

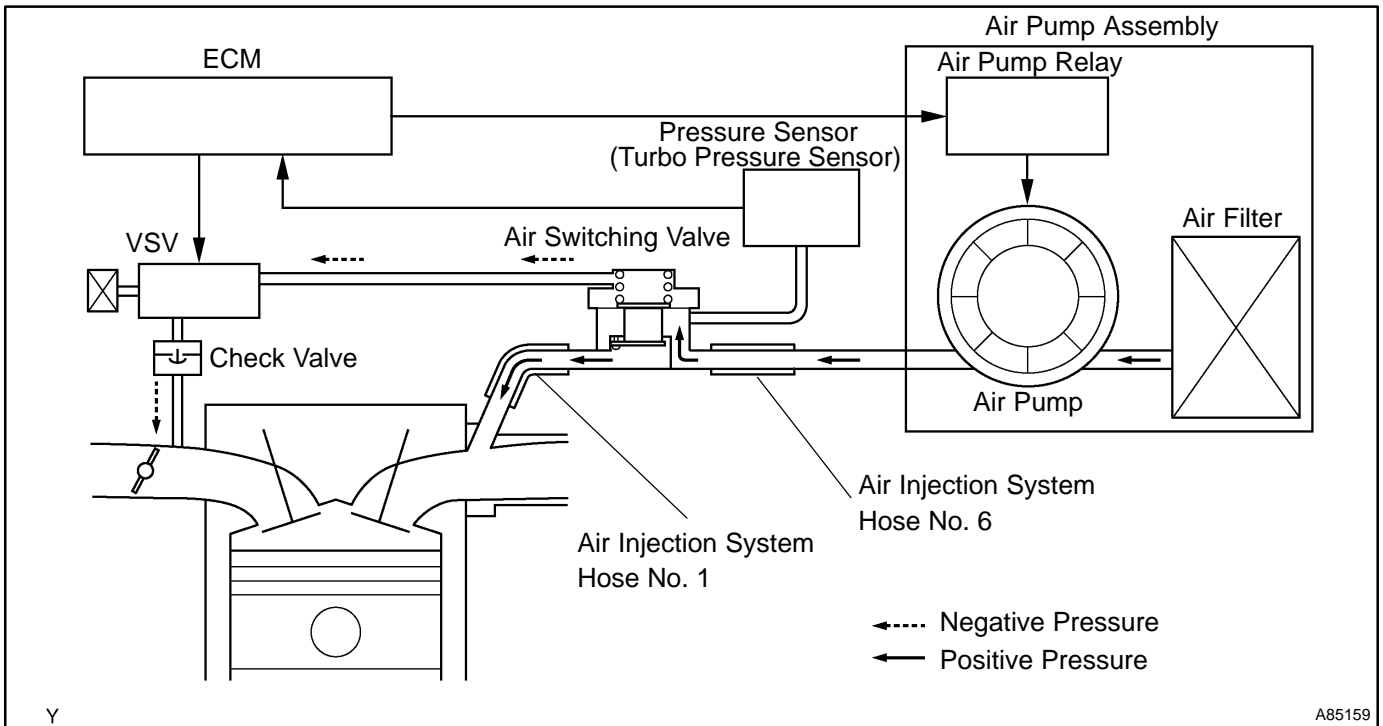
DTC	P2440	SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN BANK1
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DTC	P2441	SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSE BANK1
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CIRCUIT DESCRIPTION

To accelerate the activation of catalyst when warming up the engine, the air injection system pumps the secondary air to the exhaust manifold by pressure. The secondary air is supplied by the air pump and it is pumped to the exhaust manifold through the air switching valve. Open and close movement of the air switching valve is regulated by the vacuum switching valve (VSV). The air pump and the air switching valve are observed by the ECM and are used to detect malfunction in this system.

The ECM monitors the secondary air injection system and detects malfunction using a pressure sensor located on the air switching valve.



DTC No.	DTC Detection Condition	Trouble Area
P2440	Although the ECM has ordered the VSV to close the air switching valve while the engine is running but if the pressure sensor detects pulsation of the exhaust gas	<ul style="list-style-type: none"> • VSV • Air switching valve • Open or short in VSV circuit • Pressure sensor • Open or short in pressure sensor circuit • ECM
P2441	Although the ECM has ordered the VSV to open air switching valve while the engine is running but if the pressure sensor is unable to detect pulsation of the exhaust gas	<ul style="list-style-type: none"> • VSV • Air switching valve • Open or short in VSV circuit • Vacuum hose and check valve • Air injection hose. • Pressure sensor • Open or short in pressure sensor circuit • ECM

MONITOR DESCRIPTION

The ECM observes the pressure in the secondary air passage using the pressure sensor located on the air switching valve in the secondary air injection system. The sensor detects an exhaust pressure in the secondary air passage.

If the ECM receives the pulsation signal from the sensor despite the ECM ordering the VSV to close the air switching valve, or if the ECM has not received the signal from the sensor despite the ECM ordering the VSV to open the valve, the ECM interprets this as a fault in the secondary air injection system and sets a DTC.

MONITOR STRATEGY

Related DTCs	P2440	AIR control valve stuck open
	P2441	AIR control valve stuck close
Required sensors/component	Pressure sensor	
Frequency of operation	Continuous	
Duration	2 minutes	
MIL operation	2 driving cycles	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of disable a Monitor" (on page 05-316)	
Battery voltage	11 V	–
Atmospheric pressure	45 kPa (338 mmHg)	–
Engine	Running	
P2440:		
Air pump and Air switching valve: OFF	10 seconds	–
P2441:		
Air pump and Air switching valve: ON	6 seconds	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P2440:	
Number of times the following condition is met:	4 times or more
Cumulative pressure pulsation of secondary air injection	30 kPa (225 mmHg) or more (vary with smoothed pressure of secondary air injection)
P2441:	
Number of times the following condition is met:	4 times or more
Cumulative pressure pulsation of secondary air injection	20 kPa (150 mmHg) or less (vary with smoothed pressure of secondary air injection)

WIRING DIAGRAM

Refer to DTC P2430 on page 05-570.

INSPECTION PROCEDURE

Hand-held tester:

HINT:

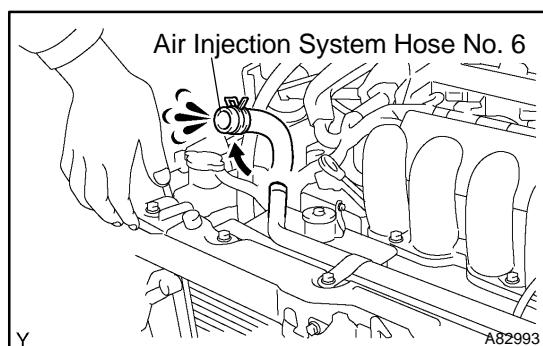
To check the pressure condition in the secondary air passage, the hand-held tester is available.

1 IS THE DTC P2430,P2431,P2432 OR P2433 BEING OUTPUT

YES → **GO TO DTC CHART (See Page 05-326)**

NO

2 PERFORM ACTIVE TEST BY HAND-HELD TESTER(VSV FOR SECONDARY AIR INJECTION SYSTEM)



- (a) Connect the hand-held tester to the DLC3 on the vehicle.
- (b) Turn the ignition switch ON and push the hand-held tester main switch ON.
- (c) Disconnect the air injection system hose No. 6.
- (d) Start the engine.
- (e) Select the item "DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / SECOND AIR VSV / ALL or USER DATA" (press the right or left button).

NOTICE:

When selecting USER DATA, select SECONDARY AIR" and "SECOND AIR VSV" on the screen by pressing the "YES" button on the tester.

HINT:

When operating the VSV in the secondary air system, the air pump is also operated at the same time.

- (f) Put your hand at the disconnected hose end, and check that the exhaust gas pressure pulsation is applied to your hand when turning on the VSV for air switching valve with the ACTIVE TEST. And also check that the exhaust gas pressure pulsation is not applied to your hand when turning off the VSV for air switching valve.

NOTICE:

This test allows the technician to operate the VSV for only 5 seconds. If you perform the test again, more than 30 seconds interval must be required after the previous test is done.

HINT:

"SECONDARY AIR (air pump)" means the signal output from the ECM to operate the air pump.

OK → **Go to step 9**

NG

3 CHECK AIR INJECTION SYSTEM NO.1 HOSE

- (a) Check that the air injection hose No.1 is securely connected to both exhaust manifold and air switching valve.
- (b) Inspect the air injection hose No.1 for blockage or damage.

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REPAIR OR REPLACE AIR INJECTION SYSTEM NO.1 HOSE

OK

4 CHECK STORED DTC

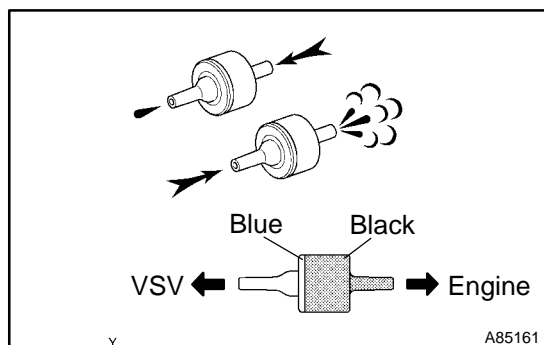
- (a) Read the DTC using the hand-held tester or the OBD II scan tool.

Display (DTC Output)	Proceed to
P2440	A
P2441	B

A

Go to step 6

B

5 CHECK VACUUM HOSE AND CHECK VALVE

- (a) Check each vacuum hose connection between the pressure sensor and air switching valve, the air switching valve and the VSV, and the VSV and intake manifold.
- (b) Inspect the vacuum hose for blockage or damage.
- (c) Check that check valve is correctly installed.
- (d) Check that there is air-flow in the check valve from the VSV to the engine. Also, check that there is no air-flow in the opposite side.

NG

REPAIR OR REPLACE VACUUM HOSE AND CHECK VALVE

OK

6 INSPECT AIR SWITCHING VALVE ASSY (See page 12-18)

NG

REPLACE AIR SWITCHING VALVE ASSY

OK

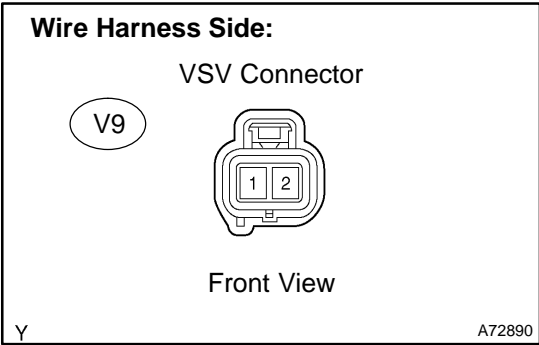
7 INSPECT VACUUM SWITCHING VALVE ASSY (See page 12-18)

NG

REPLACE VACUUM SWITCHING VALVE ASSY

OK

8 CHECK HARNESS AND CONNECTOR(ECM-VACUUM SWITCHING VALVE FOR SECONDARY AIR INJECTION SYSTEM)



- (a) Disconnect the V9 vacuum switching valve (VSV) connector.
- (b) Disconnect the E3 ECM connector.
- (c) Check the resistance between the wire harness side connectors.

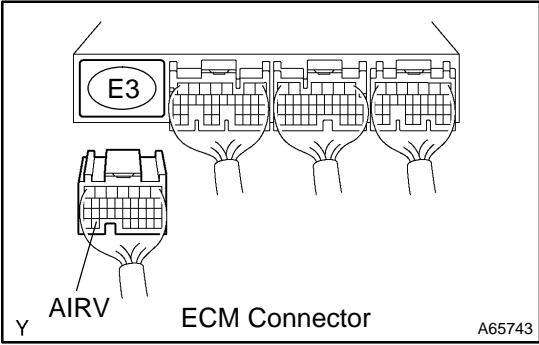
Standard (Check for open):

Tester Connection	Specified Condition
VSV (V9-2) - AIRV (E3-33)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VSV (V9-2) or AIRV (E3-33) - Body ground	10 kΩ or higher

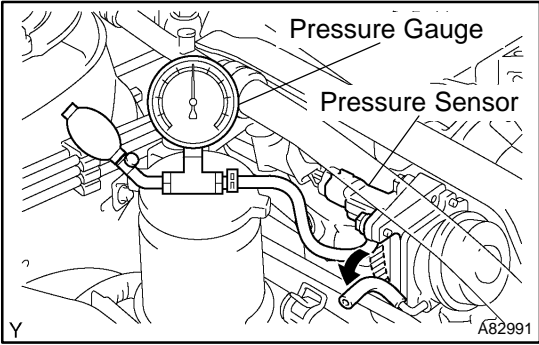
- (d) Reconnect the VSV connector.
- (e) Reconnect the ECM connector.



NG REPAIR OR REPLACE HARNESS AND CONNECTOR

OK

9 INSPECT ECM(AIR VOLTAGE)



- (a) Connect the pressure gauge to the pressure sensor as shown in the illustration.
- (b) Connect the hand-held tester to the DLC3 on the vehicle.
- (c) Turn the ignition switch ON and push the hand-held tester main switch ON (Do not start engine).
- (d) Select the item "DIAGNOSIS / ENHANCED OBD II / DATA LIST / 2ND AIR PRESS."
- (e) Check that the pressure displayed on the hand-held tester fluctuates when applying the pressure to the pressure sensor with the pressure gauge.

NG REPLACE PRESSURE SENSOR (TURBO PRESSURE SENSOR)

OK

REPLACE ECM (See page 10-20)

OBD II scan tool (excluding hand-held tester):

1 IS THE DTC P2430,P2431,P2432 OR P2433 BEING OUTPUT

YES → **GO TO DTC CHART (See page 05-326)**

NO

2 CHECK STORED DTC

(a) Read the DTC using the hand-held tester or the OBD II scan tool.

Display (DTC Output)	Proceed to
P2440	A
P2441	B

A → **Go to step 4**

B

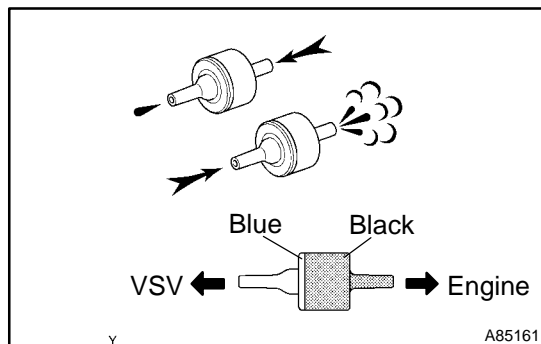
3 CHECK AIR INJECTION SYSTEM NO.1 HOSE

- (a) Check that the air injection hose No.1 is securely connected to both exhaust manifold and air switching valve.
 (b) Inspect the air injection hose No.1 for blockage or damage.

NG → **REPAIR OR REPLACE AIR INJECTION SYSTEM NO.1 HOSE**

OK

4 CHECK VACUUM HOSE AND CHECK VALVE



- (a) Check each vacuum hose connection between the pressure sensor and air switching valve, the air switching valve and the VSV, and the VSV and intake manifold.
 (b) Inspect the vacuum hose for blockage or damage.
 (c) Check that check valve is correctly installed.
 (d) Check that there is air-flow in the check valve from the VSV to the engine. Also, check that there is no air-flow in the opposite side.

NG → **REPAIR OR REPLACE VACUUM HOSE AND CHECK VALVE**

OK

5 INSPECT AIR SWITCHING VALVE ASSY (See page 12-18)

NG → **REPLACE AIR SWITCHING VALVE ASSY**

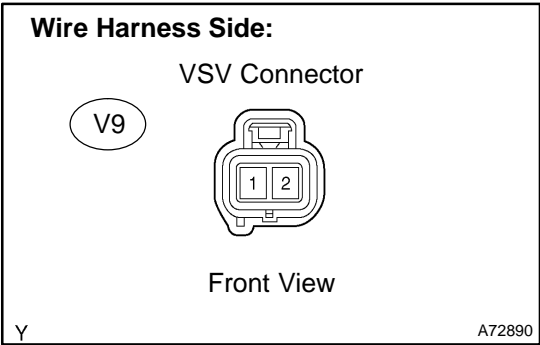
OK

6 INSPECT VACUUM SWITCHING VALVE ASSY (See page 12-18)

NG → **REPLACE VACUUM SWITCHING VALVE ASSY**

OK

7 CHECK HARNESS AND CONNECTOR(ECM-VACUUM SWITCHING VALVE FOR SECONDARY AIR INJECTION SYSTEM)



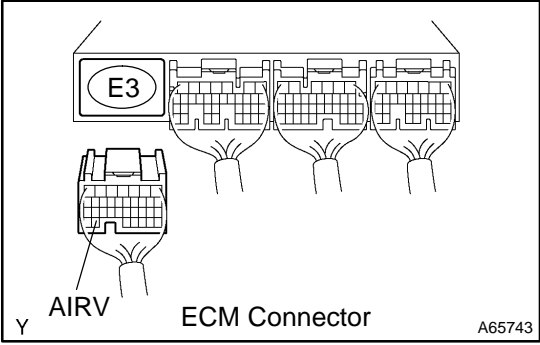
- (a) Disconnect the V9 vacuum switching valve (VSV) connector.
- (b) Disconnect the E3 ECM connector.
- (c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
VSV (V9-2) - AIRV (E3-33)	Below 1 Ω

Standard (Check for short):

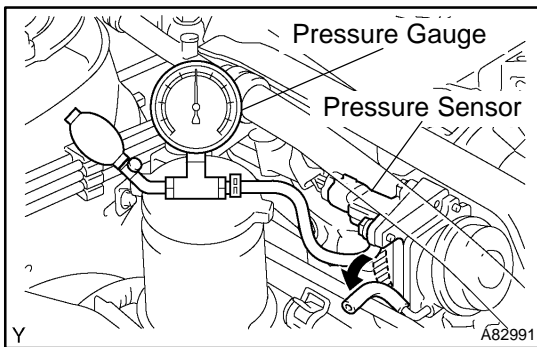
Tester Connection	Specified Condition
VSV (V9-2) or AIRV (E3-33) - Body ground	10 kΩ or higher



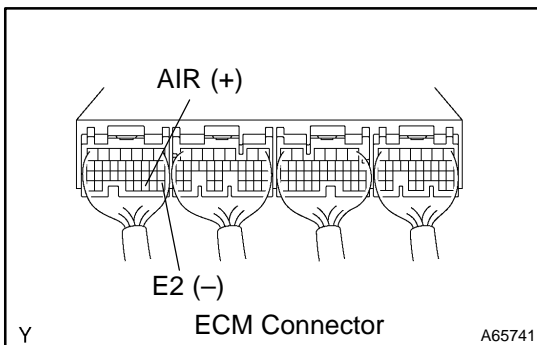
- (d) Reconnect the VSV connector.
- (e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

8 INSPECT ECM(AIR VOLTAGE)

- (a) Connect the pressure gauge to the air pressure sensor as shown in the illustration.
- (b) Turn the ignition switch ON (Do not start engine).
- (c) Check for voltage change between terminals AIR and E2 of the ECM connector when applying the pressure to the pressure sensor with the pressure gauge.

**NG****REPLACE PRESSURE SENSOR (TURBO PRESSURE SENSOR)****OK****REPLACE ECM (See page 10-20)**