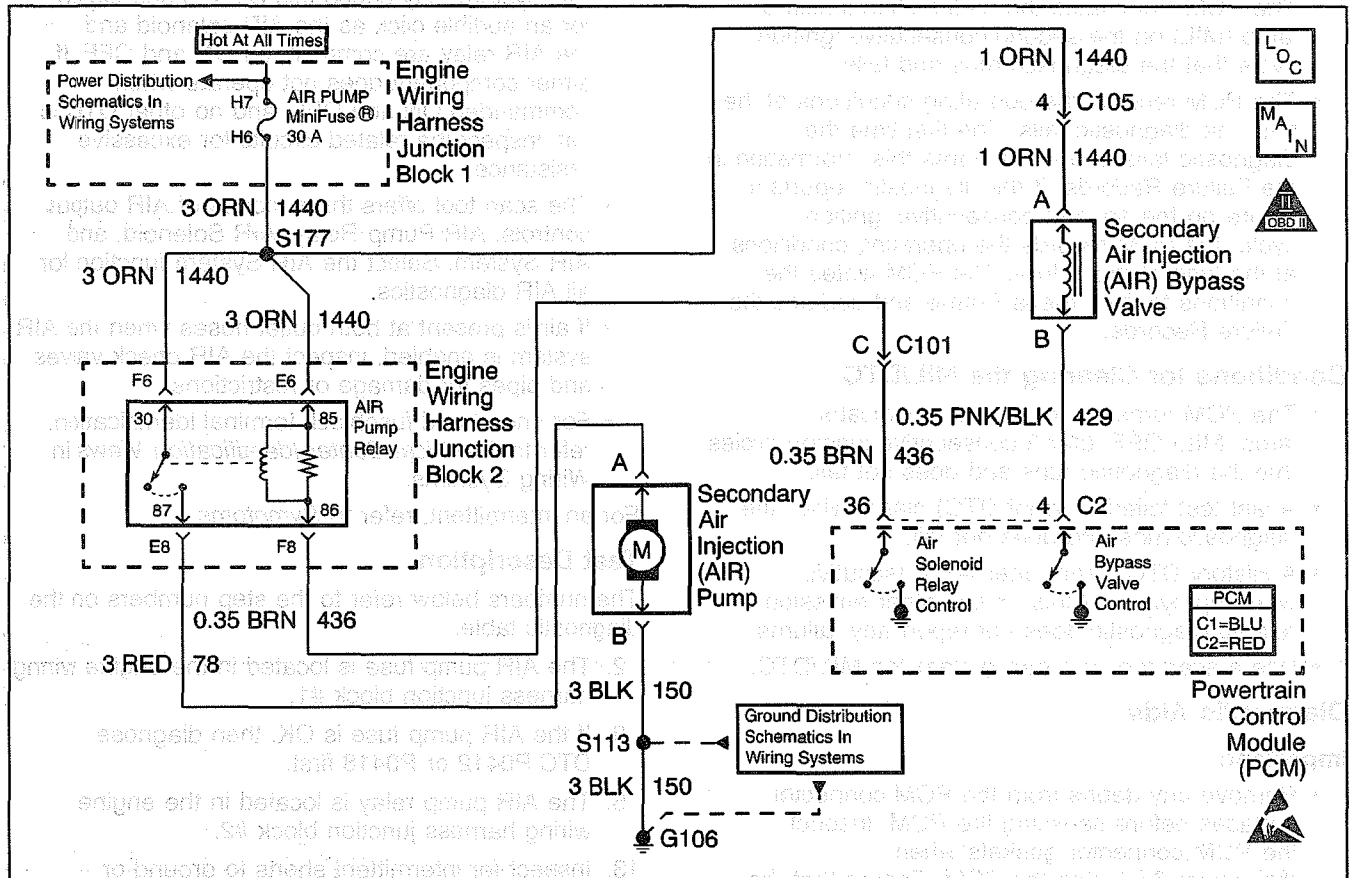


DTC P0410 Secondary Air Injection (AIR) System



582474

Circuit Description

An AIR pump is used on this vehicle to lower tail pipe emissions on start-up. The PCM supplies a ground to the AIR pump relay, which energizes the AIR pump. The PCM monitors the HO2S voltages to diagnose the AIR system.

During the AIR test the PCM activates the AIR pump during closed loop operation. When the AIR is activated, the PCM monitors the HO2S voltages and short term fuel trim values for both banks of the engine. If the AIR system is operating properly, the HO2S voltages should go low and the short term fuel trim should go high.

If the PCM determines that the HO2S voltages for BOTH banks did not respond as expected during the tests, DTC P0410 sets. If only one sensor responded, the PCM sets either a DTC P1415 or P1416 to indicate on which bank the AIR system is inoperative.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171–P0175, P0200, P0300, P0335, P0336, P0351–P0358, P0443, P0500, P0502, P0503, P1258, and HO2S DTCs not set.

- The engine operates for more than 2 seconds.
- The engine run time is more than 15 seconds after closed loop operation.
- The engine speed is more than 900 RPM.
- The maximum air flow is 22 g/s.
- The ECT is between 66°C (151°F) and 110°C (255°F).
- The IAT is more than -10°C (14°F).
- The ignition voltage is more than 11.7 volts.
- The engine load is less than 42.5 percent.
- Not operating in power enrichment mode OR deceleration fuel cut-off mode.
- In short term Fuel Trim cells 1, 2, and 5.

Conditions for Setting the DTC

- HO2S voltage does not go below 222 mV for 1 second, when the AIR pump turns ON during closed loop operation.
- Short term fuel trim does not change a predetermined value, when the AIR pump turns ON during closed loop operation.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM turns the malfunction indicator lamp (MIL) OFF after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the J 35616-A connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters in Wiring Systems*.

- Excessive resistance in any circuit related to the AIR system may cause this DTC to set. Listen for an audible click as the AIR solenoid and the AIR relay are commanded ON and OFF. If either component does not operate when commanded ON and OFF, and no other DTC is set, inspect the related circuits for excessive resistance.
- The scan tool offers three modes of AIR output controls. AIR Pump Relay, AIR Solenoid, and AIR System. Select the AIR System function for all AIR diagnostics.
- If air is present at both outlet hoses when the AIR system is enabled, inspect the AIR check valves and pipes for damage or restrictions.
- For underhood fuseblock terminal identification, refer to *Electrical Center Identification Views in Wiring Systems*.

For an intermittent, refer to *Symptoms*.

Test Description

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

2. The AIR pump fuse is located in the engine wiring harness junction block #1.
3. If the AIR pump fuse is OK, then diagnose DTC P0412 or P0418 first.
5. The AIR pump relay is located in the engine wiring harness junction block #2.
13. Inspect for intermittent shorts to ground or connections, if the AIR pump functions properly.
22. Inspect the circuits for a short to ground between the AIR pump fuse and the AIR pump relay. Also inspect the circuit for a short to ground between the splice and the AIR solenoid valve.

DTC P0410 Secondary Air Injection (AIR) System

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	Go to Step 2	Go to A Powertrain On Board Diagnostic (OBD) System Check
2	Is the AIR Pump fuse OK?	—	Go to Step 3	Go to Step 15
3	Is DTC P0412 or P0418 also set?	—	Go to DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit or DTC P0418 Secondary Air Injection (AIR) Pump Relay Control Circuit	Go to Step 4
4	<ol style="list-style-type: none"> 1. Install the scan tool. 2. Turn ON the ignition with the engine OFF. 3. Enable the AIR system with a scan tool in output controls. Does the AIR pump turn ON?	—	Go to Step 9	Go to Step 5
5	<p>Important: Refer to <i>Electrical Center Identification Views</i> in <i>Wiring Systems</i> for relay terminal identification.</p> <ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the AIR pump relay. 3. Turn ON the ignition with the engine OFF. 4. Probe the AIR pump relay B+ supply circuit terminal (switch side of relay) using the test lamp J 34142-B connected to a ground. Refer to <i>Using Connector Test Adapters</i> in <i>Wiring Systems</i>. Is the test lamp illuminated?	—	Go to Step 6	Go to Step 19
6	Jumper the B+ terminal to the AIR pump feed circuit at the relay harness connector using a fused jumper wire. Refer to <i>Using Fused Jumper Wires</i> in <i>Wiring Systems</i> . Does the AIR pump turn ON?	—	Go to Step 26	Go to Step 7
7	<ol style="list-style-type: none"> 1. The jumper still installed. 2. Disconnect the AIR pump electrical connector. 3. Probe terminal A of the AIR pump electrical connector using the test lamp J 34142-B connected to battery ground. Refer to <i>Using Connector Test Adapters</i> in <i>Wiring Systems</i>. Is the test lamp illuminated?	—	Go to Step 8	Go to Step 20
8	<ol style="list-style-type: none"> 1. The jumper still installed. 2. Connect the test lamp J 34142-B from terminal A to terminal B of the AIR pump harness connector. Is the test lamp illuminated?	—	Go to Step 29	Go to Step 21
9	<ol style="list-style-type: none"> 1. Disconnect the vacuum source from the AIR solenoid valve. Refer to <i>AIR Solenoid Valve Replacement</i>. 2. Connect a vacuum gauge to the vacuum source. 3. Start and idle the engine. Is an engine vacuum displayed on the vacuum gauge?	—	Go to Step 10	Go to Step 25

DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
10	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Reconnect the vacuum source to the AIR solenoid valve. 3. Disconnect the vacuum hose to the AIR shut off valve at the AIR solenoid valve. 4. Connect a vacuum gauge to the AIR solenoid valve port. 5. Start and idle the engine. 6. Enable the AIR system with a scan tool in output controls. <p>Is an engine vacuum indicated on the vacuum gauge when the AIR system is enabled?</p>	—	Go to Step 11	Go to Step 28
11	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Reconnect the vacuum hose to the AIR solenoid valve. 3. Disconnect the vacuum hose from the AIR Shut-off valve. Refer to <i>Secondary AIR Injection Shut Off Valve Replacement</i>. 4. Connect a vacuum gauge to the AIR shut off supply vacuum hose. 5. Start and idle the engine. 6. Enable the AIR system with the scan tool in output controls. <p>Is an engine vacuum indicated on the vacuum gauge when the AIR system is enabled?</p>	—	Go to Step 12	Go to Step 25
12	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Install the vacuum hose to the AIR shut OFF valve. 3. Disconnect the AIR supply hose (from the AIR pump) at the connector (located near the left wheel well). 4. Start and idle the engine. 5. Enable the AIR system with the scan tool in output controls. <p>Is air present at the AIR shut off valve supply hose?</p>	—	Go to Step 13	Go to Step 24
13	<ol style="list-style-type: none"> 1. Connect the AIR shut off valve supply hose. 2. Disconnect both AIR hoses from the AIR pipe check valves. 3. Start and idle the engine. 4. Enable the AIR system with the scan tool in output controls. <p>Is air present at both hoses?</p>	—	Go to Diagnostic Aids	Go to Step 14
14	<ol style="list-style-type: none"> 1. Inspect the AIR hoses for restrictions or damage. 2. If you find an AIR hose restricted or damaged, repair as necessary. <p>Did you find and correct the condition?</p>	—	Go to Step 31	Go to Step 27
15	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Remove the AIR pump relay from the underhood electrical center 2. 3. Remove the AIR pump fuse from the underhood electrical center 1. 4. Disconnect the AIR solenoid harness connector. 5. Probe the battery feed terminal for the AIR pump relay harness connector with the test lamp J 34142-B connected to B+. <p>Does the test lamp illuminate?</p>	—	Go to Step 22	Go to Step 16

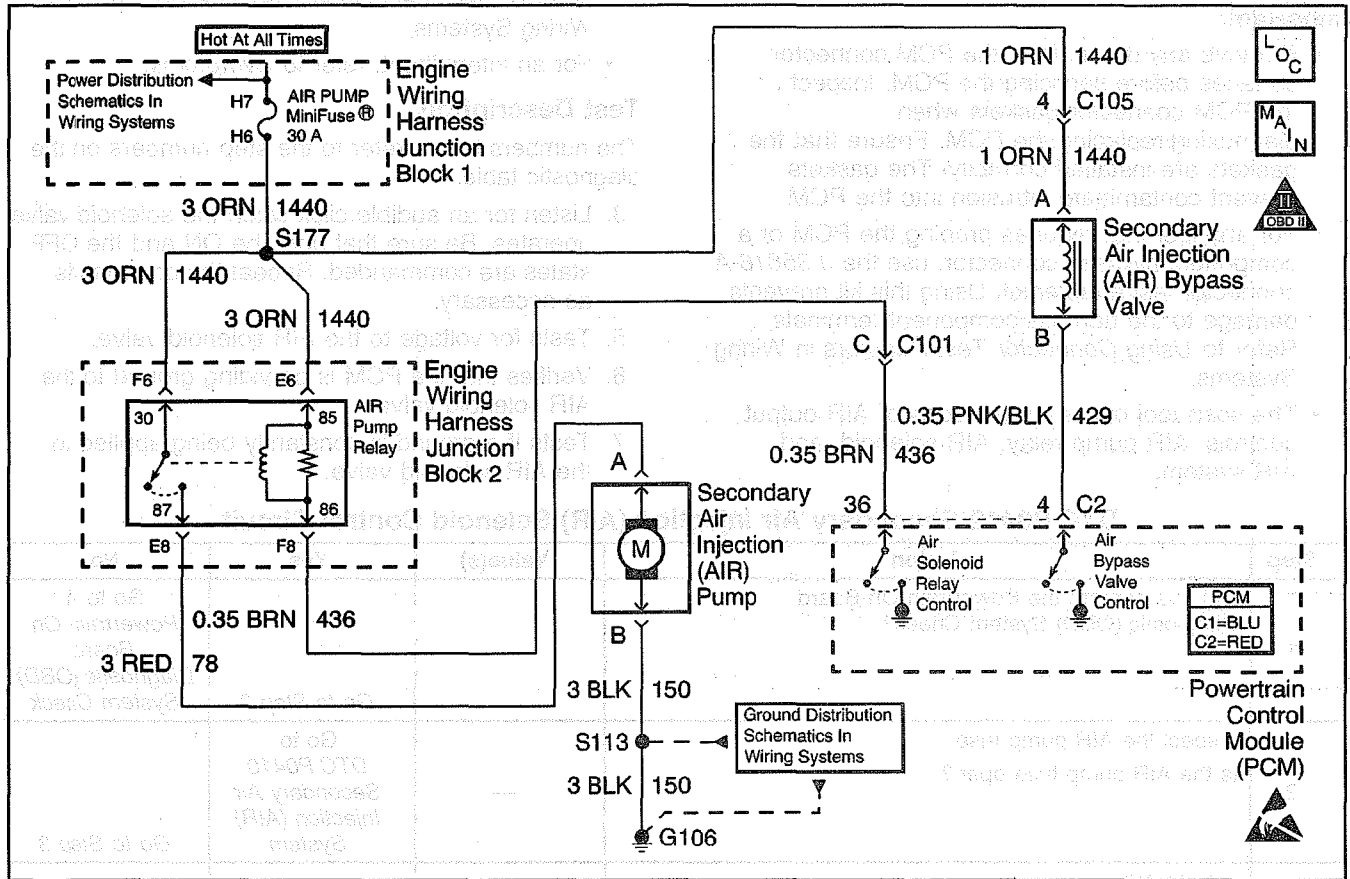
DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
16	1. Disconnect the AIR pump harness connector. 2. Probe the AIR pump electrical connector terminal A (harness side) with the test lamp <i>J 34142-B</i> connected to B+. Does the test lamp illuminate?	—	Go to Step 23	Go to Step 17
17	1. Turn OFF the ignition. 2. Re-install the following components/electrical connector: <ul style="list-style-type: none"> • A new AIR pump fuse • The AIR pump relay • The AIR solenoid 3. Turn ON the ignition leaving the engine OFF. 4. Enable the AIR system with the scan tool in output controls. Does the AIR pump fuse open?	—	Go to Step 28	Go to Step 18
18	1. Connect the AIR pump electrical connector. 2. Enable the AIR pump with a scan tool in output controls. Does the AIR pump fuse open?	—	Go to Step 30	Go to Diagnostic Aids
19	Repair the open circuit between the fuse and the relay. Refer to <i>Wiring Repairs</i> in Wiring Systems. Is the action complete?	—	Go to Step 31	—
20	Repair the open circuit between the AIR pump and the AIR relay. Refer to <i>Wiring Repairs</i> in Wiring Systems. Is the action complete?	—	Go to Step 31	—
21	Repair the faulty ground connection or the open ground circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Is the action complete?	—	Go to Step 31	—
22	Repair the short to ground in the ignition feed circuit. Refer to <i>Wiring Repairs</i> in Wiring Systems. Is the action complete?	—	Go to Step 31	—
23	Repair the short to ground in the circuit between the AIR pump relay and the AIR pump. Refer to <i>Wiring Repairs</i> in Wiring Systems. Is the action complete?	—	Go to Step 31	—
24	1. Inspect the AIR inlet hose and AIR outlet hose from the AIR pump for restrictions or damage. 2. Repair the restriction or damage to the AIR hose. Is the action complete?	—	Go to Step 31	—
25	Repair the vacuum hose as necessary. Is the action complete?	—	Go to Step 31	—
26	Replace the AIR pump relay. Is the action complete?	—	Go to Step 31	—
27	Replace the AIR Shut-off valve. Refer to <i>Secondary AIR Injection Shut Off Valve Replacement</i> . Is the action complete?	—	Go to Step 31	—
28	Replace the AIR solenoid valve. Refer to <i>AIR Solenoid Valve Replacement</i> . Is the action complete?	—	Go to Step 31	—

DTC P0410 Secondary Air Injection (AIR) System (cont'd)

Step	Action	Value(s)	Yes	No
29	1. Inspect for poor connections at the AIR pump electrical connector. Refer to <i>Testing for Intermittent and Poor Connections</i> in Wiring Systems. 2. Repair the poor connection as necessary. Refer to <i>Repairing Connector Terminals</i> in Wiring Systems. Did you find and correct the condition?	—	Go to Step 31	Go to Step 30
30	Replace the AIR pump. Refer to <i>Secondary AIR Injection Pump Replacement</i> Is the action complete?	—	Go to Step 31	—
31	1. Select the Diagnostic Trouble Codes (DTC) option and the Clear DTC Information option using the scan tool. 2. Idle the engine at the normal operating temperature. 3. Select the Specific DTC option under the Diagnostic Trouble Code (DTC) option using a scan tool. 4. Operate vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the scan tool indicate that this test passed?	—	Go to Step 32	—
32	Select the Capture Info option and the Review Info option using the scan tool. Are any DTCs displayed that you have not diagnosed?	—	Go to the applicable DTC table	System OK

DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit



582474

Circuit Description

The PCM controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is to supply the ground for the component being controlled. Each driver has a fault line which the PCM monitors. When the PCM commands a component ON, the voltage of the control circuit should be low (near 0 volts). When the PCM commands the control circuit to a component OFF, the voltage potential of the circuit should be high (near the battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status changes causing the DTC to set.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6.0 volts and 18 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All the above conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The PCM illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The PCM records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the PCM stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the PCM records the operating conditions at the time of the failure. The PCM writes the conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A last test failed (current DTC) clears when the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm-up cycles, if this or any other emission related diagnostic does not report any failures.
- Use a scan tool in order to clear the MIL/DTC.

Diagnostic Aids

Important:

- Remove any debris from the PCM connector surfaces before servicing the PCM. Inspect the PCM connector gaskets when diagnosing/replacing the PCM. Ensure that the gaskets are installed correctly. The gaskets prevent contaminate intrusion into the PCM.
- For any test that requires probing the PCM or a component harness connector, use the *J 35616-A* connector test adapter kit. Using this kit prevents damage to the harness/component terminals. Refer to *Using Connector Test Adapters* in *Wiring Systems*.
- The scan tool offers three modes of AIR output controls. AIR pump relay, AIR solenoid, and AIR system.

- For underhood fuseblock terminal identification, refer to *Electrical Center Identification Views* in *Wiring Systems*.
- For an intermittent, refer to *Symptoms*.

Test Description

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

3. Listen for an audible click when the solenoid valve operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.
5. Tests for voltage to the AIR solenoid valve.
6. Verifies that the PCM is providing ground to the AIR solenoid valve.
7. Tests if a ground is constantly being applied to the AIR solenoid valve.

DTC P0412 Secondary Air Injection (AIR) Solenoid Control Circuit

Step	Action	Value(s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	—	Go to Step 2	Go to A Powertrain On Board Diagnostic (OBD) System Check
2	Inspect the AIR pump fuse Is the AIR pump fuse open?	—	Go to DTC P0410 Secondary Air Injection (AIR) System	Go to Step 3
3	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the AIR solenoid valve ON and OFF. Does the AIR solenoid valve turn ON and OFF with each command?	—	Go to Step 4	Go to Step 5
4	1. Review the Freeze Frame and/or Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC as specified in the supporting text or as close to the Freeze Frame and/or Failure Records data that you observe. Does the DTC reset?	—	Go to Step 5	Go to Intermittent Conditions
5	1. Turn OFF the ignition. 2. Disconnect the AIR solenoid valve electrical connector. 3. Turn ON the ignition, with the Ignition OFF. 4. Probe the AIR solenoid valve B+ supply circuit with the test lamp <i>J 34142-B</i> connected to ground. Refer to <i>Probing Electrical Connectors</i> in <i>Wiring Systems</i> . Does the test lamp illuminate?	—	Go to Step 6	Go to Step 12
6	1. Connect a test lamp between the control circuit of the AIR solenoid valve and the B+ supply circuit of the AIR solenoid valve. 2. With a scan tool, command the AIR solenoid valve ON and OFF. Does the test lamp turn ON and OFF with each command?	—	Go to Step 10	Go to Step 7