DTC | P1442 | SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE NO.2 BANK 1 STUCK CLOSE

DTC | P1445 | SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE NO.2 BANK 2 STUCK CLOSE

DTC | P2441 | SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSE BANK1

CIRCUIT DESCRIPTION

Refer to DTC P0412 on page 05–217.

<table>
<thead>
<tr>
<th>DTC No.</th>
<th>DTC Detection Condition</th>
<th>Trouble Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1442</td>
<td>Air switching valve No.2 (Bank 1) stuck close: No pressure change (decrease) after the ECM sends an open air switching valve No.2 (Bank 1) signal. (2 trip detection logic)</td>
<td>• VSV for air injection control circuit (Bank 1) • Vacuum hose (VSV for air injection control – air switching valve No.2) • Air injector pipe (Air switching valve No.2 – exhaust manifold) • Air switching valve No.2 (Bank 1) • VSV for air injection control (Bank 1) • ECM</td>
</tr>
<tr>
<td>P1445</td>
<td>Air switching valve No.2 (Bank 2) stuck close: No pressure change (decrease) after the ECM sends an open air switching valve No.2 (Bank 2) signal. (2 trip detection logic)</td>
<td>• VSV for air injection control circuit (Bank 2) • Vacuum hose (VSV for air injection control – air switching valve No.2) • Air injector pipe (Air switching valve No.2 – exhaust manifold) • Air switching valve No.2 (Bank 2) • VSV for air injection control (Bank 2) • ECM</td>
</tr>
<tr>
<td>P2441</td>
<td>Air switching valve stuck close: The pressure sensor does not detect exhaust pulsation when system operates. (All of air switching valve ON) This DTC means either of following conditions. (a) Electromagnetic air switching valve stuck closed. (b) Both of “air switching valve No.2 (Bank 1)” and “air switching valve No.2 (Bank 2)” are stuck closed. (2 trip detection logic)</td>
<td>• Vacuum hoses (Throttle body – VSVs for air injection control) • Air switching valve • Air injector pipe (Air switching valve No.2 – exhaust manifold) • Air injection hose • Air switching valve No.2 (Bank 1 and/or 2) • VSV for air injection control (Bank 1 and/or 2) • Air injection driver • Air injection driver circuit • ECM</td>
</tr>
</tbody>
</table>

MONITOR DESCRIPTION

Refer to DTC P1441, P1444 and P2440 on page 05–290.
## MONITOR STRATEGY

| Related DTCs | P1442: Air switching valve No. 2 (Bank 1) is stuck closed  
P1445: Air switching valve No. 2 (Bank 2) is stuck closed  
P2441: Air switching valve and air switching valve No. 2 are stuck closed |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Required sensors/components</td>
<td>Pressure sensor, Air switching valve No. 2 (Bank 1, 2), Electromagnetic air switching valve</td>
</tr>
<tr>
<td>Frequency of operation</td>
<td>Continuous</td>
</tr>
</tbody>
</table>
| Duration | P1442 (Air switching valve No. 2 (Bank 1) is stuck open): 20 sec.  
P1445 (Air switching valve No. 2 (Bank 2) is stuck open): 20 sec.  
P2441 (Air switching valve is stuck open): 8 sec. |
| MIL operation | 2 driving cycles |
| Sequence operation | None |

## TYPICAL ENABLING CONDITION

### P1442, P1445: Air switching valve No. 2 (Bank 1 and/or Bank 2) are stuck closed

- The monitor will run whenever these DTCs are not present: See page 05-20
- Atmospheric pressure: 76 kPa (570 mmHg) or more
- Battery voltage: 11.5 V or more
- Idle: ON
- Engine RPM: Less than 3,750 rpm
- Time after secondary air injection out of operation: 10 sec. or more
- Air injection pressure sensor fail: Not detected

### P2441: Electromagnetic air switching valve is stuck closed or air switching valve No. 2 (Bank 1 and Bank 2) are stuck closed

- The monitor will run whenever these DTCs are not present: See page 05-20
- Atmospheric pressure: 76 kPa (570 mmHg) or more
- Battery voltage: 11.5 V or more
- Time after secondary air injection out of operation: 6 sec. or more
- AIR pump: ON
- Air switching valve: ON
- Air switching valve No. 2 (Bank 1): ON
- Air switching valve No. 2 (Bank 2): ON
- Engine RPM: Less than 3,750 rpm
- Delay time after engine started: 6 sec. or more
- Air injection pressure sensor fail: Not detected

## TYPICAL MALFUNCTION THRESHOLDS

### P1442: Air switching valve No. 2 bank 1 is stuck closed

- Both of the following conditions are met: Conditions 1 and 2
  1. Cumulative pressure pulsation: 15 kPa (113 mmHg) or more  
     (when AI ON (Air pump ON, all of air switching valves are ON))
  2. Air pressure change: Less than 1 kPa (7.5 mmHg)  
     (when opening air switching valve No. 2 (Bank 1))

### P1445: Air switching valve No. 2 bank 2 is stuck closed

- Both of the following conditions are met: Conditions 1 and 2
  1. Cumulative pressure pulsation: 15 kPa (113 mmHg) or more  
     (when AI ON (Air pump ON, all of air switching valves are ON))
  2. Air pressure change: Less than 1 kPa (7.5 mmHg)  
     (when opening air switching valve No. 2 (Bank 2))
P2441: Electromagnetic air switching valve is stuck closed or air switching valve No. 2 (Bank 1 and Bank 2) are stuck closed

| Cumulative pressure pulsation | Less than 15 kPa (113 mmHg) (when AI ON (Air pump ON, all of air switching valves are ON)) |

**MONITOR RESULT**

Refer to page 05–28 for detailed information.

The test value and test limit information are described as shown in the following table. Check the monitor result and test values after performing the monitor drive pattern (refer to "Confirmation Monitor").

- MID (Monitor Identification Data) is assigned to each emissions–related component.
- TID (Test Identification Data) is assigned to each test value.
- Scaling is used to calculate the test value indicated on generic OBD II scan tools.

**Secondary air injection (AIR) system**

<table>
<thead>
<tr>
<th>MID</th>
<th>TID</th>
<th>Scaling</th>
<th>Description of Test Value</th>
<th>Minimum Test Limit</th>
<th>Maximum Test Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$71$</td>
<td>$E1$</td>
<td>Multiply by 0.01 (g/s)</td>
<td>Test value of AIR amount insufficient</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E2$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pump stuck ON</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E9$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pump stuck OFF</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E4$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR control valve ON</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E5$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR control valve OFF</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E6$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pressure change for AIR valve</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E7$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pressure change for AIR VSV bank 1</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E5$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pressure change for AIR VSV bank 2</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
<tr>
<td>$71$</td>
<td>$E9$</td>
<td>Multiply by 0.01 (kPa)</td>
<td>Test value of AIR pressure pulsation for AIR VSV when AIR pressure is low</td>
<td>Minimum test limit</td>
<td>Maximum test limit</td>
</tr>
</tbody>
</table>

**WIRING DIAGRAM**

Refer to DTC P1441, P1444 and P2440 on page 05–290.
INSPECTION PROCEDURE

1 CHECK ANY OTHER DTCs OUTPUT (IN ADDITION TO SECONDARY AIR INJECTION SYSTEM DTCs)

(a) Connect a hand-held tester to the DLC3.
(b) Turn the ignition switch to ON and turn the tester ON.
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

<table>
<thead>
<tr>
<th>Display (DTC Output)</th>
<th>Proceed To</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;P1442 and/or P1444&quot; and P2441</td>
<td>A</td>
</tr>
<tr>
<td>P1442 and/or P1444</td>
<td>B</td>
</tr>
<tr>
<td>&quot;P1442 and/or P1444 and/or P2441&quot; and other DTCs</td>
<td>C</td>
</tr>
</tbody>
</table>

HINT:
If any DTCs other than P1441 and/or P1444 and P2440 are output, troubleshoot those DTCs first.

- A
- B Go to step 5
- C GO TO DTC CHART (See page 05–60)

2 CHECK VACUUM HOSES (THROTTLE BODY – VSV FOR AIR INJECTION CONTROL)

(a) Check that the vacuum hoses between the throttle body and VSV for air injection control are securely connected.
   OK: The vacuum hoses are securely connected.
(b) Inspect the vacuum hoses for blockages and damage.
   OK: The vacuum hoses have no blockages and damages.

NG REPAIR OR REPLACE VACUUM HOSES
3  CHECK PIPES AND HOSES (AIR INJECTION SYSTEM)

(a) Remove the intake manifold.
(b) Check all pipes and hoses of the air injection system.
   OK:
   All the air injection pipes and hoses are securely connected.
(c) Check all pipes and hoses of the air injection system for blockage or damage.
   OK:
   The air injection system pipes and hoses have no blockage or damage.

NG  REPAIR OR REPLACE PIPE OR HOSE

OK

4  CHECK AIR SWITCHING VALVE (OPERATION)

(a) Remove the intake manifold.
(b) Remove the air switching valve.
(c) Blow air into port A and check that air is not discharged from port B.
   OK:
   Not discharged
(d) Apply battery positive across the terminals.
(e) Blow air into port A and check that air is discharged from port B.
   OK:
   Discharged

NG  REPLACE AIR SWITCHING VALVE AND GO TO STEP 6

OK
5 CHECK AIR SWITCHING VALVE NO.2 (OPERATION)

(a) Start the engine and warm it up.
(b) Turn the ignition switch to OFF.
(c) Connect the hand-held tester to the DLC3.
(d) Turn the ignition switch to ON and push the hand-held tester main switch ON.
(e) Select the following menu items: DIAGNOSIS/ENHANCED OBD II/ SYSTEM CHECK/ AIR INJ CHECK/ MANUAL OPERATION/OPERATION 5 and 6

HINT:
OPERATION 5: AP: ON, EASV: OPEN, ASV1: OPEN, ASV2: CLOSE
OPERATION 6: AP: ON, EASV: OPEN, ASV1: CLOSE, ASV2: OPEN

NOTICE:
• This test only allows technicians to operate the AI system for 5 seconds. Furthermore, the test can be performed 4 times a trip. If the test is repeated, intervals of at least 30 seconds are required between tests.
While the AI system operation using the hand-held tester is prohibited, the tester displays the prohibition (WAIT or ERROR). If the ERROR (AI STATUS NG) is displayed on the tester, stop the engine for 10 minutes and then try again.
• When performing the AIR INJ CHECK operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
• Turn the ignition switch to OFF when the AIR INJ CHECK operation finishes.
(f) Read value of the A/F BANK1 and BANK2 on the hand-held tester.

Result:

<table>
<thead>
<tr>
<th>Air switching valve No.2 operation</th>
<th>Air−fuel ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>18 or more</td>
</tr>
<tr>
<td>Close</td>
<td>Approximately 14.5</td>
</tr>
</tbody>
</table>

HINT:
• When the ASV No.2 operates normally, the A/F value is 18 or more when the valve is open, and approximately 14.5 when the valve is closed.
• Perform the following procedures only on the bank of which the valve is not open.

NEXT
6 CHECK VSV(AIR INJECTION CONTROL)

(a) Turn the ignition switch OFF.
(b) Disconnect the vacuum hoses from the VSV for air injection control.
(c) Connect the hand-held tester to the DLC3.
(d) Start the engine and turn the tester ON.
(e) When the air switching valve is operated using the hand-held tester, check that negative pressure from the port A.
(f) Select the following menu items: DIAGNOSIS/ENHANCED OBD II/SYSTEM CHECK/ AIR INJ CHECK/ MANUAL OPERATION/OPERATION 2

HINT:
OPERATION 2: AP: ON, EASV:OPEN, ASV1:OPEN, ASV2:OPEN

NOTICE:
- This test only allows technicians to operate the AI system for 5 seconds. Furthermore, the test can be performed 4 times a trip. If the test is repeated, intervals of at least 30 seconds are required between tests.
  While the AI system operation using the hand-held tester is prohibited, the tester displays the prohibition (WAIT or ERROR). If the ERROR (AI STATUS NG) is displayed on the tester, stop the engine for 10 minutes and then try again.
- When performing the AIR INJ CHECK operation after the battery cable has been reconnected, wait for 7 minutes with the ignition switch turned to ON or the engine running.
- Turn the ignition switch to OFF when the AIR INJ CHECK operation finishes.
  OK: Negative pressure from port A
(g) Reconnect the vacuum hose.

NG Go to step 10
7 CHECK VACUUM HOSES(AIR SWITCHING VALVE – VSV FOR AIR INJECTION CONTROL)

(a) Check that the vacuum hoses between the air switching valve(s) No.2 and VSV for air injection control are securely connected.

OK: The vacuum hose(s) are securely connected.

(b) Check the vacuum hoses for blockages and damage.

OK: The vacuum hoses have no blockages and damages.

NG → REPAIR OR REPLACE VACUUM HOSES

OK

8 CHECK AIR SWITCHING VALVE NO.2(OPERATION)

(a) Remove the air switching valve No.2.

(b) Blow air into port B and check that air is not discharged from the port C.

OK: Not discharged from port C

(c) Apply vacuum 30 kPa (225 mmHg) to port A, blow air into port B and check that air is discharged from the port C.

OK: Discharged from port C

NG → REPLACE AIR SWITCHING VALVE NO.2

OK
9 CHECK AIR INJECTION PIPE(AIR SWITCHING VALVE NO.2 – EXHAUST MANIFOLD)

(a) Check that the air injection pipe between the air switching valve(s) No.2 and exhaust manifold are securely connected.
   OK: The air injection pipe is securely connected.

(b) Check the air injection pipe for blockages and damage.
   OK: The air injection pipe has no blockages and damages.

NG REPAIR OR REPLACE AIR INJECTION PIPE

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–13)

10 CHECK VSV(AIR INJECTION CONTROL)

(a) Disconnect the 2 vacuum hoses.

(b) Check that air does not flow from the port A as shown in the illustration.
   OK: Not flow from port A

NG REPLACE VSV

OK

REPLACE ECM (See page 10–16)