to step 12).

8) Repair open in A/C clutch status circuit from splice to PCM. After repairs, go to step 12).

9) Repair open in ignition feed circuit to A/C relay. After repairs, go to step 12).

10) Repair open in A/C status circuit from A/C relay to splice. After repairs, go to step 12).

11) Replace PCM. Program replacement PCM using required

equipment. After replacing PCM, go to next step.
12) Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
13) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids
If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1635: 5-VOLT REFERENCE 1 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description
PCM uses the 5-volt reference 1 circuit as a sensor feed to MAP sensor and EGR valve pintle position sensor. PCM monitors voltage on the 5-volt reference 1 circuit. If voltage is out of tolerance, DTC will set.

Code Enable Criteria
For DTC to run, engine must be running. DTC will set when PCM detects a voltage out of tolerance condition on the 5-volt reference 1 circuit for more than 10 seconds.

Diagnostic Procedures
1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.
2) Using scan tool, observe the FREEZE FRAME/FAILURE RECORDS data for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or as close to FREEZE FRAME/FAILURE RECORDS data observed. If DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, go to DIAGNOSTIC AIDS.
3) Check PCM and engine grounds. Ensure that grounds are clean and secure. Repair as necessary. After repairs, go to step 13). If no problem is found, go to next step.
4) Turn ignition off. Disconnect EGR valve connector. Turn ignition on, with engine off. Using a DVOM, check voltage between chassis ground and EGR connector terminal "D" (Gray wire). If voltage reading is about 5 volts, go to step 6). If voltage reading is not about 5 volts, go to next step.
5) If voltage reading is more than 5 volts, go to step 9). If voltage reading is not more than 5 volts, go to step 7).
6) Reconnect EGR valve connector. Disconnect MAP sensor connector. Using DVOM, check voltage between engine ground and MAP sensor connector terminal "C" (Gray wire). If voltage reading is about 5 volts, go to DIAGNOSTIC AIDS. If voltage reading is not about 5 volts, go to step 10).
7) Monitor DVOM while disconnecting all other devices connected to 5-volt reference circuit one at a time. See WIRING DIAGRAMS. If voltage changes when one of the components are disconnected, replace affected component. After replacing component, go to step 13). If no problem is found, go to next step.
8) Turn ignition off. Disconnect PCM connector. Check 5-volt

reference circuit for a short to ground or any sensor low reference circuit. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to step 12).

9) Turn ignition off. Disconnect PCM connectors. Turn ignition on, with engine off. Check for short to voltage in Light Green wire between MAP sensor and PCM. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 12).

10) Check for short between EGR control high circuit and 5-volt reference circuit. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to next step.

11) Replace EGR valve. After replacing EGR valve, so to step 13).

12) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

13) Using scan tool, clear DTCs. Turn ignition off for at least 30 seconds. Start engine and allow it to reach normal operating temperature. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If scan tool does not indicate that this test ran and passed, go to step 2).

14) Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no undiagnosed DTCs are displayed, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.

DTC P1639: 5-VOLT REFERENCE 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Description

PCM uses the 5-volt reference 2 circuit as a sensor feed for the A/C refrigerant pressure sensor. The PCM monitors voltage on the 5-volt reference 2 circuit. If voltage is out of tolerance, DTC will set.

Code Enable Criteria

For DTC to run, engine must be running. DTC will set when PCM detects a voltage out of tolerance condition on the 5-volt reference 2 circuit for more than 10 seconds.

Diagnostic Procedures

1) If powertrain diagnostic system check was performed, go to next step. If powertrain diagnostic system check was not performed, go to POWERTRAIN DIAGNOSTIC SYSTEM CHECK under DIAGNOSTIC SYSTEM CHECKS. After performing powertrain diagnostic system check, go to next step.

2) Using scan tool, observe the FREEZE FRAME/FAILURE records data for this DTC. Turn ignition off for 30 seconds. Start engine. Operate vehicle within the conditions for running the DTC or as close to FREEZE FRAME/FAILURE records observed. If DTC fails this ignition cycle, go to next step. If DTC does not fail this ignition cycle, go to DIAGNOSTIC AIDS.

3) Inspect PCM and engine grounds. Ensure that grounds are clean and secure. Repair as necessary. After repairs, go to step 12). If no problem is found, go to next step.

4) Turn ignition off. Disconnect A/C pressure sensor connector. Turn ignition on, with engine off. Using a DVOM, check voltage between a known-good ground and A/C pressure sensor connector terminal "B" (Light Blue/black wire). If voltage reading is about 5

volts, go to step 10). If voltage reading is not about 5 volts, go to next step.

5) If voltage reading is more than 5 volts, go to next step. If voltage reading is not more than 5 volts, go to step 7).

6) Turn ignition off. Disconnect PCM connectors. Check for short to voltage on Light Blue/Black wire between A/C pressure sensor and PCM. After repairs, go to step 12). If circuit is okay, go to step 11).

7) Check continuity between the A/C pressure sensor connector terminals "B" (Light Blue/Black wire) and "C" (Red/Black wire). If continuity exists, go to next step. If continuity does not exists, go to step 9).

8) Leave ignition off. Check continuity between a known-good chassis ground and A/C pressure sensor connector terminal "B" (Light Blue/Black wire). If continuity exists, go to step 11). If continuity does not exist, go to next step.

9) Repair Light Blue/Black wire for short to chassis ground or short to Red/Black wire in A/C pressure sensor circuit. After repairs, go to step 12).

10) Replace A/C pressure sensor. After replacing sensor, go to step 12).

11) Replace PCM. Perform PCM relearn procedure. See POWERTRAIN CONTROL MODULE PROGRAMMING under PROGRAMMING. After replacing PCM, go to next step.

12) Using scan tool, observe the stored information and Capture Info. If any undiagnosed DTCs are displayed, diagnose affected DTCs. See DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTC are displayed, system is okay.

13) Using scan tool, observe the stored information and Capture Info. If DTC resets, go to step 2). If DTC does not reset, system is okay.

Diagnostic Aids

If problem is intermittent, see INTERMITTENT TROUBLE CODE DETERMINATION under SELF-DIAGNOSTIC SYSTEM.