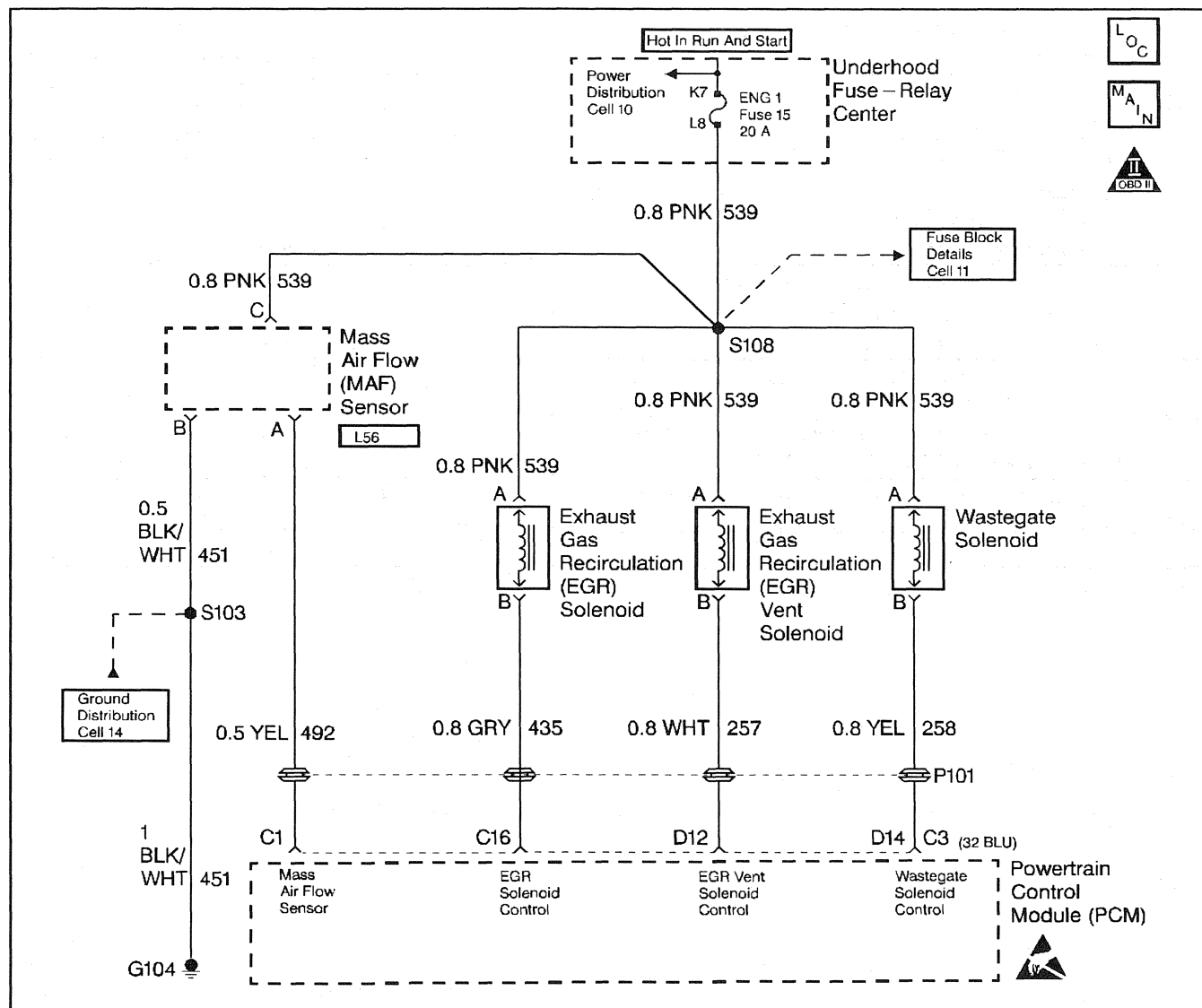


## DTC P0101 Mass Air Flow System Performance



56429

### Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on, engine coolant temperature, throttle angle and engine speed. This is a type B DTC.

### Conditions for Setting the DTC

- The engine is running.
- Engine Speed between 506 and 806 RPM.
- Throttle angle is 0%.

- The above conditions met for greater than 3 seconds.
- The change in MAF sensor is less than a calculated value.

### Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) on the second consecutive fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and the Fail Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0101 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0101 can be cleared by using the scan tool Clear Info function.

### Diagnostic Aids

Check for the following conditions:

- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the scan tool while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or dirty air filter element. A Wide-Open throttle acceleration from a stop should cause the Mass Air Flow displayed on a scan tool to increase. If not, check for a restriction.

If DTC P0101 cannot be duplicated, the information included in the Fail Records data can be useful in determining vehicle mileage since the DTC was last set. This may assist in determining how often the DTC sets.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

### Test Description

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

2. This step verifies that the problem is present at idle.
5. A voltage reading of less than 4 or over 6V at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
6. Verifies that ignition feed voltage and a good ground are available at the MAF sensor.

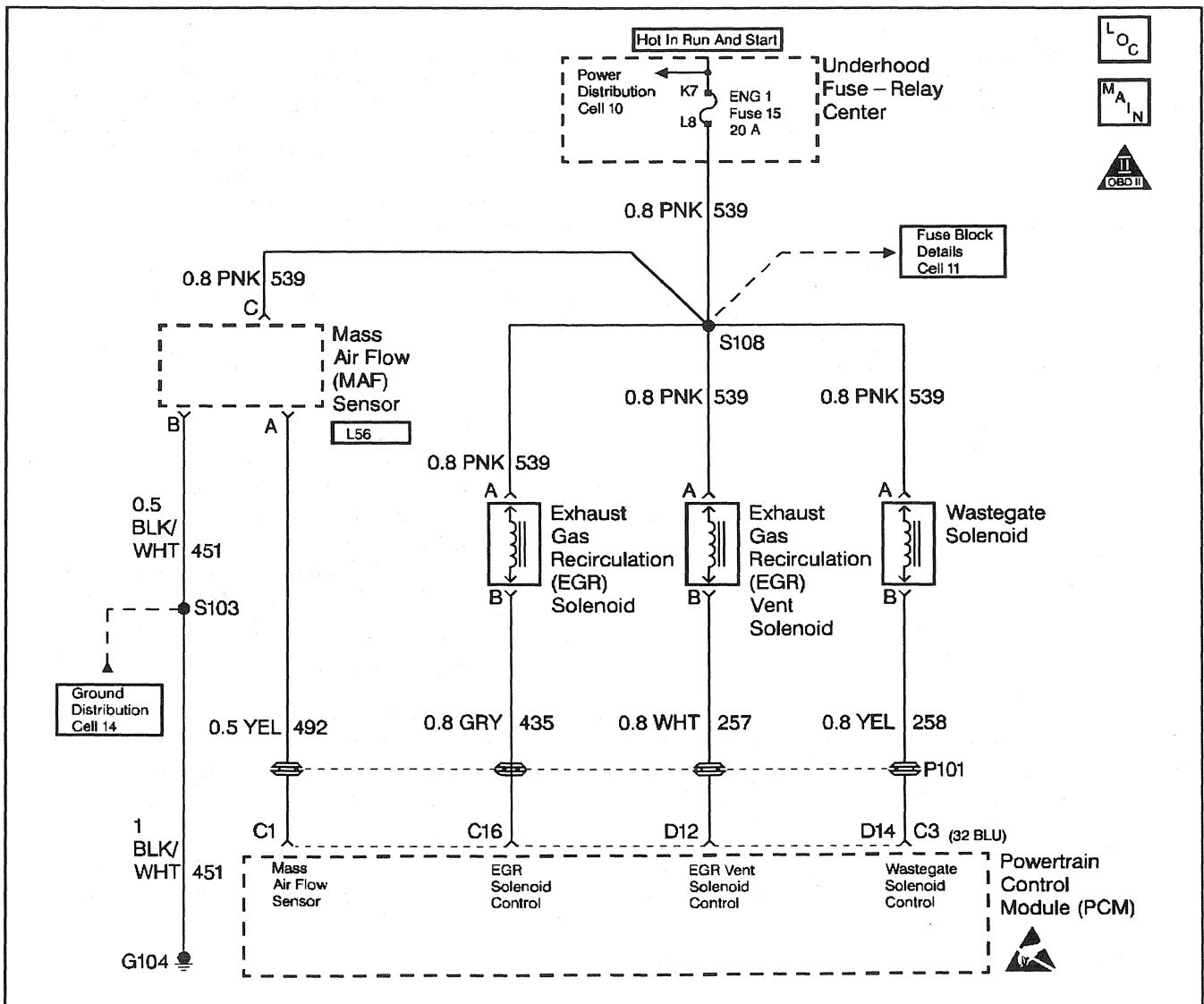
**DTC P0101 Mass Air Flow System Performance**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTC(s) use the scan tool to record Freeze Frame and Failure Records for reference, as data will be lost when the Clear Info function is used. Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Turn the ignition ON, engine OFF. 2. Review and record scan tool Fail Records data. 3. Operate the vehicle within the Fail Records conditions as noted. 4. Using a scan tool, monitor Specific DTC info for DTC P0101. Does the scan tool indicate DTC P0101 Failed This Ign?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Check for the following conditions: <ul style="list-style-type: none"> <li>• Plugged intake air duct or dirty air filter element</li> <li>• Intake manifold vacuum leaks</li> <li>• Leaks at EGR valve flange and tower gasket.</li> </ul> 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 17	Go to Step 4
4	1. Turn the ignition ON, throttle closed. 2. Observe the APP Angle display on the scan tool. Is the APP Angle near the specified value?	0%	Go to Step 5	Go to <i>DTC P0121 APP Sensor1 Circuit Performance</i>
5	1. Turn the ignition OFF. 2. Disconnect the MAF sensor connector. 3. Turn the ignition ON, engine OFF. 4. Using a DVM, measure the voltage between the MAF signal circuit and chassis ground. Is the voltage near the specified value?	5V	Go to Step 6	Go to Step 7

## DTC P0101 Mass Air Flow System Performance (cont'd)

Step	Action	Value(s)	Yes	No
6	Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector. Is the test light ON?	—	Go to Step 10	Go to Step 9
7	Is the voltage less than the specified value?	4.5V	Go to Step 11	Go to Step 8
8	1. Turn the ignition OFF, disconnect the PCM. 2. Turn the ignition ON, engine OFF. 3. Measure the voltage between the MAF signal circuit and ground. Does the voltage measure near the specified value?	0V	Go to Step 15	Go to Step 13
9	1. Connect a test light between MAF sensor ignition feed circuit and the chassis ground. Is the test light ON?	—	Go to Step 12	Go to Step 13
10	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, replace the terminal(s). Was a poor connection found?	—	Go to Step 17	Go to Step 15
11	1. Check the MAF signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF sensor ground circuit. 2. If the MAF signal circuit is open or shorted, repair it as necessary. Was the MAF sensor signal circuit open or shorted?	—	Go to Step 17	Go to Step 16
12	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Go to Step 17	—
13	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Go to Step 17	—
14	Locate and repair the short to voltage in the MAF sensor signal circuit. Is the action complete?	—	Go to Step 17	—
15	Replace the MAF sensor. Is the action complete?	—	Go to Step 17	—
16	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 17	—
17	1. Using the scan tool, select DTC, Clear Info. 2. Start the engine and idle until normal operating temperature is reached. 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 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 additional DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

# DTC P0102 MAF Sensor Circuit Low Frequency



56429

## Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration, high load situation or no EGR flow, while a small quantity of air indicates deceleration, idle or full EGR situations.

The MAF sensor produces a frequency signal. DTC P0102 will be set if the signal from the MAF sensor does not match a predicted value based on, engine coolant temperature, APP angle and engine speed.

DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor. This is a type B DTC.

## Conditions for Setting the DTC

- The engine is running.
- Engine run time is greater than 2 seconds.
- Ignition ON for 2 seconds
- MAF sensor is less than 1280 Hz.

## Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) on the second consecutive fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and the Fail Records data.

**Conditions for Clearing the MIL/DTC**

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0102 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0102 can be cleared by using the scan tool Clear Info function.

**Diagnostic Aids**

Check for the following conditions:

- Poor connection at PCM. Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness. Inspect the wiring harness for damage. If the harness appears to be OK, observe the scan tool while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or filter element. A Wide-Open throttle acceleration from a stop should cause the Mass Air Flow displayed on a scan tool to increase.

If DTC P0102 cannot be duplicated, the information included in the Fail Records data can be useful in determining vehicle mileage since the DTC was last set.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

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

- This step verifies that the problem is present at idle.
- A voltage reading of less than 4 or over 6V at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
- Verifies that ignition feed voltage and a good ground are available at the MAF sensor.
- This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to *PCM Replacement/Programming*.

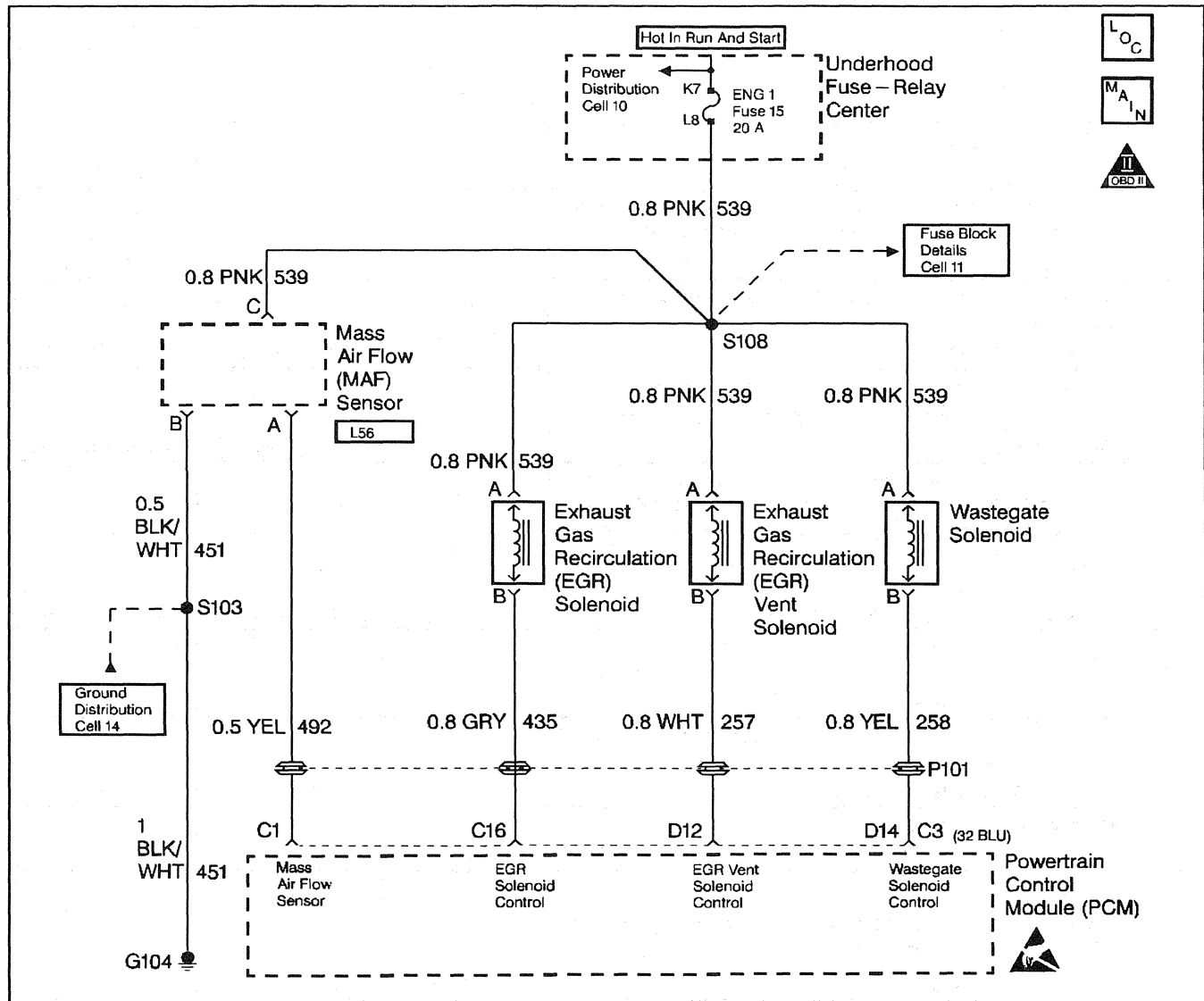
**DTC P0102 MAF Sensor Circuit Low Frequency**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTC(s) use the scan tool to record Freeze Frame and Failure Records for reference, as data will be lost when the Clear Info function is used.  Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	<i>Go to Step 2</i>	<i>Go to Powertrain OBD System Check</i>
2	1. Start the engine. 2. With the engine idling, monitor the MAF display on the scan tool.  Is the MAF display below the specified value?	1280 Hz	<i>Go to Step 4</i>	<i>Go to Step 3</i>
3	1. Turn the ignition ON, engine OFF. 2. Review and record the scan tool Fail Records data. 3. Operate the vehicle within the Fail Records conditions as noted. 4. Using a scan tool, monitor the Specific DTC info for DTC P0102.  Does scan tool indicate DTC P0102 failed this Ign?	—	<i>Go to Step 4</i>	<i>Refer to Diagnostic Aids</i>
4	1. Check for the following conditions: <ul style="list-style-type: none"> <li>• Objects blocking the MAF sensor inlet.</li> <li>• Large intake manifold leaks</li> <li>• Large leaks at the EGR valve flange or tower gasket.</li> <li>• Large leaks downstream of the MAF sensor.</li> </ul> 2. If a problem is found, repair as necessary.  Was a problem found?	—	<i>Go to Step 14</i>	<i>Go to Step 5</i>

## DTC P0102 MAF Sensor Circuit Low Frequency (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Disconnect the MAF sensor connector. 3. Turn the ignition ON, engine OFF. 4. Using a J 39200, measure the voltage between the MAF signal circuit and ground. Is the voltage near the specified value?	5V	Go to Step 6	Go to Step 9
6	Connect a test light between the MAF sensor ignition feed and ground circuit at the MAF sensor harness connector. Is the test light ON?	—	Go to Step 8	Go to Step 7
7	Connect a test light between MAF sensor ignition feed circuit and battery ground. Is the test light ON?	—	Go to Step 10	Go to Step 11
8	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, repair as necessary. Was a poor connection found?	—	Go to Step 14	Go to Step 12
9	1. Check the MAF signal circuit between the PCM and the MAF sensor for an open, short to ground, short to the MAF sensor ground circuit, or short to voltage. 2. If the MAF sensor signal circuit is open or shorted, repair as necessary. Was the MAF signal circuit open or shorted?	—	Go to Step 14	Go to Step 13
10	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Go to Step 14	—
11	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Go to Step 14	—
12	Replace the MAF sensor. Is the action complete?	—	Go to Step 14	—
13	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 14	—
14	1. Using the scan tool, select DTC, Clear Info. 2. Start the engine and idle until normal operating temperature is reached. 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 15	Go to Step 2
15	Using the scan tool, select Capture Info, Review Info. Are any additional DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

## DTC P0103 MAF Sensor Circuit High Frequency



56429

### Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on, engine coolant temperature, throttle angle and engine speed.

DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor. This is a type B DTC.

### Conditions for Setting the DTC

- The engine is running.
- Engine run time is greater than 2 seconds.
- Engine Speed.
- Above conditions present for over 2 seconds.
- MAF signal frequency is greater than 10496 Hertz

### Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) on the second consecutive fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and the Fail Records data.

**Conditions for Clearing the MIL/DTC**

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0103 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0103 can be cleared by using the scan tool Clear Info function.

**Diagnostic Aids**

Check for the following conditions:

- Poor connection at PCM Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness Inspect the wiring harness for damage. If the harness appears to be OK, observe the scan tool while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

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

- This step verifies that the problem is present at idle.
- A frequency reading with the MAF sensor connector disconnected indicates an Electro-Magnetic Interference (EMI) related fault or a poor connection.
- This vehicle is equipped with a PCM which utilizes an Electrically Erasable Programmable Read Only Memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to *PCM Replacement/Programming*.

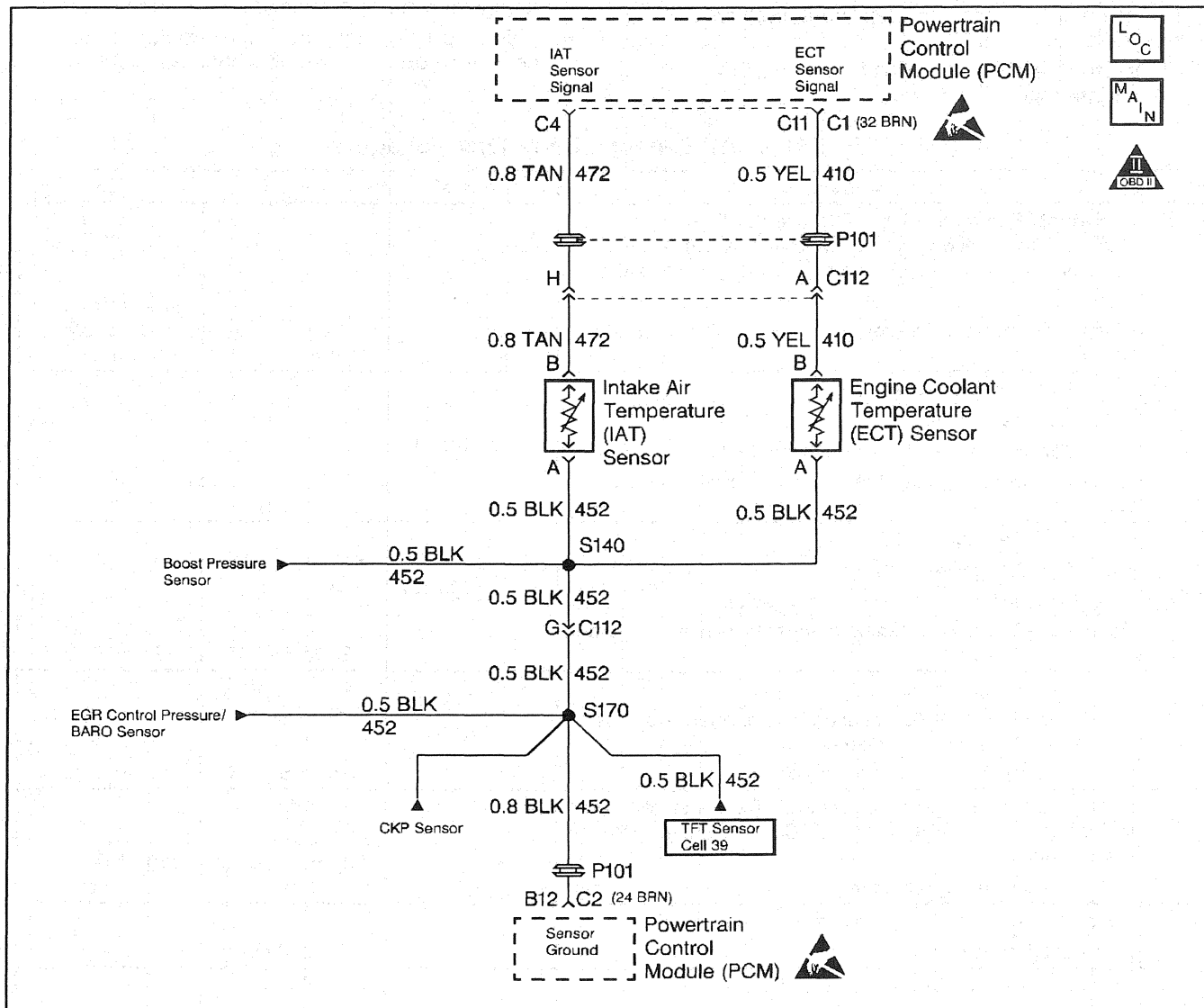
**DTC P0103 MAF Sensor Circuit High Frequency**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTC(s) use the scan tool to record Freeze Frame and Failure Records for reference, as data will be lost when the Clear Info function is used. Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Start the engine. 2. With the engine idling, monitor the MAF display on the scan tool. Is the MAF display above the specified value?	10496 Hz	Go to Step 4	Go to Step 3
3	1. Turn the ignition ON, engine OFF. 2. Review and record the scan tool Fail Records data. 3. Operate the vehicle within the Fail Records conditions as noted. 4. Using a scan tool, monitor the Specific DTC info for DTC P0103. Does the scan tool indicate DTC P0103 Failed This Ign?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Turn the ignition OFF. 2. Disconnect the MAF sensor connector. 3. Turn the ignition ON, engine idling. 4. Using a scan tool, monitor the MAF display. Does the scan tool indicate a MAF display at the specified value?	00 Hz	Go to Step 5	Go to Step 7
5	1. Check for a poor connection at the MAF sensor harness terminals. 2. If a poor connection is found, replace the terminal(s). Was a poor connection found?	—	Go to Step 10	Go to Step 6
6	Replace the MAF sensor. Is the action complete?	—	Go to Step 10	—

## DTC P0103 MAF Sensor Circuit High Frequency (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check the MAF sensor harness for incorrect routing. Verify the harness is not near aftermarket add-ons. 2. If incorrect routing is found, correct harness routing. Was a problem found?	—	Go to Step 10	Go to Step 8
8	1. Check the MAF sensor signal circuit terminal connections at the PCM. 2. If a poor connection is found, repair as necessary. Was a poor connection found?	—	Go to Step 10	Go to Step 9
9	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 10	—
10	1. Using the scan tool, select DTC, Clear Info. 2. Start the engine and idle until normal operating temperature is reached. 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 additional DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

## DTC P0112 IAT Sensor Circuit Low Voltage



56422

## 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. This is a type B DTC.

## 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 71 °C (160 °F) 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*. A skewed sensor could result in poor driveability complaints. Refer to *Temperature vs Resistance*.

**Test Description**

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

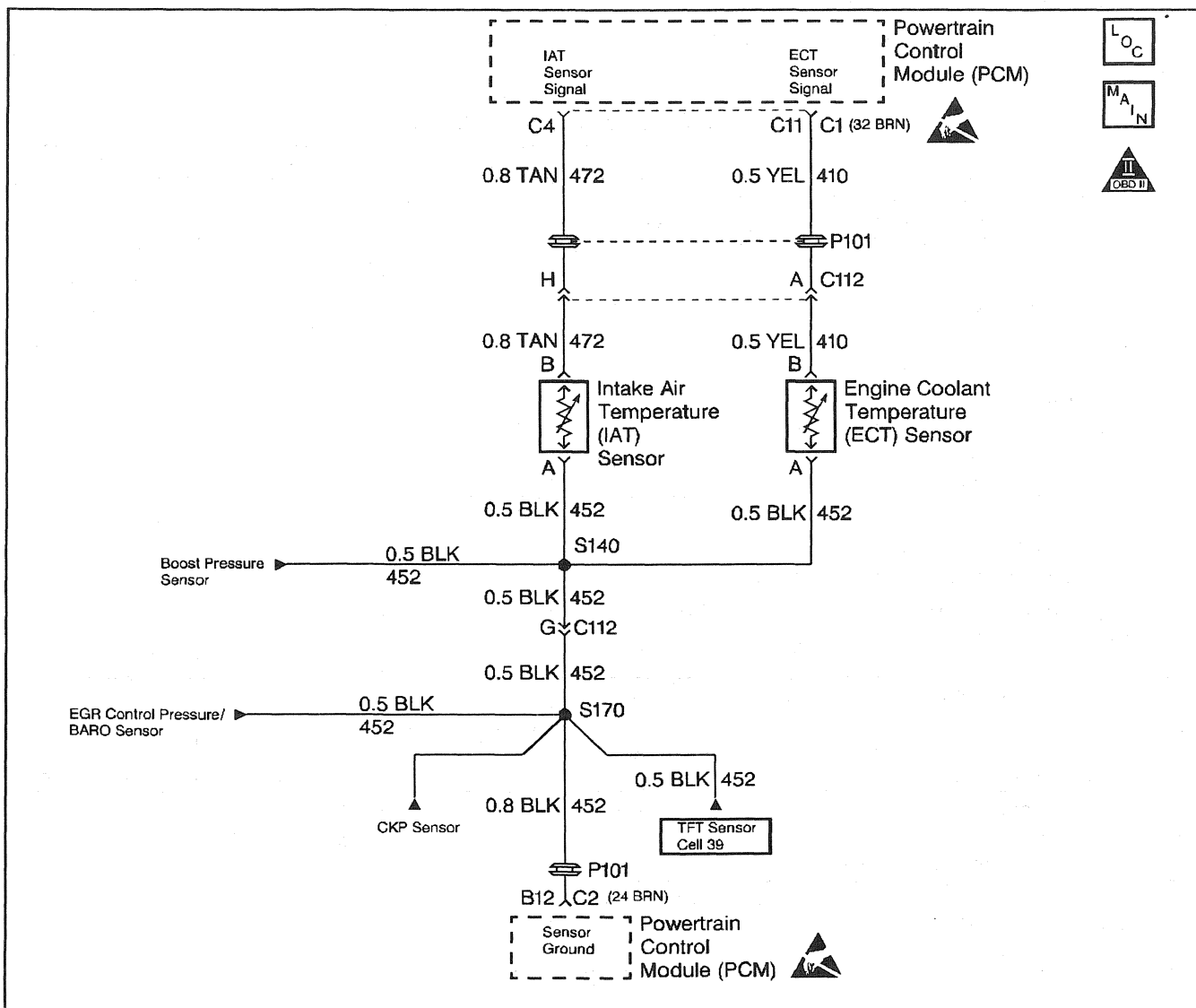
2. This Step determines if P0112 is a hard failure or an intermittent condition.

3. This test will determine if the PCM can recognize an open sensor.
4. This step will determine if the problem is a short to ground or a malfunctioning PCM.

**DTC P0112 IAT Sensor Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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. Does the IAT display a temperature colder 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 <i>J 39200</i> , measure the resistance across the IAT 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 to those table(s). Are any 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. Refer to <i>IAT Sensor</i> . Is the action complete?	—	Go to Step 9	—
8	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 P0113 IAT Sensor Circuit High Voltage



56422

### 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. This is a type B DTC.

### Conditions for Setting the DTC

- Engine operating for 8 minutes.
- IAT less than or equal to  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ).
- 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  $5^{\circ}\text{C}$  ( $40^{\circ}\text{F}$ ) from start up coolant temperature and engine coolant temperature exceeds  $71^{\circ}\text{C}$  ( $160^{\circ}\text{F}$ ) that same ignition cycle.
- Use of a Scan Tool.

### Diagnostic Aids

The scan tool displays intake air temperature in degrees centigrade. Refer to *Intermittents*. A skewed sensor could result in poor driveability complaints. Refer to *Temperature vs Resistance*.

**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 malfunctioning PCM.

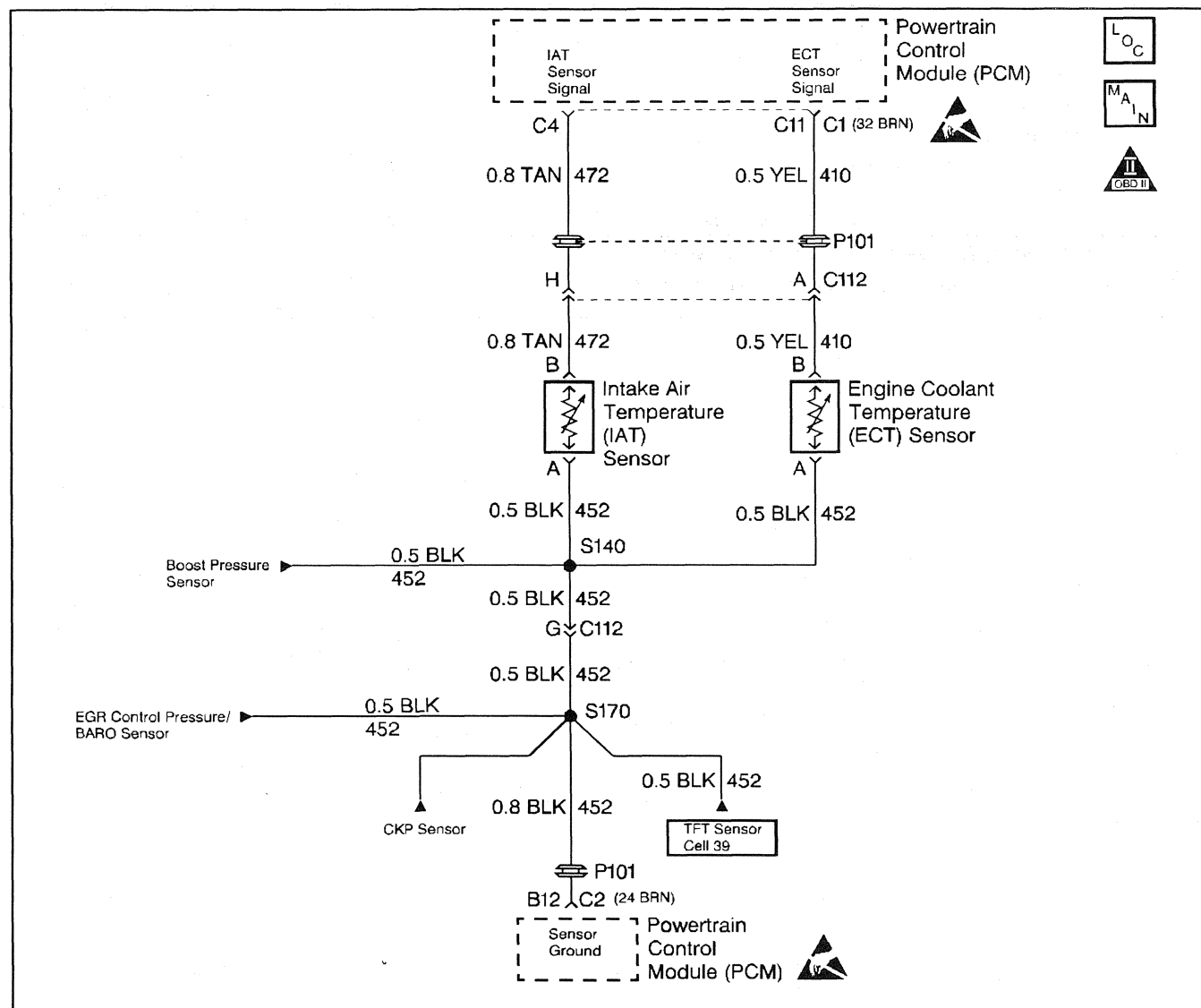
**DTC P0113 IAT Sensor Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the IAT display on scan tool.  Does the IAT display a temperature 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 a 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 other DTCs are stored, refer to Diagnostic Aids.  Are there any other 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 IAT sensor. Refer to <i>IAT Sensor</i> .  Is the action complete?	—	Go to Step 12	—
11	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  Is the action complete?	—	Go to Step 12	—

## DTC P0113 IAT Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 13	—
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 P0117 ECT Sensor Circuit Low Voltage



56422

### 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 the harness routing for a potential short to ground. After the engine is started, the ECT temperature should rise steadily to about 85 °C (185 °F). Refer to *Intermittents*. A skewed sensor could result in poor driveability complaints. Refer to *Temperature vs Resistance*.

**Test Description**

The numbers below refer to the step numbers on the diagnostic table.

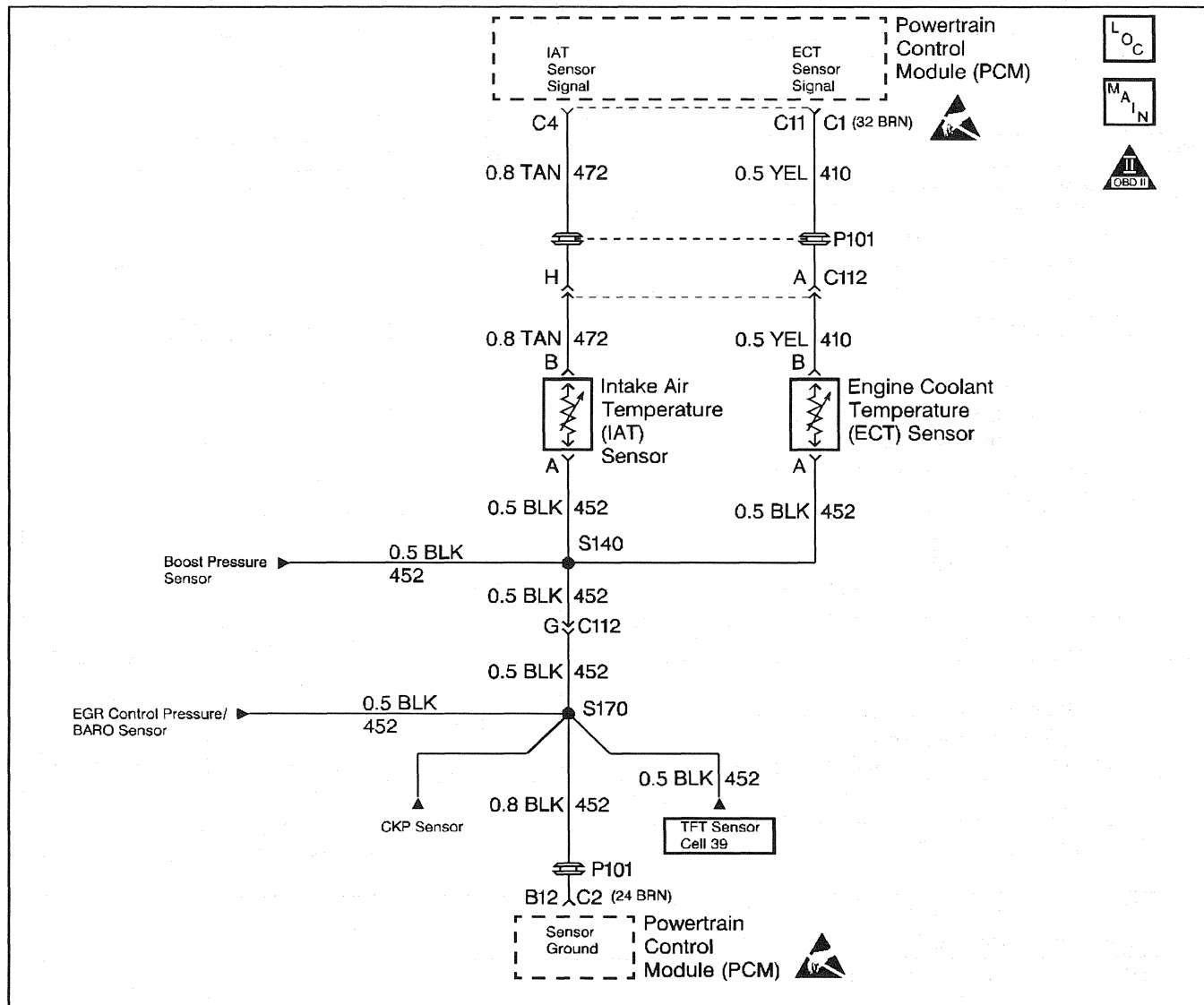
2. If the fault is still present, the engine coolant voltage will greater than 151 °C (303 °F).

3. This test simulates a DTC P0117. If the PCM recognizes the high signal voltage (low temperature) the PCM and the wiring are okay.
4. This step will determine if the problem is a short to ground or a malfunctioning PCM.

**DTC P0117 ECT Sensor Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing the DTCs, use the scan tool to record the Freeze Frame and the Failure Records for reference. This data will be lost when the Clear Info function is used.  Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Connect the scan tool. 2. Start the engine. 3. Monitor the Engine Coolant Temperature (ECT) display on scan tool.  Does the scan tool display an ECT greater than the specified value?	151 °C (303 °F)	Go to Step 3	Go to Step 5
3	1. Turn off the engine. 2. Turn ON the ignition. 3. Disconnect the ECT sensor connector.  Does the scan tool display an ECT a temperature colder than or equal to the specified value?	-30 °C (-22 °F)	Go to Step 7	Go to Step 4
4	1. Turn off the ignition. 2. Using the <i>J 39200</i> , 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	The DTC is intermittent. If no additional DTCs are stored, refer to the Diagnostic Aids. If the additional DTCs are stored, refer to those tables first.  Are any additional DTCs stored?	—	Go to The Applicable DTC Table	Go to Diagnostic Aids
6	Repair the short to the ground in the ECT signal circuit. Is the action complete?	—	Go to Step 9	—
7	Replace the ECT sensor. Refer to <i>ECT Sensor</i> . Is the replacement complete?	—	Go to Step 9	—
8	Replace the PCM. <b>Important:</b> If the PCM is malfunctioning, reprogram the PCM. Refer to <i>PCM Replacement/Programming</i> .  Is the replacement complete?	—	Go to Step 9	—
9	1. Using the scan tool, select the DTC and the Clear Info. 2. Start the Engine. 3. Idle the Engine at the normal operating temperature. 4. Select the DTC and the Specific. 5. Enter the DTC number which was set. 6. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 10	Go to Step 2
10	Using the scan tool, select the Capture Info and the Review Info.  Are any DTCs displayed that have not been diagnosed?	—	Go to The Applicable DTC Table	System OK

## DTC P0118 ECT Sensor Circuit High Voltage



56422

### 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 running for at least 8 minutes.
- ECT less than  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ).
- 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  $5^{\circ}\text{C}$  ( $40^{\circ}\text{F}$ ) from start up coolant temperature and engine coolant temperature exceeds  $71^{\circ}\text{C}$  ( $160^{\circ}\text{F}$ ) that same ignition cycle.
- Use of a Scan Tool.

### Diagnostic Aids

Check harness routing for a potential short to voltage. After engine is started, the ECT temperature should rise steady to about  $85^{\circ}\text{C}$  ( $185^{\circ}\text{F}$ ). A skewed sensor could result in poor driveability complaints. Refer to *Temperature vs Resistance*.

**Test Description**

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

2. This test determines if P0118 is an intermittent condition.

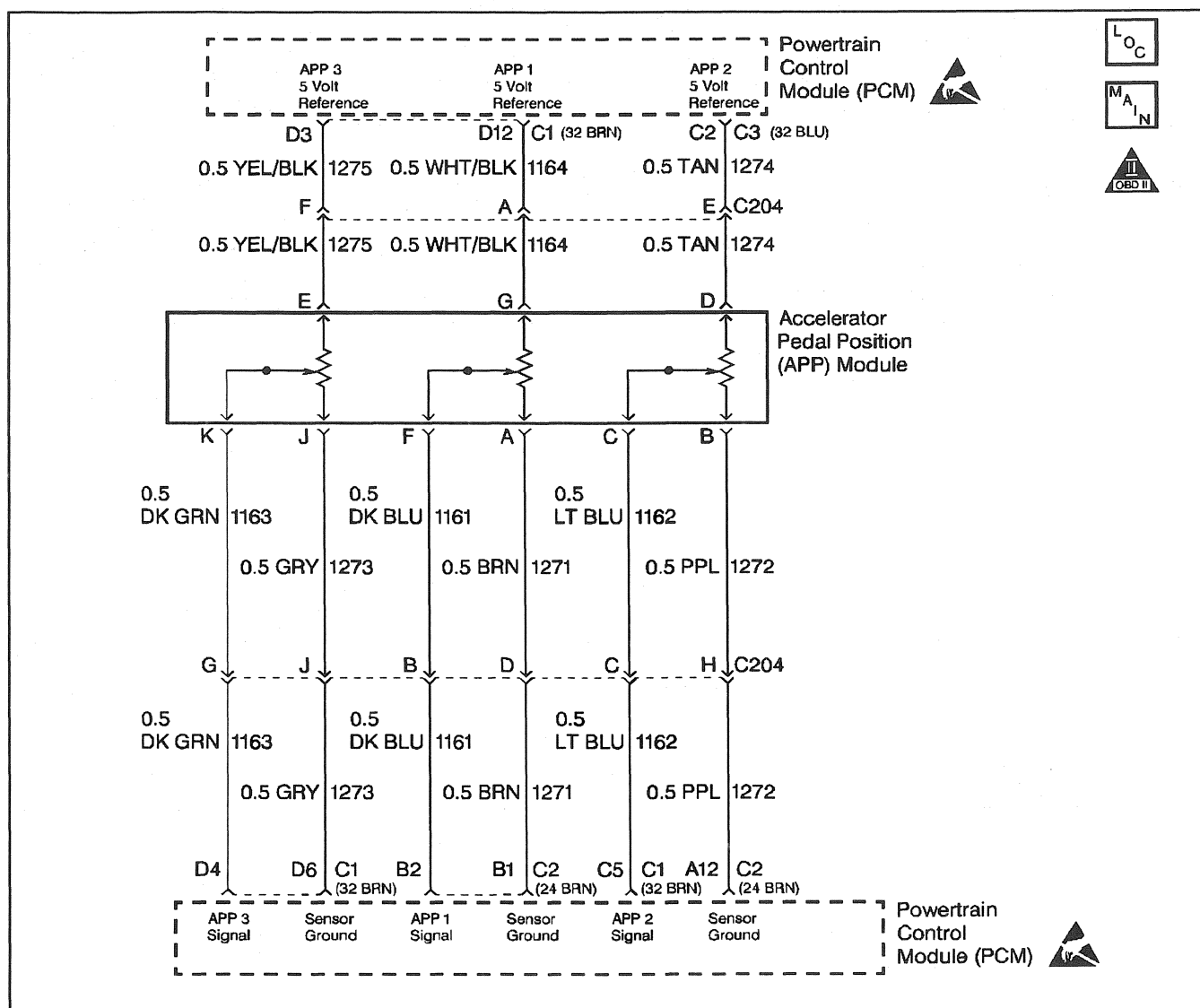
3. This test will determine if signal circuit is open, or a malfunctioning PCM.

**DTC P0118 ECT Sensor Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the ECT display on scan tool. Does the ECT display a temperature 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 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	The DTC is intermittent. If no other DTC(s) are stored, refer to Diagnostic Aids. Are there any other 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 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 ECT sensor. Refer to <i>ECT Sensor</i> . Is the action complete?	—	Go to Step 12	—
11	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 12	—

## DTC P0118 ECT Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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



56421

- The input from APP 1 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.
- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

An intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

A scan tool reads APP 1 position in volts. It should read about 0.45 to 0.95 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 cannot read). The scan tool reads only output voltages.

**Test Description**

Number(s) below refer to the step 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.

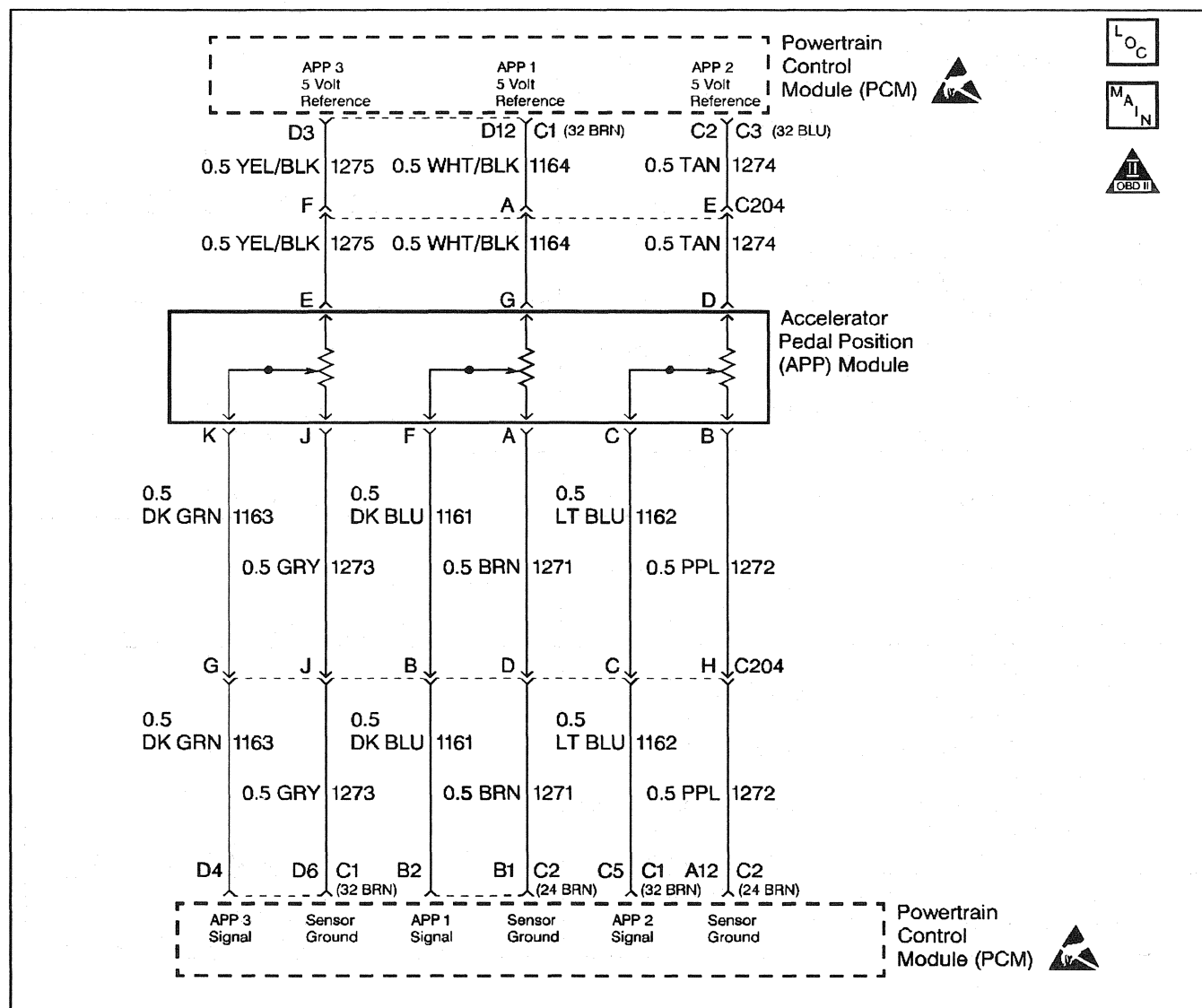
**DTC P0121 APP Sensor 1 Circuit Performance**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe APP voltages on the scan tool.  Are APP voltages at specified values (values listed are APP 1, APP 2, and APP 3 respectively)?	0.45–0.95V 4.0–4.5V 3.6–4.1V	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 the applicable DTC table(s) first.  Are any additional DTCs stored?	—	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 <i>J 39200</i> connected to ground, probe APP sensor 5 volt reference circuits at APP harness terminals G, D, and E.  Is the voltage greater than or equal to 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

## DTC P0121 APP Sensor 1 Circuit Performance (cont'd)

Step	Action	Value(s)	Yes	No
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. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 APP Sensor 1 Circuit Low Voltage



56421

### 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 D 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.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

A scan tool reads APP 1 position in volts. Should read about 0.45 to 0.95 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 0.74 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 step 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.

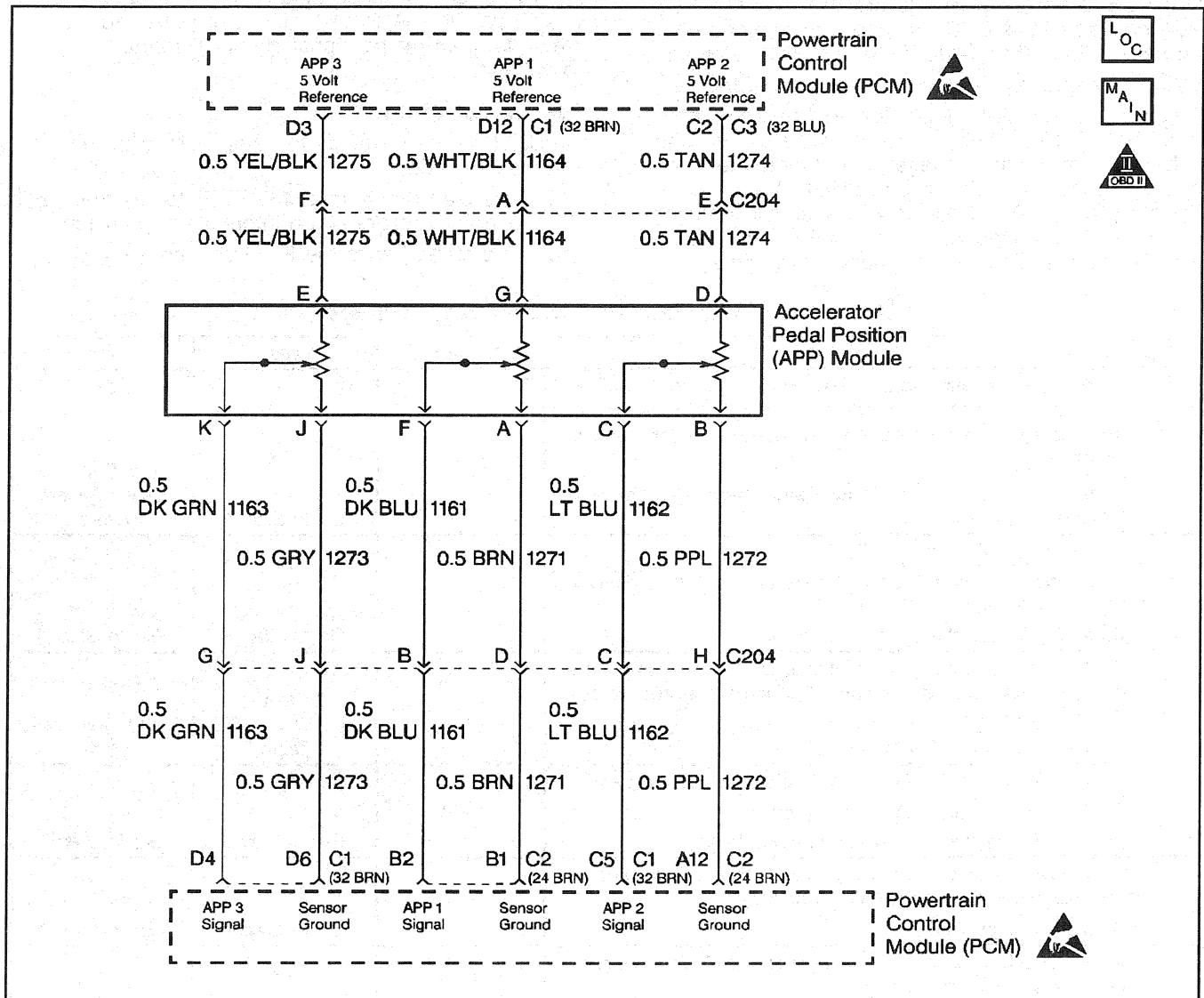
**DTC P0122 APP Sensor 1 Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	<i>Go to Step 2</i>	<i>Go to Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the APP 1 voltage on the Scan Tool.  Is APP 1 voltage less than or equal to the specified value?	0.25V	<i>Go to Step 4</i>	<i>Go to Step 3</i>
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 any additional DTCs stored?	—	<i>Go to the Applicable DTC Table</i>	<i>Go to Diagnostic Aids</i>
4	1. Disconnect the APP sensor electrical connector. 2. Jumper the APP 1 signal circuit and the 5 volt reference circuit 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	<i>Go to Step 10</i>	<i>Go to Step 5</i>
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	<i>Go to Step 6</i>	<i>Go to Step 8</i>
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?	—	<i>Go to Step 12</i>	<i>Go to Step 7</i>
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace terminal if necessary.  Did the terminal require replacement?	—	<i>Go to Step 13</i>	<i>Go to Step 12</i>

## DTC P0122 APP Sensor 1 Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
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 it as necessary. Was the 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. Refer to <i>APP Module</i> Is the action complete?	—	Go to Step 13	—
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 14	Go to Step 2
14	Using the Scan Tool, select Capture Info, Review Info. Are there any DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

## DTC P0123 App Sensor 1 Circuit High Voltage



56421

### 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 D DTC.

### Conditions for Setting the DTC

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

### Action Taken When the DTC Sets

- The input from APP 1 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

An intermittent may be caused by the following:

A scan tool reads APP 1 position in volts. Should read about 0.45 to 0.95 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 0 APP operation. Scan APP 1 sensor while depressing accelerator pedal with engine

stopped and ignition ON. Display should vary from about 0.74 volt when throttle was closed to about 3.7 volt 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.

**Test Description**

Number(s) below refer to the step 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.

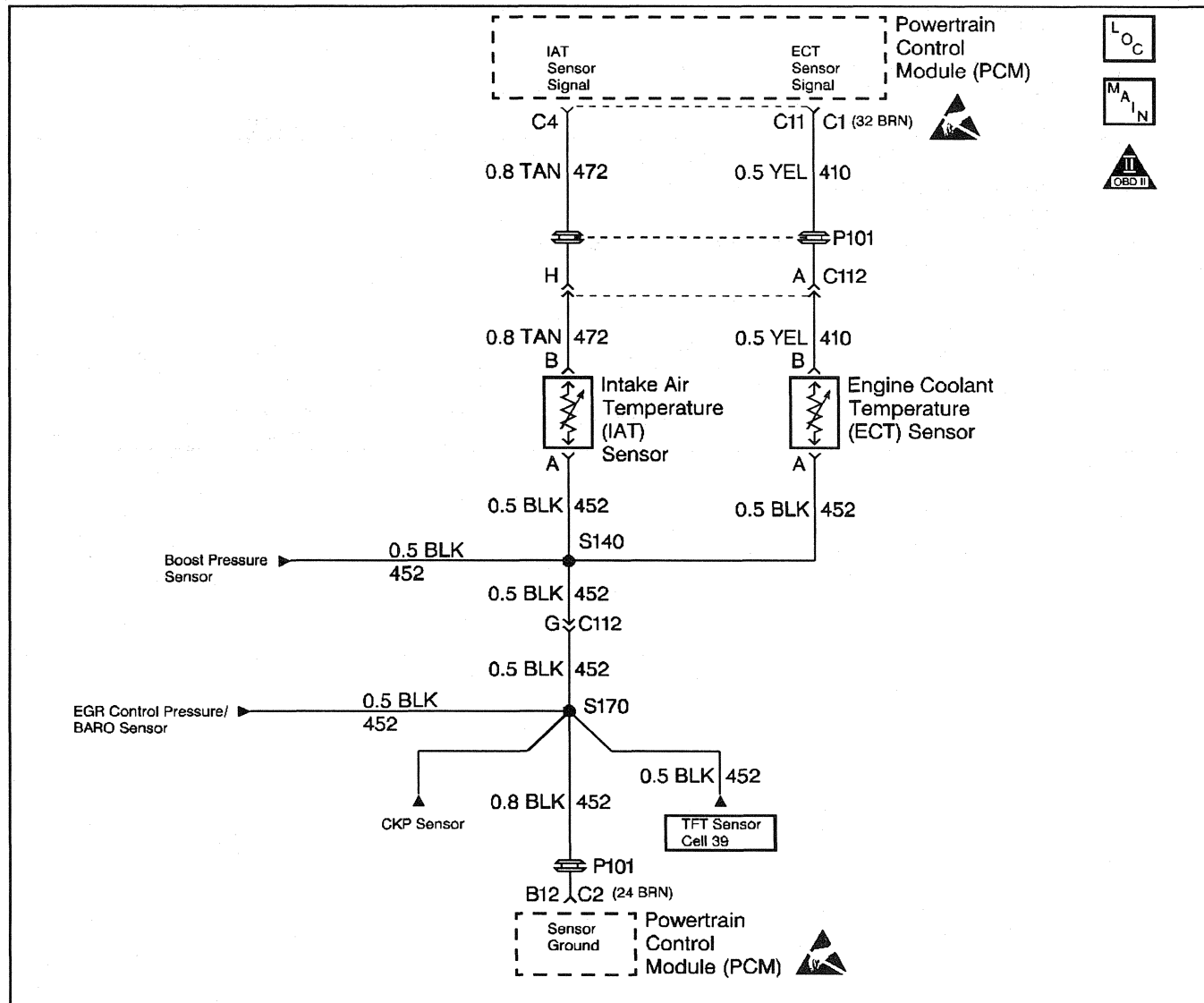
**DTC P0123 App Sensor 1 Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the 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 the applicable DTC table(s) first.  Are any 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 1 display on the scan tool.  Is APP 1 less than the specified value?	0.25V	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 it as necessary.  Was APP 1 sensor ground circuit open?	—	Go to Step 11	Go to Step 10
9	Replace the APP module. Refer to <i>APP Module</i> .  Is the action complete?	—	Go to Step 11	—

## DTC P0123 App Sensor 1 Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	<i>Go to Step 11</i>	—
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic Passed?	—	<i>Go to Step 12</i>	<i>Go to Step 2</i>
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 P0126 Insufficient ECT for Stable Operation



56422

### Circuit Description

While the engine is warming, the PCM monitors the ECT sensor to determine how long it takes the engine to reach the coolant temperature required for Closed Loop operation. DTC P0126 will set if the PCM determines that the engine does not reach Closed Loop temperature in a specified amount of time. This test will not run if either the intake air or engine coolant temperature is too low at start up. The PCM will only run this DTC on a cold start and only once per cold start. This is a type B DTC.

### Conditions for Setting the DTC

- Engine run time greater than 600 seconds.
  - DTCs P0112, P0113, P0117, P0118, not set.
  - Engine coolant less than 56°C (133°F).
- or
- Intake air greater than -7°C (20°F).
  - Fuel burned since start is greater than 1,000,000 cu. mm.
  - Total idle time since start is less than 450 seconds.
1. Engine run time greater than 300 seconds.
  2. DTCs P0112, P0113, P0117, P0118, not set.
  3. Engine coolant less than 56°C (133°F).
  4. Intake air greater than -7°C (20°F).
  5. Fuel burned since start is greater than 468,120 cu. mm.
  6. Total idle time since start is less than 225 seconds.

**Action Taken When the DTC Sets**

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) on the second consecutive drive trip that the diagnostic runs and fails.
- The PCM will record operating conditions at the time the diagnostic fails. The first time the diagnostic fails, this information will be stored in Failure Records. If the diagnostic reports a failure on the second consecutive drive trip, the operating conditions at the time of failure will be written to Freeze Frame and the Failure record will be updated.

**Conditions for Clearing the MIL/DTC**

- The PCM will turn the MIL OFF after three consecutive drive trips that the diagnostic runs and does not fail.
- A last test failed (Current DTC) will clear when the ignition is cycled and the diagnostic runs and does not fail.
- A History DTC will clear after forty consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- PCM battery voltage is interrupted.
- Using a Scan tool.

**Diagnostic Aids**

- Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or Failure Records data can be useful in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also be used to determine how many ignition cycles the diagnostic reported a pass and/or a fail. Operate vehicle within the same freeze frame conditions (RPM, load, vehicle speed, temperature etc.) that were noted. This will isolate when the DTC failed.

- If other DTCs are set that share the same ground and/or 5.0 volt reference circuit, check for faulty connections and for faulty wiring.
- If the engine has been allowed to sit overnight, the engine coolant temperature and intake air temperature values should display within a few degrees of each other.
- If the engine coolant temperature exceeds 60°C (140°F), this indicates that the engine is capable of reaching the proper temperature, but not necessarily in the correct amount of time. This diagnostic table must be repeated on a cold engine, engine coolant and intake air temperature less than 50°C (122°F) and within 3°C (5°F) of each other, and the time required to reach the temperature threshold must be measured. When starting a cold engine, measure the amount of time it takes the engine to reach the specified temperature. The engine should reach the specified temperature within 8 minutes. If the specified temperature is not reached within 7 minutes, check the following:
  - Coolant level.
  - Thermostat operation.
  - Cooling fan.
  - Refer to *Engine Cooling System (6B)* for additional information.

**Test Description**

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

2. An ECT failure could cause a DTC P0126 to set, so correct any ECT DTCs that are set.
6. If it is obvious that the engine is not reaching full operating temperature, for example the radiator hoses never gets very warm, or there is a complaint of little or no heat from the heater, this step could be skipped.

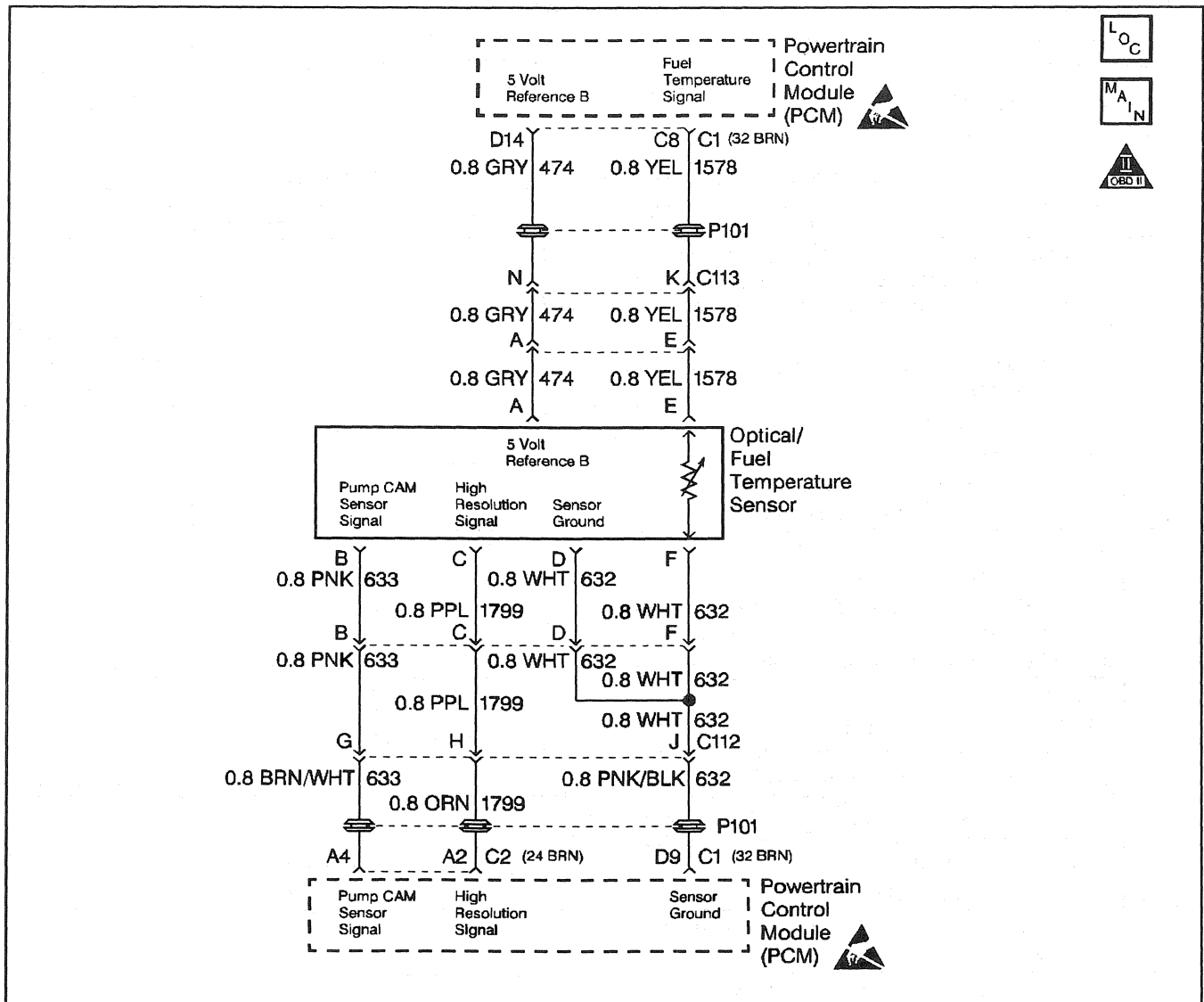
**DTC P0126 Insufficient ECT for Stable Operation**

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Are any engine coolant temperature DTCs set?	—	Go to applicable DTC table	Go to Step 3
3	1. Install the scan tool. 2. Turn the ignition ON, engine OFF. 3. Disconnect the ECT sensor. Does scan tool indicate the ECT sensor is less than the specified value?	-35°C (-31°F)	Go to Step 4	Go to <i>DTC P0117 ECT Sensor Circuit Low Voltage</i>
4	Using a jumper wire, jumper terminals at the ECT sensor harness connector together. Does the scan tool indicate the ECT is greater than the specified value?	150°C (302°F)	Go to Step 5	Go to <i>DTC P0118 ECT Sensor Circuit High Voltage</i>

## DTC P0126 Insufficient ECT for Stable Operation (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Reconnect the ECT sensor. 2. Start and idle the engine. 3. With the engine idling, observe the ECT sensor display on the Engine 1 Data List of the scan tool.  <b>Important:</b> Allow time for the engine to warm up if it has not already reached the specified temperature. 7 minutes is the maximum amount of time it should take to reach this temperature from a cold start. Less time should be necessary if the engine is already warm.  Does the scan tool indicate the engine coolant temperature reached the specified value?	60°C (140°F)	System must be rechecked on a cold start. Refer to Diagnostic Aids	Go to Step 6
6	Using a DVM (J 39200), measure the resistance of the ECT sensor. Refer to <i>Temperature vs Resistance</i> Is the ECT resistance close to the value indicated in the Temperature Vs Resistance Table?	—	Go to Step 7	Go to Step 8
7	For an engine cooling system problem, check for the following conditions: <ul style="list-style-type: none"> <li>• Thermostat operation</li> <li>• Coolant level</li> <li>• Coolant to water ratio</li> <li>• Cooling fan operation etc.</li> </ul> Refer to <i>Engine Cooling System</i> . Is the action complete?	—	Go to Step 9	—
8	Replace the ECT sensor. Refer to <i>ECT Sensor</i> . Is the action complete?	—	Go to Step 9	—
9	1. Using the scan tool, select DTC, Clear Info. 2. Start the 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 the diagnostic RAN.  Does the scan tool indicate that this test 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 P0182 Fuel Temperature Sensor CKT 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.

An intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

**Test Description**

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

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

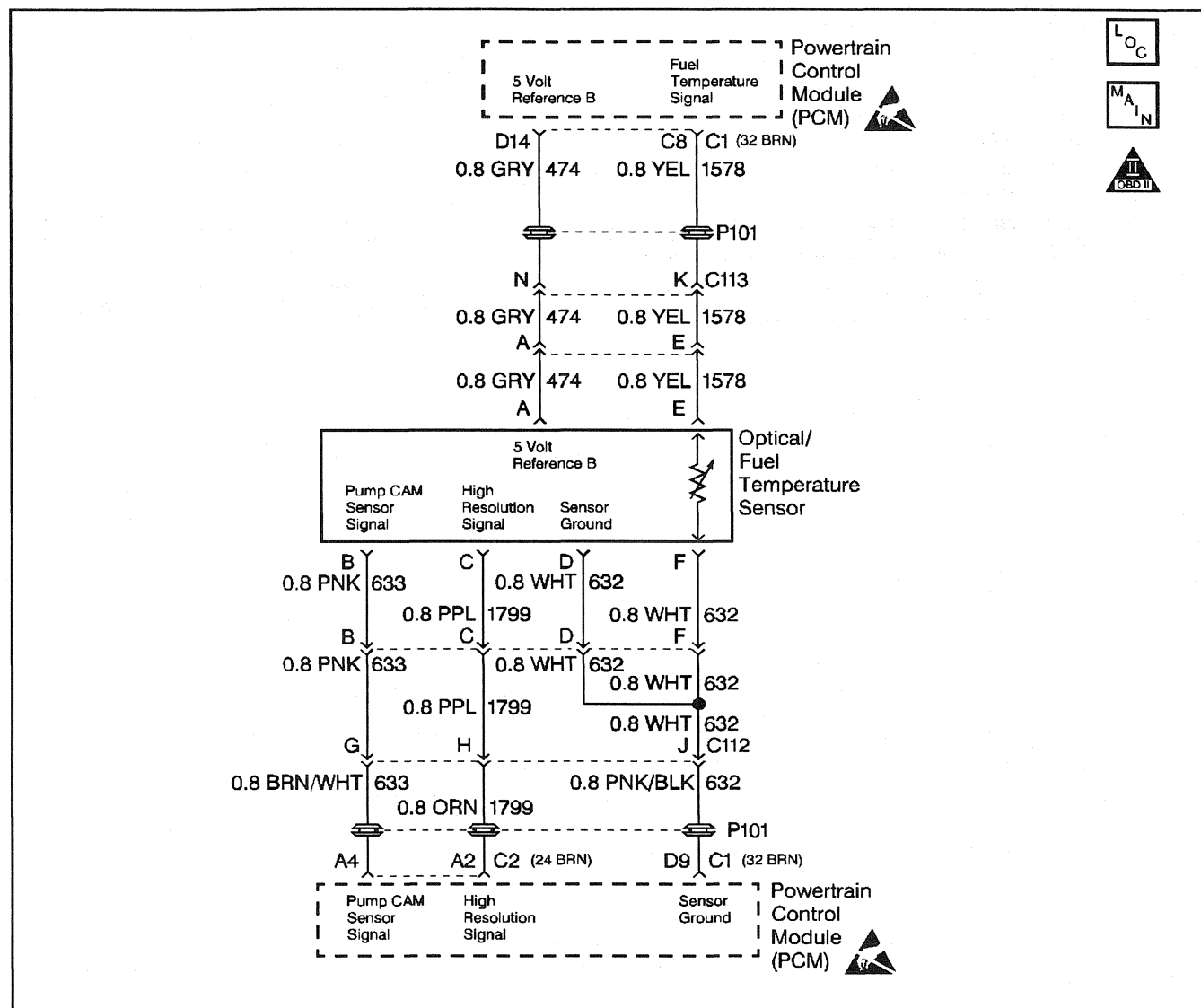
**DTC P0182 Fuel Temperature Sensor CKT Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Scan tool connected. 2. Start the engine. 3. Monitor the Fuel Temp display on 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 <i>J 39200</i> 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 to the applicable DTC table(s) first. Are additional DTC(s) stored?	—	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. Refer to <i>Fuel Injection Pump</i> . <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . Is the action complete?	—	Go to Step 9	—
8	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 9	—

**DTC P0182 Fuel Temperature Sensor CKT Low Voltage (cont'd)**

Step	Action	Value(s)	Yes	No
9	<ol style="list-style-type: none"><li>1. Using the Scan Tool, select DTC, Clear Info.</li><li>2. Start engine and idle at normal operating temperature.</li><li>3. Select DTC, Specific, then enter the DTC number which was set.</li><li>4. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li></ol> Does the Scan Tool indicate that the diagnostic 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 CKT High Voltage



56420

### 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 18 °C (64 °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. A faulty connection, or an open in the signal circuit.

An intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation

### Test Description

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

2. This step determines if DTC P0183 is a hard failure or an intermittent condition.

3. This test simulates 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. This will determine if there is a wiring problem or a malfunctioning PCM.

### DTC P0183 Fuel Temperature Sensor CKT High Voltage

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Scan Tool connected. 2. Start and idle engine. 3. Monitor the Fuel Temp display on Scan Tool. Is Fuel Temp less than or equal to 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 other DTC(s) are stored, refer to Diagnostic Aids. If additional DTCs are stored, refer to those table(s) first. 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 12
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 10
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 the PCM connectors for proper connections and replace terminals, if necessary. Was a problem found?	—	Go to Step 13	Go to Step 12

## DTC P0183 Fuel Temperature Sensor CKT High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the injection pump. Refer to <i>Fuel Injection Pump</i> <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . Is the action complete?	—	Go to Step 13	—
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 this DTC as specified in the supporting text. Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 14	Go to Step 2
14	Using the Scan Tool, select Capture Info, Review Info. Are there any DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

**DTC P0215 Engine Shutoff Control Circuit**

Refer to *PCM, Fuel Solenoid Driver, Water in Fuel Sensor*.

**Circuit Description**

The injection pump 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 step number(s) on the Diagnostic Table.

- This step will check the control circuit for an open.

**DTC P0215 Engine Shutoff Control Circuit**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Ignition OFF. 2. Disconnect the ESO harness electrical connector. 3. Ignition ON, engine OFF. 4. With a test light connected to chassis ground, probe the ESO ignition feed circuit at the engine harness connector. Is test light ON?	—	Go to Step 3	Go to Step 5
3	1. Ignition OFF 2. With a test light, jumper the ESO engine harness terminals together. 3. Ignition ON, engine OFF. Is test light ON?	—	Go to Step 4	Go to Step 6
4	Check the ESO and the PCM harness for a poor connection and replace terminals if necessary. Did the terminal require replacement?	—	Go to Step 9	Go to Step 7
5	1. Check the ESO ignition feed circuit for: • An open wire • An open fuse 2. If the ESO ignition feed circuit was faulty, repair it as necessary. Was a repair performed?	—	Go to Step 9	—

## DTC P0215 Engine Shutoff Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check the ESO control circuit for the following conditions: <ul style="list-style-type: none"> <li>• An open wire</li> <li>• Poor connection at the PCM.</li> </ul> 2. If the ESO control circuit was faulty, repair it as necessary. Was a repair performed?	—	Go to Step 09	Go to Step 8
7	Replace the injection pump. Refer to <i>Fuel Injection Pump</i> <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . Is the action complete?	—	Go to Step 9	—
8	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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

The diagram illustrates the wiring for the Ignition Timing Stepper (ITS) Motor. The motor is shown with two coils, Coil 1 and Coil 2, and a central motor symbol. The motor is labeled "Ignition Timing Stepper (ITS) Motor". The motor's internal components are labeled L\_O\_C, M\_A\_I\_N, and OBD II.

The motor is connected to the Powertrain Control Module (PCM) via a 4-pin connector. The wiring is as follows:

- Coil 1: 0.8 BLK 1031 (D) to 0.8 RED/BLK 1031 (C) to 0.8 TAN/BLK 1030 (A7) to ITS Coil 1 High.
- Coil 1: 0.8 BLK 1030 (A) to 0.8 ORN/BLK 1032 (B) to 0.8 TAN/BLK 1030 (A8) to ITS Coil 1 Low.
- Coil 2: 0.8 BLK 1032 (B) to 0.8 YEL/BLK 1033 (D) to 0.8 YEL/BLK 1033 (A9) to ITS Coil 2 Low.
- Coil 2: 0.8 BLK 1033 (C) to 0.8 YEL/BLK 1033 (E) to 0.8 YEL/BLK 1033 (A10) to ITS Coil 2 High.

The PCM is labeled "Powertrain Control Module (PCM)".

71687

2. This step determines if DTC P0216 is a hard failure or an intermittent.
4. This step checks for an open or short in the injection timing coil circuit 1.
5. This step checks for an open or short in the injection timing coil circuit 2.
6. 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 Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Engine at operating temperature. 2. Scan injection timing at idle and at 1500 RPM. Does scan tool display a difference greater than or equal to the specified value between Actual Inj Time and Desired Inj Time at idle or at 2700 RPMs?	5°	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 any additional DTCs stored?	—	Go to the Applicable 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 the PCM. 2. Disconnect Injection Timing Stepper motor. 3. Start and idle engine. 4. Using scan tool, command Time Set ON. 5. With J 39200 connected to ground, check for a varying voltage on all terminals at injection timing Stepper motor electrical harness. Does voltage vary on all circuits?	—	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 13
8	1. Reconnect all sensors. 2. Check for one of the following: • Injection timing set correctly. Refer to <i>Checking/Adjust Injection Timing</i> . • Sheared camshaft driven key. Refer to Engine Mechanical. 3. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 18	Go to Step 16

## DTC P0216 Injection Timing Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition OFF. 2. Disconnect the Stepper motor and check for an open or short in one of the following: <ul style="list-style-type: none"> <li>• Coil 1 low circuit</li> <li>• Coil 1 high circuit</li> <li>• If a problem is found, repair it as necessary.</li> </ul> Was a repair performed?	—	Go to Step 18	Go to Step 11
10	1. Ignition OFF. 2. Disconnect Stepper motor and check for an open or short in one of the following: <ul style="list-style-type: none"> <li>• Coil 2 low circuit</li> <li>• Coil 2 high circuit</li> <li>• If a problem is found, repair it as necessary.</li> </ul> Was a repair performed?	—	Go to Step 18	Go to Step 11
11	Check for poor electrical connection at the injection timing Stepper motor. Did any terminals require replacement?	—	Go to Step 18	Go to Step 16
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	1. Check crankshaft sensor pigtail for a short to ground. 2. If the circuit is shorted to ground, repair it as necessary. Was a repair performed?	—	Go to Step 18	Go to Step 15
14	Check the circuit for a poor connection and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 18	Go to Step 17
15	Replace crankshaft position sensor. Refer to <i>Crankshaft Position Sensor</i> . Is the action complete?	—	Go to Step 18	—
16	Replace Injection pump. Refer to <i>Fuel Injection Pump</i> . <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . Is the action complete?	—	Go to Step 18	—
17	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 18	—
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 P0219 Engine Overspeed Condition**

Refer to *PCM, Fuel Solenoid Driver, Water in Fuel Sensor*.

**Circuit Description**

The PCM has the ability to put the vehicle in a 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.

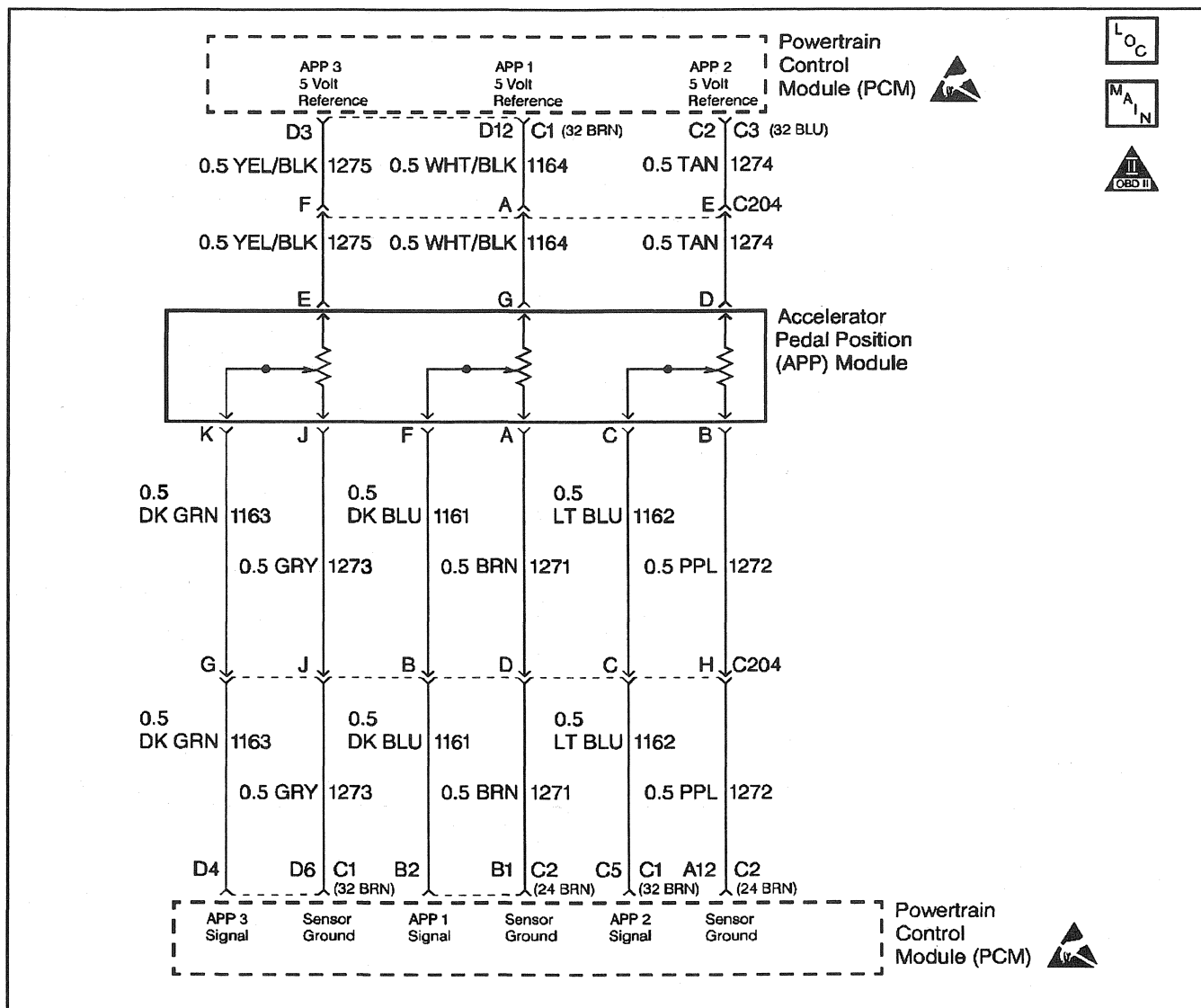
**Test Description**

Number(s) below refer to the step 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	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Replace Injection pump.  <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0220 APP Sensor2 Circuit**

56421

**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 D 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**

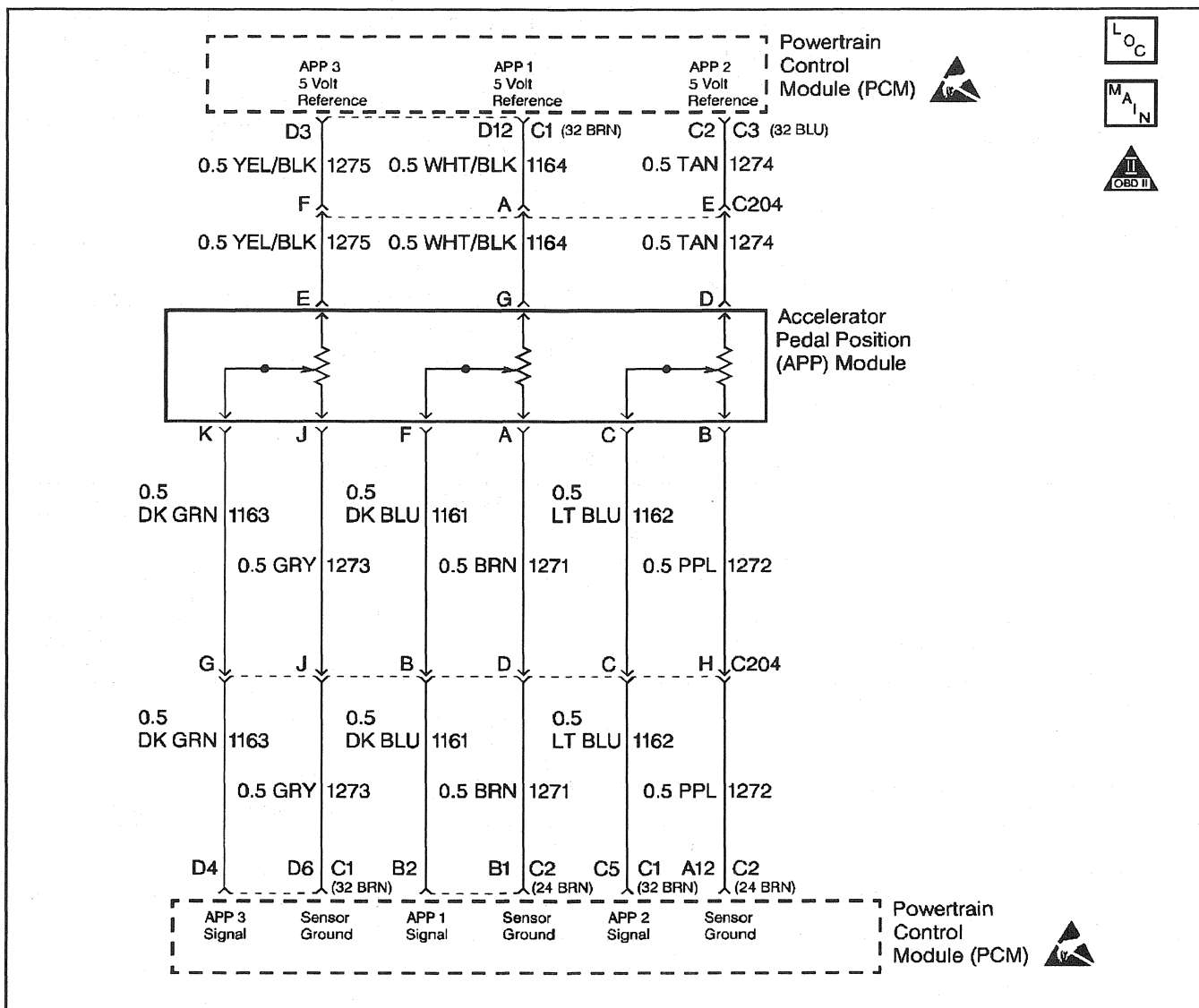
Number(s) below refer to the step number(s) on the Diagnostic Table.

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

**DTC P0220 APP Sensor2 Circuit**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Disconnect the APP sensor electrical connector. 2. Ignition ON, engine OFF. 3. With <i>J 39200</i> 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 table(s) first. Are additional DTC(s) 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 shorted to ground?	—	Go to Step 6	Go to Step 5
5	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 APP Sensor 2 Circuit Performance



56421

### 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 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.
- This DTC will not turn on the Service Throttle Soon lamp by itself.
- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

An intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

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 WOT. Also, 90% pedal travel is acceptable for correct APP operation. 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 step number(s) on the Diagnostic Table.

- This step determines if there is a good 5 volt reference.
- This step will check for an open in the ground circuit.

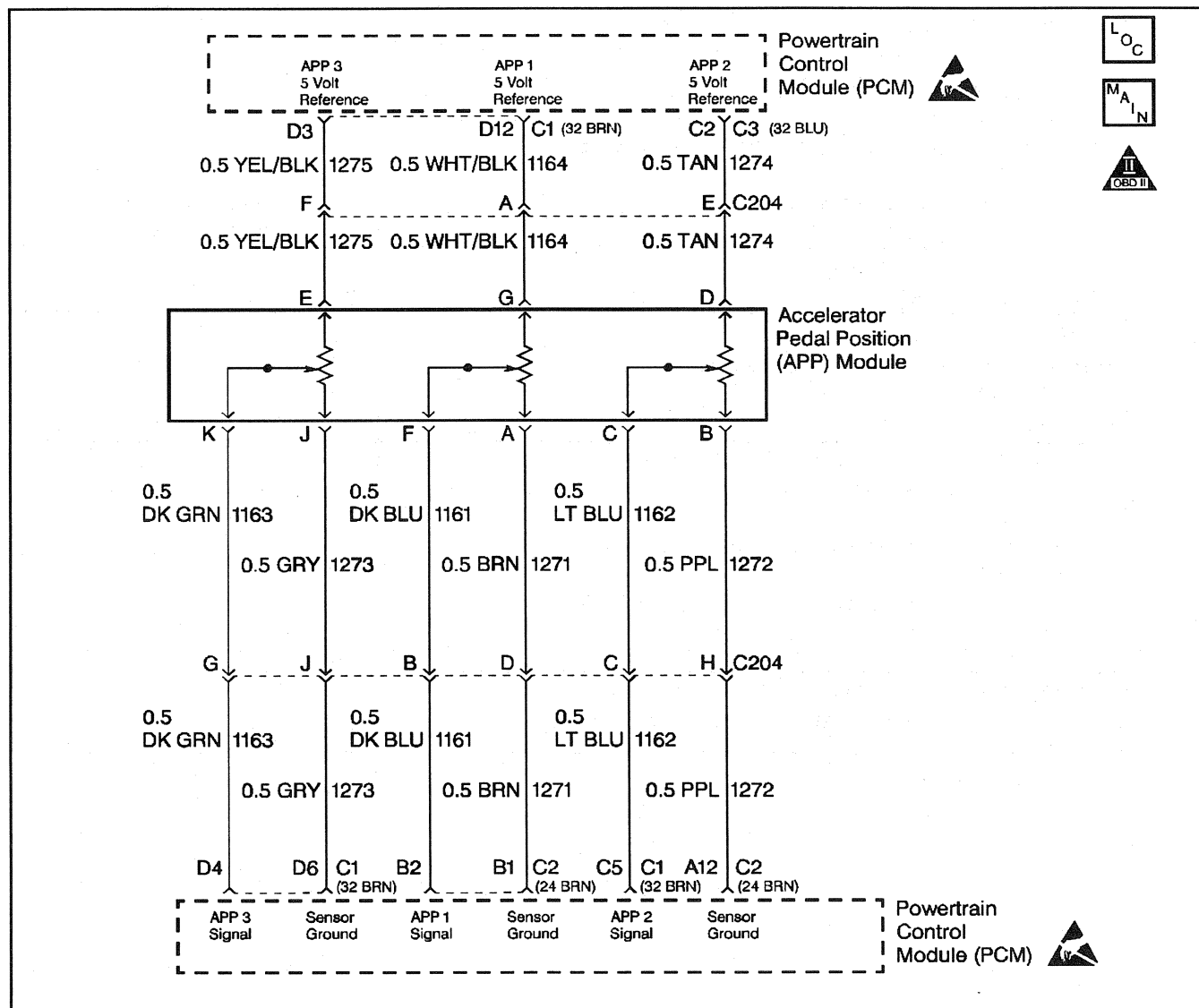
**DTC P0221 APP Sensor 2 Circuit Performance**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe APP voltages on the scan tool.  Are APP voltages at specified values (values are listed as APP 1, APP 2, and APP 3 respectively)?	0.45–0.95V 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 the applicable DTC table(s) first.  Are any additional DTCs stored?	—	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 greater than or equal to 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 it as necessary.  Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 11	Go to Step 7

## DTC P0221 APP Sensor 2 Circuit Performance (cont'd)

Step	Action	Value(s)	Yes	No
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. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 APP Sensor 2 Circuit Low Voltage



56421

### 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 D DTC.

### Conditions for Setting the DTC

- Voltage is less than .25 volt on APP 2 sensor.
- Condition met for 2 seconds.

### Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

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 WOT. Also, 90% pedal travel is acceptable for correct APP operation.

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 step 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.

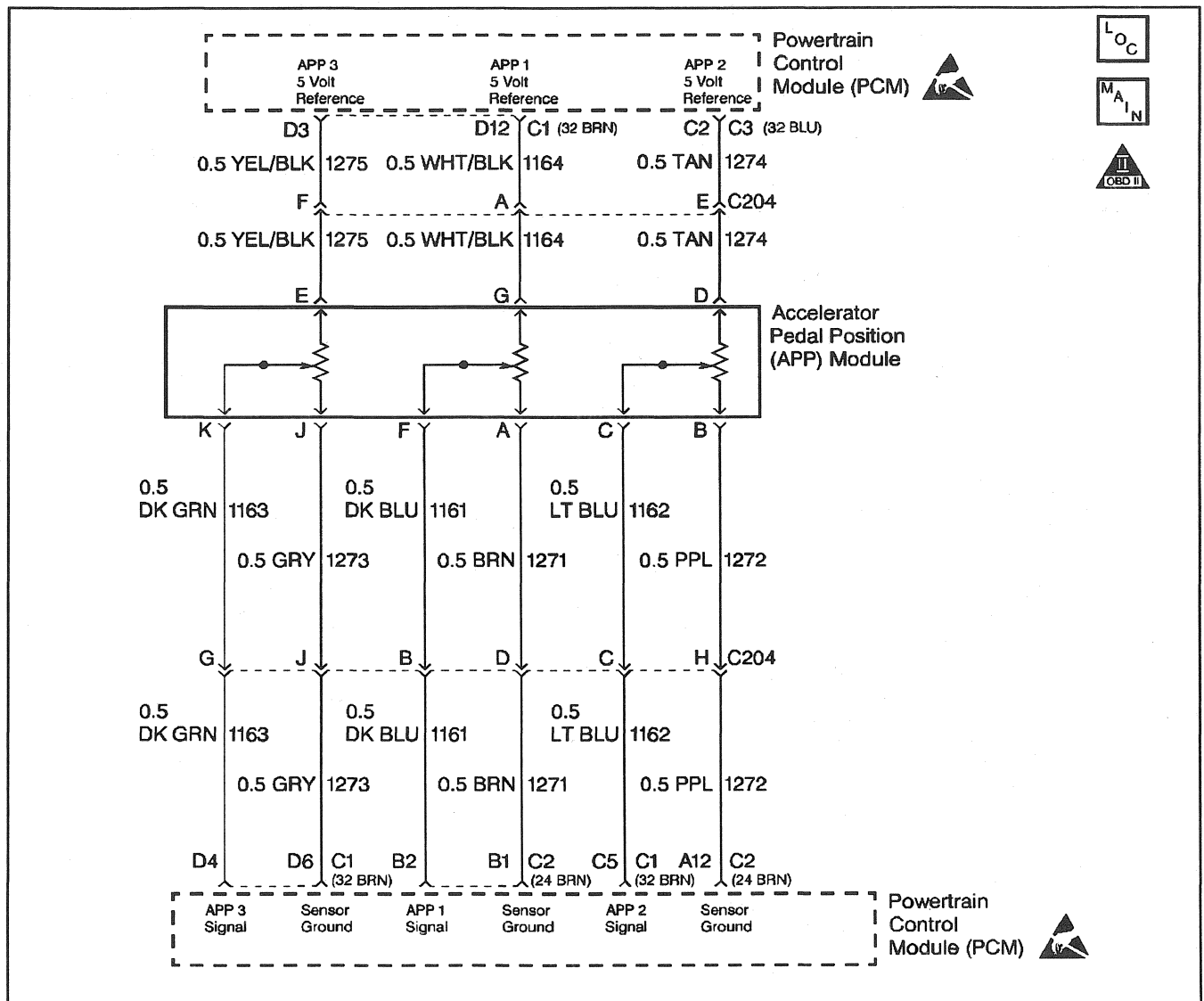
**DTC P0222 APP Sensor2 Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the APP 2 voltage on the Scan Tool.  Is APP 2 voltage less than or equal to the specified value?	0.25V	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 any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
4	1. Disconnect the APP sensor electrical connector. 2. Use the <i>J 39200</i> in order to probe the APP 2, 5 volt reference circuit at APP harness.  Is APP 2 voltage greater than the specified value?	5V	Go to Step 5	Go to Step 6
5	Use the <i>J 39200</i> in order to probe APP 2 sensor signal circuit at the APP sensor harness.  Is APP 2 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 it 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 the 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 2 signal circuit for an open, or a short to ground. 3. If the APP 2 sensor signal circuit is open or shorted to ground, repair it as necessary.  Was the APP 2 signal circuit open or shorted to ground?	—	Go to Step 13	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 13	Go to Step 12

## DTC P0222 APP Sensor 2 Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
10	Check for a poor electrical connection at the APP sensor. Was a repair performed?	—	Go to Step 13	Go to Step 11
11	Replace the APP module. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 13	—
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 13	—
13	1. Use the Scan Tool in order to 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 there any DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

## DTC P0223 APP Sensor 2 Circuit High Voltage



56421

### 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 D DTC.

### Conditions for Setting the DTC

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

### Action Taken When the DTC Sets

- The input from APP 2 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

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 WOT. Also, 90% pedal travel is acceptable for correct APP operation. Scan APP 2 signal 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. Its possible P1125 will set along with P0223 if the signal circuit is open.

**Test Description**

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

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

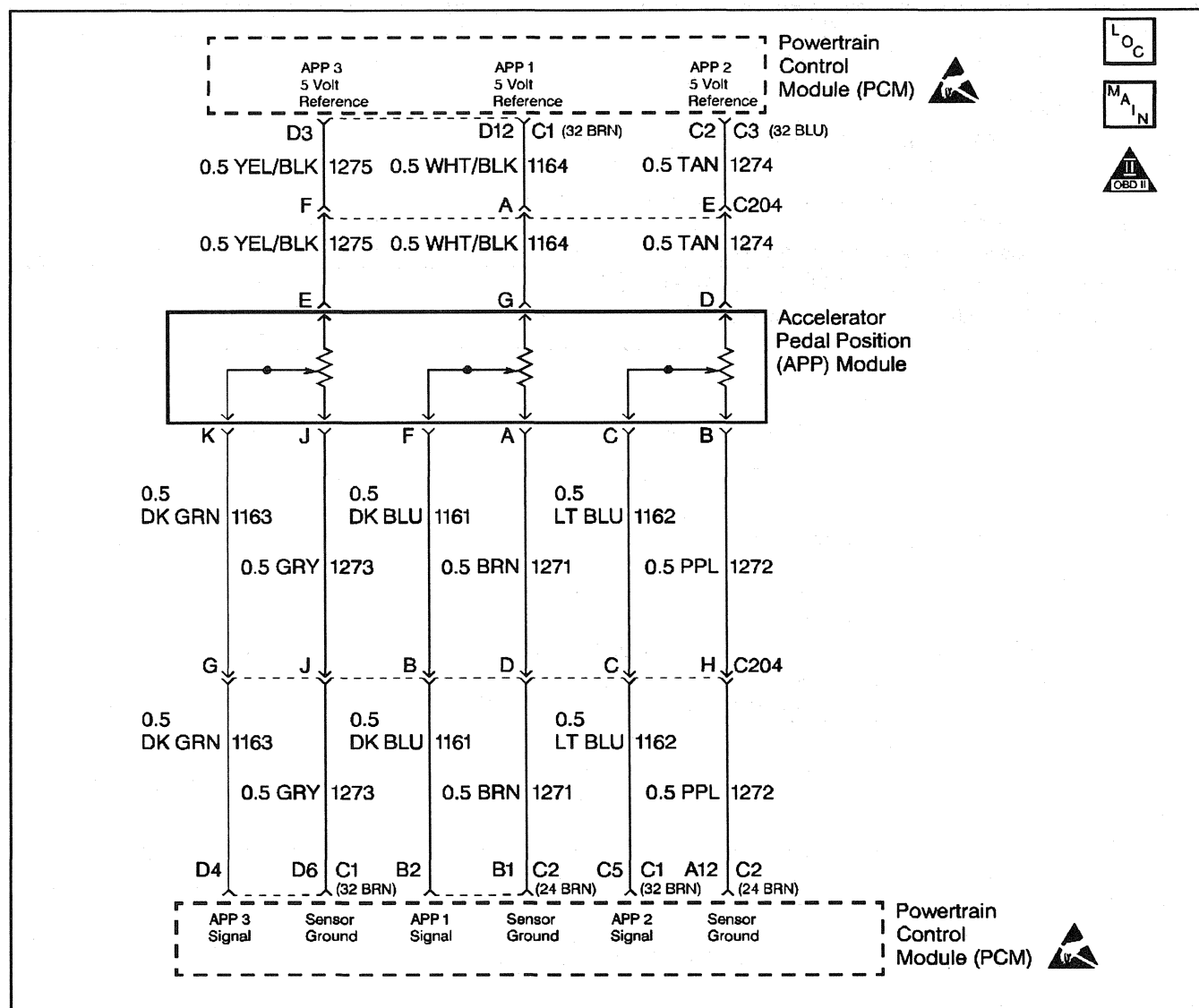
**DTC P0223 APP Sensor 2 Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the 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 the applicable DTC table(s) first.  Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
4	1. Disconnect the APP sensor harness connector. 2. 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 5	Go to Step 7
5	Use a fused jumper wire in order to jump the APP 2 signal circuit to the APP 2 ground circuit at the APP harness connector.  Does the scan tool display the APP 2 voltage less than the specified value.	0.25V	Go to Step 8	Go to Step 6
6	1. Check for an open on the APP 2 sensor signal circuit. 2. If the APP 2 sensor signal circuit is open, repair it as necessary.  Was the APP 2 sensor signal circuit open?	—	Go to Step 11	Go to Step 10
7	1. Check for an open sensor ground circuit. 2. If a problem is found, repair it as necessary.  Was the APP 2 sensor ground circuit open?	—	Go to Step 11	Go to Step 10
8	Check for a poor electrical connection at the APP sensor.  Was the repair performed?	—	Go to Step 11	Go to Step 9
9	Replace the APP module. Refer to <i>APP Module</i> .  Is the action complete?	—	Go to Step 11	—
10	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  Is the action complete?	—	Go to Step 11	—

**DTC P0223 APP Sensor 2 Circuit High Voltage (cont'd)**

Step	Action	Value(s)	Yes	No
11	<ol style="list-style-type: none"><li>Using the Scan Tool, select DTC, Clear Info.</li><li>Start engine and idle at normal operating temperature.</li><li>Select DTC, Specific, then enter the DTC number which was set.</li><li>Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li></ol> Does the Scan Tool indicate that this diagnostic 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 APP Sensor 3 Circuit



56421

**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 D DTC.

**Conditions for Setting the DTC**

- Reference voltage on APP 3 below 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. Multiple DTCs will be present.

**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 intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

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

**Test Description**

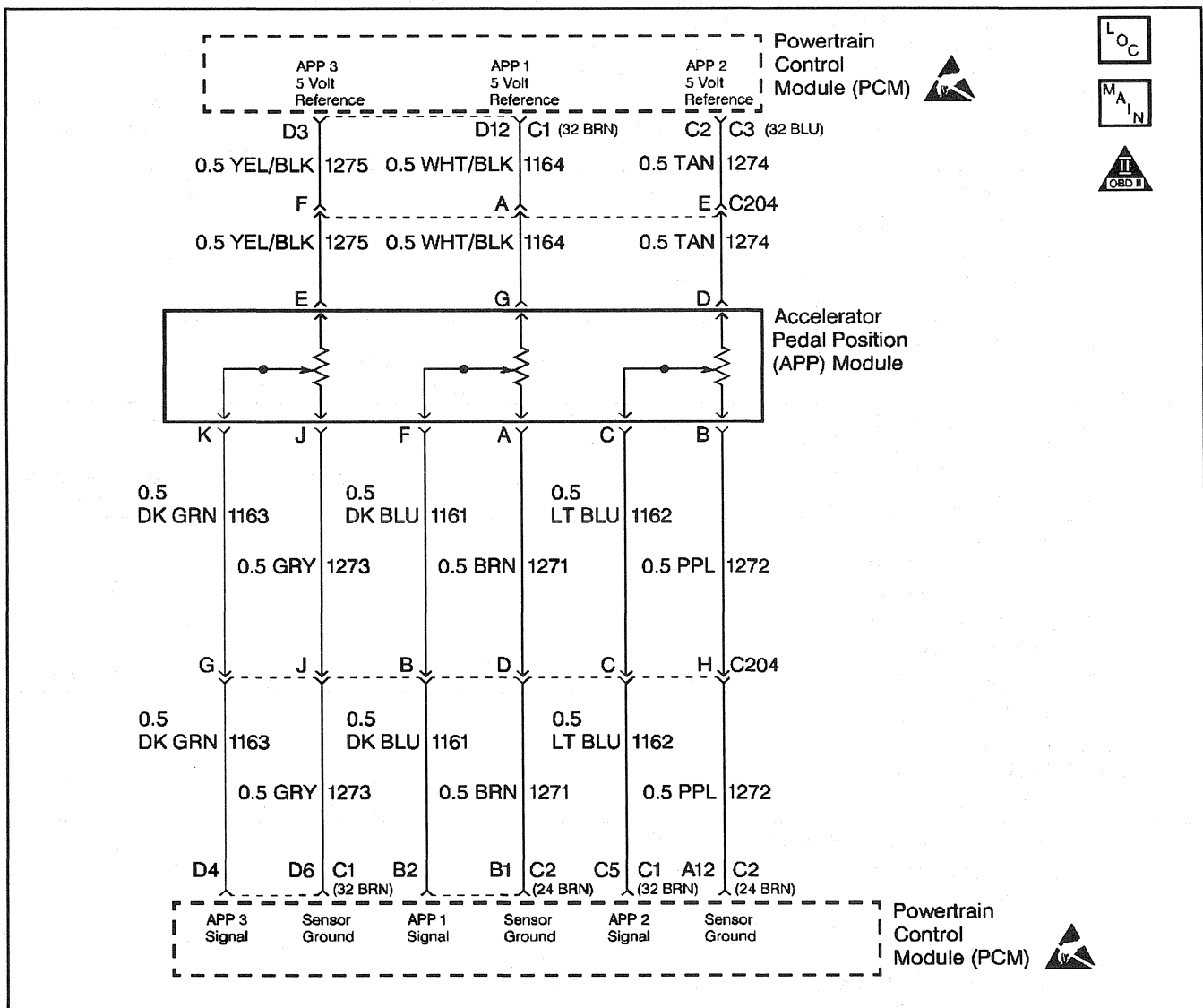
Number(s) below refer to the step number(s) on the Diagnostic Table.

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

## DTC P0225 APP Sensor 3 Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain 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 the voltage less than the specified value?	4.8V	Go to Step 5	Go to Step 3
3	Are any other APP DTCs set?	Go to the Applicable DTC Table	Go to Step 4	
4	The 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
5	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 shorted to ground?	—	Go to Step 7	Go to Step 6
6	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0226 APP Sensor 3 Circuit Performance



56421

### 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 D DTC.

### Conditions for Setting the DTC

- Ignition voltage 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 2 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.
- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

An intermittent may be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

A scan tool reads APP 3 position in volts. 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 step number(s) on the Diagnostic Table.

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

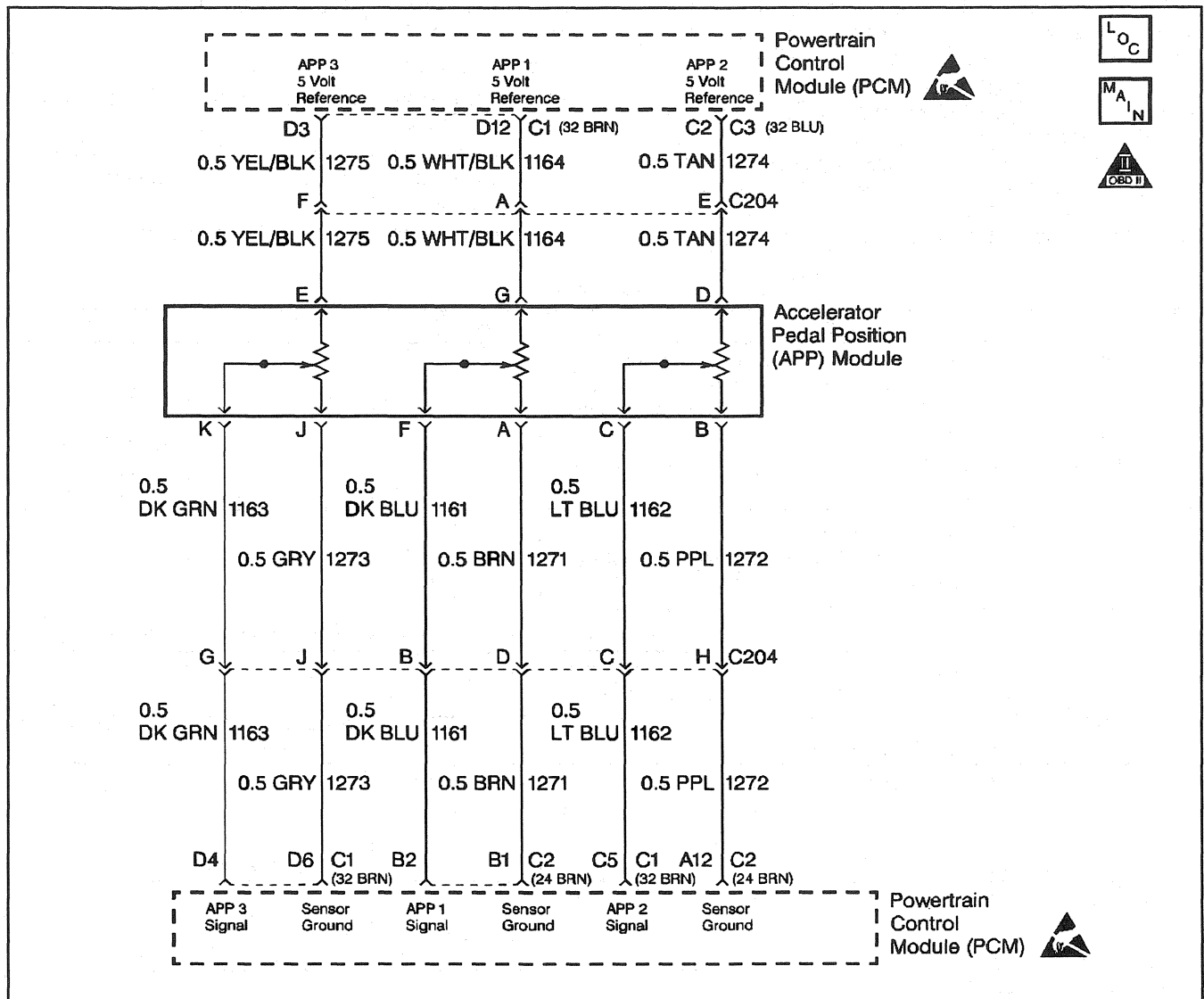
**DTC P0226 APP Sensor 3 Circuit Performance**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe APP voltages on the scan tool.  Are APP voltages at specified values (values are listed as APP 1, APP 2, and APP 3 respectively)?	0.45–0.95V 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 the applicable DTC table(s) first.  Are any additional DTCs stored?	—	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 <i>J 39200</i> connected to ground, probe APP sensor 5 volt reference circuits at APP harness terminals G, D, and E.  Is voltage greater than or equal to 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 it as necessary.  Was the 5 volt reference circuit open or shorted to ground?	—	Go to Step 11	Go to Step 7

## DTC P0226 APP Sensor 3 Circuit Performance (cont'd)

Step	Action	Value(s)	Yes	No
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. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 APP Sensor 3 Circuit Low Voltage



### 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 D 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.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

A scan tool reads APP 3 position in volts. 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 step number(s) on the Diagnostic Table.

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

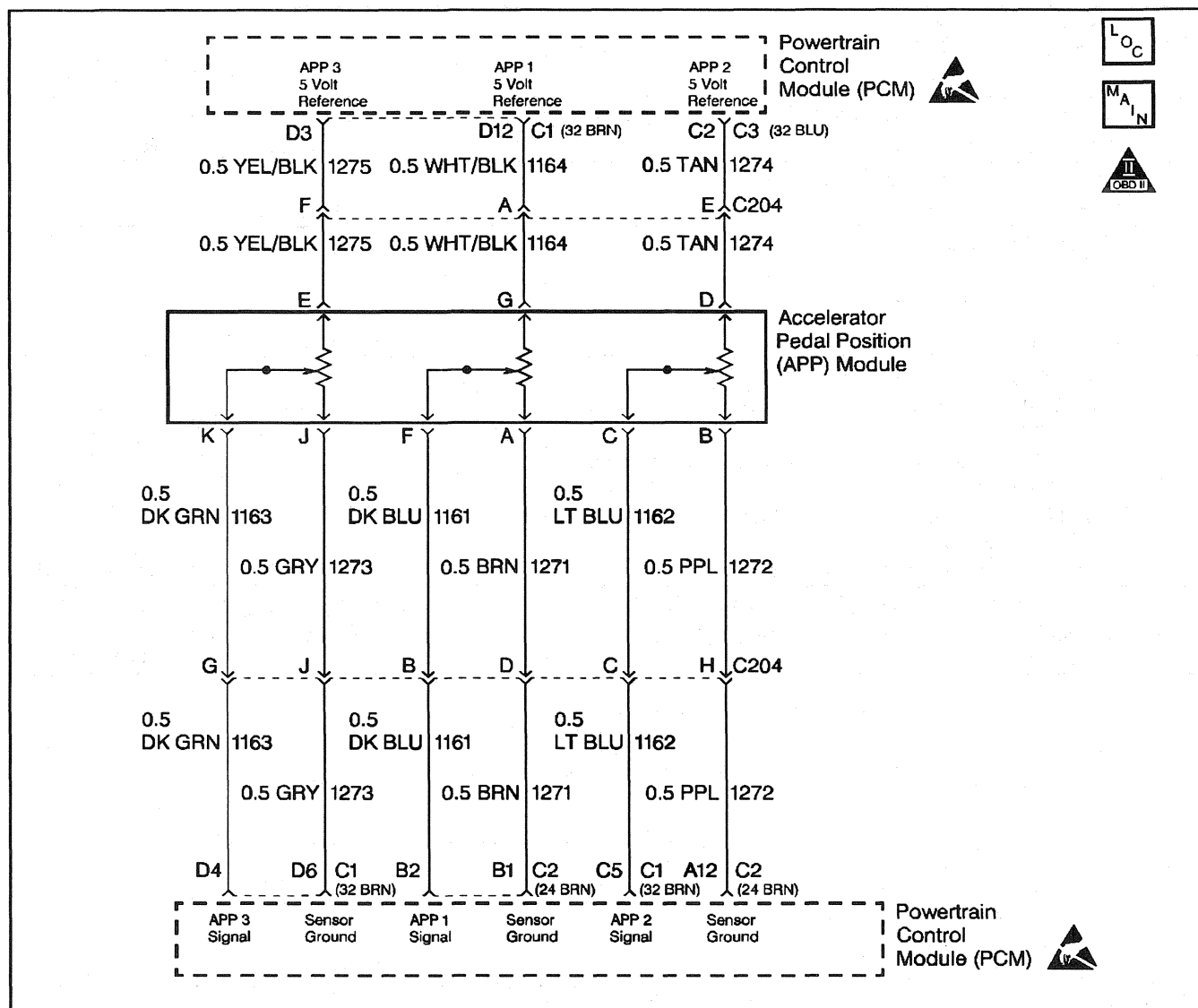
**DTC P0227 APP Sensor 3 Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the APP 3 voltage on the Scan Tool.  Is APP 3 voltage less than or equal to the specified value?	0.25V	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 any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
4	1. Disconnect the APP sensor electrical connector. 2. Use the <i>J 39200</i> in order to probe the APP 3, 5 volt reference circuit at the APP harness.  Is the voltage at the specified value?	5V	Go to Step 5	Go to Step 6
5	Use <i>J 39200</i> in order to probe the APP 3 signal circuit at the APP harness.  Is the voltage at 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 it 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 it as necessary.  Was the APP 3 signal circuit open or shorted to ground?	—	Go to Step 13	Go to Step 9

## DTC P0227 APP Sensor 3 Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
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	Go to Step 11
11	Replace the APP module. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 13	—
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 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 there any DTCs displayed that have not been diagnosed?	—	Go to the Applicable DTC Table	System OK

## DTC P0228 APP Sensor3 Circuit High Voltage



56421

### 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 D DTC.

### Conditions for Setting the DTC

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

### Action Taken When the DTC Sets

- The input from APP 3 sensor is ignored.
- This DTC will not turn on the Service Throttle Soon lamp by itself.

- 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**

There are no driveability issues associated with the APP module unless a DTC is present. The most likely causes of this DTC are poor connections or the sensor itself. The least likely is a PCM problem.

A scan tool reads APP 3 position in volts. 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 step number(s) on Diagnostic Table.

2. This step will determine if DTC P0228 is the result of a hard failure or an intermittent condition.
3. This step checks the PCM and wiring.

**DTC P0228 APP Sensor 3 Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the APP 3 display on the scan tool. Is APP 3 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 the applicable DTC table(s) first. Are additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
4	1. Disconnect the APP sensor harness connector. 2. Probe the APP 3 sensor ground circuit at the APP sensor harness connector with a test light connected to B+. Is the test light ON?	—	Go to Step 5	Go to Step 7
5	Use a fused jumper wire in order to jump the APP 3 signal circuit to the APP 3 ground circuit at the APP harness connector. Does the scan tool display the APP 3 voltage less than the specified value?	0.25V	Go to Step 8	Go to Step 6
6	1. Check for an open on the APP 3 sensor signal circuit. 2. If the APP 3 sensor signal is open, repair it as necessary. Was the APP 3 sensor signal circuit open?	—	Go to Step 11	Go to Step 10
7	1. Check for an open sensor ground circuit. 2. If a problem is found, repair it as necessary. Was APP 3 sensor ground circuit open?	—	Go to Step 11	Go to Step 10
8	Check for a poor electrical connection at the APP sensor. Was a repair performed?	—	Go to Step 11	Go to Step 9

## DTC P0228 APP Sensor 3 Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the APP module. Refer to <i>APP Module</i> . Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 11	—
11	<ol style="list-style-type: none"> <li>Using the Scan Tool, select DTC, Clear Info.</li> <li>Start engine and idle at normal operating temperature.</li> <li>Select DTC, Specific, then enter the DTC number which was set.</li> <li>Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li> </ol> Does the Scan Tool indicate that this diagnostic 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 Pump Feedback Circuit Low Voltage**

Refer to *PCM, Fuel Pump, Lift Pump*.

**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.
- The difference between ignition voltage and fuel pump voltage is greater than 4 volts.
- Condition 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 step number(s) on the Diagnostic Table.

3. This step checks the fuel lift pump circuit.

**DTC P0231 Fuel Pump Feedback Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTCs 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Install the scan tool. 2. Turn the ignition ON. 3. With the scan tool, command the fuel pump ON. Does the scan tool indicate the fuel pump is operating?	—	Go to Diagnostic Aids	Go to Step 3
3	1. Turn the ignition OFF. 2. With a <i>J 39200</i> connected to ground, backprobe the fuel lift pump signal circuit at the PCM. 3. Probe the fuel pump test terminal with a fused jumper to B+. Is the voltage at the specified value?	B+	Go to Step 8	Go to Step 4
4	1. Remove the fuel pump relay. 2. Verify the <i>J 39200</i> is still connected. 3. From underneath the U/H relay center, probe the A3 terminal with a fused jumper to B+. Is the voltage at the specified value?	B+	Go to Step 5	Go to Step 6
5	1. Check for a poor connection at the fuel pump relay center. 2. If a problem is found, repair the problem as necessary. Was a problem found?	—	Go to Step 17	—
6	1. Check for an open or short to ground on the fuel pump signal circuit. 2. If a problem is found, repair the problem as necessary. Was a problem found?	—	Go to Step 18	Go to Step 7

## DTC P0231 Fuel Pump Feedback Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check for poor connections at the PCM and at the relay center. 2. If a problem is found, repair the problem as necessary. Was a problem found?	—	Go to Step 18	Go to Step 15
8	1. Remove the fuel pump relay. 2. Turn the ignition ON. 3. Connect a test light to ground. 4. Probe the fuel pump relay harness connector terminal 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 18	—
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 18	—
12	1. Turn the ignition OFF. 2. Connect a test light between terminal number B3 of the fuel pump relay harness connector and ground. 3. Monitor the test light. 4. Turn the ignition ON. Does the test light come ON during the glow plug cycle and then go OFF after the glow plug cycle is complete?	—	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 18	—
15	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 18	—
16	Check for a poor connection at fuel pump relay connector terminal number B3. Was a problem found?	—	Go to Step 18	Go to Step 17
17	Replace the fuel pump relay. Refer to <i>Fuel Pump Relay</i> . Is the action complete?	—	Go to Step 18	—
18	After Repair, use the scan tool Clear Info function and road test vehicle. check for DTCs, Current or history. Review test status information. If status is test(s) Failed or DTCs are present begin diagnosis again, on that DTCs. If last test Failed is not present and no DTCs are present repair is complete. Are the repairs complete?	—	Go to Step 19	—
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 P0236 TC Boost System**

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

**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 is greater than, 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.
- 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.

The turbocharger wastegate actuator uses a pulse width modulated vacuum solenoid that causes vacuum to fluctuate under normal conditions. A steady vacuum reading indicates a restricted or plugged solenoid vent filter or solenoid vent orifice.

**Test Description**

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

4. This will check the wastegate solenoid and filter. If the filter is plugged, the filter will not allow the solenoid to vent and this will cause an overboost condition.
5. This step checks the turbocharger wastegate actuator for vacuum leaks. The actuator must hold vacuum.
6. This step will check for vacuum leaks at the lines.

**DTC P0236 TC Boost System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Is DTC P1656 set?	—	Go to <i>DTC P1656 Wastegate Solenoid Control Circuit</i>	Go to Step 3
3	1. Disconnect the vacuum line at the turbocharger wastegate actuator. 2. Install a vacuum gage 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 (vacuum will fluctuate)?	15 in. Hg	Go to Step 4	Go to Step 6

## DTC P0236 TC Boost System (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the wastegate solenoid electrical connector with the engine still running. 2. With the vacuum gage still in place, observe the vacuum at idle. Is the vacuum greater than the specified value?	1 in. Hg	Go to Step 10	Go to Step 5
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 the vacuum pump to the turbocharger wastegate actuator for the following: <ul style="list-style-type: none"> <li>• Leaks</li> <li>• Deformities</li> <li>• Pinches</li> </ul> 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 is 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 (refer to Engine Mechanical for further testing). 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. If additional DTCs were stored, refer to those table(s). Are any additional DTCs stored?	—	Go to the Applicable 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 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 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 Applicable DTC Table	System OK

**DTC P0237 TC Boost Sensor Circuit Low Voltage**

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

**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**

- Boost Pressure less than 40 kPa.
- Condition met for 2 seconds.

**Action Taken When the DTC Sets**

The MIL will be illuminated after 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**

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.

An intermittent may be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

**Test Description**

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

- This step will determine if DTC P0237 is the result of a hard failure or an intermittent condition.
- This step simulates conditions for a DTC P0237. If the PCM recognizes the change, the PCM and signal circuit are OK.
- In this step, components that share the 5 volt reference can cause the reference voltage to be shorted to ground. This can be checked by disconnecting each component that shares the 5 volt reference one at a time, including the PCM while checking for continuity on that circuit to chassis ground.

**DTC P0237 TC Boost Sensor Circuit Low Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Scan tool connected. 2. Engine idling. 3. Observe Boost pressure display on scan tool Does the scan tool display a Boost Pressure less than or equal to the specified value?	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 Boost Pressure greater than or equal to the specified value?	202 kPa	Go to Step 6	Go to Step 4

## DTC P0237 TC Boost Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF. 2. The Boost sensor still disconnected. 3. Remove the jumper wire. 4. Probe 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 Boost Pressure greater than or equal to the specified value?	202 kPa	Go to Step 8	Go to Step 7
5	The DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs are stored, refer to those table(s) first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
6	1. Check for a poor connection at the Boost sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 10
7	1. Check for the following in Boost sensor signal circuit. <ul style="list-style-type: none"> <li>• For an open.</li> <li>• For a short to ground.</li> </ul> 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 11
8	1. Check for an open in the Boost sensor 5 volt reference circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 9
9	1. Check for a short to ground in the Boost sensor 5 volt reference circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 12
10	Replace the Boost sensor. Refer to <i>Boost Sensor (Diesel)</i> . Is the action complete?	—	Go to Step 13	—
11	1. Check the terminal connectors at the PCM for a poor connections. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 12
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 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 Applicable DTC Table	System OK

**DTC P0238 TC Boost Sensor Circuit High Voltage**

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

**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**

- Boost Pressure greater than or equal (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**

Very little boost can be attained by revving the engine in neutral.

An intermittent may be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

**Test Description**

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

- This step will determine if the PCM is responding to a low signal voltage. This will indicate that the PCM is OK.
- If the scan display is still less than or equal to 9 kPa by disconnecting the PCM the short to voltage is in the wiring.
- If the voltmeter value stays the same by disconnecting the PCM the short to battery voltage is in the wiring.

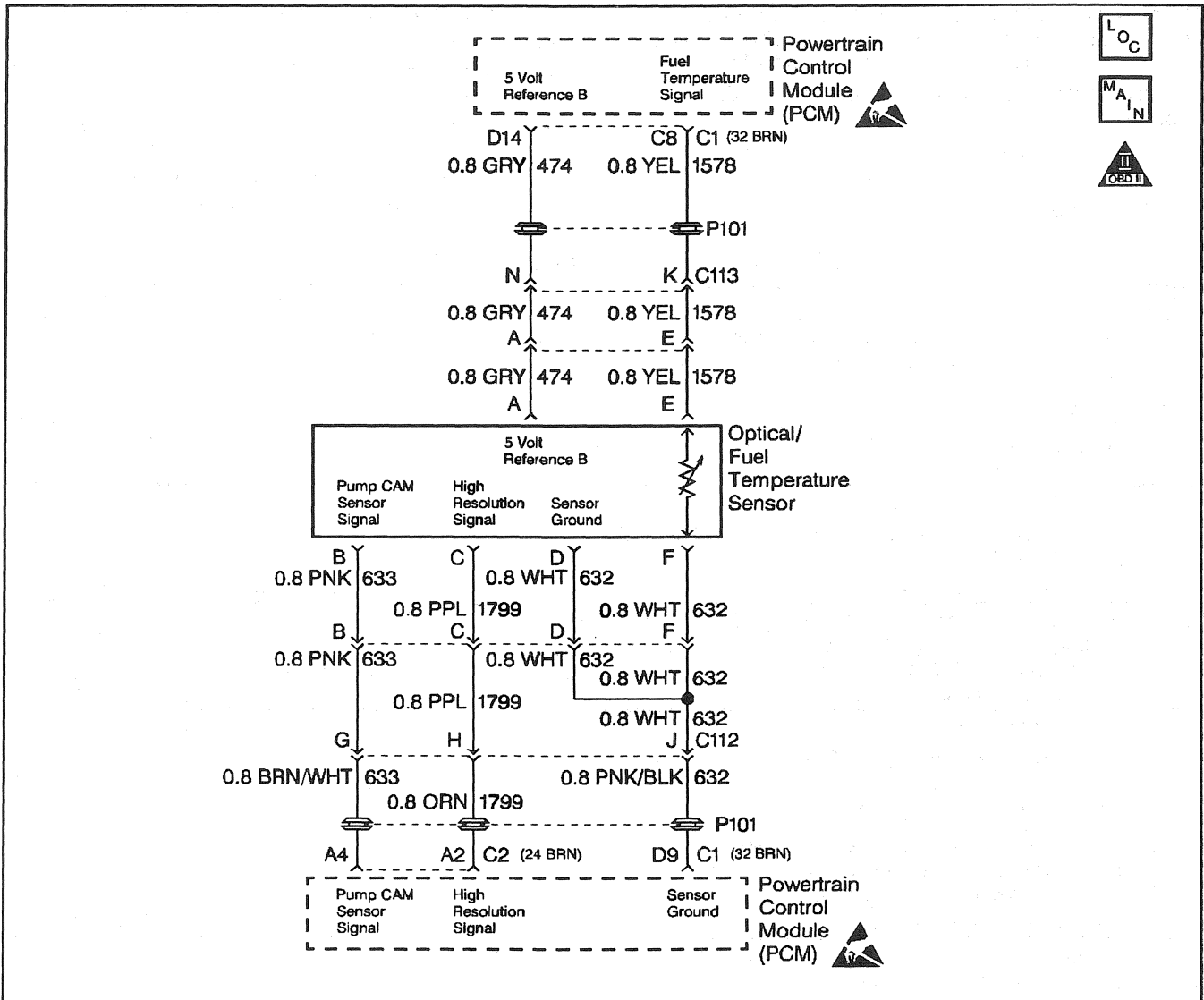
**DTC P0238 TC Boost Sensor Circuit High Voltage**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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	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 table(s) first.  Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
5	1. Ignition ON, engine OFF. 2. With a J 39200 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

## DTC P0238 TC Boost Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
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	1. Check the Boost sensor for a restriction. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 13	Go to Step 8
8	Replace the Boost sensor. Refer to <i>Boost Sensor (Diesel)</i> . Is the action complete?	—	Go to Step 13	—
9	1. Check for a short to voltage in the Boost sensor signal circuit. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 13	Go to Step 12
10	1. Check for a short to battery voltage in the Boost sensor 5 volt reference circuit. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 13	Go to Step 12
11	Repair the Boost sensor ground circuit. Is the action complete?	—	Go to Step 13	—
12	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 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 Applicable DTC Table	System OK

## DTC P0251 Injection Pump Cam System



56420

## 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

- 8 consecutive cam pulses missing.
- or
- An average of 8 cam pulses missing.

## 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. Its possible a P0251 and P0370 will set if vehicle has run out of fuel.

An intermittent condition can be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

**Test Description**

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

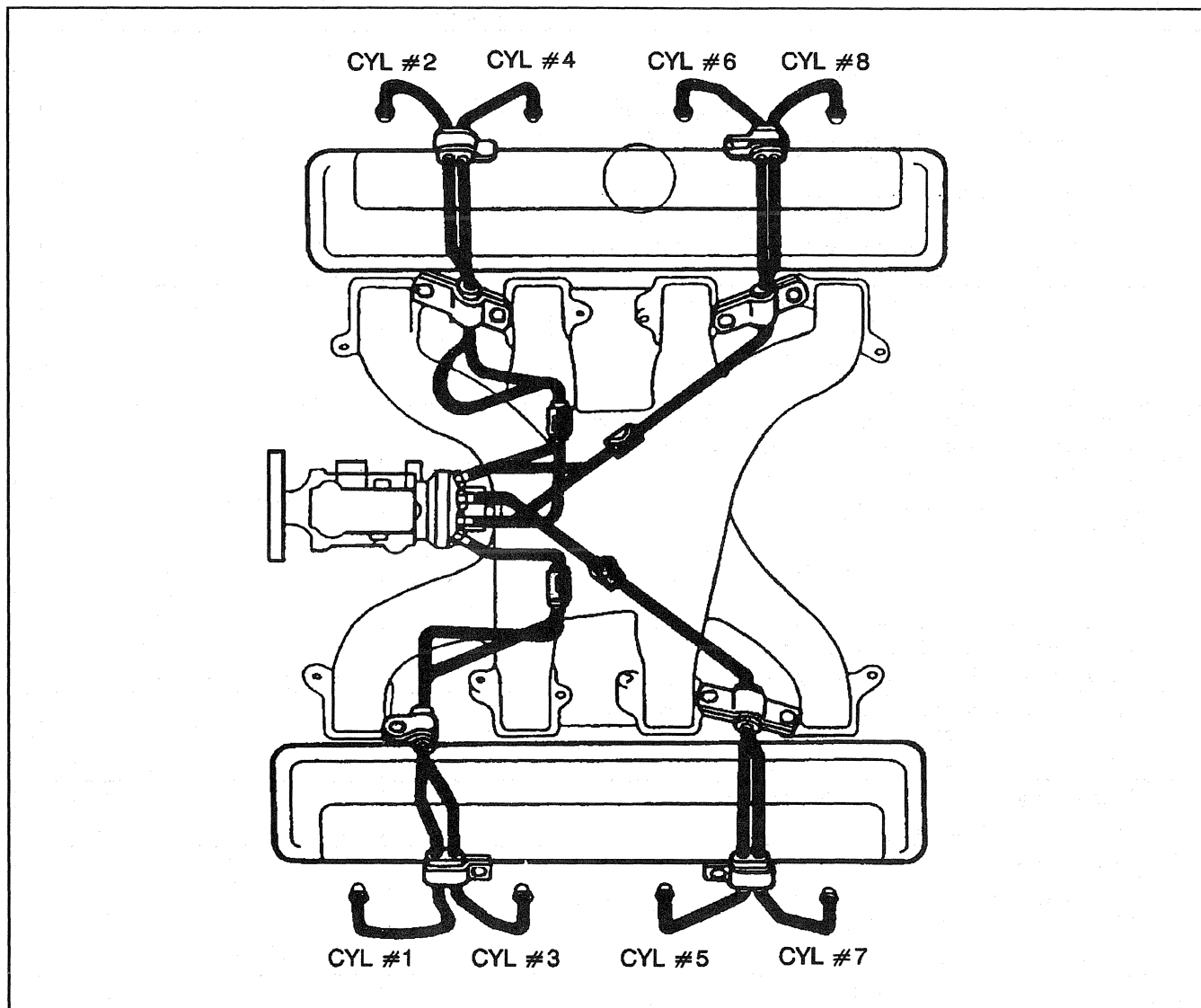
2. This step will determine if this is a hard or intermittent DTC.
4. This step will determine if there is a 5 volt reference.
6. This step will check to see if the sensor is sending a signal back to the PCM.

**DTC P0251 Injection Pump Cam System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Start and idle engine. 2. 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. 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
4	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 at the harness connector and chassis ground.  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 Optical/Fuel temperature sensor. 2. Start and idle engine. 3. With scan tool, command 900 RPM. 4. With J 39200 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. Removed electrical harness filter from vehicle. 2. Check resistance on the electrical harness filter 5 volt reference circuit (terminal A).  Is resistance greater than specified value?	2.0 Ohms	Go to Step 15	Go to Step 8

## DTC P0251 Injection Pump Cam System (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Electrical harness filter removed from vehicle. 3. Disconnect the PCM, and check the Optical/Fuel temperature 5 volts reference circuit for an open, short to ground, or short to the sensor ground circuit. 4. If the Optical/Fuel temperature 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the Optical/Fuel temperature 5 volt reference circuit open or shorted to ground?	—	Go to Step 16	Go to Step 10
9	1. Check for an open or a poor sensor ground terminal connection at the 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 the Cam signal circuit is open or shorted to ground, repair it as necessary. 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 if necessary. Did the terminal require replacement?	—	Go to Step 16	Go to Step 14
13	Replace injection pump. Refer to <i>Fuel Injection Pump</i> . Is the action complete?	—	Go to Step 16	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 16	—
15	Replace electrical harness filter. Is the 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 the Applicable DTC Table	System OK

**DTC P0263 Cylinder 1 Balance System**

29653

**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 amount 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**

The PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

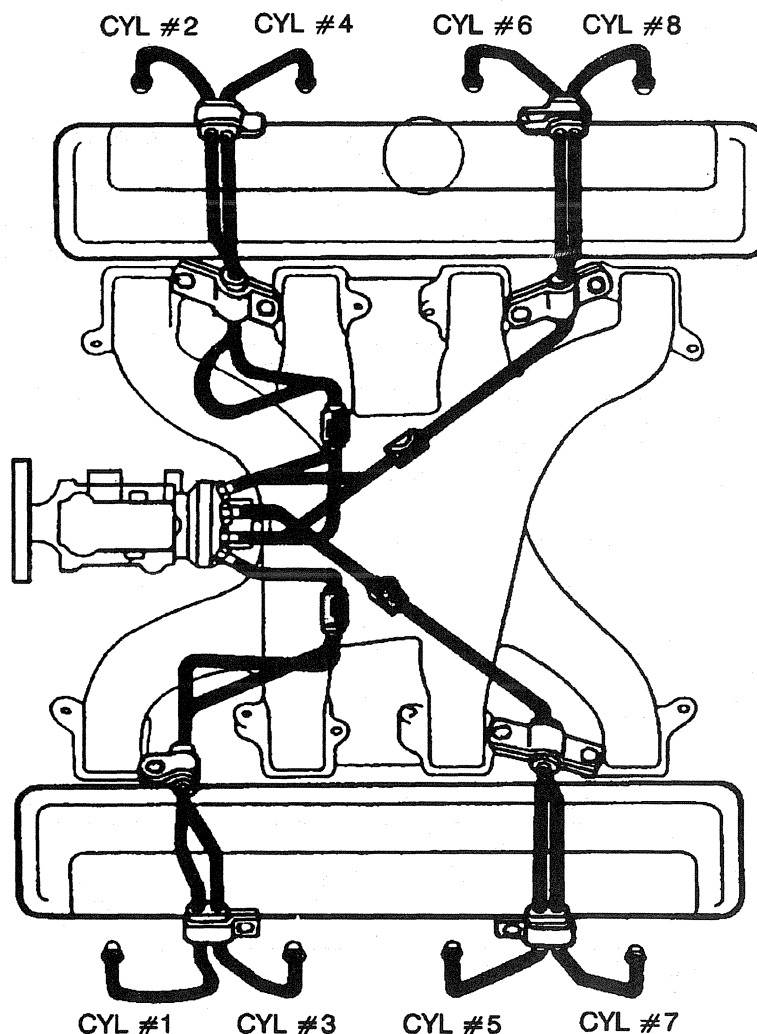
**Test Description**

Number(s) below refer to the step 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 Cylinder 1 Balance System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0266 Cylinder 2 Balance System**

29653

**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 amount exceeds define limits, DTC P0266 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

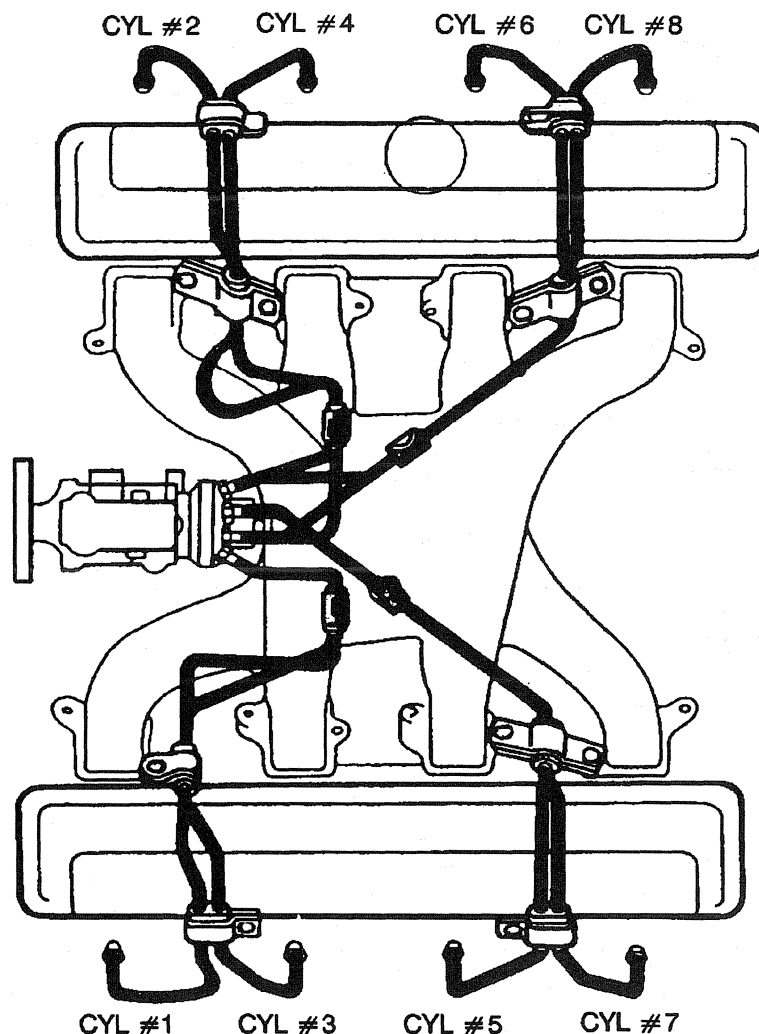
**Test Description**

Number(s) below refer to the step 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 P0266 Cylinder 2 Balance System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0269 Cylinder 3 Balance System**

29653

**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 amount exceeds define limits, DTC P0269 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

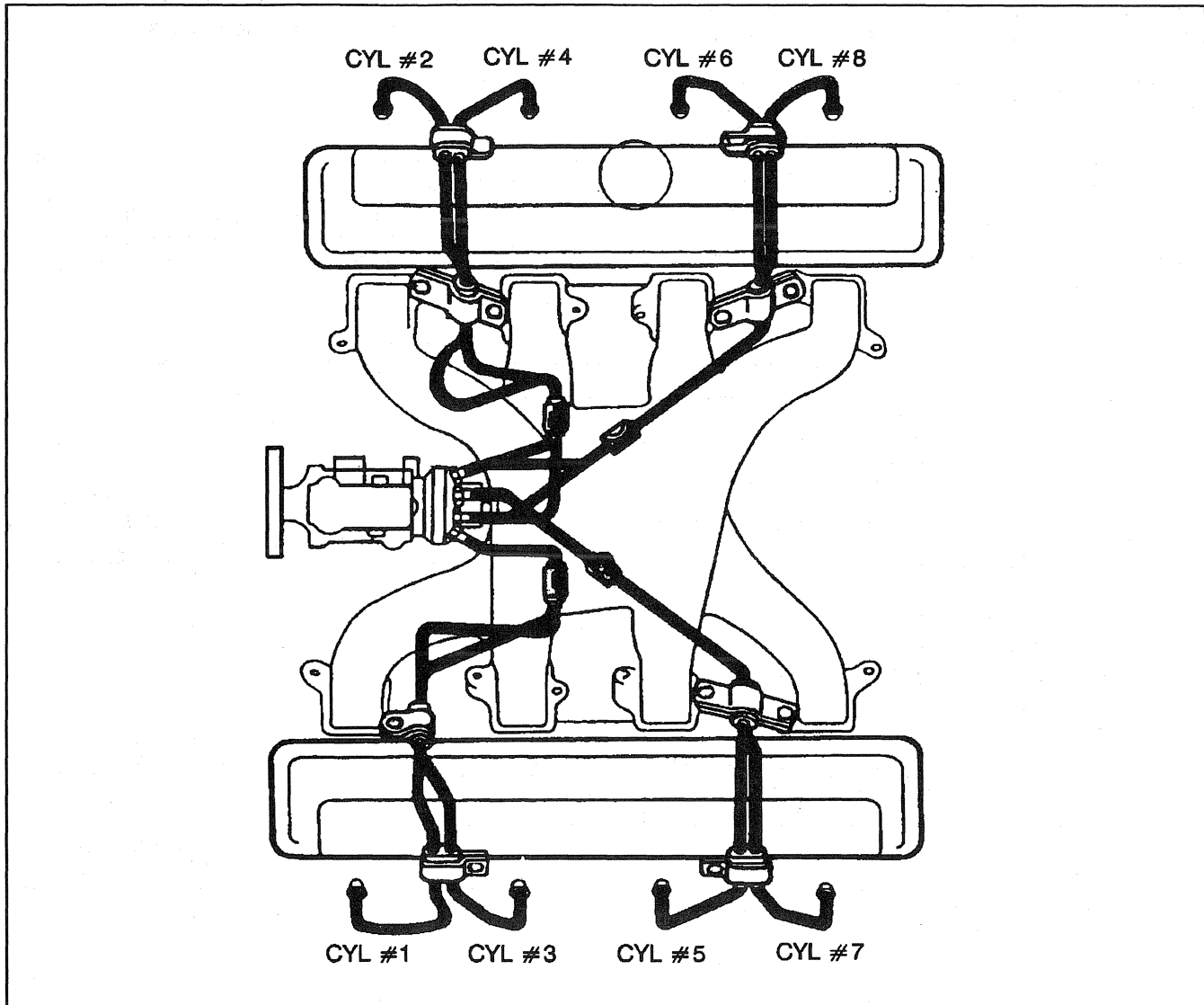
**Test Description**

Number(s) below refer to the step 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 P0269 Cylinder 3 Balance System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0272 Cylinder 4 Balance System**

29653

**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 amount exceeds define limits, DTC P0272 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

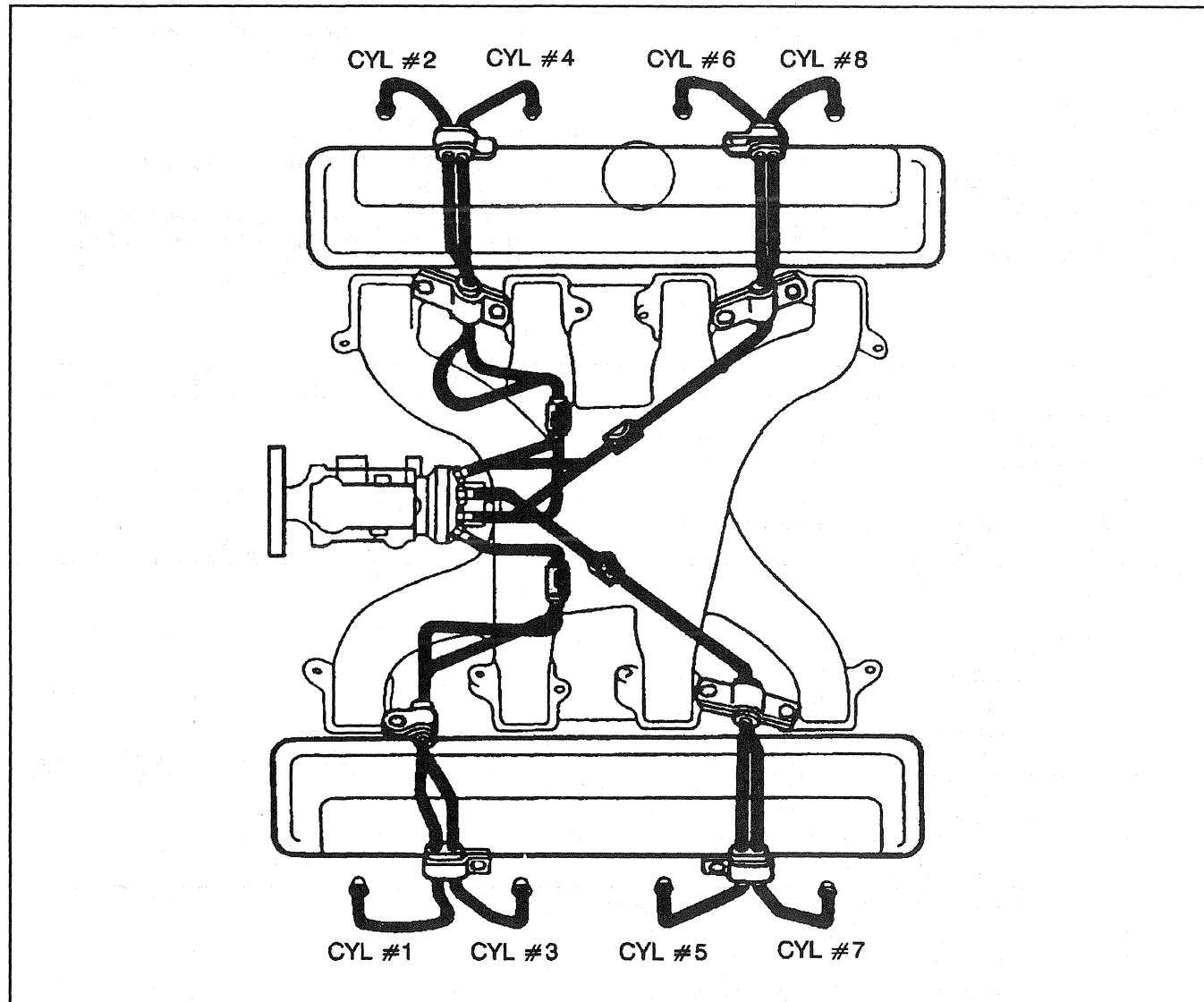
**Test Description**

Number(s) below refer to the step 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 P0272 Cylinder 4 Balance System**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0275 Cylinder 5 Balance System**

29653

**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 amount exceeds define limits, DTC P0275 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**

The MIL will not illuminate. The PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, its possible fuel system restrictions could cause fuel correction amounts to exceed limits.

Check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump.
- Restricted fuel filter.

- Fuel system waxing.

### Test Description

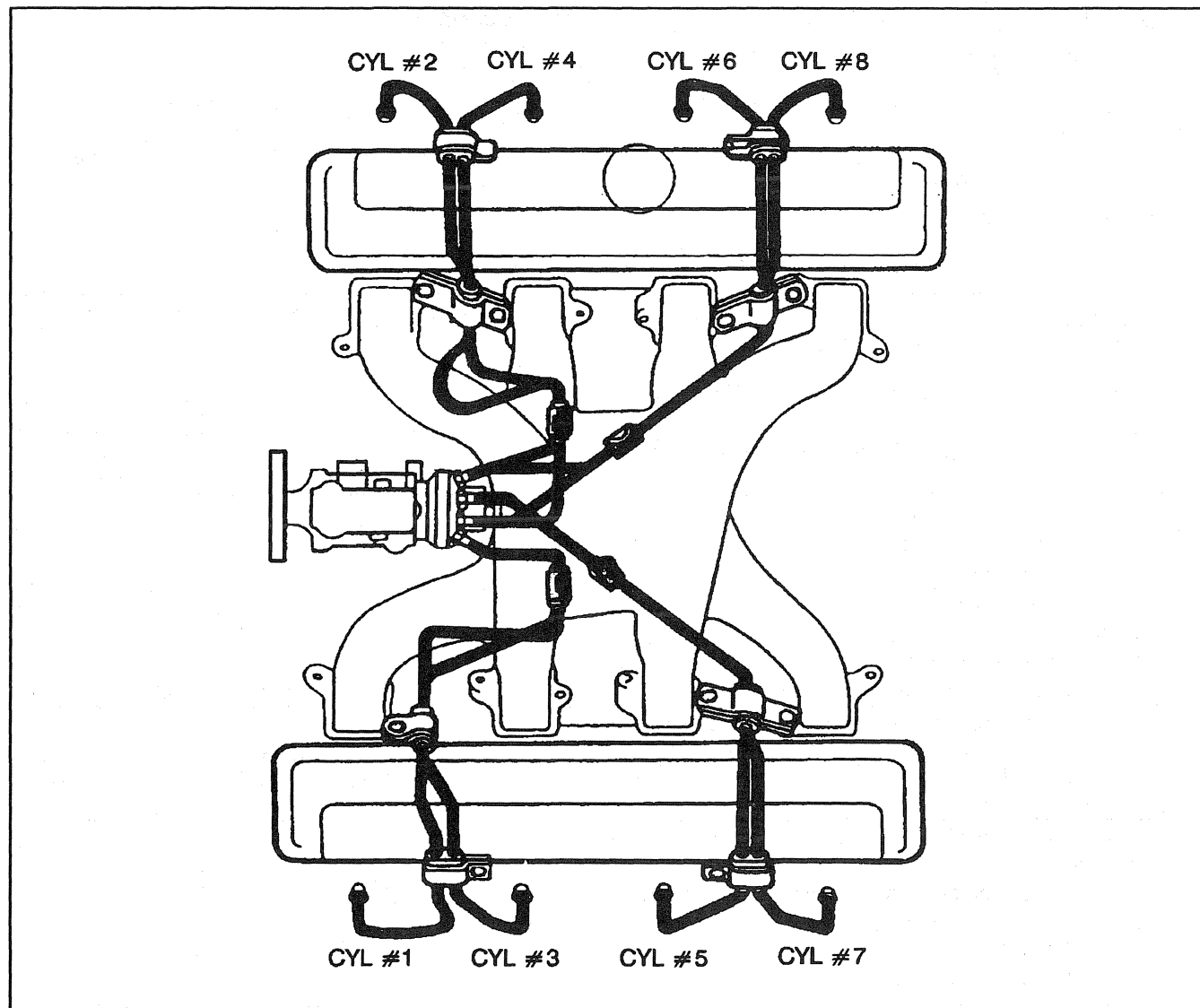
Number(s) below refer to the step number(s) on the Diagnostic Table.

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 P0275 Cylinder 5 Balance System

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 P0278 Cylinder 6 Balance System



29653

**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 amount exceeds define limits, DTC P0278 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

### Test Description

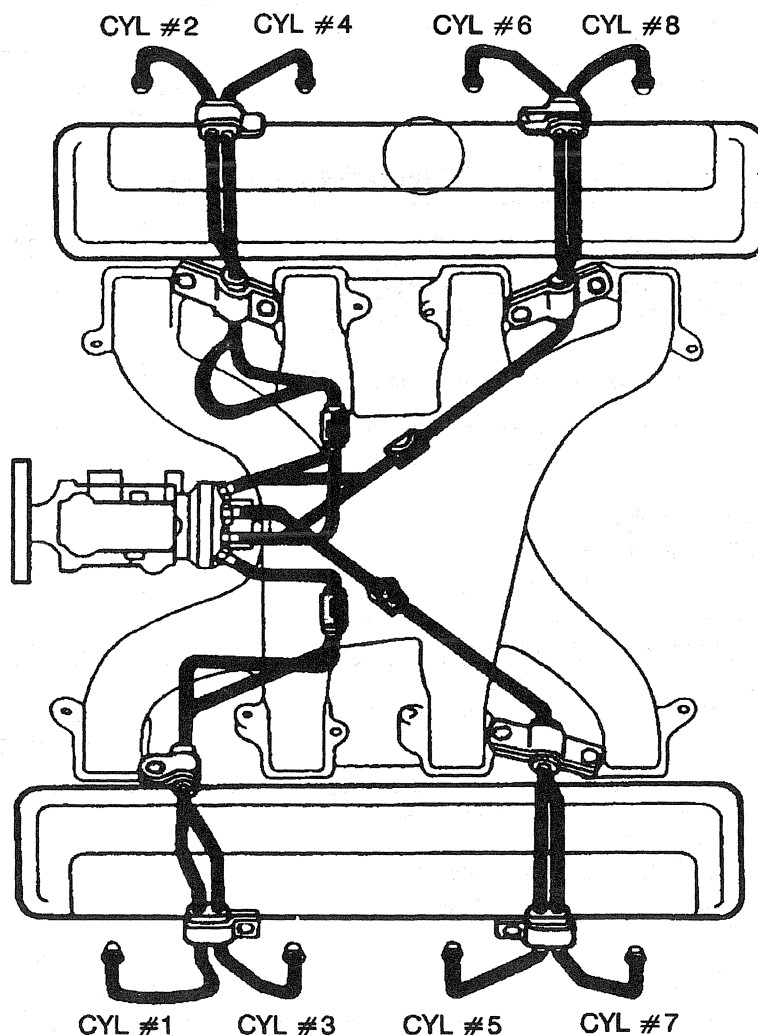
Number(s) below refer to the step number(s) on the Diagnostic Table.

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 P0278 Cylinder 6 Balance System

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0281 Cylinder 7 Balance System



29653

**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 amount exceeds define limits, DTC P0281 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

### Test Description

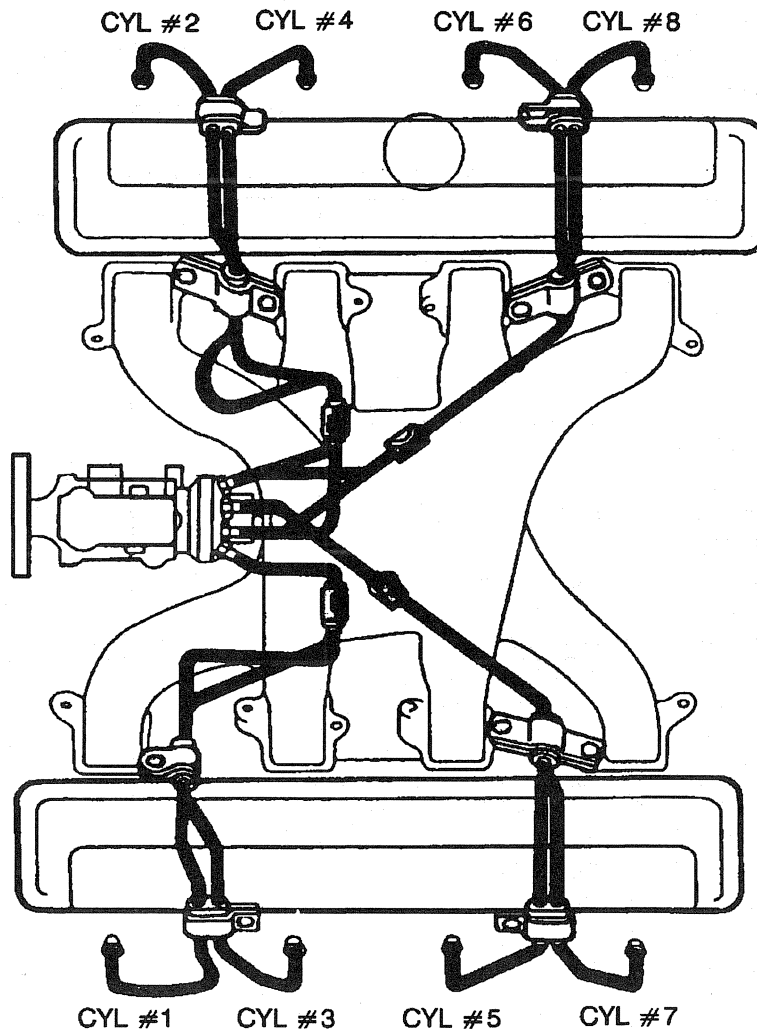
Number(s) below refer to the step number(s) on the Diagnostic Table.

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 P0281 Cylinder 7 Balance System

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 P0284 Cylinder 8 Balance System



29653

**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 amount exceeds define limits, DTC P0284 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 idleThe PCM will record operating conditions at the time the diagnostic fails. This information will be stored in Failure Records.

**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**

Injector balance test on scan tool should be used to confirm fault cylinder problems. Scan tool will cutout specific cylinder requested. It is 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 can 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 malfunctioning nozzles or engine mechanical (low compression) problems.

If multiple cylinder balance DTCs are set and no problem is found, check for the following:

- Pinched or restricted fuel feed lines between fuel tank and fuel injection pump
- Restricted fuel filter.

### Test Description

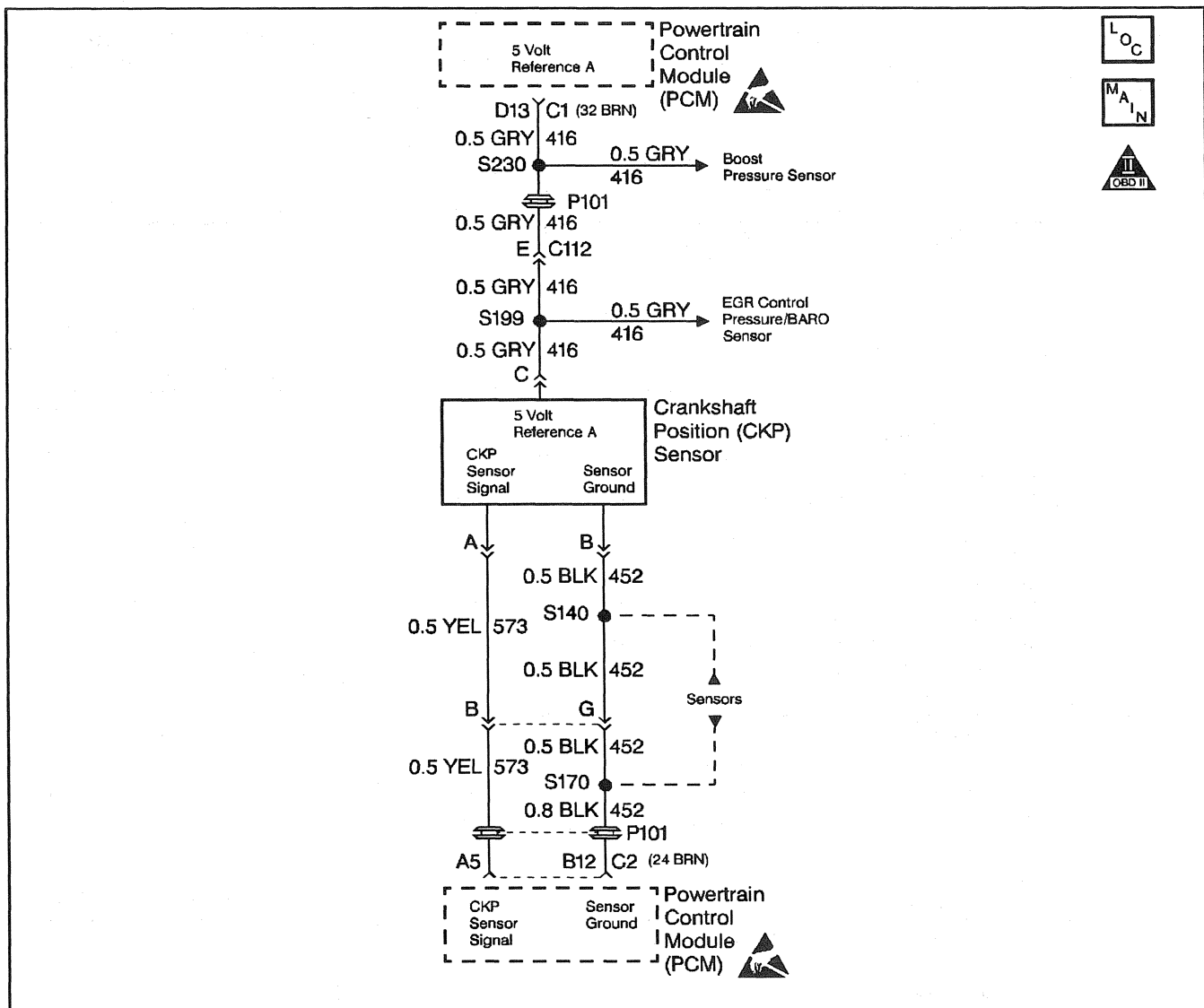
Number(s) below refer to the step number(s) on the Diagnostic Table.

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 P0284 Cylinder 8 Balance System

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain 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 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
4	Check for the following basic engine mechanical or fuel delivery problems in that cylinder. <ul style="list-style-type: none"> <li>• Low compression (refer to Engine Mechanical)</li> <li>• Injection nozzle malfunctioning (refer to Fuel Systems)</li> <li>• Kinked or bent injection lines.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the fuel injection pump. Refer to <i>Fuel Injection Pump</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 CKT



56424

### 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

- 8 consecutive crank pulses missing.
- An average of 8 consecutive crank pulses missing.

### 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 poor 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 step 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.

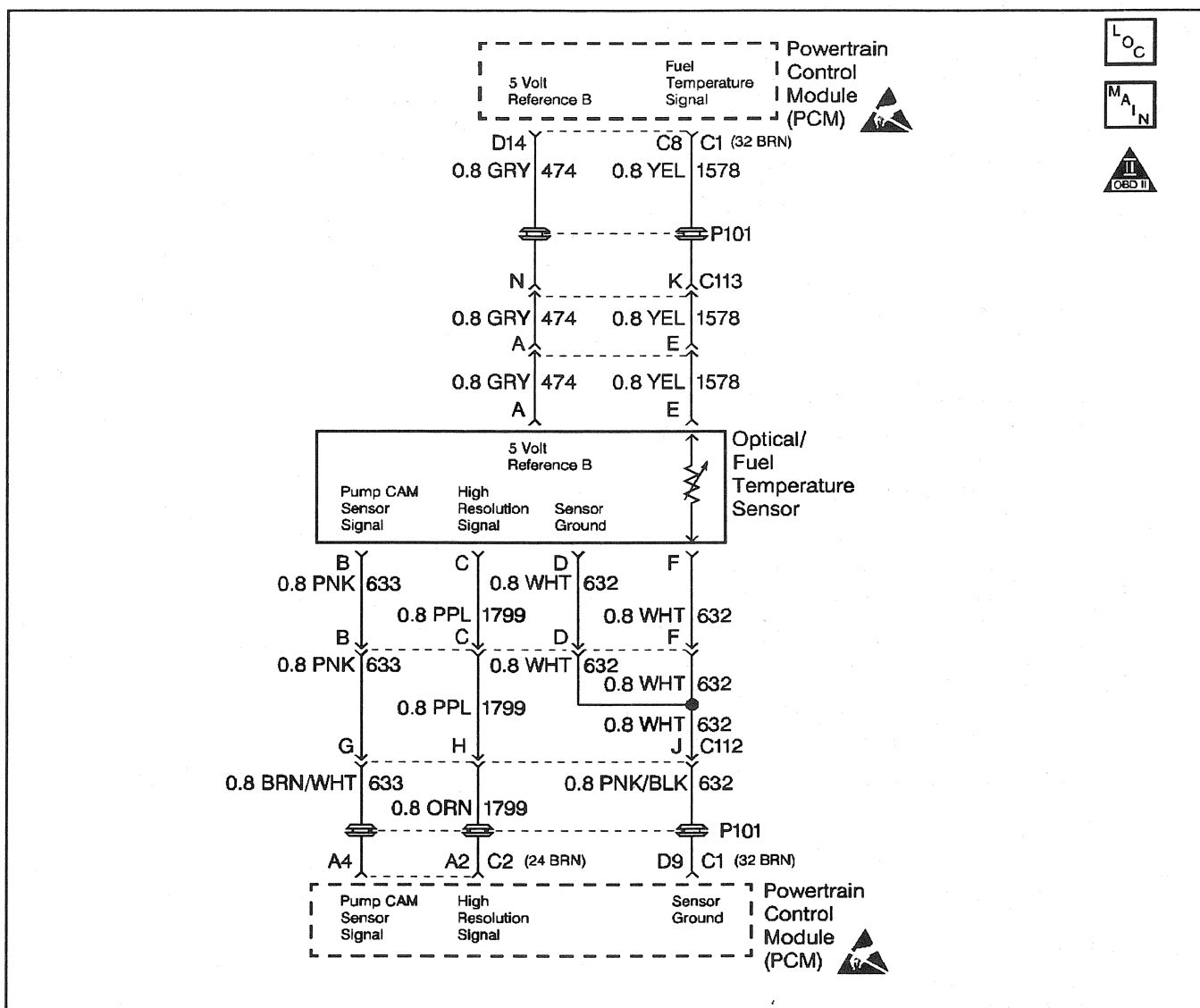
### DTC P0335 Crankshaft Position (CKP) Sensor CKT

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Start and idle engine. 2. Observe the Crank 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. If no additional DTCs are stored, refer to the Applicable DTC Table(s) first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the CKP sensor electrical connector. 3. Ignition ON engine OFF. 4. With a DVM J 39200, measure voltage between the CKP 5 volt reference circuit and chassis ground. Is the voltage within the specified range?	4.8-5.2V	Go to Step 5	Go to Step 7
5	Probe the sensor ground circuit with a test light connected to B+. Is test light ON?	—	Go to Step 6	Go to Step 8
6	1. Reconnect CKP sensor. 2. Back probe CKP signal circuit at the PCM with a DVM J 39200 connected to ground. 3. Crank engine. Is the voltage greater than or equal to the specified value?	4V	Go to Step 11	Go to Step 10
7	1. Ignition OFF. 2. Disconnect the PCM, and check the CKP 5 volt reference circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the CKP 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was a repair performed?	—	Go to Step 14	Go to Step 9
8	1. Check for an open or a poor sensor ground terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 14	Go to Step 13
9	Check the CKP 5 volt reference 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 13

## DTC P0335 Crankshaft Position (CKP) Sensor CKT (cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition OFF. 2. Disconnect the PCM, and check the CKP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. Check the terminal connections at the CKP sensor for damage or a poor connection. 4. If a problem is found, repair the problem as necessary. Was a repair performed?	—	Go to Step 14	Go to Step 11
11	Check the CKP 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. Refer to <i>Crankshaft Position Sensor</i> . After replacing the sensor, the PCM must be programmed with a new TDC Offset. Refer to <i>TDC Offset</i> . Is the action complete?	—	Go to Step 14	—
13	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 14	—
14	1. Using the scan tool, select DTC, Clear Info. 2. Start the 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 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 Applicable DTC Table	System OK

## DTC P0370 Timing Reference High Resolution



56420

### 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). Its 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 missing (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 the vehicle runs out of fuel. DTCs P0335, P1216, and P1217 may set along with this DTC.

The least likely cause of failure is the PCM.

**Test Description**

Number(s) below refer to the step 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	<b>Important:</b> 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 performed?	—	<i>Go to Step 2</i>	<i>Go to Powertrain OBD System Check</i>
2	1. Ignition OFF. 2. Disconnect the Optical/Fuel temperature sensor electrical connector. 3. Ignition ON engine OFF. 4. Using a <i>J 39200</i> , measure voltage between the Optical/Fuel Temperature 5 volt reference circuit at the harness connector and chassis ground.  Is the voltage at specified value?	4.8-5.2V	<i>Go to Step 3</i>	<i>Go to Step 5</i>
3	1. Verify the optical sensor is still disconnected. 2. Probe the sensor ground circuit with a test light connected to B+ at the harness connector.  Is test light ON?	—	<i>Go to Step 4</i>	<i>Go to Step 8</i>
4	1. Reconnect Optical/Fuel temperature sensor. 2. Start and idle engine. 3. With scan tool, command 900 RPM. 4. With <i>J 39200</i> on Hertz (Hz) scale, back probe high resolution signal circuit at PCM.  Is Hertz reading at specified value?	3840 Hz (±100)	<i>Go to Step 11</i>	<i>Go to Step 10</i>
5	Is the vehicle equipped with an electrical filter harness at the optical sensor?	—	<i>Go to Step 6</i>	<i>Go to Step 7</i>
6	1. Removed electrical harness filter from vehicle. 2. Check resistance across the electrical harness filter 5 volt reference circuit (terminal A).  Is resistance greater than specified value?	2.0 Ohms	<i>Go to Step 14</i>	<i>Go to Step 7</i>
7	1. Ignition OFF. 2. Electrical harness filter removed from vehicle (if equipped). 3. Disconnect the PCM, and check the Optical/Fuel temperature 5 volts reference circuit for an open, short to ground, or short to the sensor ground circuit. 4. If the Optical/Fuel temperature 5 volt reference circuit is open or shorted to ground, repair it as necessary.  Was the Optical/Fuel temperature 5 volt reference circuit open or shorted to ground?	—	<i>Go to Step 15</i>	<i>Go to Step 9</i>

## DTC P0370 Timing Reference High Resolution (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for an open or a poor sensor ground terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 14	Go to Step 12
9	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 15	Go to Step 13
10	1. Ignition OFF. 2. Disconnect the PCM, and check the high resolution signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. Check the harness connector at the fuel injection pump for a poor terminal connection. 4. If a problem is found, repair the problem as necessary. Was a repair made?	—	Go to Step 15	Go to Step 12
11	Check the high resolution signal circuit for a poor connection at the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 15	Go to Step 13
12	Replace Injection pump. <b>Important:</b> The new injection pump must be timed. Refer to <i>Fuel Injection Pump</i> . Is the action complete?	—	Go to Step 15	—
13	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 15	—
14	Replace electrical harness filter. 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 Applicable DTC Table	System OK

**DTC P0380 Glow Plug Circuit Performance**

Refer to *PCM, Glow Plugs, Underhood Fuse-Relay Center*.

**Circuit Description**

The glow plug system is used to assist in providing the heat required to begin combustion during cold engine 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 4.0 volts.
- or
- PCM has commanded glow plugs OFF and voltage at the glow plugs is greater than 4.0 volts.
- or
- 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**

The MIL will be illuminated after 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**

If glow plug relay is stuck in the ON position, check for proper operation of glow plugs, refer to *Glow Plug System Check*. 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 the OFF for 12 seconds.

The glow plug output feed wire nut and battery feed wire nut at the relay should be checked for proper torque (5 N.m 44 lb in) and for corrosion.

An intermittent may be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

**Test Description**

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

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 out put voltage has been seen by the PCM.

**DTC P0380 Glow Plug Circuit Performance**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. With a test light connected to ground, probe the B+ side of the glow plug relay (red wire). 2. Ignition ON, engine OFF. Is test light ON?	—	Go to Step 3	Go to Step 2
3	1. Ignition ON, engine OFF. 2. With scan tool command glow plugs ON. 3. Observe Glow Plugs display on scan tool (with the system enabled). 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 were stored refer to those table(s). Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids

## DTC P0380 Glow Plug Circuit Performance (cont'd)

Step	Action	Value(s)	Yes	No
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 the harness ground circuit. Is test light ON?	—	Go to Step 7	Go to Step 11
7	1. Ignition ON, engine OFF. 2. Glow plug relay harness 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 the 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	Repair the open in the battery feed circuit. Is action complete?	—	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 it 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 repair performed?	—	Go to Step 18	Go to Step 17
14	1. Check glow plug relay signal circuit for an open or short to ground. 2. If the glow plug relay signal circuit is open or shorted to ground, repair it as necessary. Was a repair performed?	—	Go to Step 18	Go to Step 15
15	Check glow plug relay signal 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
16	Replace glow plug relay. Refer to <i>Glow Plug Relay</i> . Is the action complete?	—	Go to Step 18	

## DTC P0380 Glow Plug Circuit Performance (cont'd)

Step	Action	Value(s)	Yes	No
17	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 18	—
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 P0400 EGR Flow Malfunction**

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

Refer to *Emission Hose Routing Diagram-Diesel*.

**Circuit Description**

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

**Conditions for Setting the DTC**

- With a 75 kPa Baro or greater, (Idle No EGR MAF) – (Idle Full EGR MAF(commanded by PCM)) is less than .0820 g/cyl
- Lowest achieved EGR pressure at full EGR is less than look up table value (internal to PCM)
- MAF value is greater than or equal to 0.1484 g/cyl.

**Action Taken When the DTC Sets**

The PCM will shut down the EGR.

**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 most likely cause of failure is a restricted vacuum line from the EGR valve to the vacuum tee (including the vacuum tee).

To run the diagnostic test the engine must be at the operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

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

2. This step checks for the correct amount of vacuum at the EGR valve.
3. At zero vacuum and at 15 in. Hg, there should be a difference greater than 0.10 g/cyl. If the difference is not greater than 0.10 g/cyl the EGR valve is malfunctioning.

**DTC P0400 EGR Flow Malfunction**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Install a vacuum gage in place of the EGR valve. 2. Start and idle the engine. 3. Apply parking brake. 4. Place the vehicle in drive. 5. At idle, observe vacuum.  Is the vacuum at the specified value?	5 – 7 in. Hg	Go to Step 3	Go to Step 5
3	1. Install a vacuum pump on EGR valve. 2. Start and idle engine in park. 3. Monitor Cylinder Air display on scan tool. 4. Apply 15 in. Hg of vacuum to EGR valve.  While applying the vacuum, does Cylinder Air decrease by greater than the specified value?	0.10 g/cyl	Go to Step 4	Go to Step 7

## DTC P0400 EGR Flow Malfunction (cont'd)

Step	Action	Value(s)	Yes	No
4	DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs were stored refer to those table(s). Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
5	Check the vacuum source at the solenoid assembly. Is vacuum at the specified value?	15 in. Hg	Go to Step 6	Go to Step 8
6	Repair restricted or leaky vacuum hose (from solenoid assembly to EGR valve). Is action complete?	—	Go to Step 9	—
7	Replace EGR valve. Is action complete?	—	Go to Step 9	—
8	Repair the vacuum pump. Refer to Vacuum Pump diagnosis and repair. Is action complete?	—	Go to Step 9	
9	<b>Important:</b> After repairs, the EGR ALM cells must be reset (under special functions in scan tool). Are EGR ALM cells reset?	—	Go to Step 10	—
10	1. After Repairs use the scan tool Clear Info function and road test vehicle. 2. Check for DTC(s) Current or History. Review test status information. If status is test Failed or DTC(s) are present begin diagnosis again on that DTC(s). 3. If last test Failed is not present and no DTC(s) are present repair is complete. Are the repairs complete?	—	Go to Step 11	—
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

**Wiring Diagram: 1995 Ford Taurus 3.0L V6**

**Legend:**

- LOC: Local
- MAN: Manual
- OBD II: On Board Diagnostics II

**Key Components and Connections:**

- Hot In Run And Start:** Power Distribution Cell 10, K7, L8, ENG 1 Fuse 15 20 A.
- Underhood Fuse-Relay Center:** Fuse Block Details Cell 11.
- 0.8 PNK 539:** Main power line for the PCM and solenoids.
- 0.5 BLK/WHT 451:** Ground line for the PCM and sensors.
- 0.5 YEL 492:** Ground line for the MAF Sensor.
- 0.8 GRN 435:** Ground line for the EGR Solenoid.
- 0.8 WHT 257:** Ground line for the EGR Vent Solenoid.
- 0.8 YEL 258:** Ground line for the Wastegate Solenoid.
- Powertrain Control Module (PCM):** Connected to the MAF Sensor, EGR Solenoid, EGR Vent Solenoid, and Wastegate Solenoid.
- Mass Air Flow (MAF) Sensor:** L56, connected to the PCM.
- Exhaust Gas Recirculation (EGR) Solenoid:** Connected to the PCM.
- Exhaust Gas Recirculation (EGR) Vent Solenoid:** Connected to the PCM.
- Wastegate Solenoid:** Connected to the PCM.
- Ground Distribution Cell 14:** Connected to the PCM.

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

Five ALM Cells that are less than .5.

The PCM will shut down the EGR.

- 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.

The most likley cause of failure is a condition causing low back pressure.

To run the diagnostic test the engine must be at the operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

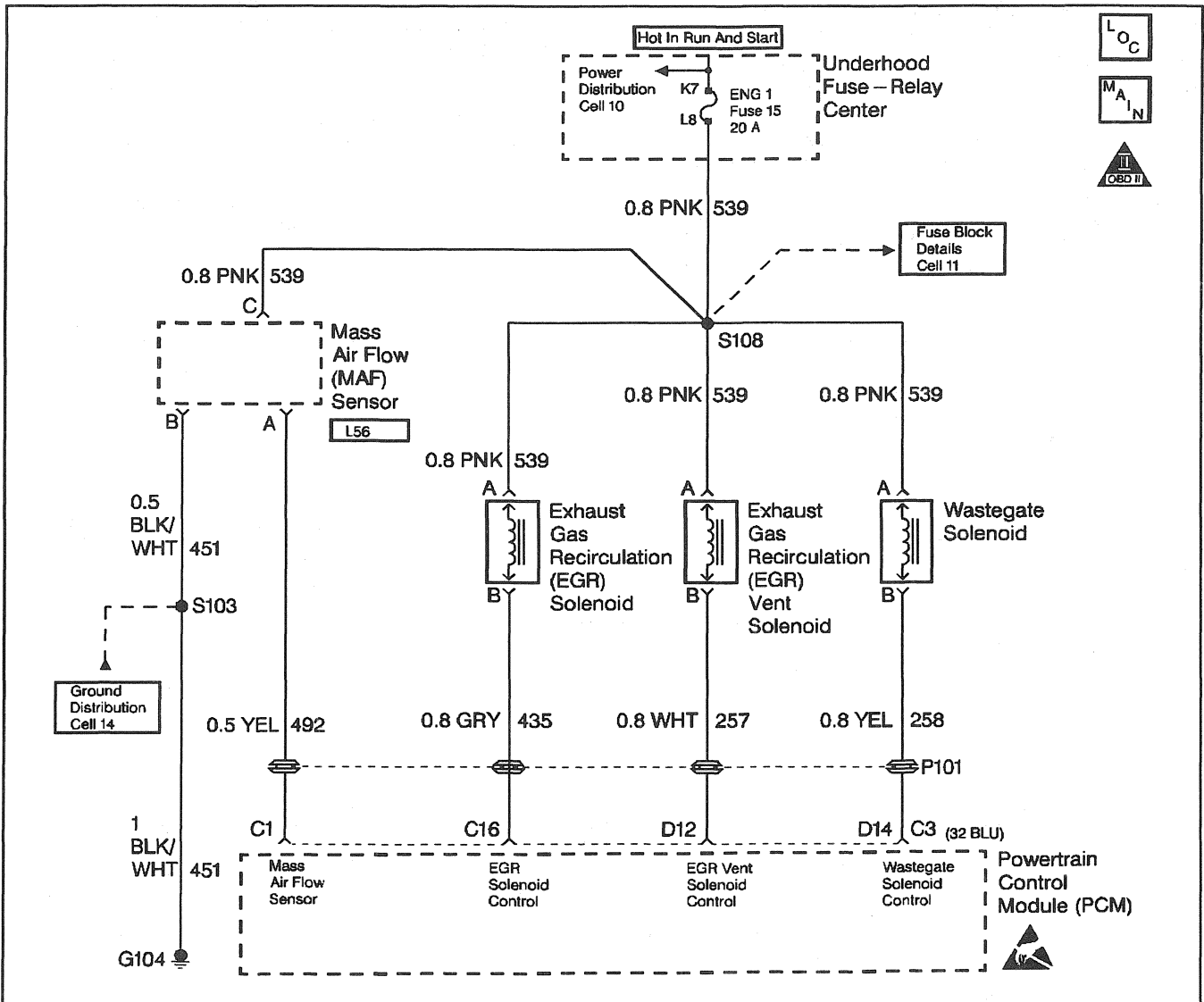
### Test Description

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

2. This step checks for a low back pressure problem.

### DTC P0401 EGR System Flow Insufficient

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Are there any other EGR DTCs set?	—	Go to the applicable DTC Table	Go to Step 3
3	Check for the following conditions: <ul style="list-style-type: none"> <li>• Plugged EGR ports.</li> <li>• Exhaust system leaks.</li> <li>• Exhaust system modifications.</li> </ul> Has a repair been performed?	—	Go to Step 4	—
4	<b>Important:</b> After repairs, the EGR ALM cells must be reset (under special functions in scan tool).  Are EGR ALM cells reset?	—	Go to Step 5	—
5	<ol style="list-style-type: none"> <li>1. Using the Scan Tool, select DTC, Clear Info.</li> <li>2. Start the engine and idle at normal operating temperature.</li> <li>3. Select DTC, Specific, then enter the DTC number which was set.</li> <li>4. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li> </ol> Does the Scan Tool indicate that the diagnostic Passed?	—	Go to Step 6	Go to Step 2
6	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 P0402 EGR Flow Excessive**

56429

**Circuit Description**

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration, high load situation or no EGR flow, while a small quantity of air indicates deceleration, idle or full EGR situations.

The PCM will monitor MAF and EGR pressures at different ranges to determine correct EGR flow rates. This is a type B DTC.

**Conditions for Setting the DTC**

Five ALM Cells that are greater than 1.5.

**Action Taken When the DTC Sets**

The PCM will shut down the EGR.

**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 most likely cause of failure is a mechanical problem in the EGR valve not allowing it to close.

To run the diagnostic test the engine must be at the operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back

pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

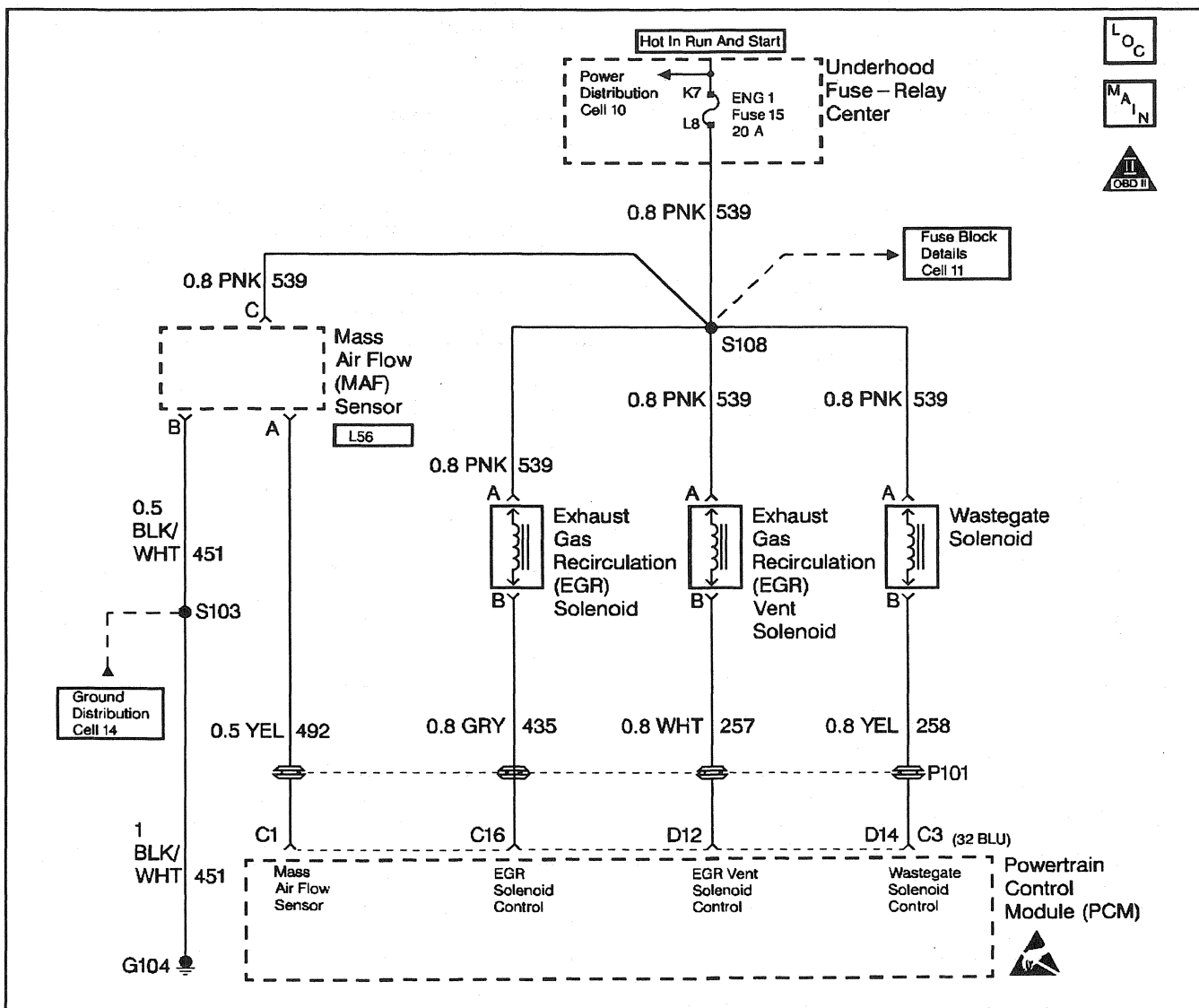
Number(s) below refer to the step number(s) on the Diagnostic Table.

- If the EGR valve is at fault, excessive black smoke will be present.

**DTC P0402 EGR Flow Excessive**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Are there any other EGR DTCs set?	—	Go to the applicable DTC Table	Go to Step 3
3	1. Repair one of the following conditions: <ul style="list-style-type: none"> <li>Malfunctioning EGR valve (valve not remaining closed).</li> <li>Restriction in exhaust system (high back pressure).</li> </ul> 2. Repair as necessary. Is action complete?	—	Go to Step 4	—
4	<b>Important:</b> After repairs, the EGR ALM cells must be reset (under special function in scan tool).  Are EGR ALM cells reset?	—	Go to Step 5	—
5	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 until scan tool indicates diagnostic Ran.  Does the Scan Tool indicate that this diagnostic Passed?	—	Go to Step 6	Go to Step 2
6	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 P0404 EGR System Performance



56429

## Circuit Description

The PCM operates a solenoid to control the EGR valve. This solenoid is normally open. By providing a ground path the PCM energizes the solenoid which then allows vacuum to pass to the EGR valve. During normal operation, the PCM compares its desired EGR signal with the EGR pressure signal and makes corrections in the duty cycle accordingly. If there is a difference in the PCM command and what is at the EGR valve sensed by the EGR control pressure/BARO sensor, the PCM makes minor adjustments to correct.

## Conditions for Setting the DTC

- DTCs P0405, P0406, P0102 and P0103 are not set.
- All EGR tests have been completed (internal to PCM).
- Measured EGR pressure unchanged.

## Action Taken When the DTC Sets

The PCM will shut down the EGR.

## 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 will cause a DTC P0404. Check all vacuum lines and components connected to the hoses for leaks or sharp bends or deformities. Check vacuum source to

EGR solenoid assembly. Also check for small leak in EGR valve, and proper vacuum line routing.

To run the diagnostic test the engine must be at operating temperature, vehicle in drive at idle for approximately 1 minute, then with vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back

pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

### Test Description

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

3. This step checks vacuum to the EGR valve control pressure/BARO sensor.

### DTC P0404 EGR System Performance

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Install vacuum gage in place of EGR control pressure/BARO. 2. Start and idle engine (engine at operating temperature). 3. At idle observe vacuum. Is vacuum at the specified value?	5 –7 Hg	Go to Step 3	Go to Step 4
3	Repair restriction between EGR control pressure/BARO sensor and vacuum tee (including vacuum tee). Is action complete?	—	Go to Step 5	—
4	Replace EGR Control Pressure/BARO sensor. Refer to <i>EGR Control Pressure Sensor</i> . Is the action complete?	—	Go to Step 5	—
5	<b>Important:</b> After Repairs, the EGR ALM cells must be reset (under special functions in scan tool). Are EGR ALM cells reset?	—	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 the vehicle until scan tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 P0405 EGR Sensor Circuit Low Voltage

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

Refer to *Emission Hose Routing Diagram-Diesel*.

### Circuit Description

A EGR Control Pressure/Baro sensor is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. This signal is used to control EGR duty cycle calculated by the PCM. This is a type B DTC.

### Conditions for Setting the DTC

- Actual EGR less than or equal to .24 volts (15 kPa).
- Condition met for 2 seconds.

### Action Taken When the DTC Sets

The PCM will shut down the EGR.

### 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, the EGR pressure is equal to atmospheric pressure with the signal voltage being high.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

### Test Description

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

2. This step determines if P0405 is a hard failure or an intermittent condition.
3. Jumpering the 5 volt reference circuit to the signal circuit will determine if the sensor is at fault, or if there is a problem with the PCM or wiring.
4. The scan tool may not display 5 volts. The important thing is that the PCM recognized the voltage as more than 4 volts, indicating that the PCM and the signal circuit are OK.

### DTC P0405 EGR Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Install Scan tool. 2. Engine idling. 3. Observe EGR Sensor display on scan tool. Does the scan tool display EGR Sensor less than or equal to the specified value?	0.24V	Go to Step 3	Go to Step 5
3	1. Turn the Ignition OFF. 2. Disconnect the 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. Turn the Ignition ON. Does the scan tool display EGR Sensor voltage greater than the specified value?	4.0V	Go to Step 6	Go to Step 4

## DTC P0405 EGR Sensor Circuit Low Voltage (cont'd)

Step	Action	Value(s)	Yes	No
4	1. Turn the Ignition OFF. 2. Remove the jumper wire. 3. Probe the sensor signal circuit at the harness connector with a test light connected to B+. 4. Turn the Ignition ON. Does the scan tool display EGR Sensor voltage greater than the specified value?	4.0V	Go to Step 9	Go to Step 7
5	The DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs are stored refer to those table(s) first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
6	Check for a poor connection at the EGR Control pressure/BARO sensor. Was a problem found?	—	Go to Step 12	Go to Step 11
7	Check for an open EGR Control pressure/BARO sensor signal circuit. Was a problem found?	—	Go to Step 12	Go to Step 8
8	Check the EGR Control pressure/BARO 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 Control pressure/BARO 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 Control pressure/BARO sensor 5 volt reference circuit. Was a problem found?	—	Go to Step 12	Go to Step 13
11	Replace the EGR Control pressure/BARO sensor. Refer to <i>EGR Control Pressure Sensor</i> . Is the action complete?	—	Go to Step 14	—
12	Repair the circuit as necessary. Is the action complete?	—	Go to Step 14	—
13	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 14	—
14	<b>Important:</b> After Repairs, the EGR ALM cells must be reset (under special functions in scan tool). Are EGR ALM cells reset?	—	Go to Step 14	—
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 Applicable DTC Table	System OK

## DTC P0406 EGR Sensor Circuit High Voltage

Refer to *PCM, EGR, BAaro Boost Pressure Sensor, IAT, ECT*.

Refer to *Emission Hose Routing Diagram-Diesel*.

### Circuit Description

A EGR Control Pressure/Baro sensor is used to monitor the amount of vacuum in the EGR circuit. It senses the actual vacuum in the EGR vacuum line and sends a signal back to the PCM. This signal is used to control EGR duty cycle calculated by the PCM. This is a type B DTC.

### Conditions for Setting the DTC

- Actual EGR greater than or equal to 3.96 volts (85 kPa).
- Desired EGR is less than or equal to 60 kPa.
- EGR vent is closed.
- Conditions met for 2 seconds.

### Action Taken When the DTC Sets

PCM will shut off EGR system.

### 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, the manifold pressure is equal to atmospheric pressure with the signal voltage being high. This information is used by the PCM as an indicator of vehicle altitude. If DTC P0406 is intermittent, refer to *Intermittents*.

To run the diagnostic test the engine must be at the operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

### Test Description

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

2. This step will check for EGR Vent Solenoid DTC.
3. This step determines if DTC P0406 is a hard failure or an intermittent condition.
4. This step simulates conditions for a DTC P0405. If the PCM recognizes the change, the PCM and the signal circuit are OK.

### DTC P0406 EGR Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Is DTC P1653 set?	—	Go to the Applicable DTC Table	Go to Step 3
3	1. Connect the scan tool. 2. Engine idling.  Does the scan tool display EGR Control pressure/BARO sensor voltage greater than the specified value?	4.0V	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect the EGR Control Pressure/Baro sensor electrical connector. 3. Turn the ignition ON.  Does the scan tool display a EGR Control pressure/BARO sensor voltage less than the specified value?	1.0V	Go to Step 6	Go to Step 10

## DTC P0406 EGR Sensor Circuit High Voltage (cont'd)

Step	Action	Value(s)	Yes	No
5	DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs are stored refer to those table(s) first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
6	1. Ignition ON, engine Off. 2. With a <i>J 39200</i> connected to ground, probe the 5 volt reference circuit at the EGR Control Pressure/BARO Sensor harness connector. Is voltage greater than the specified value?	5.2V	Go to Step 11	Go to Step 7
7	Probe the EGR Control Pressure/Baro sensor ground circuit with a test light to B+. Is the test light ON?	—	Go to Step 8	Go to Step 12
8	Check the EGR vacuum source for a restriction. Was a problem found?	—	Go to Step 13	Go to Step 9
9	Replace the malfunctioning EGR Control Pressure/Baro sensor. Refer to <i>EGR Control Pressure Sensor</i> . Is the action complete?	—	Go to Step 15	—
10	Check for a short to voltage in the sensor signal circuit. Was a problem found?	—	Go to Step 13	Go to Step 14
11	1. Check for a short to voltage in the 5 volt reference circuit. 2. If a problem is found, repair as necessary. Was a repair performed?	—	Go to Step 15	Go to Step 14
12	Repair the open in the sensor ground circuit. Is the action complete?	—	Go to Step 15	—
13	Repair as necessary. Is the action complete?	—	Go to Step 15	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 15	—
15	<b>Important:</b> After Repairs, the EGR ALM cells must be reset (under special functions in scan tool). Are EGR ALM cells reset?	—	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 the vehicle until Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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 the Applicable DTC Table	System OK

**DTC P0501 Vehicle Speed Sensor Circuit**

Refer to *PCM, VSS Buffer, VSS, EBCM*.

**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 PCM. The buffer sends two different signals to the PCM. 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 must be 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 during which the diagnostic does not fail (coolant temperature has risen 5°C (40°F) from the start up coolant temperature and the engine coolant temperature exceeds 71°C (160°F) during that same ignition cycle.
- Use of a Scan tool.

**Diagnostic Aids**

Check connections at VSS buffer and PCM. Refer to 4L80E Diagnostic Trouble Codes in Transmission if DTC P0722 or DTC P0723 is also set.

**Test Description**

Number(s) below refer to 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	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 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 <i>J 39200</i> on the AC scale. 2. Transmission in any drive range with drive wheels rotating.  Does voltage increase on <i>J 39200</i> 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

## DTC P0501 Vehicle Speed Sensor Circuit (cont'd)

Step	Action	Value(s)	Yes	No
7	DTC is intermittent. If no additional DTCs are stored, refer to Diagnostic Aids. If additional DTCs are stored refer to those table(s) first. Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids
8	Repair the open in the ignition feed circuit. Is the action complete?	—	Go to Step 15	—
9	Repair the open in the ground circuit. Is the 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 connections at buffer module and PCM. Was a repair performed?	—	Go to Step 15	Go to Step 14
13	Replace VSS Buffer module. Refer to <i>Vehicle Speed Signal Buffer</i> . Is the action complete?	—	Go to Step 15	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 Applicable DTC Table	System OK

**DTC P0567 Cruise Resume Circuit**

Refer to *PCM, Cruise Control Switch, Transfer Case Switch*.

**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 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 step 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	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 connector containing the Resume switch signal circuit. 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 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
5	1. Resume switch signal circuit is shorted to voltage or stuck in the ON position. 2. Repair as necessary.  Is the action complete?	—	Go to Step 8	—
6	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  Is the action complete?	—	Go to Step 7	—

**DTC P0567 Cruise Resume Circuit (cont'd)**

Step	Action	Value(s)	Yes	No
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 until the scan tool indicates that the diagnostic RAN. Does the Scan Tool indicate that this diagnostic 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**

Refer to *PCM, Cruise Control Switch, Transfer Case Switch*.

**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 a 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 Resume switch signal circuit.

or

- Cruise switch ON.
- Resume 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 is stuck in the ON position or the driver is holding the Set/Coast switch ON for longer than 25.5 seconds, DTC P0568 will set.

DTC P0568 only checks the signal circuit for a short to voltage.

**Test Description**

Number(s) below refer to the step 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	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 connector containing the Set switch signal circuit. 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 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
5	1. Set switch signal circuit is shorted to voltage or stuck in the ON position. 2. Repair as necessary.  Is the action complete?	—	Go to Step 8	—
6	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  Is the action complete?	—	Go to Step 7	—

## DTC P0568 Cruise Set Circuit (cont'd)

Step	Action	Value(s)	Yes	No
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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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**

Refer to *PCM, EBCM, Brake Switch, Auto Transmission*.

**Circuit Description**

The TCC normally closed brake switch supplies a B+ signal on CKT 420 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 820 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 tool.

**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 step number(s) on the Diagnostic Table.

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

**DTC P0571 Cruise Brake Switch Circuit**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 Open and then Closed 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 a test light connected to ground, probe normally open feed circuit (terminal B).  Is 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 a test light connected to ground, probe normally closed feed circuit (terminal F).  Is test light ON?	—	Go to Step 7	Go to Step 12

## DTC P0571 Cruise Brake Switch Circuit (cont'd)

Step	Action	Value(s)	Yes	No
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 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
9	Check normally open feed circuit (terminal B) for and open or short to ground. Is the action complete?	—	Go to Step 17	—
10	Check normally open Cruise Brake switch signal circuit for and open or short to ground. Was a repair performed?	—	Go to Step 17	Go to Step 11
11	Check the 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 and open or short to ground. Is the action complete?	—	Go to Step 17	—
13	Check normally closed Brake switch signal circuit for and open or short to ground. Was a repair performed?	—	Go to Step 17	Go to Step 14
14	Check the normally closed Brake switch signal circuit for a poor connection at PCM? Was a repair performed?	—	Go to Step 17	Go to Step 16
15	Replace stop lamp switch. Is the action complete?	—	Go to Step 17	—
16	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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 Internal Control Module Memory Check Sum

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 Control Module Programming

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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

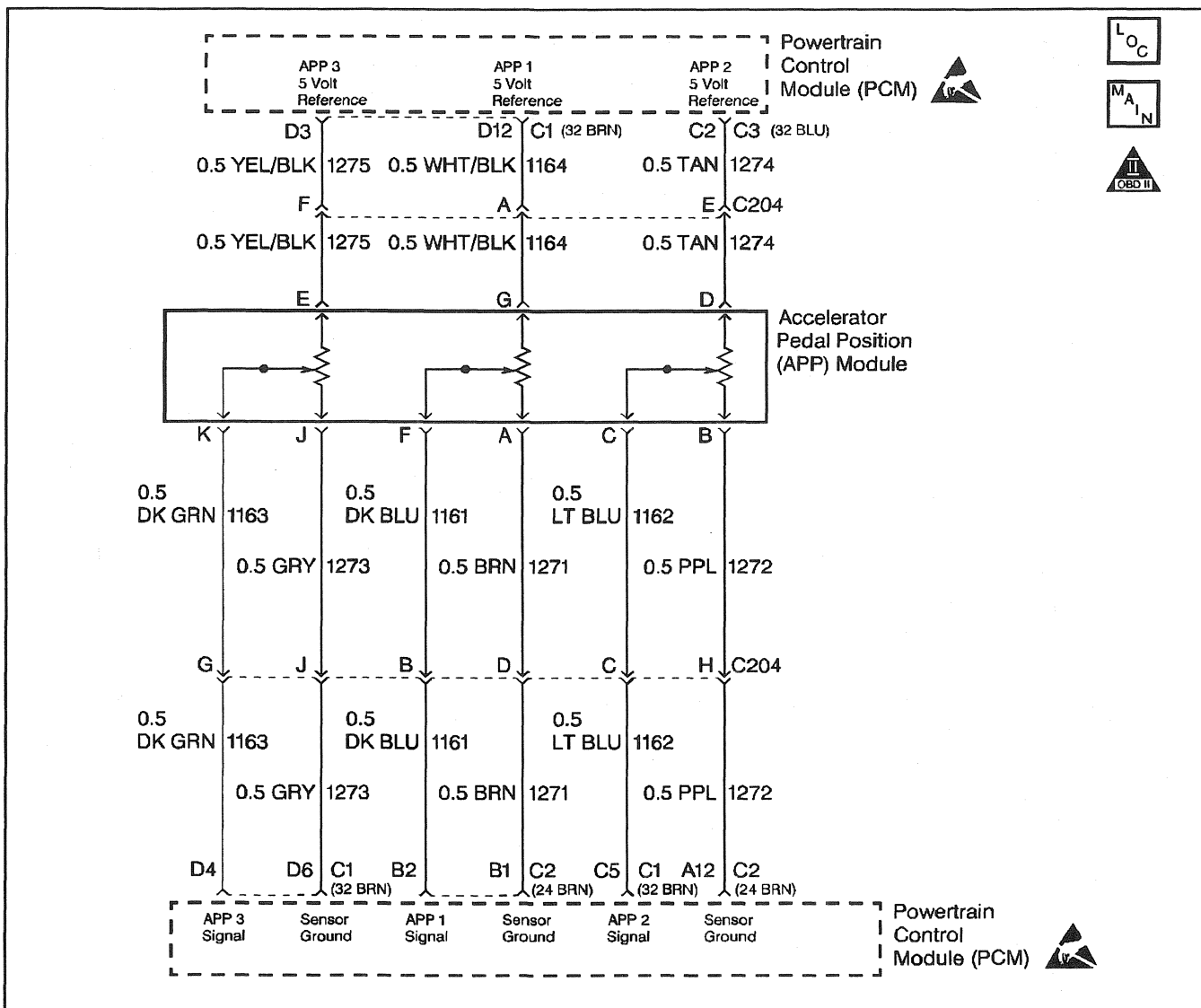
## DTC P0604 Control Module Random Access Memory

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 until the Scan Tool indicates that the diagnostic has Ran.  Does the Scan Tool indicate that this diagnostic 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	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is DTC P0370 set?	—	Go to DTC P0370 Timing Reference High Resolution	Go to Step 3
3	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that this diagnostic 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 APP System



56421

## 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 D DTC.

## Conditions for Setting the DTC

PCM has recognized an intermittent APP fault and there are no other 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 diagnosis first.

## Test Description

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

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

## DTC P1125 APP System

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain 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 the applicable DTC table(s) first.  Are any 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 shorted to ground?	—	Go to Step 6	Go to Step 5
5	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to PCM Replacement/Programming.  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that the diagnostic 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

56429

The most likely cause of failure is a leaky intake duct after the MAF sensor.

To run the diagnostic test the engine must be at operating temperature, vehicle in drive at idle for approximately 1 minute, then with vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

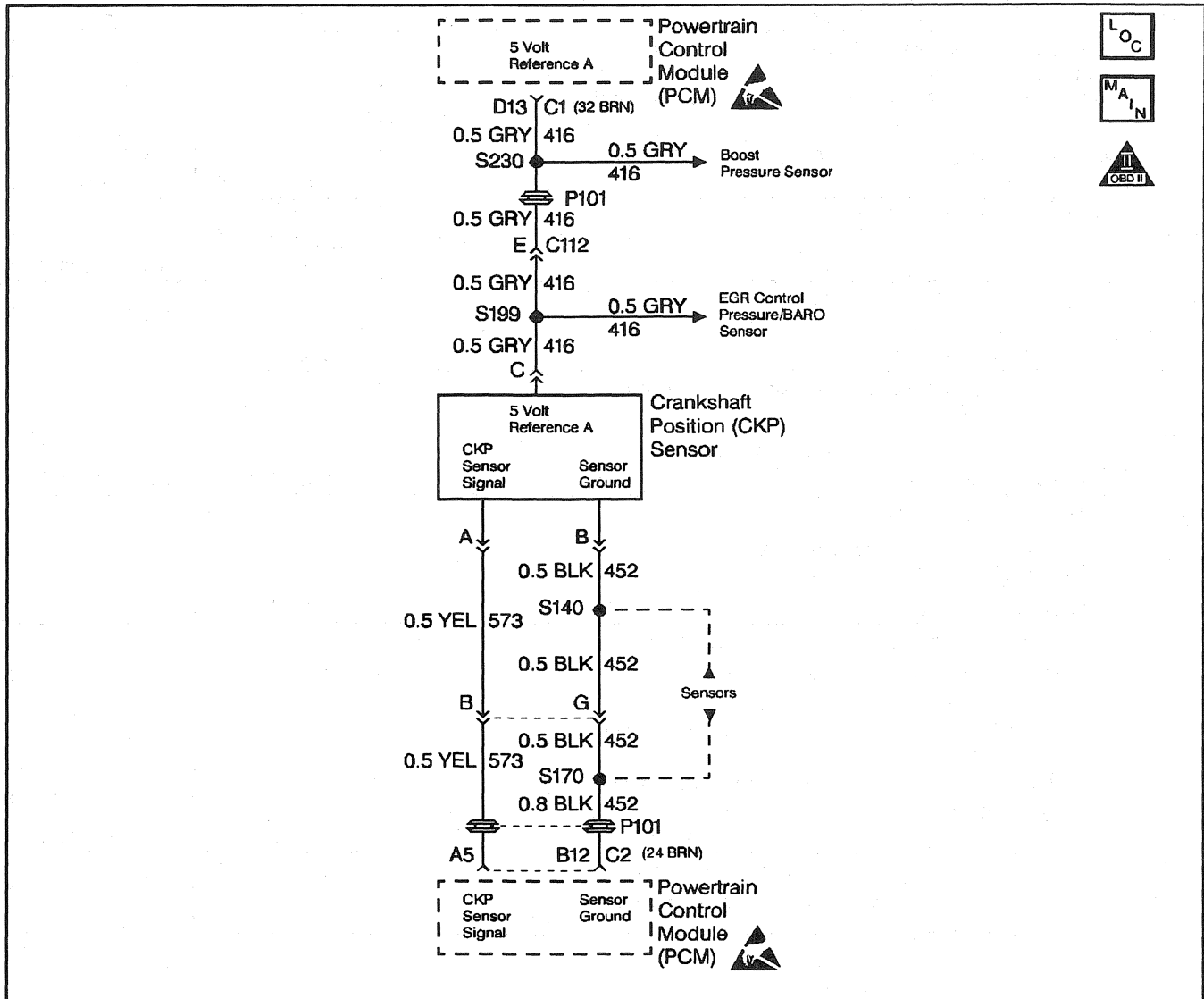
**Test Description**

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

3. A large leak in the intake system will set MAF sensor DTC. All intake ducts should be checked after the MAF sensor.

**DTC P1191 Intake Air Duct Leak**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Are there any EGR DTCs set?	—	Go to the applicable DTC Table	Go to Step 3
3	Check for the following conditions: <ul style="list-style-type: none"> <li>• Air inlet duct leaks (after the MAF sensor).</li> <li>• All intake manifold gasket in place.</li> </ul> Has a repair been performed?	—	Go to Step 4	—
4	<b>Important:</b> After repairs, the EGR ALM cells must be reset (under special functions in scan tool).  Are EGR ALM cells reset?	—	Go to Step 5	—
5	<ol style="list-style-type: none"> <li>1. Using the Scan Tool, select DTC, Clear Info.</li> <li>2. Start the engine and idle at normal operating temperature.</li> <li>3. Select DTC, Specific, then enter the DTC number which was set.</li> <li>4. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li> </ol> Does the Scan Tool indicate that this diagnostic Passed?	—	Go to Step 6	Go to Step 2
6	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**

56424

**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

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Are there any other DTCs set?	—	Go to the Applicable DTC Table	Go to Step 3
3	Clear all codes and reset injection timing until TDC Offset is between specified values. Refer to <i>TDC Offset</i> .  Is timing within specified value?	-0.25 to -0.75	Go to Step 6	Go to Step 4
4	Check the crankshaft position sensor for the following. <ul style="list-style-type: none"> <li>• Proper installation.</li> <li>• Loose or broken sensor mounting tab.</li> </ul> Was a repair performed?	—	Go to Step 6	Go to Step 5
5	Replace the Injection Pump.  <b>Important:</b> The new injection pump must be timed. Refer to <i>Fuel Injection Pump</i> .  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 until the Scan Tool indicates that the diagnostic has Ran.  Does the Scan Tool indicate that this diagnostic 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 P1216 Fuel Solenoid Response Time Too Short**

Refer to *PCM, Fuel Solenoid Driver, Water in Fuel Sensor*.

**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 12 volts and less than 15 volts.
- Engine coolant temperature greater than 50 °C (122 °F).
- ENGINE SPEED greater than 1350 RPM.
- Requested fuel rate is greater than 0.0 mm.
- Inj. Pump Closure Time less than .75 ms.

**Action Taken When the DTC Sets**

The MIL will not illuminate.

**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 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.

An intermittent can be caused by the following:

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

**Test Description**

Number(s) below refer to the step 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 at fault.

**DTC P1216 Fuel Solenoid Response Time Too Short**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Is DTC P0219 set?	—	Go to <i>DTC P0219 Engine Overspeed Condition</i>	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 or equal to 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. Is the Inj. Pump Closure Time display less than or equal to 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 were stored refer to those applicable DTC table(s) first.  Are any additional DTCs stored?	—	Go to the Applicable DTC Table	—

## DTC P1216 Fuel Solenoid Response Time Too Short (cont'd)

7	1. Check the Closure ground circuit for an open. 2. If the Closure ground 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 and check connections at the driver. 2. If a problem is found, repair the problem 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 the PCM and replace terminal if necessary. Did the terminal require replacement?	—	Go to Step 12	Go to Step 11
10	Replace the Injection pump. Refer to <i>Fuel Injection Pump</i> . <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . Is the action complete?	—	Go to Step 12	—
11	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 until the Scan Tool indicates that the diagnostic has Ran. Does the Scan Tool indicate that this diagnostic 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

Refer to *PCM, Fuel Solenoid Driver, Water in Fuel Sensor*.

### 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 milli seconds. This is a type D DTC.

### Conditions for Setting the DTC

- Battery voltage greater than 12 volts and less than 15 volts.
- Engine coolant temperature greater than 50 °C (122 °F).
- ENGINE SPEED greater than 1350 RPM.
- Requested fuel rate is greater than 0.0 mm.
- Closure Time greater than 2.5 ms.

### Action Taken When the DTC Sets

The MIL will not illuminate.

### 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 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.

Poor performance and starting conditions will exist. Fuel contamination could also cause this DTC.

### Test Description

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

3. This step determines if DTC 1217 is a hard failure or an intermittent.
6. 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	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Is DTC P0370 set?	—	Go to <i>DTC P0370 Timing Reference High Resolution</i>	Go to Step 3
3	1. Start and idle engine. 2. Observe Inj. Pump Closure Time display 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 J 39200 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 were stored refer to those DTC table(s) first.  Are any additional DTCs stored?	—	Go to the Applicable DTC Table	Go to Diagnostic Aids

## DTC P1217 Fuel Solenoid Response Time Too Long (cont'd)

6	Repair the fuel solenoid driver ignition feed circuit poor connections or aftermarket add-ons. Refer to <i>Connect Add-On Electrical Operated Equipment to Battery</i> . Was a repair performed?	—	Go to Step 8	—
7	<b>Important:</b> Before replacing the Injection pump, check for fuel system contamination. Refer to <i>Contamination Testing</i> . Replace the Injection pump. Refer to <i>Fuel Injection Pump</i> . <b>Important:</b> The new injection pump must be timed. Refer to <i>Checking/Adjust Injection Timing</i> . 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 until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this diagnostic 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

Refer to *PCM, Fuel Solenoid Driver, Water in Fuel Sensor*.

### 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 value.
- 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 Tool.

### Diagnostic Aids

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

### Test Description

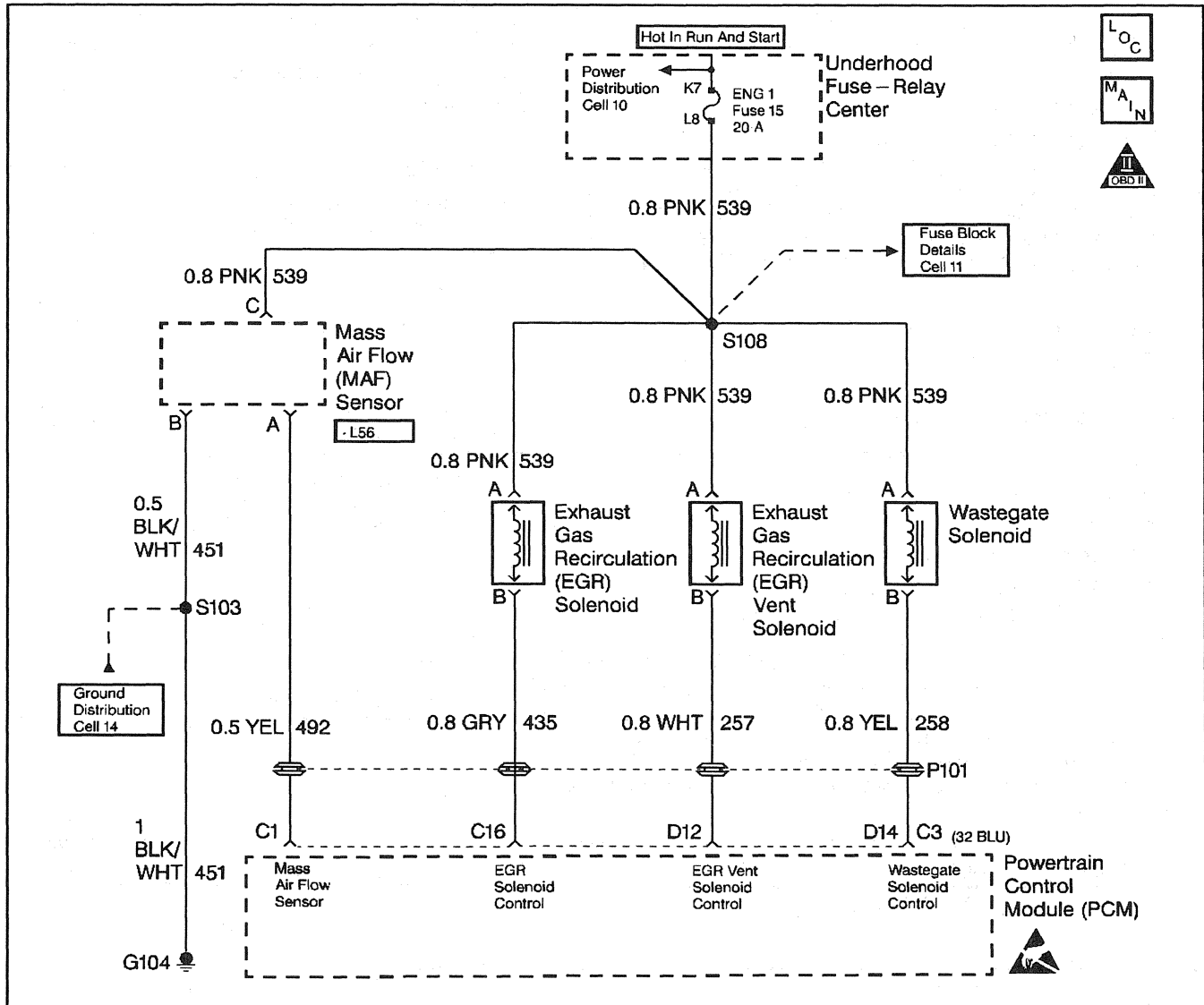
Number(s) below refer to the step number(s) on the Diagnostic Table.

3. This step will determine if there is a problem with the connection at the fuel solenoid driver or malfunctioning injection pump. This DTC will only clear DTC Status when a Time Set procedure has been activated (injection timing does not have to be adjusted).

### DTC P1218 Injection Pump Calibration Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Are there any other DTCs set?	—	Refer to Applicable 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 performed). 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. <b>Important:</b> The new injection pump must be timed. Refer to <i>Fuel Injection Pump</i> .  Is the action complete?	—	Go to Step 6	—
5	DTC is intermittent. 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 the Applicable 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 the Applicable DTC Table	System OK

## DTC P1406 EGR Valve Position



56429

Refer to *Emission Hose Routing Diagram*.

### Circuit Description

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration, high load situation or no EGR flow, while a small quantity of air indicates deceleration, idle or full EGR situations.

The PCM will monitor MAF and EGR pressures at different ranges to determine correct EGR flow rates. This is a type B DTC.

### Conditions for Setting the DTC

- DTCs P0405, P0406, P0102 and P0103 not set.

- All MAF and EGR Control Pressure test complete (internal to PCM).
- EGR in Closed Loop.
- IAT greater than or equal to 20°C (68°F) and less than or equal to 95°C (203°F).
- ALM cells not changed for greater than 2 seconds.
- Fuel rate between 10 and 25 mm<sup>3</sup>.
- Engine RPM between 1500 and 2100.
- Engine speed stable.
- Above conditions persist for at least 3 seconds.

### Action Taken When the DTC Sets

The PCM will shut down the EGR.

**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 will cause a DTC P1406. Carefully check all vacuum lines and components connected to the hoses for leaks or deformities. Check vacuum source to EGR solenoid assembly. Also check for small leak in EGR valve, and proper vacuum line routing. Vacuum line ends can be trimmed to ensure a tight fit if length permits.

To run the diagnostic test the engine must be at the operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

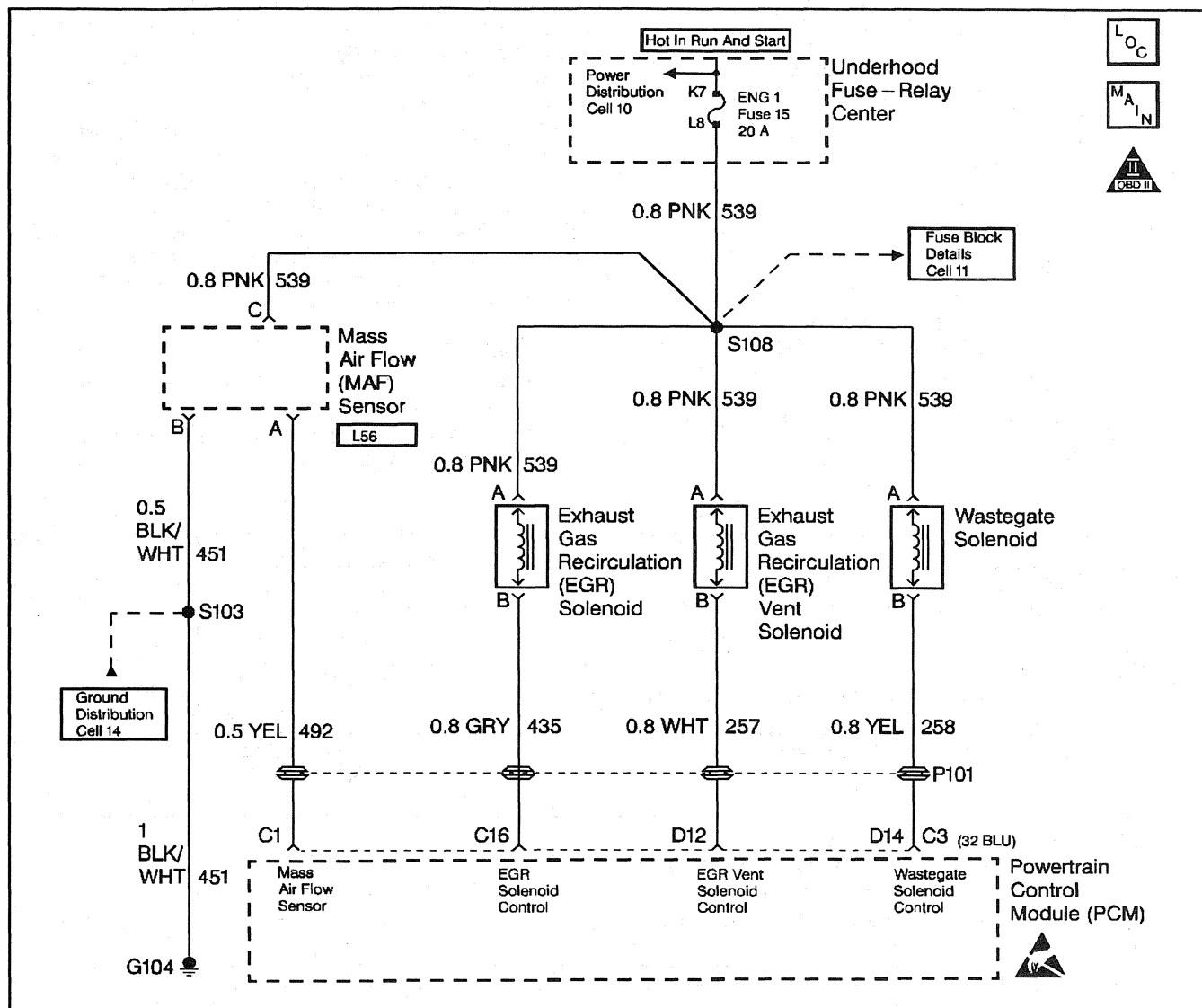
Number(s) below refer to the step number(s) on the Diagnostic Table.

3. Vacuum lines should be checked carefully for proper fit and deformities.

**DTC P1406 EGR Valve Position**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Are there any other EGR DTCs set?	—	Go To The Applicable DTC Table	Go to Step 3
3	Repair one of the following conditions: <ul style="list-style-type: none"> <li>• Restriction in vacuum line from the EGR valve to the vacuum tee (including the vacuum tee).</li> <li>• Malfunctioning EGR valve (EGR valve stuck open).</li> </ul> Is action complete?	—	Go to Step 4	—
4	<b>Important:</b> After Repairs, the EGR ALM cells must be reset (under special functions in scan tool).  Are EGR ALM cells reset?	—	Go to Step 5	—
5	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 until the scan tool indicates the diagnostic Ran. Does the Scan Tool indicate that this diagnostic Passed?	—	Go to Step 6	Go to Step 2
6	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 P1409 EGR Vacuum System Leak



56429

**Circuit Description**

The Mass Air Flow (MAF) sensor measures the amount of air entering the engine during a given time. The PCM uses the mass air flow information to monitor EGR flow rates. A large quantity of air entering the engine indicates an acceleration, high load situation or no EGR flow, while a small quantity of air indicates deceleration, idle or full EGR situations.

The PCM will monitor MAF and EGR pressures at different ranges to determine correct EGR flow rates. This is a type B DTC.

**Conditions for Setting the DTC**

- DTCs P0405, P0406, P0102 and P0103 not set.
- All MAF and EGR Control Pressure tests complete (internal to PCM).

- Engine at operating temperature.
- IAT greater than or equal to 20°C (68°F) and less than or equal to 95°C (203°F).

**Action Taken When the DTC Sets**

The MIL will illuminate on the second consecutive test fail.

**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 will cause a DTC P1409. Carefully check all vacuum lines and components connected to the hoses for leaks or deformities. Check vacuum source to EGR solenoid assembly. Also check for small leak in EGR valve, and proper vacuum line routing, refer to *Emission Hose Routing Diagram*. Vacuum line ends can be trimmed to ensure a tight fit if length permits.

To run the diagnostic test the engine must be at operating temperature, vehicle in drive at idle for approximately 1 minute, then with the vehicle in park hold engine rpm steady between 1500 and 2100 rpm for 30 seconds. If the diagnostic test fails to run, vehicle must be driven.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

**Test Description**

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

3. This step checks for a vacuum source to the EGR valve.
4. This step checks for a malfunctioning EGR vent solenoid.
5. This step checks for a good vacuum source.

**DTC P1409 EGR Vacuum System Leak**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install a vacuum gage in place of the EGR valve. 2. Start the engine. 3. Place the vehicle in drive. 4. At idle, observe the vacuum. Is the vacuum at the specified value?	5 – 7 in. Hg	Go to Step 4	Go to Step 3
3	1. Disconnect the vacuum feed to the EGR vent solenoid. 2. Install the vacuum gage on the vacuum feed. 3. Start the engine. 4. Place the vehicle in drive. 5. Observe the vacuum gage at idle. Is there any vacuum present?	—	Go to Step 7	Go to Step 5
4	1. Turn the ignition OFF. 2. Install a vacuum pump on the EGR valve. 3. Pump the vacuum pump up to 15 in. Hg of vacuum. Does the EGR valve hold vacuum?	—	Go to Step 6	Go to Step 11
5	Check the main vacuum source at the solenoid assembly. Is the vacuum greater than or equal to the specified value?	15 in. Hg	Go to Step 10	Go to Step 8
6	DTC is intermittent. 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 the Applicable DTC Table	Go to Diagnostic Aids
7	Repair one of the following: • Leaking or deformed vacuum hoses at EGR vent solenoid. • Malfunctioning EGR vent solenoid. Was a repair performed?	—	Go to Step 12	Go to Step 10

## DTC P1409 EGR Vacuum System Leak (cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check for a leaking or deformed vacuum hose to the vacuum pump. 2. Repair as necessary. Is action complete?	—	Go to Step 12	—
9	Replace vacuum pump. Is the action complete?	—	Go to Step 12	—
10	Repair one of the following: • Leaking or deformed vacuum hoses at EGR solenoid. • Malfunctioning EGR solenoid. Is action complete?	—	Go to Step 12	—
11	Replace EGR valve. Refer to <i>EGR Valve</i> . Is the action complete?	—	Go to Step 12	—
12	<b>Important:</b> After Repairs, the EGR ALM cells must be reset (under special functions in scan tool). Are EGR ALM cells reset?	—	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 until 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 Applicable DTC Table	System OK

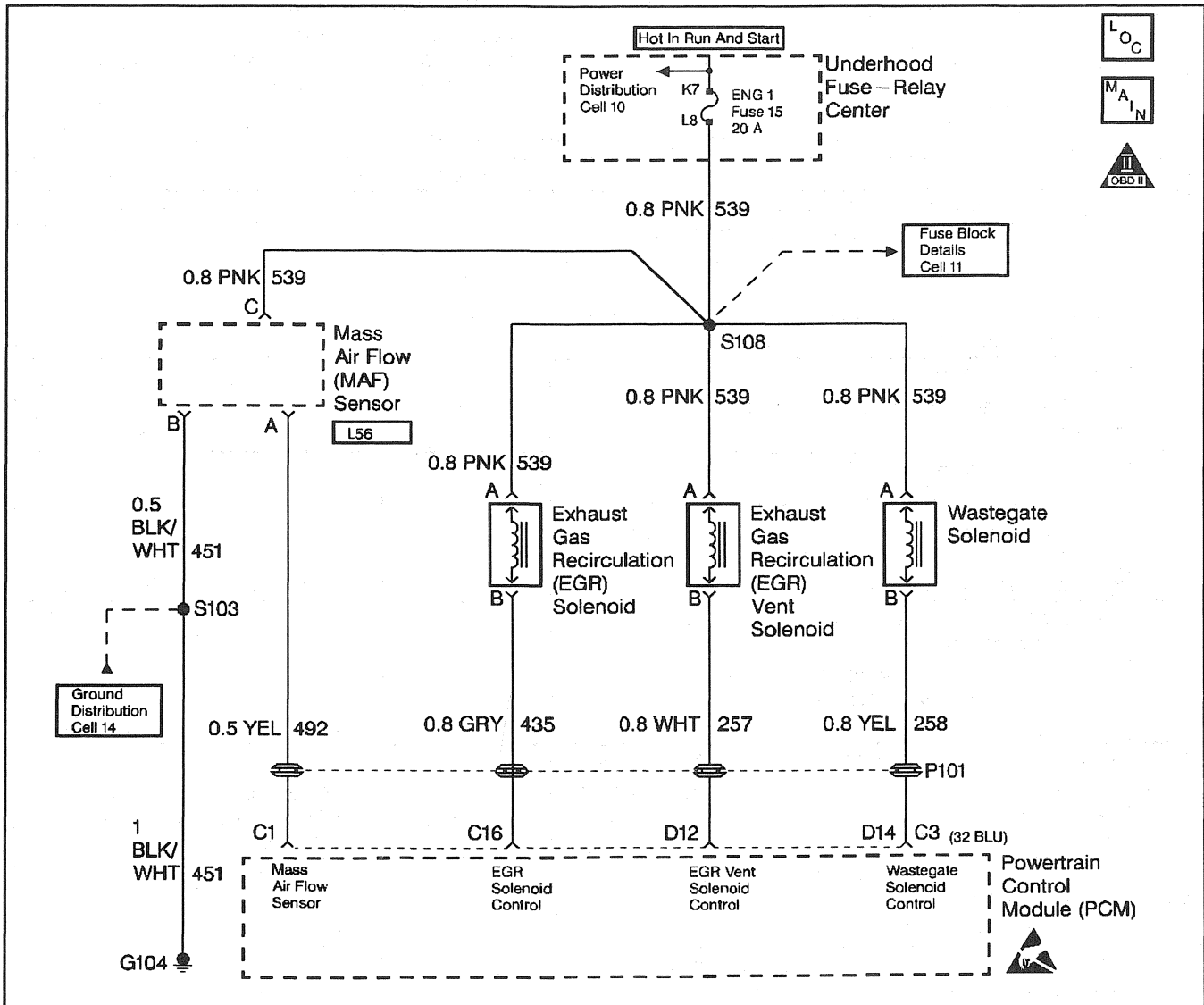
## DTC P1621 EEPROM Write

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 Powertrain On-Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	Replace the PCM.  <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> .  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 the vehicle until the Scan Tool indicates that the diagnostic Ran.  Does the Scan Tool indicate that the diagnostic 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	<p><b>Important:</b> 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.</p> <p>Was the Powertrain On-Board Diagnostic (OBD) System Check performed?</p>	—	Go to Step 2	Go to Powertrain OBD System Check
2	<p>Replace the PCM.</p> <p><b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i>.</p> <p>Is the action complete?</p>	—	Go to Step 3	—
3	<p>1. Using the Scan Tool, select DTC, Clear Info.</p> <p>2. Start engine and idle at normal operating temperature.</p> <p>3. Select DTC, Specific, then enter the DTC number which was set.</p> <p>4. Operate vehicle until the Scan Tool indicates that the diagnostic Ran.</p> <p>Does the Scan Tool indicate that this diagnostic Passed?</p>	—	Go to Step 4	Go to Step 2
4	<p>Using the Scan Tool, select Capture Info, Review Info.</p> <p>Are any DTCs displayed that have not been diagnosed?</p>	—	Go to the Applicable DTC Table	System OK

## DTC P1635 5 Volt Reference Low



56429

**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, EGR Control Pressure/Baro and Crankshaft Position sensors) and BRD14 (Optical/Fuel temperature sensor (Cam/HI.Res). This is a type D 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 tool.

**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 step number(s) on the Diagnostic Table.

2. Checks to confirm that a DTC is still present.

3. Checks to determine if there is a 5 volt reference from the PCM.

4. Checks to determine if there is a short-to-ground in the reference circuit or a short-to-ground in the PCM.

**DTC P1635 5 Volt Reference Low**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain 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 J 39200 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 were stored refer to those table(s). Are any additional DTCs stored?	—	Go to the applicable DTC table	Go to Diagnostic Aids
6	Replace EGR Control Pressure/BARO sensor. Refer to <i>EGR Control Pressure Sensor</i> . Is the action complete?	—	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 PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the vehicle until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that the diagnostic 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

**Hot In Run And Start**

Power Distribution Cell 10

H8

J7

GAGES Fuse 4 10 A

IP Fuse Block

0.8 PNK 39

S213

0.35 PNK 39

22

Fuse Block Details Cell 11

Instrument Cluster Cell 81

SERVICE THROTTLE SOON Indicator

Malfunction Indicator Lamp (MIL) (SERVICE ENGINE SOON)

21

0.35 WHT/BLK 176

E C200

0.35 WHT/BLK 176

D11

23

0.5 BRN/WHT 419

B6 C100

P101

0.5 BRN/WHT 419

C14 C3 (32 BLU)

Service Throttle Soon Indicator Control

MIL Control

Powertrain Control Module (PCM)

LOC

MAIN

OBD II

29548

A dash light is illuminated by the PCM if diagnostics have detected certain errors related to the engine performance or engine sensor status. When the PCM is commanding the MIL ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the MIL 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 MIL circuit. This is a type D DTC.

- MIL requested ON.
- Voltage on MIL control circuit high (near battery volts).
- MIL requested OFF.
- Voltage on MIL control circuit low (near 0 volts).

Will not turn ON the MIL.

- 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.

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

- Poor connections
- Rubbed through wire insulation
- Broken wire inside the insulation.

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

2. Be sure that both the ON and the OFF states are commanded. Repeat the commands as many times as necessary.
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 P1641 MIL Control Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTCs 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. Using a scan tool, command the lamp ON and OFF. Does the 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 were stored refer to those table(s). Are any additional DTCs stored?	—	Go to the Applicable DTC table	Go to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the PCM connector containing the lamp control circuit. 3. Ignition ON, engine OFF. Is the lamp OFF?	—	Go to Step 5	Go to Step 7
5	1. Ignition ON, engine OFF. 2. 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	MIL control circuit is shorted to ground, repair as necessary. Is the action complete?	—	Go to Step 10	—
8	Check the MIL circuit for the following: • Open ignition feed to the bulb. • Malfunctioning bulb. • Control circuit open or shorted to B+. Is the repair complete?	—	Go to Step 10	—
9	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 until the Scan Tool indicates that the diagnostic Ran. Does the Scan Tool indicate that this 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 the Applicable DTC Table	System OK

## DTC P1643 Wait to Start Lamp Control Circuit

Refer to *PCM, Glow Plugs, Underhood Fuse-Relay Center*.

### 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 lamp 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

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

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

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.

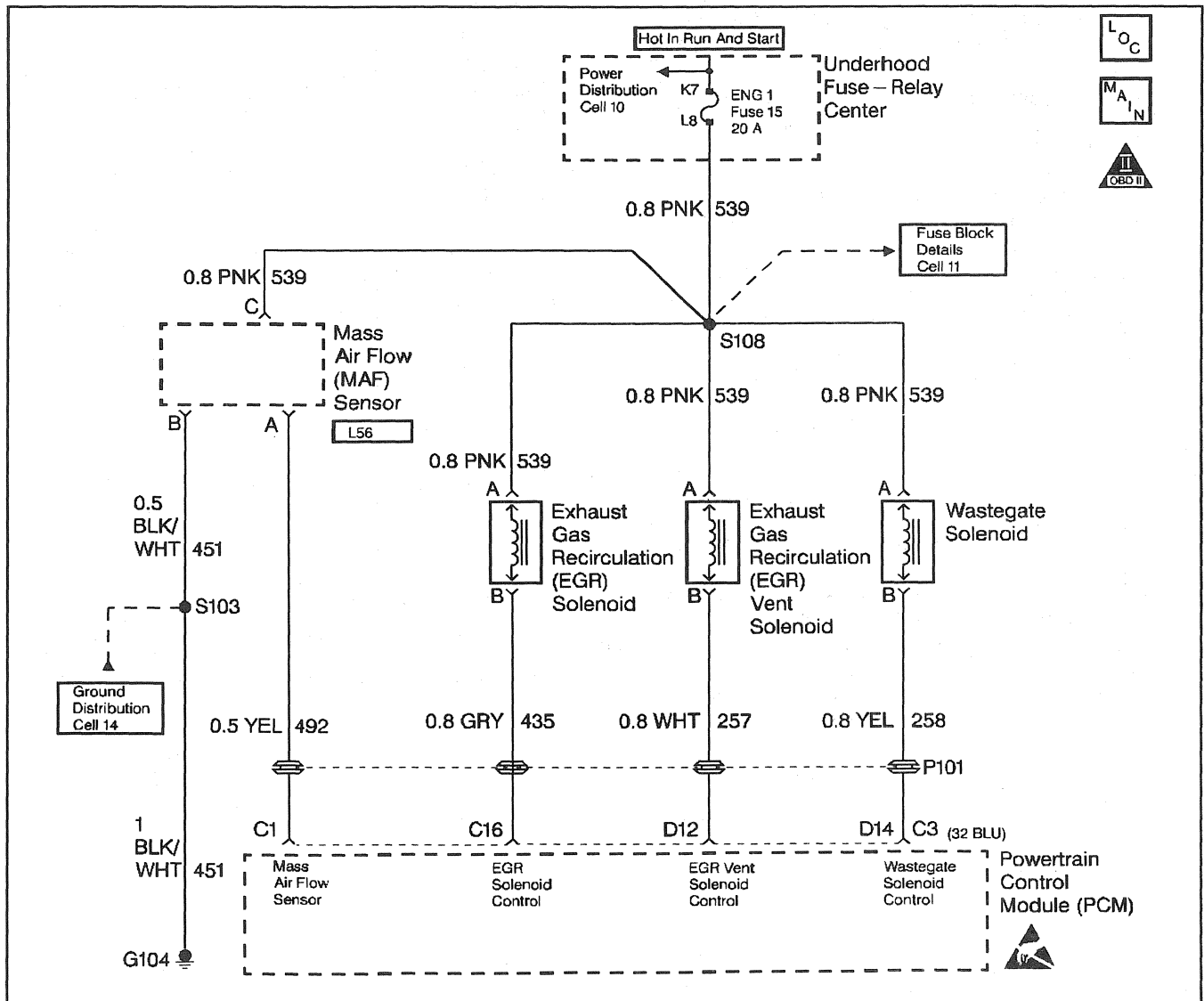
### DTC P1643 Wait to Start Lamp Control Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	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 intermittent. 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 fused 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 performed?	—	Go to Step 10	Go to Step 9

## DTC P1643 Wait to Start Lamp Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
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. <ul style="list-style-type: none"> <li>• Open ignition feed to the bulb</li> <li>• malfunctioning bulb</li> <li>• Control circuit open or shorted to B+.</li> </ul> Was a repair performed?	—	Go to Step 10	—
9	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . Is the action complete?	—	Go to Step 10	—
10	<ol style="list-style-type: none"> <li>1. Using the Scan Tool, select DTC, Clear Info.</li> <li>2. Start engine and idle at normal operating temperature.</li> <li>3. Select DTC, Specific, then enter the DTC number which was set.</li> <li>4. Operate the vehicle until the Scan Tool indicates that the diagnostic Ran.</li> </ol> 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 P1653 EGR Vent Solenoid Control Circuit



56429

### Circuit Description

The EGR flow is controlled by the vacuum actuated EGR valve. The EGR vent solenoid purges to atmosphere the vacuum level at the EGR valve actuator as commanded by the PCM. This is done when the EGR flow is desired to turn off quickly. When the PCM is commanding the EGR vent ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the EGR vent 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 EGR vent solenoid. This is a type B code.

### Conditions for Setting the DTC

- PCM requested EGR vent ON.

- Voltage on EGR vent control circuit high (near battery volts).
  - Conditions met for 2 seconds.
- or
- PCM requested EGR vent solenoid OFF.
  - Voltage on EGR vent control circuit low (near 0 volts).
  - Conditions met for 2 seconds.

### Action Taken When the DTC Sets

The MIL will be illuminated after 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 scan tool has a 5 second ON time abort. The EGR vent solenoid can be commanded ON for as many times as needed, in 5 second intervals. Its possible other EGR DTCs may set along with DTC P1653. This diagnostic can be checked at key up. A quick operational check can be made by commanding the EGR vent solenoid ON and OFF with the scan tool while monitoring Actual EGR. Actual EGR will display BARO (approximately) when EGR solenoid is OFF.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen)

in which each cell covers a range of engine speed (RPM) and load (mm3).

An intermittent may be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

### 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.

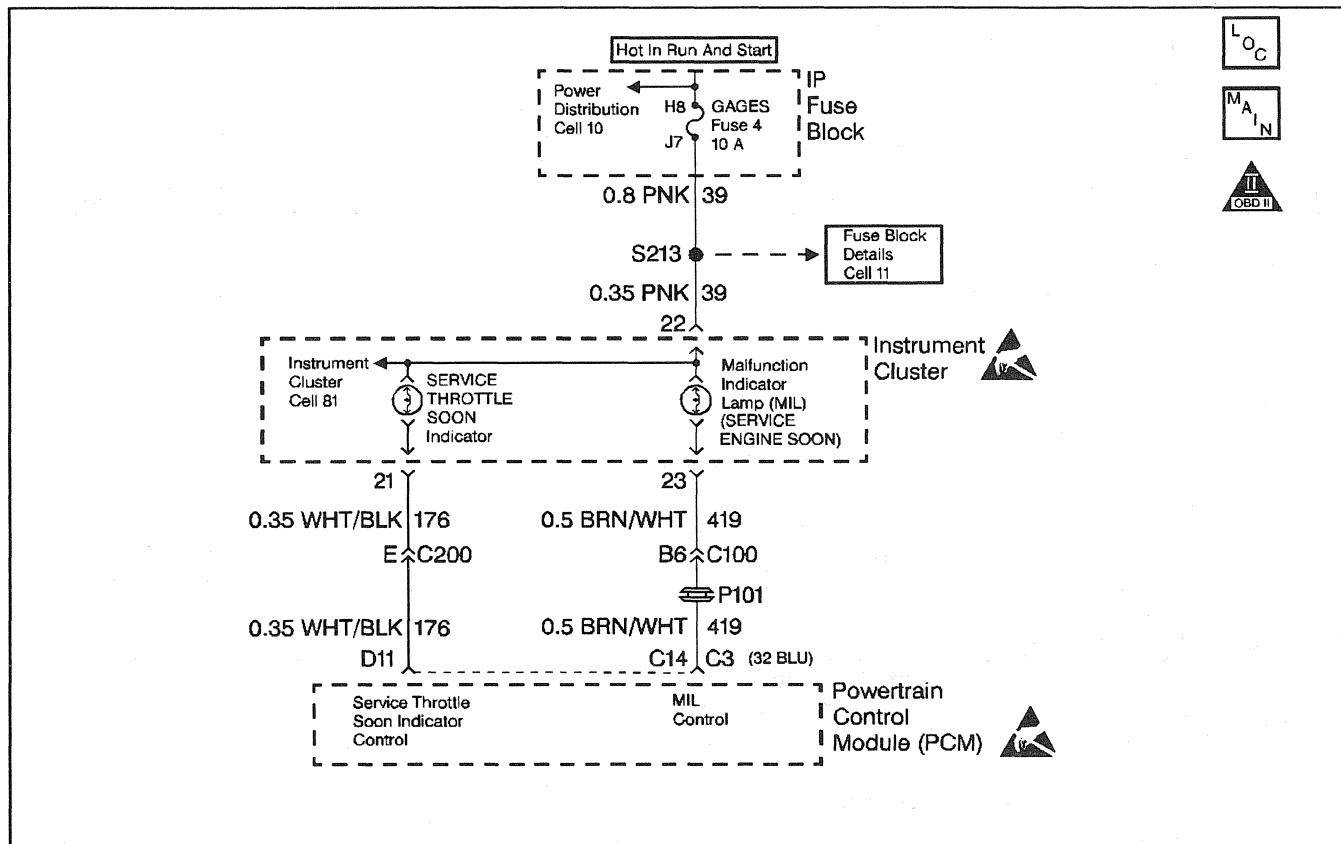
### DTC P1653 EGR Vent Solenoid Control Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Scan tool connected. 2. Ignition ON, engine OFF. 3. With scan tool, command EGR Vent 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 EGR Vent 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?	0.75 A	Go to Step 8	Go to Step 4
4	1. Ignition OFF. 2. PCM connector still disconnected. 3. Disconnect EGR Vent 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

## DTC P1653 EGR Vent Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect EGR Vent 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 EGR Vent solenoid ignition feed circuit at the 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 harness 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
9	Check for a poor connection at the EGR Vent solenoid and replace terminals as necessary. Did the terminals require replacement?	—	Go to Step 15	Go to Step 13
10	Repair EGR Vent solenoid control circuit. Is the action complete?	—	Go to Step 15	—
11	Check for a poor connection at the PCM and EGR Vent solenoid. 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 EGR Vent solenoid. Is the action complete?	—	Go to Step 15	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 the 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

## DTC P1654 Service Throttle Soon Lamp Control CKT



29548

### Circuit Description

A dash light is illuminated by the PCM if the diagnostics has detected certain errors related to the Accelerator Pedal Position (APP) sensor. When the PCM is commanding the Service Throttle Soon Lamp ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the Service Throttle Soon Lamp 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 Service Throttle Soon Lamp. This is a type D DTC.

### Conditions for Setting the DTC

- Service Throttle Soon lamp requested ON.
  - Voltage on the Service Throttle Soon control circuit high (near battery volts).
- or
- Service Throttle Soon lamp requested OFF.
  - Voltage on the Service Throttle Soon control circuit low (near 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 Tool.

### Diagnostic Aids

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

### Test Description

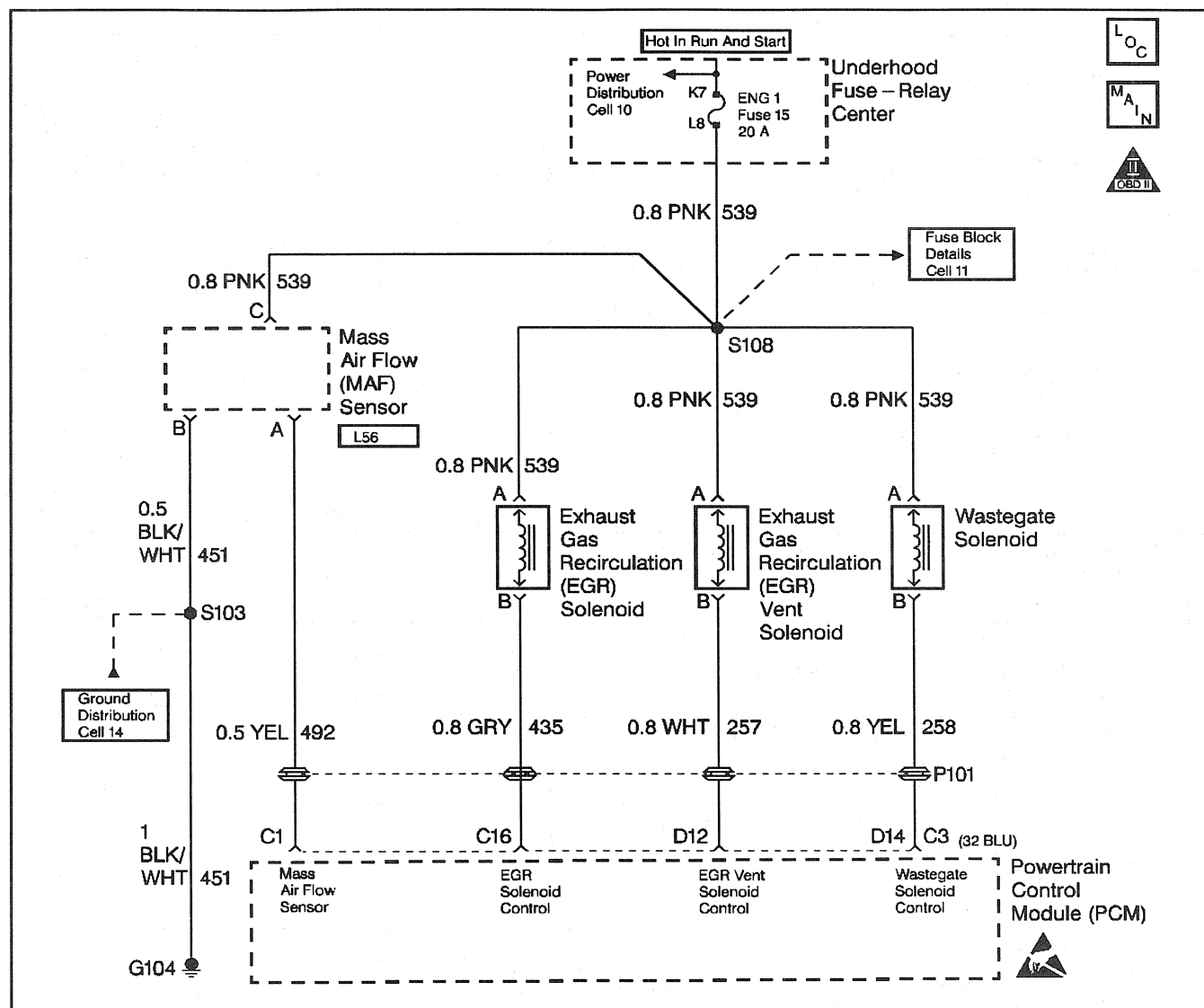
Number(s) below refer to the step number(s) on the Diagnostic Table.

- Be sure that both the ON and the OFF states are commanded. Repeat the commands as many times as necessary.
- If no trouble is found in the control circuit or the connections at the PCM, the PCM maybe malfunctioning, however, this is an extremely unlikely failure.

## DTC P1654 Service Throttle Soon Lamp Control CKT

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> Before clearing DTCs 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
2	1. Ignition ON, engine OFF. 2. Using a scan tool, command the lamp ON and OFF. Does the 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 were stored refer to those table(s). Are any additional DTCs stored?	—	Go to the Applicable DTC table	Go to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the PCM connector containing the lamp control circuit. 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	Service Throttle Soon lamp control circuit is shorted to ground, repair as necessary. Is the action complete?	—	Go to Step 10	—
8	Check the Service Throttle Soon circuit for the following: • Open ignition feed to the bulb. • Malfunctioning bulb. Is the repair complete?	—	Go to Step 10	—
9	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 P1655 EGR Solenoid Control Circuit



56429

### Circuit Description

The EGR flow is controlled by the vacuum actuated EGR valve. The EGR pulse width modulated solenoid meters the vacuum level at the EGR valve actuator as commanded by the PCM. When the PCM is commanding the EGR solenoid ON, the voltage potential of the circuit will be low (near 0 volts). When the PCM is commanding the EGR 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 EGR solenoid. This is a type B code.

## Conditions for Setting the DTC

- PCM requested EGR solenoid ON.
- Voltage on EGR solenoid control circuit high (near battery volts).
- 2 consecutive faults detected.
- Conditions met for 2 seconds.

or

- PCM requested EGR solenoid OFF.
- Voltage on EGR solenoid control circuit low (near 0 volts).
- 2 consecutive faults detected.
- Conditions met for 2 seconds.

### Action Taken When the DTC Sets

The MIL will illuminate on the 2 test fail.

### 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 scan tool has a 5 second ON time abort. The EGR solenoid can be commanded ON for as many times as needed, in 5 second intervals. Its possible other EGR DTCs may set along with DTC P1655. This diagnostic can be checked at key up. A quick operational check can be made by commanding the EGR solenoid ON and OFF with the scan tool while monitoring Actual EGR. Actual EGR will display Baro (approximately) when EGR solenoid is OFF. Full EGR will be achieved when EGR solenoid is commanded ON with the scan tool.

The Adaptive Learn Matrix (ALM) is used to adjust the EGR vacuum control based on Mass Air Flow (MAF). The ALM may change as a result of back pressure increases over the life of the vehicle or other engine system variations. The ALM is made up of sixteen cells (numbered from zero to fifteen) in which each cell covers a range of engine speed (RPM) and load (mm3).

An intermittent may be caused by the following:

- Poor connections.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

**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.

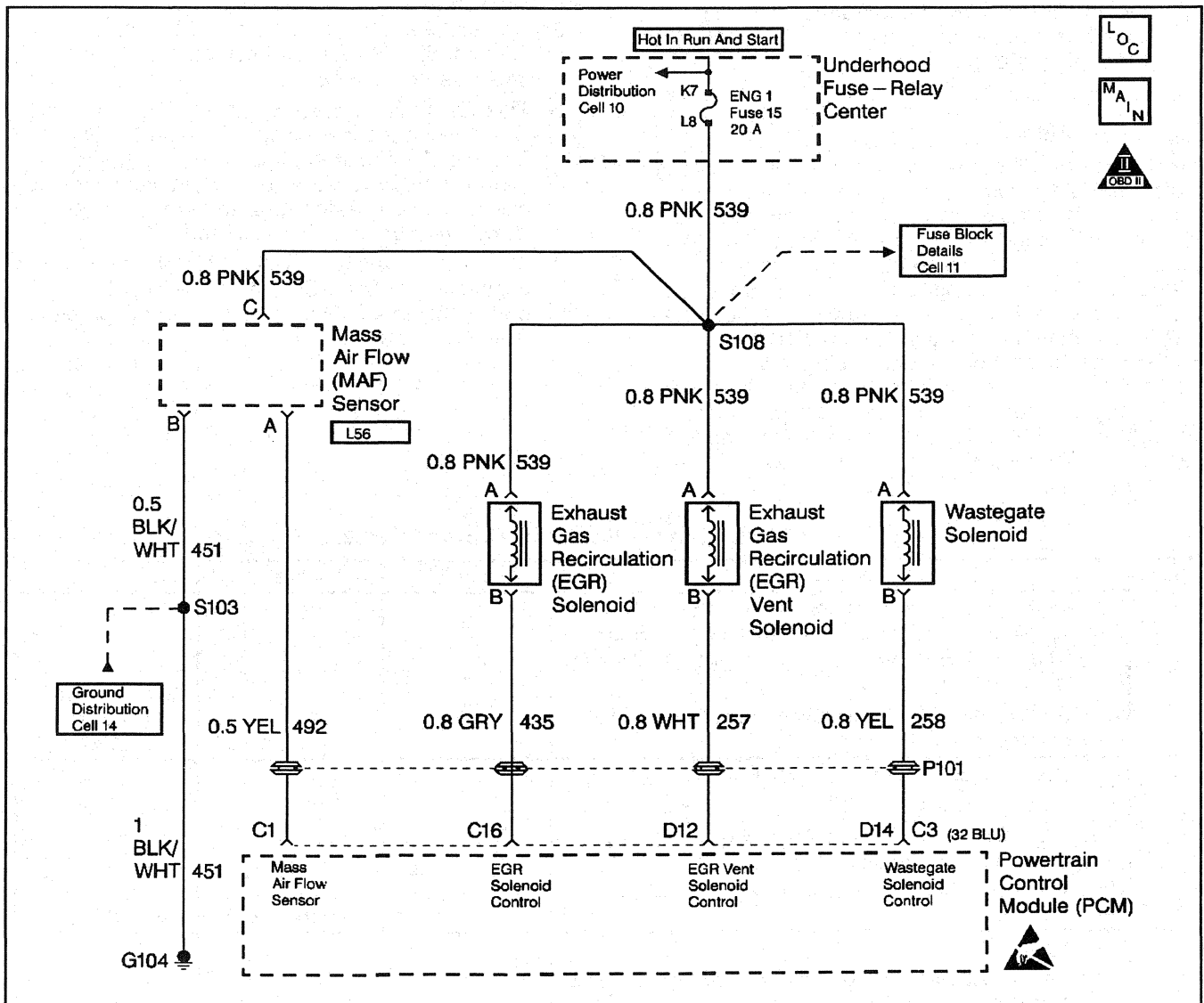
**DTC P1655 EGR Solenoid Control Circuit**

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Scan tool connected. 2. Ignition ON, engine OFF. 3. With scan tool, command EGR solenoid ON and OFF and listen for an audible "click".  Does the EGR 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 EGR 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 than the specified value, but not zero?	0.75 A	Go to Step 8	Go to Step 4
4	1. Ignition OFF. 2. PCM connector still disconnected. 3. Disconnect EGR 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

## DTC P1655 EGR Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect EGR 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 EGR 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 harness 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
9	Check for a poor connection at the EGR solenoid and replace terminals as necessary. Did the terminals require replacement?	—	Go to Step 15	Go to Step 13
10	Repair EGR solenoid control circuit. Is the action complete?	—	Go to Step 15	—
11	Check for a poor connection at the PCM, EGR 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 EGR solenoid. Is the action complete?	—	Go to Step 15	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 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

## DTC P1656 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

- 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.

### DTC P1656 Wastegate Solenoid Control Circuit

Step	Action	Value(s)	Yes	No
1	<b>Important:</b> 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 performed?	—	Go to Step 2	Go to <i>Powertrain OBD System Check</i>
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 <i>J 39200</i> 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 than the specified value, but not zero?	0.75 A	Go to Step 8	Go to Step 4
4	1. Ignition OFF. 2. PCM connector still disconnected. 3. Disconnect Boost solenoid. 4. Using DVM <i>J 39200</i> , 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

## DTC P1656 Wastegate Solenoid Control Circuit (cont'd)

Step	Action	Value(s)	Yes	No
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 harness 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
9	Check for a poor connection at the Boost solenoid and replace terminals as necessary. Did the terminals 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 <i>Wastegate Solenoid</i> . Is the action complete?	—	Go to Step 15	—
14	Replace the PCM. <b>Important:</b> The new PCM must be programmed. Refer to <i>PCM Replacement/Programming</i> . 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 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