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 the BASIC TESTING article. Failure to do so may result in lost diagnostic time.

If no faults were found while performing basic diagnostic procedures, proceed with **DIAGNOSTIC PROCEDURE** under SELF-DIAGNOSTIC SYSTEM. If no fault codes are present and driveability problems exist, proceed to TESTS W/O CODES article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.). If only intermittent codes are present, see INTERMITTENTS in TESTS W/O CODES article.

SELF-DIAGNOSTIC SYSTEM

DIAGNOSTIC SYSTEM

NOTE: Powertrain Control Module (PCM) may also be referred to as Vehicle Control Module (VCM) in some diagnostic text and illustrations. Terms may be used interchangeably.

PCM/VCM is equipped with a self-diagnostic system which detects system failures or abnormalities. When a malfunction occurs, PCM/VCM will store a Diagnostic Trouble Code (DTC) and, in most cases, illuminate the Malfunction Indicator Light (MIL) located on instrument cluster. Malfunctions are recorded as hard failures or as intermittent failures.

There are 4 types of DTC category:

- Type "A" Emissions related, turns on MIL the first time DTC sets.
- Type "B" Emissions related, turns on MIL if fault is active for 2 consecutive driving cycles.
- Type "C" Non-emissions related, does not turn on MIL, but will turn on SERVICE light.
- Type "D" Non-emissions related, does not turn on MIL or SERVICE light.

Hard Failures

Most hard failures cause MIL to illuminate and remain on until malfunction is repaired. If MIL comes on and remains on (light may flash) during vehicle operation, cause of malfunction must be determined. See **DIAGNOSTIC PROCEDURE** .

If a sensor fails, PCM/VCM will use a substitute value in its calculations to continue engine operation. In this condition, vehicle is functional, but it will most likely display degraded driveability.

Intermittent Failures

Intermittent failures cause MIL to flicker or glow and go out about 10 seconds after intermittent fault goes away. Corresponding DTC, however, will be retained in PCM/VCM memory. If related fault does not reoccur within 50 engine starts, trouble code will be erased from control module memory. Intermittent failures may be caused by sensor, connector or wiring related problems. See INTERMITTENTS in TESTS W/O CODES article.

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 1 or 2 scan tool. See scan tool operator's manual for additional information.

The following are Tech 1 or 2 scan tool sub-menus in the DTC INFO and SPECIFIC DTC modes:

DTC INFO MODE

Used to search for a specific type of stored DTC information. There are 7 choices in this mode. Technician may be instructed to test DTC(s) in a certain manner. Follow the affected DTC test procedures. To get complete description of any status, hit ENTER key before pressing the desired F-key.

DTC STATUS

This selection will display any DTC(s) that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC test which run and passed will cause that affected DTC to be removed from scan tool screen.

FAIL THIS IGN.

This selection will display all DTCs that have failed during the present ignition cycle.

HISTORY

This selection will display only DTC(s) that are stored in the control module's history memory. It will not type "B" DTCs. It will display all type "A" and type "B" DTCs that have the MIL illuminated and have failed within the last 40 warm-up cycles. It will also display type "C" DTCs that have failed within the 40 warm-up cycles.

LAST TEST FAIL

This selection will display only DTCs that have failed the last time the test ran. The last test may have ran during the previous ignition cycle, if a type "A" or "B" DTC is displayed. For type "C" DTCs, the last failure must have occurred during the current ignition cycle to be displayed as LAST TEST FAIL.

MIL REQUEST

This selection will display only DTCs that are requesting the MIL. Type "C" DTCs cannot be displayed using this option. This selection will report type "B" DTCs only after the MIL has been requested.

NOT RUN SCC

Not Run Since Code Clear option will display up to 33 DTCs that have not run since DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

TEST FAIL SCC

Test Fail Since Code Clear selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed over 40 warm-up cycles before this option is selected will not be displayed.

FAILED SINCE CLEAR

This message indicates the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

NOT RUN SINCE CL.

Not Run Since Cleared message indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passed or failed) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

NOT RUN THIS IGN.

Not Run This Ignition message indicates the selected diagnostic test has not run this ignition cycle.

TEST RAN AND PASSED

This message indicates the selected diagnostic test has:

- Passed the last test.
- Ran and passed during this ignition cycle.
- Ran and passed since DTCs were last cleared.
- Test has not failed since DTCs were last cleared.

If this message is displayed, repair is done. If FAILED THIS IGN. message is displayed, repair is incomplete and further diagnosis is required.

DIAGNOSTIC PROCEDURE

Diagnosis of computerized engine control system should be performed in 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 On-Board Diagnostic (OBD) System Check must be performed before using specific DTC testing procedure. See **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
2. If DTC(s) were displayed, determine whether codes are hard or intermittent trouble codes. Hard codes will cause MIL to illuminate continuously while engine is running. See **HARD OR INTERMITTENT**

TROUBLE CODE DETERMINATION . For diagnosing hard codes, proceed to appropriate DTC test. For diagnosing intermittent codes, proceed to INTERMITTENTS in TESTS W/O CODES article.

3. If no DTCs are present and a driveability problem exists, refer to SYMPTOMS in TESTS W/O CODES article. Doing so will help identify proper system or component to check in SYSTEM/COMPONENT TESTS article.
4. After necessary repairs are made, clear DTCs, verify vehicle will enter "closed loop" operation and ensure DTC does not reset.

POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK

NOTE: Tech 1 or 2 scan tool is required to perform OBD system check.

The OBD System Check determines:

- If Malfunction Indicator Light (MIL) operates.
- If PCM is operating and can recognize a fault.
- If any DTCs are stored.

After performing procedures in PRELIMINARY INSPECTION & ADJUSTMENTS, BASIC FUEL SYSTEM CHECKS and BASIC IGNITION SYSTEM CHECKS in BASIC TESTING 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 diagnostic circuit check, if no codes are indicated and driveability problems still exist, see TESTS W/O CODES article and SCAN TOOL USAGE.

1. Connect scan tool to Data Link Connector (DLC). Turn ignition on with engine off. If scan tool does not display data, go to next step. If scan tool displays data, go to step 3).
2. Using scan tool, select DIAGNOSTIC CIRCUIT CHECK, CLASS 2 MESSAGE MONITOR. If scan tool displays other modules as active, go to DLC DIAGNOSIS OR NO SCAN TOOL DATA. If scan tool does not display other modules as active, go to appropriate system for diagnosis of faulty module. See appropriate article in the ACCESSORIES/SAFETY EQUIPMENT section.
3. If engine starts and continues to run, go to next step. If engine does not start or continue to run, go to NO START - ENGINE CRANKS OKAY (WITH DIS) under NO START DIAGNOSIS in BASIC TESTING article.
4. If engine continues to run after vehicle exceeds 2 MPH, go to next step. If engine does not continue to run after vehicle exceeds 2 MPH, go to BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section.
5. Using scan tool, check if DTC P1626 or DTC P1631 stored in history. If either DTC is stored, diagnose DTC. If neither DTC is stored, go to next step.
6. Using scan tool, observe DTC information. If DTC status LAST TEST FAILED, TEST FAILED THIS IGNITION, MIL REQUEST, or HISTORY DTCs are set, save DTC FREEZE FRAME and/or FAILURE RECORDS information, or REFRESH INFO. If any DTCs are displayed, diagnose DTC. If no DTCs are displayed, go to next step.
7. Compare scan tool engine data with actual control system data values. If data value is within limits, see TESTS W/O CODES article. If data value is not within limits, go to next step.

8. Vehicle is equipped with a column lock system. System is necessary because of location of ignition lock cylinder. Body Control Module (BCM) controls a motor mounted on steering column that unlocks steering wheel. If BCM is unable to determine if column is unlocked or if vehicle speed is present, Powertrain Control Module (PCM) will disable fuel. If condition is intermittent, check for improper installation of electrical components. Inspect aftermarket theft deterrent devices, lights and cellular telephones. Ensure aftermarket equipment is not connected to Class 2 circuit. If intermittent condition cannot be located, cellular telephone communication signal may be cause. If multiple DTCs are set, check IGN 1 mini relay operation. Relay protects battery from parasitic draw and powers transmission, EVAP solenoid, MAF sensor, AIR pump and AIR solenoid relays, and TCC/Cruise and extended-travel brake switches.

DLC DIAGNOSIS OR NO SCAN TOOL DATA

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on with engine off. Connect scan tool to Data Link Connector (DLC). If scan tool powers up, go to next step. If scan tool does not power up, go to step 5).
3. Turn ignition off for 15 seconds. Immediately attempt to start engine. If engine is not cranked within 5 seconds after ignition is turned on, misdiagnosis could occur. If engine starts and then stalls after about 5 seconds, go to BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section. If engine does not start or starts and stalls after about 5 seconds, go to next step.
4. If engine cranks but does not start, go to step 9). If engine does not crank, go to step 13).
5. Disconnect scan tool from DLC. Turn ignition on, with engine off. Using a test light connected to ground, probe DLC terminal No. 16 (Purple wire). See WIRING DIAGRAMS article. If test light illuminates, go to next step. If test light does not illuminate, go to step 16).
6. Using a test light connected to battery voltage, probe DLC terminals No. 4 (Black wire) and No. 5 (Black/White wire). See WIRING DIAGRAMS article. If test light illuminates on both circuits, go to next step. If test light does not illuminate on either circuit, go to step 8).
7. Inspect scan tool connections to DLC. Also, inspect DLC terminals for proper tension. After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
8. Repair open in ground circuit to DLC terminals No. 4 (Black wire) and No. 5 (Black/White wire). After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
9. Turn ignition off. Disconnect PCM harness connector C2. Turn ignition on. Using a test light connected to battery ground, probe PCM connector C2, terminals No. 19 (PCM ignition 1 feed), No. 20 (PCM battery feed), and No. 61 (PCM battery feed). See WIRING DIAGRAMS article. If test light illuminates on each circuit, go to next step. If test light does not illuminate on any circuit, go to step 14).
10. Using DVOM, check resistance between chassis ground and PCM connector C2 terminals No. 21 (PCM ground), and No. 60 (PCM ground). See WIRING DIAGRAMS article. If resistance is equal to or less than 5 ohms on both circuits, go to next step. If resistance is not less than 5 ohms on either circuit, go to step 15).
11. Check PCM for proper connections. Repair as necessary. After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** . If no problem is found, go to next step.
12. Replace PCM. Perform PCM relearn procedures. After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .

13. Repair open in Class 2 circuit (Dark Green wire) between splice pack and PCM. After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
14. Repair circuit that did not illuminate test light. After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
15. Repair faulty PCM ground circuit (Black/White wire). After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .
16. Repair faulty battery supply circuit (Purple wire). After repairs, perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** .

READING TROUBLE CODES

NOTE: Use of Tech 1 or 2 scan tool is required to retrieve DTCs. Refer to user reference manual supplied with scan tool.

TROUBLE CODE DEFINITIONS

TROUBLE CODE DEFINITION

Code No.	Circuit Affected
P0101	MAF System Performance
P0102	MAF Sensor Circuit-Low Frequency
P0103	MAF Sensor Circuit-High Frequency
P0107	MAP Sensor Circuit-Low Voltage
P0108	MAP Sensor Circuit-High Voltage
P0112	IAT Sensor Circuit-Low Voltage
P0113	IAT Sensor Signal Voltage High
P0117	ECT Sensor Circuit Low Voltage
P0118	ECT Sensor Signal High Voltage
P0125	ECT Excessive Time To Closed Loop
P0131	HO2S Circuit Low Voltage-Bank 1, Sensor 1
P0132	HO2S Circuit High Voltage-Bank 1, Sensor 1
P0133	HO2S Slow Response-Bank 1, Sensor 1
P0134	HO2S Insufficient Activity-Bank 1, Sensor 1
P0135	HO2S Heater Circuit-Bank 1, Sensor 1
P0137	HO2S Circuit Low Voltage-Bank 1, Sensor 2
P0138	HO2S Circuit High Voltage-Bank 1, Sensor 2
P0140	HO2S Insufficient Activity-Bank 1, Sensor 2
P0141	HO2S Heater Circuit-Bank 1, Sensor 2
P0151	HO2S Circuit Voltage Low-Bank 2, Sensor 1
P0152	HO2S Circuit Voltage High-Bank 2, Sensor 1
P0153	HO2S Slow Response-Bank 2, Sensor 1
P0154	HO2S Circuit Insufficient Activity-Bank 2, Sensor 1

P0155	HO2S Heater Circuit-Bank 2, Sensor 1
P0157	HO2S Circuit Voltage Low-Bank 2, Sensor 2
P0158	HO2S Circuit Voltage High-Bank 2, Sensor 2
P0160	HO2S Insufficient Activity-Bank 2, Sensor 2
P0161	HO2S Heater Circuit-Bank 2, Sensor 2
P0171	Fuel Trim System Lean-Bank 1
P0172	Fuel Trim System Rich-Bank 1
P0174	Fuel Trim System Lean-Bank 2
P0175	Fuel Trim System Rich-Bank 2
P0230	Fuel Pump Control Circuit
P0300	Engine Misfire Detected
P0325	Knock Sensor Module Circuit
P0327	Knock Sensor Circuit-Front
P0332	Knock Sensor Circuit
P0335	CKP Sensor Circuit
P0336	CKP Sensor System Performance
P0341	CMP Sensor Circuit Performance
P0342	CMP Sensor Circuit Low Voltage
P0343	CMP Sensor Circuit High Voltage
P0351	Ignition Control No. 1 Circuit
P0352	Ignition Control No. 2 Circuit
P0353	Ignition Control No. 3 Circuit
P0354	Ignition Control No. 4 Circuit
P0355	Ignition Control No. 5 Circuit
P0356	Ignition Control No. 6 Circuit
P0357	Ignition Control No. 7 Circuit
P0358	Ignition Control No. 8 Circuit
P0410	AIR System
P0412	AIR Solenoid Relay Control Circuit
P0418	AIR Pump Relay Control Circuit
P0420	TWC System Low Efficiency-Bank 1
P0430	TWC Low Efficiency-Bank 2
P0441	EVAP System-No Flow During Purge
P0443	EVAP Canister Purge Sol. Circuit Fault
P0461	Fuel Level Sensor Circuit Performance
P0462	Fuel Level Sensor Circuit-Voltage Low
P0463	Fuel Level Sensor Circuit-Voltage High
P0480	Cooling Fan Relay No. 1 Control Circuit
P0481	Cooling Fan Relay No. 2 & 3 Control Circuit
P0500	VSS Circuit
P0506	IAC System RPM Low

P0507	Idle Speed High
P0522	Engine Oil Pressure Sensor Circuit-Voltage Low
P0523	Engine Oil Pressure Sensor Circuit-Voltage High
P0530	A/C Refrigerant Pressure Sensor Circuit
P0562	System Voltage Low
P0563	System Voltage High
P0567	Cruise Resume Circuit
P0568	Cruise Set Circuit
P0571	Cruise Brake Switch Circuit
P0601	PCM Memory
P0602	PCM Not Programmed
P0604	PCM RAM Performance
P0606	PCM Internal Comm. Interrupted
P0608	VSS Output Circuit
P0650	MIL Control Circuit
P0654	Engine Speed Output Circuit
P0704	Clutch Switch Circuit
P0705(1)	Trans. Range Switch Circuit
P0705(1)	Trans. Range Switch Circuit
P0706(1)	Trans. Range Switch Performance
P0801(1)	Reverse Inhibit Solenoid Control Circuit
P0803(1)	1-4 Upshift Solenoid Control Circuit
P0804(1)	1-4 Upshift Light Control Circuit
P1111	IAT Sensor Circuit Intermittent High Voltage
P1112	IAT Sensor Circuit Intermittent Low Voltage
P1114	ECT Sensor Circuit Intermittent Low Voltage
P1115	ECT Sensor Circuit Intermittent High Voltage
P1125	APP System
P1133	HO2S Insufficient Switching-Bank 1, Sensor 1
P1134	HO2S Transition Time Ratio-Bank 1, Sensor 1
P1153	HO2S Insufficient Switching-Bank 2, Sensor 1
P1154	HO2S Transition Time Ratio-Bank 2, Sensor 1
P1220	TP Sensor No. 2 Circuit
P1221	TP Sensor No. 1 & 2 Performance
P1258	Engine Coolant Overtemp.-Fuel Disabled
P1275	APP Sensor No. 1 Circuit
P1276	APP Sensor No. 1 Performance
P1280	APP Sensor No. 2 Circuit
P1281	APP Sensor No. 2 Performance

P1285	APP Sensor No. 3 Circuit
P1286	APP Sensor No. 3 Performance
P1380	ABS DTC Rough Road Data Unstable
P1351	Ignition Control No. 1 Circuit
P1352	Ignition Control No. 2 Circuit
P1381	Misfire Detected, No EBCM/PCM/VCM Serial Data
P1415	AIR System-Bank 1
P1416	AIR System-Bank 2
P1431	Fuel Level Sensor No. 2 Circuit Performance
P1432	Fuel Level Sensor No. 2 Circuit Low Voltage
P1433	Fuel Level Sensor No. 2 Circuit High Voltage
P1441	EVAP System Flow During Non-Purge
P1514	TAC System MAF Performance
P1515	Command Vs. Actual Performance (PCM)
P1516	Command Vs. Actual TP Performance (TAC)
P1517	TAC Module Processor Serial Data Circuit
P1518	PCM-To-TAC Module Serial Data Circuit
P1539	A/C Clutch Status Circuit Voltage High
P1545	A/C Clutch Relay Control Circuit
P1546	A/C Clutch Status Circuit Voltage Low
P1571	ASR Desired Torque Circuit
P1574	Stoplight Control Circuit
P1575	Extended Brake Travel Switch Circuit Voltage High
P1626	Loss Of Serial Communication W/Theft Deterrent Or Theft Deterrent System Fuel Enable Circuit
P1630	Theft Deterrent System-PCM In Learn Mode
P1631	Theft Deterrent System-Password Incorrect
P1635	5-Volt Reference No. 1 Circuit
P1639	5-Volt Reference No. 2 Circuit
P1644	Delivered Torque Output Circuit
P1652	PCM Chassis Pitch Output Circuit
(1) Covered in entirety in AUTO TRANS DIAGNOSIS article in the AUTO TRANS DIAGNOSIS section.	

HARD OR INTERMITTENT TROUBLE CODE DETERMINATION

During any diagnostic procedure, determine if DTC(s) are hard failure codes or intermittent failure codes. Diagnostic procedures will not always help analyze intermittent codes. To determine hard codes and intermittent codes:

1. Enter diagnostic mode. Read and record all stored DTCs. Exit diagnostic mode, and clear DTCs. See **CLEARING DIAGNOSTIC TROUBLE CODES (DTC)** .

2. Apply parking brake, and place transmission in Neutral or Park. Block drive wheels, and start engine. MIL should go out. Operate warm engine at specified RPM for 2 minutes and note MIL.
3. If MIL illuminates, enter diagnostic mode. Read and record DTCs. This will reveal hard failure codes. Oxygen sensor related DTCs may require a road test to reset hard failure after DTCs were cleared.
4. If MIL does not illuminate, all stored DTCs were intermittent failures.

NOTE: DTCs will be recorded at various operating times. Some DTCs require operation of that sensor or switch for 5 seconds; others require operation for 5 minutes or longer at normal operating temperature, vehicle speed and load. Therefore, some DTCs may not set in a service bay operational mode and may require road testing vehicle in order to duplicate conditions under which code will set.

CLEARING DIAGNOSTIC TROUBLE CODES (DTC)

To clear DTCs from memory, either to determine if malfunction will occur again or after making necessary repairs, disconnect power supply to ECM/PCM/VCM for at least 30 seconds or clear codes using a scan tool.

ECM/PCM/VCM LOCATION

On most models, ECM/PCM/VCM is located behind right or left side of dash, behind right or left kick panel, or on left or right side of engine compartment. For a more precise location, see COMPONENT LOCATIONS in SYSTEM/COMPONENT TESTS article.

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.

SPECIAL TOOLS (DIAGNOSTIC)

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

NOTE: A scan tool plugged into 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 lights and 6 jumper wires 6" long (one wire with female connectors at both ends, one wire with male connectors at both ends and 4 wires with male and female connectors at opposite ends). 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.

SCAN TOOL USAGE

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 ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK. If vehicle does not pass OBD system check, information received may be invalid.

Scan tool is a specialized tester which, when plugged into 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 cuts down 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 ECM/PCM/VCM; 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. See SCAN DATA.

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.

SUMMARY

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

DIAGNOSTIC TROUBLE CODES

NOTE: Before clearing DTCs, perform procedures under POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK . Record FREEZE FRAME and FAILURE RECORDS for reference during testing. Data will be erased when DTCs are cleared. If ECM/PCM/VCM is replaced, NEW ECM/PCM/VCM must be programmed using special manufacturer's equipment.

DTC P0101 - MAF SENSOR SYSTEM PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor is hot-wire type and is used to measure airflow rate into engine. MAF sensor has a battery feed, ground and signal circuit. As airflow increases, a greater amount of current is required to maintain hot wires at a constant temperature. MAF sensor converts changes in current draw to a frequency signal read by PCM. PCM calculates airflow (grams per second) based on this signal.

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.

This test checks for a stuck MAF sensor signal. If MAF sensor frequency varies less than a predetermined minimum amount, DTC will set.

DTC will set when following conditions are present:

- DTC P0102, P0103, P0107, P0108, P0121, P0122, P0123, P1120, P1220 or P1221 not set.
- Engine running.
- Engine speed 50-2800 RPM.
- TP sensor angle less than 50 percent when BARO-MAP is greater than 65 kPa.
- Ignition voltage 10-16 volts.
- MAF frequency 50 percent different from speed density calculation.
- Change in TP sensor is less than 3 percent.
- Conditions stable for 2 seconds.
- Conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: MAP value decreases by about 100 kPa for every 1000 feet of altitude.

2. Turn ignition on, with engine off. Using scan tool, select MAP from ENGINE 1 DATA LIST function. If MAP value is greater than 100 kPa (sea level), go to next step. If MAP value is not greater than 100 kPa (sea level), go to step 19).
3. Remove MAP sensor from intake manifold, leaving harness connector connected. Install a hand-held vacuum pump to MAP sensor. Observe MAP sensor reading on scan tool while applying vacuum. Each one in. Hg applied should result in 3-4 kPa drop. Value should change smoothly with each increase in vacuum. If MAP value changed smoothly without any erratic reading, go to next step. If reading is

erratic, go to step 19).

4. Apply up to 20 in. Hg to MAP sensor. If MAP sensor reading is 34 kPa or less, go to next step. If MAP sensor reading is not 34 kPa or less, go to step 19).
5. Remove vacuum source from MAP sensor. If MAP sensor reading returns to original value, go to next step. If reading does not return to original value, go to step 19).
6. 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 and enter DTC P0101. 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.
7. Check for blockage in MAF sensor inlet screen, intake manifold leak, vacuum leak at throttle body, leak at EGR valve flange and pipes, or faulty PCV valve. Repair or replace as necessary. After repairs, go to step 21). If no problem is found, go to next step.
8. Turn ignition off. Disconnect MAF sensor connector. Turn ignition on, with engine off. Using DVOM, check voltage between MAF sensor signal circuit and ground. If DVOM reads about 5 volts, go to next step. If DVOM does not read about 5 volts, go to step 10).
9. Connect test light between MAF sensor ignition feed circuit and ground circuit at sensor harness connector. If test light illuminates, go to step 13). If test light does not illuminate, go to step 12).
10. If voltage is less than 4.5 volts, go to step 14). If voltage is not less than 4.5 volts, go to next step.
11. Turn ignition off. Disconnect PCM harness connector. Turn ignition on, with engine off. Using a DVOM, check voltage between MAF sensor signal circuit and ground. If voltage is zero volts, go to step 20). If voltage is not about zero volts, go to step 17).
12. Connect a test light between MAF sensor ignition feed circuit and chassis ground. If test light illuminates, go to step 15). If test light does not illuminate, go to step 16).
13. Check for poor connection at MAF sensor harness terminal. Repair or replace as necessary. After repairs, go to step 21). If connection is okay, go to step 18).
14. Check MAF signal circuit between PCM and MAF sensor for open, short to ground or short to MAF ground circuit. Repair open or shorted circuit. After repairs, go to step 21). If circuits are okay, go to step 20).
15. Locate and repair open in ground circuit to MAF sensor. After repairs, go to step 21).
16. Locate and repair open in ignition feed circuit to MAF sensor. After repairs, go to step 21).
17. Locate and repair short to voltage in MAF sensor signal circuit. After repairs, go to step 21).
18. Replace MAF sensor. After replacing MAF sensor, go to step 21).
19. Replace MAP sensor. After replacing MAP sensor, go to step 21).
20. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
21. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select SPECIFIC DTC, then enter DTC P0101. 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).
22. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are

displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. Also, check for vacuum or PCV system leaks, incorrect PCV valve, engine oil dipstick not fully seated or engine oil filler cap loose or missing.

DTC P0102 - MAF SENSOR CIRCUIT LOW FREQUENCY

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor is hot-wire type and is used to measure airflow rate into engine. MAF sensor has a battery feed, ground and signal circuit. As airflow increases, a greater amount of current is required to maintain hot wires at a constant temperature. MAF sensor converts changes in current draw to a frequency signal read by PCM. PCM calculates airflow (grams per second) based on this signal.

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.

This test checks for a stuck MAF sensor signal. If MAF sensor frequency varies less than a predetermined minimum amount, DTC will set.

DTC will set when following conditions are present:

- Engine running.
- Engine speed at greater than 300 RPM.
- Ignition voltage at least 8 volts.
- MAF frequency less than 10 Hz.
- Conditions met for one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select ENGINE 2 DATA LIST and monitor MAF sensor grams per second (gm/s) display. If MAF sensor value is less than 10 Hz, go to step 4). If MAF sensor value is not less than 10 Hz, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0102. 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 MAF sensor harness connector. Turn ignition on, with engine off. Using DVOM, check voltage between MAF signal circuit and battery ground. If voltage is about 5 volts, go to next step. If voltage is not as specified, go to step 8).
5. Connect test light between MAF sensor ignition feed circuit and ground circuit at harness connector. If test light illuminates, go to step 7). If test light does not illuminate, go to next step.
6. Connect test light between MAF sensor ignition feed circuit and ground. If test light illuminates, go to step 9). If test light does not illuminate, go to step 10).
7. Check for poor connection at MAF sensor harness terminals. Repair or replace terminal(s). After repairs, go to step 13). If terminals are okay, go to step 11).
8. Check MAF signal circuit between PCM and MAF sensor for open, short to ground, or short to MAF ground. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to step 12).
9. Locate and repair open in ground circuit to MAF sensor. After repairs, go to step 13).
10. Locate and repair open in ignition feed circuit to MAF sensor. After repairs, go to step 13).
11. Replace MAF sensor. After replacing MAF sensor, go to step 13).
12. Replace and program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0102. Operate vehicle in 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. Also, check for vacuum or PCV system leaks, incorrect PCV valve, engine oil dipstick not fully seated, or engine oil filler cap loose or missing.

DTC P0103 - MAF SENSOR CIRCUIT HIGH FREQUENCY

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Mass Airflow (MAF) sensor is hot-wire type and is used to measure airflow rate into engine. MAF sensor has a battery feed, ground and signal circuit. As airflow increases, a greater amount of current is required to maintain hot wire at a constant temperature. MAF sensor converts changes in current draw to a frequency signal read by PCM. PCM calculates airflow (grams per second) based on this signal.

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. This test checks for a stuck MAF sensor signal. If MAF sensor frequency varies less

than a predetermined minimum amount, DTC will set.

DTC will set when following conditions are present:

- Engine running.
- Engine speed greater than 300 RPM.
- Ignition voltage greater 8 volts.
- MAF frequency greater than 11,250 Hz.
- Conditions met for one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select ENGINE 2 DATA LIST and monitor MAF sensor frequency display. If MAF sensor value is greater than 11,250 Hz, go to step 4). If MAF sensor value is not greater than 11,250 Hz, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0103. 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 MAF sensor harness connector. Start engine. Using scan tool, monitor MAF sensor grams display again. If MAF frequency is not displayed, go to next step. If MAF sensor frequency is displayed, go to step 7).
5. Check for poor connection at MAF sensor harness connector terminal. Repair or replace as necessary. After repairs, go to step 10). If harness connector terminals are okay, go to next step.
6. Replace MAF sensor. After replacing MAF sensor, go to step 10).
7. Check MAF sensor harness for incorrect routing near secondary ignition wires or components, or solenoids, relays or motors. Correct problem as necessary. After repairs, go to step 10). If routing is okay, go to next step.
8. Check MAF sensor signal circuit terminal connections at PCM. Repair or replace as necessary. After repairs, go to step 10). If connections are okay, go to next step.
9. Replace PCM. Program replacement PCM using necessary equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0103. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. Also, check for water entering air intake system to MAF sensor. Water rapidly cools hot wire in sensor, causing a false indication of excessive airflow.

DTC P0107 - MAP SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures pressure changes within intake manifold to indicate engine load. MAP sensor is mounted on top of intake manifold. MAP sensor has a 5-volt reference circuit, ground and a signal circuit.

MAP sensor voltage (depending on altitude) can range from 1.0-1.5 volts at idle (high vacuum) to 4.0-4.9 volts at wide open throttle (low vacuum). When PCM senses a signal voltage lower than normal operating range of sensor, DTC will set.

DTC will set when following conditions are present:

- No TP sensor DTCs set.
- TP angle less than 20 percent when engine speed is greater than 1200 RPM.
- TP angle not greater than zero percent when engine speed is less than 1200 RPM.
- MAP is less than .10 volt.
- Conditions met for greater than 2 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor Failed This Ignition option under DTC information option. If DTC P1635 fails in this ignition cycle, go to DTC P1635 diagnostic test. If DTC P1635 did not fail in this ignition cycle, go to next step.
3. Monitor MAP sensor voltage on ENGINE 1 DATA LIST. If MAP sensor voltage is less than .10 volt, go to step 5). If sensor voltage is not less than .10 volt, go to next step.
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 DTC P0107. 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. Disconnect MAP sensor harness connector. Using a fused jumper wire, jumper 5-volt reference circuit and MAP signal circuit at MAP sensor harness connector. Observe MAP voltage display on scan tool. If MAP sensor voltage is about 5 volts, go to step 11). If MAP voltage is not about 5 volts, go to next step.

6. Using a test light connected to battery voltage, probe MAP sensor signal circuit at MAP sensor harness connector. Observe MAP voltage display on scan tool. If MAP voltage is about 5 volts, go to next step. If MAP voltage is not about 5 volts, go to step 8).
7. Turn ignition off. Disconnect PCM harness connector. Check for open or short to ground in 5-volt reference circuit. Repair as necessary. After repairs, go to step 13). If circuits are okay, go to next step.
8. Check 5-volt reference circuit at PCM connector for poor terminal connection. Repair as necessary. After repairs, go to step 13). If connection is okay, go to step 12).
9. Turn ignition off. Disconnect PCM harness connector. Check MAP sensor circuit for open, short to ground or short to sensor ground circuit. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to next step.
10. Check for poor connection on MAP sensor signal circuit at PCM. Repair or replace as necessary. After repairs, go to step 13). If connection is okay, go to step 11).
11. Check MAP sensor signal circuit for poor connection at PCM. Repair as necessary. If terminals are okay, replace MAP sensor. After repairs, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0107. Operate vehicle within conditions that set 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM's 5-volt reference circuits are internally connected within PCM. If all MAP sensor circuits are okay, check related 5-volt reference circuits. If it is determined that DTC is intermittent, performing DTC P1107 diagnostics may isolate cause of fault.

DTC P0108 - MAP SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Manifold Absolute Pressure (MAP) sensor measures pressure changes within intake manifold to indicate engine load. MAP sensor is mounted on top of intake manifold. MAP sensor has a 5-volt reference circuit, ground and a signal circuit.

MAP sensor voltage (depending on altitude) can range from 1.0-1.5 volts at idle (high vacuum) to 4.0-4.9 volts

at wide open throttle (low vacuum). When PCM senses a signal voltage higher than normal operating range of sensor, DTC will set.

DTC will set when following conditions are present:

- No TP sensor related DTCs set.
- Engine operating.
- TP sensor angle less than 5 percent when engine speed is less than 1000 RPM.
- TP sensor angle less than 18 percent when engine speed is greater than 1000 RPM.
- MAP voltage greater than 4.3 volts.
- Conditions met for greater than 4 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION option under DTC information option. If scan tool indicates that DTC P1635 failed this ignition, diagnose DTC P1635 first. If scan tool does not indicate that DTC P1635 failed this ignition, go to next step.
3. If engine is running rough or unstable, repair idle problem first. See TESTS W/O CODES article. After repairs, start engine. Using scan tool, select ENGINE 1 DATA LIST function and monitor MAP sensor voltage. If MAP sensor voltage is greater than 4.3 volts, go to step 5). If MAP sensor voltage is not greater 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 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 DTC P0108. 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. Disconnect MAP sensor harness connector. Note MAP sensor voltage displayed on scan tool. If MAP sensor voltage is less than one volt, go to next step. If MAP sensor voltage is not less than one volt, go to step 7).
6. Using a test light connected to battery voltage, probe MAP sensor harness ground circuit. If test light illuminates, go to step 8). if test light does not illuminate, go to step 10).
7. Check MAP sensor signal circuit for short to voltage or to 5-volt reference circuit. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 12).
8. Using DVOM, check voltage between 5-volt reference circuit and battery ground. If voltage reading is about 5 volts, go to next step. If voltage reading is not about 5 volts, go to step 15).
9. Check for plugged or leaking vacuum supply to MAP sensor. Repair as necessary. After repairs, go to step 13). If vacuum supply is okay, go to step 14).
10. Check for poor sensor ground terminal connection at PCM. Replace faulty terminal. After repairs, go to step 16). If terminal is okay, go to next step.
11. Check continuity of MAP sensor ground circuit. If resistance is greater than 5 ohms, repair open or poor

terminal connection. After repairs, go to step 16). If resistance is not greater than 5 ohms, go to next step.

12. Replace PCM. Program replacement PCM using necessary equipment. After replacing PCM, go to step 16).
13. Replace MAP sensor. After replacing MAP sensor, go to step 16).
14. Repair vacuum supply to MAP sensor. After repairs, go to step 16).
15. Repair 5-volt reference circuit for short to battery voltage. After repairs, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0108. Operate vehicle within conditions that set 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 3).
17. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM. If all MAP sensor circuits are okay, check related 5-volt reference circuits. If it is determined that DTC is intermittent, performing DTC P1106 diagnostics may isolate cause of fault.

IAT TEMPERATURE-TO-RESISTANCE VALUES

IAT TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241
158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520
50 (10)	5670

DTC P0112 - IAT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor which changes resistance based on temperature. IAT sensor is located in air intake passage of engine air induction system. IAT sensor has a signal circuit and a ground circuit. PCM applies 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 air temperature.

When intake air is cold, sensor resistance is high and when intake air is warm, sensor resistance low. When PCM senses a signal voltage lower (temperature higher) than normal operating range of sensor, DTC will set.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0117, P0118, P0125, P0500, P0502, or P0503 not set.
- Engine running for more than 30 seconds.
- Vehicle speed greater than 25 MPH.
- IAT greater than 282°F (139°C).
- Conditions met for 5.0 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor IAT display. If IAT reading is greater than 282°F (139°C), go to step 4). If IAT reading is not greater than 282°F (139°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 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 DTC P0112. 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. Disconnect IAT sensor harness connector. Note IAT sensor value displayed on scan tool. IAT sensor value should be -38°F (-39°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 PCM harness connector and check IAT signal circuit for short to ground. Repair as necessary. After repairs, go to step 8). If circuit is okay, go to step 7).
6. Replace IAT sensor. After replacing IAT sensor, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
8. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0112. Operate vehicle within conditions that set 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

If engine is allowed to sit overnight, ECT and IAT sensor values should be within a few degrees of each other. If temperatures are not within 5°F (3°C), see SYSTEM/COMPONENT TESTS article. If it is determined that DTC is intermittent, performing DTC P1112 diagnostics may isolate cause of fault.

DTC P0113 - IAT SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Intake Air Temperature (IAT) sensor is a thermistor which changes resistance based on temperature. IAT sensor is located in air intake passage of engine air induction system. IAT sensor has a signal circuit and a ground circuit. PCM applies 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 air temperature.

When intake air is cold, sensor resistance is high and when intake air is warm, sensor resistance low. When PCM senses a signal voltage higher than normal operating range of sensor, DTC will set.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0117, P0118, P0125, P0500, P0502 or P0503 not set.
- Engine coolant temperature greater than 32°F (0°C).
- Intake air temperature less than -31°F (-35°C).
- Vehicle speed less than 7 MPH.
- MAF less than 15 gm/s.
- Conditions met for 4.5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor IAT display. If IAT value is -38°F (-39°C), go to step 4). If IAT value is not as specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0113. 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. Disconnect IAT sensor harness connector. Connect a fused jumper wire across IAT sensor harness connector terminals. Note IAT sensor value displayed on scan tool. If IAT value is 284°F (140°C), go to step 9). If IAT value is not as specified, go to next step.
5. Connect jumper wire between IAT sensor signal circuit and known good ground. Note IAT sensor value displayed on scan tool. If IAT value is 284°F (140°C), go to step 8). If IAT value is not as specified, go to

next step.

6. Turn ignition off. Disconnect PCM harness connector. Check IAT signal circuit for open. Repair as necessary. After repairs, go to next step. If circuit is okay, go to step 11).
7. Repair IAT sensor signal circuit. After repairs, go to step 12).
8. Turn ignition off. Disconnect PCM harness connector. Check IAT sensor ground circuit for open. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 11).
9. Replace IAT sensor. After replacing IAT sensor, go to step 12).
10. Repair IAT sensor ground. 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 DTC P0113. Operate vehicle within conditions that set 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, diagnose affected DTC(s).

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

If engine is allowed to sit overnight, ECT and IAT sensor values should be within a few degrees of each other. If temperatures are not within 5°F (3°C), see SYSTEM/COMPONENT TESTS article.

If it is determined that DTC is intermittent, performing DTC P1111 diagnostics may isolate cause of fault.

ECT TEMPERATURE-TO-RESISTANCE VALUES

ECT TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
212 (100)	177
194 (90)	241
158 (70)	467
122 (50)	973
104 (40)	1459
86 (30)	2238
68 (20)	3520
50 (10)	5670

DTC P0117 - ECT SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor which changes resistance based on temperature. ECT sensor is located in water pump housing. ECT sensor has a signal circuit and a ground circuit. PCM applies about 5 volts on signal circuit to sensor and monitors changes in this voltage caused by changes in resistance of sensor to determine coolant temperature.

When coolant is cold, sensor resistance is high and when coolant is warm, sensor resistance low. When PCM senses a signal voltage lower than normal operating range of sensor, DTC will set.

DTC will set when following conditions are present:

- Engine operating for greater than or 10 seconds.
- Engine coolant temperature greater than 282°F (139°C).
- Conditions met for 20 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor ECT display. If ECT value is greater 282°F (139°C), go to step 4). If ECT value is not as specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0117. 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. Disconnect ECT sensor harness connector. Observe ECT display on scan tool. If ECT value is less than -22°F (-30°C), go to step 6). If ECT value is not less than specified, go to next step.
5. Turn ignition off. Disconnect PCM harness connector and check ECT sensor signal circuit for short to ground. Repair as necessary. After repairs, go to step 8). if circuit is okay, go to step 7).
6. Replace ECT sensor. After replacing ECT sensor, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
8. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0117. Operate vehicle within conditions that set 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).

9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

If engine is allowed to sit overnight, ECT and IAT sensor values should be within a few degrees of each other. If temperatures are not within 5°F (3°C), see SYSTEM/COMPONENT TESTS article.

If it is determined that DTC is intermittent, performing DTC P1114 diagnostics may isolate cause of fault.

DTC P0118 - ECT SENSOR CIRCUIT VOLTAGE HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor which changes resistance based on temperature. ECT sensor is located in water pump housing. ECT sensor uses a signal circuit and a ground circuit. PCM applies voltage (about 5 volts) on signal circuit to sensor and monitors changes in this voltage caused by changes in resistance of sensor to determine coolant temperature.

When coolant is cold, sensor resistance is high and when coolant is warm, sensor resistance is low. When PCM senses a signal voltage higher than normal operating range of sensor, DTC will set.

Conditions for setting DTC:

- Engine operating for greater than 60 seconds.
- Engine coolant temperature less than -38°F (-39°C).
- Conditions met for 20 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor ECT display. If ECT value is -38°F (-39°C), go to step 4). If ECT value is not as specified, 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, and as close to conditions recorded in

FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0118. If scan tool indicates this test failed this ignition, go to next step. If scan tool does not indicate this test failed this ignition, see DIAGNOSTIC AIDS.

4. Disconnect ECT sensor harness connector. Observe ECT display on scan tool. If ECT value is 284°F (140°C), go to step 9). If ECT value is not as specified, go to next step.
5. Connect a fused jumper wire between ECT signal circuit and ground. If ECT value is 284°F (140°C), go to step 8). If ECT value is not as specified, go to next step.
6. Turn ignition off. Disconnect PCM harness connector and check ECT sensor signal circuit for open. Repair as necessary. After repairs, go to step 7). if circuit is okay, go to step 11).
7. Repair ECT sensor signal circuit. After repairs, got step 12).
8. Turn ignition off. Disconnect PCM harness connector. Check ECT sensor ground circuit for open. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 11).
9. Replace ECT sensor. After replacing ECT sensor, go to step 12).
10. Repair ECT sensor ground circuit. 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 DTC P0118. Operate vehicle within conditions that set 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, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

If engine is allowed to sit overnight, ECT and IAT sensor values should be within a few degrees of each other. If temperatures are not within 5°F (3°C), see SYSTEM/COMPONENT TESTS article.

If it is determined that DTC is intermittent, performing DTC P1115 diagnostics may isolate cause of fault.

DTC P0125 - ECT EXCESSIVE TIME TO REACH CLOSED LOOP

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

While engine is warming, PCM monitors Engine Coolant Temperature (ECT) sensor to determine how long it takes engine to reach coolant temperature required for closed loop operation. DTC will set if PCM determines that engine is not reaching closed loop temperature in a specified amount of time. Test will not run if either intake air or engine coolant temperature is too low at start up. PCM will only run this DTC on a cold start and

only once per cold start cycle.

DTC will set when following conditions are present:

- DTCs P0112, P0113, P0117 or P0118 not set.
- Engine is operating.
- Engine coolant temperature at start-up is 50-104°F (10-40°C).
- Intake air temperature greater than 19°F (-7°C).
- Vehicle speed is greater than one MPH.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If other ECT related DTCs are present, diagnose affected DTC(s). If no other related DTCs are present, go to next step.
3. Install scan tool. Turn ignition on, with engine off. Disconnect ECT sensor connector. If scan tool reads less than -31°F (-35°C), go to step 4). If scan tool does not read less than -31°F (-35°C), go to DTC P0117 test.
4. Connect a fused jumper wire across ECT sensor harness terminals. If scan tool indicates that ECT is greater than 282°F (139°C), go to next step. If scan tool indicates that ECT is not greater than 282°F (139°C), go to DTC P0118 test.
5. Reconnect ECT sensor connector. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and observe ECT sensor, with engine at idle. If coolant temperature reading is at least 93°F (34°C), recheck system on a cold start. See DIAGNOSTIC AIDS. If coolant temperature is not as specified, go to next step.
6. Using DVOM, check ECT sensor resistance. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** table. If ECT resistance value is close to value as indicated, go to next step. If ECT resistance value is not as specified, go to step 8).
7. For cooling system problem, check thermostat operation, coolant level, coolant-to-water ratio, cooling fan operation, etc. After repairs, go to step 9).
8. Replace ECT sensor. After replacing ECT sensor, go to next step.
9. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0125. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS can be useful in determining how many miles since DTC set. It can also be used to determine how many ignition cycles

diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed. If other DTCs are set, DTCs that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring.

If engine is allowed to sit overnight, ECT and IAT values should display within a degrees of each other. If temperature is not within 5°F (3°C), check for faulty ECT or IAT sensor.

If it is determined that DTC is intermittent, performing DTC P1114 or P1115 diagnostic may isolate cause of fault.

If ECT is greater 93°F (34°C), this indicates that engine is capable of reaching proper temperature, but not necessarily in correct amount of time. This test must be repeated on a cold engine, engine coolant and intake air temperature at less than 122°F (50°C) and within 5°F (3°C) of each other. When starting a cold engine, engine should reach specified temperature within 7 minutes. If specified temperature is not reached within specified time, check coolant level, thermostat operation or if cooling fans are operating at all times.

DTC P0131 - HO2S CIRCUIT VOLTAGE LOW BANK 1, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies 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 10 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 PCM detects HO2S voltage is less than predetermined voltage, DTC will set.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- AIR, EGR and catalyst diagnostics not active.
- Engine coolant temperature greater than 118 °F (48°C).
- Ignition voltage greater than 9 volts
- Fuel system operating in "closed loop".
- Fuel trim enabled.
- Air fuel ratio is 14.5:1-14.7:1.
- TP angle 3-20 percent.
- HO2S signal voltage stays less than 200 mV for 33 seconds.
- HO2S signal voltage stays less than 360 mV for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next

step.

2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage, with engine at idle. If HO2S voltage is less than 200 mV, go to step 4). If HO2S voltage is not less than 200 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 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 DTC P0131. 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. Disconnect HO2S connector. Connect a fused jumper wire between PCM connector (harness side), HO2S low circuit and ground. If sensor voltage is 350-550 mV, see DIAGNOSTIC AIDS. If sensor voltage is not 350-550 mV, go to next step.
5. Turn ignition off. Disconnect PCM harness connector. Check HO2S signal circuit for short to ground or short to sensor ground circuit. Repair circuit as necessary. After repairs, go to next step. If circuit(s) are okay, go to step 7).
6. Repair HO2S signal circuit. After repairs, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
8. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0131. 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for HO2S pigtail wire for breaks, contamination or grounding on exhaust manifold. Check for intermittent ground in signal wire between sensor connector and sensor.

Check for lean injector(s). Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for fuel contamination, improper fuel pressure or exhaust leak, especially near HO2S. Check for vacuum or crankcase leak, causing a lean condition.

DTC P0132 - HO2S CIRCUIT VOLTAGE HIGH BANK 1, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies 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 10 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 PCM detects HO2S voltage is greater than predetermined voltage, DTC will set.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358, P0410, P0412, P0418, P0420, P0430, P1258, P1415 or P1416 not set.
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- Fuel trim enabled.
- Air fuel ratio is 14.5:1-14.7:1.
- AIR, EGR and catalyst diagnostics not active.
- Deceleration fuel cut-off modes is enabled for greater than one second.
- HO2S signal voltage stays greater than 775 mV for 33 seconds or greater than 540 mV for 50 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage, with engine speed at about 1200 RPM. If HO2S voltage is more than 775 mV, go to step 4). If HO2S reading is less than specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, SPECIFIC, and then P0132. 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. While monitoring HO2S voltage, remove HO2S heater fuse. If HO2S voltage drops to within a range of 350-550 mV with power to heater disconnected, go to next step. If voltage does not drop to within specified range, go to step 7).
5. Disconnect HO2S connector. Connect a fused jumper wire between ground and HO2S connector (PCM side), low signal circuit. If reading is 350-550 mV, go to step 10). If reading is not as specified, go to next step.
6. Turn ignition on, with engine off. While monitoring HO2S voltage, remove HO2S heater fuse. If HO2S voltage drops to within a range of 350-550 mV with power to heater disconnected, go to step 9). If voltage does not drop to within specified range, go to step 8).
7. Turn ignition off. Disconnect PCM harness connector. Disconnect HO2S connector. Turn ignition on. Using DVOM, check voltage between ground and sensor signal circuit at PCM connector. If voltage is present, go to next step. If voltage is not present, see DIAGNOSTIC AIDS.
8. Repair short to voltage in HO2S signal circuit. After repairs are complete, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery positive circuit. After repairs, go to next step. If circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature.

Select DTC, SPECIFIC, then enter DTC P0132. 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check if fuel pressure is too high. PCM can compensate for some increase; however, if fuel pressure is too high, DTC will set. Check for leaking injector(s) or faulty fuel pressure regulator. See SYSTEM/COMPONENT TESTS article.

Check EVAP system for fuel saturation. Check MAF sensor. Disconnect MAF connector and see if rich condition is corrected. If rich condition is corrected, check for incorrectly installed MAF sensor or faulty MAF sensor. Check HO2S wires for breaks or contamination. Check TP sensor. See SYSTEM/COMPONENT TESTS article.

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

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies 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 the voltage samples to determine amount of time sensor voltage is out of range. If PCM detects HO2S voltage is greater than predetermined voltage, DTC will set.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage, with engine speed at about 1200 RPM. If HO2S voltage is greater than 774 mV, go to step 4). If HO2S reading is less than specified, 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 the 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 DTC P0132. If scan tool indicates that this test failed this ignition, go to next step. If scan tool did not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
4. Remove HO2S heater fuse, while monitoring HO2S voltage. If voltage drops within 375-525 mV range, go to next step. If voltage does not drop to within 375-525 mV, go to step 7).
5. Reinstall fuse. Disconnect HO2S harness connector. Install jumper wire between ground and low signal circuit on PCM side of harness connector. If voltage reading is 375-525 mV, go to step 10). If voltage reading is not 375-525 mV, go to next step.

6. Remove HO2S heater fuse. Observe HO2S voltage. If voltage drops to within 375-525 mV range, go to step 9). If voltage does not drop to within 375-525 mV, go to step 8).
7. Turn ignition off. Disconnect HO2S signal circuit connector from PCM. Disconnect HO2S harness connector. Turn ignition on. Using DVOM, check voltage on sensor signal circuit at PCM harness connector. If any voltage reading is present, go to next step. If voltage reading is not present, see DIAGNOSTIC AIDS.
8. Repair short to voltage in HO2S signal circuit. After repairs, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery positive circuit. After repairs, go to next step. If circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0132. Operate vehicle within the 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check if fuel pressure is too high. PCM can compensate for some increase; however, if fuel pressure is too high, DTC will set. Check for leaking injector(s) or faulty fuel pressure regulator. See SYSTEM/COMPONENT TESTS article.

Check EVAP system for fuel saturation. Check MAF sensor. Disconnect MAF harness connector and see if rich condition is corrected. If rich condition is corrected, check for incorrectly installed MAF sensor or faulty MAF sensor. Check HO2S wires for breaks or contamination. Check TP sensor. See SYSTEM/COMPONENT TESTS article.

DTC P0133 - HO2S SLOW RESPONSE BANK 1, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. With this information, an average time for all transitions can be determined. If average response time is too slow, DTC will set.

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 greater than 600 mV to less than 300 mV. A sensor that responds too slowly is most likely defective and should be replaced.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221, or P1258 not set.
- Engine coolant greater than 149°F (65°C).
- Ignition voltage greater than 9 volts.
- AIR, EGR and catalyst diagnostics not active.
- Fuel system operating in closed loop.
- Engine speed at 1000-2300 RPM.
- Engine airflow 15-35 gm/s.
- EVAP canister purge duty cycle greater than zero percent.
- Engine operating time greater 120 seconds.
- Lean-to-rich (less than 300 mV to greater than 600 mV) response average time is greater than 100 milliseconds.
- Rich-to-lean (greater than 600 mV to less than 300 mV) response average time is greater than 100 milliseconds.
- Conditions met for 100 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTC(s) are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and operate vehicle within parameters when DTC was set. Using scan tool, select DTC INFO and monitor FAIL THIS IGN data. If scan tool indicates that DTC P0133 test failed, go to next step. If scan tool does not indicate that DTC P0133 test failed, see DIAGNOSTIC AIDS.
3. If scan tool also indicates that P0153 test failed, go to step 8). If scan tool does not indicate that P0153 test failed, go to next step.
4. Check exhaust system for leaks. Repair as necessary. After repairs, repeat step 2). If exhaust is okay, go to next step.
5. Ensure Bank 1 HO2S 1 is securely installed. Check terminals for corrosion or damaged wiring. Repair as necessary. After repairs, go to step 9). If wiring and terminals are okay, go to next step.
6. Disconnect Bank 1 HO2S 1. Connect a fused Jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is 350-550 mV, go to next step. If HO2S voltage is not as specified, go to step 10).
7. Connect a fused jumper wire between ground and PCM connector (PCM side), Bank 1 HO2S 1 high and low signal circuit. Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is not less than 200 mV, go to step 11).
8. Replace HO2S. Determine cause of sensor contamination, otherwise new sensor will be damaged. After replacing HO2S, go to step 13).

9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor low signal circuit or grounded high signal circuit. After repairs, go to step 13).
11. Repair open in sensor high signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 1 HO2S 1 sensor. After replacing HO2S, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0133. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P0134 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies 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 10 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 PCM detects HO2S voltage is out of the bias range, DTC will set.

DTC will set when following conditions are present:

- DTCs P0100, P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage greater than 9 volts.
- AIR, EGR and catalyst diagnostics are not active.
- Engine running for greater than 70 seconds.
- Fuel system in closed loop.
- Engine coolant temperature greater than 118°F (48°C).
- HO2S voltage steady 350-550 mV.

- Conditions present for 60 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Increase engine speed to greater than 1200 RPM for 2 minutes. Using scan tool, select ENGINE 1 DATA LIST and monitor Bank 1 HO2S 1 voltage. If voltage is varying outside range of 350-550 mV, go to next step. If voltage is not varying as specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0134. 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 on, with engine off. Disconnect Bank 1 HO2S 1 connector. Connect a fused jumper wire between ground and PCM connector (PCM side), high and low signal circuits. If voltage is less than 200 mV, go to step 8). If voltage is not less than 200 mV, go to next step.
5. Remove jumper wire. Using DVOM, check voltage between HO2S sensor high and heater ground circuit, on PCM harness side. If voltage is greater than 375 mV, go to next step. If measured voltage is not greater than 375 mV, go to step 7).
6. Turn ignition off. Disconnect PCM harness connector. Check resistance of Bank 1 HO2S 1 low circuit. If measured resistance is greater than 2 ohms, go to step 13). If resistance is not greater than 2 ohms, go to step 9).
7. Turn ignition off. Disconnect PCM harness connector. Check continuity of Bank 1 HO2S 1 signal circuit. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).
8. Check for poor low circuit signal terminal connection at Bank 1 HO2S 1 connector. Repair or replace terminal as necessary. After repairs, go to step 13). If terminals are okay, go to step 11).
9. Check for poor low signal terminal connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
10. Check for poor signal circuit terminal connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
11. Replace Bank 1 HO2S 1 sensor. After replacing HO2S sensor, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0134. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

DTC P0135 - HO2S HEATER CIRCUIT BANK 1, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S signal high and low circuits. When ignition is turned on, battery voltage is supplied to HO2S heater. As heater reaches operating temperature, HO2S voltage responds by changing from a bias voltage range to normal operation (less than 300 mV). Depending on exhaust gas content, it is possible for HO2S voltage to increase to more than 450 mV.

PCM will run heater test only on a cold start and once during ignition cycle. When engine is started, PCM will determine how much time it takes HO2S voltage to go from above or below bias range threshold. If PCM detects that it took too much time to enter into normal operating range, DTC will set. The time it takes HO2S to reach operating temperature is based on amount of air that flows into engine.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- IAT and ECT are less than 122°F (50°C) and are within 14.5°F (8°C) of each other at start-up.
- Ignition voltage is 10-16 volts.
- AIR, EGR and catalyst diagnostics not active.
- Engine airflow less than 23 gm/s.
- TP sensor angle less than 20 percent.
- HO2S voltage stays 300-700 mV for a predetermined amount of time.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2. Turn ignition off. Turn ignition, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage goes from bias voltage to greater than 700 mV or less than 300 mV, see DIAGNOSTIC AIDS. If HO2S voltage does not respond as indicated, go to next step.
3. Check HO2S ignition feed fuse. If fuse is faulty, go to step 11). If fuse is okay, go to next step.
4. Raise and support vehicle. Disconnect HO2S connector. Connect test light to chassis ground and probe ignition feed circuit at HO2S connector. If test light illuminates, go to next step. If test light does not

illuminate, go to step 7).

5. Connect test light between ignition feed and heater ground at HO2S connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6. Using DVOM, check resistance between ignition feed and heater ground at HO2S connector. If resistance is 3.5-14.0 ohms, go to step 9). If resistance is not as specified, go to step 10).
7. Repair open in HO2S ignition feed circuit. After repairs, go to step 12).
8. Repair open in HO2S heater ground circuit. After repairs, go to step 12).
9. Check for poor terminal connection at HO2S connector. Repair or replace terminals. After repairs, go to step 12).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Locate and repair short to ground in HO2S ignition feed circuit and replace fuse. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0135. 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent condition. If DTC cannot be duplicated, information included in this data can be useful in determining how many miles since DTC has set.

The FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed.

The heater diagnostic will only run on a cold start and only once per ignition cycle. Oxygen supply inside HO2S is necessary for proper operation and is provided through HO2S wires. Check all HO2S wires and connections for breaks or contamination.

DTC P0137 - HO2S CIRCUIT VOLTAGE LOW BANK 1, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 millivolts) on HO2S high and low signal circuits. Oxygen sensor voltage ranges from 10 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare stored HO2S voltage samples taken each sample period and determine if majority of samples are out of operating range. If PCM detects that voltage is less than a predetermined voltage,

DTC will set.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Engine coolant temperature greater than 118 °F (48°C).
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- Fuel trim enabled.
- Air fuel ratio at 14.5:1-14.7:1.
- TP angle 3-20 percent.
- Power enrichment mode enabled for greater than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Operate vehicle within parameters specified under conditions for running DTC. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is fixed at less than 40 mV, go to step 4). If voltage is not as specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0137. 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. Disconnect HO2S connector. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low circuit ground. If HO2S voltage is 350-550 mV, see DIAGNOSTIC AIDS. If voltage is not as specified, go to next step.
5. Turn ignition off. Disconnect PCM harness connector. Check HO2S circuit for short to ground or short to sensor ground circuit. Repair as necessary. After repairs, go to next step. If circuit is okay, go to step 7).
6. Repair HO2S signal circuit. After repairs, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
8. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Then, select DTC, SPECIFIC and then enter DTC P0137. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If test does not run, or failed, repeat step 2).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

Check HO2S wires grounding against exhaust manifold. Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

Check for lean fuel injector(s) or low fuel pressure. Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for fuel contamination. Water can cause a lean condition and can set a DTC. Check for exhaust leaks near HO2S, vacuum or crankcase leaks that can cause a lean condition. Check for faulty HO2S.

DTC P0138 - HO2S CIRCUIT VOLTAGE HIGH BANK 1, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S high and low signal circuits. Oxygen sensor voltage ranges from 10 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare stored HO2S voltage samples taken each sample period and determine if majority of samples are fixed at greater than operating range. If PCM detects that voltage is greater than a predetermined voltage, DTC will set.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- Fuel trim enabled.
- AIR, EGR and catalyst diagnostics not active.
- Fuel trim learn enabled.
- Air fuel ratio 14.5:1-14.7:1.
- TP angle 0-100 percent.
- Deceleration fuel cut-off mode enabled for greater than 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Increase engine speed to about 1200 RPM. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S display. If voltage is more than 930 mV, go to step 4). If voltage is 930 mV 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0138. 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. While monitoring HO2S voltage, remove HO2S heater fuse. If HO2S voltage drops to within a range of 350-550 mV with power to heater disconnected, go to next step. If voltage does not drop to within specified range, go to step 7).
5. Disconnect HO2S harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal (PCM side) circuit. If reading is 350-550 mV, see DIAGNOSTIC AIDS. If reading is not as specified, go to next step.
6. While monitoring HO2S voltage, remove HO2S heater fuse. If HO2S voltage drops to within a range of 350-550 mV with power to heater disconnected, go to step 9). If voltage does not drop to within specified range, go to step 8).
7. Turn ignition off. Disconnect PCM connector for HO2S signal circuit wire. Disconnect HO2S harness connector. Turn ignition on. Using DVOM, check voltage between ground and sensor signal circuit at PCM connector. If voltage is present, go to next step. If voltage is not present, see DIAGNOSTIC AIDS.
8. Repair short to voltage in HO2S signal circuit. After necessary repairs, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery voltage circuit. After repairs, go to next step. If circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0138. 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check HO2S wires grounding against exhaust manifold. Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

Check for rich fuel injector(s) or fuel pressure being too high. Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for saturated EVAP canister or incorrectly installed MAF sensor. Disconnect MAF sensor and observe if rich condition is corrected. Check for leaking fuel pressure regulator or leaking regulator vacuum hose. Check TP sensor. An intermittent TP sensor output will cause system to go rich.

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

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 millivolts) on the HO2S high and low signal circuits. Oxygen sensor voltage ranges from 10 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates the voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare the stored HO2S voltage samples taken each sample period and determine if majority of the samples are fixed above the operating range. If PCM detects that voltage is greater than a predetermined voltage, DTC will set.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Warm engine to normal operating temperature. Raise engine speed to about 1200 RPM. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S display. If voltage is greater than 930 mV, go to step 4). If voltage is 930 mV 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 the 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 DTC which was set. If scan tool indicates that this test failed this ignition, go to next step. If scan tool did not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
4. Remove HO2S fuse. Monitor HO2S voltage. If voltage is 375-525 mV, go to next step. If voltage is not as specified, go to step 7).
5. Reinstall fuse. Disconnect HO2S harness connector. On PCM side of harness connector, jumper HO2S low signal circuit to ground. If voltage is 375-525 mV, go to step 10). If voltage is not as specified, go to next step.
6. With jumper wire still connected, remove HO2S fuse. Monitor HO2S voltage on scan tool. If HO2S voltage reading is within 375-525 mV, go to step 9). If voltage reading is not within 375-525 mV, go to step 8).
7. Turn ignition off. Disconnect HO2S signal circuit at PCM connector. Disconnect HO2S harness connector. Turn ignition on. Using DVOM, check voltage on HO2S sensor signal circuit at PCM harness connector. If voltage is present, go to step 8). If voltage is not present, see DIAGNOSTIC AIDS.
8. Repair short to ground in HO2S signal circuit. After repairs, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery supply circuit. After repairs, go to next step. If repair was not necessary or if circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, 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. Start and warm engine to normal operating temperature. Then, select DTC, SPECIFIC and then enter DTC P0138. Operate vehicle within the conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If test did not run or failed, repeat step 2).
13. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other undiagnosed DTC(s) are

displayed, diagnose affected DTC(s).

Diagnostic Aids

Check HO2S wires grounding against exhaust manifold. Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through the HO2S wires. Inspect all wires and terminals for breaks or contamination.

Check for rich fuel injector(s) or too high fuel pressure. Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for saturated EVAP canister or incorrectly installed MAF sensor. Disconnect MAF sensor and observe if rich condition is corrected. Check for leaking fuel pressure regulator or leaking regulator vacuum hose. Check TP sensor. An intermittent TP sensor output will cause system to go rich.

DTC P0140 - HO2S INSUFFICIENT ACTIVITY BANK 1, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S high and low signal circuits. Oxygen sensor voltage ranges from 100 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare stored HO2S voltage samples taken each sample period and determine if majority of samples are out of operating range. If PCM does not detect that voltage went out of bias range, DTC will set.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Engine running greater than 70 seconds.
- Fuel system operating in closed loop.
- AIR, EGR and catalyst diagnostics not active.
- Engine coolant greater than 118°F (48°C).
- HO2S voltage steady at 409-489 mV for 2.5 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine 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 bank 1 HO2S 2 voltage. If voltage is varying outside of 409-489 mV range, go to next step. If voltage is not varying outside of 409-489 mV range, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0140. 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 on, with engine off. Disconnect Bank 1 HO2S 2 harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side) high and low signal circuits. If voltage is less than 200 mV, go to step 8). If voltage is not less than 200 mV, go to next step.
5. Remove jumper wire. Using DVOM, check voltage between HO2S sensor high signal circuit and ground circuit. If voltage is greater than 375 mV, go to next step. If measured voltage is not greater than 375 mV, go to step 7).
6. Turn ignition off. Disconnect PCM harness connector. Check resistance of Bank 1 HO2S 2 low circuit. If resistance is more than 2 ohms, repair open or poor connection as necessary. After repairs, go to step 13). If circuit is okay, go to step 9).
7. Turn ignition off. Disconnect PCM harness connector. Check resistance of Bank 1 HO2S 2 signal circuit. If resistance is greater than 2 ohms, repair open or poor connection as necessary. After repairs, go to step 13). If circuit is okay, go to step 10).
8. Check for poor Bank 1 HO2S 2 signal or low circuit terminal connection at HO2S harness connector. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 11).
9. Check for poor Bank 1 HO2S 2 low circuit terminal connection at PCM and replace terminals if necessary. After repairs or replacing terminals, go to step 13). If terminals are okay, go to step 12).
10. Check for poor Bank 1 HO2S 2 signal circuit terminal connection at PCM and replace terminals if necessary. After repairs or replacing terminals, go to step 13). If terminals are okay, go to step 12).
11. Replace Bank 1 HO2S 2. After replacing HO2S, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After repairs, go to next step.
13. Clear DTC(s) using scan tool. Start and warm engine to normal operating temperature. Using scan tool, select DTC, SPECIFIC, then enter DTC P0140. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If test does not run or failed, repeat step 2).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other DTCs are displayed that have not been diagnosed, go to appropriate DTC.

Diagnostic Aids

Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

DTC P0141 - HO2S HEATER CIRCUIT BANK 1, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S high and low signal circuits. When ignition is turned on, battery voltage is supplied to HO2S heater. As heater reaches operating temperature, HO2S voltage responds by changing from bias voltage range to normal operation (less than 300 mV). Depending on exhaust gas content, it is possible for HO2S voltage to be greater than 450 mV.

PCM will only run heater test only on a cold start, depending on cumulative airflow, and only once an ignition cycle. When engine is started, PCM will monitor HO2S voltage. When HO2S goes more than or less than bias range threshold, PCM will determine how much time it took. If PCM detects that it took too much time for HO2S to enter into normal operating range, DTC will set. The time it takes HO2S to reach operating temperature is based on amount of air that flows into engine.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage is 10-16 volts.
- ECT and IAT are less than 122°F (50°C) and within 145°F (8°C) of each other at start-up.
- Engine airflow less than 30 gm/s.
- AIR, EGR and catalyst diagnostics not active.
- Engine coolant temperature greater than 118°F (48°C).
- HO2S voltage stays between 300-700 mV for a predetermined amount of time.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If engine has been operating, allow engine to cool down for at least one hour before proceeding with test. Turn engine off. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S goes from bias voltage to less than 300 mV or greater than 700 mV, see DIAGNOSTIC AIDS. If HO2S does not go to bias voltage or less than 300 mV or greater than 700 mV, go to next step.
3. Check HO2S ignition feed fuse. If fuse is faulty, go to step 11). If fuse is okay, go to next step.
4. Raise and support vehicle. Disconnect HO2S harness connector. Connect a test light to chassis ground. Probe ignition feed circuit at HO2S harness connector at PCM side. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
5. Connect test light to HO2S ignition feed and HO2S heater ground circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6. Using DVOM, check resistance between HO2S ignition feed and heater ground at HO2S harness connector. Resistance should be 3.5-14.0 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to step 10).
7. Repair open in HO2S ignition feed circuit to HO2S. After repairs, go to step 12).
8. Repair open in HO2S heater ground circuit. After repairs, go to step 12).
9. Check for poor HO2S harness terminals and replace as necessary. After replacing terminals, go to step

12). If HO2S harness terminals are okay, go to next step.

10. Replace HO2S. After replacing sensor, go to step 12).
11. Locate and repair short to ground in HO2S feed circuit and replace fuse. After repairs, 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 DTC P0141. Operate vehicle within conditions that set 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, diagnose affected DTC(s).

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent condition. If DTC cannot be duplicated, information included in this data can be useful in determining how many miles since DTC has set.

The FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed.

The heater diagnostic will only run on a cold start and only once per ignition cycle. Oxygen supply inside HO2S is necessary for proper operation and is provided through HO2S wires. Check all HO2S wires and connections for breaks or contamination.

DTC P0151 - HO2S CIRCUIT VOLTAGE LOW BANK 2, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies about 450 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 monitors and stores sensor voltage information and evaluates voltage samples to determine amount of time sensor voltage is out of range. If PCM detects HO2S voltage is less than predetermined voltage, DTC will set.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Engine coolant temperature greater than 118 °F (48°C).
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- AIR, EGR and catalyst diagnostics not active.
- Fuel trim enabled.

- Air fuel ratio 14.5:1-14.7:1.
- TP angle 3-20 percent.
- HO2S signal voltage stays less than 200 mV for 33 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage, with engine at idle. If HO2S voltage is less than 200 mV, go to step 4). If HO2S voltage is not less than 200 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 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 DTC P0151. 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. Disconnect HO2S harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low circuit. If sensor voltage is within specified value of 350-550 mV, see DIAGNOSTIC AIDS. If sensor voltage is not within specified value, go to next step.
5. Turn ignition off. Disconnect PCM harness connector. Check HO2S signal circuit for short to ground or short to sensor ground circuit. Repair circuit as necessary. After repairs, go to next step. If circuit(s) are okay, go to step 7).
6. Repair HO2S signal circuit. After repairs, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
8. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0151. 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for oxygen sensor pigtail wire for breaks, contamination or grounding on exhaust manifold. Check for intermittent ground in signal wire between sensor connector and sensor.

Check for lean injector(s). Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for fuel contamination, improper fuel pressure or exhaust leak, especially near oxygen sensor. Check for vacuum or crankcase leak, causing a lean condition.

DTC P0152 - HO2S CIRCUIT VOLTAGE HIGH BANK 2, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies about 450 mV between HO2S signal and ground circuits. HO2S voltage ranges from about 1000 mV when exhaust is rich to about 10 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 PCM detects HO2S voltage is more than predetermined voltage, DTC will set.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- Fuel trim enabled.
- Air fuel ratio 14.5:1-14.7:1.
- AIR, EGR and catalyst diagnostics not active.
- Deceleration fuel cut-off mode enabled for greater than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage, with engine speed at greater than 1200 RPM. If HO2S voltage is greater than 775 mV, go to step 4). If HO2S voltage is not greater 775 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 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 DTC P0152. 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. Remove HO2S heater fuse, while monitoring HO2S voltage. If voltage is within range of 350-550 mV, go to next step. If voltage is not within range of 350-550 mV, go to step 7).
5. Reinstall fuse. Disconnect HO2S harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side) HO2S low signal circuit. If voltage is within range of 350-550 mV, go to step 10). If voltage is not within range of 350-550 mV, go to next step.
6. Remove HO2S heater fuse. Observe HO2S voltage. If voltage is within range of 350-550 mV, go to step 9). If voltage is not within range of 350-550 mV, go to step 8).
7. Turn ignition off. Disconnect HO2S signal circuit connector from PCM. Disconnect HO2S harness connector. Turn ignition on. Using DVOM, check voltage on sensor signal circuit at PCM harness connector. If any voltage is present, go to next step. If voltage is not present, see DIAGNOSTIC AIDS.

8. Repair short to voltage in HO2S signal circuit. After repairs, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery voltage circuit. After repairs, go to next step. If circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, 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. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0152. 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.

Diagnostic Aids

Check if fuel pressure is too high. PCM can compensate for some increase; however, if fuel pressure is too high, DTC will set. Check for leaking injector(s) or faulty fuel pressure regulator. See SYSTEM/COMPONENT TESTS article.

Check EVAP system for fuel saturation. Check MAF sensor. Disconnect MAF harness connector and see if rich condition is corrected. If rich condition is corrected, check for incorrectly installed MAF sensor or faulty MAF sensor. Check HO2S wires for breaks or contamination. Check TP sensor. See SYSTEM/COMPONENT TESTS article.

DTC P0153 - HO2S SLOW RESPONSE BANK 2 SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. With this information, an average time for all transitions can be determined. If average response time is too slow, DTC will set.

A lean to rich transition is determined when HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich to lean transition is determined when HO2S voltage changes from greater than 600 mV to less than 300 mV. A sensor that responds too slowly is most likely defective and should be replaced.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Engine coolant temperature greater than 149°F (65°C).
- Ignition voltage greater than 9 volts.

- AIR, EGR and catalyst diagnostics not active.
- Fuel system operating in closed loop.
- Engine speed 1000-2300 RPM.
- Engine airflow 15-35 gm/s.
- EVAP canister purge duty cycle greater than zero percent.
- Engine operating for greater than 120 seconds.
- Lean-to-rich (less than 300 mV to greater than 600 mV) response average time is greater than 110 milliseconds.
- Rich-to-lean (greater than 600 mV to less than 300 mV) response average time is greater than 100 milliseconds.
- Conditions met for 100 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

NOTE: If other DTCs are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, select ENGINE 1 DATA LIST and operate vehicle within parameters when DTC was set. Using scan tool, select DTC INFO and monitor FAIL THIS IGN data. If scan tool indicates that DTC P0153 test failed, go to next step. If scan tool does not indicate that this test failed, see DIAGNOSTIC AIDS.
3. If scan tool also indicates that DTC P0133 test failed, go to step 8). If scan tool does not indicate that DTC P0133 test failed, go to next step.
4. Check exhaust system for leaks. Repair as necessary. After repairs, repeat step 2). If exhaust is okay, go to next step.
5. Ensure Bank 2 HO2S 1 is securely installed. Check corroded terminals or damaged wiring. Repair as necessary. After repairs, go to step 9). If wiring and terminals are okay, go to next step.
6. Disconnect Bank 2 HO2S 1. Connect a fused jumper wire between ground and PCM connector (PCM side), low signal ground circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is 350-550 mV, go to next step. If HO2S voltage is not 350-550 mV, go to step 10).
7. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S 1 high and low signal circuits. Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is not less than 200 mV, go to step 11).
8. Replace oxygen sensor. Determine cause of sensor contamination, otherwise new sensor will be damaged. After replacing oxygen sensor, go to step 13).
9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor ground circuit or grounded sensor signal circuit. After repairs, go to step 13).
11. Repair open in sensor signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 2 HO2S 1 sensor. After replacing oxygen sensor, go to next step.

13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0153. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through HO2S wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P0154 - HO2S INSUFFICIENT ACTIVITY BANK 2, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies about 450 mV between HO2S signal and ground circuits. HO2S voltage ranges from about 1000 mV when exhaust is rich to about 10 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 PCM detects HO2S voltage does not go out of bias range, DTC will set.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221 or P1258 not set.
- AIR, EGR and catalyst diagnostics not active.
- System operating in closed loop.
- Ignition voltage greater than 9 volts.
- Engine running for greater than 60 seconds.
- HO2S signal voltage steady 350-550 mV.
- Conditions present for 60 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

2. Start and warm engine 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 Bank 2 HO2S 1 voltage. If voltage is varying outside a range of 350-550 mV, go to next step. If voltage is not varying outside range of 350-550 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 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 DTC P0154. 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 on, with engine off. Disconnect Bank 2 HO2S 1 harness connector. connect a fuse jumper wire between ground and PCM connector ((PCM side), HO2S high and low signal circuits. If voltage is less than 200 mV, go to step 8). If voltage is not less than 200 mV, go to next step.
5. Remove jumper wire. Using DVOM, check voltage between sensor high and heater ground circuit on PCM harness side. If voltage is more than 375 mV, go to next step. If voltage is as specified, go to step 7).
6. Turn ignition off. Disconnect PCM harness connector. Check continuity of Bank 2 HO2S 1 low circuit. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to step 9).
7. Turn ignition off. Disconnect PCM harness connector. Check resistance of Bank 2 HO2S 1 signal circuit. If resistance is more than 2 ohms, repair as necessary. After repairs, go to step 13). If circuit is 2 ohms or less, go to step 10).
8. Check for poor sensor ground circuit terminal connection at Bank 2 HO2S 1 harness connector. Repair or replace terminal as necessary. After repairs, go to step 13). If terminals are okay, go to step 11).
9. Check for poor sensor ground terminal connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
10. Check for poor signal circuit terminal connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
11. Replace Bank 1 HO2S 1 sensor. After replacing oxygen sensor, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0154. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

DTC P0155 - HO2S HEATER CIRCUIT BANK 2, SENSOR NO. 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S signal and ground circuits. When ignition is turned on, battery voltage is supplied to HO2S heater. As heater reaches operating temperature, HO2S voltage responds by changing from a bias voltage range to normal operation (less than 300 mV). Depending on exhaust gas content, it is possible for HO2S voltage to increase to greater than 450 mV.

PCM will run heater test only on a cold start and once during ignition cycle. When engine is started, PCM will determine how much time it takes HO2S voltage to go from above or below bias range threshold. If PCM detects that it took too much time to enter into normal operating range, DTC will set. time it takes HO2S to reach operating temperature is based on amount of air that flows into engine.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage is 10-16 volts.
- ECT and IAT temperature are less than 122°F (50°C) and within 5°F (3°C) of each other at start-up.
- AIR, EGR and catalyst diagnostics not active.
- HO2S voltage stays between 300-700 mV for a predetermined amount of time.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If engine has been operating, allow engine to cool for about one hour before proceeding with tests.

2. Turn ignition off. Turn ignition, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage goes from bias voltage to greater than 700 mV or less than 300 mV, see DIAGNOSTIC AIDS. If HO2S voltage remains within 300-700 mV range, go to next step.
3. Check HO2S ignition feed fuse. If fuse is faulty, go to step 11). If fuse is okay, go to next step.
4. Raise and support vehicle. Disconnect HO2S harness connector. Connect test light to chassis ground and probe ignition feed circuit at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
5. Connect test light between ignition feed and heater ground at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6. Using DVOM, check resistance between ignition feed and heater ground at HO2S harness connector. If resistance is 3.5-14.0 ohms, go to step 9). If resistance is not 3.5-14.0 ohms, go to step 10).
7. Repair open in HO2S ignition feed circuit. After repairs, go to step 12).
8. Repair open in HO2S heater ground circuit. After repairs, go to step 12).

9. Check for poor terminal connection at HO2S connector. Repair or replace terminals. After repairs, go to step 12).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Locate and repair short to ground in HO2S ignition feed circuit and replace fuse. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0155. 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent condition. If DTC cannot be duplicated, information included in this data can be useful in determining how many miles since DTC has set.

FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed.

HO2S heater diagnostic will only run on a cold start and will only once per ignition cycle. Oxygen supply inside HO2S is necessary for proper operation and is provided through HO2S wires. Check all HO2S wires and connections for breaks or contamination.

DTC P0157 - HO2S CIRCUIT VOLTAGE LOW BANK 2, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S signal and ground circuits. Oxygen sensor voltage ranges from 10 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare stored HO2S voltage samples taken each sample period and determine if majority of samples are out of operating range. If PCM detects that voltage is less than a predetermined voltage, DTC will set.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Engine coolant temperature is greater than 118 °F (48°C).
- Ignition voltage greater than 9 volts.

- AIR, EGR and catalyst diagnostics not active.
- Fuel system operating in closed loop.
- Fuel trim enabled.
- TP angle 3-20 percent.
- HO2S signal voltage stays less than 90 mV.
- Conditions present for 80 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Operate vehicle within conditions for setting this DTC. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is less than 39 mV, go to step 4). If voltage is not less than specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0157. 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. Disconnect HO2S harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low circuit. If voltage is within a range of 350-550 mV, see DIAGNOSTIC AIDS. If not, go to next step.
5. Turn ignition off. Disconnect PCM harness connector. Check HO2S circuit for short to ground or short to sensor ground circuit. Repair as necessary. After repairs, go to next step. If circuit is okay, go to step 7).
6. Repair HO2S signal circuit. After repairs, go to step 8).
7. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
8. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Then, select DTC, SPECIFIC and enter DTC P0157. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If test does not run or failed, repeat step 2).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other undiagnosed DTC(s) are displayed, diagnose affected DTC(s).

Diagnostic Aids

Check HO2S wires grounding against exhaust manifold. Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

Check for lean fuel injector(s) or low fuel pressure. Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for fuel contamination. Water can cause a lean condition and can set a DTC. Check for exhaust leaks near HO2S, vacuum or crankcase leaks that can cause a lean condition. Check for faulty oxygen

sensor.

DTC P0158 - HO2S CIRCUIT VOLTAGE HIGH BANK 2 SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 mV) on HO2S signal and ground circuits. Oxygen sensor voltage ranges from 10 mV when exhaust is lean to 1000 mV when exhaust is rich. PCM monitors and stores HO2S voltage information. PCM then evaluates voltage samples to determine amount of time HO2S voltage was out of range. PCM will compare stored HO2S voltage samples taken each sample period and determine if majority of samples are fixed above operating range. If PCM detects that voltage is more than a predetermined voltage, DTC will set.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage greater than 9 volts.
- Fuel system operating in closed loop.
- AIR, EGR and catalyst diagnostics not active.
- Fuel trim enabled.
- Deceleration fuel cut-off mode enabled for greater than 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine to normal operating temperature. Increase engine speed to about 1200 RPM. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S display. If voltage is greater than 930 mV, go to step 4). If voltage is not greater than 930 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 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 DTC P0158. 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. Remove HO2S heater fuse. Monitor HO2S voltage. If voltage drops to within a range of 350-550 mV, go to next step. If voltage drop is not as specified, go to step 7).
5. Reinstall fuse. Disconnect HO2S harness connector. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. If voltage is within a range of 350-550 mV, go to step 10). If voltage is not as specified, go to next step.
6. With jumper wire still connected, remove HO2S heater fuse. Monitor HO2S voltage on scan tool. If

voltage is within a range of 350-550 mV, go to step 9). If voltage is not as specified, go to step 8).

7. Turn ignition off. Disconnect HO2S signal circuit at PCM connector. Disconnect HO2S harness connector. Turn ignition on. Using DVOM, check voltage on HO2S sensor signal circuit at PCM harness connector. If voltage is present, go to next step. If voltage is not present, see DIAGNOSTIC AIDS.
8. Repair short to voltage in HO2S signal circuit between sensor and PCM. After repairs, go to step 12).
9. Repair shorted HO2S signal circuit and HO2S heater battery supply circuit. After repairs, go to next step. If repair is not necessary or if circuits are okay, go to step 11).
10. Replace HO2S. After replacing HO2S, 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. Start and warm engine to normal operating temperature. Then, select DTC, SPECIFIC and then enter DTC P0158. Operate vehicle within conditions for setting this DTC. If scan tool indicates that this test ran and passed, go to next step. If test does not run or failed, repeat step 2).
13. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other undiagnosed DTC(s) are displayed, diagnose affected DTC(s).

Diagnostic Aids

Check HO2S wires grounding against exhaust manifold. Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

Check for rich fuel injector(s) or too high fuel pressure. Perform injector balance test. See SYSTEM/COMPONENT TESTS article. Check for saturated EVAP canister or incorrectly installed MAF sensor. Disconnect MAF sensor and observe if rich condition is corrected. Check for leaking fuel pressure regulator or leaking regulator vacuum hose. Check TP sensor. An intermittent TP sensor output will cause system to go rich.

DTC P0160 - HO2S INSUFFICIENT ACTIVITY BANK 2, SENSOR NO. 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies about 450 millivolts (mV) between HO2S high and low signal circuits. HO2S voltage ranges from about 1000 mV when exhaust is rich to about 10 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 PCM detects HO2S voltage is out bias range, DTC will set.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221 or P1258 not set.
- Engine running for greater than 70 seconds.

- Fuel system operating in closed loop.
- System voltage greater than 9 volts.
- AIR, EGR and catalyst diagnostics not active.
- Engine coolant temperature greater than 118°F (48°C).
- HO2S voltage steady 409-489 mV.
- Conditions present for 2 minutes and 30 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and warm engine 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 Bank 2 HO2S 2 voltage. If voltage is varying outside of 409-489 mV range, go to next step. If not, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0160. 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 on, with engine off. Disconnect Bank 2 HO2S 2 harness connector. Connect a fused jumper wire between ground and PCM connector (harness side) HO2S high and low signal circuits. If voltage is less than 200 mV, go to step 8). If voltage is not less than 200 mV, go to next step.
5. Remove jumper wire. Using DVOM, check voltage between sensor high and heater ground circuit, on PCM harness side. If voltage is greater than 375 mV, go to next step. If not, go to step 7).
6. Turn ignition off. Disconnect PCM harness connector. Check resistance of bank 2 HO2S 2 low circuit. If resistance is greater than 2 ohms, repair as necessary. After repairs, go to step 13). If resistance is not greater than 2 ohms, go to step 9).
7. Turn ignition off. Disconnect PCM harness connector. Check resistance of Bank 1 HO2S 1 signal circuit. If resistance is greater than 2 ohms, repair as necessary. After repairs, go to step 13). If resistance is not greater than 2 ohms, go to step 10).
8. Check low circuit signal terminal for poor connection at Bank 2 HO2S 2 harness connector. Repair or replace terminal as necessary. After repairs, go to step 13). If terminals are okay, go to step 11).
9. Check low signal terminal for poor connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
10. Check signal circuit terminal for poor connection at PCM harness. Repair or replace terminals as necessary. After repairs, go to step 13). If terminals are okay, go to step 12).
11. Replace Bank 2 HO2S 2 sensor. After replacing oxygen sensor, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0160. 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).

14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Oxygen supply inside HO2S is necessary for its proper operation. This supply of oxygen is provided through HO2S wires. Inspect all wires and terminals for breaks or contamination.

DTC P0161 - HO2S HEATER CIRCUIT BANK 2, SENSOR 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies a bias voltage (about 450 millivolts) on HO2S signal high and low circuits. When ignition is turned on, battery voltage is supplied to HO2S heater. As oxygen sensor heater reaches operating temperature, HO2S voltage responds by changing from a bias voltage range to normal operation (less than 300 millivolts). Depending on exhaust gas content, it is possible for HO2S voltage to increase to greater than 450 mV.

PCM will run heater test only on a cold start and once during ignition cycle. When engine is started, PCM will determine how much time it takes HO2S voltage to go from above or below bias range threshold. If PCM detects that it took too much time to enter into normal operating range, DTC will set. time it takes HO2S to reach operating temperature is based on amount of air that flows into engine.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0335, P0336, P0351-P0358 or P1258 not set.
- Ignition voltage is 10-16 volts.
- ECT and IAT temperatures are less than 122°F (50°C) and within 14.5°F (8°C) of each other.
- Engine airflow less than 30 gm/s.
- AIR, EGR and catalyst diagnostics not active.
- HO2S voltage stays between 300-700 mV for a predetermined amount of time.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If engine has been operating, allow engine to cool down for about 1 hour before proceeding with tests.

2. Turn ignition off. Turn ignition on, with engine off. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage goes from bias voltage to greater than 700 mV or less than 300

mV, see DIAGNOSTIC AIDS. If HO2S voltage does not go from bias voltage to less than 300 mV or greater than 700 mV, go to next step.

3. Check HO2S ignition feed fuse. If fuse is faulty, go to step 11). If fuse is okay, go to next step.
4. Raise and support vehicle. Disconnect HO2S harness connector. Connect test light to chassis ground and probe ignition feed circuit at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 7).
5. Connect test light between ignition feed circuit and heater ground at HO2S harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
6. Using DVOM, check resistance between ignition feed and heater ground at HO2S harness connector. Resistance should be 3.5-14.0 ohms. If resistance is as specified, go to step 9). If resistance is not as specified, go to step 10).
7. Repair open in HO2S ignition feed circuit. After repairs, go to step 12).
8. Repair open in HO2S heater ground circuit. After repairs, go to step 12).
9. Check for poor terminal connection at HO2S connector. Repair or replace terminals. After repairs, go to step 12).
10. Replace HO2S. After replacing HO2S, go to step 12).
11. Locate and repair short to ground in HO2S ignition feed circuit and replace fuse. After repairs, go to next step.
12. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0161. 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 DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent condition. If DTC cannot be duplicated, information included in this data can be useful in determining how many miles since DTC has set.

FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed.

HO2S heater diagnostic will only run once on a cold start and only once per ignition cycle. Oxygen supply inside HO2S is necessary for proper operation and is provided through HO2S wires. Check all HO2S wires and connections for breaks or contamination.

DTC P0171 - FUEL TRIM SYSTEM LEAN BANK 1

Circuit 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. DTC will set if PCM detects an excessively rich or lean condition.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0300, P0335, P0336, P0351-P0358, P0401, P0404, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1111, P1112, P1258, P1404, P1415 or P1416 not set.
- Engine coolant temperature 120-239°F (60-115°C).
- BARO greater than 74 kPa.
- MAF 5-90 gm/s.
- MAP 26-90 kPa.
- IAT between -4 to 194°F (-20 to 90°C).
- Engine speed 400-3000 RPM.
- TP sensor angle less than 90 percent.
- Vehicle speed less than 85 MPH.
- Fuel level greater than 10 percent.
- PCM detects average long term fuel trim cell values are more than a predetermined threshold.
- Conditions met for 6 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTC(s) are present, except P0174, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Ensure system is in "closed loop". Using scan tool, select FUEL TRIM DATA LIST and monitor LT FT BN 1. If LT FT is less than 23 percent, go to next step. If values are not as specified, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0171. 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. If DTC P0174 is also present, go to next step. If DTC P0174 is not present, go to step 6).
5. Check vacuum hoses for splits, kinks and proper routing. MAF sensor, air induction system, throttle Body, intake manifold, PCV system and EGR valve for vacuum leaks. Check for fuel contamination. Check for good PCM and sensor grounds. Check engine mechanical condition. Repair as necessary. After repairs, go to step 7). If engine mechanical repairs are not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.
6. Check bank 1 for exhaust leaks or loose exhaust hardware. Ensure oxygen sensor is properly installed. Check vacuum leaks that will affect bank 1 only. Check engine mechanical condition. After repairs, go to next step. If repairs are not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.
7. Repair or replace any faulty items. After repairs, go to next step.
8. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0171. Operate vehicle within conditions that set 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, diagnose affected DTC(s).

Diagnostic Aids

If DTC P0171 cannot be duplicated, problem could have been caused by engine running out of fuel. A fuel delivery malfunction will cause DTC to set. Check all items that can cause a lean condition.

DTC P0172 - FUEL TRIM SYSTEM RICH BANK 1

Circuit 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. DTC will set if PCM detects an excessively rich or lean condition.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0300, P0335, P0336, P0351-P0358, P0401, P0404, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1111, P1112, P1258, P1404, P1415 or P1416 not set.

- Engine coolant temperature between 120-239°F (60-115°C).
- BARO greater than 74 kPa.
- MAF 5-90 gm/s.
- MAP 26-90 kPa.
- IAT -4 to 194°F (-20 to 194°C).
- Engine speed 400-3000 RPM.
- TP sensor angle less than 90 percent.
- Vehicle speed less than 85 MPH.
- PCM detects average long term fuel trim cell values are less than a predetermined threshold.
- Conditions met for 49 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

NOTE: If other DTC(s) are present, except P0175, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Ensure system is in "closed loop" operation. Using scan tool, select FUEL TRIM DATA LIST and monitor LT FT BN 1. If LT FT is greater than -13 percent, go to next step. If LT FT is not greater than -13 percent, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0172. 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. If DTC P0175 is also present, go to next step. If DTC P0175 is not present, go to step 6).
5. Check for collapsed air intake duct, restricted fuel filter, improperly installed MAF sensor, foreign objects in MAF sensor inlet or for fuel in fuel regulator hose. Repair as necessary. After repairs, go to step 7). If components are okay, or repair is not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.
6. Check for leaking fuel injector(s) in bank 1. Repair or replace as necessary. After repairs, go to step 9). If injector(s) are okay, go to step 8).
7. Replace or repair affected components. After repairs, go to step 9).
8. Replace faulty HO2S. After replacing oxygen sensor, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0172. Operate vehicle within conditions that set 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, diagnose affected DTC(s).

Diagnostic Aids

For intermittent problem, see TESTS W/O CODES article.

DTC P0174 - FUEL TRIM SYSTEM LEAN BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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 a rich condition. DTC will set if PCM detects an excessively rich or lean condition.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0300, P0335, P0336, P0351-P0358, P0401, PO404, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1111, P1112, P1258, P1404, P1415 or P1416 not set.
- Engine coolant temperature 120-239°F (60-115°C).
- BARO greater than 74 kPa.
- MAF 5-90 gm/s.
- MAP 26-90 kPa.
- IAT -4 to 194°F (-20 to 90°C).
- Engine speed 400-3000 RPM.
- TP sensor angle less than 90 percent.
- Vehicle speed less than 85 MPH.
- Fuel level greater than 10 percent.
- PCM detects average long term fuel trim cell values greater than a predetermined threshold.
- Conditions met for 6 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

NOTE: If other DTC(s) are present, except for P0171 and P0174, diagnose the other DTC(s) first.

2. Start and warm engine to normal operating temperature. Ensure system is in "closed-loop". Using scan tool, select FUEL TRIM DATA LIST and monitor LT FT BN 2. If LT FT BN 2 is less than 23 percent, go to next step. If displayed value is not less 23 percent, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0174. 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. If DTC P0171 is also present, go to next step. If DTC P0171 is not present, go to step 6).
5. Check vacuum hoses for splits, kinks and proper routing. Check for vacuum leaks at throttle Body, intake manifold, EGR valve or MAF sensor. Check for fuel contamination. Check for engine mechanical failure. Repair problem as necessary. After repairs, go to step 7). If problem is not found or repair is not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.
6. Inspect bank 2 for exhaust leaks, missing or loose hardware. Check if bank 2 HO2S is installed properly and if connectors are secured. Check vacuum leaks that will only affect bank 1. Check engine mechanical condition. Repair problem as necessary. After repairs, go to next step. If problem is not found or repair is not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.
7. Repair or replace affected faulty components. After repairs or replacement, go to next step.
8. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0174. 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

If DTC cannot be duplicated, DTC may have been set by engine running out of fuel. A fuel delivery malfunction will also cause DTC to set. Inspect related items that can cause a lean condition.

DTC P0175 - FUEL TRIM SYSTEM RICH BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. DTC will set if PCM detects an excessively rich or lean condition.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0300, P0335, P0336, P0351-P0358, P0401, P0404, P0405, P0410, P0412, P0418, P0443, P0500, P0502, P0503, P1111, P1112, P1258, P1404, P1415 or P1416 not set.
- Engine coolant temperature 120-239°F (60-115°C).
- Barometric pressure greater than 74 kPa.
- MAF 5-90 gm/s.
- MAP 26-90 kPa.
- IAT -4 to 194°F (-20 to 90°C).
- Engine speed 400-3000 RPM.
- TP sensor angle less than 90 percent.
- Vehicle speed less than 85 MPH.
- PCM detects average long term fuel trim cell values below predetermined threshold.
- Conditions met for 49 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTC(s) are present, except P0172 and P0175, diagnose other DTC (s) first.

2. Warm engine to normal operating temperature. Ensure system is in "closed loop". Using scan tool, select FUEL TRIM DATA LIST and monitor LF FT BN 2. If LT FT BN 2 displayed value is greater than -13 percent, go to next step. If displayed value is not greater than -13 percent, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0175. 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. If DTC P0172 is also present, go to next step. If DTC P0172 is not present, go to step 6).
5. Check for collapsed air intake duck, restricted air filter, improperly mounted MAF sensor, foreign objects blocking inlet screen or for fuel in pressure regulator hose. Repair as necessary. After repairs, go to step

7). If problem is not found or repairs are not necessary, diagnose fuel system. See SYSTEM/COMPONENT TESTS article.

6. Check for leaking fuel injector(s) in bank 2. If injector(s) are leaking, go to step 9). If injector(s) are okay, go to step 8).
7. Repair or replace affected components. After repairs, go to step 9).
8. Replace faulty HO2S. After replacing HO2S, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0175. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

If problem is intermittent, see TESTS W/O CODES article.

DTC P0230 - FUEL PUMP CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel pump is powered by fuel pump relay. PCM energizes fuel pump relay at ignition on for 2-3 seconds. Fuel pump will remain on for as long as PCM receives reference pulse from electronic ignition system.

Conditions for setting DTC:

- Engine speed greater than 600 RPM.
- System voltage is 6-16 volts.
- PCM determines that fuel pump driver commanded state and actual state do not match.
- Conditions met for at least 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then 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 5).
3. Turn ignition off. Disconnect PCM harness connector. Turn ignition on. Using DVOM on 10-amp scale, check current between battery positive and PCM connector (harness side), fuel pump relay control circuit. If current is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If not, go to next step.
4. Turn ignition off. Remove fuel pump relay. Using DVOM, check resistance between ground and PCM

connector (harness side), fuel pump relay control circuit. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).

5. Turn ignition off. Remove fuel pump relay. Connect a test light between fuel pump relay connector terminals No. 85 and 86. Turn ignition on. Using scan tool, command fuel pump relay on and off. If test light turns on and off as commanded, go to step 8). If test light does not turn on, go to step 7).
6. Check resistance between fuel pump ground circuit at underhood relay block to battery ground. If resistance is 0-5 ohms, go to next step. If resistance is not 0-5 ohms, go to step 9).
7. Turn ignition off. Install fuel pump relay. Disconnect PCM harness connector. Turn ignition on, engine off. Connect a fused jumper wire between battery positive and PCM connector (harness side), fuel pump relay control circuit. If relay operates, go to step 12). If relay does not operate, go to step 10).
8. Check connections at fuel pump relay. Repair as necessary. After repairs, go to step 13). If connections are okay, go to step 11).
9. Repair open in fuel pump relay ground circuit. After repairs, go to step 13).
10. Repair faulty relay control circuit as necessary. After repairs, go to step 13).
11. Replace fuel pump relay. After replacing relay, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0230. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Scan tool will appear to not run if diagnostic passes. Using FREEZE FRAME and/or FAILURE RECORDS may aid in locating an intermittent condition.

DTC P0300 - ENGINE MISFIRE DETECTED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor is mounted through side of engine block at rear of bank 2, behind starter. CKP reluctor (24X) is located on crankshaft, immediately in front of rear main bearing. CKP sensor will send a pulse on every falling edge of 24X 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.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0107, P0108, P0117, P0118, P0125, P0335, P0336, P0341, P0342, P0343, P0500, P0502, P0503, P0601, P0742, P1120, P1220, P1221 or P1258 not set.
- Engine speed 400-3000 RPM.
- Ignition voltage 11-16 volts.
- Engine coolant temperature 19-266°F (-7-130°C).
- Fuel level more than 10 percent.
- Throttle angle steady within one percent.
- ABS and traction control not active.
- Transmission not changing gears.
- AIR diagnostics not active.
- A/C clutch steady.
- Not in fuel-shutoff or decel fuel cut-off.
- ABS signals not exceeding rough road thresholds.
- PCM determines that an emission-type misfire is present.
- PCM determines that a catalyst damaging misfire is present.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTC(s), except P0131, P0132, P0133, P0151, P0152, P0153, P0171, P0172, P0174, P0175, P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P1133, P1135, P1136, P1153, P1155 or P1156 are present, diagnose affected DTC(s) first.

2. Start and operate engine at idle. 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 step 4). If no misfire counter is incrementing, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0300. 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. If only one cylinder is misfiring, go to step 6). If more than one of cylinders are misfiring, go to next step.
5. Check vacuum hoses for splits, kinks and proper routing. Check for leaks at throttle Body, intake manifold, EGR valve or CCV system. Check PCM grounds for proper connection. Check that all injector harness connectors are connected to proper injector/cylinder. Check injector and control fuses for open. Check low fuel pressure or restricted fuel flow. Repair as necessary. After repairs, go to step 17). If components are okay, or repair is not necessary, go to next step.

6. Turn ignition off. Disconnect injector connector to affected cylinder(s). Connect injector test light to injector connector. Start and operate engine at idle. If injector test light flashes, go to next step. If injector test light does not flash, perform fuel injector coil test. See SYSTEM/COMPONENT TESTS article.
7. Turn ignition off. Reconnect injector connector(s). Disconnect spark plug wire to affected cylinder(s). Connect spark tester between ground and spark plug wire. Crank engine. If spark is present, go to step 9). If spark is not present, go to next step.
8. Using DVOM, check spark plug wire to affected cylinder(s). If resistance is less than 700 ohms, diagnose ignition system. See SYSTEM/COMPONENT TESTS article. If not, go to step 16).
9. Remove and check spark plug from affected cylinder(s). If spark plug is okay, go to next step. If spark plug is not okay, go to step 11).
10. Swap spark plug to another cylinder that is operating properly. Operate vehicle under same conditions that misfire occurred. If misfire moved with spark plug, go to step 15). If misfire is still present at original cylinder, perform fuel injector coil test. See SYSTEM/COMPONENT TESTS article.
11. If spark plug is fouled with oil or coolant, diagnose mechanical engine problem. If spark plug is not fouled, go to next step.
12. If spark plugs are gas fouled, diagnose fuel system. See SYSTEM/COMPONENT TESTS article. If spark plug is not fouled, go to next step.
13. Check spark plug for signs of cracks, wear or improper gap. If spark plug is faulty, go to next step. If spark plug is okay, perform fuel injector coil test. See SYSTEM/COMPONENT TESTS article.
14. Replace or re-gap spark plug. After replacing or re-gapping spark plug, go to step 17).
15. Replace faulty spark plug(s). After replacing spark plug(s), go to step 17).
16. Replace faulty spark plug wire(s). After replacing spark plug wire(s), go to next step.
17. If complaint is due to MIL flashing, perform DTC P0420 or P0430 test. If MIL is not flashing, go to next step.
18. 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).
19. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

A misfire could be caused by excessive vibration from sources other that engine. Check following for possible cause, tire/wheel out of balance/round, uneven brake rotor or drum surface, or a rough road condition.

Running vehicle out of fuel may set this DTC or DTCs P0461 and P1431. Check for restriction in fuel filter or fuel lines. If problem is intermittent, see TESTS W/O CODES article.

DTC P0325 - KNOCK SENSOR MODULE CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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.

Conditions for setting DTC:

- Engine speed is 1500-3500 RPM.
- Engine coolant temperature greater than 158°F (70°C).
- TP sensor angle greater than .5 percent.
- Engine operating fro greater than 20 seconds.
- A malfunction with KS module or circuits to module are faulty.
- Conditions present for 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
3. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0325. 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).
4. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

If diagnostic test does not run, check if KS module is missing or faulty KS module circuit. Check KS module terminals for corrosion. If corrosion is present, check module access cover seal for cuts or nicks.

DTC P0327 - KNOCK SENSOR CIRCUIT FRONT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. When

PCM determines that this frequency is less than or more than expected amount, DTC will set.

DTC will set when following conditions are present:

- Engine operating for greater than 20 seconds.
- Engine coolant temperature greater than 158°F (70°C).
- Engine speed 1500-3500 RPM.
- Throttle angle greater than 0.5 percent.
- MAP is less than 60 kPa.
- PCM determines frequency is less than or greater than expected amount for less than 3 second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Ensure engine mechanical problem is not causing knock. 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 DTC P0327. 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. KS is located behind intake manifold. Disconnect KS connector. Using DVOM, check resistance between KS and engine block. Resistance should be 93,000-107,000 ohms. If resistance is as specified, go to next step. If resistance is not as specified, go to step 6).
4. Turn ignition off. Connect DVOM between KS and ground. Set DVOM to AC voltage scale. Tap on engine while observing signal on DVOM. If any signal is present, go to next step. If signal is not present, go to step 7).
5. Disconnect PCM harness connector. Turn ignition on, with engine off. Check KS signal circuit between PCM and KS harness connector for open, short to voltage or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 8).
6. Remove intake manifold. Check KS signal circuit between KS jumper harness connector (located at back of intake manifold) and KS connector for open or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
7. Replace KS. After replacing sensor, go to step 10).
8. Check KS signal circuit for poor terminal connection at PCM. Repair as necessary. After repairs, go to step 10). If terminal connections are okay, go to next step.
9. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0327. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are

displayed, go to applicable DTC test.

Diagnostic Aids

Check KS for proper connection. A loose or over-torqued KS can cause DTC to set.

DTC P0332 - KNOCK SENSOR CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. 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. When PCM determines that this frequency is less than or more than expected amount, DTC will set.

DTC will set when following conditions are present:

- Engine operating for greater than 20 seconds.
- Engine coolant temperature greater than 158°F (70°C).
- Engine speed 1500-3500 RPM.
- Throttle angle greater than 0.5 percent.
- MAP is less than 60 kPa.
- PCM determines frequency is less than or greater than expected amount for less than 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Ensure engine mechanical problem is not causing knock. 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 DTC P0332. 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. Disconnect KS harness connector. Using DVOM, check resistance between KS signal circuit and ground. If resistance is 93,000-107,000 ohms, go to next step. If resistance is not 93,000-107,000 ohms, go to step 6).
4. Turn ignition off. Connect DVOM between KS and ground. Set DVOM to AC voltage scale. Tap on engine while observing signal on DVOM. If any signal is present, go to next step. If signal is not present, go to step 7).

5. Turn ignition off. Disconnect PCM harness connector. Turn ignition on and check KS signal circuit between PCM and KS harness connector for open, short to voltage or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 8).
6. Remove intake manifold. Check for open or short to ground in signal circuit between KS jumper harness connector located at back of intake manifold. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
7. Replace KS. After replacing sensor, go to step 10).
8. Check KS signal circuit for poor terminal connection at PCM. Repair as necessary. After repairs, go to step 10). If terminal connection is okay, go to next step.
9. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0332. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check KS for proper connection. A loose or over-torqued KS can cause DTC to set.

DTC P0335 - CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor is mounted on right rear of engine block, behind starter. CKP reluctor (24X) is located on rear of crankshaft. CKP sensor will send a pulse on every falling edge of 24X 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.

Conditions for setting DTC:

- DTCs P0101, P0102, P0103, P0341, P0342 or P0343 not set.
- CMP sensor is transitioning.
- Ignition voltage 5-17 volts.
- MAF greater than 3 gm/s.
- Ignition switch in CRANK mode.

- PCM determines CKP sensor signal out of range for less than 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If engine starts and runs, go to next step. If engine does not start and run, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P0335. 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.

CAUTION: Before proceeding, remove ignition and fuel feed circuit fuses to prevent personal injury from engine rotation, sparks or excessive engine fueling.

4. Disconnect CKP sensor harness connector. Turn ignition on, with engine off. Connect a test light between ground and PCM connector (PCM side), CKP sensor ignition feed circuit. If test light illuminates, go to next step. If test light does not illuminate, go to step 8).
5. Connect test light between CKP sensor harness connector ignition feed and ground circuits. If test light illuminates, go to next step. If test light does not illuminate, go to step 9).
6. Momentarily connect test light between CKP sensor signal circuit and CKP sensor ignition feed circuit. If fuel pump operates when ignition voltage was applied to CKP sensor signal circuit, go to step 11). If fuel pump does not operate, go to next step.
7. Connect CKP sensor connector. Turn ignition off. Disconnect PCM harness connector. Using Brown jumper from Connector Kit (J 35616-A) and DVOM set to 40 VAC scale, check voltage (front probe) to signal circuit. If voltage is 4-6 volts, go to step 15). If voltage is not as specified, go to step 10).
8. Check for open or short in CKP sensor ignition feed circuit. Repair as necessary. After repair, go to step 16). If circuit is okay, go to step 15).
9. Check for open or short in CKP sensor ground circuit. Repair as necessary. After repair, go to step 16). If circuit is okay, go to step 15).
10. Check for CKP sensor signal circuit for open, short to ground or short to voltage. Repair as necessary. After repair, go to step 16). If circuit is okay, go to next step.
11. Visually inspect CKP sensor for physical damage, loose or improper installation, wiring routed too close to secondary ignition components or poor connections/terminal contact at sensor or PCM. Repair as necessary. After repairs, go to step 16). If components and circuits are okay, go to next step.
12. Visually inspect CKP sensor reluctor wheel for damage. Replace or repair reluctor wheel as necessary. After repair, go to step 16). If reluctor wheel is okay, go to next step.
13. Check for poor connections/terminal at CKP sensor or for proper reluctor wheel installation. Repair as necessary. After repairs, go to step 16).
14. Replace CKP sensor. After replacing sensor, go to step 16).

15. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0335. 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).
17. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CKP sensor. Check for excessive timing gear/chain tension, excessive distributor drive backlash, damaged crankshaft reluctor wheel or for improper installation. Check engine front cover assembly for damage or sensor coming in contact with reluctor wheel.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0336 - CRANKSHAFT POSITION SENSOR CIRCUIT PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Crankshaft Position (CKP) sensor is mounted on right rear of engine block, behind starter. CKP reluctor (24X) is located on rear of crankshaft. CKP sensor will send a pulse on every falling edge of 24X 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.

DTC will set when following conditions are present:

- Engine speed 500-4000 RPM.
- Ignition voltage 5-17 volts.
- PCM determines CKP sensor signal out of range for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

2. Start and operate engine at idle for 2 minutes. Using scan tool, monitor FAILED THIS IGNITION display under DTC P0336. 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. 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 9). If routing is okay, go to next step.
4. Check for poor connections/terminal tension at CKP sensor. Repair as necessary. After repairs, go to step 9). If connection or terminal tension is okay, go to next step.
5. Check for poor CKP sensor circuit connections/terminal tension at PCM. Repair as necessary. After repairs, go to step 9). If connection or terminal tension is okay, go to next step.
6. Remove and inspect CKP sensor. Replace CKP sensor if necessary. If CKP sensor is okay, go to next step.
7. Visually inspect CKP sensor reluctor wheel for damage. Replace or repair reluctor wheel as necessary. If reluctor wheel is okay, go to next step.
8. Replace CKP sensor. After replacing sensor, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0336. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CKP sensor. Check for damaged crankshaft reluctor wheel or for improper installation. Check engine front cover assembly for damage or sensor coming in contact with reluctor wheel.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0341 - CAMSHAFT POSITION SENSOR CIRCUIT PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Camshaft Position (CMP) sensor is mounted on top of engine block at rear of valley cover. CMP works in conjunction with CMP reluctor (1X). Reluctor is located on inside engine, immediately in front of rear cam bearing. CMP sensor is used to determine whether a cylinder is on a firing or exhaust stroke. As camshaft rotates, reluctor wheel interrupts a magnetic field produced by magnet inside sensor. Sensor produces signal sent to PCM. PCM uses 1X signal along with CKP sensor 24X signal to determine crankshaft position and

stroke. A slightly longer cranking time may be a symptom of this DTC.

Conditions for setting DTC:

- Ignition voltage is 5-17 volts.
- Engine speed is less than 4000 RPM.
- PCM detects CMP-to-CKP mismatch has occurred for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle for 2 minutes. Using scan tool, monitor FAILED THIS IGNITION display under DTC P0341. 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. Visually inspect CMP sensor circuits for routing too close to secondary ignition components, after-market components, solenoids, relays and motors. Repair as necessary. After repairs, go step 9). If routing is okay, go to next step.
4. Check for poor connections/terminal tension at CMP sensor. Repair as necessary. After repairs, go to step 9). If connection or terminal tension is okay, go to next step.
5. Check for poor CMP sensor circuit connections/terminal tension at PCM. Repair as necessary. After repairs, go to step 9). If connection or terminal tension is okay, go to next step.
6. Remove CMP and inspect sensor. Replace CMP sensor if necessary. If CMP sensor is okay, go to next step.
7. Visually inspect CMP sensor reluctor wheel for damage. Replace or repair reluctor wheel as necessary. If reluctor wheel is okay, go to next step.
8. Replace CMP sensor. After replacing sensor, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0341. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for damaged camshaft reluctor wheel or for improper installation. Check engine front cover assembly for damage or sensor coming in contact with reluctor wheel.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC

failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0342 - CAMSHAFT POSITION SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Camshaft Position (CMP) sensor is mounted on top of engine block at rear of valley cover. CMP works in conjunction with CMP reluctor (1X). Reluctor is located on inside engine, immediately in front of rear cam bearing. CMP sensor is used to determine whether a cylinder is on a firing or exhaust stroke. As camshaft rotates, reluctor wheel interrupts a magnetic field produced by magnet inside sensor. Sensor produces signal sent to PCM. PCM uses 1X signal along with CKP sensor 24X signal to determine crankshaft position and stroke. A slightly longer cranking time may be a symptom of this DTC.

Conditions for setting DTC:

- System voltage is 9-17 volts.
- Engine speed is less than 4000 RPM.
- PCM detects CMP signal is stuck low for 1.5 seconds when signal should be high.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select CAM SIGNAL INPUT and monitor HIGH/LOW TRANSITION counter. If counter is incrementing, go to next step. If counter is not incrementing, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0342. 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 PCM connector. Connect a DVOM to ground. Using Brown wire from Connector Kit (J 35616-A), connect DVOM (set to duty cycle) to CMP sensor signal circuit at PCM connector (harness side). Crank engine. If duty cycle is 45-55 percent, go to step 17). If duty cycle is not as specified, go to next step.
5. Turn ignition off. Reconnect PCM connector. Remove intake manifold. Disconnect CMP sensor connector. Turn ignition on. Using DVOM, check voltage between battery ground and CMP sensor connector B+ reference circuit. If DVOM reads battery voltage, go to next step. If DVOM does not read battery voltage, go to step 8).
6. Using DVOM, check voltage between CMP sensor connector B+ reference and ground circuits. If DVOM reads battery voltage, go to step 9). If DVOM does not read battery voltage, go to next step.
7. Check for open in CMP sensor connector ground circuit. Repair circuit as necessary. After repair, go to

step 21). If circuit is okay, go to step 17).

8. Check for open or short to ground in CMP sensor connector B+ reference circuit. Repair circuit as necessary. After repair, go to step 20). If circuit is okay, go to step 17).
9. Turn ignition on. Using DVOM, check voltage between ground CMP sensor connector signal circuit. If voltage is less than one volt, go to next step. If voltage is not as specified, go to step 14).
10. Check voltage between battery positive and CMP sensor connector signal circuit. If voltage is less than one volt, go to next step. If voltage is not as specified, go to step 15).
11. Turn ignition off. Disconnect PCM connector. Using DVOM, check resistance between CMP sensor signal circuit between CMP sensor connector and PCM. If resistance is less than 5 ohms, go to step 17). If resistance is not as specified, go to step 16).
12. Repair open or short to ground in CMP sensor B+ reference circuit. After repair, go to step 20).
13. Repair open CMP sensor ground circuit. After repair, go to step 20).
14. Repair short to voltage in CMP sensor signal circuit. After repair, go to step 20).
15. Repair short to ground in CMP sensor signal circuit. After repair, go to step 20).
16. Repair open CMP sensor signal circuit. After repair, go to step 20).
17. Check connections at PCM. Repair as necessary. After repairs, go to step 20). If connections are okay, go to next step.
18. Replace CMP sensor and go to step 20).
19. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
20. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0342. 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).
21. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for damaged camshaft reluctor wheel or for improper installation. Check engine front cover assembly for damage or sensor coming in contact with reluctor wheel.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0343 - CAMSHAFT POSITION SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Camshaft Position (CMP) sensor is mounted on top of engine block, at rear of valley cover. CMP works in conjunction with CMP reluctor (1X signal). Reluctor is located on inside of engine, immediately in front of rear cam bearing. CMP sensor is used to determine whether a cylinder is on a firing or exhaust stroke. As camshaft rotates, reluctor wheel interrupts a magnetic field produced by magnet inside sensor. Sensor produces signal to PCM. PCM uses 1X signal along with CKP sensor 24X signal to determine crankshaft position and stroke. A slightly longer cranking time may be a symptom of this DTC.

Conditions for setting DTC:

- System voltage is 9-17 volts.
- Engine speed is less than 4000 RPM.
- PCM detects CMP signal is stuck high for 1.5 seconds when signal should be low.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select CAM SIGNAL INPUT and monitor HIGH/LOW TRANSITION counter. If counter is incrementing, go to next step. If counter is not incrementing, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0343. 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 PCM connector. Connect a DVOM to ground. Using Brown wire from Connector Kit (J 35616-A), connect DVOM (set to duty cycle) to CMP sensor signal circuit at PCM connector (harness side). Crank engine. If duty cycle is 45-55 percent, go to step 17). If duty cycle is not as specified, go to next step.
5. Turn ignition off. Reconnect PCM connector. Remove intake manifold. Disconnect CMP sensor connector. Turn ignition on. Using DVOM, check voltage between battery ground and CMP sensor connector B+ reference circuit. If battery voltage is present, go to next step. If battery voltage is not present, go to step 8).
6. Using DVOM, check voltage between CMP sensor connector B+ reference and ground circuits. If voltage is 13-16 volts, go to step 9). If voltage is not as specified, go to next step.
7. Check for open in CMP sensor connector ground circuit. Repair circuit as necessary. After repair, go to step 21). If circuit is okay, go to step 17).
8. Check for open or short to ground in CMP sensor connector B+ reference circuit. Repair circuit as necessary. After repair, go to step 20). If circuit is okay, go to step 17).
9. Turn ignition on. Using DVOM, check voltage between ground CMP sensor connector signal circuit. If voltage is less than 1.0 volt, go to next step. If voltage is not less than 1.0 volt, go to step 14).

10. Check voltage between battery positive and CMP sensor connector signal circuit. If voltage is less than 1.0 volt, go to next step. If voltage is not less than 1.0 volt, go to step 15).
11. Turn ignition off. Disconnect PCM connector. Using DVOM, check resistance between CMP sensor signal circuit between CMP sensor connector and PCM. If resistance is less than 5 ohms, go to step 17). If resistance is not as specified, go to step 16).
12. Repair open or short to ground in CMP sensor B+ reference circuit. After repair, go to step 20).
13. Repair open CMP sensor ground circuit. After repair, go to step 20).
14. Repair short to voltage in CMP sensor signal circuit. After repair, go to step 20).
15. Repair short to ground in CMP sensor signal circuit. After repair, go to step 20).
16. Repair open CMP sensor signal circuit. After repair, go to step 20).
17. Check connections at PCM. Repair as necessary. After repairs, go to step 20). If connections are okay, go to next step.
18. Replace CMP sensor and go to step 20).
19. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
20. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0343. 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).
21. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for damaged camshaft reluctor wheel or for improper installation. Check engine front cover assembly for damage or sensor coming in contact with reluctor wheel.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0351 - IGNITION CONTROL NO. 1 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC NO. 1 status. If scan tool displays DTC P0351, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0351. 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 ignition coil No. 1 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 1 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 1 signal circuit. If voltage is greater than 1.0 volt, go to step 9). If voltage is not greater than 1.0 volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 1 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 1 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil. After replacing ignition coil, go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0351. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at ignition coil and PCM. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0352 - IGNITION CONTROL NO. 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 2 status. If scan tool displays DTC P0352, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0352. 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 ignition coil No. 2 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 2 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 2 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 2 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).

7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 2 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil and go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0352. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0353 - IGNITION CONTROL NO. 3 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 3 status. If scan tool displays DTC P0353, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0353. 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 ignition coil No. 3 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 3 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 3 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 3 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 3 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil and go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0353. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC

failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0354 - IGNITION CONTROL NO. 4 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 4 status. If scan tool displays DTC P0354, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0354. 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 ignition coil No. 4 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 4 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 4 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 4 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 4 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil. After replacing ignition coil, go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to

step 13). If connection or terminal tension is okay, go to next step.

12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0354. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0355 - IGNITION CONTROL NO. 5 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 5 status. If scan tool displays DTC P0355, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0355. 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 ignition coil No. 5 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 5 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 5 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 5 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 5 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil and go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0355. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0356 - IGNITION CONTROL NO. 6 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 6 status. If scan tool displays DTC P0356, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0356. 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 ignition coil No. 6 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 6 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 6 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 6 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 6 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil. After replacing ignition coil, go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0356. 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).

14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0357 - IGNITION CONTROL NO. 7 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.
- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 7 status. If scan tool displays DTC P0357, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0357. 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 ignition coil No. 7 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 7 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.

5. Using DVOM, check voltage on IC No. 7 signal circuit. If voltage is greater than one volt, go to step 9). If voltage is not greater than one volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 7 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 7 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil. After replacing ignition coil, go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0357. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0358 - IGNITION CONTROL NO. 8 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This engine uses an individual ignition coil/module and circuit for each cylinder. Sequencing and timing are controlled by PCM. DTC will set if IC circuit is out of range.

DTC will set when following conditions are present:

- System voltage is 9-17 volts.

- PCM detects IC circuit is open or shorted to ground or voltage.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, select MISFIRE DATA LIST and monitor IC No. 8 status. If scan tool displays DTC P0358, go to step 4). If scan tool does not display this DTC, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function, then enter DTC P0358. 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 ignition coil No. 8 connector. Using a DVOM in AC Hertz (Hz) scale, check frequency of IC No. 8 signal circuit. Start and operate engine at idle. If frequency is 3-20 Hz, go to step 8). If frequency is not as specified, go to next step.
5. Using DVOM, check voltage on IC No. 8 signal circuit. If voltage is greater than 1.0 one volt, go to step 9). If voltage is not greater then 1.0 volt, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity of IC signal circuit from ignition coil No. 8 connector to PCM connector. If continuity exists, go to next step. If continuity does not exist, go to step 10).
7. Using DVOM, check resistance of IC signal between ground and ignition coil No. 8 connector. If resistance is infinite, go to step 11). If resistance is not infinite, go to step 10).
8. Replace ignition coil. After replacing ignition coil, go to step 13).
9. Repair IC signal circuit for short to voltage. After repair, go to step 13).
10. Repair IC signal circuit for open or short to ground. After repair, go to step 13).
11. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 13). If connection or terminal tension is okay, go to next step.
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0358. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections/terminal tension at CMP sensor. Check for rubbed-through wire insulation, broken

wire inside insulation or misrouted harness.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0410 - AIR SYSTEM

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Secondary Air Injection (AIR) system is used to lower tailpipe emissions during start up. PCM supplies ground to AIR pump relay, energizing pump.

PCM runs 2 tests using HO2S voltages to diagnose AIR system. Tests consist of:

- Test I PCM monitors HO2S voltages when AIR pump is enabled. If HO2S voltage drops to a predetermined range, PCM assumes that AIR pump is operational. If HO2S voltage increases to a predetermined range, PCM assumes that AIR pump is disabled. If HO2S voltages are out of range or inconclusive, diagnostic will proceed to next test.
- Test II During this test, PCM will activate AIR pump during "closed loop" operation. When AIR is activated, PCM will monitor HO2S voltages and short term trim values for both banks of engine. If PCM determines that HO2S voltages for both banks does not respond as expected during tests, DTC P0410 will set. If only one sensor responded, PCM will set either a DTC P1415 or P1416 to indicate which bank AIR system is inoperative.

DTC will set when following conditions are present:

TEST I

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171, P0172, P0174, P0175, P0300, P0401, P0404, P0405, P0412, P0418, P0441, P0443, P0506, P0507, P1120, P1220, P1221, P1404, P1441 or any HO2S DTCs not set.
- Engine operating greater than 2 seconds.
- TP sensor angle not moving greater than one percent.
- Engine load less than 25 percent.
- Engine airflow less than 30 gm/s.
- Ignition voltage greater than 11.7 volts.
- Air fuel ratio greater than 13:1.
- ECT less than 228°F (109°C).
- HO2S voltage drops to less than 400 mV.

TEST II

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171, P0172, P0174, P0175, P0300, P0401, P0404, P0405, P0412, P0418, P0441, P0443, P0506, P0507, P1120, P1220, P1221, P1404, P1441 or any HO2S DTCs not set.
- Engine operating greater than 200 seconds.
- Engine speed greater than 600 RPM.
- Engine airflow less than 22 gm/s.
- Ignition voltage greater than 11.7 volts.
- ECT greater than 158°F (70°C).
- IAT greater than 50°F (10°C).
- Engine load less than 25 percent.
- HO2S voltage does not drop to less than 222 mV within 1.5 seconds.
- Short term fuel trim does not go above a predetermined amount.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P0412 or P0418 is also present, diagnose DTC. If DTCs are not present, go to next step.
3. Check AIR pump fuse. If fuse is okay, go to next step. If fuse is open, go to step 11).
4. Turn ignition on, with engine off. Using scan tool, enable AIR pump. If pump turns on, go to step 8). If AIR pump does not turn on, go to next step.
5. Turn ignition off. Disconnect AIR pump relay. Turn ignition on, engine off. Using test light connected to ground, probe power supply circuit to relay. If test light illuminates, go to next step. If test light does not illuminate, go to step 17).
6. Turn ignition off. Reconnect AIR pump relay. Disconnect AIR pump harness connector. Connect test light between battery negative terminal and probe AIR pump harness connector terminal "A". Turn ignition on, engine off. Using scan tool, enable AIR pump. If test light illuminates, go to next step. If test light does not illuminate, go to step 18).
7. Connect test light between AIR pump harness connector terminals "A" and "C". Using scan tool, enable AIR pump. If test light illuminates, go to step 27). If test light does not illuminate, go to step 19).
8. Turn ignition off. Disconnect AIR pump harness connector. Using test light connected to negative battery terminal, probe AIR pump harness connector terminal "B". Turn ignition on, with engine off. Using scan tool, enable AIR pump. If test light illuminates, go to next step. If test light does not illuminate, go to step 20).
9. Turn ignition off. Reconnect AIR pump harness connector. Disconnect AIR pump outlet hose. Turn ignition on. Using scan tool, enable AIR pump. If air is present at pump outlet, go to next step. If air is not present, go to step 27).
10. Check for restriction or blockage in AIR hoses/pipes between AIR pump and to where system branches to both sides of engine. Repair as necessary. After repairs, go to step 29). If AIR hoses/pipes are not restricted or blocked, go to next step.

11. Turn ignition off. Remove AIR pump relay, AIR solenoid relay and AIR pump bleed valve solenoid. Install new fuse(s). Turn ignition on, with engine off. Recheck fuse(s). If fuse blows, go to step 21). If fuse does not blow, go to next step.
12. Install AIR solenoid relay. Using scan tool, enable AIR pump relay/solenoid relay. Recheck fuse(s). If fuse blows, go to step 22). If fuse is okay, go to next step.
13. Install AIR pump harness connector. Using scan tool, enable AIR pump. Recheck fuse(s). If fuse blows, go to step 28). If fuse is okay, go to next step.
14. Disconnect AIR pump harness connector. Install AIR pump relay. Using scan tool, enable AIR pump. Recheck fuse(s). If fuse blows, go to step 23). If fuse is okay, go to next step.
15. Install AIR pump harness connector. Using scan tool, enable AIR pump. Recheck fuse(s). If fuse blows, go to step 28). If fuse is okay, go to next step.
16. Install EVAP canister purge valve pump harness connector. Using scan tool, enable EVAP canister purge valve. Recheck fuse(s). If fuse blows, go to step 24). If fuse is okay, see DIAGNOSTIC AIDS.
17. Repair open circuit between fuse and relay. After repairs, go to step 29).
18. Check for continuity between AIR pump and AIR pump relay. If circuit is open, repair as necessary. After repairs, go to step 29). If circuit is okay, go to step 25).
19. Repair faulty ground connection or open AIR pump ground circuit. After repairs, go to step 29).
20. Check for continuity between AIR pump and AIR pump relay. If circuit is open, repair as necessary. After repairs, go to step 29). If circuit is okay, go to step 26).
21. Repair short to ground in ignition feed circuit between fuse and relay. After repairs, go to step 29).
22. Repair short to ground between AIR solenoid relay and AIR pump. After repairs, go to step 29).
23. Repair short to ground between AIR pump relay and AIR pump. After repairs, go to step 29).
24. Replace AIR bleed valve solenoid. After replacing solenoid, go to step 29).
25. Replace AIR pump solenoid. After replacing solenoid, go to step 29).
26. Repair AIR solenoid relay. After replacing relay, go to step 29).
27. Check AIR pump electrical connections. Repairs as necessary. After repairs, go to step 29). If connections are okay, go to next step.
28. Replace AIR pump. After replacing pump, go to next step.
29. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0410. 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).
30. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

If no problem can be found in ignition feed circuit, check IGN 1 mini relay for proper operation. Check both sides or ENG IGN 1 fuse to determine if power is being supplied from IGN 1 mini-relay.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can

be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0412 - AIR SOLENOID RELAY CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to AIR injection pump relay coil. PCM controls relay by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command AIR solenoid relay on and off. If relay turns on and off as commanded, go to next step. If relay does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Install DVOM. Set DVOM to 10-amp scale. Check current from relay control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not as specified, go to next step.
4. Turn ignition off. Remove AIR solenoid relay. Check resistance from relay control circuit in PCM harness connector to ground. If resistance is infinite, go to step 12). If resistance is not infinite, go to step 10).
5. Turn ignition off. Remove AIR solenoid relay. Connect test light between relay coil terminals in relay harness connector. Turn ignition on. Using scan tool, command relay on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light to ground and probe ignition feed circuit in AIR solenoid relay harness connector. If

test light illuminates, go to next step. If test light does not illuminate, go to step 11).

7. Turn ignition off. Reinstall AIR solenoid relay. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Connect a fused jumper wire between to ground and PCM connector (harness side), relay control circuit. If relay operates, go to step 9). If relay does not operate, go to step 10).
8. Check connections at AIR solenoid relay. Repair as necessary. After repairs, go to step 14). If relay connection is okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty AIR solenoid relay control circuit. After repairs, go to step 14).
11. Repair faulty AIR solenoid relay ignition feed circuit. After repairs, go to step 14).
12. Replace AIR solenoid relay. After replacing relay, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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 DTC P0412. 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).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0418 - AIR PUMP RELAY CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to AIR injection pump relay coil. PCM controls relay by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command AIR pump relay on and off. If relay turns on and off as commanded, go to next step. If relay does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Using a DVOM set to 10-amp scale, check current from relay control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not as specified, go to next step.
4. Turn ignition off. Remove AIR pump relay. Check resistance from relay control circuit in PCM harness connector to ground. If resistance is infinite, go to step 12). If resistance is not infinite, go to step 10).
5. Turn ignition off. Remove AIR pump relay. Connect test light between relay coil terminals in relay harness connector. Turn ignition on. Using scan tool, command relay on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light to ground and probe ignition feed circuit in AIR pump relay harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
7. Turn ignition off. Reinstall AIR pump relay. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Connect a fused jumper wire between to ground and PCM connector (harness side), relay control circuit. If relay operates, go to step 9). If relay does not operate, go to step 10).
8. Check connections at AIR pump relay. Repair as necessary. After repairs, go to step 14). If relay connection is okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty AIR pump relay control circuit. After repairs, go to step 14).
11. Repair faulty AIR pump relay ignition feed circuit. After repairs, go to step 14).
12. Replace AIR pump relay. After replacing relay, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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 DTC P0418. 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).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0420 - TWC SYSTEM LOW EFFICIENCY BANK 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

A 3-way catalytic converter is used to maintain low emissions. PCM monitors exhaust gasses from converter using Bank 1 HO2S 2. Sensor is located in exhaust stream past 3-way catalytic converter. These sensors produce an output signal which indicates oxygen capacity of catalyst. This determines catalyst's ability to convert exhaust emissions effectively.

During normal operation, Bank 1 HO2S 2 signal will be far less active than that produced by Bank 1 HO2S 1. If a problem exists causing PCM to detect excessive Bank 1 HO2S 2 activity outside of an acceptable range for an extended period of time, PCM will set a DTC. This indicates that 3-way catalytic converter's oxygen storage capacity is less than acceptable range.

DTC will set when following conditions are present:

- No AIR, CKP, CMP, IAT, IC, MAF, MAP, ECT, TP, EVAP, left bank HO2S, misfire, left bank fuel trim, injector, VSS, engine protection or transmission related DTCs set.
- ECT greater than 149°F (65°C).
- Vehicle speed between 20-85 MPH.
- IAT greater than -22°F (-30°C).
- TP sensor angle greater than 2 percent.
- Engine speed 800-3000 RPM.
- MAP 25-80 kPa.
- Engine airflow 14-40 gm/s.
- Closed loop fuel control enabled.
- PCM determines oxygen storage capability of catalytic converter has degraded to less than a calibrated threshold.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If any other DTCs are present, diagnose affected DTCs first. If other DTCs are not present, go to next

step.

3. Check that 3-way catalytic converter is original equipment. Check for converter damage and rattle inside converter. Inspect for exhaust system leak, especially near HO2S. Ensure HO2S connectors are secured and not touching exhaust. If damage to converter is obvious, go to next step. Repair other exhaust leaks. After repairs, go to step 5).
4. Replace catalytic converter. After replacing converter, go to next step.
5. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0420. 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).
6. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

DTC P0430 - TWC SYSTEM LOW EFFICIENCY BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

A Three-Way Catalytic (TWC) converter is used to maintain low emissions. PCM monitors exhaust gasses from converter using Bank 2 HO2S 2 located in exhaust stream past TWC converter. These sensors produce an output signal which indicates oxygen capacity of catalyst. This determines catalysts ability to convert exhaust emissions effectively.

During normal operation Bank 2 HO2S 2 signal will be far less active than that produced by Bank 2 HO2S 1. If a problem exists causing PCM to detect excessive Bank 2 HO2S 2 activity outside of an acceptable range for an extended period of time, PCM will set a DTC. This indicates that 3-way catalytic converter's oxygen storage capacity is less than acceptable range.

DTC will set when following conditions are present:

- No AIR, CKP, CMP, ECT, engine protection, IAT, IC, injector, left bank HO2S, MAF, MAP, misfire, right bank fuel trim or transmission DTCs set.
- Engine operating.
- ECT greater than 149°F (65°C).
- IAT greater than -22°F (-30°C).
- TP sensor angle greater than 2 percent.
- Engine speed 800-3000 RPM.
- MAP 25-80 kPa.
- Engine airflow between 14-40 gm/s.
- Fuel system in closed loop fuel control.
- PCM determines oxygen storage capability of catalytic converter has degraded to less than calibrated threshold.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If any other DTCs are present, diagnose affected DTCs first. If other DTCs are not present, go to next step.
3. Check that 3-way catalytic converter is original equipment. Check for converter damage and rattle inside converter. Inspect for exhaust system leak, especially near HO2S. Ensure HO2S connectors are secured and not touching exhaust. If damage to converter is obvious, go to next step. Repair other exhaust leaks. After repairs, go to step 5).
4. Replace catalytic converter. After replacing converter, go to next step.
5. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0430. 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).
6. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

DTC P0441 - EVAP SYSTEM NO FLOW DURING PURGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

EVAP vacuum switch is a normally closed switch, mounted in vacuum line between EVAP canister and EVAP solenoid. Battery voltage is supplied to switch through a pull-up resistor in PCM. When PCM commands EVAP canister purge solenoid valve open (purge on), engine vacuum draws evaporative emissions from canister and EVAP switch opens (signal voltage high) providing feedback to PCM, indicating EVAP system is operating. When PCM commands purge off, EVAP vacuum switch closes (signal voltage low), confirming that purging has ceased.

DTC will set when following conditions are present:

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0443, P1120, P1220, P1221 or P1441 not set.
- ECT less than 239°F (115°C).
- IAT greater than 37°F (3°C) when first started, but less than 176°F (80°C) when operating.
- Difference between ECT and IAT not greater than 18°F (10°C) at engine start-up.
- Engine speed 800-3000 RPM.
- Throttle angle 8-60 percent.
- MAP greater than 15 kPa.
- BARO greater than 75 kPa.
- Purge duty cycle greater than 90 percent.

- PCM detects low signal voltage on EVAP vacuum switch signal circuit when PCM is commanding purge ON.
- Conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P0443 is present, diagnose DTC P0443 first. Turn ignition on, with engine off. Using scan tool, check EVAP vacuum switch status. If scan tool indicates that EVAP vacuum switch is not purging, go to next step. If scan tool indicates that EVAP vacuum switch is purging, go to step 5).
3. Start engine. Using scan tool, command EVAP canister purge solenoid on, while observing EVAP vacuum switch status. If scan tool indicates that canister is purging when solenoid is commanded on, see DIAGNOSTIC AIDS. If solenoid is not purging when commanded on, go to next step.
4. Turn ignition off. Disconnect purge hose from EVAP vacuum switch. Connect a vacuum gauge to canister side of EVAP switch. Start engine. Using scan tool, command EVAP canister purge solenoid on, while observing vacuum gauge. If vacuum gauge indicates vacuum reading close to engine vacuum when solenoid is commanded on, go to next step. If vacuum reading is close to engine vacuum, go to step 7).
5. Disconnect EVAP vacuum switch harness connector. If scan tool indicates PURGE, go to step 9). If scan tool does not indicate PURGE, go to next step.
6. Turn ignition off. Disconnect PCM connector. Using DVOM, check continuity between EVAP vacuum switch signal circuit and ground. If DVOM reads infinity, go to step 10). If DVOM does not read infinity, go to step 12.
7. Disconnect vacuum harness from EVAP canister purge solenoid and connect vacuum gauge to manifold side of vacuum harness. If normal manifold vacuum is indicated, go to next step. If manifold vacuum is not indicated, go to step 13).
8. Rotate vacuum harness connector enough to reconnect only manifold vacuum supply hose to solenoid. Connect vacuum gauge to other port on solenoid. Using scan tool, command EVAP canister purge solenoid on, while observing vacuum gauge. If vacuum is indicated when solenoid is commanded on, go to step 14). If vacuum is not indicated when solenoid is commanded on, go to step 15).
9. Replace EVAP vacuum switch. After replacing vacuum switch, go to step 16).
10. Check connections at PCM. After repairs, go to step 16).
11. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 16).
12. Repair signal circuit shorted to ground. After repairs, go to step 16).
13. Check for blocked or restricted manifold vacuum port. Check for kinked or leaking hose between EVAP solenoid and intake manifold. Repair as necessary. After repairs, go to step 16). If vacuum port and vacuum lines to affected components are okay, go to next step.
14. Check for restricted, kinked or leaking hose between EVAP solenoid and vacuum switch. After repairs, go to step 16).
15. Replace EVAP solenoid. After replacing solenoid, go to next step.
16. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0441. 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).

17. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Before replacing any components, check for misrouted harness, rubbed-through wire insulation, wire broken inside insulation, kinked or damaged vacuum hoses or for physical damage to system components.

DTC P0443 - EVAP PURGE SOLENOID CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to EVAP canister purge solenoid. PCM controls solenoid by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component off, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command EVAP solenoid on and off. If solenoid turns on and off as commanded, go to next step. If solenoid does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM harness connector containing solenoid control circuit. Turn ignition on. Using DVOM, set DVOM to 10-amp scale. Check current from solenoid control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not less than .75 amp, go to next step.
4. Turn ignition off. Disconnect EVAP solenoid. Using DVOM, check resistance from solenoid control circuit in PCM harness connector and ground. If resistance is not infinite, go to step 12). If resistance is

infinite, go to step 10).

5. Turn ignition off. Disconnect EVAP solenoid. Connect test light between solenoid harness connectors. Turn ignition on. Using scan tool, command solenoid on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light ground and probe ignition feed circuit in solenoid harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
7. Turn ignition off. Reconnect EVAP solenoid. Disconnect PCM connector containing solenoid control circuit. Turn ignition on. Connect a fused jumper wire between ground and PCM connector (harness side), solenoid control circuit. If solenoid operates, go to step 9). If solenoid does not operate, go to step 10).
8. Check connections at EVAP solenoid. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty EVAP solenoid control circuit. After repairs, go to step 14).
11. Repair faulty EVAP solenoid ignition feed circuit. After repairs, go to step 14).
12. Replace EVAP solenoid. After replacing solenoid, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, 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 DTC P0443. 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).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0461 - FUEL LEVEL SENSOR CIRCUIT PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor changes resistance based on fuel level. When fuel tank is full, sensor resistance is high. PCM monitors changes on signal circuit to determine fuel level. This information is sent to fuel gauge.

Diagnostic checks for stuck fuel level sensor signal. If PCM determines fuel level signal appears to be stuck

based on lack of signal variation, DTC P0461 sets.

DTC will set when following conditions are present:

- Fuel level left fuel tank indicates does not decrease by at least 0.8 gallon (3 liters).
- More than 100 miles have been accumulated.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Disconnect fuel level sensor connector at fuel tank. Using scan tool, read fuel level sensor voltage. If voltage reading is 5 volts, go to next step. If voltage reading is not 5 volts, go to step 5).
3. Connect a fused jumper wire between fuel level sensor connector signal and ground circuits at harness connector. Using scan tool monitor fuel level sensor. If scan tool voltage reads zero volts, go to next step. If scan tool voltage is not zero volts, go to step 6).
4. Remove fuel level sensor (left tank). Check for loose or broken fuel tank baffle, stuck fuel level sensor or foreign material (ice) in fuel tank. Repair fuel tank as necessary. After repairs, go to step 10). If fuel tank is okay, go to step 7).
5. Turn ignition off. Disconnect PCM connector. Check fuel level sensor signal circuit for open or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 8).
6. Disconnect PCM connector. Check fuel level sensor signal and ground circuit for open. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to step 8).
7. Replace fuel level sensor. After replacing sensor, go to step 10).
8. Check terminal connections at PCM. Repair terminals as necessary. After repairs, go to step 10). If terminals are okay, go to next step.
9. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0461. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0462 - FUEL LEVEL SENSOR CIRCUIT VOLTAGE LOW

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor changes resistance based on fuel level. When fuel tank is full, sensor resistance is high. PCM monitors changes on signal circuit to determine fuel level. This information is sent to fuel gauge.

If PCM senses fuel level signal voltage lower than .39 volt, DTC P0462 sets.

DTC will set when following conditions are present:

- Fuel level sensor voltage is less than .39 volt.
- Conditions present for 6 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P1639. If DTC P1639 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.
3. Using scan tool, read fuel level sensor voltage. If voltage is greater than .39 volt, go to next step. If voltage is not as specified, go to step 5).
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 DTC P0462. 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. Disconnect fuel level sensor connector. Using scan tool, read fuel level sensor voltage. If voltage is greater than .39 volt, go to step 7). If voltage is not as specified, go to next step.
6. Turn ignition off. Disconnect PCM connector. Check fuel level sensor signal circuit for short to ground. Repair as necessary. After repairs, go to step 9). If circuit is okay, go to step 8).
7. Replace fuel level sensor. After replacing sensor, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0462. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0463 - FUEL LEVEL SENSOR CIRCUIT VOLTAGE HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor changes resistance based on fuel level. When fuel tank is full, sensor resistance is high. PCM monitors changes on signal circuit to determine fuel level. This information is sent to fuel gauge.

If PCM senses fuel level signal voltage greater than 2.9 volts, DTC P0463 sets.

DTC will set when following conditions are present:

- Fuel level sensor voltage is greater than 2.9 volts.
- Condition present for 6 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P1639. If DTC P1639 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.
3. Using scan tool, read fuel level sensor voltage. If voltage is greater than 2.9 volts, go to step 5). If voltage is not as specified, go to next step.
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 DTC P0463. 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. Disconnect fuel level sensor connector. Connect a fused jumper wire between fuel level sensor connector signal and ground circuits. If voltage is greater than 2.9 volts, go to step 10). If voltage is not as specified, go to next step.
6. Connect jumper wire between ground and fuel level sensor connector signal circuit. If voltage is greater than 2.9 volts, go to step 9). If voltage is not as specified, go to next step.

7. Turn ignition off. Disconnect PCM connector. Check fuel level sensor signal circuit for open. If circuit is open, go to next step. If circuit is okay, go to step 12).
8. Repair fuel level sensor signal circuit as necessary. After repair, go to step 13).
9. Turn ignition off. Disconnect PCM connector. Check fuel level sensor ground circuit for open. If circuit is open, go to step 11). If circuit is okay, go to step 12).
10. Replace fuel level sensor. After replacing sensor, go to step 13).
11. Repair fuel level sensor ground circuit as necessary. After repair, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0463. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0480 - COOLING FAN RELAY NO. 1 CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to cooling fan relay coil. PCM controls relay by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage between 6-16 volts.

- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command cooling fan relay No. 1 on and off. If relay turns on and off as commanded, go to next step. If relay does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM connector. Turn ignition on. Using a DVOM set to 10-amp scale, check current from relay control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not as specified, go to next step.
4. Turn ignition off. Disconnect cooling fan relay No. 1. Check resistance from relay control circuit in PCM harness connector to ground. If resistance is infinite, go to step 12). If resistance is not infinite, go to step 10).
5. Turn ignition off. Disconnect cooling fan relay No. 1. Connect test light between relay coil terminals in relay harness connector. Turn ignition on. Using scan tool, command relay on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light to ground and probe ignition feed circuit in cooling fan relay No. 1 harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
7. Turn ignition off. Reconnect cooling fan relay No. 1. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Connect a fused jumper wire between to ground and PCM connector (harness side), relay control circuit. If relay operates, go to step 9). If relay does not operate, go to step 10).
8. Check connections at cooling fan relay No. 1. Repair as necessary. After repairs, go to step 14). If relay connection is okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty cooling fan relay No. 1 control circuit. After repairs, go to step 14).
11. Repair faulty cooling fan relay No. 1 ignition feed circuit. After repairs, go to step 14).
12. Replace cooling fan relay No. 1. After replacing relay, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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 DTC P0480. 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).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0481 - COOLING FAN RELAY NO. 2 & 3 CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to cooling fan relay coil. PCM controls relay by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage between 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If complaint is that fans are on all time, go to next step. If complaint is not that fans are on all time, go to step 4).
3. Turn ignition off. Disconnect PCM connector. Turn ignition on. If fans are on, go to step 7). If fans are not on, go to step 10).
4. Turn ignition off. Remove cooling fan relays No. 2 and 3. Connect a test light between ground and relay No. 2 coil terminal in relay harness connector. If test light illuminates, go to step 8). If test light does not illuminate, go to next step.
5. Turn ignition off. Reinstall both relays. Disconnect PCM connector. Connect test light between ground and relay No. 2 and 3 control circuit at PCM connector. If test light illuminates, go to step 9). If test light does not illuminate, go to next step.
6. Repair open circuit between PCM and splice. After repair, go to step 11).

7. Repair short to ground in relay No. 2 and 3 control circuit. After repair, go to step 11).
8. Repair short to battery voltage in relay No. 2 and 3 control circuit. After repair, go to step 11).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 11). If connections are okay, go to next step.
10. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
11. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0481. 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).
12. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0500 - VEHICLE SPEED SENSOR CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

A toothed wheel mounted on output shaft of transmission generates an AC voltage pulse as it moves past Vehicle Speed Sensor (VSS). VSS contains a permanent magnet surrounded by a coil of wire, which produces a magnetic field. As toothed ring interrupts magnetic field, an AC pulse is generated. As vehicle speed increases, AC voltage pulse also increases.

DTC will set when following conditions are present:

- DTCs P0107, P0108, P0117, P0118, P0121, P0122, P0123, P0125, P0506 and P0507, P1120, P1220 or P1221 not set.
- Engine coolant temperature greater than 95°F (35°C).
- Engine speed greater than 1000 RPM.
- TP sensor angle greater than 10 percent.
- MAP between 40-100 kPa with A/C off.
- MAP between 45-100 kPa with A/C on.
- Conditions met for 2 seconds.
- PCM detects vehicle speed at zero MPH for 50 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

CAUTION: On vehicles with independent suspension, support lower control arms so drive axles are in normal horizontal position or drive axles will be damaged.

2. Turn ignition off. Raise and support drive axles. Disable ASR/TCS system (if equipped). Start engine. With engine at idle, place transmission in gear. Using scan tool, monitor vehicle speed. If displayed vehicle speed is more than zero, see DIAGNOSTIC AIDS. If displayed vehicle speed is zero MPH, go to next step.
3. Turn ignition off. Disconnect VSS harness connector. Connect Signal Generator Tester (J 33431-B) to VSS harness. Turn ignition on. Set tester to generate VSS signal. Using scan tool, monitor displayed vehicle speed. If displayed vehicle speed is greater than zero MPH, go to next step. If displayed vehicle speed is zero MPH, go to step 5).
4. Replace faulty VSS harness connector or faulty VSS. After repairs, go to step 12).
5. Using DVOM, check voltage between VSS signal circuit to chassis ground. If voltage reading is about 5 volts, go to next step. If voltage reading is not about 5 volts, go to step 9).
6. Using DVOM, check voltage between VSS signal circuit to VSS ground circuit. If voltage reading is about 5 volts, go to next step. If voltage reading is not about 5 volts, go to step 10).
7. Check vehicle calibration code. If calibration is correct, go to next step. If calibration is incorrect, go to step 11).
8. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to step 12).
9. Repair signal circuit to VSS. After repairs, go to step 12).
10. Repair ground circuit to VSS. After repairs, go to step 12).
11. Install proper or most current calibration code. After entering calibration code, 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 DTC P0500. 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.

Diagnostic Aids

If all circuits to PCM and VSS have been thoroughly checked, check terminal connections at VSS harness connector and at PCM harness connector. If terminals and connectors are okay, replace PCM.

DTC P0506 - IDLE SYSTEM LOW

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Idle Air Control (IAC) valve is controlled by PCM. PCM uses IAC to maintain a desired idle speed, which can vary depending on input to PCM and other criteria. If PCM detects that idle speed is out of IAC systems range of control at idle, it will perform an active test while vehicle is being driven.

During this test, PCM will command IAC valve to move while monitoring MAF. If expected change in MAF is detected, and IAC operation is verified, but since idle RPM is out of IAC system control and IAC valve is working, DTC P0506 will set. DTC P1508 will set, when there is no change in MAF, and IAC valve is functional, but idle RPM is out of IAC system control.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0171, P0172, P0174, P0175, P0300, P0401, P0404, P0405, P0443, P0500, P0501, P0502, P0503 or P1441 not set.
- Engine running greater than 60 seconds.
- Engine coolant temperature greater than 140°F (60°C).
- IAT greater than 14°F (-10°C).
- BARO greater than 65 kPa.
- Ignition voltage 9-17 volts.
- Vehicle speed less than one MPH.
- Actual idle speed is 100 RPM less than desired idle speed.
- Above conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start engine. Using scan tool, command RPM from 500 RPM up to 1500 RPM, then 1500 RPM to 500 RPM. Repeat 2 times and exit from test. If RPM 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 RPM is too high (greater than 100 RPM), go to next step. If RPM does not change significantly, go to step 5).
4. Check for vacuum leaks, throttle plates not closing properly or for 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, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0506. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0507 - IDLE SPEED HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Idle Air Control (IAC) valve is controlled by PCM. PCM uses IAC to maintain a desired idle speed, which can vary depending on input to PCM and other criteria. If PCM detects that idle speed is out of IAC systems range of control at idle, it will perform an active test while vehicle is being driven.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0171, P0172, P0174, P0175, P0300, P0401, P0404, P0405, P0441, P0443, P0500, P0501, P0502, P0503, P1120, P1220, P1221 or P1441 not set.
- Engine running greater than 60 seconds.
- Engine coolant temperature greater than 140°F (60°C).
- IAT greater than 14°F (-10°C).
- BARO greater than 65 kPa.
- Ignition voltage between 9-17 volts.
- Vehicle speed not greater than one MPH.
- APP indicated angle zero percent.
- Actual idle speed is 200 RPM greater than desired idle speed.
- Conditions present for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start engine. Using scan tool, command RPM from about 500 to 1500 RPM. Repeat 2 times and exit from test. If RPM 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 RPM is too high (greater than 100 RPM), go to next step. If RPM does not change significantly, go to step 5).
4. Check for vacuum leaks, throttle plates not closing properly or for 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, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0507. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0522 - ENGINE OIL PRESSURE SENSOR CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Test Description

Engine oil pressure sensor is mounted on top rear of engine. Sensor measures changes in engine oil pressure. Sensor has a 5-volt reference, ground and signal circuit. Sensor changes resistance based on engine oil pressure. When PCM senses a signal voltage lower than the normal operating range of the sensor (.48 volt), DTC will set.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION under DTC STATUS for DTC P1635. If scan tool indicates that DTC P1635 failed in this ignition cycle, diagnose DTC P1635 first. If scan tool does not indicate that DTC P1635 failed this ignition cycle, go to next step.
3. Using scan tool, monitor engine oil pressure voltage at idle. If voltage is less than .48 volt, go to step 5). If voltage is not less than .48 volt, go to next step.
4. Turn ignition on, with engine off. Review FREEZE FRAME data and note parameters. Operate vehicle within FREEZE FRAME parameters. If test indicates that this test failed this ignition cycle while operating vehicle, go to next step. If test does not indicate that this test failed this ignition cycle, see DIAGNOSTIC AIDS.
5. Disconnect engine oil pressure sensor harness connector. Jumper sensor 5-volt reference circuit and signal circuit at harness connector. Observe engine oil pressure voltage on scan tool. If voltage is about 5 volts, go to step 11). If voltage is not about 5 volts, go to next step.
6. Connect test light between battery voltage and sensor signal circuit at harness connector. Observe sensor voltage on scan tool. If voltage reading is 5 volts, go to next step. If voltage reading is not 5 volts, go to

step 9).

7. Turn ignition off. Disconnect PCM harness connector. Check oil pressure sensor 5-volt reference circuit for open or short to ground. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to next step.
8. Check 5-volt reference circuit at PCM connector for poor connection. Repair as necessary. After repairs, go to step 13). If connection is okay, go to step 12).
9. Turn ignition off. Disconnect PCM harness connector. Check oil pressure sensor signal circuit for open, or short to ground. Repair as necessary. After repairs, go to step 13). If circuit is okay, go to next step.
10. Check engine oil pressure sensor signal circuit for poor connection at PCM. Repair as necessary. After repairs, go to step 13). If connection is okay, go to step 12).
11. Perform engine oil pressure check. Repair as necessary. If oil pressure is okay, replace engine oil pressure sensor. After replacing sensor, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter DTC P0507. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
14. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for misrouted harness, rubbed through wire insulation or broken wire inside insulation. Ensure connectors are tight and clean.

DTC P0523 - ENGINE OIL PRESSURE SENSOR CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Test Description

Engine oil pressure sensor is mounted on top rear of engine. Sensor measures changes in engine oil pressure. Sensor has a 5-volt reference, ground and signal circuit. Sensor changes resistance based on engine oil pressure. When PCM senses a signal voltage high than the normal operating range of the sensor (4.5 volts), DTC will set.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION under DTC STATUS for DTC P1635. If scan tool indicates that DTC P1635 failed in this ignition cycle, diagnose DTC P1635 first. If scan tool does not indicate that DTC P1635 failed this ignition cycle, go to next step.
3. Using scan tool, monitor engine oil pressure voltage at idle. If voltage is greater than 4.5 volts, go to step

5). If voltage is not greater than 4.5 volts, go to next step.

4. Turn ignition on, with engine off. Review FREEZE FRAME data and note parameters. Operate vehicle within FREEZE FRAME parameters. If test indicates that this test failed this ignition cycle while operating vehicle, go to next step. If test does not indicate that this test failed this ignition cycle, see DIAGNOSTIC AIDS.
5. Disconnect engine oil pressure sensor harness connector. Observe engine oil pressure voltage on scan tool. If voltage is less than one volt, go to next step. If voltage is not less than one volt, go to step 7).
6. Connect test light between battery voltage and sensor ground circuit at harness connector. If test light illuminates, go to step 8). If test light does not illuminate, go to step 9).
7. Check engine oil pressure sensor signal circuit for short to voltage or short to 5-volt reference circuit. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to step 11).
8. Check voltage between ground and 5-volt reference circuit. If voltage reading is greater than 5 volts, go to step 13). If voltage reading is not greater than 5 volts, go to next step.
9. Check for poor sensor ground connection to PCM connector. Repair as necessary. After repairs, go to step 14). If connection is okay, go to next step.
10. Check continuity of engine oil pressure sensor ground circuit. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to next step.
11. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 14).
12. Perform engine oil pressure check. Repair as necessary. If oil pressure is okay, replace engine oil pressure sensor. After replacing sensor or if sensor is okay, go to step 14).
13. Repair 5-volt reference circuit for short to voltage. After repairs, go to next step.
14. Using scan tool, select DTC, CLEAR INFO function. Start engine and allow it to reach operating temperature. Using scan tool, select DTC, SPECIFIC function and enter this DTC. Operate vehicle within conditions required to set DTC. If scan tool displays RAN AND PASSED, go to next step. If scan tool does not display RAN AND PASSED, return to step 2).
15. Using scan tool, select Read and Record INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs. If no DTCs are displayed, system is okay.

Diagnostic Aids

Check for misrouted harness, rubbed through wire insulation or broken wire inside insulation. Ensure connectors are tight and clean.

DTC P0530 - A/C REFRIGERANT PRESSURE SENSOR CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

A/C refrigerant pressure sensor is located on high side of A/C system and is used to monitor refrigerant pressure. 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. When pressures are out of range (high or low) for a predetermined time, PCM will disable A/C compressor clutch and set DTC.

DTC will set when following conditions are present:

- A/C refrigerant pressure sensor indicates A/C refrigerant pressure is less than -8 psi for 5 seconds.
- A/C refrigerant pressure sensor indicates A/C refrigerant pressure is greater than 448 psi for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine at idle. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P1635. If DTC P1635 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.
3. Turn ignition on, with engine on. Using scan tool, monitor A/C high side. If A/C high side voltage is 0.1-1.8 volts, go to next step. If A/C high side voltage is not 0.1-1.8 volts, go to step 5).
4. Turn ignition on, with engine off. Review FREEZE FRAME data and note parameters. Operate vehicle within FREEZE FRAME parameters. If test indicates that this test failed this ignition cycle while operating vehicle, go to next step. If test does not indicate that this test failed this ignition cycle, see DIAGNOSTIC AIDS.
5. Disconnect A/C refrigerant pressure sensor harness connector. If scan tool indicates that A/C high side voltage is less than one volt, go to next step. If A/C high side voltage is not less than one volt, go to step 10).
6. Using DVOM, check voltage between A/C refrigerant pressure sensor 5-volt reference circuit and battery ground. If voltage is about 5 volts, go to next step. If voltage is not about 5 volts, go to step 11).
7. Using DVOM, check voltage between A/C refrigerant pressure sensor 5-volt reference circuit and sensor ground. If voltage is about 5 volts, go to next step. If voltage is not about 5 volts, go to step 12).
8. Connect a fused jumper wire between A/C refrigerant pressure sensor 5-volt reference circuit to sensor signal ground. Scan tool should read about 5 volts. If voltage is as specified, go to next step. If voltage is not as specified, go to step 13).
9. Repair faulty A/C refrigerant pressure sensor connection or replace faulty sensor. After repairs, go to step 14).
10. Repair short to voltage in A/C refrigerant pressure sensor signal circuit. After repairs, go to step 14).
11. Repair 5-volt reference circuit to pressure sensor. After repairs, go to step 14).
12. Repair ground circuit to pressure sensor. After repairs, go to step 14).
13. Repair signal circuit to pressure sensor. 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 DTC P0530. 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).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are

displayed, go to applicable DTC test.

Diagnostic Aids

If test failed on this ignition cycle, wiggle related electrical harness connectors while monitoring scan tool. Repair as necessary.

DTC P0562 - SYSTEM VOLTAGE LOW

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM continuously monitor system voltage. System voltage information is taken from PCM's ignition feed circuits. Since voltages of less than 8 volts or more than 17.1 volts could cause improper system operation and/or component damage, PCM will operate in default mode if DTC is set.

If system voltage is too low, PCM will raise idle speed to increase generator output. If system voltage is too high, PCM disables most outputs to protect hardware. class 2 serial data is shut down when system voltage is less than 9.2 volts or more than 16 volts. Scan tool will display data if system voltage is outside this range. DVOM should be used to monitor system voltage when checking if fault is currently present.

DTC will set when following conditions are present:

- Engine running longer than 10 seconds.
- Engine speed greater than 1000 RPM.
- Vehicle speed greater than 5 MPH.
- PCM senses system voltage less than 8 volts.
- Conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start engine. Turn on headlights and blower fan to high, to load electrical system. Using DVOM, check battery voltage at battery. If battery voltage is less than 8 volts, check/diagnose charging system. If battery voltage is not less than 8 volts, go to next step.
3. Turn ignition off. Disconnect PCM connector. Turn ignition on. Using DVOM, check voltage at PCM ignition feed terminal. If voltage is less than 8 volts, go to step 7). If voltage is not less than 8 volts, go to next step.
4. Check for faulty connections at PCM. Repair as necessary. After repairs, go to step 8). If connections are okay, go to next step.
5. Turn ignition off. Reconnect PCM connector. Turn ignition on. Using scan tool, select ENG DTC, DTC INFO unction. If any DTCs are displayed, diagnose affected DTC(s) first. If DTCs are not present, go to next step.

6. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 8).
7. Repair ignition feed circuit to PCM as necessary. After repairs, go to next step.
8. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0562. 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An extremely low system voltage (less than 7 volts) may cause loss of serial data and MIL may not activate. An open ignition feed circuit will cause a no-start and MIL will not illuminate. Low system voltage may cause DTC to set.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0563 - SYSTEM VOLTAGE HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM continuously monitor system voltage. System voltage information is taken from PCM's ignition feed circuits. Since voltages of less than 8 volts or more than 17.1 volts could cause improper system operation and/or component damage, PCM will operate in default mode if DTC is set.

If system voltage is too low, PCM will raise idle speed to increase generator output. If system voltage is too high, PCM disables most outputs to protect hardware. class 2 serial data is shut down when system voltage is less than 9.2 volts or more than 16 volts. Scan tool will display data if system voltage is outside this range. DVOM should be used to monitor system voltage when checking if fault is currently present.

DTC will set when following conditions are present:

- Engine running.
- PCM senses system voltage greater than 17.1 volts.
- Conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next

step.

2. Turn off all accessories. Start and operate engine at greater than 2000 RPM. Using DVOM, check battery voltage at battery. If battery voltage is less than 17.1 volts, see DIAGNOSTIC AIDS. If battery voltage is not less than 17.1 volts, go to next step.
3. Repair charging system. After repairs, go to next step.
4. 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).
5. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check generator voltage sense circuit for high resistance or loose connections, causing intermittent overcharging condition.

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0567 - CRUISE RESUME CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Cruise RESUME/ACCEL circuit is an input to Throttle Actuator Control (TAC) module. This input allows TAC module to control and hold a requested speed. Cruise RESUME/ACCEL switch sends ignition voltage to TAC module when switch is closed (ON). If TAC module senses voltage on this circuit when it is not expected, this DTC will set.

DTC will set when following conditions are present:

- Cruise switch on.
- Resume/Accel switch on longer than 90 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Using scan tool, read cruise RESUME/ACCEL switch status. Turn ignition on, with engine off. Turn cruise switch on. If scan tool displays ON, go to next step. If scan tool does not display ON, see

DIAGNOSTIC AIDS.

3. Turn ignition off. Disconnect TAC module connector. Turn ignition on. Using appropriate jumpers from Connector Kit (J 35616-A) and a test light, front probe TAC module connector (harness side), RESUME/ACCEL switch signal circuit to ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 5).
4. Repair short to voltage in RESUME/ACCEL switch signal circuit. After repair, go to step 6).
5. Replace TAC module and go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0567. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for stuck RESUME/ACCEL switch or signal circuit shorted to voltage. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0568 - CRUISE SET CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Cruise SET/COAST circuit is an input to Throttle Actuator Control (TAC) module. This input allows TAC module to control and hold a requested speed. Cruise SET/COAST switch sends ignition voltage to TAC module when switch is closed (ON). If TAC module senses voltage on this circuit when it is not expected, this DTC will set.

DTC will set when following conditions are present:

- Cruise switch on.
- Set/Coast switch on longer than 90 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Using scan tool, read cruise SET/COAST switch status. Turn ignition on, with engine off. Turn cruise switch on. If scan tool displays ON, go to next step. If scan tool does not display ON, see DIAGNOSTIC

AIDS.

3. Turn ignition off. Disconnect TAC module connector. Turn ignition on. Using appropriate jumpers from Connector Kit (J 35616-A) and a test light, front probe TAC module connector (harness side), SET/COAST switch signal circuit to ground. If test light illuminates, go to next step. If test light does not illuminate, go to step 5).
4. Repair short to voltage in SET/COAST switch signal circuit. After repair, go to step 6).
5. Replace TAC module and go to next step.
6. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0568. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for stuck SET/COAST switch or signal circuit shorted to voltage. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0571 - CRUISE BRAKE SWITCH CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Cruise Control (CC) brake switch is a normally closed switch. When CC brake switch is closed, PCM senses ignition voltage on CC brake switch signal circuit. DTC P0751 sets if PCM senses CC brake switch signal circuit voltage when CC brake switch should be open.

DTC will set when following conditions are present:

- Engine speed greater than 700 RPM.
- Engine operating more than 2 seconds.
- Wheel speed greater than 30 MPH to enable diagnostic. Diagnostic will be disabled at less than 10 MPH.
- PCM detects voltage on cruise control brake switch circuit when cruise control brake switch should be open.
- Conditions met for 1.5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Using scan tool, read CC brake switch status. Depress brake pedal about 1/4 way down. If scan tool displays APPLIED, see DIAGNOSTIC AIDS. If scan tool does not display APPLIED, go to next step.
3. Check CC brake switch adjustment. Adjust if necessary. After adjustment, go to step 9). If adjustment is okay, go to next step.
4. Turn ignition off. Disconnect CC brake switch connector. Turn ignition on. Using scan tool, read CC brake switch status. If scan tool displays APPLIED, go to next step. If scan tool does not display APPLIED, go to step 8).
5. Turn ignition off. Disconnect PCM connector. Turn ignition on. Install Brown connector from Connector Kit (J 35616-A) into CC brake switch signal circuit at PCM connector (harness side). Using a DVOM, check voltage on CC brake switch signal circuit. If voltage is greater than .5 volt, go to next step. If voltage is not greater than .5 volt, go to step 8).
6. Repair short to voltage in brake switch signal circuit. After repairs, go to step 9).
7. Replace CC brake switch. After replacing switch, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0571. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

If no problem can be found with ignition feed circuit to CC brake switch, inspect IGN 1 mini relay for proper operation. Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0601 - PCM MEMORY

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM EEPROM contains data which is essential to running engine and transmission. PCM continuously checks integrity of this data.

DTC will set when following conditions are present:

- Ignition switch in CRANK or RUN position.
- PCM is powered up.
- PCM unable to correctly read data from flash memory.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
3. 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).
4. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Replace PCM even if DTC only exists as a history code.

DTC P0602 - PCM NOT PROGRAMMED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This DTC indicates that PCM's internal EEPROM has not been flashed with any vehicle software. If a replacement PCM is installed and not flashed, engine will not run. This DTC is used to indicate that engine cranks, but will not run due to an unflashed PCM.

DTC will set when following conditions are present:

- Ignition switch in RUN position.
- PCM is powered up.
- No software data is present in PCM.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Flash PCM with current software. If DTC is reset, go to next step. If DTC does not reset, go to step 5).
3. Verify that test equipment used is operating properly and that all connections are clean and tight. Attempt to flash PCM again. If DTC resets, go to next step. If DTC does not reset, go to step 5).

4. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
5. 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).
6. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

DTC P0604 - PCM RAM PERFORMANCE

Circuit Description

PCM performs an internal self-test on its Random Access Memory (RAM) or read/write memory. If this self-test fails, this DTC will set.

Conditions for setting this DTC:

- Ignition voltage greater than 10 volts.
- Ignition on for 5 seconds.
- PCM is powered up.
- PCM detects an internal microprocessor integrity fault or internal RAM test fails.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
3. 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).
4. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

DTC P0606 - PCM INTERNAL COMMUNICATION INTERRUPTED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This DTC indicates that PCM has detected an internal microprocessor integrity fault.

DTC will set when following conditions are present:

- PCM is powered up.
- PCM detected an internal microprocessor integrity fault.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
3. 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).
4. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

DTC P0608 - VSS OUTPUT CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Voltage is supplied to Vehicle Speed Sensor (VSS) output circuit by various components which use VSS data. PCM creates VSS output signal by rapidly grounding this circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage between 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

CAUTION: Support lower control arms so drive axles are in normal horizontal position, or drive axles will be damaged.

2. Turn ignition off. Raise and support drive wheels. Start engine. Disable ASR/TCS systems (if equipped). Place gear selector into gear. If speedometer indicates any speed, see DIAGNOSTIC AIDS. If speedometer does not indicate any speed, go to next step.
3. Install Signal Generator Tester (J 33431-B) between ground and PCM harness connector, VSS output circuit. Turn ignition on. Turn tester on and set to generate a vehicle speed signal. If speedometer indicates any speed, go to next step. If speedometer does not indicate any vehicle speed, check and repair circuits and connectors between PCM, electronic suspension control module (if equipped) and instrument cluster. If circuits and connections are okay, replace instrument cluster.
4. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 6). If connection or terminal tension is okay, go to next step.
5. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
6. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0650 - MIL CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Voltage is supplied directly to Malfunction Indicator Light (MIL). PCM controls MIL signal by grounding this circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

DTC will set when following conditions are present:

- Engine speed greater than 600 RPM.
- Ignition voltage between 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command MIL on and off. If MIL turns on and off as commanded, see DIAGNOSTIC AIDS. If MIL does not turn on or off when commanded, go to next step.
3. Turn ignition off. Disconnect PCM harness connector containing MIL control circuit. Turn ignition on. If MIL is off, go to next step. If MIL is on, go to step 5).
4. Connect a fused jumper wire between ground and MIL control circuit at PCM connector (harness side). If MIL is on, go to step 6). If MIL is not on, go to step 7).
5. Repair short to ground in MIL control circuit. After repairs, go to step 9).
6. Check connections at PCM. Repair as necessary. After repairs, go to step 9). If connections are okay, go to step 8).
7. Check for faulty MIL bulb, open ignition feed circuit to bulb, or MIL control circuit open or shorted to battery voltage. Repair as necessary. After repairs, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
9. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

If ignition feed circuit is suspected of being open, check if other bulbs on this circuit illuminate. Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0654 - ENGINE SPEED OUTPUT CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Voltage is supplied directly to engine speed output circuit. PCM creates engine speed output signal by rapidly grounding this circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

Conditions for setting DTC:

- Engine speed greater than 600 RPM.
- Ignition voltage between 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. With engine running, if vehicle tachometer indicates engine speed (RPM), see DIAGNOSTIC AIDS. If no engine RPM is indicated, go to next step.
3. Turn ignition off. Disconnect PCM connector. Install Signal Generator Tester (J 33431-B) between ground and PCM harness connector, engine speed output circuit. Turn ignition on. Turn tester on and set to generate a vehicle speed signal. If tachometer indicates any RPM, go to next step. If tachometer does not indicate any RPM, check and repair circuits and connectors between PCM and instrument cluster. If circuits and connections are okay, replace instrument cluster.
4. Check for poor connections/terminal tension at PCM connector. Repair as necessary. After repairs, go to step 6). If connection or terminal tension is okay, go to next step.
5. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
6. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be

used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0704 - CLUTCH SWITCH CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Clutch switch is a normally closed switch. When switch is closed, ignition voltage is sent to PCM. When switch is open, voltage input to PCM should go low. This diagnostic determines if clutch switch has failed by looking for clutch switch transition within a range from zero MPH to some higher speed.

DTC will set when following conditions are present:

- No VSS DTCs set.
- Vehicle speed goes from zero MPH to greater than 24 MPH and back to zero MPH for 2 seconds without PCM detecting a clutch transition. This must occur 7 times before diagnostic will report a fault.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Using scan tool, read clutch switch status. Turn ignition on, with engine off. Engage and release clutch pedal several times. If scan tool display changes when clutch is engaged and released, see DIAGNOSTIC AIDS. If scan tool display does not change, go to next step.
3. Check clutch switch adjustment. Adjust if necessary. After adjustment, go to step 15). If adjustment is okay, go to next step.
4. Turn ignition off. Disconnect clutch switch connector. Connect a fused jumper wire between clutch switch connector, ignition feed and signal circuits. If scan tool displays RELEASED, go to next step. If scan tool does not display RELEASED, go to step 6).
5. Remove jumper wire. If scan tool displays APPLIED, go to step 8). If scan tool does not display APPLIED, go to step 7).
6. Connect a test light between ground and clutch switch connector, ignition feed circuit. If test light illuminates, go to step 9). If test light does not illuminate, go to step 10).
7. Check for short to battery voltage in clutch switch signal circuit. If short is found, go to step 13). If short is not found, go to step 14).
8. Check for poor connections/terminal tension at clutch switch connector. Repair as necessary. If problem is found, go to step 13). If connection or terminal tension is okay, go to step 11).
9. Check for open in clutch switch signal circuit. If circuit is open, go to step 13). If circuit is okay, go to step 12).
10. Repair open in clutch switch ignition feed circuit. After repair go to step 15).
11. Replace clutch switch. After replacing switch, go to step 15).
12. Check for poor connections/terminal tension at PCM connector. Repair as necessary. If problem is found,

go to next step. If connection or terminal tension is okay, go to step 14).

13. Repair as necessary. After repairs, go to step 15).
14. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
15. 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).
16. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check harness connector terminals for poor connection, improper contact, poor terminals, rubbed-through wire insulation, broken wire inside insulation or misrouted harness. Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0705 - TRANSMISSION RANGE SWITCH CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Transaxle Range Switch (TRS) is part of Park/Neutral Position (PNP) switch. Combination of 4 TRS input states determine PCM commanded shift pattern. A problem which causes PCM to detect an invalid transaxle range input combination will set DTC P0705.

Conditions for setting DTC:

- System voltage greater than 8 volts.
- TRS inputs indicate an invalid combination for more than 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: Ensure PNP switch and shift cable/lever are properly adjusted before proceeding.

2. Turn ignition on, with engine off. Using scan tool, monitor PRND ABCP display while placing gear

selector in each gear position. If scan tool displays INVALID in any range, go to next step. If scan tool does not display INVALID in any range, see DIAGNOSTIC AIDS.

3. Compare scan tool display for each gear position with TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS table. If scan tool displays all circuits as OFF, go to next step. If scan tool does not display all circuits as OFF, go to step 5).

TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS

Gear Selector Position	(1) Scan Tool PRND ABCP Display
Park (P)	A=O B=X C=X P=O
Reverse (R)	A=O B=O C=X P=X
Neutral (N)	A=X B=O C=X P=O
Drive 4 (OD)	A=X B=O C=O P=X
Drive 3 (3)	A=O B=O C=O P=0
Drive 2 (2)	A=O B=X C=O P=X
Drive 1 (1)	A=X B=X C=O P=0

(1) O equals ON, X equals OFF.

4. Check for open or poor connection in PNP switch ground circuit. If problem is found, go to step 10). If no problem is found, go to next step.
5. Move gear selector through all ranges and note which circuit does not correspond with TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS table. Disconnect TRS connector. Connect a fused jumper wire between ground and circuit with incorrect value. If jumpered circuit status changes, go to step 8). If jumpered circuit status does not change, go to next step.
6. Check affected circuit for an open or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
7. Check for poor connection at PCM connector. Repair as necessary. After repairs, go to step 10). If connection is okay, go to step 9).
8. Replace PNP switch and go to step 10).
9. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed through wire insulation or broken wire inside insulation. Monitor scan tool while moving related connectors and wiring harness. Whenever a fault is detected, scan data will change from ON to OFF or from OFF to ON. Moving gear selector slowly through each gear while monitoring scan tool may also help isolate problem.

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0706 - TRANSMISSION RANGE SWITCH PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Transaxle Range Switch (TRS) is part of Park/Neutral Position (PNP) switch. Combination of 4 TRS input states determine PCM commanded shift pattern. A problem which causes PCM to detect an invalid transaxle range input combination will set DTC P0706.

Conditions for setting DTC:

- System voltage is greater than 8 volts.
- PCM detects TRS indicates a range other than Park or Neutral when engine is started.
- Diagnostic fails 2 out of 4 tests.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: Ensure PNP switch and shift cable/lever are properly adjusted before proceeding.

2. Turn ignition on, engine off. Using scan tool, monitor PRND ABCP display while placing gear selector in each gear position. If scan tool displays INVALID in any range, go to next step. If scan tool does not display INVALID in any range, see DIAGNOSTIC AIDS.
3. Compare scan tool display for each gear position with TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS table. If scan tool displays all circuits as OFF, go to next step. If scan tool does not display all circuits as OFF, go to step 5).

TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS

Gear Selector Position	(1) Scan Tool PRND ABCP Display
Park (P)	A=O B=X C=X P=O
Reverse (R)	A=O B=O C=X P=X
Neutral (N)	A=X B=O C=X P=O
Drive 4 (OD)	A=X B=O C=O P=X
Drive 3 (3)	A=O B=O C=O P=0

Drive 2 (2)	A=O B=X C=O P=X
Drive 1 (1)	A=X B=X C=O P=0
(1) O equals ON, X equals OFF.	

4. Check for open or poor connection in PNP switch ground circuit. If problem is found, go to step 10). If no problem is found, go to next step.
5. Move gear selector through all ranges and note which circuit does not correspond with TRANSAXLE RANGE SWITCH VALID INPUT COMBINATIONS table. Disconnect TRS connector. Connect a fused jumper wire between ground and circuit with incorrect value. If jumpered circuit status changes, go to step 8). If jumpered circuit status does not change, go to next step.
6. Check affected circuit for an open or short to ground. Repair as necessary. After repairs, go to step 10). If circuit is okay, go to next step.
7. Check for poor connection at PCM connector. Repair as necessary. After repairs, go to step 10). If connection is okay, go to step 9).
8. Replace PNP switch and go to step 10).
9. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
10. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P0706. 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).
11. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed through wire insulation or broken wire inside insulation. Monitor scan tool while moving related connectors and wiring harness. Whenever a fault is detected, scan data will change from ON to OFF or from OFF to ON. Moving gear selector slowly through each gear while monitoring scan tool may also help isolate problem.

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0801 - REVERSE INHIBIT SOLENOID CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to Reverse Inhibit (RI) solenoid. PCM controls solenoid by grounding

control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

Conditions for setting DTC:

- Engine speed greater than 600 RPM.
- Ignition voltage 6-16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command RI solenoid on and off. If solenoid turns on and off as commanded, go to next step. If solenoid does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM harness connector containing solenoid control circuit. Turn ignition on. Using a DVOM set to 10-amp scale, check current from solenoid control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not less than .75 amp, go to next step.
4. Turn ignition off. Disconnect RI solenoid harness connector. Check resistance from solenoid control circuit in PCM harness connector to ground. If resistance is infinite, go to step 12). If resistance is not infinite, go to step 10).
5. Turn ignition off. Disconnect RI solenoid connector. Connect test light between terminals in solenoid harness connector. Turn ignition on. Using scan tool, command solenoid on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light to ground and probe ignition feed circuit in RI solenoid harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
7. Turn ignition off. Reconnect RI solenoid connector. Disconnect PCM harness connector containing solenoid control circuit. Turn ignition on. Connect a fused jumper wire between to ground and PCM harness side connector, solenoid control circuit. If solenoid operates, go to step 9). If solenoid does not operate, go to step 10).
8. Check connections at RI solenoid. Repair as necessary. After repairs, go to step 14). If solenoid connection is okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty RI solenoid control circuit. After repairs, go to step 14).

11. Repair faulty RI solenoid ignition feed circuit. After repairs, go to step 14).
12. Replace RI solenoid. After replacing solenoid, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0803 - 1-4 UPSHIFT SOLENOID CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to 2nd gear blockout or skip shift solenoid coil. PCM controls solenoid by grounding control circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

Conditions for setting DTC:

- Engine speed greater than 600 RPM.
- Ignition voltage greater than 6 volts but less than 16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

2. Turn ignition on, with engine off. Using scan tool, command 1-4 upshift solenoid on and off. If solenoid turns on and off as commanded, go to next step. If solenoid does not turn on or off when commanded, go to step 5).
3. Turn ignition off. Disconnect PCM harness connector containing solenoid control circuit. Turn ignition on. Using a DVOM set to 10-amp scale, check current from solenoid control circuit in PCM harness connector to ground for 2 minutes. If current draw is less than .75 amp (but not zero), see DIAGNOSTIC AIDS. If current draw is not as specified, go to next step.
4. Turn ignition off. Disconnect solenoid connector. Check resistance between solenoid control circuit in PCM harness connector to ground. If resistance is infinite, go to step 12). If resistance reading is not infinite, go to step 10).
5. Turn ignition off. Disconnect solenoid connector. Connect test light between terminals in solenoid harness connector. Turn ignition on. Using scan tool, command solenoid on and off. If test light turns on and off with each command, go to step 8). If test light does not turn on and off with each command, go to next step.
6. Connect test light to ground and probe ignition feed circuit in solenoid harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 11).
7. Turn ignition off. Reconnect solenoid connector. Disconnect PCM harness connector containing solenoid control circuit. Turn ignition on. Connect a fused jumper wire between to ground and PCM connector (harness side), solenoid control circuit. If solenoid operates, go to step 9). If solenoid does not operate when energized, go to step 10).
8. Check connections at solenoid. Repair as necessary. After repairs, go to step 14). If solenoid connection is okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty solenoid control circuit. After repairs, go to step 14).
11. Repair faulty solenoid ignition feed circuit. After repairs are complete, go to step 14).
12. Replace solenoid. After replacing solenoid, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P0804 - 1-4 UPSHIFT LIGHT CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Voltage is supplied directly to skip 1-4 upshift light. PCM controls shift light signal by grounding this circuit through an internal switch called a driver. Primary function of 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 of control circuit should be low (near zero volts). When PCM is commanding control circuit to a component OFF, voltage potential of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other than what is expected, fault line status will change, causing DTC to set.

Conditions for setting DTC:

- Engine speed greater than 600 RPM.
- Ignition voltage greater than 6 volts but less than 16 volts.
- PCM detects commanded state of driver and actual state do not match.
- Conditions met for 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command 1-4 upshift light on and off. If light turns on and off as commanded, see DIAGNOSTIC AIDS. If light does not turn on or off when commanded, go to next step.
3. Turn ignition off. Disconnect PCM harness connector containing shift light control circuit. Turn ignition on. If shift light is off, go to next step. If shift light is on, go to step 5).
4. Connect a fused jumper wire between ground and shift light control circuit at PCM connector (harness side). If shift light is on, go to step 6). If shift light is not on, go to step 7).
5. Repair short to ground in shift light control circuit. After repairs, go to step 9).
6. Check connections at PCM. Repair as necessary. After repairs, go to step 9). If connections are okay, go to step 8).
7. Check for faulty shift light bulb, open ignition feed circuit to bulb, or shift light control circuit open or shorted to battery voltage. Repair as necessary. After repairs, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After repair is completed, go to next step.
9. 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).

10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORD data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many 1-4 upshift lights since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1111 - IAT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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). When signal voltage is higher than normal operating range, DTC will set.

Conditions for setting DTC:

- DTCs P0102, P0103, P0117, P0118, P0500, P0502 or P0503 not set.
- Engine operating more than 100 seconds.
- Engine coolant temperature greater than 32°F (0°C).
- IAT less than -31°F (-35°C).
- Vehicle speed less than 7 MPH.
- MAF less than 15 gm/s.
- Conditions met for 0.3 second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off, with engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P0113. If DTC P0113 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.

3. Turn ignition on, with engine off. Using scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). If sensor value changes while moving related harness connectors, go to step 6). If sensor value does not change while moving connectors, go to next step.
4. Using scan tool, observe affected sensor value while moving related wiring harnesses. If sensor value changes abruptly, go to step 7). If 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 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 DTC P1111. If scan tool indicates that this test failed this ignition, go to step 8). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
6. Repair damaged connectors or terminals. After repairs, go to step 9).
7. Repair faulty wiring. After repairs, go to step 9).
8. Reinspect all related circuits and connectors. If circuits are okay, replace sensor/component. After repairs, go to next step.
9. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

If other DTCs are present that share same ground and/or 5-volt reference circuit, check for faulty connections or faulty wiring. If engine has been allowed to sit overnight, engine coolant temperature (ECT) and intake air temperature (IAT) sensor values should display within a few degrees of each other. If temperature value is not within 5°F (3°C), see **IAT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P1112 - IAT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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). When PCM senses a signal voltage higher than normal operating range, DTC will set.

Conditions for setting DTC:

- DTCs P0102, P0103, P0117, P0118, P0500, P0502 or P0503 not set.
- Engine operating more than 30 seconds.
- Vehicle speed greater than 25 MPH.
- IAT greater than 282°F (139°C).
- Conditions met for .3 second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off, with engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P0112. If DTC P0112 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.
3. Turn ignition on, with engine off. Using scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). If sensor value changes while moving connectors, go to step 6). If sensor value does not change while moving connectors, go to next step.
4. Using scan tool, observe affected sensor value while moving related wiring harnesses. If sensor value changes abruptly, go to step 7). If 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 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 step 8). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
6. Repair damaged connectors or terminals. After repairs, go to step 9).
7. Repair faulty wiring. After repairs, go to step 9).
8. Reinspect all related circuits and connectors. If circuits are okay, replace sensor/component. After repairs, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1112. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

If other DTCs are present that share same ground and/or 5-volt reference circuit, check for faulty connections or faulty wiring. If engine has been allowed to sit overnight, engine coolant temperature (ECT) and intake air temperature (IAT) sensor values should display within a few degrees of each other. If temperature value is not within 5°F (3°C), see **IAT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P1114 - ECT SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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). When PCM senses a signal voltage higher than normal operating range (1.5-2.0 volts), DTC will set.

Conditions for setting DTC:

- Engine operating more than 10 seconds.
- PCM indicates ECT is greater than 282°F (139°C).

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off, with engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P0118. If DTC P0118 failed this ignition cycle, diagnose DTC. If DTC does not fail this ignition, go to next step.
3. Turn ignition on, with engine off. Using scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). If sensor value changes while moving connectors at component and PCM, go to step 6). If sensor value does not change while moving connectors, go to next step.
4. Using scan tool, observe affected sensor value while moving related wiring harnesses. If sensor value changes abruptly, go to step 7). If 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 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 DTC P1114. If scan tool indicates that this test failed this ignition, go to step 8). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
6. Repair damaged connectors or terminals. After repairs, go to step 9).
7. Repair faulty wiring. After repairs, go to step 9).
8. Reinspect all related circuits and connectors. If circuits are okay, replace sensor/component. After repairs, go to next step.

9. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent DTC can be caused by Electromagnetic Interference (EMI). Inspect related circuits for being too close to secondary ignition wires and generator.

If other DTC's are present that share same ground and/or 5-volt reference circuit, check for faulty connections or faulty wiring.

If engine has been allowed to sit overnight, engine coolant temperature (ECT) and intake air temperature (IAT) sensor values should display within a few degrees of each other. If temperature value is not within 5°F (3°C), check for skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P1115 - ECT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Engine Coolant Temperature (ECT) sensor is a thermistor which changes resistance based on temperature. ECT sensor is located on front of left 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 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). When PCM senses a signal voltage higher than normal operating range (1.5-2.0 volts), DTC will set.

Conditions for setting DTC:

- Engine operating more than 60 seconds.
- PCM indicates ECT is less than -31°F (-35°C).

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off, with engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC status for DTC P0117. If DTC P0117 failed this ignition cycle, diagnose DTC. If DTC does not fail this

ignition, go to next step.

3. Turn ignition on, with engine off. Using scan tool, observe affected sensor value while moving related harness connectors (at component and PCM). If sensor value changes while moving/wiggling related connectors, go to step 6). If sensor value does not change while moving/wiggling connectors, go to next step.
4. Using scan tool, observe affected sensor value while moving related wiring harnesses. If sensor value changes abruptly, go to step 7). If 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 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 step 8). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
6. Repair damaged connectors or terminals. After repairs, go to step 9).
7. Repair faulty wiring. After repairs, go to step 9).
8. Reinspect all related circuits and connectors. If circuits are okay, replace sensor/component. After repairs, go to next step.
9. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1115. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent DTC can be caused by Electromagnetic Interference (EMI). Inspect related circuits for being too close to secondary ignition wires and generator.

If other DTC's that are present share same ground and/or 5-volt reference circuit, check for faulty connections or faulty wiring.

If engine has been allowed to sit overnight, engine coolant temperature (ECT) and intake air temperature (IAT) sensor values should display within a few degrees of each other. If temperature value is not within 5°F (3°C), check for a skewed ECT sensor. See **ECT TEMPERATURE-TO-RESISTANCE VALUES** table.

DTC P1120 - TP SENSOR NO. 1 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Throttle Position (TP) sensor is a potentiometer, mounted on side of Air Control Valve assembly (throttle Body). TP sensor is actually 2 sensors within one housing.

TP sensor No. 1 signal voltage increases as throttle opens from, less than 1.1 volt at zero percent throttle to more than 3.7 volts at 100 percent throttle. TP sensor No. 2 signal voltage decreases from more than 3.9 volts at zero percent throttle to less than 1.2 volt at 100 percent throttle.

Signal circuit for TP sensor No. 1 is pulled up to 5 volts and signal circuit for TP sensor No. 2 is pulled to ground through Throttle Actuator Control (TAC) module.

Conditions for setting DTC:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- TP sensor No. 1 voltage less than .13 volt or greater than 4.87 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P1515 or P1516 is also present, diagnose affected DTC first. If DTCs are not present, go to next step.

NOTE: Disconnecting throttle actuator motor will cause additional DTCs to set.

3. Remove duct from throttle Body assembly. Disconnect throttle actuator motor connector. Manually close throttle blade while monitoring scan tool TP SENSOR NO. 1 voltage display. If voltage is .13-.67 volt, go to next step. If voltage is not as specified, go to step 7).
4. Manually rotate throttle blade to wide open throttle. If voltage is 4.09-4.87 volts, go to next step. If voltage is not 4.09-4.87 volts, go to step 7).
5. Reconnect throttle actuator motor connector. Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, select DTC function, then enter DTC P1120. Monitor scan tool while moving wiring harness and related connectors. If scan tool indicates this test failed this ignition, go to step 22). If scan tool does not indicate that this test failed this ignition, go to next step.
6. While monitoring scan tool, fully open and close throttle. If scan tool indicates this test failed this ignition, go to step 32). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
7. Disconnect TP sensor connector. Using DVOM, check voltage between battery ground and TP sensor No. 1 signal circuit. If voltage is 3.94-6.06 volts, go to step 12). If voltage is not 3.94-6.06 volts, go to next step.
8. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing TP sensor circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and TP sensor No. 1 signal circuit connector. If any voltage is present, go to step 26). If no voltage is present, go to next step.
9. Using DVOM, check continuity of TP sensor No. 1 signal circuit. If continuity exists, go to next step. If

no continuity exists, go to step 27).

10. Check for continuity between battery ground and TP sensor No. 1 signal circuit. If continuity exists, go to step 28). If no continuity exists, go to next step.
11. Check for continuity between TP sensor No. 1 signal circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 30). If no continuity exists between any circuit, go to step 33).
12. Using DVOM, check voltage between battery ground and TP sensor No. 1 5-volt reference circuit. If voltage is 3.94-6.06 volts, go to step 17). If voltage is not 3.94-6.06 volts, go to next step.
13. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing TP sensor circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and TP sensor No. 1 5-volt reference circuit connector. If any voltage is present, go to step 23). If no voltage is present, go to next step.
14. Using DVOM, check continuity of TP sensor No. 1 5-volt reference circuit. If continuity exists, go to next step. If no continuity exists, go to step 24).
15. Check for continuity between battery ground and TP sensor No. 1 5-volt reference circuit. If continuity exists, go to step 25). If no continuity exists, go to next step.
16. Check for continuity between TP sensor No. 1 5-volt reference circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 30). If no continuity exists between any circuit, go to step 33).
17. Using DVOM, check resistance between battery ground and TP sensor No. 1 ground circuit. If resistance is 0-5 ohms, go to step 19). If resistance is not 0-5 ohms, go to next step.
18. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing TP sensor circuits. Check continuity of TP sensor No. 1 ground circuit. If continuity exists, go to step 33). If no continuity exists, go to step 29).
19. Using scan tool, monitor TP sensor No. 1 voltage. Connect a fused jumper wire between TP sensor No. 1 signal and ground circuits. If voltage reading is zero volts, go to next step. If voltage reading is not zero volts, go to step 34).
20. Reconnect TAC module connector containing APP sensor circuits. Using scan tool, monitor APP sensor No. 1, No. 2 and No. 3 voltages. Connect a fused jumper wire between TP sensor No. 1 connector, signal and ground circuits. If any voltage is affected when signal circuit is grounded, go to next step. If voltage is not affected, go to step 31).
21. Turn ignition off. Disconnect Throttle Actuator Control (TAC) module connector. Check continuity of TP sensor No. 1 signal circuit and all other circuits in both TAC module connectors. If continuity exists between any circuit(s), go to step 30). If no continuity exists between any circuit, go to step 34).
22. Repair harness and connectors as necessary. After repairs, go to step 35).
23. Repair short to voltage in 5-volt reference circuit. After repairs, go to step 35).
24. Repair open 5-volt reference circuit. After repairs, go to step 35).
25. Repair short to ground in 5-volt reference circuit. After repairs, go to step 35).
26. Repair short to voltage in signal circuit. After repairs, go to step 35).
27. Repair open signal circuit. After repairs, go to step 35).
28. Repair short to ground in signal circuit. After repairs, go to step 35).
29. Repair open ground circuit. After repairs, go to step 35).

30. Repair circuit(s) shorted together. After repairs, go to step 35).
31. Check for poor terminal connections at TP sensor harness connector. Repair or replace terminals. After repairs, go to step 35). If terminals are okay, go to next step.
32. Replace throttle body assembly. After replacing throttle body, go to step 35).
33. Check for poor terminal connections at TAC module harness connector. Repair or replace terminals. After repairs, go to step 35). If terminals are okay, go to next step.
34. Replace TAC module. After replacing module, go to next step.
35. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1120. Operate vehicle within conditions that set 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).
36. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

DTC P1125 - APP SYSTEM

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator pedal position. Three sensors are located within APP module and are scaled differently.

DTC will set when following conditions are present:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- 2 or more APP sensors are out of range or all 3 APP sensors disagree, or one APP sensor out of range and the other 2 sensors disagree.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. This DTC indicates that 2 or more APP sensor DTCs are set. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTC(s).

Diagnostic Aids

An intermittent DTC can be caused by Electromagnetic Interference (EMI). Inspect related circuits for being too close to secondary ignition wires and generator.

DTC P1133 - HO2S INSUFFICIENT SWITCHING BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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 for more than 600 mV to less than 300 mV.

DTC will set when following conditions are present:

- DTCs P0102, P0103, P0112, P0113, P0117, P0118, P0125, P0335, P0336, P0351-P0358, P1220, P1221 or P1258 not set
- System operating in closed loop.
- Engine operating longer than 120 seconds.
- Engine speed 1000-2300 RPM.
- Ignition voltage greater than 9 volts.
- MAF 15-35 gm/s.
- ECT is greater than 149°F (65°C).
- EVAP purge duty cycle greater than zero percent.
- PCM determines that within 100 seconds HO2S lean-to-rich switches are less than 30, and rich-to-lean switches less than 30.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTCs are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, monitor FAIL THIS IGN under DTC info. If scan tool indicates that DTC P1133 test failed this ignition cycle, go to next step. If scan tool does not indicate that this test failed this ignition cycle, see DIAGNOSTIC AIDS.
3. If scan tool indicates that DTC P1153 test failed, go to step 8). If scan tool does not indicate that DTC P1153 test failed, go to next step.

4. Check exhaust system for leaks. Repair as necessary. After repairs, go to next step. If exhaust leak is not present, repeat step 2).
5. Ensure that Bank 1 HO2S 1 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 9). If circuits are okay, go to next step.
6. Disconnect Bank 1 HO2S 1. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is within a range of 350-550 mV, go to next step. If HO2S voltage is not as specified, go to step 10).
7. Connect a fused jumper wire between ground and BANK 1, HO2S 1 high and low signal circuits. Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is more than 200 mV, go to step 11).
8. Replace oxygen sensor. Determine cause of sensor contamination, otherwise new sensor will be damaged. After replacing oxygen sensor, go to step 13).
9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor low signal circuit or grounded high signal circuit. After repairs, go to step 13).
11. Repair open in sensor high signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 1 HO2S 1. After replacing oxygen sensor, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1134 - HO2S TRANSITION TIME RATIO BANK 1, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. If HO2S ratio is not within range, DTC will set.

Conditions for setting DTC:

- DTCs P0102, P0103, P0112, P0113, P0117, P0118, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221 or P1258 not set.
- System operating in closed loop.
- Engine speed 1000-2300 RPM.
- Engine operating longer than 2 seconds.
- MAF 15-35 gm/s.
- Ignition voltage greater than 9 volts.
- Engine coolant temperature greater than 149°F (65°C).
- EVAP purge duty cycle greater than zero percent.
- PCM determines that HO2S transition time ratio is not at expected value.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTC(s) are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, monitor FAIL THIS IGN under DTC info. If scan tool indicates that DTC P1134 test failed, go to next step. If scan tool does not indicate that this test failed, see DIAGNOSTIC AIDS.
3. If scan tool indicates that DTC P1153 test failed, go to step 8). If scan tool does not indicate that DTC P1153 test failed, go to next step.
4. Check exhaust system for leaks. Repair as necessary. After repairs, go to next step. If exhaust leak is not present, repeat step 2).
5. Ensure that Bank 1 HO2S 1 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 9). If circuits are okay, go to next step.
6. Disconnect Bank 1 HO2S 1. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is within a range of 375-525 mV, go to next step. If HO2S voltage is not as specified, go to step 10).
7. Connect a jumper wire between ground and PCM connector (PCM side), BANK 1 HO2S 1 high and low signal circuits (PCM side). Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is not less than 200 mV, go to step 11).
8. Replace oxygen sensor. Determine cause of sensor contamination, otherwise new sensor will be damaged.

After replacing oxygen sensor, go to step 13).

9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor low signal circuit or grounded high signal circuit. After repairs, go to step 13).
11. Repair open in sensor high signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 1 HO2S 1. After replacing oxygen sensor, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this P1134. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1153 - HO2S INSUFFICIENT SWITCHING BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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 greater than 600 mV. A rich to lean switch is determined when HO2S voltage changes greater than 600 mV to less than 300 mV.

DTC will set when following conditions are present:

- DTCs P0102, P0103, P0112, P0113, P0117, P0118, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221 or P1258 not set.
- System operating in closed loop.
- Engine speed 1000-2300 RPM.
- Ignition voltage greater than 9 volts.
- ECT greater than 149°F (65°C).

- MAF 15-35 gm/s.
- EVAP purge duty cycle greater than zero percent.
- PCM determines that within 100 seconds HO2S lean-to-rich switches are less than 30 on, and rich-to-lean switches less 30.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTCs are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, monitor FAIL THIS IGN under DTC info. If scan tool indicates that DTC P1153 test failed, go to next step. If scan tool does not indicate that this test failed, see DIAGNOSTIC AIDS.
3. If scan tool indicates that DTC P1133 test failed, go to step 8). If scan tool does not indicate that DTC P1133 test failed, go to next step.
4. Check exhaust system for leaks. Repair as necessary. After repairs, go to next step. If exhaust leak is not present, repeat step 2).
5. Ensure that Bank 2 HO2S 1 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 9). If circuits are okay, go to next step.
6. Disconnect Bank 2 HO2S 1. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is within a range of 375-525 mV, go to next step. If HO2S voltage is not within a range of 375-525 mV, go to step 10).
7. Connect a fused jumper wire between ground and Bank 2 HO2S 1 high and low signal circuits. Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is not less than 200 mV, go to step 11).
8. Replace oxygen sensor. Determine cause of sensor contamination, otherwise new sensor will be damaged. After replacing oxygen sensor, go to step 13).
9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor low signal circuit or grounded high signal circuit. After repairs, go to step 13).
11. Repair open in sensor high signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 2 HO2S 1. After replacing oxygen sensor, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1154 - HO2S TRANSITION TIME RATIO BANK 2, SENSOR 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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. If HO2S ratio is not within range, DTC will set.

Conditions for setting DTC:

- DTCs P0102, P0103, P0112, P0113, P0117, P0118, P0125, P0335, P0336, P0351-P0358, P1120, P1220, P1221 or P1258 not set.
- System operating in closed loop.
- Engine speed 1000-2300 RPM.
- Engine operating greater than 2 seconds.
- MAF 15-35 gm/s.
- Ignition voltage greater than 9 volts.
- Engine coolant temperature greater than 149°F (65°C).
- EVAP purge duty cycle greater than zero percent.
- PCM determines that HO2S transition time ratio is not at expected value.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If other DTCs are present, diagnose affected DTC(s) first.

2. Start and warm engine to normal operating temperature. Using scan tool, monitor FAIL THIS IGN under DTC info. If scan tool indicates that DTC P1134 test failed, go to next step. If scan tool does not indicate

that this test failed, see DIAGNOSTIC AIDS.

3. If scan tool indicates that DTC P1134 test failed, go to step 8). If scan tool does not indicate that DTC P1134 test failed, go to next step.
4. Check exhaust system for leaks. Repair as necessary. After repairs, go to next step. If exhaust leak is not present, repeat step 2).
5. Ensure that Bank 2 HO2S 1 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 9). If circuits are okay, go to next step.
6. Disconnect Bank 2 HO2S 1. Connect a fused jumper wire between ground and PCM connector (PCM side), HO2S low signal circuit. Using scan tool, select ENGINE 1 DATA LIST and monitor HO2S voltage. If HO2S voltage is within a range of 375-525 mV, go to next step. If HO2S voltage is not within a range of 375-525 mV, go to step 10).
7. Connect a fused jumper wire between ground and PCM connector (PCM side), BANK 2 HO2S 1 high and low signal circuits. Using scan tool, monitor voltage. If voltage is less than 200 mV, go to step 12). If voltage is not less than 200 mV, go to step 11).
8. Replace oxygen sensor. Determine cause of sensor contamination, otherwise new sensor will be damaged. After replacing oxygen sensor, go to step 13).
9. Repair or replace wiring or terminal as necessary. After repairs, go to step 13).
10. Repair open in sensor low signal circuit or grounded high signal circuit. After repairs, go to step 13).
11. Repair open in sensor high signal circuit or faulty PCM connectors. After repairs, go to step 13).
12. Replace Bank 1 HO2S 1. After replacing oxygen sensor, go to next step.
13. Using scan tool, select DTC, CLEAR INFO. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

A malfunction in HO2S heater circuit will set DTC. Check circuit for intermittent open or faulty connectors. Oxygen supply inside HO2S is provided through wires.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1220 - TP SENSOR NO. 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Throttle Position (TP) sensor is a potentiometer, mounted on side of Air Control Valve assembly (throttle Body). TP sensor is actually 2 sensors within one housing.

TP sensor No. 1 signal voltage increases as throttle opens from, less than 1.1 volt at zero percent throttle to greater than 3.7 volts at 100 percent throttle. TP sensor No. 2 signal voltage decreases from greater than 3.9 volts at zero percent throttle to less than 1.2 volt at 100 percent throttle.

Signal circuit for TP sensor No. 1 is pulled up to 5 volts and signal circuit for TP sensor No. 2 is pulled to ground through Throttle Actuator Control (TAC) module.

DTC will set when following conditions are present:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- TP sensor No. 2 voltage less than .13 volt or greater than 4.87 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P1515 or P1516 is also present, diagnose affected DTC first. If DTC(s) are not present, go to next step.

NOTE: Disconnecting throttle actuator motor will cause additional DTCs to set.

3. Remove duct from throttle Body assembly. Disconnect throttle actuator motor connector. Manually close throttle blade while monitoring scan tool TP SENSOR NO. 2 voltage display. If voltage is 4.3-4.8 volts, go to next step. If voltage is not 4.3-4.8 volts, go to step 7).
4. Manually rotate throttle blade to wide open throttle. If voltage is .13-1.0 volt, go to next step. If voltage is not as specified, go to step 7).
5. Reconnect throttle actuator motor connector. Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, select DTC function, then enter DTC P1220. Monitor scan tool while moving wiring harness and related connectors. If scan tool indicates this test failed this ignition, go to step 21). If scan tool does not indicate that this test failed this ignition, go to next step.
6. While monitoring scan tool, fully open and close throttle. If scan tool indicates this test failed this ignition, go to step 31). If scan tool does not indicate that this test failed this ignition, see DIAGNOSTIC AIDS.
7. Disconnect TP sensor connector. If scan tool indicates zero volt, go to next step. If scan tool does not indicate zero volt, go to step 9).
8. Connect a test light between battery positive and TP sensor No. 2 signal circuit. If scan tool indicates 5 volts, go to step 14). If scan tool does not indicate 5 volts, go to step 11).
9. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module

connector containing TP sensor circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and TP sensor No. 2 signal circuit connector. If any voltage is present, go to step 25). If no voltage is present, go to next step.

10. Turn ignition off. Disconnect Throttle Actuator Control (TAC) module connectors. Check for continuity between TP sensor No. 2 signal circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 29). If no continuity exists between any circuit, go to step 33).
11. Using DVOM, check continuity of TP sensor No. 2 signal circuit. If continuity exists, go to next step. If no continuity exists, go to step 26).
12. Check continuity between battery ground and TP sensor No. 2 signal circuit. If continuity exists, go to step 27). If no continuity exists, go to next step.
13. Check for continuity between TP sensor No. 2 5-volt reference circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 29). If no continuity exists between any circuit, go to step 32).
14. Using DVOM, check voltage between battery ground and TP sensor No. 2 5-volt reference circuit. If voltage is 3.94-6.06 volts, go to step 19). If voltage is not 3.94-6.06 volts, go to next step.
15. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing TP sensor circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and TP sensor No. 2 5-volt reference circuit connector. If any voltage is present, go to step 22). If no voltage is present, go to next step.
16. Using DVOM, check continuity of TP sensor No. 2 5-volt reference circuit. If continuity exists, go to next step. If no continuity exists, go to step 23).
17. Check for continuity between battery ground and TP sensor No. 2 5-volt reference circuit. If continuity exists, go to step 24). If no continuity exists, go to next step.
18. Check for continuity between TP sensor No. 2 5-volt reference circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 32). If no continuity exists between any circuit, go to step 33).
19. Using DVOM, check resistance between battery ground and TP sensor No. 2 ground circuit. If resistance is 0-5 ohms, go to step 30). If resistance is not 0-5 ohms, go to next step.
20. Turn ignition off. Leave TP sensor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing TP sensor circuits. Check continuity of TP sensor No. 2 ground circuit. If continuity exists, go to step 32). If no continuity exists, go to step 28).
21. Repair harness and connectors as necessary. After repairs, go to step 34).
22. Repair short to voltage in 5-volt reference circuit. After repairs, go to step 34).
23. Repair open 5-volt reference circuit. After repairs, go to step 34).
24. Repair short to ground in 5-volt reference circuit. After repairs, go to step 34).
25. Repair short to voltage in signal circuit. After repairs, go to step 34).
26. Repair open signal circuit. After repairs, go to step 34).
27. Repair short to ground in signal circuit. After repairs, go to step 34).
28. Repair open ground circuit. After repairs, go to step34).
29. Repair circuit(s) shorted together. After repairs, go to step 34).
30. Check for poor terminal connections at TP sensor harness connector. Repair or replace terminals. After

repairs, go to step 34). If terminals are okay, go to next step.

31. Replace throttle body assembly. After replacing throttle body, go to step 34).
32. Check for poor terminal connections at TAC module harness connector. Repair or replace terminals. After repairs, go to step 34). If terminals are okay, go to next step.
33. Replace TAC module. After replacing module, go to next step.
34. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1220. Operate vehicle within conditions that set 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).
35. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

DTC P1221 - TP SENSOR NO. 1 & 2 PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Throttle Position (TP) sensor is a potentiometer, mounted on side of Air Control Valve assembly (throttle Body). TP sensor is actually 2 sensors within one housing.

TP sensor No. 1 signal voltage increases as throttle opens from, less than 1.1 volt at zero percent throttle to greater than 3.7 volts at 100 percent throttle. TP sensor No. 2 signal voltage decreases from greater than 3.9 volts at zero percent throttle to less than 1.2 volt at 100 percent throttle.

Signal circuit for TP sensor No. 1 is pulled up to 5 volts and signal circuit for TP sensor No. 2 is pulled to ground through Throttle Actuator Control (TAC) module.

DTC will set when following conditions are present:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- TP sensor No. 2 disagrees with TP sensor No. 1 by more than 7.5 percent.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, monitor TP SENSORS DISAGREE parameters. If scan tool displays NO, go to next step. If scan tool does not display NO, go to step 5).

NOTE: Disconnecting throttle actuator motor will cause additional DTCs to set.

3. Remove duct from throttle Body assembly. Disconnect throttle actuator motor connector. Manually open throttle blade to wide open throttle and then slowly return if to closed throttle while stopping briefly at 25, 50, 75 and 100 percent in each direction. If scan tool display changes from NO to YES, go to step 7). If scan tool display does not change, go to next step.
4. Reconnect throttle actuator motor connector. Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, select DTC function, then enter DTC P1221. Monitor scan tool while moving wiring harness and related connectors. If scan tool indicates this test failed this ignition, go to step 14). If scan tool does not indicate that this test failed this ignition, go to DIAGNOSTIC AIDS.
5. Disconnect Throttle Actuator Control (TAC) module connector containing APP sensor circuits. If scan tool indicates all 3 parameters at zero percent, go to next step. If scan tool does not indicate that all 3 parameters are at zero percent, go to step 15).
6. Turn ignition off. Disconnect Throttle Actuator Control (TAC) module connectors. Check for continuity between TP sensor No. 1 signal circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to next step. If no continuity exists between any circuit, go to step 14).
7. Disconnect TP sensor connector. Check for continuity between TP sensor No. 1 signal circuit and all other circuits in both TAC module harness connectors. Check for continuity between TP sensor No. 2 signal circuit and all other circuits in both TAC module harness connectors. If continuity exists between any circuit(s), go to step 11). If no continuity exists between any circuit, go to step 14).
8. Disconnect TP sensor connector. Check for continuity between TP sensor connector circuits and TAC module connector circuits. If continuity exists between any circuit(s), go to next step. If no continuity exists between any circuit, go to step 12).
9. Reconnect both TAC module connectors. Turn ignition on, with engine off. Using scan tool, monitor APP and TP sensor voltages. Connect a fused jumper wire between TP sensor No. 1 signal and 5-volt reference circuits. Disconnect jumper wire and connect it between TP sensor No. 2 signal and 5-volt reference circuits. If any voltage is affected or TP sensor No. 1 or No. 2 voltage is not 3.94-6.06 volts with jumper installed, go to step 15). If voltage is not affected or is within specified range, go to next step.
10. Reconnect both TAC module connectors. Turn ignition on, with engine off. Using scan tool, monitor APP and TP sensor voltages. Connect a fused jumper wire between TP sensor No. 1 signal and ground circuits. Disconnect jumper wire and connect it between TP sensor No. 2 signal and ground circuits. If any voltage is affected or TP sensor No. 1 or No. 2 voltage is not zero to .1 volt with jumper installed, go to step 15). If voltage is not affected or is within specified range, go to step 14).
11. Repair signal circuits shorted together. After repairs, go to step 16).
12. Repair circuit with high resistance as necessary. After repair, go to step 16).
13. Check for poor terminal connections at APP sensor and TAC module connectors. Repair or replace terminals. After repairs, go to step 16). If terminals are okay, go to next step.

14. Replace accelerator pedal assembly. After replacing accelerator pedal assembly, go to step 16).
15. Replace TAC module. After replacing module, go to step 16).
16. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1221. Operate vehicle within conditions that set 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).
17. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation. If other DTCs are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring. PCM 5-volt reference circuits are internally connected within PCM.

DTC P1258 - ENGINE COOLANT OVER-TEMPERATURE FUEL DISABLED

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

In order to reduce engine temperature, PCM has ability to disable a number or fuel injectors during and engine over-temperature condition. Engine is considered over-temperature when Engine Coolant Temperature (ECT) sensor reaches more than 268°F (131°C). DTC sets when PCM senses ECT sensor is in over-temperature condition, and PCM enters protection mode.

DTC will set when following conditions are present:

- DTC P0117, P0118 or P0125 not set.
- Engine is running.
- Engine coolant temperature greater than 270°F (132°C).
- Conditions present for greater than 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If other ECT related Diagnostic Trouble Codes (DTCs) are present, diagnose affected DTC(s). If no other repair cooling system mechanical problem as necessary.

Diagnostic Aids

If an overheating condition is present, overheat condition must be repaired and engine oil and filter must be changed. Using FREEZE FRAME and/or FAILURE RECORDS data may aid in locating intermittent

condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS can be useful in determining how many miles since DTC set. It can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.) that are noted. This will isolate when DTC failed. If other DTC(s) are set that share same ground and/or 5-volt reference circuit, check for faulty connections or wiring.

DTC P1275 - APP SENSOR NO. 1 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (PAP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100% pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0% pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 1 voltage is less than 0.25 volt or greater than 4.22 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If DTC P1518 is also present, diagnose DTC P1518 first.

2. Turn ignition on, engine off. Ensure accelerator pedal is not depressed. Using scan tool in TAC DATA

LIST option, monitor APP sensor No. 1 voltage. If voltage reading is 0.25-2.24 volts, go to next step. If voltage reading is not 0.25-2.24 volts, go to step 6).

3. Fully depress accelerator pedal. Check voltage reading on scan tool. If voltage reading is 2.24-4.23 volts, go to next step. If voltage reading is not 2.24-4.23 volts, go to step 6).
4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, select DTC option and FAILED THIS IGNITION option. Move/wiggle harness connectors and related connectors. If this DTC sets, go to step 21). If this DTC does not set, go to next step.
5. Depress accelerator pedal to Wide Open Throttle (WOT) position then return to closed position. If this DTC sets, go to step 31). If this DTC does not set, problem is intermittent. See DIAGNOSTIC AIDS.
6. Disconnect APP sensor harness connector. If scan tool reads zero volts, go to next step. If scan tool does not read zero volts, go to step 8).
7. Using a test light connected to battery voltage, probe APP sensor No. 1 signal circuit. If scan tool reads 5 volts, go to step 13). If scan tool does not read 5 volts, go to step 10).
8. Turn ignition off. Leave APP sensor connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Turn ignition on, engine off. Check voltage between APP sensor No. 1 harness connector signal circuit and battery ground. If any voltage is present, go to step 25). If not voltage is present, go to next step.
9. Turn ignition off. Disconnect the other TAC module harness connector. Check continuity between APP sensor No. 1 signal circuit and all other circuits in both TAC module harness connectors. If continuity is present, go to step 29). If continuity is not present, go to step 33).
10. Turn ignition off. Disconnect TAC module harness connector containing APP sensor circuit. Check harness for continuity in APP sensor No. 1 signal circuit. If continuity is present, go to next step. If continuity is not present, go to step 26).
11. Check harness for continuity between APP sensor No. 1 signal circuit and battery ground. If continuity is present, go to step 27). If continuity is not present, go to next step.
12. Check for continuity between APP sensor No. 1 signal circuit and TAC harness connector. Check all other circuits in both TAC module harness connector. If continuity is present, go to step 29). If continuity is not present, go to step 32).
13. Check voltage between battery ground and APP sensor No. 1 harness connector 5-volt reference circuit. If voltage reading is 4.6-5.4 volts, go to step 19). If voltage reading is not 4.6-5.4 volts, go to next step.

NOTE: Disconnecting throttle actuator motor harness connector will set additional DTCs.

14. Turn ignition off. Disconnect throttle actuator motor harness connector. Turn ignition on, engine off. Rotate and hold throttle blade to WOT by hand. Check voltage between ground and APP sensor No. 1 5-volt reference circuit at harness connector. If voltage reading is 4.6-5.4 volts, go to step 32). If voltage reading is not 4.6-5.4 volts, go to next step.
15. Turn ignition off. Disconnect TAC harness connector containing APP sensor circuits. Turn ignition on, engine off. Check voltage between battery ground and APP sensor No. 1 5-volt reference circuit at harness connector. If any voltage is present, go to step 22). If not voltage is present, go to next step.
16. Check for continuity in harness between APP sensor No. 1 5-volt reference circuit and sensor ground. If continuity is present, go to next step. If continuity is not present, go to step 23).

17. Check for continuity in harness between APP sensor No. 1 5-volt reference circuit battery ground. If continuity is present, go to step 24). If continuity is not present, go to next step.
18. Disconnect the other TAC module harness connector. Check harness for continuity between APP sensor No. 1 5-volt reference circuit at TAC harness connector and all the other circuit in both TAC connectors. If continuity is present, go to step 29). If continuity is not present, go to step 32).
19. Check resistance between battery ground and APP sensor No. 1 ground circuit at APP sensor harness connector. If measured resistance is 0-5 ohms, go to step 30). If resistance is not 0-5 ohms, go to next step.
20. Turn ignition off. Leave APP sensor harness connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Check continuity of APP sensor No. 1 ground circuit. If continuity is present, go to step 33). If continuity is not present, go to step 28).
21. Repair harness/connections as necessary. After repairs are complete, go to step 35).
22. Repair short to voltage in 5-volt reference circuit. After repairs, go to step 35).
23. Repair open or high resistance in 5-volt reference circuit. After repairs, go to step 35).
24. Repair short to ground in 5-volt reference circuit. After repairs, go to step 35).
25. Repair signal circuit for short to voltage. After repairs, go to step 35).
26. Repair open or high resistance in signal circuit. After repairs, go to step 35).
27. Repair short to ground in signal circuit. After repairs, go to step 35).
28. Repair open or high resistance in ground circuit. After repairs, go to step 35).
29. Repair circuits that are shorted together. After repairs, go to step 35).
30. Check for poor connection at APP sensor harness connector. Repair as necessary. After repairs, go to step 35). If connection is okay, go to next step.
31. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 35).
32. If DTC P1120 was set when performing step 14), diagnose DTC P1120. If DTC P1120 was not set, go to next step.
33. Check for poor connection at TAC module harness connector. Repair as necessary. After repairs, go to step 35). If connector is okay, go to next step.
34. Replace TAC module. After replacing module, go to next step.
35. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
36. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage. DTC P1276 will also set when TAC module detects throttle movement when DTC P1275 is set.

DTC P1276 - APP SENSOR NO. 1 PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (APP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100% pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0% pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 1 voltage is less than 0.25 volt or greater than 4.22 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If DTC P1518 is also present, diagnose DTC P1518 first.

2. Turn ignition on, engine off. Using scan tool in TAC DATA option, monitor APP sensor No. 1 voltage. If voltage reading is 0.25-1.10 volts, go to next step. If voltage reading is not 0.25-1.10 volts, go to step 6).
3. Using scan tool, monitor APP sensors No. 1 and 2, and APP sensors No. 2 and 3 disagree parameters. Slowly depress accelerator pedal to WOT position stopping briefly at about 25%, 50% and 75% positions. Slowly return to closed position, stopping briefly at about 75%, 50% and 25% positions. If scan tool displays NO for APP sensors No. 1 and 2 disagree, and APP sensors No. 2 and 3 disagree parameters, go to next step. If scan tool does not display NO, go to step 8).

4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC INFORMATION option. Monitor scan tool while moving/wiggling related harness and connectors. If harness movement caused this DTC to set, go to step 12). If harness movement did not cause this DTC to set, go to next step.
5. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool monitor FAILED THIS IGNITION under DTC INFORMATION option. Quickly depress accelerator pedal to WOT and quickly return to closed position. If this action caused this DTC to set, go to step 16). If this action did not cause this DTC to set, problem is intermittent. See DIAGNOSTIC AIDS.
6. Disconnect TAC harness connector containing APP sensor circuits. If scan tool reads zero volts, go to next step. If scan tool does not read zero volts, go to step 17).
7. Turn ignition off. Disconnect TAC module harness connector containing TP sensor circuit. Check continuity between APP sensor No. 1 signal circuit and signal circuits to APP sensors No. 2 and 3 and TP sensors No. 1 and 2. If continuity is present, go to next step. If continuity is not present, go to step 9).
8. Disconnect APP sensor and TAC module harness connectors. Check continuity between APP sensor No. 1 signal circuit and TAC module connector, and all other circuits in both TAC module connector. If continuity is present, go to step 13). If continuity is not present, go to step 16).
9. Disconnect APP sensor harness connectors. Check continuity between APP sensor and TAC module connector containing APP sensor circuits. If continuity is present, go to next step. If continuity is not present, go to step 14).
10. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe voltages for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper APP sensor No. 1 signal circuit to 5-volt reference circuit at APP harness connector. If APP sensor No. 1 voltage is 3.94-6.06 volts, go to step 17). If voltage is not 3.94-6.06 volts, go to next step.
11. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe display voltage for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper APP sensor No. 1 signal circuit to APP sensor No. 1 ground circuit in APP harness connector. If voltage reading is 0-1 volt, go to step 17). If voltage reading is not 0-1 volt, go to step 16).
12. Repair harness/connections as necessary. After repairs are complete, go to step 18).
13. Repair signal circuits that are shorted together. After repairs, go to step 18).
14. Repair circuit with high resistance. After repairs, go to step 18).
15. Check for poor connections or terminals. Repair as necessary. After repairs, go to step 18). If terminals or connections are okay, go to next step.
16. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 18).
17. Replace TAC module. After replacing module, go to next step.
18. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
19. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage. DTC P1276 will also set when TAC module detects throttle movement when DTC P1275 is set.

DTC P1280 - APP SENSOR NO. 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (APP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100% pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0 percent pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0601, P0602, P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 2 voltage is less than 0.83 volt or greater than 4.81 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If DTC P1518 is also present, diagnose DTC P1518 first.

2. Turn ignition on, engine off. Ensure accelerator pedal is not depressed. Using scan tool in TAC DATA LIST option, monitor APP sensor No. 2 voltage. If voltage reading is 3.90-4.81 volts, go to next step. If voltage reading is not 3.90-4.81 volts, go to step 6).

3. Fully depress accelerator pedal. Check voltage reading on scan tool. If voltage reading is 0.83-2.90 volts, go to next step. If voltage reading is not 0.83-2.90 volts, go to step 6).
4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, select DTC option and FAILED THIS IGNITION option. Move/wiggle harness connectors and related connectors. If this DTC sets, go to step 21). If this DTC does not set, go to next step.
5. Slowly depress accelerator pedal to Wide Open Throttle (WOT) position then return to closed position. If this DTC sets, go to step 31). If this DTC does not set, problem is intermittent. See DIAGNOSTIC AIDS.
6. Disconnect APP sensor harness connector. Check voltage between battery ground and APP sensor No. 2 signal circuit at APP sensor harness connector. If voltage is 3.94-6.06 volts, go to step 11). If voltage is not 3.94-6.06 volts, go to next step.
7. Turn ignition off. Leave APP sensor connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Turn ignition on, engine off. Check voltage between APP sensor No. 2 harness connector signal circuit and battery ground. If any voltage is present, go to step 25). If no voltage is present, go to next step.
8. Check continuity in APP sensor No. 2 signal circuit. If continuity is present, go to next step. If continuity is not present, go to step 26).
9. Check harness for continuity between APP sensor No. 2 signal circuit and battery ground. If continuity is present, go to step 27). If continuity is not present, go to next step.
10. Check for continuity between APP sensor No. 2 signal circuit and TAC harness connector. Check all other circuits in both TAC module harness connector. If continuity is present, go to step 29). If continuity is not present, go to step 32).
11. Check voltage between battery ground and APP sensor No. 2 harness connector 5-volt reference circuit. If voltage reading is 3.94-6.06 volts, go to step 16). If voltage reading is not 3.94-6.06 volts, go to next step.
12. Turn ignition off. Disconnect TAC harness connector containing APP sensor circuits. Turn ignition on, engine off. Check voltage between battery ground and APP sensor No. 2 5-volt reference circuit at harness connector. If any voltage is present, go to step 22). If not voltage is present, go to next step.
13. Check for continuity in harness between APP sensor No. 2 5-volt reference circuit and sensor ground. If continuity is present, go to next step. If continuity is not present, go to step 23).
14. Check for continuity in harness between APP sensor No. 2 5-volt reference circuit battery ground. If continuity is present, go to step 24). If continuity is not present, go to next step.
15. Check harness for continuity between APP sensor No. 2 5-volt reference circuit at TAC harness connector and all the other circuit in both TAC connectors. If continuity is present, go to step 29). If continuity is not present, go to step 32).
16. Check resistance between battery ground and APP sensor No. 2 ground circuit at APP sensor harness connector. If measured resistance is 0-5 ohms, go to step 18). If resistance is not 0-5 ohms, go to next step.
17. Turn ignition off. Leave APP sensor harness connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Check continuity of APP sensor No. 2 ground circuit. If continuity is present, go to step 32). If continuity is not present, go to step 28).
18. Using a fused jumper wire, jumper APP sensor No. 2 signal circuit to APP sensor ground circuit in harness connector. Using scan tool, monitor APP sensor No. 2 voltage. If scan tool indicates zero volts, go to next step. If scan tool does not indicate zero volts, go to step 33).

19. Using a fused jumper wire, jumper APP sensor No. 2 signal circuit and APP sensor ground circuit. Using scan tool monitor, APP sensors No. 1 and 3 and TP sensor No. 2 voltage. If any of the sensor voltage is affected when APP sensor No. 2 signal is grounded, go to next step. If sensor voltage is not affected, go to step 30).
20. Turn ignition off. Disconnect TAC harness connector. Check continuity between APP sensor No. 2 signal circuit at TAC harness connector, and all other circuits in both TAC module connectors. If continuity is present, go to step 29). If continuity is not present, go to step 33).
21. Repair harness/connections as necessary. After repairs are complete, go to step 34).
22. Repair short to voltage in 5-volt reference circuit. After repairs, go to step 34).
23. Repair open or high resistance in 5-volt reference circuit. After repairs, go to step 34).
24. Repair short to ground in 5-volt reference circuit. After repairs, go to step 34).
25. Repair signal circuit for short to voltage. After repairs, go to step 34).
26. Repair open or high resistance in signal circuit. After repairs, go to step 34).
27. Repair short to ground in signal circuit. After repairs, go to step 34).
28. Repair open or high resistance in ground circuit. After repairs, go to step 34).
29. Repair circuits that are shorted together. After repairs, go to step 34).
30. Check for poor connection at APP sensor harness connector. Repair as necessary. After repairs, go to step 34). If connection is okay, go to next step.
31. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 34).
32. Check for poor connection at TAC module harness connector. Repair as necessary. After repairs, go to step 34). If connector is okay, go to next step.
33. Replace TAC module. After replacing module, go to next step.
34. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
35. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage. DTC P1281 will also set when TAC module detects throttle movement when DTC P1280 is set.

DTC P1281 - APP SENSOR NO. 2 PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (APP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100 percent pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0 percent pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 2 disagrees with APP sensor No. 1 by greater than 10.5 percent and APP sensor No. 2 disagrees with APP sensor No. 3 by greater than 13 percent.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If DTC P1518 is also present, diagnose DTC P1518 first.

2. Turn ignition on, engine off. Using scan tool in TAC DATA LIST, monitor APP sensors No. 1, 2 and 3. If all 3 parameters are at zero volts, go to next step. If parameters are not at zero volts, go to step 5).
3. Using scan tool, monitor APP sensors No. 1 and 2, and APP sensors No. 2 and 3 disagree parameters. Slowly depress accelerator pedal to WOT position stopping briefly at about 25%, 50% and 75% positions. Slowly return to closed position, stopping briefly at about 75%, 50% and 25% positions. If scan tool displays NO for APP sensors No. 1 and 2 disagree, and APP sensors No. 2 and 3 disagree parameters, go to next step. If scan tool does not display NO, go to step 7).
4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC INFORMATION option. Monitor scan tool while moving/wiggling related harness and connectors. If harness movement caused this DTC to set, go to step 14). If harness movement did not cause this DTC to set, see DIAGNOSTIC AIDS.
5. Turn ignition off. Disconnect TAC module harness connector containing APP sensor circuits. Turn

ignition on, engine off. If all 3 parameter are at zero volts, go to next step. If all 3 parameters are not at zero volts, go to step 15).

6. Turn ignition off. Disconnect TAC module harness connector containing TP sensor circuit. Check continuity between APP sensor No. 2 signal circuit and signal circuits to APP sensors No. 1 and 3 and TP sensors No. 1 and 2. If continuity is present, go to next step. If continuity is not present, go to step 8).
7. Disconnect APP sensor harness connectors. Check continuity between APP sensor and TAC module connector containing APP sensor circuits. If continuity is present, go to step 11). If continuity is not present, go to step 14).
8. Disconnect APP harness connector. Check harness for continuity between APP sensor harness connector and TAC module connector containing the APP sensor circuits. If continuity is present, go to next step. If continuity is not present, go to step 12).
9. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe voltages for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper APP sensor No. 2 signal circuit to 5-volt reference circuit at APP harness connector. If APP sensor No. 2 voltage is 3.94-6.06 volts, go to step 15). If voltage is not 3.94-6.06 volts, go to next step.
10. Turn ignition off. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe display voltage for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper APP sensor No. 2 signal circuit to APP sensor No. 2 ground circuit in APP harness connector. If voltage reading is 0-1 volt, go to step 15). If voltage reading is not 0-1 volt, go to step 14).
11. Repair signal circuits that are shorted together. After repairs, go to step 16).
12. Repair circuit with high resistance. After repairs, go to step 16).
13. Check for poor connections or terminals. Repair as necessary. After repairs, go to step 16). If terminals or connections are okay, go to next step.
14. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 16).
15. Replace TAC module. After replacing module, go to next step.
16. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
17. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage.

DTC P1285 - APP SENSOR NO. 3 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (APP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100 percent pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0 percent pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 3 voltage is less than 1.63 volt or greater than 4.81 volts.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, engine off. Using scan tool in TAC DATA LIST option, monitor APP sensor No. 3 voltage. If voltage reading is 3.29-4.28 volts, go to next step. If voltage reading is not 3.29-4.28 volts, go to step 6).
3. Fully depress accelerator pedal. Check voltage reading on scan tool. If voltage reading is 1.63-3.10 volts, go to next step. If voltage reading is not 1.63-3.10 volts, go to step 6).
4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, select DTC option and FAILED THIS IGNITION option. Move/wiggle harness connectors and related connectors. If this DTC sets, go to step 22). If this DTC does not set, go to next step.
5. Slowly depress accelerator pedal to Wide Open Throttle (WOT) position then return to closed position. If this DTC sets, go to step 32). If this DTC does not set, problem is intermittent. See DIAGNOSTIC AIDS.
6. Disconnect APP sensor harness connector. Check voltage between battery ground and APP sensor No. 3 signal circuit at APP sensor harness connector. If voltage is 3.94-6.06 volts, go to step 11). If voltage is not 3.94-6.06 volts, go to next step.
7. Turn ignition off. Leave APP sensor connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Turn ignition on, engine off. Check voltage between APP sensor No. 3 harness connector signal circuit and battery ground. If any voltage is present, go to step 26). If no voltage

is present, go to next step.

8. Check continuity in APP sensor No. 3 signal circuit. If continuity is present, go to next step. If continuity is not present, go to step 27).
9. Check harness for continuity between APP sensor No. 3 signal circuit and battery ground. If continuity is present, go to step 28). If continuity is not present, go to next step.
10. Check for continuity between APP sensor No. 3 signal circuit and TAC harness connector. Check all other circuits in both TAC module harness connector. If continuity is present, go to step 30). If continuity is not present, go to step 33).
11. Check voltage between battery ground and APP sensor No. 3 harness connector 5-volt reference circuit. If voltage reading is 3.94-6.06 volts, go to step 16). If voltage reading is not 3.94-6.06 volts, go to next step.
12. Turn ignition off. Leave APP sensor harness connector connected. Disconnect TAC harness connector containing APP sensor circuits. Turn ignition on, engine off. Check voltage between battery ground and APP sensor No. 3 5-volt reference circuit at harness connector. If any voltage is present, go to step 23). If no voltage is present, go to next step.
13. Check for continuity in harness between APP sensor No. 3 5-volt reference circuit and sensor ground. If continuity is present, go to next step. If continuity is not present, go to step 24).
14. Check for continuity in harness between APP sensor No. 3 5-volt reference circuit battery ground. If continuity is present, go to step 25). If continuity is not present, go to next step.
15. Check harness for continuity between APP sensor No. 3 5-volt reference circuit at TAC harness connector and all the other circuit in both TAC connectors. If continuity is present, go to step 30). If continuity is not present, go to step 33).
16. Check resistance between battery ground and APP sensor No. 3 ground circuit at APP sensor harness connector. If resistance is 0-5 ohms, go to step 18). If resistance is not 0-5 ohms, go to next step.
17. Turn ignition off. Leave APP sensor harness connector disconnected. Disconnect TAC module harness connector containing APP sensor circuit. Check continuity of APP sensor No. 2 ground circuit. If continuity is present, go to step 33). If continuity is not present, go to step 29).
18. Turn ignition on, engine off. Using a fused jumper wire, jumper APP sensor No. 3 signal circuit to APP sensor ground in APP harness connector. Using scan tool, monitor APP sensor No. 3 voltage. If scan tool indicates zero volts, go to next step. If scan tool does not indicate zero volts, go to step 34).
19. Using a fused jumper wire, jumper APP sensor No. 3 5-volt reference circuit and APP sensor ground circuit. Using scan tool monitor voltage reading. If voltage reading is zero volts, go to step 21). If voltage reading is not zero volts, go to next step.
20. Using a fused jumper wire, jumper APP sensor No. 3 and APP sensor No. 3 ground circuit. Using scan tool, monitor APP sensors No. 1 and 2 voltage. If any of the other APP sensor voltages are affected when APP sensor No. 3 signal is grounded, go to step 21). If sensor voltages are not affected, go to step 31).
21. Turn ignition off. Disconnect TAC harness connector. Check continuity between APP sensor No. 3 signal circuit at TAC harness connector, and all other circuits in both TAC module connectors. If continuity is present, go to step 30). If continuity is not present, go to step 34).
22. Repair harness/connections as necessary. After repairs, go to step 35).
23. Repair short to voltage in 5-volt reference circuit. After repairs, go to step 35).
24. Repair open or high resistance in 5-volt reference circuit. After repairs, go to step 35).
25. Repair short to ground in 5-volt reference circuit. After repairs, go to step 35).

26. Repair signal circuit for short to voltage. After repairs, go to step 35).
27. Repair open or high resistance in signal circuit. After repairs, go to step 35).
28. Repair short to ground in signal circuit. After repairs, go to step 35).
29. Repair open or high resistance in ground circuit. After repairs, go to step 35).
30. Repair circuits that are shorted together. After repairs, go to step 35).
31. Check for poor connection at APP sensor harness connector. Repair as necessary. After repairs, go to step 35). If connection is okay, go to next step.
32. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 35).
33. Check for poor connection at TAC module harness connector. Repair as necessary. After repairs, go to step 35). If connector is okay, go to next step.
34. Replace TAC module. After replacing module, go to next step.
35. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
36. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage.

DTC P1286 - APP SENSOR NO. 3 PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

The Accelerator Pedal Position (APP) sensor is mounted on accelerator pedal assembly. Sensor contains 3 individual APP sensors within one housing. There are 3 separate signal, ground and 5-volt reference circuits connected to APP and Throttle Actuator Control (TAC) modules.

Each sensor has a unique functionality:

- The APP sensor No. 1 signal increases as accelerator pedal is depressed, from less than 1.1 volt (zero percent with pedal at rest) to greater than 2.1 volts (100 percent pedal travel).
- The APP sensor No. 2 signal decreases from greater than 3.9 volts (0 percent pedal travel) to less than 2.9 volts (100 percent pedal travel).
- The APP sensor No. 3 signal decreases from greater than 3.2 volts (0 percent pedal travel) to less than 3.1 volts (100 percent pedal travel).

Observe that signal circuits for APP sensor No. 2 and APP sensor No. 3 pull up to 5 volts and APP sensor No. 1 circuit pull to ground within the TAC module.

DTC will set under the following conditions:

- DTCs P0606, P1517 or P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- APP sensor No. 3 disagrees with APP sensor No. 1 by greater than 13 percent and APP sensor No. 3 disagrees with APP sensor No. 3 by greater than 13 percent.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

NOTE: If DTC P1518 is also present, diagnose DTC P1518 first.

2. Turn ignition on, engine off. Using scan tool in TAC DATA LIST, monitor APP sensors No. 1, 2 and 3. If all 3 parameters are at zero volts, go to next step. If parameters are not at zero volts, go to step 5).
3. Using scan tool, monitor APP sensors No. 1 and 2, and APP sensors No. 2 and 3 disagree parameters. Slowly depress accelerator pedal to WOT position stopping briefly at about 25%, 50% and 75% positions. Slowly return to closed position, stopping briefly at about 75%, 50% and 25% positions. If scan tool displays NO for APP sensors No. 1 and 2 disagree, and APP sensors No. 2 and 3 disagree parameters, go to next step. If scan tool does not display NO, go to step 7).
4. Turn ignition off for 15 seconds. Turn ignition on, engine off. Using scan tool, monitor FAILED THIS IGNITION under DTC INFORMATION option. Monitor scan tool while quickly depressing accelerator pedal to WOT and releasing pedal to closed throttle position. If this DTC sets, go to step 14). If this DTC does not set, problem is intermittent. See DIAGNOSTIC AIDS.
5. Turn ignition off. Disconnect TAC module harness connector containing APP sensor circuits. Turn ignition on, engine off. If all 3 parameter are at zero volts, go to next step. If all 3 parameters are not at zero volts, go to step 15).
6. Turn ignition off. Disconnect TAC module harness connector containing TP sensor circuit. Check continuity between APP sensor No. 3 signal circuit and signal circuits to APP sensors No. 1 and 2 and TP sensors No. 1 and 2. If continuity is present, go to next step. If continuity is not present, go to step 8).
7. Disconnect APP sensor harness connectors. Check continuity between APP sensor and TAC module connector containing APP sensor circuits. If continuity is present, go to step 11). If continuity is not present, go to step 14).
8. Disconnect APP harness connector. Check harness for continuity between APP sensor harness connector and TAC module connector containing the APP sensor circuits. If continuity is present, go to next step. If continuity is not present, go to step 12).
9. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe voltages for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper

APP sensor No. 3 signal circuit to 5-volt reference circuit at APP harness connector. If APP sensor No. 3 voltage is 3.94-6.06 volts, go to step 15). If voltage is not 3.94-6.06 volts, go to next step.

10. Turn ignition off. Reconnect both TAC module harness connectors. Turn ignition on, engine off. Using scan tool, observe display voltage for APP sensors No. 1, 2 and 3, and TP sensors No. 1 and 2. Using a fused jumper wire, jumper APP sensor No. 3 signal circuit to APP sensor No. 3 ground circuit in APP harness connector. If voltage reading is 0-1 volt, go to step 15). If voltage reading is not 0-1 volt, go to step 14).
11. Repair signal circuits that are shorted together. After repairs, go to step 16).
12. Repair circuit with high resistance. After repairs, go to step 16).
13. Check for poor connections or terminals. Repair as necessary. After repairs, go to step 16). If terminals or connections are okay, go to next step.
14. Replace accelerator pedal assembly. After replacing pedal assembly, go to step 16).
15. Replace TAC module. After replacing module, go to next step.
16. Using scan tool, select DTC, CLEAR INFO. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter this DTC. Operate vehicle within the 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).
17. Using scan tool, select CAPTURE INFO, REVIEW INFO. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check for poor connections, corrosion, misrouted harness, rubbed-through wire insulation or broken wire inside insulation. The APP and TP sensor 5-volt reference circuit are internally connected within the TAC. Check the 5-volt reference circuits at the APP and TP sensors for an open, short to ground or short to voltage.

DTC P1380 - ABS DTC ROUGH ROAD DATA UNSTABLE

Circuit Description

PCM detects engine misfire by detecting variations in crankshaft deceleration between firing strokes. For accurate detection of engine misfire, PCM must be able to distinguish between crankshaft deceleration caused by actual misfire or deceleration caused by rough road conditions.

ABS system can detect if vehicle is on a rough road based on wheel acceleration/deceleration data supplied by wheel speed sensors. If ABS system detects rough road above a predetermined threshold, this information is sent to PCM via serial data. PCM can then take rough road into account when calculating misfire. Even if ABS is malfunctioning and cannot detect rough roads, misfire diagnostic will continue to run. However, if a misfire DTC is set, this additional DTC will also set indicating that rough road data was not available during misfire calculation due to ABS system malfunction.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0335, P0336, P0742, P1120, P1121, P1220 or P1221 not set.
- Vehicle speed greater than 10 MPH.

- Engine load less than 60 percent.
- DTC P0300 set.
- Engine speed is less than 3200 RPM.
- An ABS system malfunction exists preventing rough road detection data.

NOTE: ABS system must be diagnosed/serviced before diagnosing misfire. Actual engine misfire may or may not exist.

Diagnostic Procedures

Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then perform ABS system diagnosis. See ANTI-LOCK BRAKE SYSTEM article in BRAKES section.

Diagnostic Aids

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles occurred since diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1381 - MISFIRE DETECTED, NO EBCM/PCM SERIAL DATA

Circuit Description

PCM detects engine misfire by detecting variations in crankshaft deceleration between firing strokes. For accurate detection of engine misfire, PCM must be able to distinguish between crankshaft deceleration caused by actual misfire or deceleration caused by rough road conditions.

ABS system can detect if vehicle is on a rough road based on wheel acceleration/deceleration data supplied by wheel speed sensors. If ABS system detects rough road above a predetermined threshold, this information is sent to PCM via serial data. PCM can then take rough road into account when calculating misfire. Even if ABS is malfunctioning and cannot detect rough roads, misfire diagnostic will continue to run. However, if a misfire DTC is set, this additional DTC will also set indicating that rough road data was not available during misfire calculation due to ABS system malfunction.

DTC will set when following conditions are present:

- Vehicle speed greater than 10 MPH.
- Engine speed less than 3200 RPM.
- DTC P0300 set.
- A serial data malfunction exists preventing rough road detection data.
- Conditions met for 20 seconds.

NOTE: Serial data must be serviced before diagnosing misfire. Actual engine misfire may or may not exist.

Diagnostic Procedures

Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then perform ABS system diagnosis. See ANTI-LOCK BRAKE SYSTEM article in BRAKES section.

Diagnostic Aids

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1415 - AIR SYSTEM BANK 1

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

AIR pump is used to lower tailpipe emissions on start-up. PCM supplies ground to AIR pump relay, energizing pump. PCM runs 2 tests using HO2S voltages to diagnose AIR system.

Test I

1. When AIR pump is enabled, PCM monitors HO2S voltage. If HO2S voltages drop below a threshold, PCM interprets this as an indication that pump is operational.
2. When AIR pump is disabled, PCM monitors HO2S voltages. HO2S voltages should increase above a threshold and switch normally. If PCM does not sense more than a predetermined amount of HO2S rich switches, a malfunction will be reported.

Test II

1. During this test, PCM will activate AIR pump during closed loop" operation. When AIR is activated, PCM will monitor HO2S voltages and short term fuel trim values for both engine banks. If AIR is operating properly, HO2S voltages should go low and short term fuel trim should go high.
2. PCM checks that HO2S voltages return to a rich threshold when pump is disabled. If PCM determines that HO2S voltages for both banks does not respond as expected during test, DTC P0410 will set. If only one sensor responded, PCM will set either a DTC P1415 or P1416 to indicate on which bank AIR system is inoperative.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0133, P0135, P0152,

P0155, P0171, P0172, P0174, P0175, P0300, P0412, P0418, P0441, P0443, P1120, P1220, P1221, P1441 and related HO2S DTCs not set.

- Engine operating longer than 2 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine to "closed loop" status. Turn off all accessories. Using scan tool, select ENGINE 1 DATA LIST and monitor Bank 1 HO2S 1 (left front) voltage display. If HO2S voltage drops to less than 350 mV, see DIAGNOSTIC AIDS. If HO2S voltage does not drop to less than 350 mV, go to next step.
3. Ensure all hoses and pipes are connected and clamps secure. Check for heat damaged components. Repair as necessary. After repairs, go to step 6). If components are okay, go to next step.
4. Disconnect hose from check valve at left exhaust manifold. Using scan tool, enable AIR pump. If air is present at hose outlet, go to step 7). If air is not present, go to next step.
5. Repair restriction or blockage in AIR hoses/pipes between left exhaust manifold and where system branches to both sides of engine. After repairs, go to step 8).
6. Repair as necessary. After repairs, go to step 8).
7. Replace check valve. After replacing check valve, go to next step.
8. 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).
9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Casting flash in exhaust manifold may restrict amount of airflow necessary to affect HO2S voltage. Remove air pipe from manifold and inspect passage.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1416 - AIR SYSTEM BANK 2

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

AIR pump is used to lower tailpipe emissions on start-up. PCM supplies ground to AIR pump relay, energizing

pump. PCM runs 2 tests using HO2S voltages to diagnose AIR system.

Test I

1. When AIR pump is enabled, PCM monitors HO2S voltage. If HO2S voltages go below a threshold, PCM interprets this as an indication that pump is operational.
2. When AIR pump is disabled, PCM monitors HO2S voltages. HO2S voltages should increase above a threshold and switch normally. If PCM does not sense more than a predetermined amount of HO2S rich switches, a malfunction will be reported.

Test II

1. During this test, PCM will activate AIR pump during closed loop" operation. When AIR is activated, PCM will monitor HO2S voltages and short term fuel trim values for both engine banks. If AIR is operating properly, HO2S voltages should go low and short term fuel trim should go high.
2. PCM checks that HO2S voltages return to a rich threshold when pump is disabled. If PCM determines that HO2S voltages for both banks does not respond as expected during tests, DTC P0410 will set. If only one sensor responded, PCM will set either DTC P1415 or P1416 to indicate which bank AIR system is inoperative.

DTC will set when following conditions are present:

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0133, P0135, P0152, P0155, P0171, P0172, P0174, P0175, P0300, P0412, P0418, P0441, P0443, P1120, P1220, P1221, P1441 and related HO2S DTCs not set.
- Engine operating longer than 2 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and operate engine to "closed loop" status. Turn off all accessories. Using scan tool, select ENGINE 1 DATA LIST and monitor Bank 2 HO2S 1 (right front) voltage display. If HO2S voltage drops to less than 350 mV, see DIAGNOSTIC AIDS. If HO2S voltage does not drop to less than 350 mV, go to next step.
3. Ensure all hoses and pipes are connected and clamps secure. Check for heat damaged components. Repair as necessary. After repairs, go to step 6). If components are okay, go to next step.
4. Disconnect hose from check valve at right exhaust manifold. Using scan tool, enable AIR pump. If air is present at hose outlet, go to step 7). If air is not present, go to next step.
5. Repair restriction or blockage in AIR hoses/pipes between left exhaust manifold and where system branches to both sides of engine. After repairs, go to step 8).
6. Repair as necessary. After repairs, go to step 8).
7. Replace check valve. After replacing check valve, go to next step.
8. 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).

9. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Casting flash in exhaust manifold may restrict amount of air flow necessary to affect HO2S voltage. Remove air pipe from manifold and inspect passage.

Use of FREEZE FRAME and/or FAILURE RECORDS mode will aid in locating intermittent condition. If DTC cannot be duplicated, information in data can be useful in determining how many miles since DTC set. This mode can also be used to determine how many ignition cycles diagnostic reported a pass and/or fail condition. Operating vehicle within FREEZE FRAME conditions (RPM, load, vehicle speed, temperature, etc.) will isolate when DTC failed.

DTC P1431 - FUEL LEVEL SENSOR NO. 2 (RIGHT SIDE) CIRCUIT PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor No. 2 measures fuel level changes within right fuel tank. When fuel level is low, sensor output voltage is high. When fuel level is high, sensor output voltage is low.

PCM uses inputs from fuel level sensor No. 1 (left side) and fuel level sensor No. 2 (right side) to calculate total fuel remaining in both tanks. This information is sent via serial data to BCM to be displayed on fuel gauge.

Diagnostic checks for stuck fuel level sensor No. 2 signal. If PCM determines fuel level signal appears to be stuck based on lack of signal variation, DTC P1431 sets.

DTC will set when following conditions are present:

- PCM determines that fuel level sensor No. 2 voltage is inconsistent with fuel level sensor No. 1 voltage for 40 minutes.

Or

- Fuel level sensor(s) voltage input to PCM is unchanged for 40 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Disconnect fuel level sensor No. 2 connector at right fuel tank. Using scan tool, read fuel level sensor voltage. If voltage is less than .3 volt, go to next step. If voltage is not as specified, go to step 8).

3. Connect a fused jumper wire between fuel level sensor No. 2 connector signal and 5-volt reference circuits. If voltage is 5 volts, go to next step. If voltage is not as specified, go to step 9).
4. Using scan tool, monitor fuel level in left fuel tank. If left fuel tank is empty, add gasoline. Disconnect upper siphon jet pump feed pipe from right fuel tank. Insert siphon jet pump feed pipe into empty, approved gasoline container. Using scan tool, command fuel pump ON for 10 seconds. Measure volume of fuel in container. If volume is more than .633 pint (.30L), go to next step. If volume is not as specified, go to step 10).
5. Reconnect upper siphon jet pump feed pipe to right fuel tank. Disconnect upper siphon jet pump feed pipe from left fuel tank. Insert siphon jet pump feed pipe into empty, approved gasoline container. Using scan tool, command fuel pump ON for 8 seconds. Measure volume of fuel in container. If volume is more than .703 pint (.33L), go to next step. If volume is not as specified, go to step 11).
6. Remove fuel level sensor No. 2 from right fuel tank. Check for foreign material (such as ice) in fuel tank. Repair fuel tank as necessary. After repairs, go to step 15). If no foreign material is found in tank, go to next step.
7. Connect a DVOM set to 400 ohm range, between fuel level sensor No. 2 (sensor side) signal and ground circuits. Sweep sensor from stop to stop. If resistance varies smoothly from about 40-250 ohms, see DIAGNOSTIC AIDS. If resistance is not as specified, go to step 12).
8. Turn ignition off. Disconnect PCM connector. Check fuel level sensor No. 2 signal circuit for short to voltage. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 14).
9. Turn ignition off. Disconnect PCM connector. Check fuel level sensor No. 2 signal circuit for open or short to ground. Repair as necessary. After repairs, go to step 15). If circuit is okay, go to step 13).
10. Inspect siphon jet pump feed pipe for restrictions. Repair as necessary. After repairs, go to step 15).
11. Inspect siphon jet pump feed pipe for restrictions. Repair as necessary. After repairs, go to step 15). If no restrictions are found, go to next step.
12. Replace fuel level sensor No. 2 and go to step 15).
13. Check terminal connections at PCM. Repair terminals as necessary. After repairs, go to step 15). If terminals are okay, go to next step.
14. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
15. 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).
16. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. If fuel level sensor is operating okay, check operation of jet pump. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load,

vehicle speed, temperature, etc.).

DTC P1432 - FUEL LEVEL SENSOR NO. 2 (RIGHT SIDE) CIRCUIT LOW VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor No. 2 measures fuel level changes within right fuel tank. When fuel level is low, sensor output voltage is high. When fuel level is high, sensor output voltage is low.

PCM uses inputs from fuel level sensor No. 1 (left side) and fuel level sensor No. 2 (right side) to calculate total fuel remaining in both tanks. This information is sent via serial data to BCM to be displayed on fuel gauge.

Diagnostic checks for stuck fuel level sensor No. 2 signal. If PCM determines fuel level signal appears to be stuck based on lack of signal variation, DTC P1432 sets.

DTC will set when following conditions are present:

- Fuel level sensor No. 2 voltage is less than .39 volt.
- Condition met for greater than 20 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Warm engine to normal operating temperature. Using scan tool, monitor FAILED THIS IGNITION under DTC STATUS for DTC P1635. If scan tool indicates that DTC P1635 failed this ignition cycle, diagnose DTC P1635. If scan tool does not indicate that DTC P1635 failed this ignition cycle, go to next step.
3. Turn ignition on, with engine off. Using scan tool, read fuel level sensor No. 2 voltage. If voltage is less than .39 volt, go to step 5). If voltage is not as specified, go to next step.
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. Disconnect fuel level sensor No. 2 connector at right fuel tank. Connect a fused jumper wire between fuel level sensor No. 2 connector signal and 5-volt reference circuits. If voltage is 5 volts, go to step 11). If voltage is not as specified, go to next step.
6. Connect a test light between battery positive and fuel level sensor No. 2 connector signal circuit. If voltage is 5 volts, go to next step. If voltage is not as specified, go to step 9).
7. Turn ignition off. Disconnect PCM harness connector. Check fuel level sensor No. 2 5-volt reference circuit for open or short to ground. Repair as necessary. After repairs, go to step 14). If circuit is okay, go

to next step.

8. Check 5-volt reference circuit for poor terminal connections at PCM. Repair or replace terminal as necessary. After repairs, go to step 14). If terminal is okay, go to step 12).
9. Turn ignition off. Disconnect PCM harness connector. Check fuel level sensor No. 2 signal circuit for open, short to sensor ground circuit or short to ground. Repair as necessary. After repairs, go to step 14). If circuit is okay, go to next step.
10. Check signal circuit for poor terminal connection at PCM. Repair or replace terminal as necessary. After repairs, go to step 14). If terminal is okay, go to next step.
11. Replace fuel level sensor No. 2. After replacing sensor, go to step 14).
12. Check terminal contact at PCM. Repair as necessary. After repairs, go to step 14). If terminal contact is okay, go to next step.
13. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, 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, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1433 - FUEL LEVEL SENSOR NO. 2 (RIGHT SIDE) CIRCUIT HIGH VOLTAGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Fuel level sensor No. 2 measures fuel level changes within right fuel tank. When fuel level is low, sensor output voltage is high. When fuel level is high, sensor output voltage is low.

PCM uses inputs from fuel level sensor No. 1 (left side) and fuel level sensor No. 2 (right side) to calculate total fuel remaining in both tanks. This information is sent via serial data to BCM to be displayed on fuel gauge.

Diagnostic checks for stuck fuel level sensor No. 2 signal. If PCM determines fuel level signal appears to be stuck based on lack of signal variation, DTC P1433 sets.

DTC will set when following conditions are present:

- Fuel level sensor No. 2 voltage is more than 2.9 volts.
- Condition met for greater than 20 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Warm engine to normal operating temperature. Using scan tool, monitor FAILED THIS IGNITION under DTC STATUS for DTC P1635. If scan tool indicates that DTC P1635 failed this ignition cycle, diagnose DTC P1635. If scan tool does not indicate that DTC P1635 failed this ignition cycle, go to next step.
3. Turn ignition on, with engine off. Using scan tool, read fuel level sensor No. 2 voltage. If voltage is greater than 2.9 volts, go to step 5). If voltage is not greater than 2.9 volts, go to next step.
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. Disconnect fuel level sensor No. 2 connector at right fuel tank. If voltage is less than one volt, go to next step. If voltage is not as specified, go to step 7).
6. Connect a test light between battery positive and fuel level sensor No. 2 connector ground circuit. If test light illuminates, go to step 8). If test light does not illuminate, go to step 10).
7. Check fuel level sensor No. 2 signal circuit for short to voltage or to 5-volt reference circuit. Repair as necessary. After repairs, go to step 16). If circuit is okay, go to step 12).
8. Using a DVOM, check voltage between ground and fuel level sensor No. 2 5-volt reference circuit. If voltage is greater than 5.1 volts, go to step 15). If voltage is not greater than 5.1 volts, go to step 14).
9. Check sensor ground circuit for poor terminal connection at fuel level sensor No. 2. Repair or replace terminal as necessary. After repairs, go to step 16). If terminal is okay, go to next step.
10. Check sensor ground circuit for poor terminal connection at PCM. Repair or replace terminal as necessary. After repairs, go to step 16). If terminal is okay, go to next step.
11. Using DVOM, check resistance of fuel level sensor No. 2 ground circuit between sensor and PCM. If resistance is greater than 5 ohms, repair open or poor connection. After repair, go to step 16). If resistance is not greater than 5 ohms, go to next step.
12. Check terminal contact at PCM. Repair as necessary. After repairs, go to step 16). If terminal contact is okay, go to next step.
13. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 16).
14. Replace fuel level sensor No. 2 and go to step 16).
15. Repair 5 volt reference circuit for short to ground. After repair, go to next step.
16. 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).

17. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

With this DTC set, fuel gauge will display empty. Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles since diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1441 - EVAP SYSTEM FLOW DURING NON-PURGE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

EVAP vacuum switch is a normally closed switch, mounted in vacuum line between EVAP canister and EVAP solenoid. Battery voltage is supplied to switch through a pull-up resistor in PCM. When PCM commands EVAP canister purge solenoid valve open (purge on), engine vacuum draws evaporative emissions from canister and EVAP switch opens (signal voltage high) providing feedback to PCM, indicating EVAP system is operating. When PCM commands purge off, EVAP vacuum switch closes (signal voltage low), confirming that purging has ceased.

DTC will set when following conditions are present:

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0441, P0443, P1120, P1121, P1220 or P1221 not set.
- Engine coolant temperature less than 239°F (115°C).
- IAT greater than 37°F (3°C) at power up.
- Difference between ECT and IAT is less than 50°F (10°C) at power up.
- Engine speed 500-2500 RPM.
- TP angle 10-60 percent.
- MAP 20-80 kPa.
- BARO greater than 75 kPa.
- Purge not enabled.
- PCM detects high signal voltage on EVAP vacuum switch signal circuit when PCM is commanding purge on.
- Conditions met for 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

NOTE: DTC will set if vacuum lines at EVAP purge solenoid are reversed.

2. Turn ignition on, with engine off. Using scan tool, check EVAP vacuum switch status. If scan tool indicates that EVAP vacuum switch is not purging, go to next step. If scan tool indicates that EVAP vacuum switch is purging, go to step 6).
3. Using scan tool, check EVAP vacuum switch status. If EVAP vacuum switch status changes to purge when engine is started, go to step 19). If EVAP vacuum switch does not change to purge when engine is started, go to next step.
4. Start and operate engine to greater than 1500 RPM. Using scan tool, command EVAP canister purge solenoid on and off, while observing EVAP vacuum switch status. If scan tool indicates "No Purge" within 5 seconds, see DIAGNOSTIC AIDS. If scan tool does not indicate "No Purge" within 5 seconds, go to next step.
5. Turn ignition off. Disconnect purge hose from EVAP vacuum switch. Start engine and increase engine speed to 1500 RPM. Using scan tool, command EVAP canister purge solenoid on and off, while EVAP vacuum switch status. If scan tool indicates NO PURGE within 5 seconds, go to step 11). If scan tool does not indicate NO PURGE within 5 seconds, go to step 12).
6. Disconnect EVAP vacuum switch harness connector. Using test light connected to battery voltage, probe ground circuit at EVAP vacuum switch harness connector. If test light illuminates, go to next step. If test light does not illuminate, go to step 13).
7. Connect a fused jumper wire across EVAP vacuum switch harness connector terminals. If scan tool indicates EVAP vacuum switch NO PURGE, go to step 14). If EVAP vacuum switch does not indicate NO PURGE, go to next step.
8. Using DVOM, check voltage at signal circuit of EVAP vacuum switch harness connector and ground. Battery voltage should be present. If battery voltage is present, go to step 18). If battery voltage is not present, go to next step.
9. Turn ignition off. Disconnect PCM connector C2. Using DVOM, check continuity between EVAP vacuum switch signal circuit and ground. If DVOM does not read infinity, go to step 16).
10. Using DVOM, check continuity of EVAP vacuum switch signal circuit from vacuum switch harness connector to PCM connector. If resistance is less than 5 ohms, go to step 20). If resistance is more than 5 ohms, go to step 17).
11. Replace EVAP canister. After replacing canister, go to step 21).
12. Repair restricted or kinked hose between canister and EVAP vacuum switch. After repairs, go to step 21).
13. Repair open ground circuit. After repairs, go to step 21).
14. Check connections at EVAP vacuum switch. Repair as necessary. After repairs, go to step 21). If connections are okay, go to next step.
15. Replace EVAP switch. After replacing switch, go to step 21).
16. Repair shorted signal to ground. After repairs, go to step 21).
17. Repair open signal circuit. After repairs, go to step 21).
18. Check connections at PCM. Repair as necessary. After repairs, go to step 21). If connections are okay, go

to step 20).

19. Replace EVAP canister purge solenoid. After replacing solenoid, go to step 21).
20. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 16).
21. 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).
22. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Before replacing any components, check for misrouted harness, rubbed-through wire insulation, wire broken inside insulation, kinked or damaged vacuum hoses or for physical damage to system components.

DTC P1514 - TAC SYSTEM MAF PERFORMANCE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM uses Throttle Position (TP) sensor, Barometric Pressure (BARO) sensor, Intake Air Temperature (IAT) sensor and engine RPM inputs to calculate and expected Mass Airflow (MAF) value. PCM compares this value to MAF value and a speed density calculation to verify proper throttle operation.

DTC will set when following conditions are present:

- DTC P0601, P0602, P0606, P1515, P1516, P1517, P1518 or P1624 not set.
- DTCs P1120, P1220 and P1221 not set at same time.
- DTCs P1120 and P1220 not set at same time
- Engine operating longer than one second.
- Engine speed greater than 500 RPM.
- PCM detects actual MAF value and speed density much greater than expected (calculated) airflow rate.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P0101, P0102, P0103, P0107, P0108, P0112, P0113, P1111 or P1112 is also set, diagnose affected DTC(s) first. If DTC(s) is not set, go to next step.

CAUTION: Turn ignition off before inserting fingers into throttle bore. Unexpected movement of throttle blade could cause possible injury.

3. Inspect throttle for loose or damaged TP sensor, loose or damage throttle blade, broken throttle shaft or drive mechanism damage. If any of these conditions exist, replace throttle Body and go to next step. If None of these conditions exist, see DIAGNOSTIC AIDS.
4. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1514. 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).
5. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Inspect throttle blade for being broken, bent or missing. Inspect TP sensor for proper installation (a misaligned sensor will set this DTC)

DTC P1515 - COMMAND VS ACTUAL TP PERFORMANCE (PCM)

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Commanded throttle position (based on accelerator pedal position and possibly other limiting factors) is compared to actual throttle position. Both values should be within calibrated range. Commanded and actual throttle position are monitored redundantly by both PCM and TAC modules.

DTC will set when following conditions are present:

- DTC P0601, P0602, P0606, P1516, P1517, P1518 or P1624 not set.
- DTCs P1120, P1220 and P1221 not set at same time.
- DTCs P1120 and P1220 not set at same time
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 8.5 volts.
- Not in battery saver mode.
- PCM detects commanded and actual throttle positions are not within a calibrated range of each other.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. If DTC P1518 and P1221 are also set, diagnose affected DTCs first. If these DTCs are not set, go to next

step.

3. Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, monitor TP sensors No. 1 and No. 2 angles. Slowly depress accelerator pedal to wide open throttle. Slowly return to closed throttle. If TP angles increase as throttle blade is open and decrease as throttle is closed, see DIAGNOSTIC AIDS. If TP angles does not increase, go to next step.

NOTE: Disconnecting throttle actuator motor will cause additional DTCs to set.

4. Remove duct from throttle Body assembly. Disconnect throttle actuator motor connector. Manually rotate throttle blade to wide open throttle and then close throttle blade while monitoring scan tool. If TP angles increase as throttle blade is open and decrease as throttle is closed, go to next step. If TP angles does not increase, go to step 11).
5. Turn ignition off. Connect a test light across throttle actuator motor connector. Turn ignition on briefly. If test light illuminates, go to step 10). If test light does not illuminate, go to next step.
6. Turn ignition off. Leave throttle actuator motor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing throttle actuator circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and both throttle actuator circuits. If any voltage is present, go to step 12). If no voltage is present, go to next step.
7. Using DVOM, check continuity of both throttle actuator circuits between throttle actuator and TAC module. If continuity exists on both circuits, go to next step. If continuity is not as specified, go to step 13).
8. Check continuity between battery ground and both throttle actuator circuits. If continuity exists on both circuits, go to step 14). If continuity is not as specified, go to next step.
9. Check continuity between both throttle actuator circuits and all other circuits in both TAC module connector. If continuity exists between any circuit(s), go to step 15). If no continuity exists between any circuit, go to step 17).
10. Check for poor terminal connections at throttle actuator harness connector. Repair or replace terminals. After repairs, go to step 19). If terminals are okay, go to next step.
11. Replace throttle body assembly. After replacing throttle body, go to step 19).
12. Repair short to voltage in affected throttle actuator circuit(s). After repairs, go to step 19).
13. Repair open in affected throttle actuator circuit(s). After repairs, go to step 19).
14. Repair short to ground in affected throttle actuator circuit(s). After repairs, go to step 19).
15. Repair circuits shorted together. After repairs, go to step 19).
16. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 19).
17. Check for poor terminal connections at TAC module harness connector. Repair or replace terminals. After repairs, go to step 19). If terminals are okay, go to next step.
18. Replace TAC module. After replacing module, go to next step.
19. 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 that set 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).

20. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

If no problem is found, check for temperature related mechanical problems or binding. Components may not move freely in extreme heat or cold (ice) conditions.

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1516 - COMMAND VS ACTUAL TP PERFORMANCE (TAC)

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Commanded throttle position (based on accelerator pedal position and possibly other limiting factors) is compared to actual throttle position. Both values should be within calibrated range. Commanded and actual throttle position are monitored redundantly by both PCM and TAC modules.

DTC will set when following conditions are present:

- DTC P1518 not set.
- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 8.5 volts.
- Not in battery saver mode.
- TAC module detects commanded and actual throttle positions are not within a calibrated range of each other.
- PCM or TAC module cannot determine throttle position.
- Both TP sensor inputs invalid.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

   NOTE: If DTC P1221 or P1518 is also set, diagnose this DTCs first.

2. Turn ignition off for 15 seconds. Turn ignition on, with engine off. Using scan tool, monitor TP sensors No. 1 and No. 2 angles. Slowly depress accelerator pedal to wide open throttle. Slowly return pedal to closed throttle. If TP angles increase as throttle blade is open and decrease as throttle is closed, see DIAGNOSTIC AIDS. If angles does not increase, go to next step.

NOTE: Disconnecting throttle actuator motor will cause additional DTCs to set.

3. Remove duct from throttle Body assembly. Disconnect throttle actuator motor connector. Manually rotate throttle blade to wide open throttle and then close throttle blade while monitoring scan tool. If TP angles increase as throttle blade is open and decrease as throttle is closed, go to next step. If TP angles does not increase, go to step 10).
4. Turn ignition off. Connect a test light across throttle actuator motor connector. Turn ignition on briefly. If test light illuminates, go to step 9). If test light does not illuminate, go to next step.
5. Turn ignition off. Leave throttle actuator motor disconnected. Disconnect Throttle Actuator Control (TAC) module connector containing throttle actuator circuits. Turn ignition on, with engine off. Using DVOM, check voltage between battery ground and both throttle actuator circuits. If any voltage is present, go to step 11). If no voltage is present, go to next step.
6. Using DVOM, check continuity of both throttle actuator circuits between throttle actuator and TAC module. If continuity exists on both circuits, go to next step. If continuity is not as specified, go to step 12).
7. Check continuity between battery ground and both throttle actuator circuits. If continuity exists on both circuits, go to step 14). If continuity is not as specified, go to next step.
8. Check continuity between both throttle actuator circuits and all other circuits in both TAC module connector. If continuity exists between any circuit(s), go to step 14). If no continuity exists between any circuit, go to step 16).
9. Check for poor terminal connections at throttle actuator harness connector. Repair or replace terminals. After repairs, go to step 18). If terminals are okay, go to next step.
10. Replace throttle body assembly. After replacing throttle body, go to step 18).
11. Repair short to voltage in affected throttle actuator circuit(s). After repairs, go to step 18).
12. Repair open in affected throttle actuator circuit(s). After repairs, go to step 18).
13. Repair short to ground in affected throttle actuator circuit(s). After repairs, go to step 18).
14. Repair circuits shorted together. After repairs, go to step 18).
15. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to step 18).
16. Check for poor terminal connections at TAC module harness connector. Repair or replace terminals. After repairs, go to step 18). If terminals are okay, go to next step.
17. Replace TAC module. After replacing module, go to next step.
18. 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 that set 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).
19. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1517 - TAC MODULE PROCESSOR SERIAL DATA CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Throttle Actuator Control (TAC) module contains data which is essential for proper TAC system operation. TAC module continuously check integrity of this data.

When TAC module is unable to write or read data to and from RAM or TAC module is unable to correctly read data from flash memory or an internal TAC module processor fault is detected, DTC will set.

DTC will set when following conditions are present:

- DTC P1518 not set.
- Ignition switch to CRANK or RUN position.
- Ignition voltage greater than 5.23 volts.
- TAC module determines that an internal data test did not pass.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Replace TAC module. After replacing module, go to next step.
3. Using scan tool, select DTC, CLEAR INFO function. Start and warm engine to normal operating temperature. Select DTC, SPECIFIC, then enter DTC P1517. Operate vehicle within conditions that set 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).
4. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1518 - PCM TO TAC MODULE SERIAL DATA CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM and Throttle Actuator Control (TAC) module communicate through a dedicated serial data circuit. This diagnostic monitors accuracy of serial data transmission between PCM and TAC module. If a loss of data or

invalid data is detected, this DTC will set.

DTC will set when following conditions are present:

- Ignition switch in CRANK or RUN position.
- Ignition voltage greater than 8.5 volts.
- Invalid or missing serial data messages are detected for a predetermined amount of time.
- Conditions met for less than one second.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, engine off. Using test light connected to ground, probe both ends of THROT CONT fuse (located in underhood fuse block). If test light illuminates on at least one side of fuse, go to next step. If test light does not illuminate on either end of fuse, check ignition relay.

   NOTE: If DTC P0606 is also set, diagnose DTC P0606 first.

3. Using scan tool, select SPECIAL FUNCTIONS option and PCM INTEGRITY STATUS. If scan tool indicates that PCM integrity status failed, go to step 28). If scan tool does not indicate that PCM integrity status failed, go to next step.

   NOTE: If Driver Information Center (DIC) is displaying REDUCED ENGINE POWER, go to step 5).

4. Start engine and increase engine speed to 3000 RPM, if possible. Using scan tool, monitor FAIL THIS IGNITION option under DTC option. If this DTC fails this ignition cycle, go to next step. If this DTC does not fail this ignition cycle, see DIAGNOSTIC AIDS.
5. Turn ignition off. Disconnect throttle actuator harness connector. Turn ignition on, engine off. Check voltage at both circuits of throttle actuator motor harness connector. If both circuits read greater than 8 volts, go to step 11). If both circuits do not read greater than 8 volts, go to next step.
6. Turn ignition off. Check resistance on both throttle actuator motor harness connector circuits. If resistance is 0-5 ohms, go to step 9). If resistance is not 0-5 ohms, go to next step.
7. Turn ignition off. Remove THROT CONT fuse. Check continuity from TAC side of fuse terminal to battery ground. If continuity is present, go to next step. If continuity is not present, go to step 10).
8. Disconnect TAC module harness connector. Check continuity from TAC side of fuse terminal to battery ground. If continuity is present, go to step 19). If continuity is not present, go to step 27).
9. Disconnect TAC module harness connector. Check continuity from throttle actuator motor harness connector to battery ground. If continuity is present, go to step 20). If continuity is not present, go to step 27).
10. Turn ignition off. Disconnect TAC harness connector. Check continuity between TAC side of fuse terminal to ignition feed circuit of TAC at harness connector. If continuity is present, go to step 27). If continuity is not present, go to step 21).

11. Turn ignition off. Disconnect TAC module harness connector. Turn ignition on, engine off. Check voltage at both circuits of throttle actuator motor harness connector. If both circuits read zero volts, go to next step. If both circuits do not read zero volts, go to step 22).
12. Check continuity from TAC module ground circuit to battery ground. If continuity is present, go to next step. If continuity is not present, go to step 23).
13. Check voltage between ground and both serial data circuits in TAC module harness connector. If both serial data circuits read 0-4.5 volts, go to next step. If both serial data circuits do not read 0-4.5 volts, go to step 16).
14. Turn ignition off. Check resistance from serial data circuits at TAC module harness connector to battery ground. If DVOM reads OL for both circuits, go to step 17). If DVOM does not read OL for both circuits, go to next step.
15. Disconnect PCM harness connector. Check resistance from serial data circuits at TAC module harness connector to battery ground. If resistance is 0-5 ohms, go to step 24). If resistance is not 0-5 ohms, go to step 28).
16. Disconnect PCM harness connector. Check voltage at both serial data circuits at TAC module harness connector. If voltage is indicated on either circuits, go to step 25). If voltage is not indicated on either circuits, go to step 28).
17. Disconnect PCM harness connector. Check continuity of each serial data circuit between TAC module harness connector to PCM harness connector. If continuity is present on both circuits, go to next step. If continuity is not present on both circuits, go to step 26).
18. Reconnect PCM. Turn ignition on, engine off. Check voltage at serial data circuit at TAC module harness connector. If voltage reading is zero volts, go to step 28). If voltage reading is not zero volts, go to step 27).
19. Repair TAC module ignition feed circuit for short to ground. After repairs, go to step 29).
20. Repair throttle actuator motor circuit for short to ground. After repairs, go to step 29).
21. Repair TAC module ignition feed circuit for an open in circuit. After repairs, go to step 29).
22. Repair throttle actuator motor circuits for short to voltage. After repairs, go to step 29).
23. Repair TAC module ground for open. After repairs, go to step 29).
24. Repair serial data circuit for short to ground. After repairs are complete, go to step 29).
25. Repair serial data circuit for short to voltage. After repairs are complete, go to step 29).
26. Repair serial data circuit for an open. After repairs, go to step 29).
27. Replace TAC module. After replacing module, go to step 29).
28. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
29. 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 that set 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).
30. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, diagnose affected DTCs.

Diagnostic Aids

Check TAC module power and ground circuits and PCM/TAC module serial data circuits for intermittent connections. An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1539 - A/C CLUTCH STATUS CIRCUIT VOLTAGE HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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.

If PCM detects voltage on A/C clutch status terminal when A/C has not been requested, DTC will set. A short to voltage at any point in A/C status circuit, or if A/C relay contacts are stuck, will also set DTC.

DTC will set when following conditions are present:

- After PCM has disengaged A/C clutch relay, voltage is detected on A/C status circuit for greater 15 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and idle engine. Turn A/C off. 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 step 4). If scan tool does not indicate that A/C status as ON, 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, and as close to conditions recorded in FREEZE FRAME/FAILURE RECORDS as possible. Select DTC function then enter DTC P1539. 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. Remove A/C clutch relay. Start and idle engine for about 30 seconds. Using scan tool, select DTC INFO, FAIL THIS IGN. If scan tool indicates that DTC P1539 failed, go to next step. If scan tool does not indicate that DTC P1539 failed, go to step 6).
5. Repair A/C clutch status circuit for short to battery voltage. After repairs, go to step 7).
6. Replace AC clutch relay. After replacing relay, go to next step.
7. 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).
8. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTC(s) are displayed, go to applicable DTC test.

Diagnostic Aids

A/C status circuit goes to A/C compressor clutch and to A/C clutch relay. Check all circuits going to these components

DTC P1545 - A/C CLUTCH RELAY CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Ignition voltage is supplied directly to A/C compressor clutch relay coil. PCM controls relay by grounding control circuit through an internal switch called a driver. primary function of 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 on control circuit should be low (near zero). When PCM is commanding a component off, voltage of circuit should be high (near battery voltage). If fault detection circuit senses a voltage other that what is expected, fault line will change causing DTC to set.

Relay is used to control high current flow to A/C compressor clutch, allowing PCM driver to only have to handle relatively low current used by relay.

DTC will set when following conditions are present:

- DTCs P0106, P0113, P0500, P0502, P0560, P0562, P1133, P1135, P1136, P1153, P1154, P1532, P1539 or P1543 not set.
- Engine speed greater than 600 RPM.
- PCM detects commanded state of driver and actual state do not match.
- Condition is met for minimum of 10 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, command A/C relay on and off. If relay turns on and off as commanded, go to next step. If relay does not turn on and off as commanded, go to step 5).
3. Turn ignition off. Disconnect PCM containing relay control circuit. Turn ignition on. Using DVOM on 10-amp scale, measure current from relay control circuit in PCM harness connector to ground for 2 minutes. If current draw is less that .75 amp, but not zero, see DIAGNOSTIC AIDS. If current draw is not as specified, go to next step.
4. Turn ignition off. Disconnect relay. Using DVOM, check resistance from relay control circuit in PCM connector to ground. If resistance is infinite, go to step 12). If resistance is not infinite, go to step 12).
5. Turn ignition off. Disconnect relay. Connect test light between relay coil terminals in relay harness connector. Turn ignition on. Using scan tool, command relay on and off. If test light illuminates with each command, go to step 8). If test light does not illuminate with each command, go to next step.
6. Connect test light to ground and probe battery feed circuits in relay harness connector. If test light

illuminates on both terminals, go to next step. If test light does not illuminate on both terminals, go to step 11).

7. Turn ignition off. Reconnect A/C relay. Disconnect PCM harness connector containing relay control circuit. Turn ignition on. Connect a fused jumper wire between ground and PCM connector (harness side), relay control circuit. If relay activates, go to step 9). If relay does not activate, go to step 10).
8. Check connections at relay. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 12).
9. Check connections at PCM. Repair as necessary. After repairs, go to step 14). If connections are okay, go to step 13).
10. Repair faulty relay control circuit. After repairs, go to step 14).
11. Repair faulty battery feed circuit. After repairs, go to step 14).
12. Replace A/C relay. After replacing relay, go to step 14).
13. Replace PCM. Program replacement PCM using required equipment. After repair is completed, 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, go to next step. If scan tool does not indicate that this test ran and passed, repeat step 2).
15. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1546 - A/C CLUTCH STATUS CIRCUIT VOLTAGE LOW

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit 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.

DTC will set when following conditions are present:

- PCM has commanded A/C ON and no voltage is detected on A/C clutch status line for more than 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start and idle engine with A/C on. 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 DTC P1546. 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 repair is completed, 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.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1571 - ASR DESIRED TORQUE CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM supplies 5 volts on Desired Torque (DT) circuit to Electronic Brake And Traction Control Module (EBTCM). EBTCM grounds circuit when it detects wheel slip. DTC sets if DT signal is not received by PCM.

DTC will set when following conditions are present:

- Traction control not failed.
- Engine speed greater than 500 RPM for 20 seconds.
- DT signal not received by PCM for 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, read DTCs. If any ABS/Traction control DTCs are also set, diagnose affected DTCs first. If no ABS/Traction control DTCs are set, go to next step.
3. Turn ignition off. Disconnect EBTCM connector. Turn ignition on. Using a DVOM and Connector Test Kit Adaptor (J 35616-A), check voltage between ground and EBTCM connector, DT circuit. If voltage is about 5 volts, see ANTI-LOCK BRAKE SYSTEM article in the BRAKES section. If voltage is not as specified, go to next step.
4. Using a DVOM, check voltage between ground and EBTCM connector, DT circuit. If voltage is about battery voltage, go to step 7). If voltage is not as specified, go to next step.
5. Connect a test light between battery positive and EBTCM connector, DT circuit. If test light illuminates, go to step 8). If test light does not illuminate, go to next step.
6. Check for open in DT circuit. Repair as necessary. After repairs, go to step 11). If circuit is okay, go to step 9).
7. Repair short to battery voltage on DT circuit. After repairs, go to step 11).
8. Repair short to ground on DT circuit. After repairs, go to step 11).
9. Check terminal connections at PCM. Repair terminals as necessary. After repairs, go to step 11). If terminals are okay, go to next step.
10. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
11. 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).
12. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1574 - STOPLIGHT CONTROL CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Stoplight switch is normally closed. When switch is closed, Throttle Actuator Control (TAC) module senses ignition voltage on brakelight switch signal circuit. This DTC sets if TAC module senses voltage on brakelight switch signal circuit when switch should be open.

DTC will set when following conditions are present:

- Engine speed greater than 700 RPM for 20 seconds.
- Engine operating for greater than 2 seconds.
- Wheel speed greater than 30 MPH to activate diagnostic (diagnostic will be disabled if wheel speed is less than 10 MPH).
- Vehicle speed is decreasing at a rate greater than 10.4 MPH during a one second period.
- Conditions met for 1.5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start engine. Using scan tool, monitor brakelight (STOP LAMP) switch. Depress brake pedal about half-way down. If scan tool displays APPLIED, see DIAGNOSTIC AIDS. If scan tool does not display APPLIED, go to next step.
3. Check brakelight switch adjustment. Adjust if necessary. After adjustment, go to step 9). If adjustment is okay, go to next step.
4. Turn engine off. Disconnect brakelight switch connector. Turn ignition on. If scan tool displays APPLIED, go to next step. If scan tool does not display APPLIED, go to step 7).
5. Turn ignition off. Disconnect PCM connector. Turn ignition on. Install Brown connector from Connector Kit (J 35616-A) into brakelight switch signal circuit. Using a DVOM, check voltage on brakelight switch signal circuit. If voltage is greater than .5 volt, go to next step. If voltage is not greater than .5 volt, go to step 8).
6. Repair short to voltage in brakelight switch signal circuit. After repairs, go to step 9).
7. Replace brakelight switch. After replacing switch, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
9. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check brakelight switch adjustment. An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1575 - EXTENDED TRAVEL BRAKE SWITCH CIRCUIT HIGH

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Extended Travel Brake (ETB) switch is normally closed. When switch is closed, PCM senses ignition voltage on ETB switch signal circuit. This DTC sets if PCM senses voltage on ETB switch signal circuit when switch should be open.

DTC will set when following conditions are present:

- Engine speed greater than 700 RPM for 20 seconds.
- Engine operating for greater than 2 seconds.
- Wheel speed greater than 30 MPH to activate diagnostic (diagnostic will be disabled if wheel speed is less than 10 MPH).
- Vehicle speed is decreasing by a rate greater than 10.4 MPH during a one second period.
- PCM senses voltage on ETB switch circuit when ETB switch should be open.
- Conditions met for 1.5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Start engine. Using scan tool, monitor ETB switch. Depress brake pedal about half-way down. If scan tool displays APPLIED, see DIAGNOSTIC AIDS. If scan tool does not display APPLIED, go to next step.
3. Check ETB switch adjustment. Adjust if necessary. After adjustment, go to step 9). If adjustment is okay, go to next step.
4. Turn engine off. Disconnect ETB switch connector. Turn ignition on. If scan tool displays APPLIED, go to next step. If scan tool does not display APPLIED, go to step 7).
5. Turn ignition off. Disconnect PCM connector. Turn ignition on. Install Brown connector from Connector Kit (J 35616-A) into ETB switch signal circuit. Using a DVOM, check voltage on ETB switch signal circuit. If voltage is greater than .5 volt, go to next step. If voltage is not greater than .5 volt, go to step 8).
6. Repair short to voltage in ETB switch signal circuit. After repairs, go to step 9).
7. Replace ETB switch. After replacing switch, go to step 9).
8. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
9. 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).

10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Check ETB switch adjustment. An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1626 - THEFT DETERRENT SYSTEM FUEL ENABLE CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Vehicle operation is disabled if incorrect key or starting procedure is used. BCM confirms correct key resistor pellet and sends a password to PCM through serial data circuit. If password matches password stored in PCM, fuel will be enabled. If PCM does not receive password or BCM does not send it, PCM will set.

DTC will set when following conditions are present:

- Predetermined fuel enable decision point is reached.
- PCM is in Failed Enable mode due to loss of communications with BCM after correct password is received.
- No password message is received by PCM from BCM before fuel enable decision point.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Crank engine. If engine starts and runs, go to next step. If engine does not start, diagnose BCM. See BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: Before clearing DTCs, monitor all DTC status parameters and note any additional DTCs.

3. Using scan tool, clear PCM DTCs. Turn ignition off for one minute. Attempt to start engine. If engine starts and runs, see DIAGNOSTIC AIDS. If engine does not start and run, go to next step.
4. Using scan tool, read DTCs. If DTC P1626 resets, diagnose BCM. See BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section. If DTC does not set, see DIAGNOSTIC AIDS.

Diagnostic Aids

Most likely cause of DTC P1626 is loss of serial data communication from BCM. Check for loss of power to BCM. Check serial data circuit for open, short to ground or short to voltage.

DTC P1630 - THEFT DETERRENT SYSTEM PCM IN LEARN MODE

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This diagnostic checks for enable password learning flag, indicating PCM is in learn password mode. This mode allows PCM to learn password from BCM at assembly or when being serviced. Password has to be learned whenever BCM or PCM are replaced or ignition key has invalid resistor pellet.

DTC will set when following conditions are present:

- PCM is ready to learn a new password from BCM, but BCM is not sending a valid password or not sending a password at all.

Diagnostic Procedures

Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** . If DTC P1630 is still present after performing OBD system check, diagnose BCM. See BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section.

DTC P1631 - THEFT DETERRENT SYSTEM PASSWORD INCORRECT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

This diagnostic checks for mismatched passwords between BCM and PCM. Password has to be learned whenever BCM or PCM are replaced.

DTC will set when following conditions are present:

- PCM detects incorrect password from BCM.
- Fuel disable lock-out set.
- Incorrect fuel continue password is received.
- Invalid ignition key or faulty ignition switch.
- BCM is replaced.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.

2. Unless sent here after replacing PCM, check for any BCM DTCs being set. If a BCM DTC is set, diagnose DTC. See BODY CONTROL MODULE article in ACCESSORIES/SAFETY EQUIPMENT section. If T-50/T-60 scan tool is being used, go to step 5). If T-50/T-60 scan tool is not being used, go to next step.
3. If Tech 2 scan tool is being used, go to step 6). If Tech 2 scan tool is not being used, go to next step.

NOTE: While PCM is in Auto Learn Procedure, battery voltage must be maintained at all time. This procedure must be followed exactly or procedure will have to be repeated from beginning. Performing following procedures will set DTC P1630. Turn ignition off for 30 seconds, then turn ignition.

A. DTC P1630 should clear. If it does not, diagnose DTC P1630.

4. Turn ignition on, with engine off for 11 minutes. Turn ignition off for 30 seconds. Repeat turning on ignition for 11 minutes, and turning it off for 30 seconds 2 times. Turn ignition on, with engine off and wait 30 seconds. Attempt to start engine. If engine starts and operates normally, go to step 7). If engine does not start or operate normally, go to step 8).

NOTE: Performing following procedures will set DTC P1630. Turn ignition off for 30 seconds, then turn ignition on. DTC P1630 should clear. If it does not, diagnose DTC P1630.

5. Using T-50/T60 scan tool, enter SERVICE PROGRAMMING SYSTEM. Select TERMINAL-TO-VEHICLE PROGRAMMING. Select DONE and follow instructions on VEHICLE SET-UP screen. Select VEHICLE THEFT RELEARN. Follow instructions on remaining screens. PCM and BCM will be prepared for relearn. A security timer will be on for about 11 minutes or DTC P1630 sets. Keep terminal connected to vehicle during 11 minute period. When BCM and PCM are prepared to relearn, turn ignition off for 30 seconds and attempt to start engine. If engine starts and operates normally, go to step 7). If engine does not start or operate normally, go to step 8).

NOTE: Performing following procedures will set DTC P1630. Turn ignition off for 30 seconds, then turn ignition on. DTC P1630 should clear. If it does not, diagnose DTC P1630.

6. Using Tech 2 scan tool, enter SERVICE PROGRAMMING SYSTEM. After keying vehicle information, select REQUEST INFO key. Select DONE and follow instructions on VEHICLE SET-UP screen. Disconnect scan tool from vehicle and connect it to Techline terminal. At Techline terminal, select SERVICE PROGRAMMING SYSTEM. Select TERMINAL-TO-TECH 2 PROGRAMMING. Select DONE. Follow instructions on remaining screens. Select VEHICLE THEFT RELEARN. Select PROGRAM. Return scan tool to vehicle and connect to DLC. Select SERVICE PROGRAMMING SYSTEM. After keying vehicle information, select REQUEST INFO key. Select THEFT RELEARN. Follow instructions on remaining screens. PCM and BCM will be prepared for relearn. A security timer will be on for about 11 minutes or DTC P1630 sets. Keep terminal connected to vehicle during 11 minute period. When BCM and PCM are prepared to relearn, turn ignition off for 30 seconds and attempt to start engine. If engine starts and operates normally, go to next step. If engine does not start or operate normally, go to step 8).

NOTE: Before clearing DTCs, monitor all DTC status parameters and note any additional DTCs.

7. Using scan tool, clear PCM DTCs. Turn ignition off for 30 seconds. Attempt to start engine. If engine starts and operates normally, system is okay. If engine does not start and run, go to next step.
8. Using scan tool, read DTCs. If DTC P1626 or P1630 is set, diagnose affected DTC(s). If DTC P1631 resets, return to step 2).

DTC P1635 - 5-VOLT REFERENCE NO. 1 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM uses a common 5-volt reference No. 1 circuit as a sensor feed to A/C pressure, MAP, Engine Oil Pressure (EOP) and left tank fuel level sensors. PCM monitors voltage on 5-volt reference No. 1 circuit. If voltage is out of range, DTC will set.

DTC will set when following conditions are present:

- PCM detects 5-volt reference No. 1 circuit out of range.
- Condition met for greater than 2 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off. Disconnect PCM connector. Turn ignition on. Connect one lead of a DVOM to ground. Using Brown connector from Connector Kit (J 35616-A), connect other DVOM lead to 5-volt reference No. 1 circuit for following components: MAP sensor, EOP sensor, left tank fuel level sensor and A/C pressure sensor. If voltage on any circuit is greater than 5.1 volts, go to step 4). If voltage is not greater than 5.1 volts, go to next step.
3. Turn ignition off. Connect a test light lead to battery positive. Turn ignition on. Using Brown connector from Connector Kit (J 35616-A), connect test light to 5-volt reference No. 1 circuit for following components: MAP sensor, EOP sensor, left tank fuel level sensor and A/C pressure sensor. If test light illuminates for any circuit, go to step 5). If test light does not illuminate for any circuit, see DIAGNOSTIC AIDS.
4. Disconnect connector from sensor(s) than measured more than 5.1 volts. Using Brown connector from Connector Kit (J 35616-A), probe affected circuit at PCM connector (harness side). If voltage is greater than 5.1 volts, go to step 8). If voltage is not greater than 5.1 volts, go to step 6).
5. Disconnect connector from sensor(s) than illuminated test light. Connect test light lead to battery positive. Using Brown connector from Connector Kit (J 35616-A), connect test light to affected circuit at PCM connector (harness side). If test light illuminates, go to step 9). If test light does not illuminate, go to step 7).
6. Connect one lead of DVOM to ground. Turn ignition on. Connect other DVOM lead to signal circuit on

affected sensor(s). If any voltage is present, go to step 10). If no voltage is present, go to step 12).

7. Connect test light lead to battery positive. Turn ignition on. Using test light, probe signal circuit at affected sensor(s). If test light illuminates, go to step 11). If test light does not illuminate, go to step 12).
8. Repair short to voltage on appropriate 5-volt reference No. 1 circuit. After repairs, go to step 13).
9. Repair short to ground on appropriate 5-volt reference No. 1 circuit. After repairs, go to step 13).
10. Repair short to voltage on appropriate signal circuit. After repairs, go to step 13).
11. Repair short to ground on appropriate signal circuit. After repairs, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1639 - 5-VOLT REFERENCE NO. 2 CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM uses a common 5-volt reference circuit as a sensor feed to left tank fuel level sensors. PCM monitors voltage on 5-volt reference circuit. If voltage is out of range, DTC will set.

DTC will set when following conditions are present:

- PCM detects 5-volt reference is out of range.
- Condition met for greater than 2 minutes.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off. Disconnect PCM harness connector. Turn ignition on. Connect one lead of a DVOM to ground. Using Brown connector from Connector Kit (J 35616-A), connect other DVOM lead to 5-volt

reference circuit to left tank fuel level sensor. If voltage is greater than zero volts, go to step 7). If voltage is not greater than zero volt, go to next step.

3. Using Brown connector from Connector Kit (J 35616-A), connect DVOM between ground and left tank fuel level sensor. Using a fused jumper wire, jumper fuel pump control circuit to battery voltage. If DVOM reads greater than zero volts, go to step 8). If DVOM does not read greater than zero volts, go to next step.
4. Turn ignition off. Disconnect left tank fuel level sensor at fuel tank. Turn ignition on, engine off. Connect test light lead to battery positive. Using Brown connector from Connector Kit (J 35616-A), probe test light to fuel level sensor signal circuit. If test light illuminates, go to step 9). If test light does not illuminate, go to step next step.
5. Check resistance between fuel level sensor signal circuit and ground circuits at fuel tank connector. If resistance is less than 5 ohms, go to step 11). If resistance is not less than 5 ohms, go to next step.
6. Check PCM harness for continuity between fuel level sensor and all the other circuits in the disconnected PCM connector. If any of the circuits indicate a resistance of 0-5 ohms, go to step 10). If any of the circuits does not indicate a resistance of 0-5 ohms, go to step 12).
7. Repair short to voltage in fuel level sensor circuit. After repairs, go to step 13).
8. Repair short between fuel level sensor signal circuit and fuel pump feed circuit. After repairs, go to step 13).
9. Repair short to ground in fuel level sensor signal circuit. After repairs, go to step 13).
10. Repair circuits that are shorted together. After repairs, go to step 13).
11. Replace fuel level sensor. After replacing sensor, go to step 13).
12. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
13. 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).
14. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).

DTC P1644 - DELIVERED TORQUE OUTPUT CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

Electronic Brake And Traction Control Module (EBTCM) supplies 12 volts on Torque Delivered (TD) circuit to PCM. DTC sets if TD signal is not received by PCM.

DTC will set when following conditions are present:

- Traction control not failed.
- Engine speed greater than 500 RPM for 20 seconds.
- TD signal not received by PCM for 3 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition on, with engine off. Using scan tool, read DTCs. If any ABS/Traction control DTCs are also set, diagnose affected DTCs first. If no ABS/Traction control DTCs are set, go to next step.
3. Turn ignition off. Disconnect PCM harness connector. Turn ignition on. Using a DVOM and Connector Test Kit Adaptor (J 35616-A), check voltage between ground and TD circuit at PCM connector. If voltage is about battery voltage, go to next step. If voltage is not as specified, see ANTI-LOCK BRAKE SYSTEM article in BRAKES section.
4. Check terminal connections at PCM. Repair terminals as necessary. After repairs, go to step 6). If terminals are okay, go to next step.
5. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
6. 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).
7. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

An intermittent problem can be caused by misrouted harness, rubbed-through wire insulation or broken wire inside insulation.

DTC P1652 - PCM CHASSIS PITCH OUTPUT CIRCUIT

NOTE: For circuit reference, see WIRING DIAGRAMS article.

Circuit Description

PCM controls Powertrain Induced Chassis Pitch (PICP) by grounding control circuit through an internal switch called a driver. The primary function of 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 on control circuit should be low (near zero). When PCM is commanding a component off, voltage of circuit should be high

(near battery voltage). If fault detection circuit senses a voltage other that what is expected, fault line will change causing DTC to set.

PCM receives ignition voltage feed from Electronic Suspension Control (ESC) module from PICP circuit. PCM grounds this circuit when vehicle is accelerating rapidly or braking hard. ESC module commands all four shock absorber solenoids to firm position.

DTC will set when following conditions are present:

- PCM detects that commanded state of driver and actual state do not match.
- Condition met for at least 5 seconds.

Diagnostic Procedures

1. Perform **POWERTRAIN ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK** , then go to next step.
2. Turn ignition off. Disconnect ESC module. Connect a test light to battery voltage. Turn ignition on. Using Brown connector from Connector Kit (J 35616-A), connect test light to PICP circuit at ESC module connector. If test light illuminates, go to step 5). If test light does not illuminate, go to next step.
3. Using scan tool, command PICP signal ON. If test light illuminates, go to next step. If test light does not illuminate, go to step 6).
4. Repair Electronic Suspension System as necessary. See SUSPENSION article.
5. Check PICP circuit for short to ground. Repair as necessary. After repair, go to step 9). If circuit is okay, go to step 8).
6. Check PICP circuit for open. Repair as necessary. After repair, go to step 9). If circuit is okay, go to next step.
7. Check terminal connections at PCM. Repair terminals as necessary. After repairs, go to step 9). If terminals are okay, go to next step.
8. Replace PCM. Program replacement PCM using required equipment. After replacing PCM, go to next step.
9. 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).
10. Using scan tool, select CAPTURE INFO, REVIEW INFO function. If any undiagnosed DTCs are displayed, go to applicable DTC test.

Diagnostic Aids

Using FREEZE FRAME and/or FAILURE RECORDS data mode may aid in locating an intermittent condition. If DTC cannot be duplicated, information included in FREEZE FRAME and/or FAILURE RECORDS data can be useful in determining how many miles since DTC set. FAIL COUNTER and PASS COUNTER can also be used to determine how many ignition cycles diagnostic reported a pass or a fail condition. To isolate when DTC failed, operate vehicle within same freeze frame conditions (RPM, load, vehicle speed, temperature, etc.).