

DTC P0410 Secondary Air Injection (AIR) System

Refer to Engine Controls Schematics [MAF, Secondary Air Injection Pump Bypass Solenoid, IAC and Secondary AIR Pump](#) .

Circuit Description

The AIR pump is used on this vehicle to lower tail pipe emissions on start-up. The powertrain control module (PCM) grounds the AIR pump relay control circuit, which energizes the AIR pump. The PCM also grounds the AIR solenoid valve control circuit, which energizes the AIR solenoid valve. The AIR solenoid valve opens allowing manifold vacuum to open the AIR control valves. The PCM enables both control circuits when AIR system operation is desired. When the AIR system is active, the AIR pump forces fresh air into the exhaust stream in order to accelerate catalyst operation. The AIR control valves replace the conventional check valves. When the AIR system is inactive, the AIR control valves prevent air flow in either direction. DTC P0412 applies to the AIR solenoid control circuit. DTC P0418 applies to the AIR pump relay control circuit. DTC P0410 sets if an air flow problem is detected.

The PCM will run two tests using the heated oxygen sensor (HO2S) voltage to diagnose the AIR system. Both tests have two parts.

The passive test is performed during regular AIR pump operation. The passive test consists of the following:

Passive Test Part 1

When the AIR system is enabled, the PCM monitors the HO2S voltage. If the HO2S voltage goes below a threshold, the PCM interprets this as an indication that the AIR system is operational.

Passive Test Part 2

When the AIR system is disabled, the PCM monitors the HO2S voltage. The HO2S voltage should increase above a threshold and switch normally.

If both of these tests indicate a pass, no further action is taken. If one of the above tests failed or is inconclusive, the diagnostic will proceed to test two.

The active test is performed specifically for diagnostic purposes. Test two consists of the following:

Active Test Part 1

During this test the PCM turns the AIR system on during closed loop operation. When the AIR system is activated, the PCM monitors the HO2S voltage. If the AIR system is operating properly, the HO2S voltage should go below a predetermined threshold.

Active Test Part 2

The PCM turns the AIR system off. The HO2S voltage should return to above a rich threshold.

The PCM will repeat test two up to 4 consecutive times with a short delay between each command.

If the PCM determines that the HO2S voltage did not respond as expected during the tests, DTC P0410 will set.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0171, P0172, P0300, P0412, P0418, P0442, P0443, P1441 and HO2S DTCs not set.
- The engine operates for more than 3 seconds.

Test 1

- The engine speed is more than 400 RPM
- The engine load is less than 80 percent.
- The engine air flow is less than 35 g/s.
- The ignition voltage is more than 11.5 volts.
- The air fuel ratio is more than 13:1.
- The engine coolant temperature (ECT) is less than 40°C (104°F).
- The intake air temperature (IAT) is more than 10°C (50°F).
- The power enrichment, dDeceleration fuel cut off, or catalyst over temperature not active.
- The AIR system is enabled for 50 seconds. On a hot start, the AIR system operation will be delayed for 60 seconds after start-up.
- Test 1 fails if:
 - HO2S voltage does not go below 300 mV for 25 seconds during pump operation.
 - HO2S voltage does not go above 600 mV during the 15 seconds after the pump is turned off.

Test 2

- The engine operates for more than 5 minutes.
- The engine speed is more than 400 RPM.
- The EVAP purge is active
- The maximum air flow is 35 g/s.
- The ECT is more than 10°C (50°F).
- The ignition voltage is more than 11.5 volts.
- The engine load is less than 80 percent.
- The fuel system is operating in closed loop.
- Test 2 fails if the HO2S voltage is above 300 mV for 4 seconds during pump operation.

Conditions for Setting the DTC

If the HO2S voltage does not behave as expected during either of the tests, a failure is reported.

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 MIL OFF after 3 consecutive drive trips during which the diagnostic runs and passes.
- A last test failed, or the current DTC, clears when the diagnostic runs and passes.
- A History DTC clears after 40 consecutive warm-up cycles, if no other emission related diagnostic failures are reported.
- Use a scan tool in order to clear the MIL diagnostic trouble code.
- Interrupting the PCM battery voltage may or may not clear DTCs. This practice is not recommended. Refer to [Powertrain Control Module Description](#) , Clearing Diagnostic Trouble Codes.

Diagnostic Aids

Notice: Use the connector test adapter kit J 35616-A for any test that requires probing the following items:

- The PCM harness connectors
- The electrical center fuse/relay cavities
- The component terminals
- The component harness connector

Using this kit will prevent damage caused by the improper probing of connector terminals.

Notice: Do not operate the AIR pump for more than 60 seconds. Continuous operation of the AIR pump in excess of 60 seconds will damage the AIR pump.

Using Freeze Frame and/or Failure Records data may aid in locating an intermittent condition. If you cannot duplicate the DTC, the information included in the Freeze Frame and/or Failure Records data can aid in determining how many miles since the DTC set. The Fail Counter and Pass Counter can also aid in determining how many ignition cycles the diagnostic reported a pass and/or a fail. Operate the vehicle within the same Freeze Frame conditions, such as RPM, load, vehicle speed, temperature, etc., that you observed. This will isolate when the DTC failed.

If the problem is intermittent, refer to [Intermittent Conditions](#) .

Test Description

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

2. DTC P0412 AIR Solenoid Valve Control Circuit and P0418 AIR Pump Relay Control Circuit should be diagnosed first if either are set.

32. The AIR pump is not designed to run continuously. If the pump needs to be replaced, check for conditions that may cause continuous pump operation.

Step	Action	Value (s)	Yes	No
1	Did you perform the Powertrain On-Board Diagnostic (OBD) System Check?	--	Go to Step 2	Go to Powertrain On Board Diagnostic (OBD) System Check
2	Are DTCs P0412 or P0418 set?	--	Go to the applicable DTC table	Go to Step 3
3	Is the fuse that supplies power to the AIR pump OK?	--	Go to Step 4	Go to Step 15
4	Turn the AIR pump ON and OFF using a scan tool. Does the AIR pump turn ON and OFF?	--	Go to Step 10	Go to Step 5
5	Is the AIR pump running continuously?	--	Go to Step 18	Go to Step 6
6	1. Disconnect the AIR pump relay. 2. Probe the AIR pump relay B+ supply circuit in the relay connector using a test lamp connected to ground. Is the test lamp illuminated?	--	Go to Step 7	Go to Step 19
7	Jumper the B+ supply circuit to the AIR pump feed circuit using a fused jumper wire. Does the AIR pump operate?	--	Go to Step 27	Go to Step 8
8	1. Leave the fused jumper in place. 2. Disconnect the electrical connector from the AIR pump. 3. Probe terminal A on the harness side of the AIR pump electrical connector using test lamp connected to ground. Is the test lamp illuminated?	--	Go to Step 9	Go to Step 20
9	Connect a test lamp between the two terminals on the harness side in the AIR pump electrical connector. Is the test lamp illuminated?	--	Go to Step 32	Go to Step 21
10	1. Disconnect the AIR hose and pipe from the AIR pump. 2. Turn the AIR pump ON with the scan tool.	--		

	Is air flow present at the AIR pump outlet?		Go to Step 11	Go to Step 30
11	<ol style="list-style-type: none"> 1. Reconnect the AIR pump. 2. Disconnect the AIR hose and pipe from the AIR control valve. 3. Turn the AIR pump ON with the scan tool. 4. Repeat the test for both control valves. <p>Is air flow present at both AIR hose and pipe outlets?</p>	--	Go to Step 12	Go to Step 24
12	<p>With the engine running, check for engine vacuum at the AIR solenoid valve.</p> <p>Is vacuum present at the valve?</p>	--	Go to Step 13	Go to Step 25
13	<ol style="list-style-type: none"> 1. Reconnect the vacuum supply line to the solenoid valve. 2. Disconnect the vacuum lines at the AIR control valves 3. Command the AIR system ON using the scan tool. <p>Is vacuum present at both vacuum lines?</p>	--	Go to Step 28	Go to Step 14
14	<ol style="list-style-type: none"> 1. Disconnect the control side vacuum line at the solenoid valve. Leave the vacuum supply line connected to the solenoid valve. 2. Command the AIR system ON and OFF using the scan tool. <p>If the solenoid valve is operating properly, vacuum is present at the solenoid valve port when the AIR system is ON, and no vacuum is present when the AIR system is OFF.</p> <p>Is the solenoid valve operating properly?</p>	--	Go to Step 29	Go to Step 30
15	<ol style="list-style-type: none"> 1. Disconnect the AIR pump relay and the AIR pump electrical connector. 2. Install a new fuse. <p>Does the fuse open?</p>	--	Go to Step 22	Go to Step 16
16	<ol style="list-style-type: none"> 1. Install the AIR pump relay. 2. Enable the AIR pump using the scan tool. <p>Does the fuse open?</p>	--	Go to Step 23	Go to Step 17
17	<ol style="list-style-type: none"> 1. Reconnect the AIR pump electrical connector. 2. Enable the AIR pump using the scan tool. 	--	Go to Step	Go to Diagnostic

	Does the fuse open?		32	Aids
18	Disconnect the AIR pump relay. Is the pump still running?	--	Go to Step 26	Go to Step 27
19	Repair the open B+ supply circuit. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
20	Repair the feed circuit to the AIR pump. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
21	Repair the open or high resistance AIR pump ground circuit. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
22	Repair the short to ground in the ignition feed circuit to the relay. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
23	Repair the short to ground in the circuit between the AIR pump relay and the AIR pump. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
24	Check for a restriction, blockage, disconnect, or other damage to the AIR hoses or pipes between the AIR pump and the AIR solenoid valves. Is the action complete?	--	Go to Step 33	--
25	Repair the vacuum system as necessary. Is the action complete?	--	Go to Step 33	--
26	Repair the AIR pump feed circuit shorted to power. Refer to Wiring Repairs in Wiring Systems. Is the action complete?	--	Go to Step 33	--
27	Replace the AIR pump relay. Is the action complete?	--	Go to Step 33	--
	1. Reconnect all vacuum lines. 2. Reconnect the bank 2 (front) control valve AIR hose. Leave the bank 1 (rear) control valve disconnected from its			

28	<p>hose.</p> <ol style="list-style-type: none"> 3. Start the engine and idle until at full operating temperature. 4. Monitor HO2S sensor 1 voltage with the scan tool. 5. Command the AIR system ON and then OFF. Look for a corresponding drop in HO2S voltage when the AIR system is ON. 6. Repeat the test with the bank 1 (rear) control valve connected and the bank 2 (front) control valve hose disconnected. Connect only one control valve to its AIR hose at a time. 7. Replace the inoperative AIR control valve that did not affect HO2S voltage. <p>Is the action complete?</p>	--	Go to Step 33	--
29	<ol style="list-style-type: none"> 1. Inspect the vacuum lines between the AIR solenoid valve and the AIR control valves for damage. 2. Perform repairs as necessary. <p>Is the action complete?</p>	--	Go to Step 33	--
30	<p>Replace the solenoid valve.</p> <p>Is the action complete?</p>	--	Go to Step 33	--
31	<ol style="list-style-type: none"> 1. Check for poor connections at the AIR pump electrical connector. 2. Repair the poor connection as necessary. Refer to Testing for Intermittent Conditions and Poor Connections in Wiring Systems. <p>Was a problem found and corrected?</p>	--	Go to Step 33	Go to Step 30
32	<p>Replace the AIR pump. Refer to Secondary Air Injection Pump Replacement .</p> <p>Is the action complete?</p>	--	Go to Step 33	--
33	<ol style="list-style-type: none"> 1. Clear the DTCs with the scan tool. 2. Turn the key to OFF and wait 15 seconds. 3. Operate the vehicle within the conditions that are required for this diagnostic to run. Refer to the Conditions for Running the DTC. <p>Does the scan tool indicate that this test ran and passed?</p>	--	Go to Step 34	Go to Step 2
34	<p>Review Captured Info using the scan tool.</p> <p>Are there any DTCs that have not been</p>	--	Go to the applicable	

diagnosed?		DTC table	System OK
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