PCM/TECH 1 SCAN TOOL

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General Information

The control module system has a computer, Powertrain Control Module (PCM) to control fuel delivery timing, and some emission control systems.

The control module system, monitors a number of engine and vehicle functions and controls the following operations:

- Fuel control
- Fuel injection timing
- Exhaust gas recirculation
- Transmission shift and shift quality functions. Specific transmission control diagnostics are covered in Section 5 of this service manual.

Powertrain Control Module (PCM)

The diesel Powertrain Control Module (PCM) is located in the passenger compartment and is the control center of the control module system.

The PCM constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Check Engine), and store one or more DTCs which identify the problem areas to aid the technician in making repairs.

The PCM is designed to process the various input information and then send the necessary electrical responses to control fuel delivery, timing and other emission control systems. The input information has an interrelation to more than one output, therefore, if the one input failed it could effect more than one system's operation.

PCM Function

The PCM supplies a buffered 5 or 12 volts to power various sensors or switches. This is done through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, the use of a 10 megaohm impedance digital voltmeter is necessary to assure accurate voltage readings.

Reprogramming ("Flashing") The Control Module

Some vehicles allow reprogramming of the control module without removal from the vehicle. This provides a flexible and a cost-effective method of making changes in software and calibrations.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

1. Review and record the fail records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been illuminated).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the fail records and/or Freeze Frame data.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps is very important in verifying repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

Reading DTCs Using A Scan Tool

The recommended method for reading DTC(s) stored in memory is by using diagnostic Scan Tool plugged into the DLC. Follow instructions supplied by tool manufacturer.

"On-Board Diagnostic (OBD) System Check"

After the visual/physical under hood inspection, the "On-Board Diagnostic (OBD) "System Check" is the starting point for all diagnostic procedures and for locating the cause of an emissions test failure.

The correct procedure to diagnose a fault is to follow three basic steps.

1. Are the on-board diagnostics working? This is determined by performing the "On-Board Diagnostic (OBD) System Check." If the on-board diagnostics are not working, refer to diagnostic charts in this section. If the on-board diagnostics are working properly, the next step will be:
2. Is there a DTC stored? If a DTC is stored, go directly to the numbered DTC chart in this section. This will determine if the fault is still present. If no DTC is stored, the next step will be:
3. Scan Tool serial data transmitted by the control module. This involves displaying the information available on the serial data stream with a Scan Tool or one of the tools available for that purpose. Information on these tools and the meaning of the various displays can be found in this section. Normal readings under a particular operating condition can be found below the chart "On-Board Diagnostic (OBD) System Check."

Diagnostic Information

The diagnostic table and functional checks in this manual are designed to locate a faulty circuit or component through logic based on the process of elimination.

The charts are prepared with the requirements that the vehicle functioned correctly at the time of assembly and that there are no multiple failures.

The PCM performs a continual self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The PCM's language for communicating the source of a malfunctions is a system of DTCs.

Malfunction Indicator Lamp (MIL) "Check Engine"

This light is on the instrument panel and has the following functions.

- It informs the driver that a problem has occurred and that the vehicle should be taken in for service as soon as reasonably possible.
- It displays DTCs stored by the PCM which help the technician diagnose system problems.

As a bulb and system check, the light will come "ON" with the key "ON" and the engine not running. When the engine is started, the light will turn "OFF." If the light remains "ON," the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a DTC will remain stored in the PCM.

When the light remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, an "On-Board Diagnostic (OBD) System Check" must be performed. This check will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

"Check Throttle" Lamp

This light is on the instrument panel and has the following functions:

- It informs the driver that a problem has occurred in the Accelerator Pedal Position (APP) circuit and the vehicle should be taken in for service as soon as reasonably possible.
- If APP DTCs are stored by the PCM, the MIL will display these. The "Check Throttle" Lamp will not display DTCs.

As a bulb and system check, the light will come "ON" with the key "ON" for 2 seconds. When the engine is started, the light will turn "OFF." If the light remains "ON," the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a DTC will remain stored in the PCM.

When the light remains "ON" while the engine is running, or when a malfunction is suspected, an "On-Board Diagnostic (OBD) System Check" must be performed. This check will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

Circuit Description

The "On-Board diagnostic (OBD) System Check" is an organized approach to identifying a problem created by a control module system malfunction. It must be the starting point for any driveability complaint diagnosis, this will direct the service technician to the next logical step in diagnosing the complaint. Understanding the chart and using it properly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

1. When the ignition switch is cycled to "ON," the MIL should turn "ON" and remain "ON" steady. This sequence will determine that the vehicle diagnostics are operational.
2. Use Scan Tool to aid diagnosis, therefore, serial data must be available.
3. Although the PCM is powered up, a "Cranks But Will Not Run" symptom could exist because of a PCM or system problem.
4. Comparison of actual control system data with the Typical Scan Tool Data Values is a quick check to determine if any parameter is not within limits. A base engine problem (i.e., advanced cam timing) may substantially alter sensor values.
5. This step will isolate if the customer complaint is a MIL or driveability problem with no MIL. Refer to "DTC Identification" in this Section for a list of valid DTCs. An invalid DTC may be the result of a faulty Scan Tool, PROM or PCM.

Tech 1 Scan Tool

The diagnostic procedures in this manual assume the use of a Tech 1 scan tool. Since the Tech 1, produced by Expertec, is able to perform functions, such as, bidirectional communication that other scan tools are unable to perform, it has been made an essential tool. Although, the term scan tool will continue to be used for simplicity's sake, we recommend the Tech 1 be used whenever possible. Explicit instructions on connecting and using the various Tech 1 functions are contained in the Tech 1 owner's manual.

The PCM can communicate a variety of information through Data Link Connector (DLC) terminal "M." This data is transmitted at high frequency which requires a scan tool for interpretation.

PCM Identification

AM General identifies all HUMMER powerplants using the **fourth** digit of the VIN code. General Motors uses the **eighth** digit of the VIN code. When the Tech 1 Scan Tool asks for PCM identification, it will ask for the **eighth** digit. Look at the **fourth** digit of the VIN and translate to GM code:

ENGINE TYPE	
AMG	**GM**
Y	Y
Z	F

- Scroll through the choices until you read the correct character (Y or F).
- With the correct character highlighted, press the YES key to make the selection.
- The Tech 1 will prompt you to verify the engine type. Press YES if correct.

Powertrain Control Module (PCM)

Service of the PCM should normally consist of replacement of the PCM.

If the diagnostic procedures call for the PCM to be replaced, it will be necessary to program the EEPROM in the PCM using the procedure in this section

Important

- When replacing the production PCM with a service PCM, a DTC P1214 will be stored. It is important to program "TDC Offset" into the service PCM. Refer to "PCM Programming (TDC Offset)."

Important

- When a PCM has been replaced, a short glow plug duration will exist during the first ignition cycle (less than 2 seconds). After the first ignition cycle, the glow plug system will operate properly.

Important

- When replacing the production PCM with a service PCM (controller), it is important to transfer the broadcast code and production PCM number to the service PCM label. Please Do Not record on PCM cover. This will allow positive identification of PCM parts throughout the service life of the vehicle.

Important

- To prevent internal PCM damage, the ignition must be "OFF" when disconnecting or reconnecting power to PCM (for example, battery cable, PCM pigtail, PCM fuse, jumper cables, etc.). The ignition should be "OFF" for at least 30 seconds before disconnecting power to the PCM.

PCM Replacement

Remove or Disconnect

1. Negative battery cables.
2. PCM from passenger compartment.
3. Connectors from PCM.
4. PCM mounting hardware.

CAUTION: *To prevent possible electrostatic discharge to the PCM, do not touch the component leads, and do not remove integrated circuit from carrier.*

Install or Connect

1. PCM mounting hardware.
2. Connectors to PCM.
3. PCM in passenger compartment.
4. Negative battery cables.

NOTE: The MIL, antilock and brake lamps will continue to be enabled until the PCM is programmed. Once the programming is complete, the lamps will be turned "OFF" and normal operation will occur.

5. Proceed to "PCM Programming (EEPROM)"

PCM Programming (EEPROM)

1. Set up:
   - Battery is charged.
   - Ignition is "ON."
   - Battery/Cig. Lighter connection secure.
   - Data Link Connector attached.
2. Refer to up-to-date Techline terminal/equipment user's instructions.

3. If PCM fails to reprogram, do the following:
    - Check all PCM connections.
    - Check Techline terminal/equipment for latest software version.
    - Try again to reprogram PCM. If it fails again, replace the PCM. Refer to PCM replacement.
4. Allow vehicle to idle until coolant temperature is greater than 170°F (77°C) (refer to “PCM Programming TDC Offset”)

Functional Check

Vehicle must achieve a coolant temperature greater than 170°F (77°C) before an OBD system check can be performed.

- Check Data list for a TDC Offset.
- Perform OBD System Check.

PCM Programming (TDC Offset)

The PCM will automatically activate the TDC Offset program when the engine coolant is greater than 170°F (77°C). If the PCM is not programmed with a TDC Offset, a P1214 will set.

Step	Action	Value(s)	Yes	No
1	1. Connect the Scan Tool. 2. Key "ON" engine "OFF." Is the MIL "ON"?	—	Go to Step 2	Go to Chart A-1
2	Ignition "ON," engine "OFF." Does the Scan Tool display PCM data?	—	Go to Step 3	Go to Chart A-2
3	Are any DTC(s) stored?	—	Go to Step 6	Go to Step 4
4	1. Key "OFF" for 20 seconds. 2. Ignition "ON," and wait for glow plug cycle 3. Crank the engine for 10 seconds. Will the engine start?	—	Go to Step 5	Go to Chart A-3
5	Compare the Scan Tool engine data with typical values shown on following pages. Are values normal or within typical ranges?	—	Go to Step 7	Go to Step 8
6	Refer to applicable chart.	—	—	—
7	Refer to in Section 2 for engine diagnosis.	—	—	—
8	Refer to indicated "Component(s) System" checks.	—	—	—

Typical Engine Data Values

Idle/Upper Radiator Hose Hot/Closed Throttle/Park or Neutral/ACC. "OFF"

Tech 1 Parameter	Units Displayed	Typical Data Value
Engine Speed	RPM	±100 RPM from desired
Desired Idle	RPM	PCM idle command
ECT	C°/F°	85°C - 105°C (185°F - 221°F) *varies with coolant temp.
Start Up ECT	C°/F°	varies (depends on start up ECT)
IAT	C°/F°	60°C - 80°C (140°F - 177°F) *varies with incoming air
ECT Sensor	volts	1.7-2.2 volts (varies with coolant temp.)
Baro	kPa/Volts	3-5 volts (varies with altitude and baro pressure)
ESO Solenoid	on/off	on
Boost Solenoid	%	60 - 70%
Boost Pressure	kPa	60 - 103 kPa *varies with altitude
Actual EGR	kPa	75 - 85 kPa
Desired EGR	kPa	75 - 85 kPa
EGR Solenoid	%	35 - 45%
EGR Vent Sol.	on/off	on
Fuel Temp	C°/F°	60°C - 80°C (140°F - 176°F) *varies with fuel temp.
Fuel Rate	millimeters cubed	7 - 12 mm3
Glow Plug	volts	0 volts
Glow Plug System	disabled/enabled	disabled
Des. Inj Timing	Degrees	3.5 - 6.0°
Act. Inj. Timing	Degrees	3.5 - 6.0°
APP Angle	%	0%
APP 1	volts	.45 - .95 volts
APP 2	volts	4.0 - 4.5 volts
APP 3	volts	3.6 - 4.0 volts
Inj. Pump Sol. Closure Time	milliseconds	1.70 - 1.90 ms
TDC Offset	Degrees	+.75 - -1.95
Ignition Volts	volts	12 - 14 volts
MPH kp/h	MPH kp/h	0 0

Typical Engine Data Values

Idle/Upper Radiator Hose Hot/Closed Throttle/Park or Neutral/ACC. "OFF"

Tech 1 Parameter	Units Displayed	Typical Data Value
Cruise Switch	on/off	off
Cruise Active	on/off	off
Cruise Brake Sw.	open/closed	closed
Brake Switch	open/closed	open
Set Switch	on/off	off
Resume Switch	on/off	off
TR Switch	Park-Neutral, Reverse, Drive Ranges	Park
Crank Ref Missed	#	0 (missed)
Inj. Pump Cam Reference Missed	#	0 (missed)
Lift Pump	volts	12 - 15 volts
Lift Pump System	disabled/enabled	enabled
Engine Load	%	4 - 6%
Engine Torque	ft-lb	7 - 10 ft-lb
# of Current DTC's	#	0
DTC Set This Ign.	yes/no	no
Ignition volts	volts	12 - 15 volts
TFT Sensor	volts	2.5 - 3.5 volts
TFT	C°/F°	50°C - 70°C (122°F - 158°F) *varies
Calc. A/C Load	ft-lb	0 ft-lb
A/C Request	on/off	off
A/C Compressor	engaged/disengaged	disengaged
A/C Relay	yes/no	no
MIL Lamp	on/off	off
STS Lamp	on/off	off
4WDL Mode	enabled/disabled	disabled
Front Axle Switch	unlocked/locked	unlocked
A/B/C Range Sw.	on on on/off off off	off off
1-2 Sol. 2-3 Sol.	on off	on off
TCC Enabled	on/off	off
PC Solenoid	on/off	off
Device Control	yes/no	no
Engine Run Time	hours/minutes/seconds	varies

No Malfunction Indicator Lamp (MIL) "Check Engine"

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to Step 6
3	Check the fuse number 4. Is the fuse OK?	—	Go to Step 4	Go to Step 14
4	Turn the ignition "ON," probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light "ON?"	—	Go to Step 5	Go to Step 11
5	1. Turn the ignition "OFF." 2. Disconnect the black PCM connector. 3. Turn the ignition "ON." 4. Connect a fused jumper to the MIL control circuit at the PCM connector. 5. Observe the MIL. Is the MIL "ON?"	—	Go to Step 9	Go to Step 10
6	Check the PCM ignition Feed and Battery Feed fuses. Are both of the fuses OK?	—	Go to Step 7	Go to Step 13
7	1. Turn the ignition "OFF." 2. Disconnect the PCM connectors. 3. Turn the ignition "ON." 4. Probe the PCM harness ignition and battery feed circuits with a test light to ground. Is the test light "ON" both circuit?	—	Go to Step 8	Go to Step 12
8	1. Check for a faulty PCM ground or a poor PCM ground connection. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 20	Go to Step 9
9	1. Check for a poor connection at the PCM. 2. If a poor connection is found, repair as necessary. Was a problem found?	—	Go to Step 20	Go to Step 15
10	1. Check the MIL control circuit for an open. 2. If the MIL control circuit is open, repair as necessary. Was a problem found?	—	Go to Step 20	Go to Step 16
11	Repair open in the ignition feed circuit to the cluster connector. Is the action complete?	—	Go to Step 20	—
12	Locate and repair open in the PCM battery feed circuit or the PCM ignition feed circuit as necessary. Is the action complete?	—	Go to Step 20	—
13	Locate and repair short to ground in the PCM Ignition Feed circuit or the PCM Battery Feed circuit as necessary. Is the action complete?	—	Go to Step 20	—

No Malfunction Indicator Lamp (MIL) "Check Engine"

Step	Action	Value(s)	Yes	No
14	Locate and repair short to ground in the instrument cluster Ignition Feed circuit. Is the action complete?	—	Go to Step 20	—
15	Replace the PCM. NOTE: If the PCM is faulty, then PCM must be programmed. Go to PCM Replacement and Programming Procedures. Is the action complete?	—	Go to Step 20	—
16	1. Check the MIL control circuit for a poor connection at the instrument cluster connector. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 20	Go to Step 17
17	1. Remove the instrument cluster. 2. Inspect the MIL bulb. Is the bulb OK?	—	Go to Step 19	Go to Step 18
18	Replace the MIL bulb. Is the action complete?	—	Go to Step 20	—
19	Replace the instrument cluster. Is the action complete?	—	Go to Step 20	—
20	1. Using the Scan Tool, select "DTC," "Clear Info." 2. Attempt to start the engine. Does the engine start and continue to run?	—	Go to Step 21	Go to Step 2
21	1. Allow engine to idle until normal operating temperature is reached. 2. Select "DTC," "Failed This Ign." Are any DTCs displayed?	—	Go to Applicable DTC Table	Go to Step 22
22	Using the Scan Tool, select "Capture Info," "Review Info." Are any DTCs displayed that have not been diagnosed?	—	Go to Applicable DTC Table	System OK

No Scan Data

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition "OFF" for 30 seconds. 2. Ignition "ON," Engine "OFF." Is the MIL "ON"?	—	Go to Step 3	Go to Chart A-1
3	Can the Scan Tool communicate with the PCM?	—	Go to Step 4	Go to Step 7
4	With the Scan Tool, command the MIL "ON" and "OFF."	—	Go to Step 17	Go to Step 5
5	1. Ignition "OFF." 2. Disconnect the PCM connectors. 3. Ignition "ON." Is the MIL "OFF"?	—	Go to Step 6	Go to Step 18
6	With the Scan Tool, check Engine Cal ID. Is the proper CAL ID present?	—	Go to Step 28	Go to Step 19
7	With a test light to ground, probe the DLC connector (pin 16). Is the test light "ON"?	—	Go to Step 8	Go to Step 20
8	With a test light to B+, probe the DLC connector (pins 4 and 5). Is the test light "ON" for both circuits?	—	Go to Step 9	Go to Step 21
9	Check for proper operation of the cigar lighter. Does the cigar lighter operate properly?	—	Go to Step 10	Go to Step 22
10	Verify proper operation of the Scan Tool with a known good vehicle with the same equipment/controller. Does the Scan Tool communicate with known good vehicle?	—	Go to Step 11	Go to Step 23
11	1. Disconnect the Scan Tool. 2. With the DVM connected to ground, check the PCM serial data line at the DLC connector (pin 2). Is voltage on the serial data line less than the specified value?	7v	Go to Step 12	Go to Step 15
12	With the DVM connected to ground, again check the PCM serial data line at the DLC connector (pin 2). Is voltage on the serial data line less than the specified value?	1v	Go to Step 13	Go to Step 16
13	1. Ignition "OFF." 2. With the DVM connected to ground, check resistance of the serial data line at the DLC connector (pin 2). Is resistance less than the specified value?	10 Ohms	Go to Step 14	Go to Step 27
14	1. Disconnect the PCM connectors. 2. With the DVM connected to ground check resistance of the serial data line at the DLC connector (pin 2). Is resistance less than the specified value?	10 Ohms	Go to Step 24	Go to Step 28

No Scan Data

Step	Action	Value(s)	Yes	No
15	1. Ignition "OFF." 2. Disconnect the PCM Connectors. 3. Ignition "ON." 4. Check voltage on the DLC connector (pin 2). Is voltage at the specified value?	0v	Go to Step 28	Go to Step 25
16	Reprogram the EEPROM and retest. Is serial data present?	—	Go to Step 26	Go to Step 28
17	System OK.	—	—	—
18	Repair short to ground on the MIL control circuit.	—	—	—
19	Reprogram the EEPROM and retest.	—	—	—
20	1. Check fuse number 7. 2. If fuse is blown, repair short to ground in the battery feed circuit to the DLC connector (pin 16). 3. If the fuse is OK, repair open in the battery feed circuit to the DLC connector (pin 16).	—	—	—
21	Repair open in circuit that did not light the test light. Refer to Section 12 for ground distribution.	—	—	—
22	Refer to Section 12 for cigar lighter repair.	—	—	—
23	Faulty Scan Tool and/or cable.	—	—	—
24	Repair short to ground in the serial data line.	—	—	—
25	Repair short to voltage in the serial data line.	—	—	—
26	System OK.	—	—	—
27	1. Check serial data line for an open. 2. If OK, check PCM and DLC connections. 3. If OK, replace the PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to OBD System Check	—
28	Replace the faulty PCM. **NOTE:** if the PCM is faulty, the new PCM must be programmed. Go the PCM replacement and programming procedures. Is the action complete?	—	Go to OBD System Check	—

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	NOTE: Before clearing DTC(s) use the Scan Tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Check for proper condition of batteries, refer to Section 6D. Is condition of batteries OK?	—	Go to Step 3	Go to Step 24
3	Check for adequate fuel in tank. Is fuel at an adequate level?	—	Go to Step 4	Go to Step 24
4	Check the quality of fuel, refer to Section 4. Is fuel quality OK?	—	Go to Step 5	Go to Step 24
5	Check glow plug system operation, refer to Section.	—	Go to Step 6	Go to Step 24
6	Check for proper cranking speed, refer to Section. Is cranking speed OK?	—	Go to Step 7	Go to Step 24
7	Check for a restriction in the fuel return system, refer to Section. Does the fuel return system operate properly?	—	Go to Step 8	Go to Step 24
8	Ignition "ON." Dies MIL come "ON"?	—	Go to Step 9	Go to Step 16
9	Install scan tool. Does scan tool display data?	—	Go to Step 10	Go to Step 17
10	1. Loosen injector line at injector. 2. Crank engine. Is there fuel coming out of injection line?	—	Go to Step 11	Go to Step 11
11	Disconnect Optical/Fuel temperature sensor. Does vehicle start?	7v	Go to Step 12	Go to Step 15
12	1. Recommend Optical/Fuel temperature sensor. 2. Disconnect fuel solenoid driver. 3. With J 39200 connected to ground, robe fuel inject control circuit at harness terminal. 4. Crank engine. Is voltage greater than or equal specified value?	1v	Go to Step 13	Go to Step 19
13	1. Fuel solenoid driver still disconnected. 2. Jumper closure ground circuit with a test light connected to B+. Is test light "ON"?	10 Ohms	Go to Step 14	Go to Step 20
14	1. Ignition "ON," engine "OFF." 2. Probe ignition feed circuit at the fuel solenoid harness connector with a test light connected to ground. Is test light "ON"?	10 Ohms	Go to Step 15	Go to Step 22

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
15	Replace fuel injection pump.	0v	Go to Step 26	—
16	Refer to Table 3-1.	—	—	—
17	Refer to Table 3-2.	—	—	—
18	Injection system OK, refer to driveability section.	—	—	—
19	Check the fuel inject control circuit for an open or ground between the fuel solenoid driver and the PCM. Was a problem found?	—	Go to Step 23	Go to Step 25
20	Check the closure ground circuit for an open between the fuel solenoid driver and the PCM. Was a problem found?	—	Go to Step 23	Go to Step 21
21	Inspect the fuel solenoid driver connector and PCM connector for proper connection. Was a problem found?	—	Go to Step 23	Go to Step 25
22	Repair the open in the ignition feed circuit. Is action complete?	—	Go to Step 26	—
23	Repair the circuit as necessary. Is the action complete?	—	Go to Step 26	—
24	Make appropriate repairs. Is action complete?	—	Go to Step 26	—
25	Replace the faulty PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 26	—
26	1. Using the Scan Tool, select “DTC,” “Clear Info.” 2. Attempt to start engine. Does the engine start and continue to run?	—	Go to Step 27	Go to Step 2
27	1. Allow engine to idle until normal operating temperature is reached. 2. Select “DCT,” “Fail this Ign.” Are any DTCs displayed?	—	Go to Step 28	—
28	Using the scan tool, select “Capture Info,” Review Info.” Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC (DTC) IDENTIFICATION

The MIL (Service Engine Soon) lamp will be "ON" if an emission malfunction exists. If the malfunction clears, the lamp will go "OFF" and the DTC will be stored in the PCM. Any DTCs stored will be cleared if no problem recurs within l50 engine starts.

- All DTCs with the sign * are transmission related DTCs and have descriptions, diagnostic charts are in Section 5. Remember, always start with the lowest numerical engine DTC first. When diagnosing some engine DTCs, other transmission symptoms can occur.

Intermittents

A corresponding DTC will be stored in the memory of the PCM as a history DTC until DTCs have been cleared. When unexpected DTCs appear during the code reading process, one can assume that these DTCs were set by an intermittent malfunction and could be helpful in diagnosing the system. An intermittent DTC may or may not re-set. If it is an intermittent failure, a Diagnostic Trouble Code (DTC) chart is not used. Consult the "Diagnostic Aids" on the page facing the diagnostic chart corresponding to the intermittent DTC. Section "2" also covers the topic of "Intermittents". A physical inspection of the applicable sub-system most often will not resolve the problem.

Scan Tool Use With Intermittents

In some scan tool allocations, the data update rate makes the tool less effective than a voltmeter, such as when trying to detect an intermittent problem which lasts for a very short time. However, the scan tool allows manipulation of wiring harnesses or components under the hood with the engine not running, while observing the scan tool readout.

The scan tool can be plugged in and observed while driving the vehicle under the condition when the MIL "Service Engine Soon" light turns "ON" momentarily or when the engine driveability is momentarily poor. If the problem seems to be related to certain parameters that can be checked on the scan tool, they should be checked while driving the vehicle. If there does not seem to be any correlation between the problem and any specific circuit, the scan tool can be checked on each position, watching for a period of time to see if there is any change in the reading that indicates intermittent operation.

The scan tool is also an easy way to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a DTC. Comparing the sensor's readings with those of a known good vehicle may uncover the problem.

The scan tool (Figure PCM-1) has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the scan tool successfully for diagnosis lies in the technician's ability to understand the system he is trying to diagnose as well as understanding of the scan tool operation and limitations. The technician should read the tool manufacturer's operating manual to become familiar with the tool's operation.

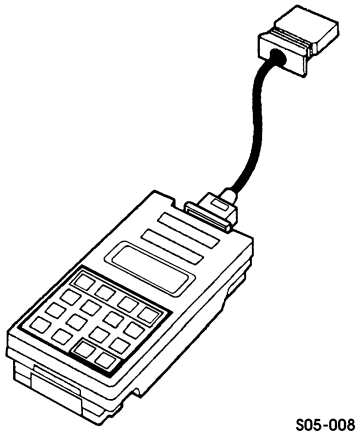

Figure PCM-1 PCM Scan Tool

Diagnostic Trouble Code (DTC) Identification

DTC	Description	Type	Illuminate MIL
P0112	IAT Sensor Circuit Low Voltage	B	Yes
P0113	IAT Sensor Circuit High Voltage	B	Yes
P0117	ECT Sensor Circuit Low Voltage	B	Yes
P0118	ECT Sensor Circuit High Voltage	B	Yes
P0121	APP Sensor 1 Circuit Performance	C	No
P0122	APP Sensor 1 Circuit Low Voltage	C	No
P0123	APP Sensor 1 Circuit High Voltage	C	No
P0182	Fuel Temperature Sensor Circuit Low Voltage	B	Yes
P0183	Fuel Temperature Sensor Circuit High Voltage	B	Yes
P0215	Engine Shutoff Control Circuit	D	No
P0216	Injection Timing Control System	B	Yes
P0219	Engine Overspeed Condition	D	No
P0220	APP Sensor 2 Circuit	C	No
P0221	APP Sensor 2 Circuit Performance	C	No
P0222	APP Sensor 2 Circuit Low Voltage	C	No
P0223	APP Sensor 2 Circuit High Voltage	C	No
P0225	APP Sensor 3 Circuit	C	No
P0226	APP Sensor 3 Circuit Performance	C	No
P0227	APP Sensor 3 Circuit Low Voltage	C	No
P0228	APP Sensor 3 Circuit High Voltage	C	No
P0231	Lift Pump Secondary Circuit Low Voltage	B	Yes
P0236	TC Boost System	B	Yes
P0237	TC Boost Sensor Circuit Low Voltage	B	Yes
P0238	TC Boost Sensor Circuit High Voltage	B	Yes
P0251	Injection Pump Cam System	A	Yes
P0263	Cylinder Balance System Fault	D	No
P0266	Cylinder Balance System Fault	D	No
P0269	Cylinder Balance System Fault	D	No
P0272	Cylinder Balance System Fault	D	No
P0275	Cylinder Balance System Fault	D	No
P0278	Cylinder Balance System Fault	D	No
P0281	Cylinder Balance System Fault	D	No

Diagnostic Trouble Code (DTC) Identification

DTC	Description	Type	Illuminate MIL
P0284	Cylinder Balance System Fault	D	No
P0335	CKP Sensor Circuit Performance	A	Yes
P0370	Timing Reference High Resolution	A	Yes
P0380	Glow Plug Circuit Performance	B	Yes
P0501	Vehicle Speed Sensor Circuit	D	No
P0567	Cruise Resume Circuit	D	No
P0568	Cruise Set Circuit	D	No
P0571	Cruise Brake Switch Circuit	D	No
P0601	PCM Memory	D	No
P0602	PCM Not Programmed	D	No
P0606	PCM Internal Communication Interrupted	A	Yes
P1125	APP System	C	No
P1214	Injection Pump Timing Offset	B	Yes
P1216	Fuel Solenoid Response Time Too Short	D	No
P1217	Fuel Solenoid Response Time Too Long	D	No
P1218	Injection Pump Calibration Circuit	B	Yes
P1621	EEPROM Write	B	Yes
P1627	A/D Performance	B	Yes
P1635	5 Volt Reference Low	D	No
P1641	Malfunction Indicator Lamp (MIL) Control Circuit	D	No
P1643	Write to Start Lamp Control Circuit	B	No
P1654	Service Throttle Soon (STS) Lamp Control Circuit	D	No
P1656	Wastegate Solenoid Control Circuit	B	Yes

DTC P0112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW VOLTAGE (FIGURE PCM-2)

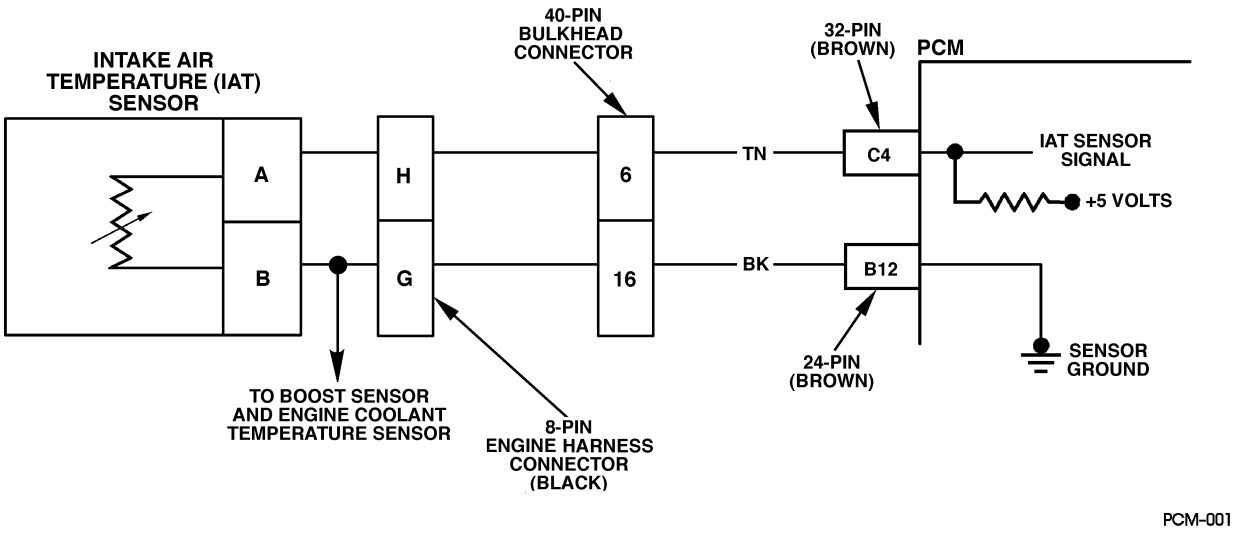

Figure PCM-2 Intake Air Temperature (IAT) Sensor Circuit Low Voltage

Circuit Description

The Intake Air Temperature (IAT) sensor is a thermistor that controls signal voltage to the PCM. When the air is cold, the sensor resistance is high, therefore the PCM will see a high signal voltage. As air warms, sensor resistance becomes less and voltage drops.

Conditions for Setting the DTC

- Engine coolant temperature less than 42.5°C (109°F).
- Intake air temperature greater than or equal to 151°C (303°F).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

A possible poor performance problem may exist during cold weather operation.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 160°F (71°C) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

Check harness routing for a potential short to ground in the signal circuit. Scan Tool displays intake air temperature in degrees centigrade. Refer to “Intermittents” on page 13. A “skewed” sensor could result in poor driveability complaints.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

2. This step determines if P0112 is a hard failure or an intermittent condition.
3. This test will determine if the PCM can recognize an open sensor.
4. This step will determine if the problem is s short to ground or a malfunctioning PCM.

DTC P0112 - Intake Air Temperature (IAT) Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**NOTE:** Before clearing DTC(s) use the Scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the IAT display on Scan Tool. Is the IAT display greater than or equal to the specified value?	151°C (303°F)	Go to Step 3	Go to Step 5
3	1. Turn the engine "OFF." 2. Turn the ignition "ON." 3. Disconnect the IAT sensor connector. Is the IAT display less than or equal to the specified value?	-30°C (-22°F)	Go to Step 7	Go to Step 4
4	1. Turn the ignition "OFF". 2. Using the J39200, measure the resistance across the IAT sensor harness connector. Is the resistance at the specified value?	Infinite	Go to Step 8	Go to Step 6
5	DCT is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids." If additional DTCs were stored, refer to those table(s). Are additional DTCs stored?	—	Go to the applicable DTC Table	Go to Diagnostic Aids
6	Repair the short to ground in the IAT signal circuit. Is the action complete?	—	Go to Step 9	—
7	Replace the IAT sensor. Is the action complete?	—	Go to Step 9	—
8	Replace the faulty PCM. NOTE: If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 9	—
9	1. Using the Scan Tool, select "DTC," "Clear Info." 2. Start engine and idle at normal operating temperature. 3. Select "DTC," "Specific," then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 10	Go to Step 2
10	Using the Scan Tool, select "Capture Info," "Review Info." Are any DTC's displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage (Figure PCM-3)

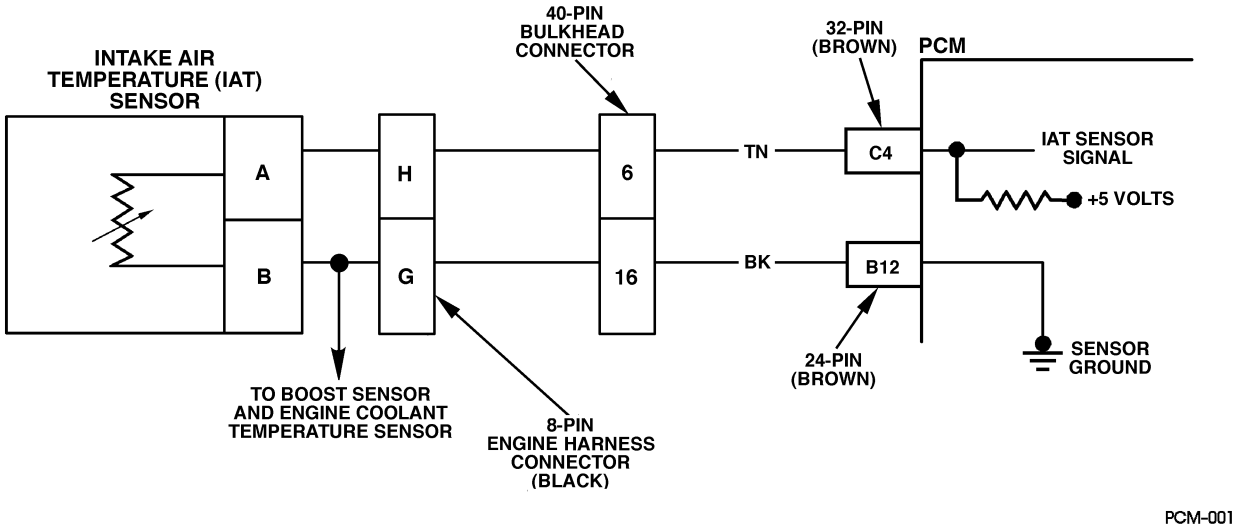

Figure PCM-3 Intake Air Temperature (IAT) Sensor Circuit high Voltage

Circuit Description

The intake air temperature sensor is a thermistor that controls signal voltage to the PCM. When the air is cold, the sensor resistance is high, therefore the PCM will see a high signal voltage. As air warms, sensor resistance becomes less and voltage drops. This is a type B DTC.

Conditions for Setting the DTC

- Engine operating for 8 minutes.
- IAT less than or equal to -30°C (-22°F).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

Possible poor performance during cold weather operation.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (Coolant temperature has risen 5°C(40°F) from start up coolant temperature and engine coolant temperature exceeds 160°F (71°C) that same ignition cycle).
- Use of a scan tool.

Diagnostic Aids

The scan tool displays intake air temperature in degrees centigrade. Refer to “Intermittent” on page 13. A “skewed” sensor could result in poor driveability complaints.

Test Description

Number(s) below refer to the step number(s) on the diagnostic Table.

2. This step determines if P0113 is a hard failure or an intermittent condition.
3. This step will determine if there is a wiring problem or a faulty PCM.

DTC P0113 - Intake Air Temperature (IAT) Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**NOTE:** Before clearing DTC(s) use the Scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the IAT display on Scan Tool. Is the IAT display colder than or equal to the specified value?	-30°C (-22°F)	Go to Step 3	Go to Step 5
3	1. Turn the engine "OFF." 2. Turn the ignition "ON." 3. Disconnect the IAT sensor connector. 4. Jumper the IAT harness terminals together. Does the scan tool display IAT greater than or equal to the specified value?	151°C (303°F)	Go to Step 6	Go to Step 4
4	Jumper the IAT sensor signal circuit to a known good ground. Does the scan tool display an IAT greater than or equal to the specified value?	151°C (303°F)	Go to Step 7	Go to Step 8
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids." Are additional DTCs stored?	—	Go to the applicable DTC Table	Go to Diagnostic Aids
6	Inspect the sensor connector and PCM connector for a proper connection. Was a problem found?	—	Go to Step 9	Go to Step 10
7	Check the IAT sensor ground circuit for an open between the IAT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
8	Check the IAT sensor signal circuit for an open between the IAT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
9	Repair the circuit as necessary. Is the action complete?	—	Go to Step 12	—
10	Replace the faulty IAT sensor. Is the action complete?	—	Go to Step 12	—
11	Replace the faulty PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 12	—
12	1. Using the Scan Tool, select "DTC," "Clear Info." 2. Start engine and idle at normal operating temperature. 3. Select "DTC," "Specific," then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13	—
13	Using the Scan Tool, select "Capture Info," "Review Info." Are any DTC's displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage (Figure PCM-4)

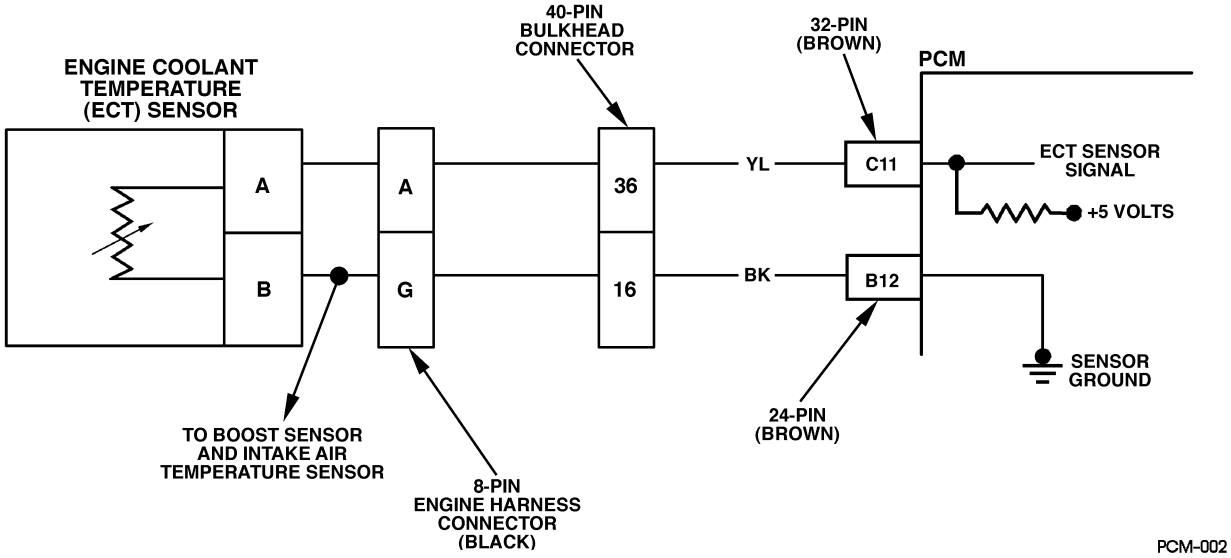

Figure PCM-4 Engine Coolant temperature (ECT) Sensor Circuit Low Voltage

Circuit Description

The engine coolant Temperature (ECT) sensor is a thermistor that controls signal voltage to the PCM. When the engine is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As the engine warms, sensor resistance becomes less and voltage drops. The voltage measured across the thermistor is interpreted as a temperature. This is a type B DTC.

Conditions for Setting the DTC

Engine coolant temperature greater than or equal to 151°C (303°F) for 2 seconds.

Action Taken When the DTC Sets

- High idle
- No TCC
- Shift schedules will be affected.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

Check harness routing for a potential short to ground. After engine is started, the coolant temperature should rise steadily to about 85°C (185°F). refer to “Intermittents” on page 13. A “skewed” sensor could result in poor driveability complaints.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

2. This step determines if P0117 is a hard failure or an intermittent condition.
3. This test will check the PCM and the wiring.

DTC P0117 - Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**NOTE:** Before clearing DTC(s) use the Scan tool "Capture Info" to record Freeze Frame and Failure Record for reference. This data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the ECT display on Scan Tool. Does the scan tool display ECT greater than or equal to the specified value?	151°C (303°F)	Go to Step 3	Go to Step 5
3	1. Turn the engine "OFF." 2. Turn the ignition "ON." 3. Disconnect the ECT sensor connector. Does the scan tool display ECT less than or equal to the specified value?	-30°C (-22°F)	Go to Step 7	Go to Step 4
4	1. Turn the ignition "OFF". 2. Using the J 39200, check the resistance across the ECT sensor harness connector. Is the resistance at the specified value?	Infinite	Go to Step 8	Go to Step 6
5	DCT is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids." If additional DTCs were stored, refer to those table(s) first. Are any additional DTCs stored?	—	Go to the applicable DTC Table	Go to Diagnostic Aids
6	Repair the short to ground in the ECT signal circuit. Is the action complete?	—	Go to Step 9	—
7	Replace the faulty ECT sensor. Is the action complete?	—	Go to Step 9	—
8	Replace the faulty PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 9	—
9	1. Using the Scan Tool, select "DTC," "Clear Info." 2. Start engine and idle at normal operating temperature. 3. Select "DTC," "Specific," then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 10	Go to Step 2
10	Using the Scan Tool, select "Capture Info," "Review Info." Are any DTC's displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage (Figure PCM-5)

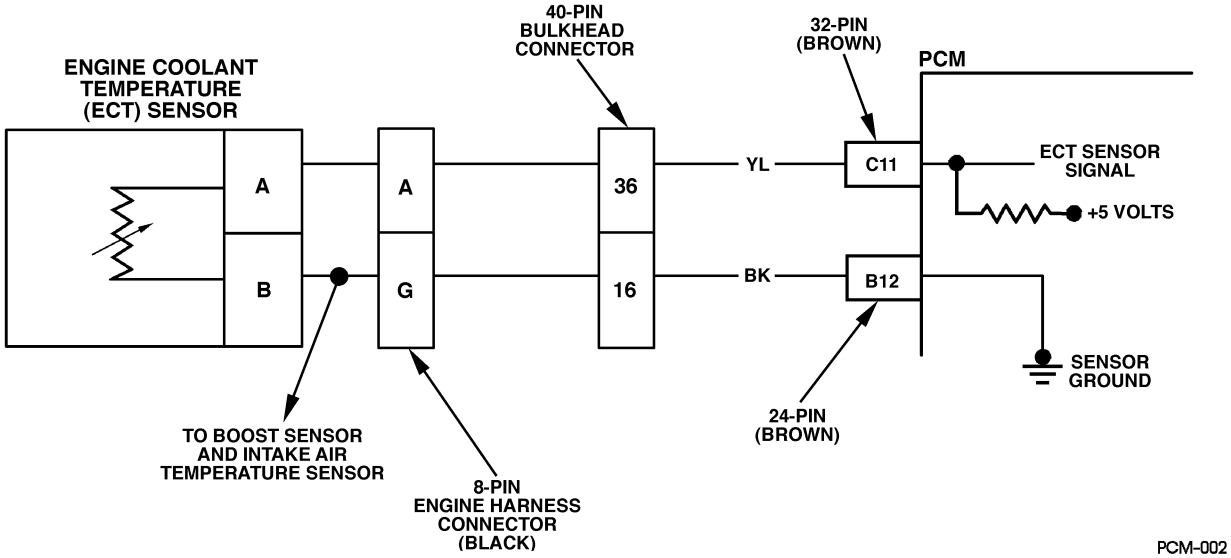

Figure PCM-5 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

Circuit Description

The Engine Coolant Temperature (ECT) sensor is a thermistor that controls signal voltage to the PCM. When the engine is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As the engine warms, the sensor resistance becomes less and the voltage drops. The voltage measured across the thermister is interpreted as a temperature. This is a type B DTC.

Conditions for Setting the DTC

- Engine running for at least 8 minutes.
- ECT less than -30°C (-22°F).
- Conditions met for 2 seconds

Action Taken When the DTC Sets

Idle increase

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (161°F) that same ignition cycle).
- Use of a scan tool.

Diagnostic Aids

- Check harness routing for a potential short to ground. After engine is started, the ECT temperature should rise steady to about 85°C (185°F). A mis-scaled sensor could result in poor driveability complaints.

Test Description

Number(s) below refer to number(s) on the diagnostic tables.

2. This test determines if PO 118 is an intermittent condition.
3. This test will determine if signal circuit is open, or a faulty PCM.

DTC P0118 - Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the ECT display on Scan Tool. Is the ECT display less than or equal to the specified value?	-30°C (-22°F)	Go to Step 3	Go to Step 5
3	1. Turn the engine "OFF." 2. Turn the ignition "ON." 3. Disconnect the ECT sensor connector. 4. Jumper the ECT harness terminals together. Does the scan tool display ECT greater than or equal to the specified value?	151°C (303°F)	Go to Step 6	Go to Step 4
4	Jumper the ECT sensor signal circuit to a known good ground. Does the scan tool display a ECT greater than the specified value?	151°C (303°F)	Go to Step 7	Go to Step 8
5	DCT is intermittent. If no other DTC(s) are stored, go to "Diagnostic Aids". Are there other DTCs stored?	—	Go to applicable DTC Table	Go to Diagnostic Aids
6	Inspect the sensor connector and PCM connector for a proper connection. Was a problem found?	—	Go to Step 9	Go to Step 10
7	Check the ECT sensor ground circuit for an open between the ECT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
8	Check the ECT sensor signal circuit for an open between the ECT sensor and the PCM. Was a problem found?	—	Go to Step 9	Go to Step 11
9	Repair the circuit as necessary. Is the action complete?	—	Go to Step 12	—
10	Replace the faulty ECT sensor. Is the action complete?	—	Go to Step 12	—
11	Replace the faulty PCM. **NOTE:** If the PCM is faulty, the new PCM must be programmed. Go to PCM replacement and programming procedures. Is the action complete?	—	Go to Step 12	—
12	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13	—
13	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTC's displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DTC P0121 Accelerator Pedal Position (APP) Sensor 1 Circuit Performance (Figure PCM-6)

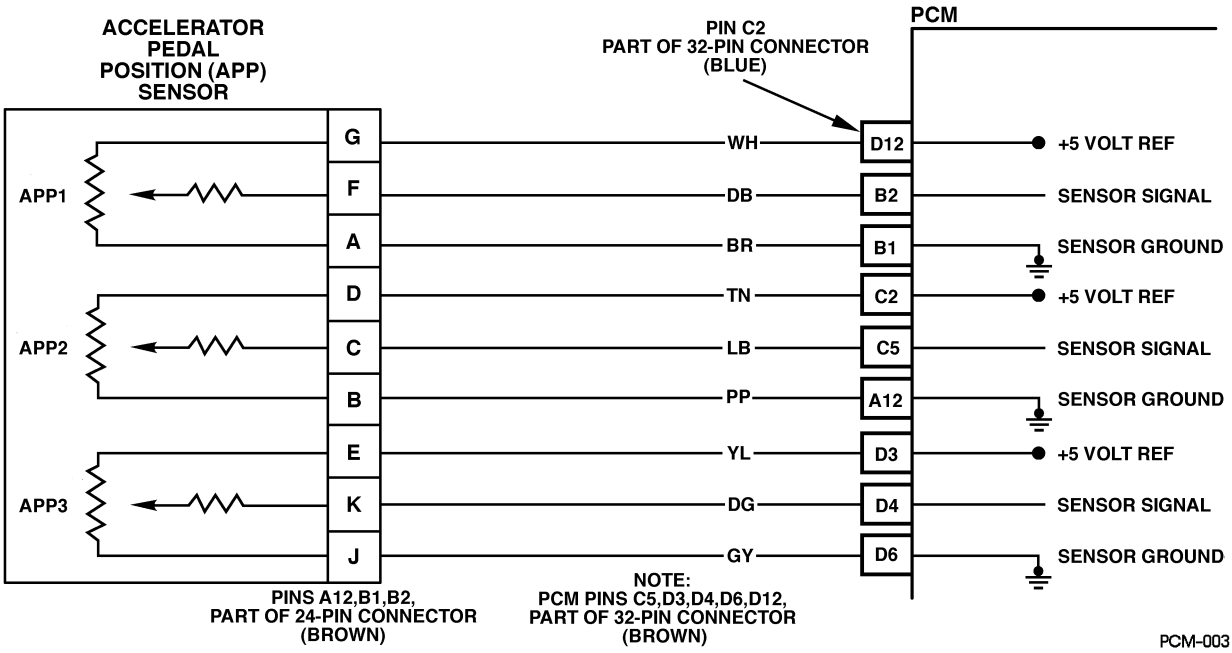

Figure PCM-6 Accelerator Pedal Position (APP) Sensor 1 Circuit Performance

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator pedal position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Ignition voltage greater than 6.4 volts.
- Engine speed greater than 300 RPM.
- The difference between APP 1 and APP 2 is greater than .23 volts (PCM compares pre-scaled voltage (internal to PCM)).
- The difference between APP 1 and APP 3 is greater than .50 volts (PCM compares pre-scaled voltage (internal to PCM)).
- No in range faults for APP 2 or APP 3 (PCM checks for high and low voltage faults).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 1 sensor is ignored.
- A current and history DTC will set but it will not turn on the “Service Throttle Soon” lamp.
- Throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will turn “ON” the “Service Throttle Soon” lamp and limit power. If a third APP malfunction is present, the “Service Throttle Soon” lamp will be “ON” and only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 1 position in volts. It should read about .45 to .95 volt with throttle closed and ignition “ON” or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Scan APP 1 sensor while depressing accelerator pedal with engine stopped and ignition “ON”. Display should vary from about .74 volt when throttle was closed to over about 3.7 volts when throttle is held at Wide Open Throttle (WOT) position. The following chart will check voltages on all APP circuits to see if they fall in normal ranges. The PCM compares pre-scaled voltages (these are voltages that the scan tool can’t read). The scan tool reads only output voltages.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

4. This step determines if there is a good 5 volt reference.

5. This step will check for an open in the ground circuit.

DTC P0121 - Accelerator Pedal Position (APP) Sensor 1 Circuit Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP voltages on the scan tool. Are APP voltages at specified values?	.45-.95v 4.0-4.5v 3.6-4.0v	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J39200 connected to ground, probe APP sensor 5 volt reference circuits at APP harness terminals "G", "D" and "E". Is voltage at the specified value on all circuits?	4.75v	Go to Step 5.	Go to Step 6.
5	1. Ignition "ON", engine "OFF". 2. With a test light connected to B+, probe APP sensor ground circuits at the APP sensor harness terminals "A", "B" and "J". Is Test light ON (all circuits)?	—	Go to Step 9.	Go to Step 8.
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 11.	Go to Step 8.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 11.	Go to Step 10.
8	1. Ignition "OFF". 2. Disconnect the PCM, and check for an open sensor ground circuit to the PCM. 3. If problem is found, repair as necessary. Was APP sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 11.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0122 Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage (Figure PCM-7)

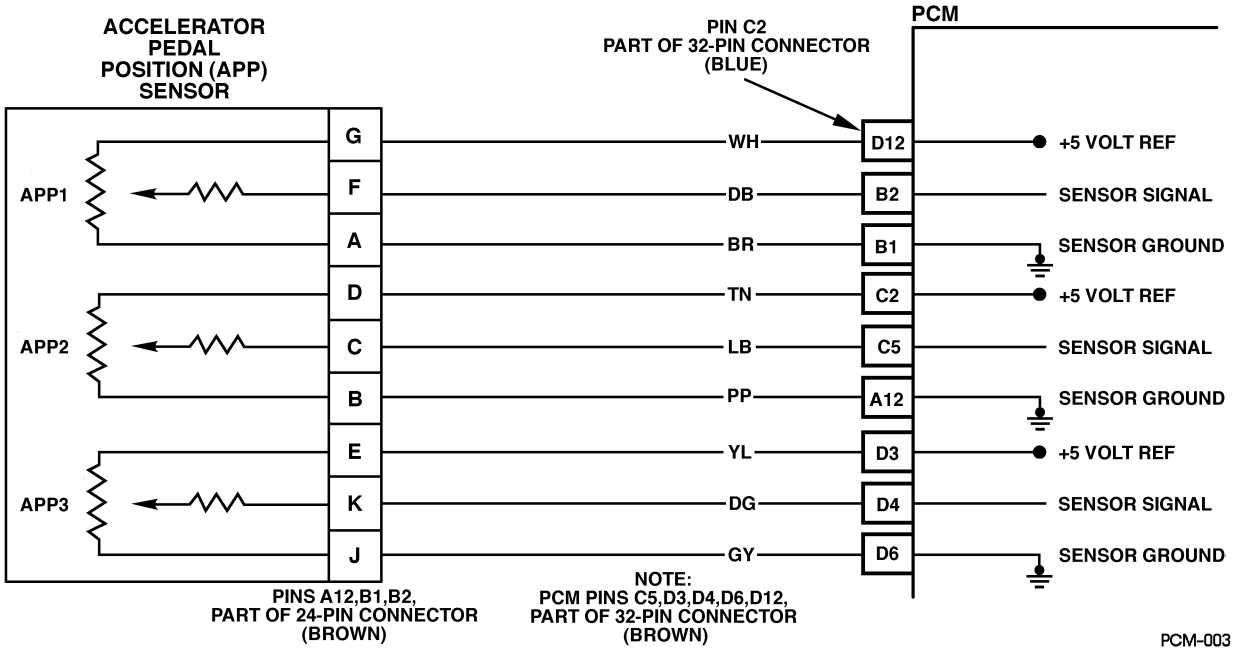

Figure PCM-7 Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is less than .25 volts on APP 1.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 1 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Check Throttle" lamp.
- The throttle will operate normally as long as there is only one sensor malfunctioning. If two different APP sensors have a malfunction, the "Check Throttle" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 1 position in volts. It should read about .45 to .95 volt with throttle closed and ignition "ON" or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Scan APP sensor while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about .74 volt when throttle is closed to about 3.7 volts when throttle is held at Wide Open Throttle (WOT) position. A DTC P0122 will result if the signal or reference circuit are open.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if P0122 is the result of a hard failure or an intermittent condition.

4. This step checks the PCM and wiring.

DTC P0122 - Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 1 voltages on the scan tool. Is APP 1 voltages less than or equal to specified value?	.25v	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those table(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Jumper APP 1 5 volt reference circuit and the APP 1 signal together at the APP sensor harness connector. 3. Observe the APP 1 voltage on the Scan Tool. Is APP 1 voltage greater than the specified value?	4.75v	Go to Step 10.	Go to Step 5.
5	1. Connect a test light between B+ and the APP 1 sensor signal circuit at the APP sensor harness connector. 2. Observe the APP 1 voltage on the Scan Tool. Is APP 1 voltage greater than the specified value?	4.75v	Go to Step 6.	Go to Step 8.
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 12.	Go to Step 7.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 13.	Go to Step 12.
8	1. Ignition "OFF". 2. Disconnect the PCM, and check the APP 1 signal circuit for an open, short to ground. 3. If the APP 1 sensor signal circuit is open or shorted to ground, repair as necessary. Was APP 1 signal circuit open or shorted to ground?	—	Go to Step 13.	Go to Step 9.
9	Check the APP 1 sensor signal circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 13.	Go to Step 12.
10	Check for a poor electrical connection at the APP module and repair if necessary. Was a problem found?	—	Go to Step 13	Go to Step 11
11	Replace the APP module. Is Action complete?	—	Go to Step 13.	—
12	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 13.	—
13	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 14.	Go to Step 2.
14	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0123 Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage (Figure PCM-8)

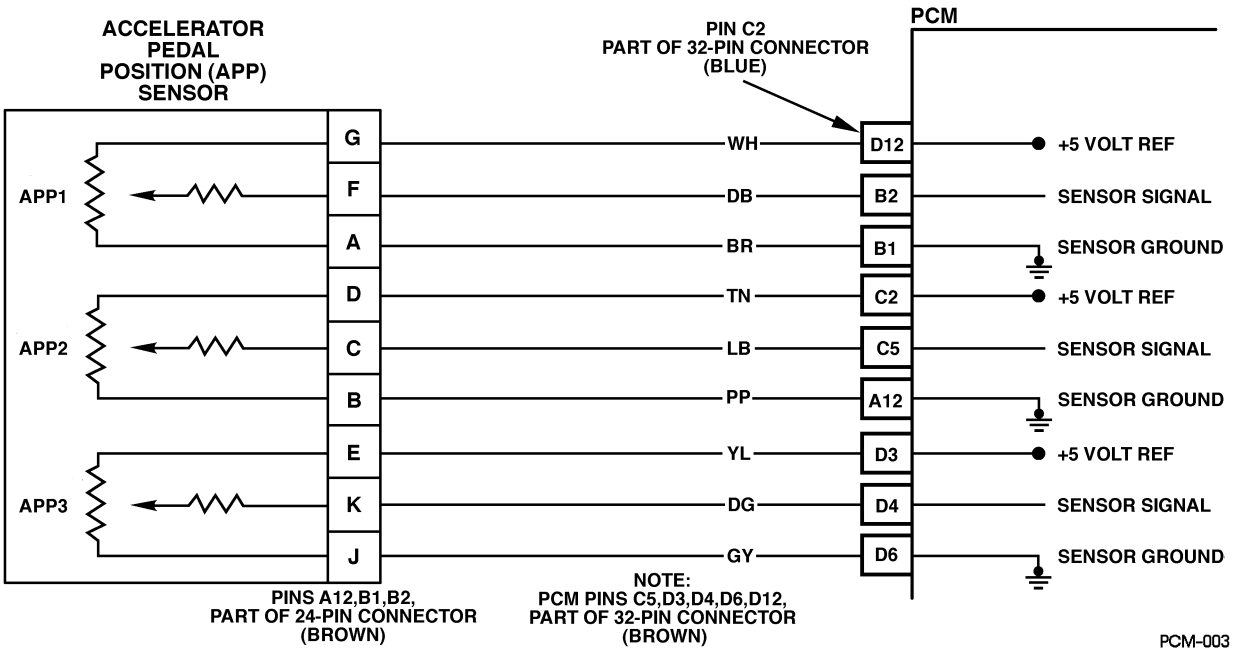

Figure PCM-8 Accelerator Pedal Position (APP) Sensor Circuit High Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is greater than 4.75 volts on APP 1 sensor.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 1 sensor is ignored.
- A current and history DTC will set but it will not turn on the “Check Throttle” lamp. The throttle will operate normally as long as there is only one sensor malfunctioning. If two different APP sensors have a malfunction, the “Check Throttle” lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the “Service Throttle Soon” lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 1 position in volts. It should read about .45 to .95 volt with throttle closed and ignition “ON” or at idle. Voltage should increase at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Scan APP 1 sensor while depressing accelerator pedal with engine stopped and ignition “ON”. Display should vary from about .74 volt when throttle is closed to about 3.7 volts when throttle is held at Wide Open Throttle (WOT) position. A P0123 will result if the ground circuit is open or the signal circuit is shorted to voltage. Refer to Intermittents in Section 2.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if DTC P0123 is the result of a hard failure or an intermittent condition.
3. This step checks the PCM and wiring.

DTC P0123 - Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 1 display on the scan tool. Is APP 1 above the specified value?	4.75v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Observe the APP 1 display on the Scan Tool. Is APP 1 less than the specified value?	.25v	Go to Step 5.	Go to Step 6.
5	Probe APP 1 sensor ground circuit at the APP sensor harness connector with a test light connected to B+. Is the test light "ON"?	—	Go to Step 7.	Go to Step 8.
6	1. Check for a short to voltage on the APP 1 sensor signal circuit. 2. If the APP 1 sensor signal circuit is shorted, repair it as necessary. Was the APP 1 sensor signal circuit shorted?	—	Go to Step 11.	Go to Step 10.
7	Check for poor electrical connections at the APP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Go to Step 11.	Go to Step 9.
8	1. Check for an open sensor ground circuit. 2. If a problem is found, repair as necessary. Was APP 1 sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 11.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0182 Fuel Temperature Sensor Circuit Low Voltage (Figure PCM-9)

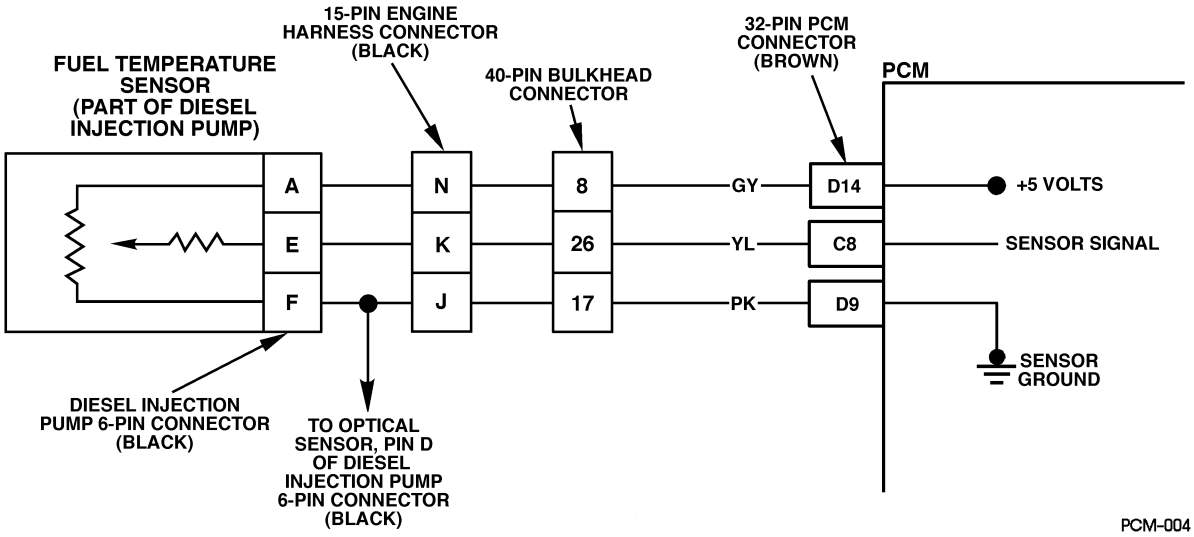

Figure PCM-9 Fuel Temperature Sensor Circuit Low Voltage

Circuit Description

The fuel temperature sensor is a thermistor that controls signal voltage to the PCM. When the fuel is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As fuel warms, sensor resistance becomes less and voltage drops. The fuel temperature sensor is integrated with the optical sensor. This is a type B DTC.

Conditions for Setting the DTC

- Fuel temperature greater than 102°C (215°F).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

Poor idle quality during hot conditions.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A scan tool reads fuel temperature in degrees centigrade. After engine is started, the fuel temperature should rise steadily.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if DTC P0182 is a hard failure or an intermittent condition.
3. This step will determine if signal circuit is shorted to ground.

DTC P0182 - Fuel Temperature Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the Fuel Temp display on the scan tool. Is Fuel Temp greater than the specified value?	102°C (215°F)	Go to Step 3.	Go to Step 5.
3	1. Engine "OFF". 2. Ignition "ON". 3. Disconnect the Optical/Fuel Temperature sensor connector. Is Fuel Temp less than or equal to the specified value?	17°C (63°F)	Go to Step 7.	Go to Step 4.
4	1. Ignition "OFF". 2. Using the J 39200, measure the resistance across the Fuel Temperature sensor harness connector. Is the resistance at the specified value?	Infinite	Go to Step 8.	Go to Step 6.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer those chart(s).	—	Go to the applicable DTC table	Go to *Diagnostic Aids.*
6	Repair the short to ground in the Fuel Temp signal circuit. Is the action complete?	—	Go to Step 9.	—
7	Replace the fuel injection pump. ***Notice:*** If fuel injection pump is faulty, the new injection pump must be timed. Go to *Checking or Adjusting injection timing.* Is the action complete?	—	Go to Step 9.	—
8	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 9.	—
9	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 10.	Go to Step 2.
10	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0183 Fuel Temperature Sensor Circuit High Voltage (Figure PCM-10)

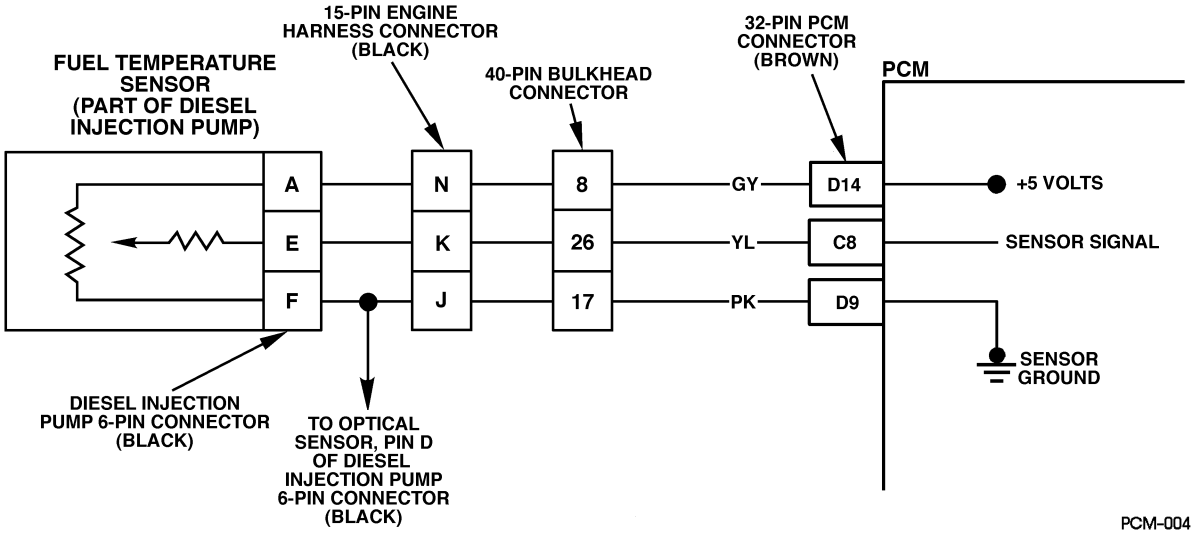

Figure PCM-10 Fuel Temperature Sensor Circuit High Voltage

Circuit Description

The fuel temperature sensor is a thermistor that controls signal voltage to the PCM. When the fuel is cold, the sensor resistance is high, therefore the PCM will see high signal voltage. As fuel warms, sensor resistance becomes less and voltage drops. The fuel temperature sensor is integrated with the optical sensor. This is a type B DTC.

Conditions for Setting the DTC

- Engine operating for 8 minutes.
- Fuel temperature less than or equal to 17°C (63°F).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

Poor idle quality during hot conditions.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A scan tool reads fuel temperature in degrees centigrade. After engine is started, the fuel temperature should rise steadily. A faulty connection, or an open in the signal circuit.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if DTC P0183 is a hard failure or an intermittent condition.
3. This step stimulates a DTC P0182. If the PCM recognizes the low signal voltage (high temp) the PCM and wiring are OK.
4. This test will determine if signal circuit is open. There should be 5 volts at sensor connector if measured with J 39200-DVM. This will determine if there is a wiring problem or a faulty PCM.

DTC P0183 - Fuel Temperature Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Start and idle engine. 3. Monitor the Fuel Temp display on the scan tool. Is Fuel Temp less than the specified value?	18°C (64°F)	Go to Step 3.	Go to Step 5.
3	1. Engine "OFF". 2. Ignition "ON". 3. Disconnect the Optical/Fuel Temperature sensor connector. 4. Jumper the Fuel Temperature harness terminals together. Does the Scan Tool display fuel temperature greater than the specified value?	105°C (221°F)	Go to Step 6.	Go to Step 4.
4	Jumper the Fuel Temperature sensor signal circuit to a known good ground. Does the Scan Tool display a Fuel Temp greater than the specified value?	105°C (221°F)	Go to Step 7.	Go to Step 8.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those chart(s). Are any other DTCs stored?	—	Go to the applicable DTC table	Go to *Diagnostic Aids.*
6	Inspect the sensor connector and PCM connector for proper connection. Was a problem found?	—	Go to Step 9.	Go to Step 10.
7	Check the Fuel Temperature sensor ground circuit for an open between the Fuel Temp sensor and the PCM. Was a problem found?	—	Go to Step 9.	Go to Step 11.
8	Check the Fuel Sensor signal circuit for an open between the Fuel Temp sensor and the PCM. Was a problem found?	—	Go to Step 9.	Go to Step 10.
9	Repair the circuit as necessary. Is the action complete?	—	Go to Step 13.	—
10	Inspect PCM connectors for proper connections and replace terminals, if necessary. Was a problem found?	—	Go to Step 13.	Go to Step 12.
11	Replace the injection pump. Is the action complete?	—	Go to Step 12.	—
12	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 12.	—
13	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13.	Go to Step 2.
14	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0215 Engine Shutoff Solenoid Control Circuit (Figure PCM-11)

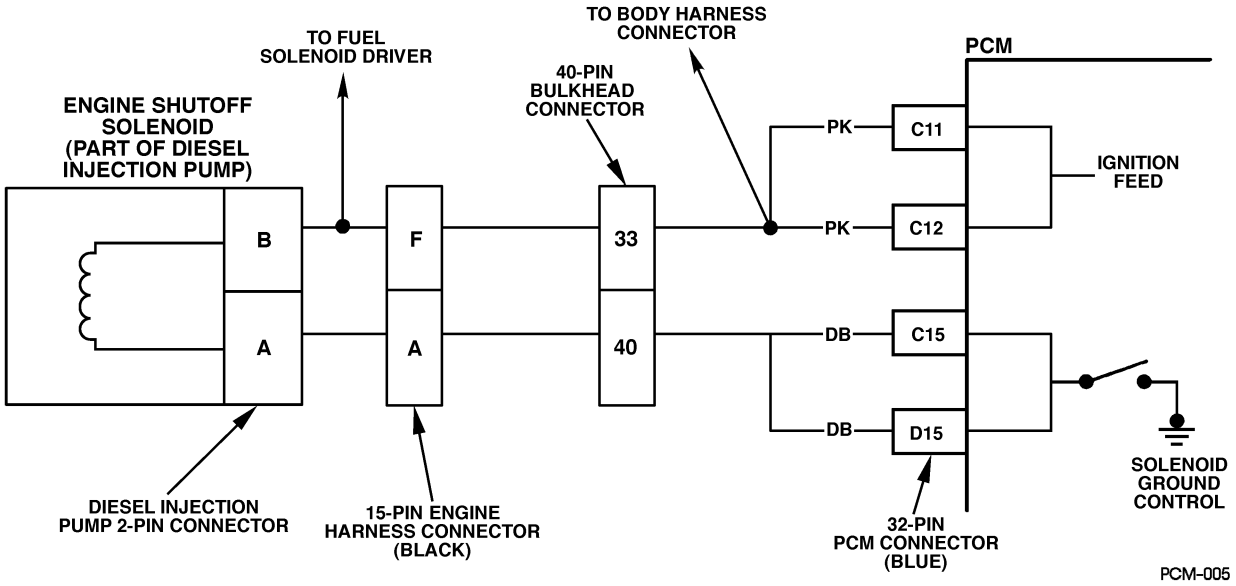

Figure PCM-11 Engine Shutoff Solenoid Control Circuit

Circuit Description

The injection fuel supply line has a solenoid controlled shutoff located in the injection pump. When the solenoid is energized (key in the run position), the valve is open and fuel is supplied to the injection pump. By providing a ground path, the PCM energizes the solenoid. This is a type D DTC.

Conditions for Setting the DTC

- PCM requested ESO "ON".
- Control circuit voltage at the PCM is greater than 8 volts.
- Conditions met for 2 seconds.

or

- PCM requested ESO "OFF".
- Control circuit voltage at the PCM is less than 8 volts.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

P0215 will not turn "ON" the MIL.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

An open in the control circuit or the ignition feed circuit will cause a P0215. Also a no start condition will exist. The Scan Tool has the ability to turn the engine shutoff solenoid "ON" and "OFF". This can be used as a quick operational check.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This step will check the ignition feed circuit for an open.

DTC P0215 - Engine Shutoff Solenoid Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. Using scan tool, command ESO "ON" and "OFF". Does ESO respond to scan tool commands?	—	Go to Step 4.	Go to Step 3.
3	1. Ignition "OFF". 2. Disconnect the PCM electrical connector. 3. Ignition "ON", engine "OFF". 4. With a test light connected to chassis ground, probe ESO control circuit at PCM harness connector. Is test light "ON".	—	Go to Step 5.	Go to Step 6.
4	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored refer those table(s).	—	—	—
5	Check the ESO control circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 8.	Go to Step 7.
6	1. Check the ESO control circuit for: • an open • faulty bulb • faulty fuse 2. If the ESO control circuit was faulty, repair it as necessary. Was repair performed?	—	Go to Step 8.	—
7	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 8.	—
8	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 10.	Go to Step 2.
9	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	Go to Step 2.

DTC P0216 Injection Timing Control System (Figure PCM-12)

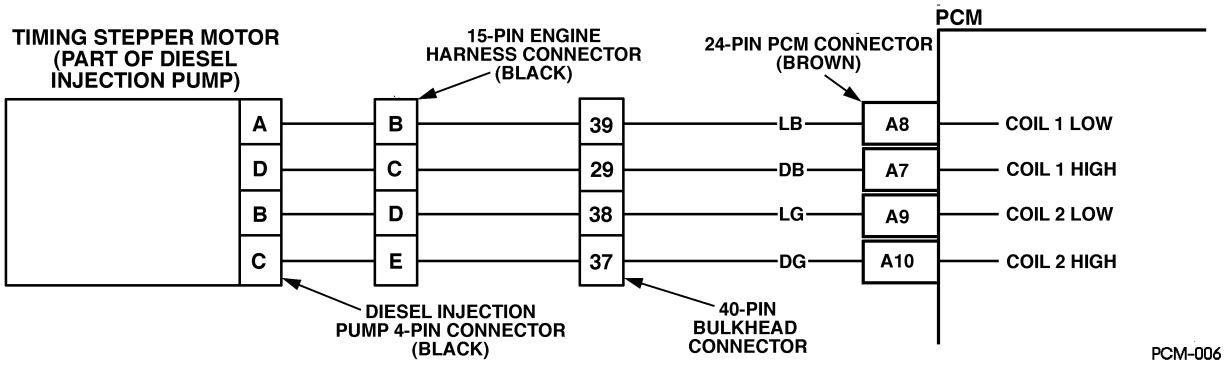

Figure PCM-12 Injection Timing Control System

Circuit Description

Timing of the combustion event is accomplished by delivering a pulse of fuel into the combustion chamber at a desired degree of cylinder travel. This desired degree (defines the current position of the cylinder in relationship of Top Dead Center). This test compares desired timing to measured timing when certain conditions have been met. To retard injection timing the PCM extends the stepper motor. To advance injection timing the PCM retracts the stepper motor. This is a type B DTC.

Conditions for Setting the DTC

- Engine speed has not changed more than 56 rpm for 20.8 seconds.
- A 5 degree difference between Act. Inj. Time and Des. Inj. Time.

Action Taken When the DTC Sets

Possible combustion noise.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up

  coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A hard start and possible poor performance condition might exist. Act. Inj. Time will freeze at the point of the fault. DTC P0216 will set if injection timing is not set correctly. Refer to Checking and Adjusting Injection Timing.

Test Description

Number(s) refer to the number(s) on the diagnostic table.

2. This step determines is a hard failure or an intermittent.
3. This step checks for an open or short in the injection timing coil circuit 1.
4. This step checks for an open or short in the injection timing coil circuit 2.
5. The important thing in this step is that the PCM is sending a varying voltage (voltage may vary between 1 and 12 (usually you will see voltage vary between 5 and 6 when engine is idling)), this will indicate that the PCM is OK and that there is a problem with the injection timing stepper motor. If there is a steady voltage present on any circuit, this will indicate a problem with the PCM or a circuit shorted to voltage.

DTC P0216 - Injection Timing Control System

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Engine at operating temperature. 2. Scan injection timing at idle and at 1500 rpm. Difference between Actual Inj. Time and Desired at idle or 1500 rpms?	5°	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. An additional DTCs are stored.	—	Go to the DTC table	Go to Diagnostic Aids
4	1. Ignition "OFF". 2. Disconnect PCM. 3. Measure resistance between coil 1 low and coil 1 high at PCM harness. Is resistance between specified value?	10-60 Ohms	Go to Step 5.	Go to Step 9.
5	Measure resistance between coil 2 low and coil 2 high at PCM harness. Is resistance between specified value?	10-60 Ohms	Go to Step 6.	Go to Step 10.
6	1. Reconnect PCM. 2. Disconnect Injection Timing Stepper motor. 3. Start and idle engine. 4. Using scan tool, command Time Set "ON". 5. Check for varying voltage on all terminals at injection timing stepper motor electrical harness. Does voltage vary?	—	Go to Step 7.	Go to Step 12.
7	1. Disconnect crankshaft position sensor. 2. Measure resistance between crankshaft position sensor signal and 5 volt reference circuit at sensor pigtail. Is resistance between specified value?	950-1050 Ohms	Go to Step 8.	Go to Step 15.
8	Check for inj. timing set correctly and/or sheared camshaft driven key Was a repair performed?	—	Go to Step 18.	Go to Step 16.
9	1. Ignition "OFF". 2. Disconnect PCM, check for open in the coil 1 low and high circuit 3. If a problem is found, repair it as necessary. Was a repair required?	—	Go to Step 18.	Go to Step 16.
10	1. Ignition "OFF". 2. Disconnect PCM, check for open in coil 2 low and high circuit 3. If a problem is found, repair it as necessary. Was a repair required?	—	Go to Step 18.	Go to Step 16.
11	Check for poor electrical connection at the injection timing stepper motor. Was a repair performed?	—	Go to Step 12.	Go to Step 17.
12	Check the circuit for a short to ground or a poor connection at the PCM. Was a repair performed?	—	Go to Step 18.	Go to Step 17.
13	Check crankshaft sensor pigtail for a short to ground. Repair it as necessary. Was the circuit shorted to ground?	—	Go to Step 18.	Go to Step 14.
14	Check the circuit for a poor connection and replace terminal if necessary. Did Terminal require replacement?	—	Go to Step 18.	Go to Step 17.
15	Replace crankshaft position sensor. Is action complete?	—	Go to Step 18.	—
16	Replace injection pump. Is action complete?	—	Go to Step 18.	—
17	Replace the faulty PCM. Is the action complete?	—	Go to Step 18.	—

DTC P0216 - Injection Timing Control System

Step	Action	Value(s)	Yes	No
18	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 19.	Go to Step 2.
19	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK.

DTC P0219 Engine Overspeed Condition (Figure PCM-13)

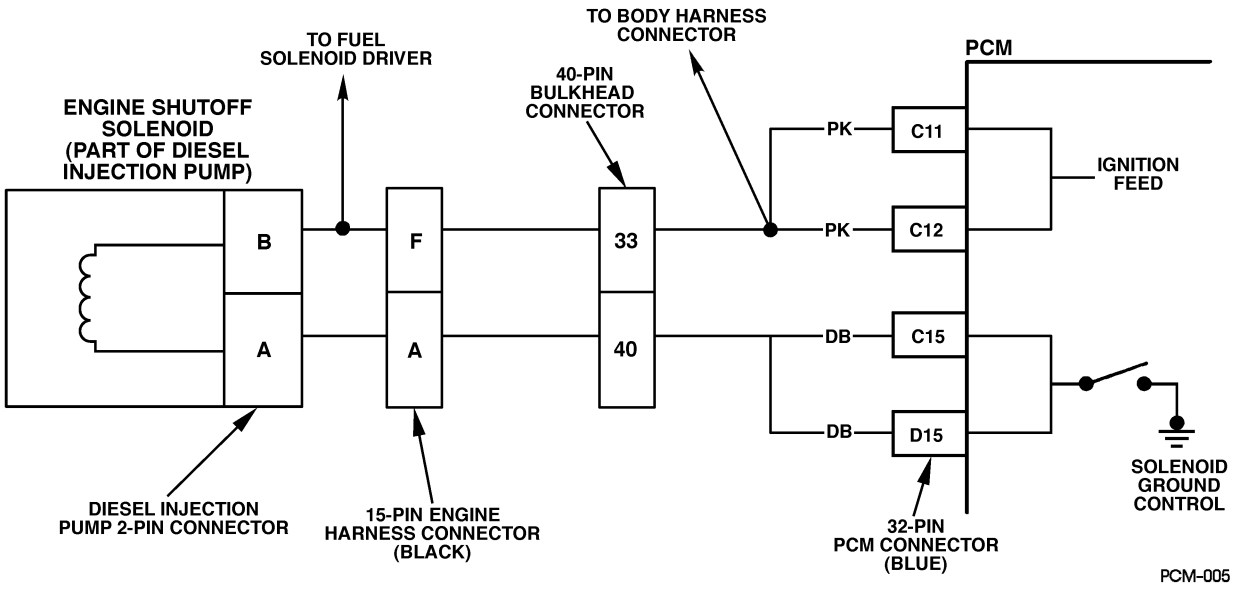

Figure PCM-13 Engine Overspeed Condition

Circuit Description

The PCM has the ability to put the vehicle in an ESO controlled idle if an engine overspeed condition has been detected. This is a type D DTC.

Conditions for Setting the DTC

5 ESO cycles with an rpm drop.

Action Taken When the DTC Sets

ESO controlled idle (the PCM will control rpm by turning the ESO "ON" and "OFF". RPM will fluctuate from 800 to 1200 when DTC is set).

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

This DTC will not set if an external fuel source is causing an overspeed condition. A DTC P1216 will set along with DTC P0219

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. The injection pump is being replaced in this step.

DTC P0219 - Engine Overspeed Condition

Step	Action	Value(s)	Yes	No
1	Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Replace injection pump. ***Notice:*** If injection pump is faulty, the new injection pump must be timed. Go to *Checking and Adjusting Injection Timing* in section 4. Is action complete?	—	Go to Step 4.	Go to Step 2.
3	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 4.	Go to Step 2.
4	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to Applicable DTC table	Go to Step 2.

DTC P0220 Accelerator Pedal Position (APP) Sensor 2 Circuit (Figure PCM-14)

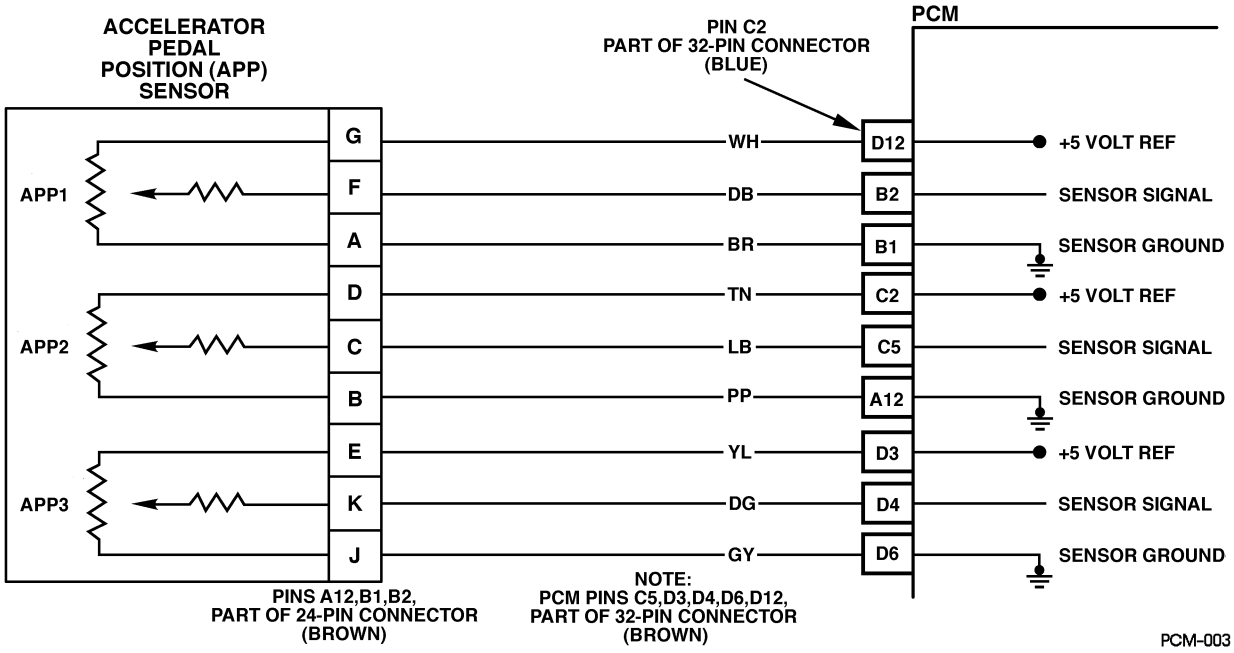

Figure PCM-14 Accelerator Pedal Position (APP) Sensor 2 Circuit

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Reference voltage on APP 2 less than 4.8 volts.
- Condition met for 2 seconds.

Action Taken When the DTC Sets

If DTC P0220 is stored, the PCM will turn “ON” the “Service Throttle Soon” lamp and limit power.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

The most likely cause of this DTC is loose connectors or terminals. All 5 volt reference circuits must be checked for proper reference voltage. Volt meter accuracy is important.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if there is a good voltage reference.

DTC P0220 - Accelerator Pedal Position (APP) Sensor 2 Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J 39200 connected to ground, check all APP 5 volt reference circuits at APP harness. Is voltage less than specified value?	4.8v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for a short to ground. 3. If the 5 volt reference circuit is shorted to ground, repair as necessary Was the 5 volt reference circuit shorted to ground?	.25v	Go to Step 5.	Go to Step 6.
5	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 6.	—
6	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 7.	Go to Step 2.
7	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0221 Accelerator Pedal Position (APP) Sensor 2 Circuit Performance (Figure PCM-15)

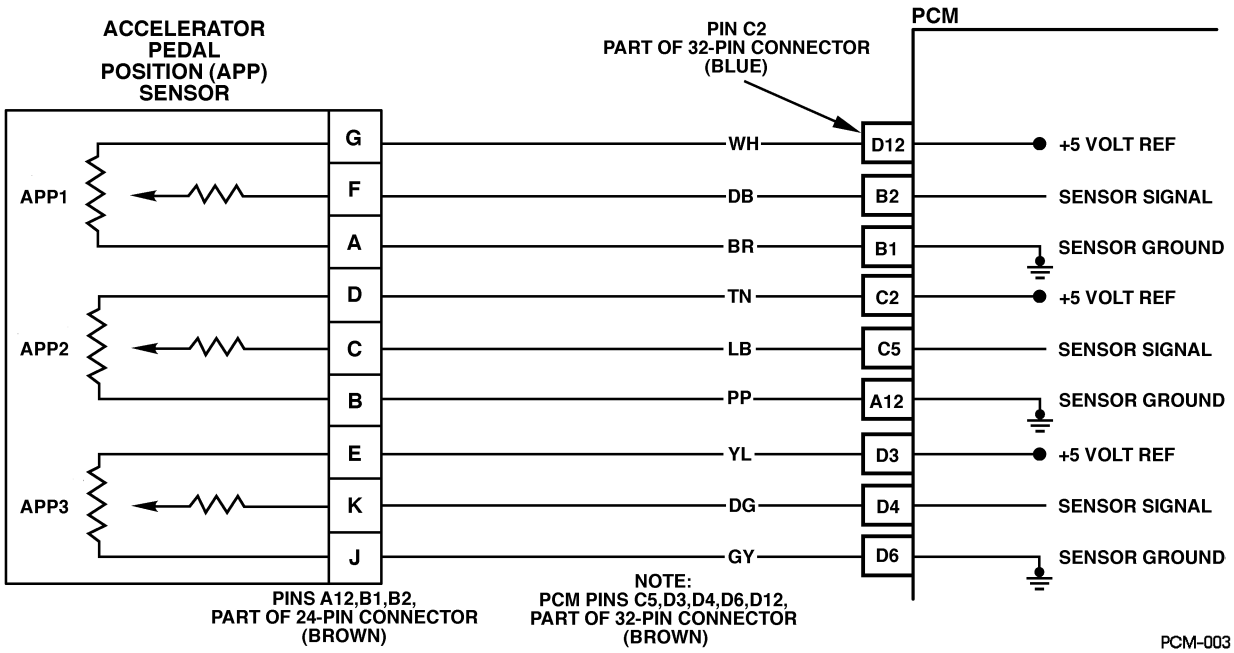

Figure PCM-15 Accelerator Pedal Position (APP) Sensor 2 Circuit Performance

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Ignition voltage is greater than 6.4 volts.
- Engine speed greater than 300 rpm.
- The difference between APP 2 and APP 1 is greater than .23 volts (PCM compares pre-scaled voltage (internal to PCM)).
- The difference between APP 2 and APP 3 is greater than .50 volts (PCM compares pre-scaled voltage (internal to PCM)).
- No in range faults for APP 1 or APP 3 (PCM checks for high and low voltage faults).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp.
- The throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will then turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present, the "Service Throttle Soon" lamp will be "ON" and will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Refer to Section 2 for "Intermittents". Scan APP 2 sensor while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

4. This step determines if there is a good 5 volt reference.

5. This step will check for an open in the ground circuit.

DTC P0221 - Accelerator Pedal Position (APP) Sensor 2 Circuit Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP voltages on the scan tool. Are APP at specified values?	.45-.95v 4.0-4.5v 3.6-4.0v	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J 39200 connected to ground, probe APP sensor 5 volt reference circuits at APP harness terminals "G", "D" and "E". Is voltage at the specified value on all circuits?	4.75v	Go to Step 5.	Go to Step 6.
5	1. Ignition "ON", engine "OFF". 2. With a test light connected to B+, probe APP sensor ground circuits at the APP sensor harness terminals "A", "B" and "J". Is the test light "ON" (all circuits)?	—	Go to Step 9.	Go to Step 8.
6	1. Ignition "OFF" 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 11.	Go to Step 7.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 11.	Go to Step 10.
8	1. Ignition "OFF" 2. Disconnect the PCM and check for an open sensor ground circuit to the PCM. 3. If problem is found, repair as necessary. Was APP sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 10.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0222 Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage (Figure PCM-16)

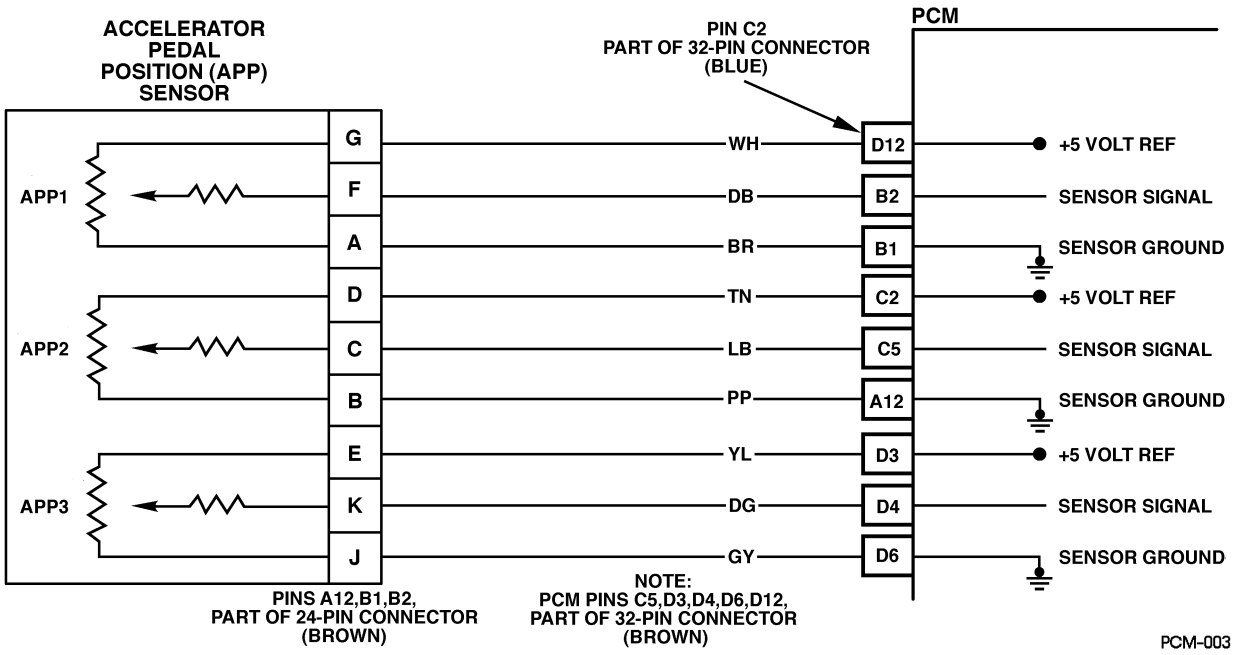

Figure PCM-16 Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is less than .25 volts on APP 2 sensor.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- A current and history DTC will set but it will not turn on the “Service Throttle Soon” lamp.
- The throttle will operate normally as long as there is only one sensor malfunction present. If two different APP sensors have a malfunction, the “Service Throttle Soon” lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the “Service Throttle Soon” lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition “ON” or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). An open or short to ground in CKT 996 or 993 will result in a P0222. Refer to Section 2 for “Intermittents”. Scan APP 2 sensor while depressing accelerator pedal with engine stopped and ignition “ON”, Display should vary from about 4.5 volts when throttle was closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position.

Test Description

Number(s) below refer to the circled number(s) on the diagnostic table.

2. This step determines if P0222 is the result of a hard failure or an intermittent condition.
3. This step checks the PCM and wiring.

DTC P0222 - Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 2 voltages on the scan tool. Is APP 2 voltage less than or equal to the specified value?	.25v	Go to Step 3.	Go to Step 4.
3	DTC is intermittent.. Are additional DTCs stored?	—	Go to the DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Jumper APP 2 5 volt reference circuit and the APP 2 signal together at the APP sensor harness connector. 3. Observe the APP 2 voltage on the Scan Tool. Is APP 2 voltage greater than the specified value?	4.75v	Go to Step 10.	Go to Step 5.
5	1. Connect a test light between B+ and the APP 1 sensor signal circuit at the APP sensor harness connector. 2. Observe the APP 2 voltage on the Scan Tool. Is APP 2 voltage greater than the specified value?	4.75v	Go to Step 6.	Go to Step 8.
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 12.	Go to Step 7.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 12.	Go to Step 11.
8	1. Ignition "OFF". 2. Disconnect PCM, and check APP 2 signal circuit for short to ground. 3. Repair as necessary. Was APP 2 signal circuit open or shorted to ground?	—	Go to Step 12.	Go to Step 9.
9	Check the APP 2 sensor signal circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 12.	Go to Step 11.
10	Replace the APP module. Is Action complete?	—	Go to Step 12.	—
11	Replace the faulty PCM. Is the action complete?	—	Go to Step 12.	—
12	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13.	Go to Step 2.
13	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK

DTC P0223 Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage (Figure PCM-17)

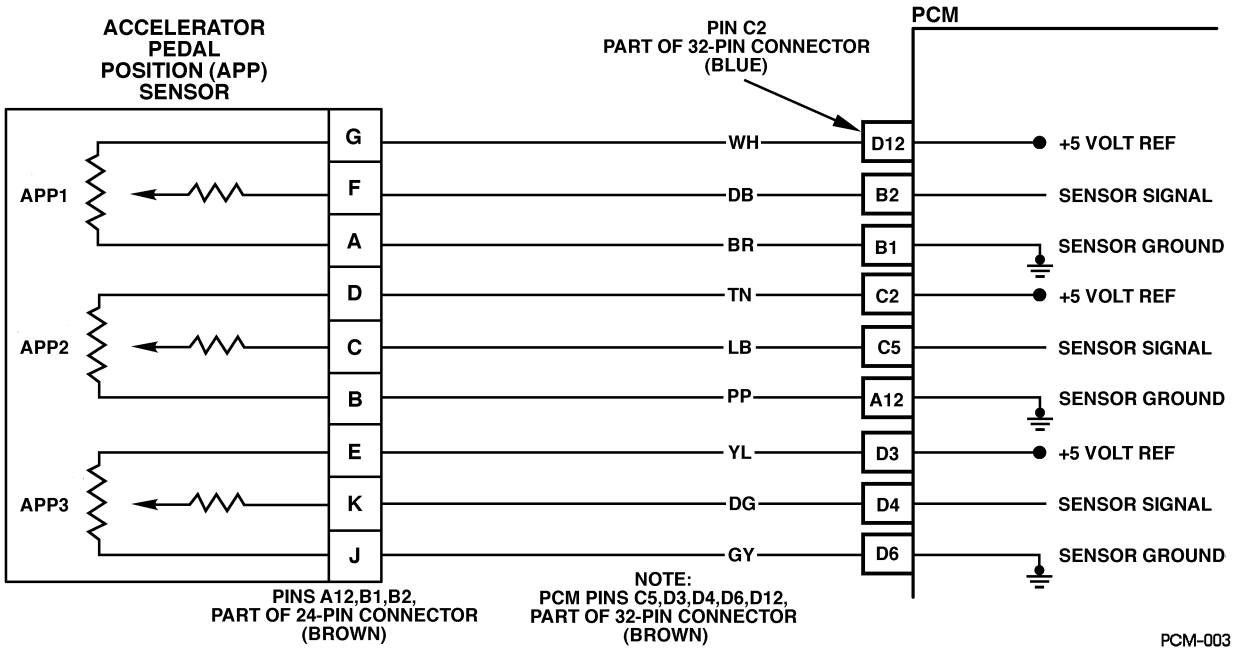

Figure PCM-17 Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is greater than 4.75 volts on APP 2.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Ignition must be cycled if P1125 is also set.
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 2 position in volts and should read about 4.5 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Refer to Section 2 for "Intermittents". Scan APP 2 signal while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about 4.5 volts when throttle is closed to about 1.5 volts when throttle is held at Wide Open Throttle (WOT) position. Its possible P1125 will set along with P0223 if the signal circuit is open.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if P0223 is a hard failure or an intermittent condition.
3. This step will check for an open in the ground circuit.

DTC P0223 - Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 2 display on the scan tool. Is APP 2 greater than or equal to the specified value?	4.75v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Observe the APP 2 display on the Scan Tool. Is APP 2 less than or equal to the specified value?	.25v	Go to Step 5.	Go to Step 6.
5	Probe APP 2 sensor ground circuit at the APP sensor harness connector with a test light connected to B+. Is the test light "ON"?	—	Go to Step 7.	Go to Step 8.
6	1. Check for a short to voltage on the APP 2 sensor signal circuit. 2. If the APP 2 sensor signal circuit is shorted, repair it as necessary. Was the APP 2 sensor signal circuit shorted?	—	Go to Step 11.	Go to Step 10.
7	Check for poor electrical connections at the APP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Go to Step 11.	Go to Step 10.
8	1. Check for an open sensor ground circuit. 2. If a problem is found, repair as necessary. Was APP 2 sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 10.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0225 Accelerator Pedal Position (APP) Sensor 3 Circuit (Figure PCM-18)

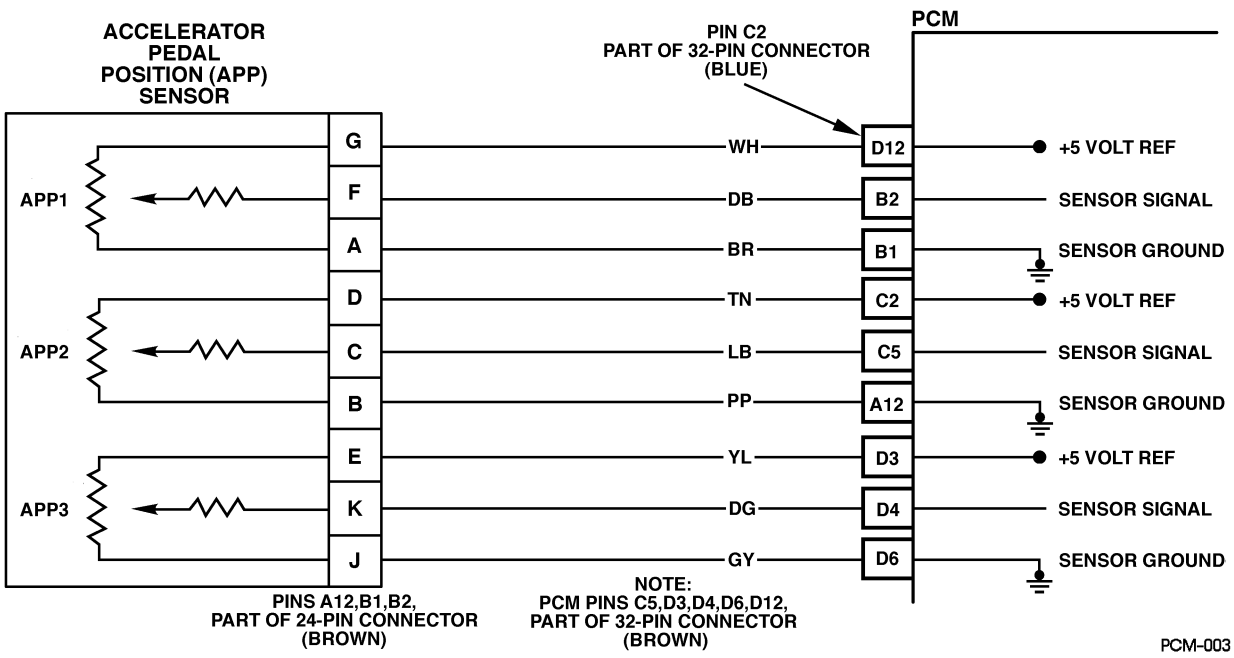

Figure PCM-18 Accelerator Pedal position (APP) Sensor 3 Circuit

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Reference voltage on APP 3 less than 4.8 volts.
- Condition met for 2 seconds.

Action Taken When the DTC Sets

If DTC P0225 is present, the PCM will turn “ON” the “Service Throttle Soon” lamp and limit power.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

All 5 volt reference circuits must be checked for proper reference voltage. Volt meter accuracy is important.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will check all 5 volt reference circuits.

DTC P0225 - Accelerator Pedal Position (APP) Sensor 3Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J 39200 connected to ground, check all APP 5 volt reference circuits at APP harness. Is voltage less than specified value?	4.8v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for a short to ground. 3. If the 5 volt reference circuit is shorted to ground, repair as necessary Was the 5 volt reference circuit shorted to ground?	.25v	Go to Step 6.	Go to Step 5.
5	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 6.	—
6	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 7.	Go to Step 2.
7	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0226 Accelerator Pedal Position (APP) Sensor 3 Circuit Performance (Figure PCM-19)

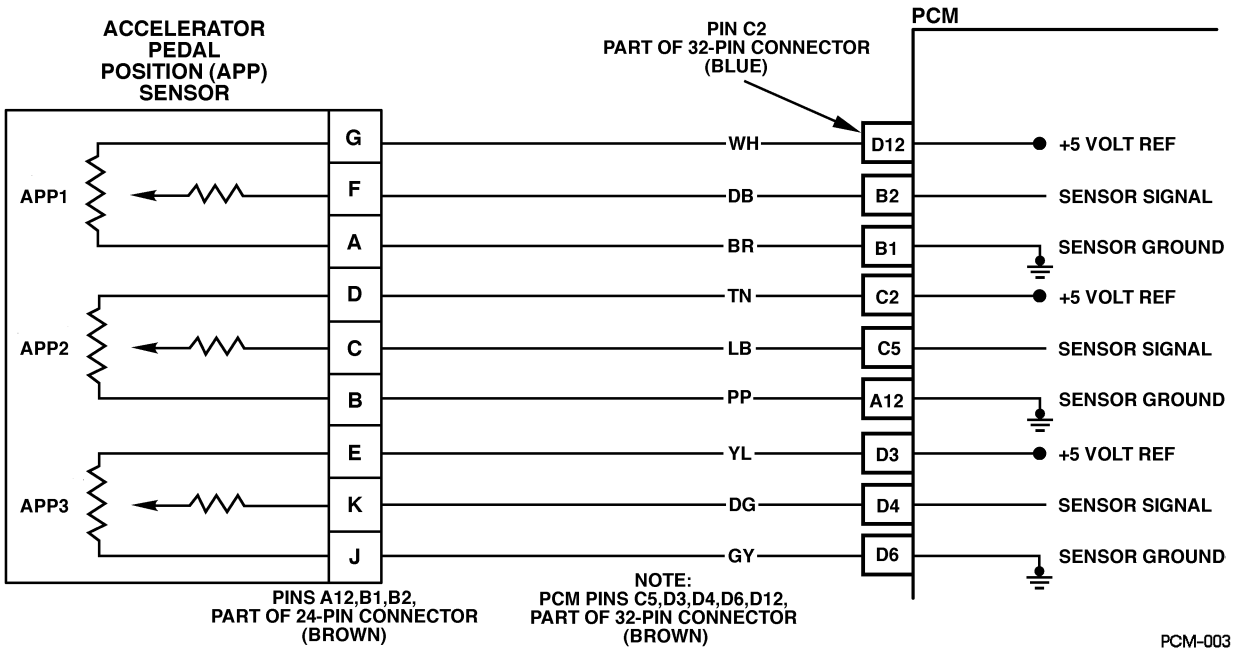

Figure PCM-19 Accelerator Pedal Position (APP) Sensor 3 Circuit Performance

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Ignition voltage is greater than 6.4 volts.
- Engine speed greater than 300 rpm.
- The difference between APP 3 and APP 1 is greater than .23 volts (PCM compares pre-scaled voltage (internal to PCM)).
- The difference between APP 3 and APP 2 is greater than .50 volts (PCM compares pre-scaled voltage (internal to PCM)).
- No in range faults for APP 1 or APP 2 (PCM checks for high and low voltage faults).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 3 sensor is ignored.
- A current and history DTC will set but it will not turn "ON" the "Service Throttle Soon" lamp.
- The throttle will operate normally as long as there is only one malfunction present. If there are two APP malfunctions present, the PCM will then turn "ON" the "Service Throttle Soon" lamp and limit power. If a third APP malfunction is present, the "Service Throttle Soon" lamp will be "ON" and will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 3 position in volts and should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON". Display should vary from about 4.0 volts when throttle was closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if there is a good reference voltage.

DTC P0226 - Accelerator Pedal Position (APP) Sensor 3 Circuit Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP voltages on the scan tool. Are APP voltages at specified values?	.45-.95v 4.0-4.5v 3.6-4.0v	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s).	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J 39200 connected to ground, probe APP sensor 5 volt reference circuits at APP harness terminals "G", "D" and "E". Is voltage at the specified value on all circuits?	4.75v	Go to Step 5.	Go to Step 6.
5	1. Ignition "ON", engine "OFF". 2. With a test light connected to B+, probe APP sensor ground circuits at the APP sensor harness terminals "A", "B" and "J". Is the test light "ON" (all circuits)?	—	Go to Step 9.	Go to Step 8.
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 11.	Go to Step 7.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 11.	Go to Step 10.
8	1. Ignition "OFF". 2. Disconnect the PCM and check for an open sensor ground circuit to the PCM. 3. If problem is found, repair as necessary. Was APP sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 11.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0227 Accelerator Pedal Position (APP) Sensor 3 Circuit Low Voltage (Figure PCM-20)

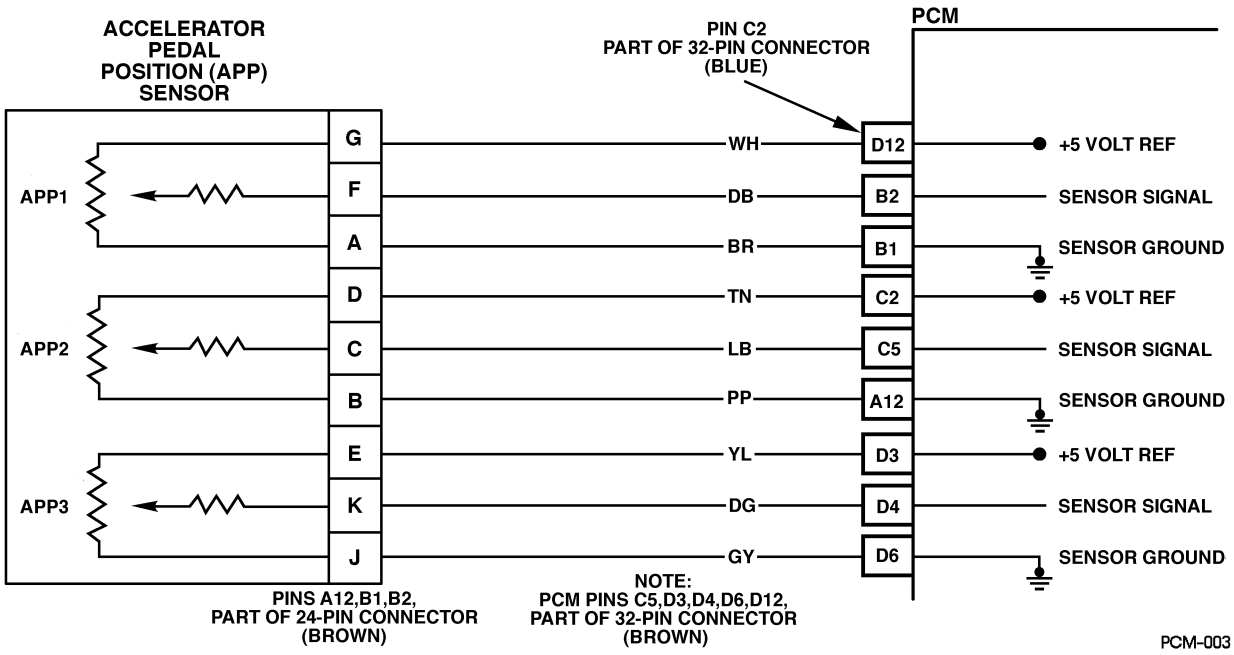

Figure PCM-20 Accelerator Pedal Position (APP) Sensor 3 Circuit Low Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is less than .25 volts on APP 3 sensor.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 3 sensor is ignored.
- A current and history DTC will set but it will not turn on the "Service Throttle Soon" lamp.
- The throttle will operate normally as long as there is only one sensor malfunction present. If two different APP sensors have a malfunction, the "Service Throttle Soon" lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the "Service Throttle Soon" lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 3 position in volts and should read about 4.0 volts with throttle closed and ignition "ON" or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also 90% pedal travel is acceptable for correct APP operation. Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition "ON", Display should vary from about 4.0 volts when throttle was closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position. Refer to "Intermittents", in Section 2.

Test Description

Number(s) below refer to the circled number(s) on the diagnostic table.

2. This step determines if P0227 is the result of a hard failure or an intermittent condition.
3. This step checks the PCM and wiring.

DTC P0227 - Accelerator Pedal Position (APP) Sensor 3 Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 3 voltages on the scan tool. Is APP 3 voltage less than or equal to the specified value?	.25v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those table(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Jumper APP 3 5 volt reference circuit and the APP 3 signal together at the APP sensor harness connector. 3. Observe the APP 3 voltage on the Scan Tool. Is APP 3 voltage greater than the specified value?	5v	Go to Step 5.	Go to Step 6.
5	1. Connect a test light between B+ and the APP 3 sensor signal circuit at the APP sensor harness connector. 2. Observe the APP 3 voltage on the Scan Tool. Is APP 3 voltage greater than the specified value?	5v	Go to Step 10.	Go to Step 8.
6	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 13.	Go to Step 7.
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 13.	Go to Step 12.
8	1. Ignition "OFF". 2. Disconnect the PCM, and check the APP 3 signal circuit for an open, short to ground. 3. If the APP 3 sensor signal circuit is open or shorted to ground, repair as necessary. Was APP 3 signal circuit open or shorted to ground?	—	Go to Step 13.	Go to Step 9.
9	Check the APP 3 sensor signal circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 13.	Go to Step 12.
10	Check for a poor electrical connection at the APP sensor. Was a repair performed?	—	Go to Step 13.	To to Step 12.
11	Replace the APP module. Is Action complete?	—	Go to Step 13.	—
12	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 13.	—
13	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 14.	Go to Step 2.
14	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0228 Accelerator Pedal Position (APP) Sensor 3 Circuit High Voltage (Figure PCM-21)

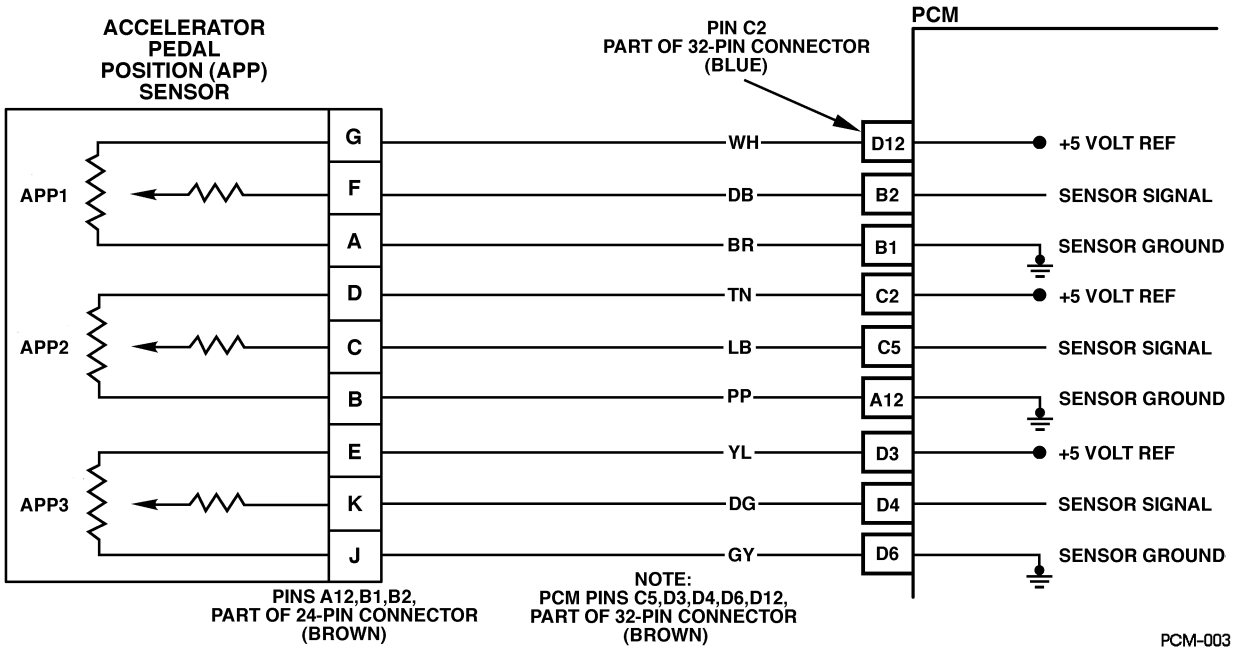

Figure PCM-21 Accelerator Pedal Position (APP) Sensor 3 Circuit High Voltage

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

- Voltage is greater than 4.75 volts on APP 3 sensor.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- The input from APP 3 sensor is ignored.
- A current and history DTC will set but it will not turn on the “Service Throttle Soon” lamp. The throttle will operate normally as long as there is only one malfunction present. If two different APP sensors have a malfunction, the “Service Throttle Soon” lamp will light and the PCM will limit power. If three APP sensors have a malfunction present, the “Service Throttle Soon” lamp will light and the PCM will only allow the engine to operate at idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

A scan tool reads APP 3 position in volts and should read about 4.0 volts with throttle closed and ignition “ON” or at idle. Voltage should decrease at a steady rate as throttle is moved toward Wide Open Throttle (WOT). Also, 90% pedal travel is acceptable for correct APP operation. Refer to Section 2 for “Intermittents”. Scan APP 3 sensor while depressing accelerator pedal with engine stopped and ignition “ON”. Display should vary from about 4.0 volts when throttle is closed to about 2.0 volts when throttle is held at Wide Open Throttle (WOT) position.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if P0228 is a hard failure or an intermittent condition.
3. This step checks the PCM and wiring.

DTC P0228 - Accelerator Pedal Position (APP) Sensor 3 Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record Freeze Frame and Failure Record for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON", engine "OFF". 2. With the throttle closed, observe APP 3 display on the scan tool. Is APP 3 above the specified value?	4.75v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs were stored, refer to those chart(s). Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to *Diagnostic Aids.*
4	1. Disconnect the APP sensor electrical connector. 2. Observe the APP 3 display on the Scan Tool. Is APP 3 less than or equal to the specified value?	—	Go to Step 5.	Go to Step 7.
5	Probe APP 3 sensor ground circuit at the APP sensor harness connector with a test light connected to B+. Is the test light "ON"?	0.25v	Go to Step 8.	Go to Step 6.
6	1. Check for a short to voltage on the APP 3 sensor signal circuit. 2. If the APP 3 sensor signal circuit is shorted, repair it as necessary. Was the APP 3 sensor signal circuit shorted?	—	Go to Step 11.	Go to Step 10.
7	1. Check for an open sensor ground circuit. 2. If a problem is found, repair as necessary. Was APP 3 sensor ground circuit open?	—	Go to Step 11.	Go to Step 10.
8	Check for poor electrical connections at the APP sensor and replace terminals if necessary. Did any terminals require replacement?	—	Go to Step 11.	Go to Step 9.
9	Replace the APP module. Is Action complete?	—	Go to Step 11.	—
10	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 11.	—
11	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 12.	Go to Step 2.
12	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0231 Fuel Lift Pump Secondary Circuit Low Voltage (Figure PCM-22)

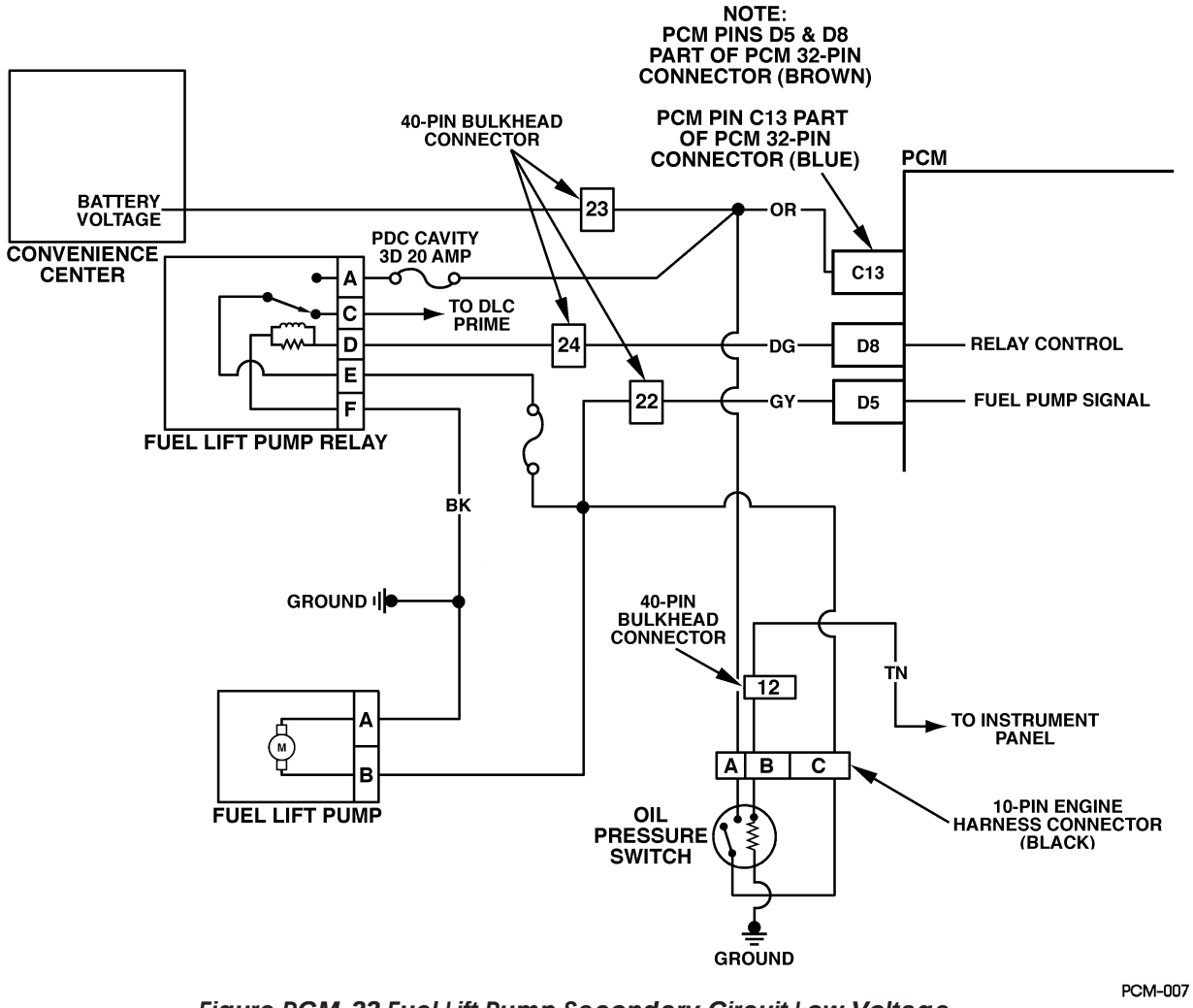

Figure PCM-22 Fuel Lift Pump Secondary Circuit Low Voltage

Circuit Description

The status of the lift pump is monitored by the PCM. This signal is also used to store a DTC if the fuel pump relay is defective or fuel pump voltage is lost while the engine is running. There should be about 12 volts on circuit 120 during glow plug cycle. This is a Type B DTC.

Conditions for Setting the DTC

- Fuel lift pump commanded "ON".
- Ignition voltage minus 4 volts.
- Fuel lift pump voltage less than ignition voltage value.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

No action taken.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool

Diagnostic Aids

This DTC will not check the fuel pump operation.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This step will check the fuel pump circuit.

DTC P0231 - Fuel Lift Pump Secondary Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Turn the ignition "OFF" for 20 seconds. 2. Turn the ignition "ON". 3. Listen for the fuel lift pump. Does the lift pump operate during glow plug cycle and then turn "OFF"?	—	Go to *Diagnostic Aids.*	Go to Step 3.
3	1. Turn the ignition "OFF". 2. Probe the fuel pump test terminal with a fused jumper to "B+". Does the fuel pump operate?	—	Go to Step 8.	Go to Step 4.
4	1. Disconnect the fuel pump relay. 2. Probe the fuel pump test terminal with a fused jumper to "B+". Does the fuel pump operate?	—	Go to Step 5.	Go to Step 6.
5	Replace the faulty fuel pump relay. Is the action complete?	—	Go to Step 6.	—
6	Check for a an open fuel pump signal circuit. Was a problem found?	—	Go to Step 7.	Go to Step 8.
7	Repair the open fuel pump signal circuit. Is the action complete?	—	Go to Step 8.	—
8	1. Turn the ignition "OFF". 2. Remove the fuel pump relay. 3. Connect a test light to ground. 4. Probe the fuel pump relay harness connector terminal number "B1". Is the test light "ON"?	—	Go to Step 10.	Go to Step 9.
9	Repair the open in the battery feed circuit to the fuel pump relay. Is the action complete?	—	Go to Step 10.	—
10	Connect a test light between terminal number "B1" and terminal number "A1" of the fuel pump relay harness connector. Is the test light "ON"?	—	Go to Step 12.	Go to Step 11.
11	Repair the open fuel pump relay ground circuit. Is the action complete?	—	Go to Step 12.	—
12	1. Turn the ignition "OFF". 2. Connect a test light between terminal number "B3" and ground. 3. Monitor the test light. 4. Turn the ignition "ON". Was a problem found?	—	Go to Step 16.	Go to Step 13.
13	Check for an open in circuit from fuel pump relay harness connector terminal number "B3" and PCM. Was a problem found?	—	Go to Step 14.	Go to Step 15.
14	Repair the open in the fuel pump relay control circuit. Is the action complete?	—	Go to Step 15.	—
15	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 16.	—
16	Check for a faulty connection at fuel pump relay harness connector terminal number "B3". Was a problem found?	—	Go to Step 18.	Go to Step 17.
17	Replace the faulty fuel pump relay. Is the action complete?	—	Go to Step 18.	—

DTC P0236 Turbocharger (TC) Boost System (Figure PCM-23)

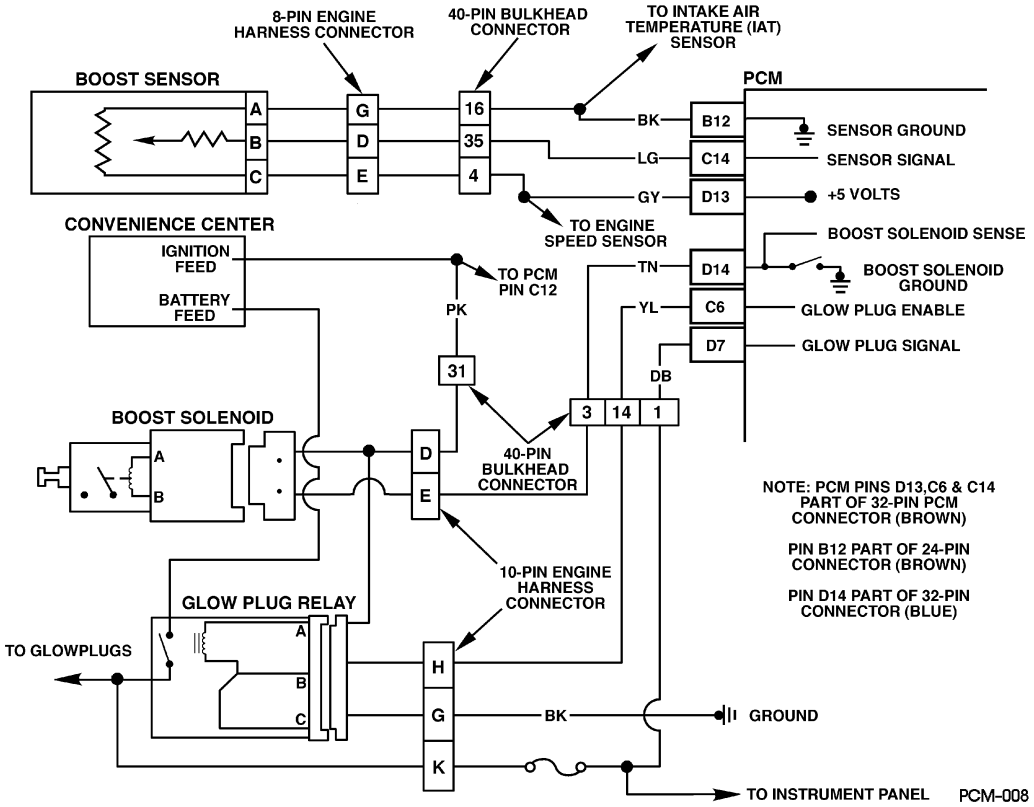

Figure PCM-23 Turbocharger (TC) Boost System

Circuit Description

The PCM operates a solenoid to control boost. This solenoid is normally open. By providing a ground path the PCM energizes the solenoid which then allows vacuum to pass to the wastegate valve. During normal operation, the PCM compares its wastegate duty cycle signal with the boost signal and makes corrections in the duty cycle accordingly. This is a type B DTC.

Conditions for Setting the DTC

- Engine speed greater than 2400 RPM.
- Fuel rate greater than 20 mm.
- Boost pressure less than or equal to 20 kPa from desired (internal to PCM).
- Conditions met for 10 seconds.

or

- Engine speed greater than 1800 but less than 2400 RPM.
- Fuel rate greater than 20 mm.
- Boost pressure less than or equal to (110 kPa) - ((100 kPa - Baro)/2) (internal to PCM).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

- Poor performance.
- Reduce maximum fuel.
- No TCC.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A vacuum leak or a pinched vacuum line may cause a DTC P0236. Check all vacuum lines and components connected to the hoses for leaks or sharp bends. Check vacuum source. A possible EGR DTC will store if there is a problem with the vacuum source. Also check for proper vacuum line routing. This diagnostic checks for a “skewed” sensor.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

This will check the Boost sensor scaling. One step will check the scaling with vacuum applied and one without.

DTC P0236 - Turbocharger (TC) Boost System

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Is DTC P1656 set?	—	Go to DTC table.	Go to Step 3
3	1. Disconnect the vacuum line at the turbocharger wastegate actuator. 2. Install a vacuum gauge in place of the turbocharger wastegate actuator. 3. Start the engine. 4. Observe the vacuum at idle. Is the vacuum greater than or equal to the specified value?	15 in. Hg	Go to Step 4.	Go to Step 6
4	1. Disconnect wastegate solenoid electrical connector with engine running. 2. With the vacuum gauge still in place, observe the vacuum at idle. Is the vacuum greater than the specified value?	1 in. Hg	Go to Step 7	Go to Step 12
5	1. Turn the engine OFF. 2. Connect a hand held vacuum pump to the turbocharger wastegate actuator. 3. Apply 5 in. Hg of vacuum. Does the turbocharger wastegate actuator hold vacuum?	—	Go to Step 7	Go to Step 12
6	1. Check all vacuum lines from vacuum pump to turbocharger wastegate actuator: • leaks • deformities • pinches 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 9
7	1. Verify the engine if OFF. 2. Disconnect all vacuum lines to the wastegate actuator. 3. Grip the wastegate actuator rod with a pair of pliers. 4. Attempt to move the wastegate actuator rod back and forth. Does the turbocharger wastegate actuator rod move freely?	—	Go to Step 8	Go to Step 12
8	DTC is intermittent. If no additional DTCs are stored, refer to diagnostic Aids. Are any additional DTCs stored?	—	Go to the DTC table.	Go to Diagnostic Aids
9	Check the vacuum pump for proper output (refer to Engine MEchanical). Is the action complete?	—	Go to STep 13.	
10	Check for a plugged wastegate solenoid filter. Repair as necessary. Is the wastegate solenoid filter plugged?	—	Go to Step 13	Go to Step 11
11	Replace the wastegate solenoid. Is the action complete?	—	Go to Step 13	—
12	Replace the turbocharger wastegate actuator. Is the action complete?	—	Go Step 13	—
13	1. Using the Scan Tool, select DTC, clear info. 2. Start engine and idle at normal operating temperature. 3. Select DTC, Specific, then enter the DTC number which was set. 4. Operate the vehicle until the Scan Tool indicates that the diagnostic RAN. Does the Scan Tool indicate that this diagnostic Passed?	—	Go to Step 14	Go to Step 2
14	Using the Scan Tool, select Capture Info, Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC TAble	System OK

DTC P0237 Turbocharger (TC) Boost Sensor Circuit Low Voltage (Figure PCM-24)

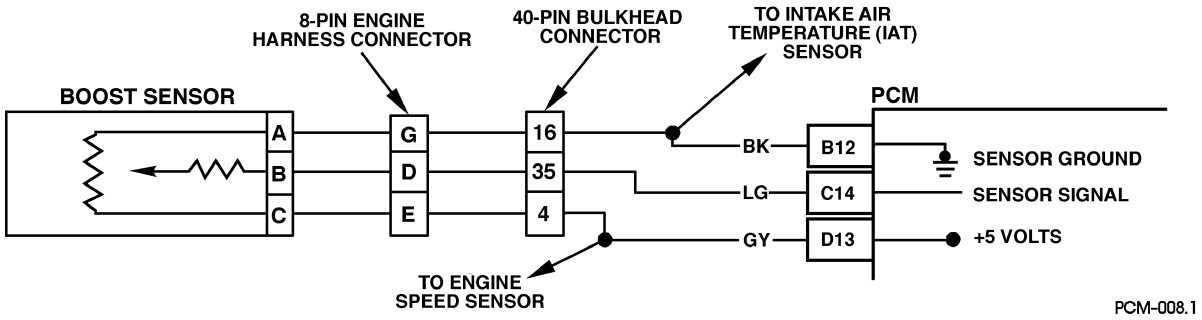

Figure PCM-24 Turbocharger (TC) Boost Sensor Circuit Low Voltage

Circuit Description

The PCM sends a 5 volt reference signal to the boost sensor. As manifold pressure changes, the electrical resistance of the boost sensor also changes. By monitoring the sensor output voltage, the PCM detects how much pressure is being produced by the turbocharger in the intake manifold. The PCM uses the boost sensor to control turbo boost and fuel at different loads. This is a type B DTC.

Conditions for Setting the DTC

- Boost pressure less than 40 kPa.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

No turbo boost.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

With the ignition “ON” and the engine stopped, boost pressure is equal to atmospheric pressure. Comparison of this reading with known good vehicle using the same sensor is a good way to check accuracy of a “suspect” sensor. Readings should be the same +.4 volt. Very little boost can be attained by revving the engine in neutral. If the Boost sensor signal circuit is open or shorted to ground, Boost solenoid will show a zero duty cycle. A J 39200 can be used to measure (actual) signal voltage at the PCM harness connector.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if DTC P0237 is the result of a hard failure or an intermittent condition.
3. This step simulates conditions for a DTC P0237. If the PCM recognizes the change, the PCM and signal circuit are OK.

DTC P0237 - Turbocharger (TC) Boost Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Engine idling. 3. With J 39200 connected to ground, probe PCM harness connector Boost signal circuit. Does the J 39200 display a voltage less than the specified value?	1.0v (40 kPa)	Go to Step 3.	Go to Step 5.
3	1. Turn the ignition "OFF". 2. Disconnect the Boost sensor electrical connector. 3. Jumper the Boost sensor 5 volt reference to the Boost sensor signal circuit at the harness. 4. Turn the ignition "ON". Does the scan tool display a Pressure greater than specified value?	202 kPa	Go to Step 6.	Go to Step 4.
4	1. Turn the ignition "OFF". 2. Boost sensor still disconnected. 3. Remove the jumper wire. 4. Jumper the Boost sensor signal circuit at the harness with a test light connected to B+. 5. Turn the ignition "ON". Does the scan tool display a Pressure greater than specified value?	202 kPa (4.0v)	Go to Step 8.	Go to Step 7.
5	DTC is intermittent. Are additional DTCs stored?	—	Go to DTC table.	See Diagnostic Aids
6	Check for a faulty connection at the Boost sensor. Was a problem found?	—	Go to Step 13.	Go to Step 10.
7	Check for an open or short to ground in Boost sensor signal circuit. Was a problem found?	—	Go to Step 13.	Go to Step 11.
8	Check for an open in the Boost sensor 5 volt reference circuit. Was a problem found?	—	Go to Step 13.	Go to Step 9.
9	Check for a short to ground in Boost sensor 5 volt reference circuit. Was a problem found?	—	Go to Step 13.	Go to Step 12.
10	Replace the faulty Boost sensor. Is the action complete?	—	Go to Step 13.	—
11	Check the terminal connectors at the PCM for a poor connections and repair if necessary. Was a problem found?	—	Go to Step 13.	Go to Step 12.
12	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 13.	—
13	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 14.	Go to Step 2.
14	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK.

DTC P0238 Turbocharger (TC) Boost Sensor Circuit High Voltage (Figure PCM-25)

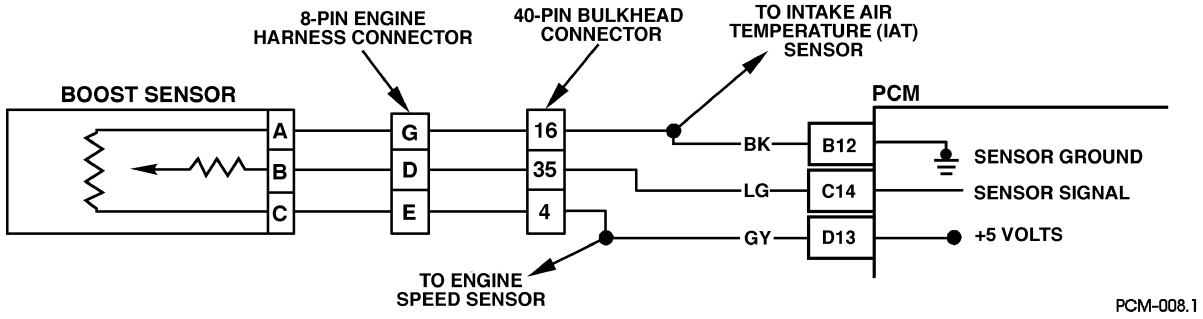

Figure PCM-25 Turbocharger (TC) Boost Sensor Circuit High Voltage

Circuit Description

The PCM sends a 5 volt reference signal to the boost sensor. As manifold pressure changes, the electrical resistance of the boost sensor also changes. By monitoring the sensor output voltage, the PCM detects how much pressure is being produced by the turbocharger in the intake manifold. The PCM uses the boost sensor to control turbo boost and fuel at different loads. This is a type B DTC.

Conditions for Setting the DTC

- Boost Pressure greater than or equal to 4.8 volts (202 kPa).
- Engine Speed less than 3506 RPM.

Action Taken When the DTC Sets

No turbo boost.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

With the ignition “ON” and the engine stopped, boost pressure is approximately equal to Baro. Comparison of this reading with known good vehicle using the same sensor is a good way to check accuracy of a “suspect” sensor. Readings should be the same +.4 volt. Very little boost can be attained by revving the engine in neutral. A J 39200 can be used to measure (actual) signal voltage at the PCM harness connector.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step simulates conditions for a DTC P0237. If the PCM recognizes the change, the PCM and the signal circuit are OK.
3. This step will make sure the PCM is responding to a low signal voltage. This will indicate that the PCM is OK.

DTC P0238 - Turbocharger (TC) Boost Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Engine idling. Does the scan tool display a Boost Pressure greater than or equal to the specified value?	202 kPa (4.8v)	Go to Step 3.	Go to Step 4.
3	1. Turn the ignition "OFF". 2. Disconnect the Boost sensor electrical connector. 3. Turn the ignition "ON". Does the scan tool display a Boost Pressure less than or equal to the specified value?	9 kPa	Go to Step 5.	Go to Step 9.
4	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those chart(s). Are additional DTCs stored?	—	Go to the Applicable DTC table.	Go to Diagnostic Aids.
5	1. Ignition ON, engine OFF> 2. With a J39200 connected to ground, probe the 5 volt reference circuit at the boost sensor harness. Is voltage greater than the specified value?	5.2v	Go to Step 10.	Go to Step 6.
6	1. Boost sensor disconnected. 2. Jumper the Boost sensor ground circuit at the harness with a test light connected to B+. Is the test light "ON".	—	Go to Step 7.	Go to Step 11.
7	Check the Boost sensor for a restriction. Was a problem found.	—	Go to Step 13.	Go to Step 8.
8	Replace the faulty Boost sensor. Is the action complete?	—	Go to Step 13.	—
9	Check for a short to voltage in the Boost sensor signal circuit. Was a problem found?	—	Go to Step 13.	Go to Step 12.
10	Check for a short to ground in the Boost sensor circuit. Was a problem found?	—	Go to Step 13.	Go to Step 12.
11	Repair the Boost sensor circuit as necessary. Is the action complete?	—	Go to Step 13.	—
12	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 13.	—
13	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 14.	Go to Step 2.
14	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0251 Injection Pump Cam System (Figure PCM-26)

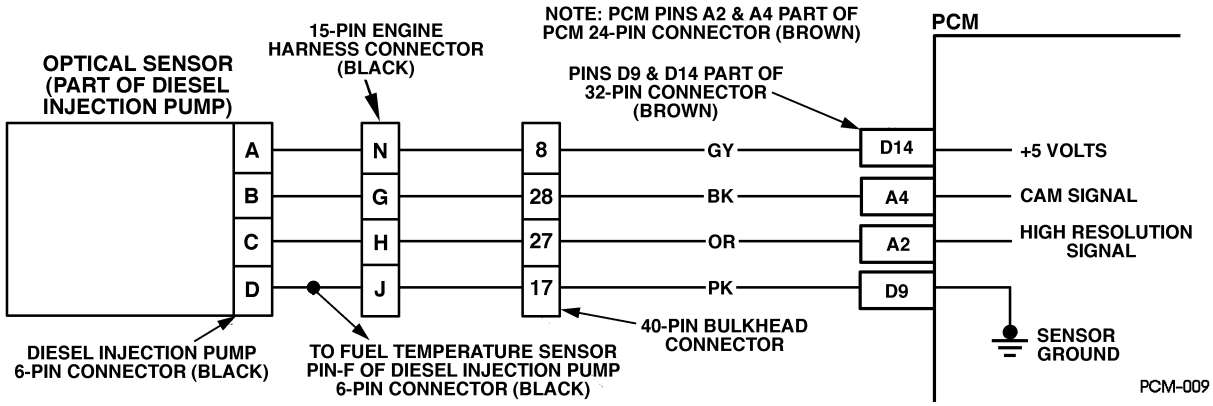

Figure PCM-26 Injection Pump Cam System

Circuit Description

The optical sensor provides a pump cam signal to the PCM by counting pulses on the sensor disk located in the injection pump. The pump cam is one of the most important inputs by the PCM for fuel control and timing. This test monitors the number of crankshaft position pulses that have occurred since the last cam pulse. The physical one to one correspondence between the pump cam and the crankshaft implies if more crank pulses are detected than cam pulses, cam pulses have been missed. This is a type A DTC.

Conditions for Setting the DTC

- RPM less than 300.
- 8 consecutive cam pulses missing for 8 #1 cylinder.

or

- RPM greater than or equal to 300.
- 8 consecutive cam pulses missing for 32 #1 cylinder.

Action Taken When the DTC Sets

Backup fuel.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool (ignition must be cycled before DTC is cleared).

Diagnostic Aids

When PCM is in backup fuel, fast idle and poor performance problems will exist. If P0251 is also stored, there is a possible problem with signal circuit. P0251 and P0370 will set if vehicle has run out of fuel.

Test Description

Number(s) refer to the number(s) on the diagnostic table.

2. This step will determine if this is a hard or intermittent DTC.
4. This step will determine if there is a 5 volt reference.
6. This step will check to see if the sensor is sending a signal back to the PCM.

DTC P0251 - Injection Pump Cam System

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Start and idle engine. With the throttle closed, observe the Cam Ref Missed display on scan tool. Does scan tool display specified value?	8	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. Are additional DTCs stored?	—	Go to DTC table.	Go to Diagnostic Aids.

DTC P0251 - Injection Pump Cam System

Step	Action	Value(s)	Yes	No
4	1. Ignition “OFF”. 2. Disconnect the Optical/Fuel temperature sensor electrical connector. 3. Ignition “ON” engine “OFF”. 4. Measure voltage between Optical/Sensor 5 volt circuit and chassis ground at harness connector. Is voltage at specified value?	5v	Go to Step 5.	Go to Step 7.
5	Probe the sensor ground circuit with a test light connected to B+ at the harness connector. Is test light “ON”?	—	Go to Step 6.	Go to Step 8.
6	1. Reconnect the Optical/Fuel temperature sensor. 2. Start and idle engine. 3. With scan tool, command 900 rpm. 4. On Hertz (Hz) scale, back probe Cam signal circuit at PCM. Is Hertz reading at specified value?	60 Hz (± 3 Hz)	Go to Step 12.	Go to Step 11.
7	1. Remove electrical harness filter from vehicle. 2. Check resistance on 5 volt reference circuit (terminal “A”). Is resistance greater than specified value?	2.0 Ohms	Go to Step 15.	Go to Step 8.
8	1. Ignition “OFF”. 2. Electrical harness filter removed from vehicle. 3. Disconnect the PCM and check the Optical/Sensor 5 volt circuit for an open, short to ground, or short to the sensor ground circuit. 4. If Optical/Sensor 5 volt circuit is open or shorted to ground, repair it as necessary. Was 5 volt circuit open or shorted to ground?	—	Go to Step 16.	Go to Step 10.
9	1. Check for open or poor sensor ground terminal connection at PCM. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 16.	Go to Step 14.
10	Check the Optical/Fuel Temperature 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 16.	Go to Step 14.
11	1. Ignition “OFF”. 2. Check the Cam signal circuit for an open or short to ground. 3. If Cam signal circuit is open or shorted to ground, repair it. Was the Cam signal circuit open or shorted to ground?	—	Go to Step 16.	Go to Step 13.
12	Check for a poor connection at the PCM harness terminal and replace. Did the terminal require replacement?	—	Go to Step 16.	Go to Step 14.
13	Replace injection pump. Is action complete?	—	Go to Step 16.	—
14	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Is the action complete?	—	Go to Step 16.	—
15	Replace electrical harness filter. Is action complete?	—	Go to Step 16.	—
16	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 17.	Go to Step 2.
17	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to DTC table	System OK.

DTC P0263, P0266, P0269, P0272, P0275, P0278, P0281 and P0284 Cylinder Balance System Faults (Figure PCM-27)

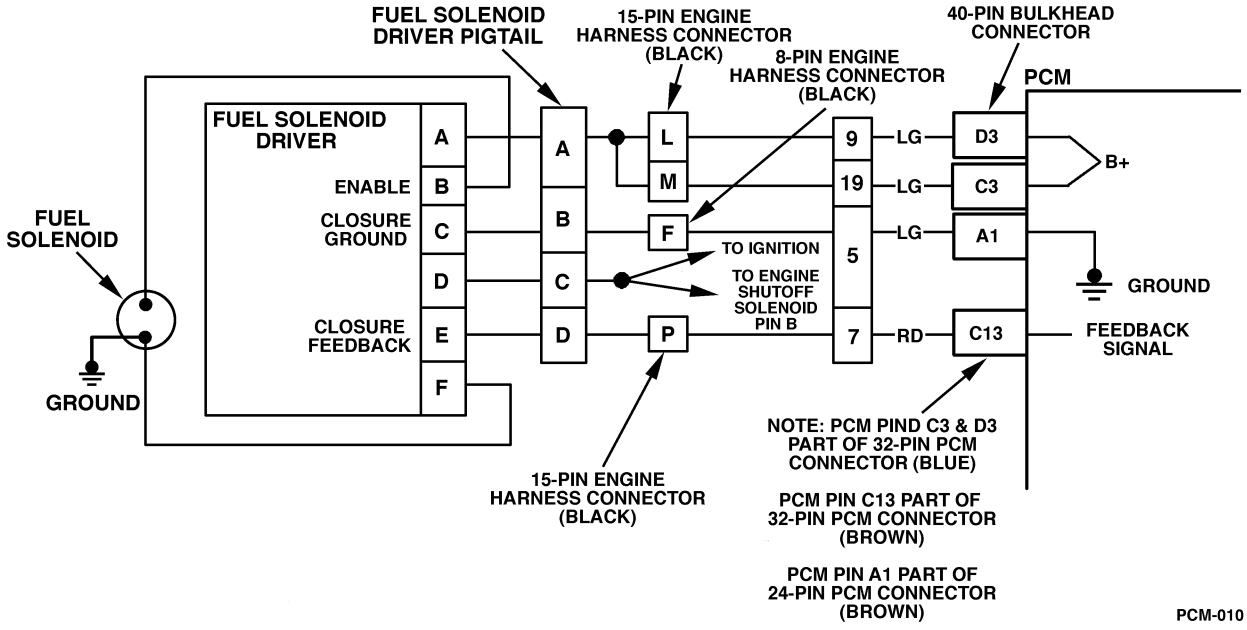

Figure PCM-27 Cylinder Balance System Faults

Circuit Description

The PCM has the ability to increase and decrease the amount of fuel to each cylinder to provide smooth idle operation. If the fuel correction exceeds define limits, DTC P0263 will set. This is a type D DTC.

Conditions for Setting the DTC

- Engine at idle.
- Engine coolant at normal temperatures.
- Cylinder fault must be constant.
- Fuel correction amount exceeds limits (internal to PCM).
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

Possible rough idle.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagn ostic Aids

Injector balance test on scan tool should be used to confirm faulty cylinder. Scan tool will cutout specific cylinder requested. If original complaint was multiple cylinder balance DTCs and vehicle has a manual transmission, dual mass flywheel could be at fault. It's possible that if a cylinder balance fault has been detected and engine has been running for a long time, the PCM will try to increase or decrease fuel in other cylinders to compensate for a rough idle which will cause multiple cylinder balance DTCs to set. The scan tool snap shot mode can be used to properly identify the suspected cylinder. The most likely cause of cylinder balance DTCs are faulty nozzles or engine mechanical (low compression) problems.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will properly identify a suspected cylinder by looking for a RPM drop (if RPM drops, cylinder is contributing, if not, cylinder is not contributing).

DTC P0263, P0266, P0269, P0272, P0275, P0278, P0281 and P0284 Cylinder Balance System Faults

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Start and idle engine. 3. Engine at operating temperature. 4. Make sure all DTCs are cleared. 5. Using the scan tool, cutout ("Inj. Balance") the suspected cylinder. Is there an RPM drop in the suspected cylinder?	—	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those table(s). Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to Diagnostic Aids.
4	Check for a basic engine mechanical or fuel delivery problem in that cylinder. Was a repair performed?	—	Go to Step 6.	Go to Step 5.
5	Replace the fuel injection pump. Refer to *Fuel Injection Pump*. Is the action complete?	—	Go to Step 6.	—
6	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 7.	Go to Step 2.
7	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0335 Crankshaft Position (CKP) Sensor Circuit Performance (Figure PCM-28)

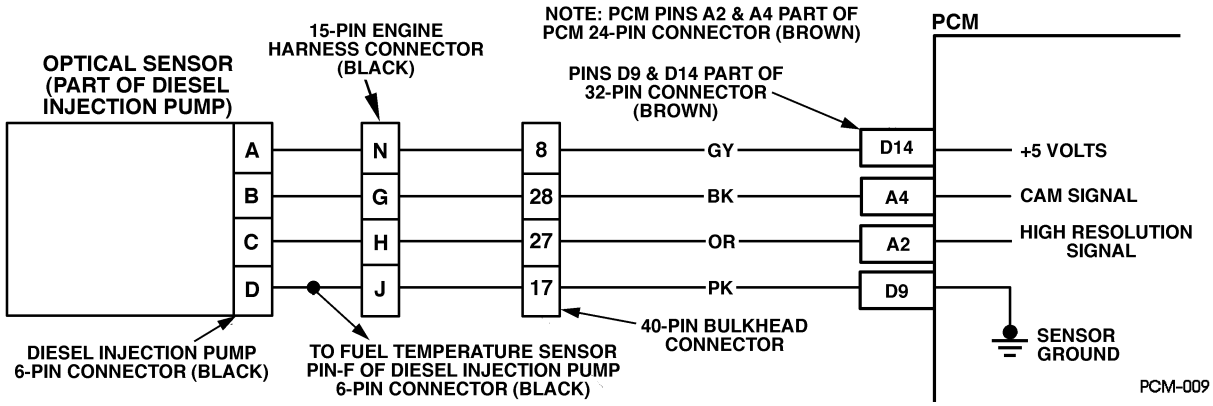

Figure PCM-28 Crankshaft Position (CKP) Sensor Circuit Performance

Circuit Description

The crankshaft position sensor is a "Hall-effect" type sensor that monitors crankshaft position and speed. There are four teeth 90 degrees apart on the front of the crankshaft sprocket that induce a pulse in the sensor which is transmitted to the PCM. There is a physical one to one correspondence between the pump cam and crankshaft. This is a type A DTC.

Conditions for Setting the DTC

- RPM less than 300.
- 8 consecutive cam pulses missing for 8 #1 cylinder events.

or

- RPM greater than or equal to 300.
- 8 consecutive cam pulses missing for 32 #1 cylinder events.

Action Taken When the DTC Sets

Backup fuel.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

When PCM is in backup fuel, long crank times, fast idle and poor performance conditions will exist. Check for good connection at crankshaft position sensor and at PCM. Many intermittent problems are caused by faulty electrical connections or wiring. When attempting to diagnose an intermittent problem, always begin by trying to reproduce the conditions under which the failure occurs. This usually involves raising the engine to a higher temperature or operating it near RPM that the problem occurs. Since heat and vibration are often the cause of intermittent, this may bring out the failure.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if DTC P0335 is the result of a hard failure or an intermittent condition.
4. This step checks the 5 volt reference circuit (the 5 volt reference may vary slightly).
5. This step checks the ground circuit.

DTC P0335 - Crankshaft Position Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Start and idle engine. With throttle closed, observe "Crank Ref. Missed" display on scan tool. Does scan tool display specified value?	8	Go to Step 4.	Go to Step 3.

DTC P0335 - Crankshaft Position Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
3	DTC is intermittent. If no additional DTCs are stored, refer to “Diagnostic Aids”. If additional DTCs are stored, refer those table(s). Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to Diagnostic Aids.
4	Ignition “OFF”. Disconnect the Optical/Fuel temperature sensor electrical connector. Ignition “ON" engine “OFF”. Using a DVM (J 39200), measure voltage between the Optical/Fuel temperature 5 volt reference circuit and chassis ground. Is voltage at specified value?	4.8 - 5.2v	Go to Step 5.	Go to Step 7.
5	Probe sensor ground circuit with test light connected to B+. Is test light “ON”?	—	Go to Step 6.	Go to Step 8.
6	Reconnect the Optical/Fuel temperature sensor. Back probe the Optical/Fuel temperature sensor signal circuit at the PCM with a DVM (J 39200) connected to ground. Crank engine. Is voltage at the specified value?	4v	Go to Step 11.	Go to Step 10.
7	Ignition “OFF”. Disconnect PCM and check Optical/Fuel Temp. 5 volt reference circuit for open, short to ground, or short to sensor ground circuit. If the Optical/Fuel temperature 5 volt reference circuit is open or shorted to ground, repair as necessary. Was the circuit open or shorted to ground?	—	Go to Step 14.	Go to Step 9.
8	Check for open or poor sensor ground terminal conn. at PCM. If a problem is found, repair it. Was a repair performed?	—	Go to Step 14.	Go to Step 13.
9	Check the Optical/Fuel temperature 5 volt reference circuit for a poor connection at PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 14.	Go to Step 13.
10	Ignition “OFF”. Disconnect PCM and check Optical/Fuel temperature signal circuit for open, short to ground, or short to sensor ground circuit. If the Optical/Fuel temperature signal circuit is open or shorted to ground, repair it. Was the Optical/Fuel temperature signal circuit open or shorted to ground?	—	Go to Step 14.	Go to Step 11.
11	Check the Optical/Fuel temperature signal circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 14.	Go to Step 12.
12	Replace the Crankshaft position sensor. After replacing the sensor, the PCM must be programmed with a new TDC OFFset. *Refer to the Service Manual for more information on the Crankshaft Position Sensor or reprogramming the PCM.* Is the action complete?	—	Go to Step 14.	—
13	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Is the action complete?	—	Go to Step 14.	—
14	Using the Scan Tool, select “DTC”, “Clear Info”. Start engine and idle at normal operating temperature. Select “DTC”, “Specific”, then enter the DTC number which was set. Operate vehicle within the conditions for setting this DTC. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 15.	Go to Step 2.
15	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK.

DTC P0370 Timing Reference High Resolution (Figure PCM-29)

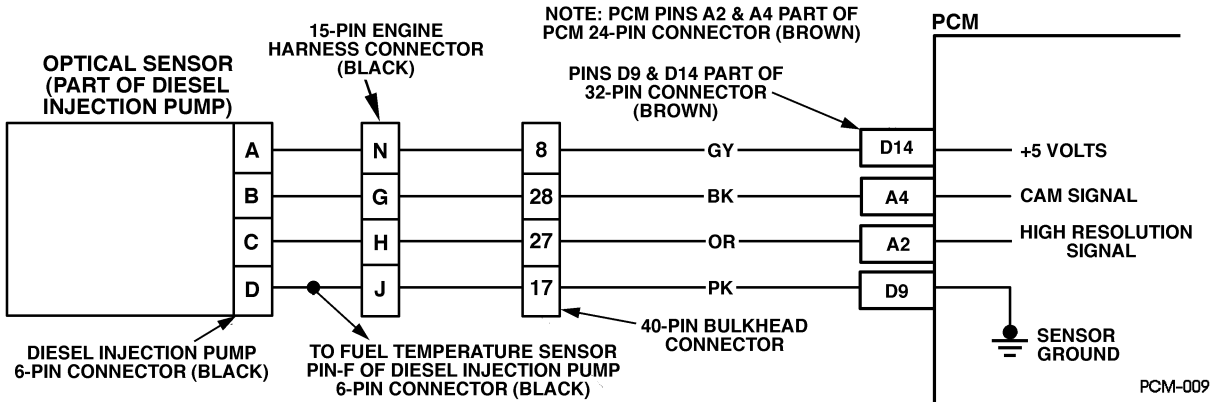

Figure PCM-29 Timing Reference High Resolution

Circuit Description

The optical sensor provides a high resolution signal to the PCM by counting pulses on the sensor disk located in the injection pump. The high resolution is one of the most important inputs by the PCM for fuel control and timing. This test monitors the number of high resolution pulses which have been missed (not detected). It's based on a comparison between the number of pulses that were detected since the last pump cam pulse and the number of the pulses that should have occurred. This is a type A DTC.

Conditions for Setting the DTC

A number of High Resolution pulses (internal to PCM) per every 8 cam reference pulses.

Action Taken When the DTC Sets

Backup fuel.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

When PCM is in backup fuel, fast idle and poor performance problems will exist. If P0251 is also stored, the snap shot mode on the scan tool should be used to properly identify fault. It is possible P0370 may set if there is air in fuel system (vehicle running out of fuel).

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if there is a 5 volt reference.
3. This step checks the ground circuit.
4. This step will check to see if the sensor is sending a signal back to the PCM.

DTC P0370 - Timing Reference High Resolution

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "OFF". 2. Disconnect the Optical/Fuel temperature sensor electrical connector. 3. Ignition "ON" engine "OFF". 4. Using a J 39200, measure voltage between the Optical/Fuel temperature 5 volt reference circuit and chassis ground at harness connector. Is voltage at the specified value?	.24 v	Go to Step 3.	Go to Step 5.
3	1. Ignition "OFF". 2. Disconnect EGR Control Pressure/BARO sensor electrical connector. 3. Jumper the sensor 5 volt reference circuit to the sensor signal circuit at the harness connector. 4. Ignition "ON". Does the scan tool display Actual EGR greater than the specified value?	4.0 v	Go to Step 6.	Go to Step 4.
4	1. Ignition "OFF". 2. Remove the jumper wire. 3. Probe the sensor signal circuit with a test light connected to B+ at the harness connector. 4. Ignition "ON". Does the scan tool display Actual EGR greater than the specified value?	4.0 v	Go to Step 9.	Go to Step 7.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer those charts(s) first.	—	—	—
6	Check for a faulty connection at the EGR sensor. Was a problem found?	—	Go to Step 12.	Go to Step 11.
7	Check for an open EGR sensor signal circuit. Was a problem found?	—	Go to Step 12.	Go to Step 8.
8	Check the EGR sensor signal circuit for a short to ground. Was a problem found?	—	Go to Step 12.	Go to Step 13.
9	Check for an open in the EGR sensor 5 volt reference circuit. Was a problem found?	—	Go to Step 12.	Go to Step 10.
10	Check for a short to ground in the EGR sensor 5 volt reference circuit. Was a problem found?	—	Go to Step 12.	Go to Step 13.
11	Replace the faulty EGR sensor. Is action complete?	—	Go to Step 14.	—
12	Repair the circuit as necessary. Is action complete?	—	Go to Step 14.	—
13	Replace the faulty PCM. Is the action complete?	—	Go to Step 14.	—
14	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 15.	Go to Step 2.
15	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK.

DTC P0380 Glow Plug Circuit Performance (Figure PCM-30)

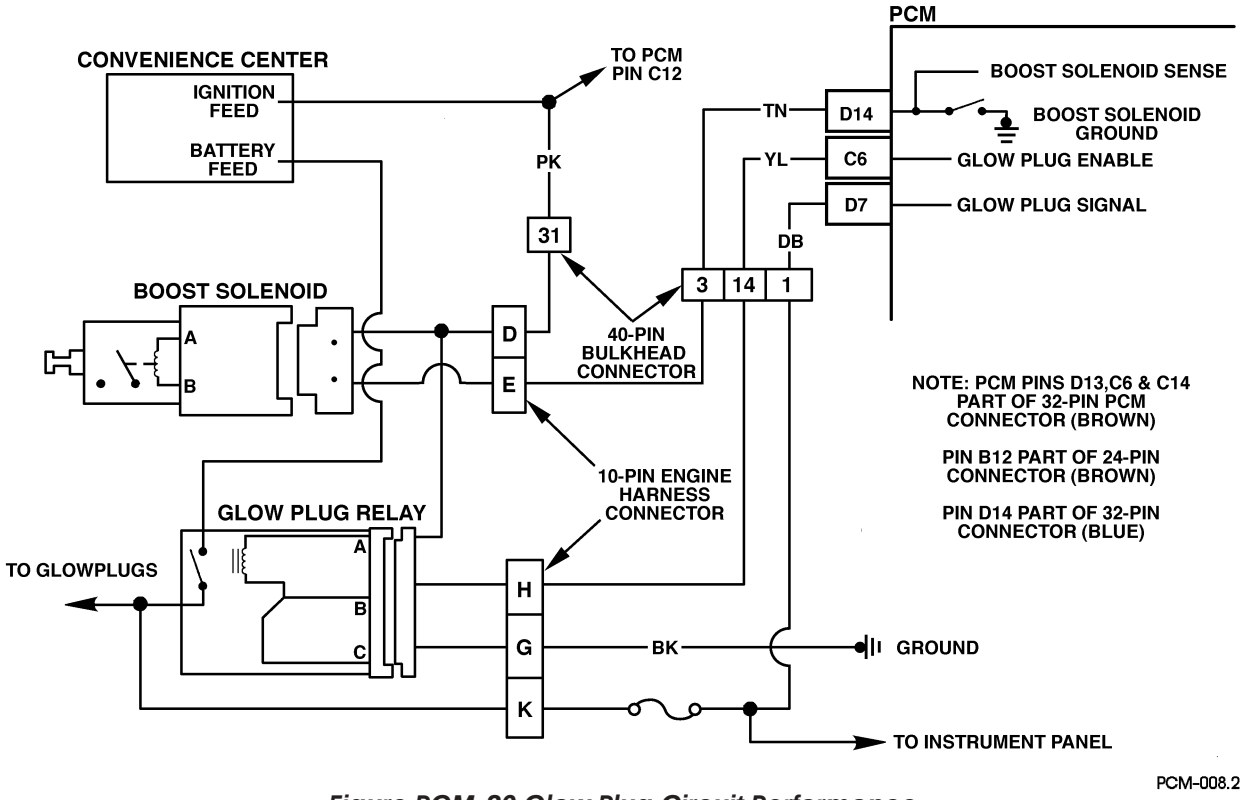

Figure PCM-30 Glow Plug Circuit Performance

Circuit Description

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures. The glow plugs are heated before and during cranking, as well as initial engine operation. The PCM controls the glow plug "ON" times by monitoring coolant temperatures and glow plug voltage. This is a type B code.

Conditions for Setting the DTC

- PCM has commanded glow plugs "ON" and voltage at the glow plugs is less than .8 volts.
- PCM has commanded glow plugs "OFF" and voltage at the glow plugs is less than .8 volts.
- PCM has commanded glow plugs "ON" and there is more than a 2 volt difference between glow plug voltage and ignition voltage.

Action Taken When the DTC Sets

Hard start or no start and possible white smoke.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

If glow plug relay is stuck in the "ON" position, check for proper operation of glow plugs. When glow plugs are commanded "ON" by the Tech 1, an internal PCM timer protects the glow plugs from damage by cycling them "ON" for 3 seconds and the "OFF" for 12 seconds.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if P0380 is a hard failure.
3. This step will determine if PCM is requesting the glow plug system "ON".
7. This step will determine if the glow plug relay has been activated, and output voltage has been seen by the PCM.

DTC P0380 - Glow Plug Circuit Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info". Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool installed. 2. Ignition "ON" engine "OFF". 3. With scan tool command glow plugs "ON". 4. Observe "Glow Plug System" on scan tool display. Does scan tool display "Glow Plug System" enabled?	—	Go to Step 3.	Go to Step 7.
3	1. Ignition "ON" engine "OFF". 2. With scan tool command glow plugs "ON". 3. Observe "Glow Plugs" display on scan tool display. Does scan tool display "Glow Plugs" at specified value?	B+ (+/- 2.0v)	Go to Step 4.	Go to Step 5.
4	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer those table(s). Are additional DTCs stored?	—	Go to the applicable DTC table.	Go to Diagnostic Aids.
5	1. Disconnect glow plug relay connector. 2. Ignition "ON" engine "OFF". 3. With test light connected to ground, probe glow plug relay harness ignition feed circuit. Is test light "ON"?	—	Go to Step 6.	Go to Step 10.
6	1. Ignition "ON" engine "OFF". 2. Connect test light between glow plug harness ignition feed circuit and harness ground circuit. Is test light "ON"?	—	Go to Step 7.	Go to Step 11.
7	1. Ignition "ON" engine "OFF". 2. Glow plug harness still disconnected. 3. With a J 39200 connected to ground, probe glow plug relay control circuit at the glow plug harness connector. 4. With scan tool, command glow plugs "ON". Is voltage at specified value?	B+	Go to Step 8.	Go to Step 12.
8	1. Reconnect glow plug relay. 2. Ignition "ON" engine "OFF". 3. With test light connected to ground, probe glow plug side of relay. 4. With scan tool, command glow plugs "ON". Is test light "ON" when scan tool commands glow plugs "ON"?	—	Go to Step 14.	Go to Step 16.
9	Check glow plug relay control circuit for a poor connection at the PCM and replace terminal if necessary. Did any terminals require replacement?	—	Go to Step 18.	—
10	Repair open or short to ground in glow plug relay ignition feed circuit. Is the action complete?	—	Go to Step 18.	—
11	Repair open or poor connections in glow plug relay ground circuit. Is the action complete?	—	Go to Step 18.	—
12	1. Check glow plug relay control circuit for an open or short to ground. 2. If the glow plug relay control circuit is open or shorted to ground, repair as necessary. Was a problem found?	—	Go to Step 18.	Go to Step 13.
13	Check glow plug relay control circuit for a poor connection at the PCM and replace terminal if necessary. Was a problem found?	—	Go to Step 18.	Go to Step 17.
14	1. Check glow plug relay signal control circuit for an open or short to ground. 2. If the glow plug relay signal circuit is open or shorted to ground, repair as necessary. Was a problem found?	—	Go to Step 18.	Go to Step 15.
15	Check glow plug relay control circuit for a poor connection at the PCM and replace terminal if necessary. Was a problem found?	—	Go to Step 18.	—
16	Replace glow plug relay. Is the action complete?	—	Go to Step 18.	—
17	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 18.	—

DTC P0380 - Glow Plug Circuit Performance

Step	Action	Value(s)	Yes	No
18	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for Setting this DTC. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 19.	Go to Step 2.
19	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0501 Vehicle Speed Sensor Circuit (Figure PCM-31)

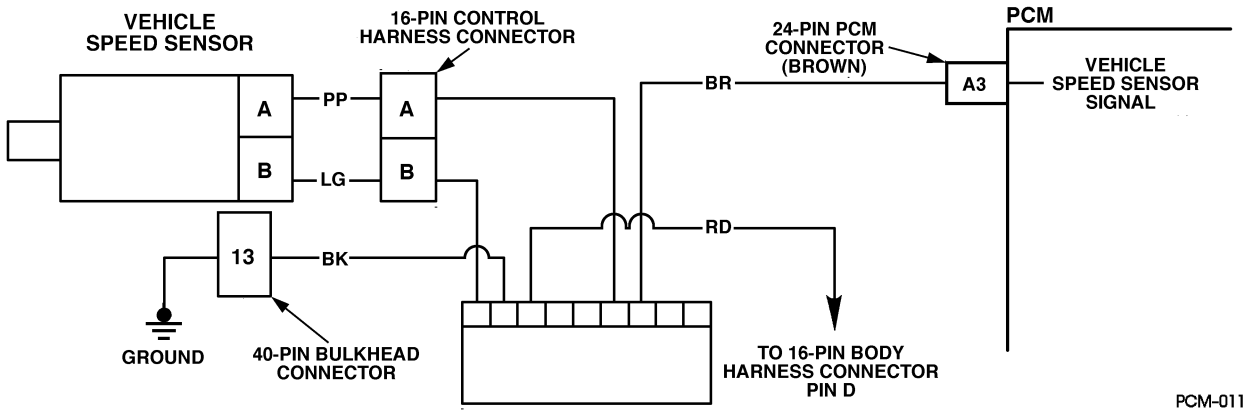

Figure PCM-31 Vehicle Speed Sensor Circuit

Circuit Description

The speed sensor circuit consists of a magnetic induction type sensor, a vehicle speed sensor buffer module and wiring. Gear teeth pressed on the output shaft induce an alternating current in the sensor. This signal is transmitted to the buffer. The buffer compensates for various axle ratios and converts the signal into a square wave for use by the speedometer, cruise control, antilock brake and the PCM. The buffer sends two different signals to the PCM. The CKT 437 circuit relays the transmission output speed which is used to control shift points, line pressure, TCC, DTC P0723 and DTC P0723. The CKT 834 circuit relays the vehicle speed which is used to control engine operating functions and DTC P0501. When DTC P0501 or P0723 is set, second gear only at a maximum line pressure will occur. This is a type D DTC.

Conditions for Setting the DTC

- Vehicle speed greater than 20 mph.
- Four wheel low not selected.
- VSS buffer calculated speed is less than half the transmission calculated speed.

or

- VSS buffer calculated speed is greater than transmission calculated speed by 20 mph.
- All conditions met for 2 seconds.

Action Taken When the DTC Sets

No cruise control.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

Check connections at VSS buffer and PCM. Refer to 4L80EDiagnostic Diagnostic Trouble Codes, Section 10 if DTC P0722 or DTC P0723 is also set.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This tests for B+ at VSS buffer.
4. This tests for proper ground path for vehicle speed sensor signal buffer.

DTC P0501 - Vehicle Speed Sensor Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Install scan tool. 2. Raise drive wheels. 3. Engine operating. 4. Transmission in any drive range. With drive wheels rotating, does vehicle speed increase with drive wheel speed increase?	—	Go to Step 7.	Go to Step 3.
3	1. Transmission in park. 2. Back probe VSS buffer module ignition feed circuit with a test light connected to ground. Is the test light "ON"?	—	Go to Step 4.	Go to Step 8.
4	Back probe VSS buffer module ignition feed circuit to the ground circuit with a test light. Is the test light "ON"?	—	Go to Step 5.	Go to Step 9.
5	1. Back probe VSS buffer module at VSS input circuit (C7) to the other VSS input circuit (C12) with a J 39200 on the AC scale. 2. Transmission in any drive range with drive wheels rotating. Does voltage increase on J 39200 with drive wheel increase?	—	Go to Step 6.	Go to Step 10.
6	Does scan tool display a trans output speed (MPH) increase with drive wheel increase?	—	Go to Step 11.	Go to Step 13.
7	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
8	Repair the open in the ignition feed circuit. Is action complete?	—	Go to Step 15.	—
9	Repair the open in the ground circuit. Is action complete?	—	Go to Step 15.	—
10	Check the complete VSS input circuit for an open or short to ground. Was a repair performed?	—	Go to Step 15.	—
11	Check VSS output circuit for an open or short to ground. Was a repair performed?	—	Go to Step 15.	Go to Step 12.
12	Check VSS output circuit for a poor connection at buffer module and PCM. Was a repair performed?	—	Go to Step 15.	Go to Step 14.
13	Replace VSS buffer module. Is action complete?	—	Go to Step 15.	—
14	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 15.	—
15	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 16.	Go to Step 2.
16	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the DTC table	System OK.

DTC P0567 Cruise Resume Circuit (Figure PCM-32)

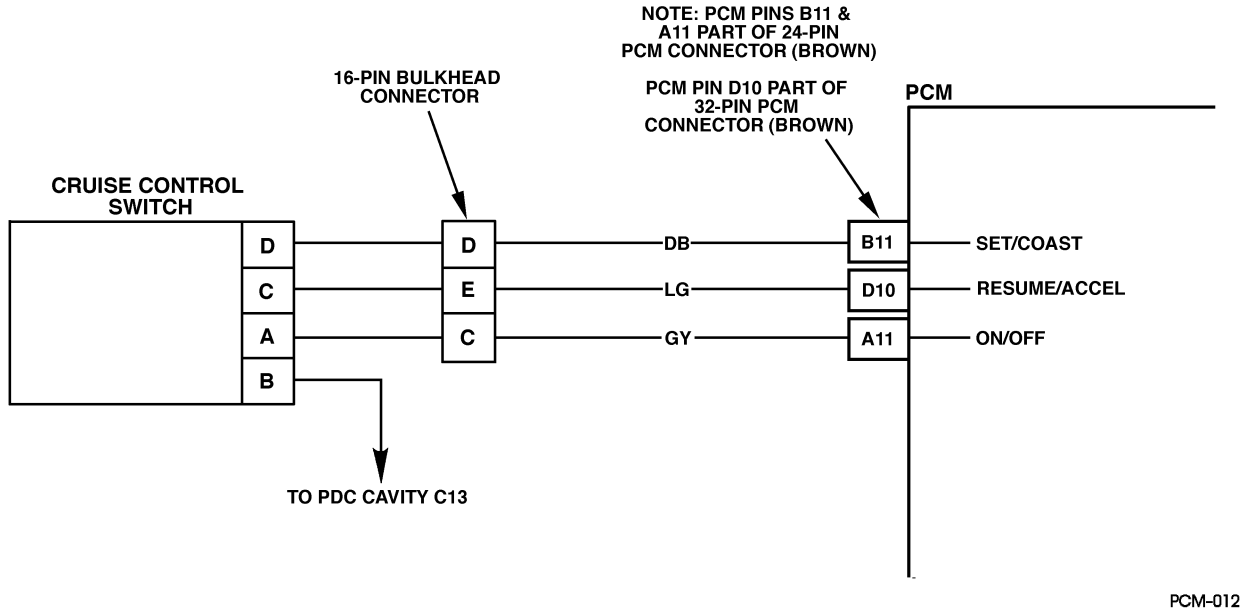

Figure PCM-32 Cruise Resume Circuit

Circuit Description

The cruise Resume/Accel switch is an input to the fuel control portion of the PCM. These inputs allow the PCM to control and hold a requested speed. Cruise Resume/Accel switch sends ignition voltage to the PCM when the switch is closed ("ON"). This is a type D DTC.

Conditions for Setting the DTC

- Cruise switch "OFF".
- Ignition voltage on Resume switch signal circuit.

or

- Cruise switch "ON".
- Resume switch "ON" for longer than 25.5 seconds

Action Taken When the DTC Sets

- Will not turn on the MIL.
- The PCM will disallow all cruise inputs.
- TCC shift schedules may be affected.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

Check for a resume/accel switch stuck in the engage position or the signal circuit is shorted to voltage.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if the signal circuit is shorted to voltage.
3. This step determines if the PCM or switch is at fault.

DTC P0567 - Cruise Resume Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Ignition "ON", engine "OFF". 3. Cruise switch "OFF". Does scan tool display Resume Switch "ON"?	—	Go to Step 3.	Go to Step 4.
3	1. Ignition "ON". 2. Disconnect the PCM brown 32 way connector. 3. Probe the Resume switch signal circuit at the PCM harness with a test light connected to chassis ground. Is the test light "ON"?	—	Go to Step 5.	Go to Step 7.
4	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table	Go to Diagnostic Aids.
5	1. Resume switch signal circuit is shorted to voltage. 2. Repair as necessary. Is action complete?	—	Go to Step 8.	—
6	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 7.	—
7	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 8.	Go to Step 2.
8	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0568 Cruise Set Circuit (Figure PCM-33)

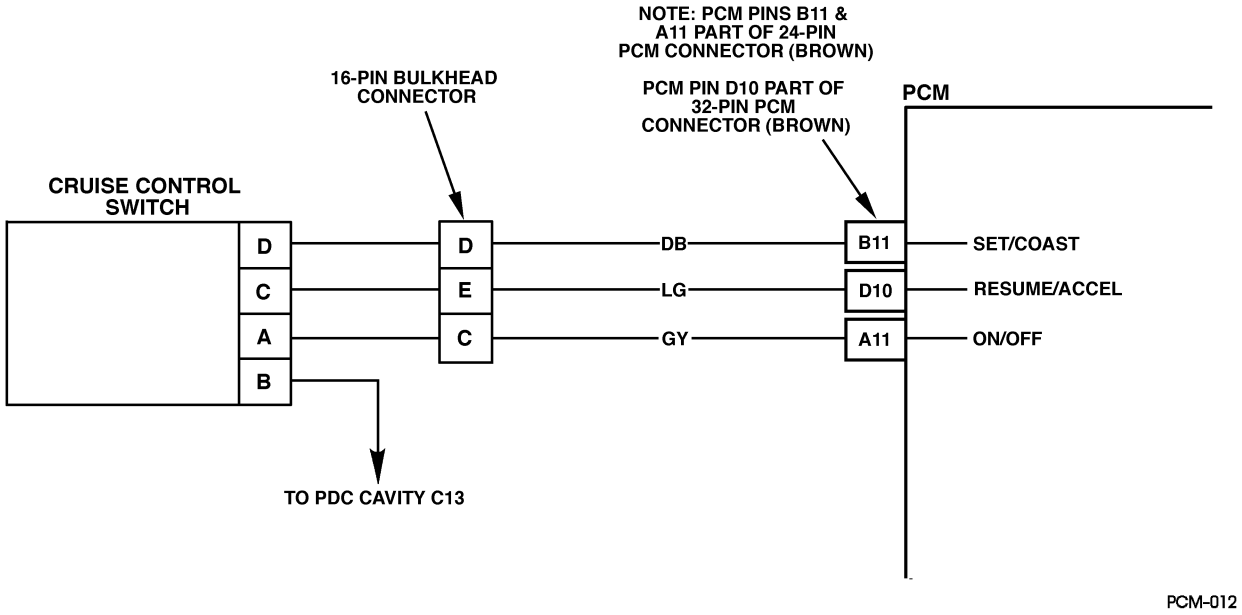

Figure PCM-33 Cruise Set Circuit

Circuit Description

The cruise Set/Coast switch is an input to the fuel control portion of the PCM. These inputs allow the PCM to control and hold a requested speed. Cruise Set/Coast switch sends an ignition voltage signal to the PCM when the Set/Coast switch is "ON". This is a type D DTC.

Conditions for Setting the DTC

- Cruise switch "OFF".
- Ignition voltage on Set switch signal circuit.

or

- Cruise switch "ON".
- Set switch "ON" for longer than 25.5 seconds

Action Taken When the DTC Sets

- The PCM will disallow all cruise inputs.
- TCC shift schedules may be affected.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

If the Set/Coast switch stuck in the "ON" position or the driver is holding the Set/Coast switch "ON" for longer than 25.5 seconds, DTC P0569 will set. DTC P0568 only checks the signal circuit for a short to voltage.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step determines if the signal circuit is shorted to voltage.
3. This step determines if the PCM or switch is at fault.

DTC P0568 - Cruise Set Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Ignition "ON", engine "OFF". 3. Cruise switch "OFF". Does scan tool display Set switch "ON"?	—	Go to Step 3.	Go to Step 4.
3	1. Ignition "ON". 2. Disconnect the PCM brown 24 way connector. 3. Probe the Set switch signal circuit at the PCM harness with a test light connected to chassis ground. Is the test light "ON"?	—	Go to Step 5.	Go to Step 7.
4	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table	Go to Diagnostic Aids
5	1. Resume switch signal circuit is shorted to voltage. 2. Repair as necessary. Is action complete?	—	Go to Step 8.	—
6	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 7.	—
7	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 8.	Go to Step 2.
8	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0571 Cruise Brake Switch Circuit (Figure PCM-34)

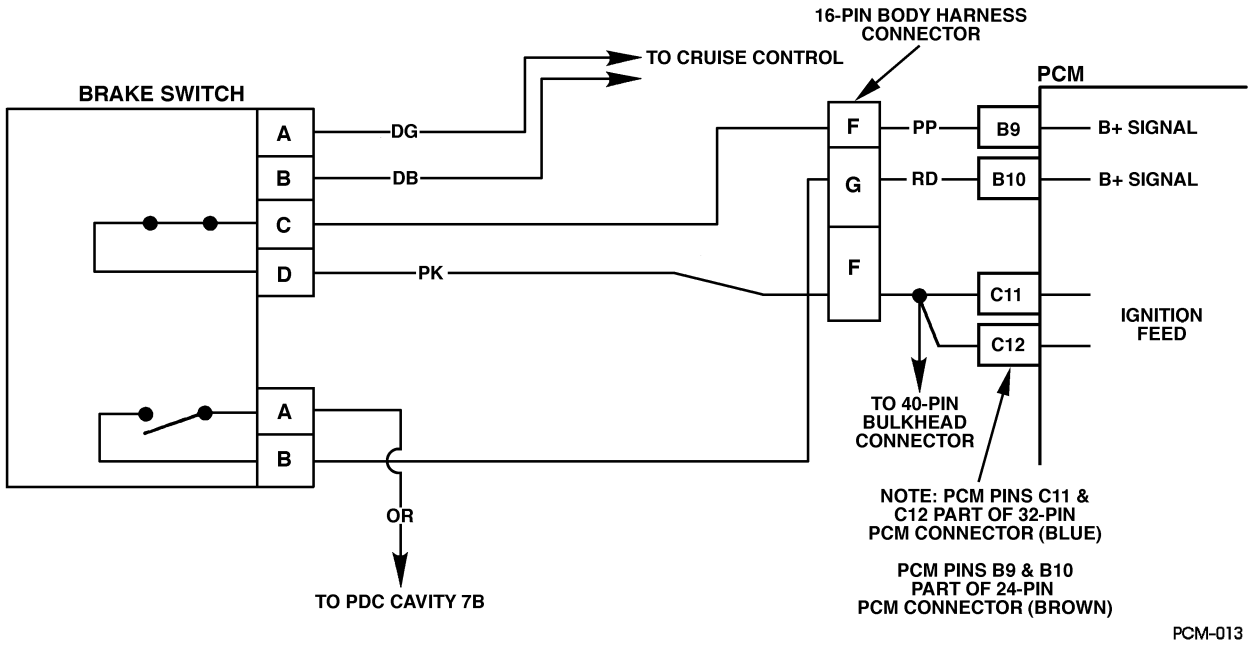

Figure PCM-34 Cruise Brake Switch Circuit

Circuit Description

The TCC normally closed brake switch supplies a B+ signal on CKT 810 to the PCM. The circuit is opened when the brakes are applied. The stop lamp/cruise control normally open brake switch supplies a B+ signal on CKT 22 to the PCM when the brake is applied. This is a type D DTC.

Conditions for Setting the DTC

- Switches disagree for 10 consecutive minutes.

or

- TCC and cruise control brake switches are not toggling "open" and "closed" during 6 brake applications on same ignition cycle.

Action Taken When the DTC Sets

Fourth gear operation in hot mode, and cruise control operation.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

Refer to PCM Intermittent Diagnostic Trouble Codes or Performance. Check customer driving habits and/or unusual traffic conditions (i.e. stop and go, expressway traffic).

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This test simulates brake switch closed or brakes "OFF".
4. This test checks the feed circuit.

DTC P0571 - Cruise Brake Switch Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool installed. 2. Ignition "ON", engine "OFF". 3. Apply brakes. Does scan tool display Cruise Brake switch "Closed" and then "Open" when brake is released?	—	Go to Step 3.	Go to Step 4.
3	Apply brakes again. Does scan tool display Brake switch "Closed" and then "Open" when brake is released?	—	Go to Step 8.	Go to Step 6.
4	1. Ignition "ON", engine "OFF". 2. Stop lamp switch disconnected. 3. With test light connected to ground, probe normally open feed circuit (terminal "B"). Is the test light "ON"?	—	Go to Step 5.	Go to Step 9.
5	1. Disconnect stop lamp switch. 2. Jumper normally open (terminal "A") feed circuit and the normally open signal circuits (terminal "B") together. Does scan tool display Cruise Brake switch "Closed"?	—	Go to Step 6.	Go to Step 10.
6	1. Ignition "ON", engine "OFF". 2. Stop lamp switch disconnected. 3. With test light connected to ground, probe normally closed feed circuit (terminal "F"). Is the test light "ON"?	—	Go to Step 7.	Go to Step 12.
7	1. Stop lamp switch disconnected. 2. Jumper normally closed (terminal "F") feed circuit and the normally closed signal circuits (terminal "E") together. Does scan tool display Cruise Brake switch "Closed"?	—	Go to Step 6.	Go to Step 14.
8	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
9	Check normally open signal circuit (terminal "B") for an open or short to ground. Is action complete?	—	Go to Step 17.	—
10	Check normally open Cruise Brake switch signal circuit for an open or short to ground. Was a repair performed?	—	Go to Step 17.	Go to Step 11.
11	Check normally open Cruise Brake switch signal circuit for a poor connection at PCM. Was a repair performed?	—	Go to Step 17.	Go to Step 16.
12	Check normally closed feed circuit (terminal "F") for an open or short to ground. Is action complete?	—	Go to Step 17.	—
13	Check normally closed Cruise Brake switch signal circuit for an open or short to ground. Was a repair performed?	—	Go to Step 17.	Go to Step 14.
14	Check normally closed Cruise Brake switch signal circuit for a poor connection at PCM. Is action complete?	—	Go to Step 17.	—
15	Replace stop lamp switch. Is action complete?	—	Go to Step 17.	—

DTC P0571 - Cruise Brake Switch Circuit

Step	Action	Value(s)	Yes	No
16	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 17.	—
17	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 18.	Go to Step 2.
18	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0601 - PCM Memory Check

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool “Capture Info” to record freeze frame and failure records for reference, as data will be lost when “Clear Info” function is used. Was the *“On-Board Diagnostic (OBD) System Check”* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 3.	—
3	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 4.	Go to Step 2.
4	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0602 - PCM Programming

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool “Capture Info” to record freeze frame and failure records for reference, as data will be lost when “Clear Info” function is used. Was the *“On-Board Diagnostic (OBD) System Check”* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 3.	—

DTC P0602 - PCM Programming

Step	Action	Value(s)	Yes	No
3	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 4.	Go to Step 2.
4	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P0606 - PCM Internal Communication Interrupted

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool “Capture Info” to record freeze frame and failure records for reference, as data will be lost when “Clear Info” function is used. Was the *“On-Board Diagnostic (OBD) System Check”* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Is DTC P0370 set?	—	Refer to the applicable DTC table	Go to Step 3.
3	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 4.	—
4	1. Using the Scan Tool, select “DTC”, “Clear Info”. 2. Start engine and idle at normal operating temperature. 3. Select “DTC”, “Specific”, then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 5.	Go to Step 2.
5	Using the Scan Tool, select “Capture Info”, “Review Info”. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1125 Accelerator Pedal Position (APP) System (Figure PCM-35)

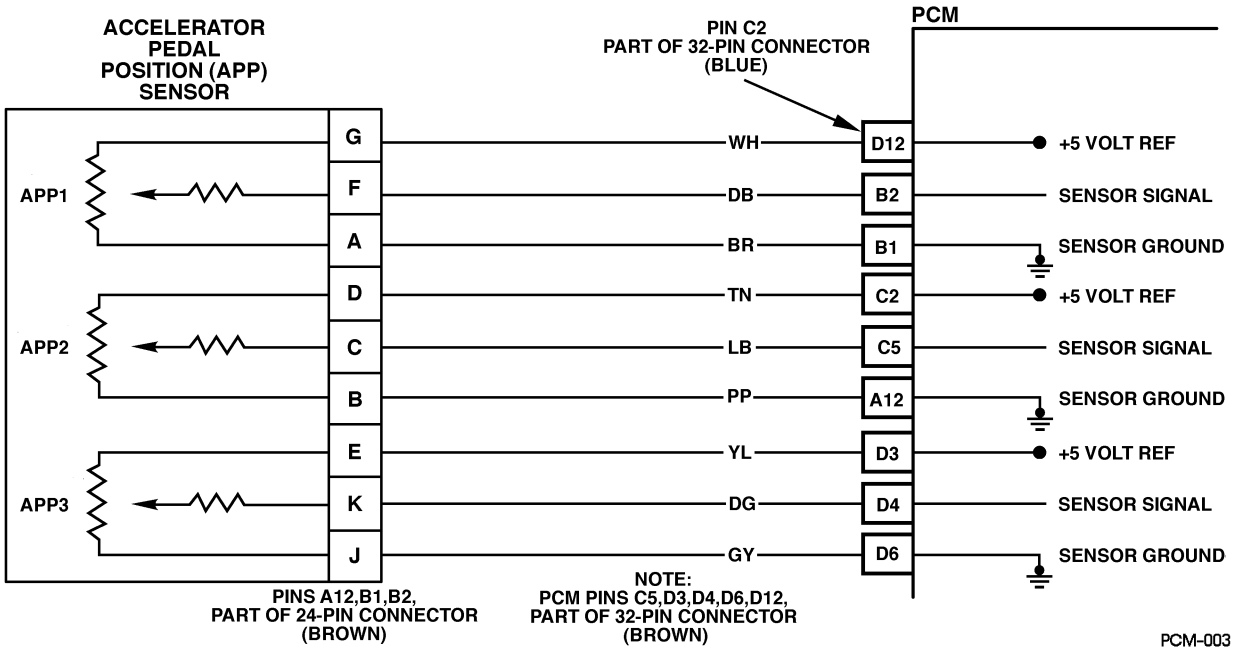

Figure PCM-35 Accelerator Pedal Position (APP) System

Circuit Description

The Accelerator Pedal Position (APP) module provides a voltage signal that changes relative to accelerator position. There are three sensors located within the APP module that are scaled differently. This is a type C DTC.

Conditions for Setting the DTC

PCM has recognized an intermittent APP fault and there are no current APP faults stored.

Action Taken When the DTC Sets

Vehicle will operate at limited power.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a Scan Tool.

Diagnostic Aids

A DTC P1125 will set along with multiple APP DTCs. All other DTCs should be diagnosed first.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

1. This step determines if DTC P1125 is a hard failure or an intermittent condition.

DTC P1125 - Accelerator Pedal Position (APP) System

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Disconnect the APP sensor electrical connector. 2. Ignition "ON", engine "OFF". 3. With J 39200 connected to ground, check all APP 5 volt reference circuits at APP harness. Is voltage less than specified value?	4.8v	Go to Step 4.	Go to Step 3.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table	Go to Diagnostic Aids
4	1. Ignition "OFF". 2. Disconnect the PCM and check the 5 volt reference circuit for a short to ground. 3. If the 5 volt reference circuit is shorted to ground, repair it as necessary. Was the 5 volt reference circuit is shorted to ground?	—	Go to Step 6.	Go to Step 5.
5	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 6.	—
6	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 7.	Go to Step 2.
7	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1214 Injection Pump Timing Offset Error (Figure PCM-36)

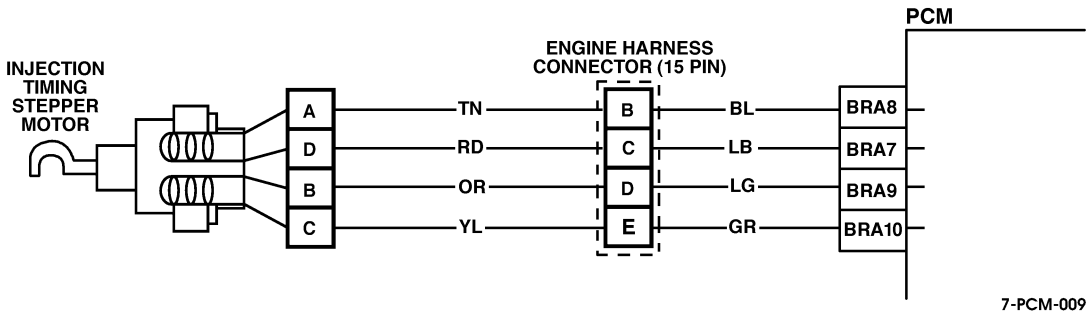

Figure PCM-36 Injection Pump Timing Offset Error

Circuit Description

The PCM has the ability to determine the amount of offset needed to bring the engine to top dead center. This is used by the PCM to determine proper injection time.

Conditions for Setting the DTC

TDC offset greater than 2.5 degrees.

or

TDC Offset less than -2.5 degrees.

Action Taken When the DTC Sets

The MIL will illuminate on 2 test failures.

Conditions for Clearing the MIL/DTC

- •The PCM will turn the MIL off after three consecutive trips without a fault condition.
- •A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5° C (40° F) from start up coolant temperature and engine coolant temperature exceeds 71° C (160° F) that same ignition cycle.
- Use of a Scan Tool.

Diagnostic Aids

The PCM will only run the diagnostic test when a time set procedure has been activated. It is highly unlikely that the vehicle will be brought in with this DTC set. Refer to TDC Offset.

DTC P1214 - Injection Pump Timing Offset Error

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to the applicable DTC table	Go to Diagnostic Aids
3	Are there any other DTCs set?	—	Go to the applicable DTC table	Go to Step 4.
4	Clear all codes and reset injection timing until "TDC Offset" is between specified values. Refer to *TDC Offset*. Is timing within specified value?	- 0.25 to - 0.75	Go to Step 7.	Go to Step 5.
5	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 6.	—
6	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 7.	Go to Step 3.
7	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1216 Fuel Solenoid Response Time Too Short (Figure PCM-37)

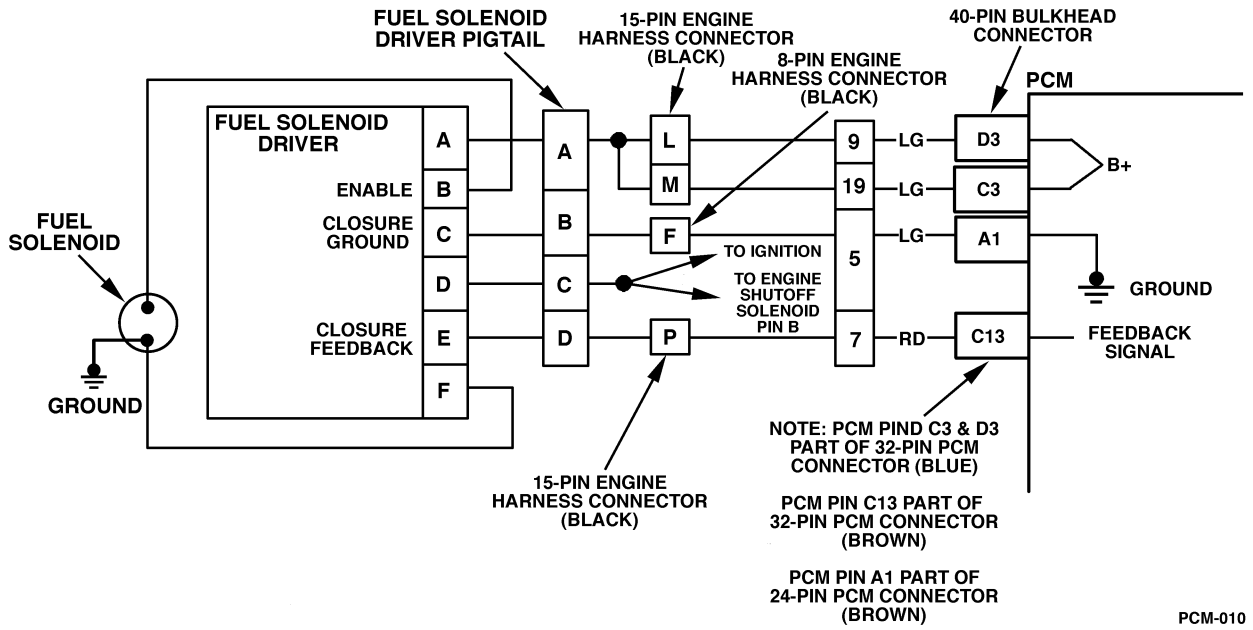

Figure PCM-37 Fuel Solenoid Response Time Too Short

Circuit Description

The injection pump delivers fuel to individual cylinders by opening and closing a solenoid control fuel valve. The PCM monitors the amount of time it takes for the fuel solenoid valve to physically close after commanded to close. Closure time out of range is seen as a fault. This response time is measured in milliseconds. This is a type D DTC.

Conditions for Setting the DTC

- Battery voltage greater than 10 volts and less than 16 volts.
- Engine coolant temperature greater than -1°C (34°F).
- Engine speed greater than 506 RPM.
- Requested fuel rate is greater than 0.0 mm.
- Inj. Pump Closure Time less than .75 ms.

Action Taken When the DTC Sets

Possible poor performance or no start.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

If DTC P1216 is set with any other DTCs, diagnose them first. If the vehicle is running close to the DTC setting closure time, vehicle should be checked during cold start ups and during hot conditions.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This step will determine if the ground circuit is open which causes the vehicle not to start.
3. This step will determine if the signal circuit is open or an injection pump (fuel solenoid) is a fault.

DTC P1216 - Fuel Solenoid Response Time Too Short

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	**Is DTC P0219 set?**	—	Go to applicable table.	Go to Step 3.
3	**Will engine start?**	—	Go to Step 4.	Go to Step 7.
4	1. Engine at operating temperature. 2. Observe Inj. Pump Closure Time on scan tool. Is the scan tool display less than the specified value?	0.75 ms	Go to Step 5.	Go to Step 6.
5	1. Engine running. 2. Again, observe Inj. Pump Closure Time on scan tool. Does Inj. Pump Closure Time display the specified value?	0.1 ms	Go to Step 8.	Go to Step 10.
6	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
7	1. Check the Closure ground circuit for an open. 2. If the Closure circuit is open, repair as necessary. Was a repair performed?	—	Go to Step 12.	Go to Step 10.
8	1. Check the Closure signal circuit for an open or short to ground. 2. If the Closure signal circuit is open or shorted to ground, repair as necessary. Was a repair performed?	—	Go to Step 12.	Go to Step 9.
9	Check the Closure signal circuit for a poor connection at PCM and replace terminal if necessary. Is action complete?	—	Go to Step 12.	Go to Step 11.
10	Replace injection pump. ***Notice:*** If injection pump is faulty, the new injection pump must be timed. Refer to *Checking and Adjusting Injection Timing* in Section 4. Is the action complete?	—	Go to Step 12.	—
11	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 12.	—
12	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 13.	Go to Step 2.
13	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1217 Fuel Solenoid Response Time Too Long (Figure PCM-38)

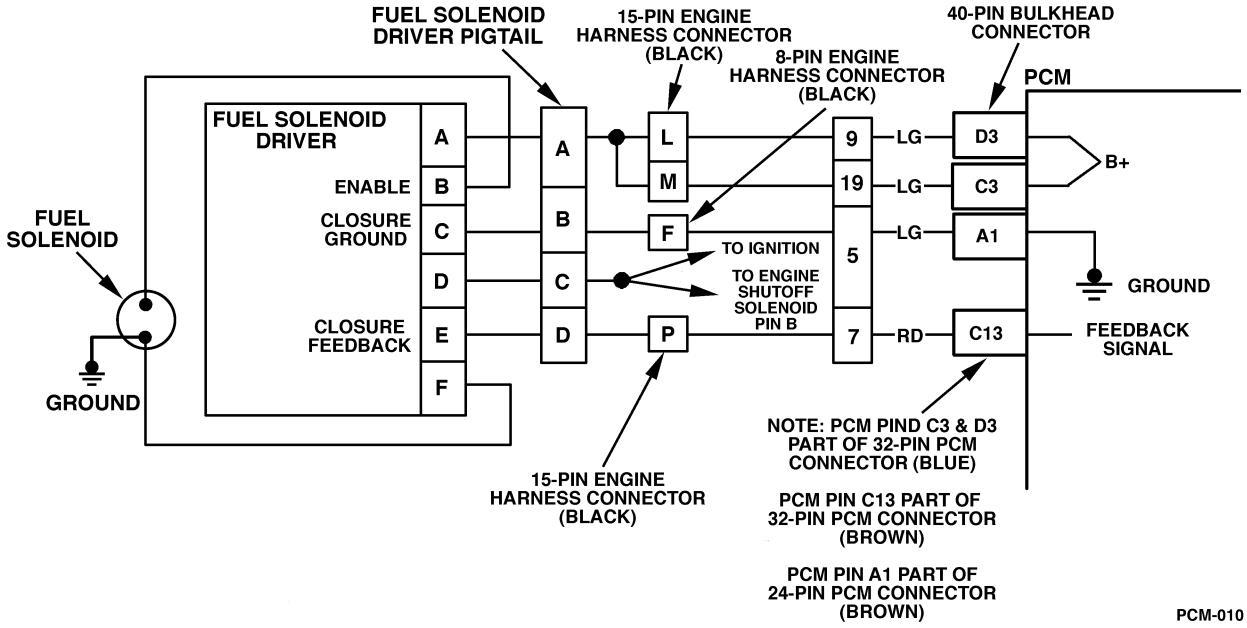

Figure PCM-38 Fuel Solenoid Response Time Too Long

Circuit Description

The injection pump delivers fuel to individual cylinders by opening and closing a solenoid control fuel valve. The PCM monitors the amount of time it takes for the fuel solenoid valve to physically close after commanded to close. Closure time out of range is seen as a fault. This response time is measured in milliseconds. This is a type D DTC.

Conditions for Setting the DTC

- Battery voltage greater than 10 volts and less than 16 volts.
- Engine coolant temperature greater than -1°C (34°F).
- Engine speed greater than 506 RPM.
- Requested fuel rate is greater than 0.0 mm.
- Inj. Pump Closure Time less than .75 ms.

Action Taken When the DTC Sets

Possible poor performance.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

A weak (mechanical failure) fuel solenoid will result in a DTC P1217. If DTC P1217 is set with any other DTCs, diagnose them first. If the vehicle is running close to the DTC setting closure time, vehicle should be checked during cold start ups and during hot conditions.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This step will determine if DTC P1217 is a hard failure or an intermittent.

This step will determine if the solenoid is at fault, or if there is a problem with the PCM or wiring.

DTC P1217 - Fuel Solenoid Response Time Too Long

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Is DTC P0370 set?	—	Refer to applicable table.	Go to Step 3.
3	1. Start the engine and idle until operating temperature is reached. 2. Observe Inj. Pump Closure Time on scan tool. Is the scan tool display greater than the specified value?	2.4 ms	Go to Step 4.	Go to Step 5.
4	1. All accessories on (includes aftermarket add-ons). 2. Engine idling. 3. All post glow plug cycles completed. 4. With a J39200 connected to ground, measure voltage at the FUEL SOL fuse (fuel solenoid driver ignition feed circuit) in the U/H relay center. Is voltage between specified value?	12 - 15v	Go to Step 7.	Go to Step 6.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
6	Repair the fuel solenoid driver ignition feed circuit poor connections or aftermarket add-ons. Was a repair performed?	—	Go to Step 8.	—
7	Before replacing the fuel solenoid driver, check the fuel system for contamination. Replace the fuel solenoid driver. Is the action complete?	—	Go to Step 8.	—
8	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 9.	Go to Step 2.
9	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1218 Injection Pump Calibration Circuit (Figure PCM-39)

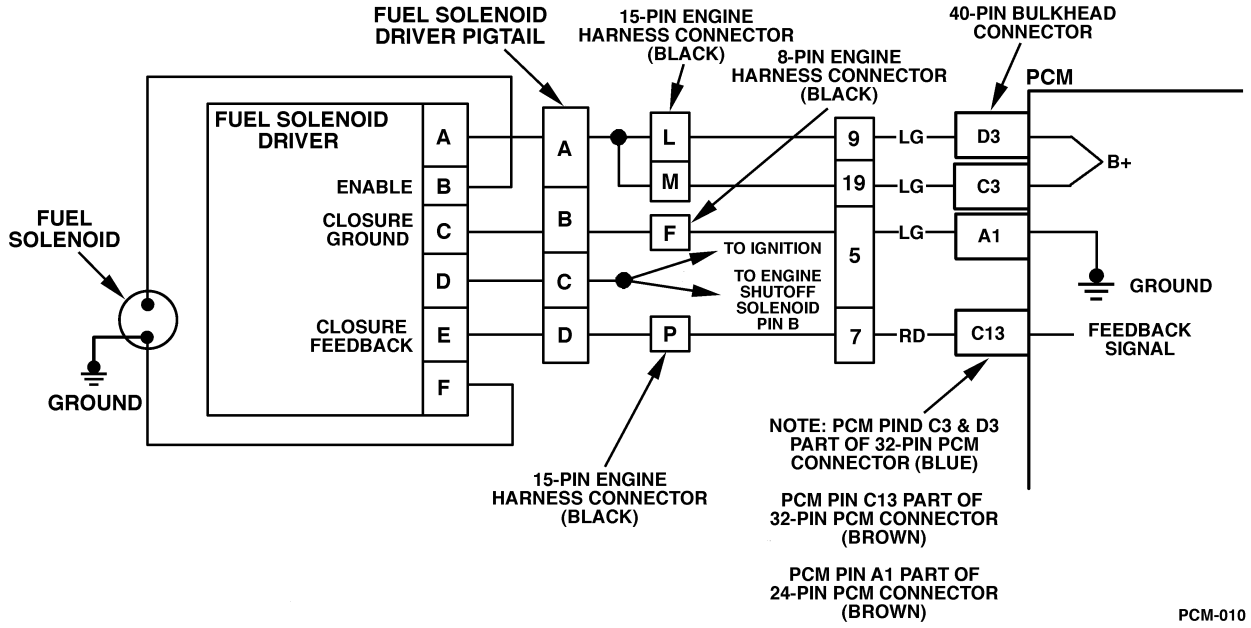

Figure PCM-39 Injection Pump Calibration Circuit

Circuit Description

The PCM uses a calibrated resistor mounted internally in the injection pump to determine fuel rates. The resistor value is stored in the PCM memory. If the PCM memory has been disturbed or the PCM has been replaced, the PCM will relearn the resistor value on the next ignition cycle. This is a type B DTC.

Conditions for Setting the DTC

- PCM currently does not have a valid resistor valve.
- PCM is unable to read a resistor value.

Action Taken When the DTC Sets

The lowest fuel table. Possible poor performance problem.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

Check connection at fuel injector driver. Clear DTC, and cycle ignition. If DTC clears, treat condition as intermittent.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This step will determine if there is a problem with the connection at the fuel solenoid driver or faulty injection pump.

DTC P1218 Injection Pump Calibration Circuit

Step	Action	Value(s)	Yes	No
1	**Important**: Before clearing DTCs use the scan tool Capture Info to record freeze frame and failure records for reference, as data will be lost when Clear Info function is used. Was the Powertrain On-Board Diagnostic (OBD) System Check perfommed?	—	Go to Step 2.	Go to *Powertrain OBD System Check.*
2	Are than any other DTCs set?	—	Refer to Aplicable DTC Table	Go to Step 3.
3	1. Check connection at Fuel Solenoid Driver. 2. Clear DTC, and cycle ignition. 3. Start and idle engine. 4. Activate Time set procedure (the diagnostic will only run when a Time Set procedure is perfommed). 5. Exit out of Time set procedure and Select DTC, Specific, then enter the DTC number. Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 5.	Go to Step 4.
4	Replace injection pump. Important: The new injection pump must be timed. Refer to *Fuel Injection Pump*. Is the action complete?	—	Go to Step 6.	—
5	DTC is intemmittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs were stored refer to those table(s). Are any additional DTC(s) stored?	—	Go to Aplicable DTC Table.	Go to *Diagnostic Aids.*
6	Using the Scan Tool, select Capture Info, Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to Aplicable DTC Table.	System OK.

DTC P1621 EEPROM Write

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 3.	—
3	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 4.	Go to Step 2.
4	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1627 - A/D Performance

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 3.	—
3	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 4.	Go to Step 2.
4	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1635 PCM 5 Volt Reference Low (Figure PCM-40)

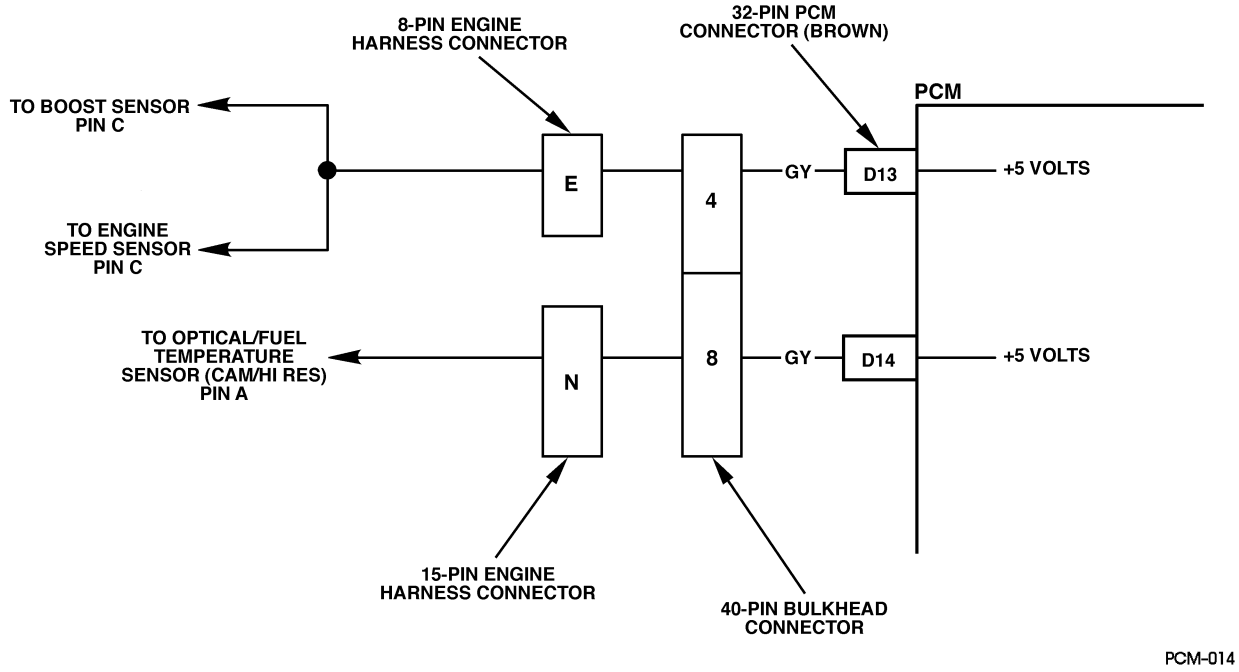

Figure PCM-40 PCM 5 Volt Reference Low

Circuit Description

The PCM provides a 5 volt supply for use in powering up sensors. This test monitors the voltage present at terminals BRD13 (shared by Boost and Crankshaft Position sensors) and BRD14 (Optical/Fuel temperature sensor (Cam/HI Res)). This is a type B DTC.

Conditions for Setting the DTC

5 volt reference is less than 1 volt.

Action Taken When the DTC Sets

- Backup fuel.
- No EGR.
- No turbo boost.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

During the time the failure is present, the setting of additional DTCs that share a 5 volt reference may also set.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

1. Checks to confirm that a DTC is still present.
2. Checks to determine if there is a 5 volt reference from the PCM.
3. Checks to determine if there is a short-to-ground in CKT 350 or CKT 375, or a short-to-ground in the PCM.

DTC P1635 - PCM 5 Volt Reference Low

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool installed. 2. Crank engine for 15 seconds or start up. Does DTC reset?	—	Go to Step 3.	Go to Step 5.
3	1. Ignition ON, engine OFF> 2. Disconnect EGR Control Pressure/BARO sensor. 3. With J39200 DVM, probe 5 volt reference circuit at harness connector. Is voltage less than the specified value?	4.0v	Go to Step 4.	Go to Step 6.
4	1. Disconnect PCM connector with EGR sensor 5 volt reference circuit. 2. With test light connected to B+, probe 5 volt reference circuit at PCM harness. Is test light ON?	—	Go to Step 7.	Go to Step 8.
5	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
6	Replace EGR Control Pressure/BARO sensor.	—	Go to Step 8.	—
7	Repair short to ground in 5 volt reference circuit. Is the action complete?	—	Go to Step 8.	—
8	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 9.	Go to Step 8.
9	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 6.	Go to Step 2.
10	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1641 Malfunction Indicator Lamp (MIL) Control Circuit (Figure PCM-41)

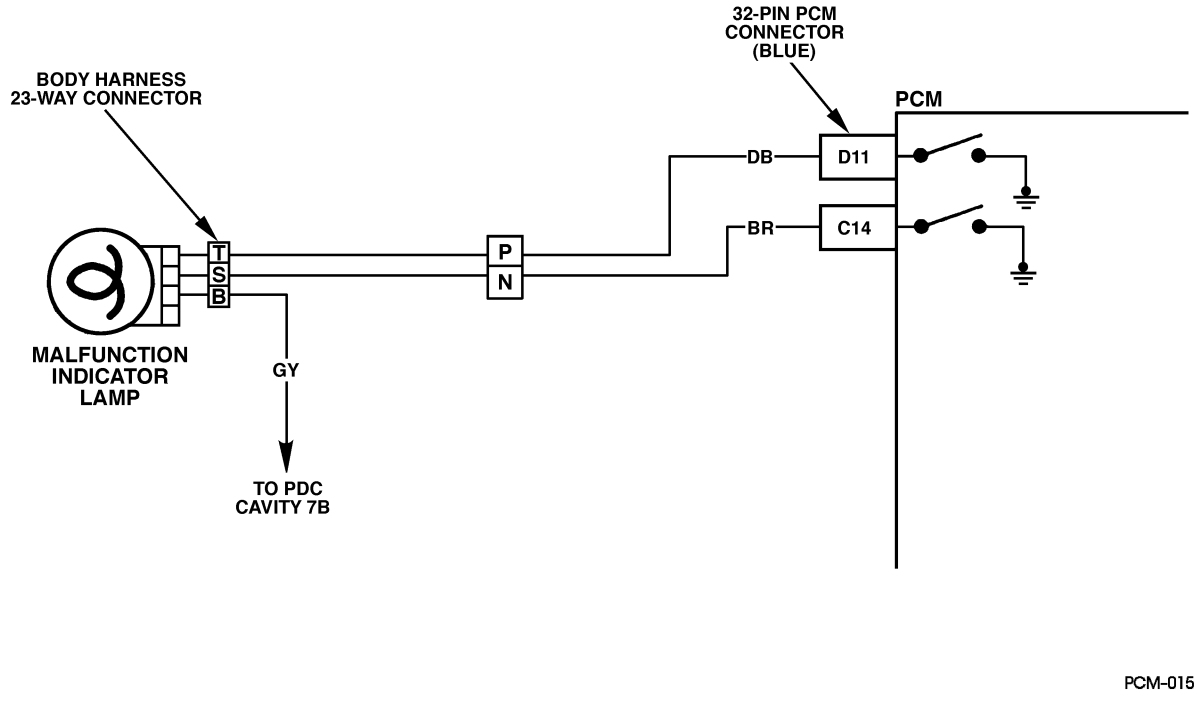

Figure PCM-41 Malfunction Indicator Lamp (MIL) Control Circuit

Circuit Description

A dash light is illuminated by the PCM if diagnostics have detected certain errors related to the engine performance or engine sensor status. Illumination is accomplished by the PCM providing a ground path for the lamp circuit. This is a type D DTC.

Conditions for Setting the DTC

- MIL requested "ON".
- Voltage at the MIL control circuit is greater than 0 volts.

or

- MIL requested "OFF".
- Voltage at the MIL control circuit is greater than 0 volts.

Action Taken When the DTC Sets

Will not turn "ON" the MIL.

Conditions for Clearing the MIL/DTC

- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

A faulty bulb or the control circuit shorted to ground will cause a P1641 to set.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

3. This test will check the control circuit for a short to ground.
5. This test will check the control circuit for an open.

DTC P1641 - Malfunction Indicator Lamp (MIL) Control Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Ignition "ON" engine "OFF". Is the MIL "OFF"?	—	Go to Step 3.	Go to Step 5.
3	1. Ignition "OFF". 2. Disconnect the blue 32 way PCM electrical connector. 3. Ignition "ON" engine "OFF". Is the MIL "ON"?	—	Go to Step 4.	Go to Step 6.
4	MIL control circuit is shorted to ground. Is the action complete?	—	Go to Step 7.	—
5	1. Check the MIL control circuit for the following: • opens • poor connection at PCM • faulty bulb • faulty fuse. Was a problem found?	—	Go to Step 7.	Go to Step 6.
6	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 7.	—
7	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 8.	Go to Step 2.
8	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1643 Wait to Start Lamp Control Circuit (Figure PCM-42)

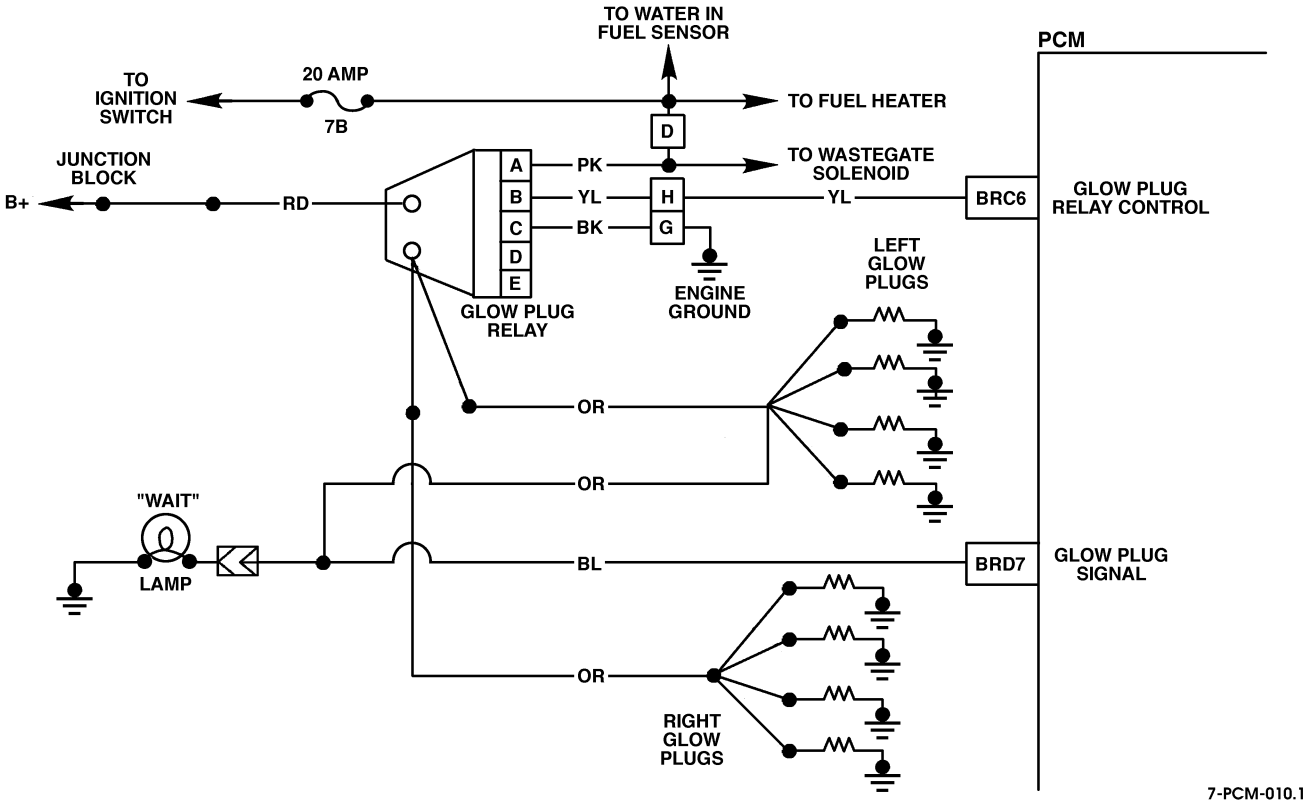

Figure PCM-42 Wait to Start Lamp Control Circuit

Circuit Description

A dash light (Wait To Start) is illuminated by the PCM when the glow plugs are commanded ON. When the PCM is commanding the Wait To Start lamp ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the Wait To Start lamp OFF, the voltage potential of the circuit will be high (near battery volts). The primary function of the PCM is to supply the ground for the Wait To Start lamp circuit. This is a type B DTC.

Conditions for Setting the DTC

- Wait To Start lamp requested ON.
- Voltage on Wait To Start tamp circuit high (near battery volts).

or

- Wait To Start lamp requested OFF.
- Voltage on Wait To Start lamp control circuit low (near 0 volts).Action Taken When the DTC Sets

Action Taken When the DTC Sets

No Wait To Start lamp.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5° C (40° F) from start up coolant temperature and engine coolant temperature exceeds 71° C (160° F) that same ignition cycle.
- Use of a Scan tool.

Diagnostic Aids

A faulty bulb or the control circuit shorted to ground will cause a P1643 to set.

Test Description

5. 2.Repeat the command as many times as necessary (when glow plugs are commanded ON by the scan tool, an internal PCM timer protects the glow plugs from damage by cycling them ON for 3 seconds and OFF for 12 seconds. After the 12 seconds has elapsed, the glow plugs can be commanded ON again).
9. If no trouble is found in the control circuit or the connection at the PCM, the PCM maybe malfunctioning, however, this is an extremely unlikely failure.

DTC P1643 Wait to Start Lamp Control Circuit

Step	Action	Value(s)	Yes	No
1	**Important**: Before clearing DTC(s) use the scan tool to record freeze frame and failure records for reference, as data will be lost when Clear Info function is used. Was the Powertrain On-Board Diagnostic (OBD) System Check perfommed?	—	Go to Step 2.	Go to *Powertrain OBD System Check.*
2	1. Ignition ON, engine OFF. 2. Using a scan tool, command the Glow Plug system ON. Does the lamp turn ON?	—	Go to Step 3.	Go to Step 4.
3	DTC is intemnittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs were stored refer to those table(s). Are additional DTC(s) stored?	—	Go to the applicable DTC table	Go to *Diagnostic Aids.*
4	1. Ignition OFF. 2. Disconnect the PCM connector containing the Wait To Start lamp control circuit. 3. Ignition ON, engine OFF. Is the lamp OFF?	—	Go to Step 5.	Go to Step 7.
5	With a fusede jumper wire connected to ground, probe the Wait To Start lamp control circuit in the PCM harness connector. Is the lamp ON?	—	Go to Step 6.	Go to Step 8.
6	Check connections at PCM. Was a repair perfomned?	—	Go to Step 10.	Go to Step 9.
7	Wait To Start control circuit is shorted to ground, repair as necessary. Is the action complete?	—	Go to Step 10.	—
8	Check the Wait To Start circuit for the following. • Open ignition feed to the bulb • malfunctioning bulb • Control circuit open or shorted to B+. Was a repair performed?	—	Go to Step 10.	—
9	Replace the PCM. **Important**: The new PCM must be programmed. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 10.	—
10	1. Using the Scan Tool, select DTC, Clear Info. 2. Start engine and idle at normal operating temperature. 3. Select DTC, Specific, then enter the DTC number which was set. 4. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 11.	Go to Step 2.
11	Using the Scan Tool, select Capture Info, Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1654 Check Throttle Circuit (Figure PCM-43)

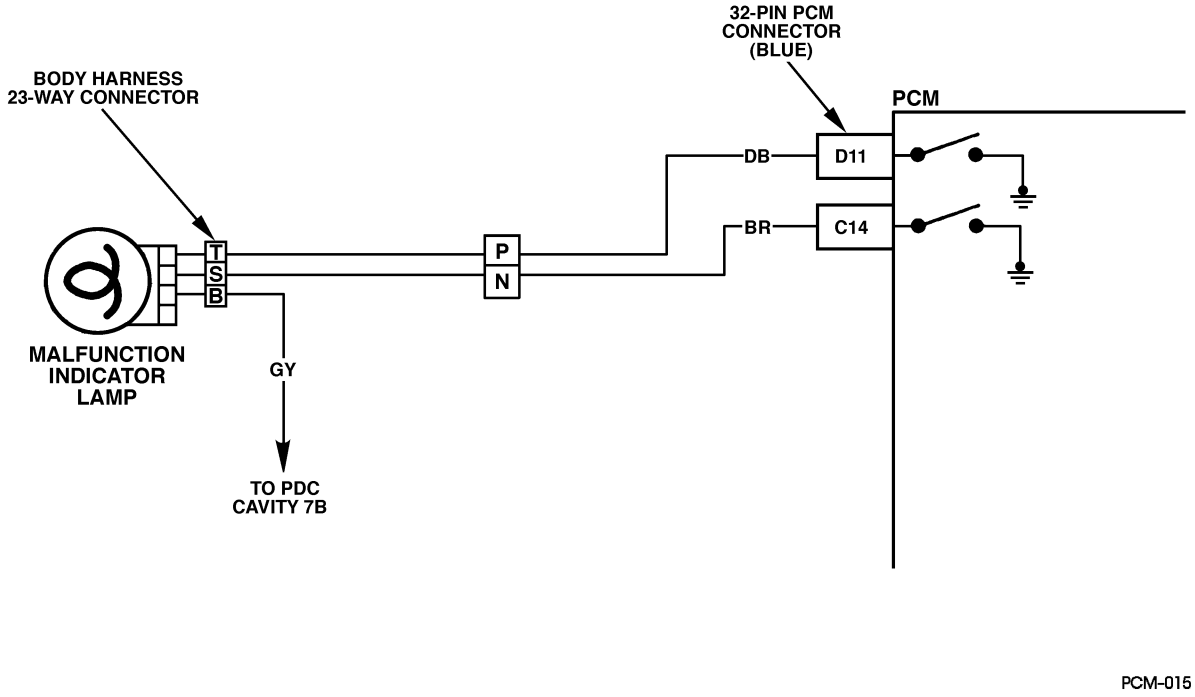

Figure PCM-43 Check Throttle Circuit

Circuit Description

A dash light is illuminated by the PCM if diagnostics have detected certain errors related to the Accelerator Pedal Position (APP) sensor. Illumination is accomplished by the PCM providing a ground path for the light circuit. This is a type D DTC.

Conditions for Setting the DTC

- Check Throttle lamp requested "ON".
- Voltage at the Check Throttle control circuit is greater than 0 volts.

or

- Check Throttle lamp requested "OFF".
- Voltage at the Check Throttle control circuit is equal to 0 volts.

Action Taken When the DTC Sets

Will not turn "ON" the MIL.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from start up coolant temperature and engine coolant temperature exceeds 71°C (160°F) that same ignition cycle).
- Use of a scan.

Diagnostic Aids

A faulty bulb or the control circuit shorted to ground will cause a P1654 to set.

Test Description

Number(s) below refer to the number(s) on the diagnostic table.

2. This test checks the ability of the PCM to command the Check Throttle lamp on during the bulb check (Check Throttle lamp should be "ON" for 2 seconds and then go out).
3. This test will check the control circuit for a short to ground.
6. This test will check the control circuit for an open.

DTC P1654 - Check Throttle Circuit

Step	Action	Value(s)	Yes	No
1	**Important:** Before clearing DTC(s) use the scan tool "Capture Info" to record freeze frame and failure records for reference, as data will be lost when "Clear Info" function is used. Was the *"On-Board Diagnostic (OBD) System Check"* performed?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Ignition "ON" engine "OFF". 2. Using a scan tool, command the lamp ON and OFF. Does the Check Throttle lamp turn ON and OFF with each command?	—	Go to Step 3.	Go to Step 4.
3	DTC is intermittent. If no additional DTCs are stored, refer to "Diagnostic Aids". If additional DTCs are stored, refer to those charts(s) first. Are additional DTCs stored?	—	Go to applicable DTC table.	Go to *Diagnostic Aids*
4	1. Ignition "OFF". 2. Disconnect the blue 32 way PCM electrical connector. 3. Ignition "ON" engine "OFF". Is the lamp "OFF"?	—	Go to Step 5.	Go to Step 7.
5	With a fused jumper wire connected to ground, probe the lamp control circuit in the PCM harness connector. Is the lamp ON?	—	Go to Step 6.	Go to Step 8.
6	1. Check for poor connections at PCM. 2. If a problem was found, repair as necessary. Was a repair performed?	—	Go to Step 10.	Go to Step 9.
7	Check Throttle control circuit is shorted to ground. Is the action complete?	—	Go to Step 10.	—
8	Check the Check Throttle control circuit for the following: • opens • poor connection at PCM • faulty bulb • faulty fuse. Was a problem found?	—	Go to Step 10.	—
9	Replace the faulty PCM. ***Notice:*** If the PCM is faulty, the new PCM must be programmed. Go to *PCM replacement and programming procedures.* Is the action complete?	—	Go to Step 10.	—
10	1. Using the Scan Tool, select "DTC", "Clear Info". 2. Start engine and idle at normal operating temperature. 3. Select "DTC", "Specific", then enter the DTC number which was set. 4. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Scan Tool indicate that this diagnostic Ran and Passed?	—	Go to Step 11.	Go to Step 2.
11	Using the Scan Tool, select "Capture Info", "Review Info". Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK.

DTC P1656 Wastegate Solenoid Control Circuit (Figure PCM-44)

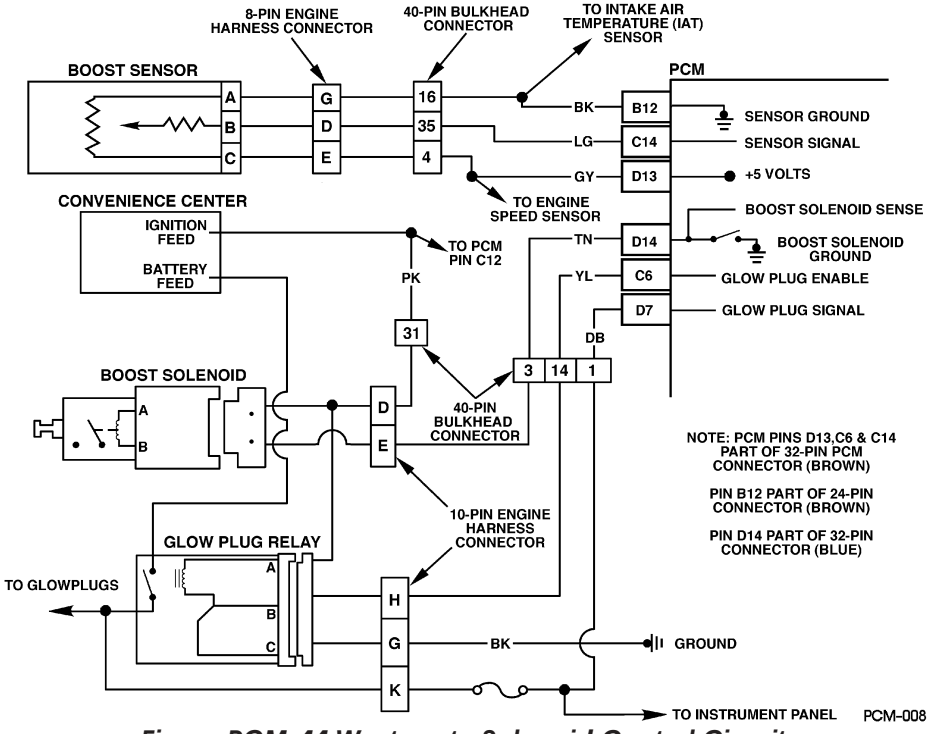

Figure PCM-44 Wastegate Solenoid Control Circuit

Circuit Description

The turbocharger wastegate is a vacuum actuated valve used to control the exhaust gas heat sent to the turbo. The wastegate pulse width modulated solenoid meters the vacuum level at the wastegate valve actuator as commanded by the PCM. When the PCM is commanding the Wastegate solenoid ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the wastegate solenoid OFF, the voltage potential of the circuit will be high (near battery volts). The primary function of the PCM in this circuit is to supply the ground for the wastegate solenoid. This is a type B code.

Conditions for Setting the DTC

- Conditions for Setting the DTC
- PCM requested Wastegate solenoid ON.
- Voltage on Wastegate solenoid control circuit high (near battery volts).
- 2 consecutive faults detected.
- Conditions met for 2 seconds.
- or
- PCM requested Wastegate solenoid OFF.
- Voltage on Wastegate solenoid control circuit low (near 0 volts).
- 2 consecutive faults detected.
- Conditions met for 2 seconds.

Action Taken When the DTC Sets

Low Power.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL off after three consecutive trips without a fault condition.
- A History DTC will clear when forty consecutive warm-up cycles that the diagnostic does not fail (coolant temperature has risen 5° C (40° F) from start up coolant temperature and engine coolant temperature exceeds 71° C (160° F) that same ignition cycle.
- Use of a Scan Tool.

Diagnostic Aids

This diagnostic will set when control circuit does not follow the PCM command (when the solenoid is requested ON voltage will drop, when the solenoid is OFF ignition voltage will be present). The scan tool has a 5 second ON time abort. The wastegate solenoid can be commanded ON for as many times as needed, in 5 second intervals. Its possible DTC P0236 may set along with DTC P1656. This diagnostic can be checked during key up. The engine will not respond to scan tool commands at idle (engine unable to achieve boost pressures greater than BARO at idle) or at any engine speed greater than idle (PCM control abort to prevent engine damage).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Table.

2. Be sure that both the ON and OFF states are commanded. Repeat the commands as many times as necessary.
3. This check can detect a partially shorted coil which would cause excessive current flow. Leaving the circuit energized for 2 minutes allows the coil to warm up. When warm, the coil may open (Amps drop to zero), or short (Amp draw greater than 0.75A).
14. If no trouble is found in the control circuit or the connection at the PCM, the PCM may be malfunctioning. However, this is an extremely unlikely failure.

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DTC P1656 Wastegate Solenoid Control Circuit

Step	Action	Value(s)	Yes	No
1	**Important**: Before clearing DTCs use the scan tool Capture Info Was the Powertrain On-Board Diagnostic (OBD) System Check perfom-med?	—	Go to Step 2.	Go to *OBD System Check.*
2	1. Scan tool connected. 2. Ignition ON, engine OFF. 3. With scan tool, command Boost solenoid ON and OFF and listen for an audible click. Does the solenoid turn ON and OFF (audible click) with each command?	—	Go to Step 3.	Go to Step 5.
3	1. Ignition OFF. 2. Disconnect the PCM connector containing the Boost solenoid control circuit. 3. Ignition ON. 4. Using DVM J 39200 on 10 Amp scale, measure current from the solenoid control circuit in the PCM harness connector to ground for 2 minutes. Is current draw less then the specified value, but not zero?.	0.75A	Go to Step 8.	Go to Step 4.
4	1. Ignition OFF. 2. PCM connector still disconnected. 3. Disconnect Boost solenoid. 4. Using DVM J 39200, measure resistance from the solenoid control circuit in the PCM harness connector to ground. Does DVM display infinite resistance?	—	Go to Step 13.	Go to Step 10.
5	1. Disconnect Boost solenoid. 2. Ignition ON, engine OFF. 3. Connect a test light between the terminals at the harness connector. 4. Using a scan tool. command the solenoid ON and OFF. Does test light turn ON and OFF with each command?	—	Go to Step 9.	Go to Step 6.
6	1. Ignition ON engine OFF. 2. With a test light connected to ground, probe the ignition feed circuit at the Boost solenoid harness connector. Is the test light ON?	—	Go to Step 7.	Go to Step 12.
7	1. Ignition OFF. 2. Reconnect solenoid. 3. Disconnect the PCM harness containing the solenoid control circuit. 4. Ignition ON. 5. With a fused jumper wire connected to ground, probe the solenoid control circuit in the PCM hamess connector. Does the solenoid operate (audible click)?	—	Go to Step 11.	Go to Step 10
8	DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs were stored refer to the applicable DTC table(s) first. Are any additional DTCs stored?	—	Go to the applicable DTC table	Go to *Diagnostic Aids*

DTC P1656 Wastegate Solenoid Control Circuit

Step	Action	Value(s)	Yes	No
9	Check for a poor connection at the Boost solenoid and replace temminals as necessary. Did the temminals require replacement?	—	Go to Step 15.	Go to Step 13
10	Repair Boost solenoid control circuit. Is the action complete?	—	Go to Step 15.	—
11	Check for a poor connection at the PCM, Boost solenoid control circuit. Was a problem found?	—	Go to Step 15.	Go to Step 14
12	Repair the open in the ignition feed circuit. Is the action complete?	—	Go to Step 15.	—
13	Replace the Boost solenoid. Refer to Wastegate Solenoid Is the action complete?	—	Go to Step 15.	—
14	Replace the PCM. **Important**: The new PCM must be programmed. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 15.	—
15	1. Using the scan tool, select DTC, Clear Info. 2. Start engine and idle at nommal operating temperature. 3. Select DTC, Specific, then enter the DTC number which was set. 4. Operate vehicle until the Scan Tool indicates that the diagnostic Ran. Does the scan tool indicate that this diagnostic Passed?	—	Go to Step 15.	Go to Step 2
16	Using the scan tool, select Capture Info, Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to the applicable DTC table	System OK