

DTC**P0657****Actuator Supply Voltage Circuit / Open****DESCRIPTION**

The ECM monitors the output voltage to the throttle actuator. This self-check ensures that the ECM is functioning properly. The output voltage usually is 0 V when the engine switch is turned off. If the output voltage is higher than 7 volts when the engine switch is turned off, the ECM will illuminate the MIL and set a DTC when the engine switch is turned on.

DTC	DTC Setting Condition	Trouble Area
P0657	Throttle actuator power supply error	ECM

MONITOR STRATEGY

Related DTC	P0657: ETCS power supply
Required sensors/Components (main)	ECM
Required sensors/Components (sub)	Throttle actuator
Frequency of Operation	Once per driving cycle
Duration	Within 1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever this DTC is not present	None
Engine switch	From ON to OFF

TYPICAL MALFUNCTION THRESHOLDS

Throttle actuator power supply	7 V or more
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INSPECTION PROCEDURE**1****CHECK WHETHER DTC OUTPUT RECURS (IN ADDITION TO DTC P0657)**

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Clear the DTC.
- (e) Turn the engine switch off.
- (f) Disconnect the battery negative terminal and wait for 1 minute.
- (g) Connect the battery negative terminal.
- (h) Turn the engine switch on (IG) for 10 seconds.
- (i) Turn the engine switch off.
- (j) Turn the engine switch on (IG).
- (k) Enter the following menus: DIAGNOSIS / ENHANCED II / DTC INFO / CURRENT CODES.
- (l) Read the DTCs.

Result

Display (DTC output)	Proceed to
P0657	A

Display (DTC output)	Proceed to
No output DTC	B

B

CHECK FOR INTERMITTENT PROBLEMS

A

REPLACE ECM (See page [ES-543](#))

DTC**P0630****VIN not Programmed or Mismatch - ECM / PCM****DESCRIPTION**

DTC P0630 is set when the Vehicle Identification Number (VIN) is not stored in the Engine Control Module (ECM) or the input VIN is not accurate. Input the VIN with the intelligent tester.

DTC No.	DTC Detection Condition	Trouble Area
P0630	- VIN not stored in ECM - Input VIN in ECM not accurate	ECM

MONITOR STRATEGY**ES**

Related DTCs	P0630: VIN not programmed
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Sub)	-
Frequency of Operation	Continuous
Duration	0.325 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more
Engine switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

VIN code	Not programmed
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COMPONENT OPERATING RANGE

VIN code	Programmed
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INSPECTION PROCEDURE**1****READ DTC OUTPUT**

- Connect the intelligent tester to the DLC3.
- Turn the engine switch on (IG) and turn the tester on.
- Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- Read the DTCs.

Result

Display (DTC Output)	Proceed to
P0630	A
P0630 and other DTCs	B

If any DTCs other than P0630 are output, troubleshoot those DTCs first.

NOTICE:
If P0630 is set, the VIN must be input to the ECM using the intelligent tester. However, all DTCs are cleared automatically by the tester when inputting the VIN. If DTCs other than P0630 are set, check them first.

B  **GO TO DTC CHART (See page [ES-59](#))**

A

2 **INPUT VIN WITH INTELLIGENT TESTER**

NEXT

ES

END

DTC**P0617****Starter Relay Circuit High****DESCRIPTION**

While the engine is being cranked, the positive battery voltage is applied to terminal STA of the ECM. If the ECM detects the Starter Control (STA) signal while the vehicle is being driven, it determines that there is a malfunction in the STA circuit. The ECM then illuminates the MIL and sets the DTC. This monitor runs when the vehicle is driven at 12.4 mph (20 km/h) for over 20 seconds.

DTC No.	DTC Detection Condition	Trouble Area
P0617	When conditions (a), (b) and (c) are met, positive (+B) battery voltage of 10.5 V or more is applied to ECM for 20 seconds (1 trip detection logic): (a) Vehicle speed more than 12.4 mph (20 km/h) (b) Engine speed more than 1,000 rpm (c) STA signal ON	• Park/Neutral Position (PNP) switch • Starter relay circuit • Cranking holding function circuit • Engine switch • ECM

MONITOR STRATEGY

Related DTCs	P0617: Starter signal
Required Sensors/Components (Main)	STARTER relay, PMP switch, Engine switch
Required Sensors/Components (Sub)	Vehicle speed sensor (VSS), Crankshaft Position (CKP) sensor
Frequency of Operation	Continuous
Duration	20 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever this DTC is not present:	None
Battery voltage	10.5 V or more
Vehicle speed	12.43 mph (20 km/h) or more
Engine speed	1,000 rpm or more

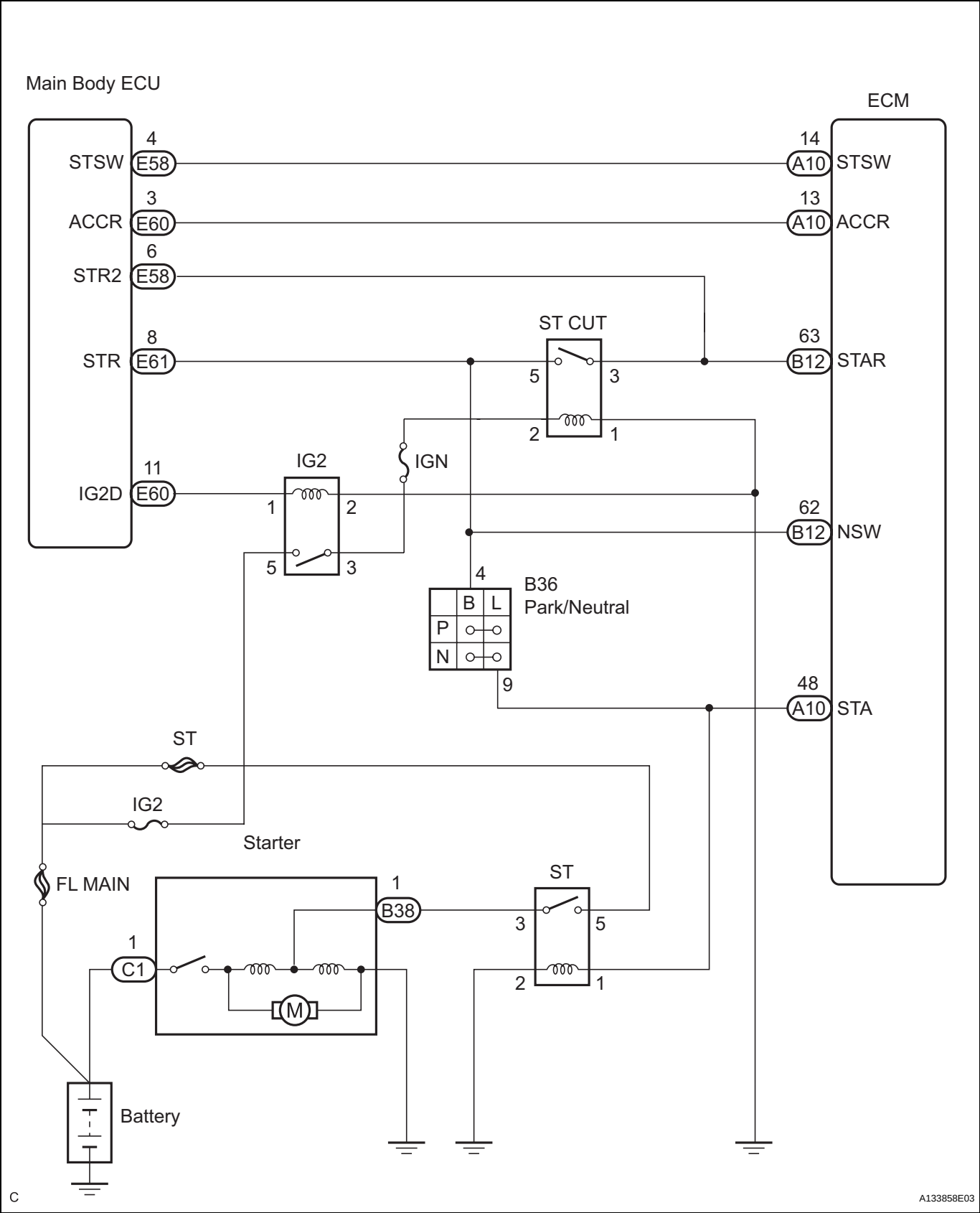
TYPICAL MALFUNCTION THRESHOLDS

Starter signal	ON
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ES

ES

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- The following troubleshooting flowchart is based on the premise that the engine is cranked normally. If the engine does not crank, proceed to the problem symptoms table (See page [ES-28](#)).
- Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1 READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)

ES

- Connect the intelligent tester to the DLC3.
- Turn the engine switch on (IG) and turn the tester on.
- Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG.
- Check the value displayed on the tester when the engine switch is turned on (IG) and the engine is started.

OK

Condition	Engine switch on (IG)	Engine start
STARTER SIG	OFF	ON

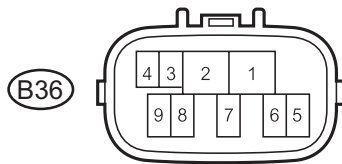
OK

REPLACE ECM (See page [ES-543](#))

NG

2 INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY

Component Side:



Park/Neutral Position Switch

A107908E07

- Inspect the Park/Neutral Position (PNP) switch.
 - Disconnect the B36 switch connector.
 - Measure the resistance according to the value(s) in the table below.

Standard resistance

Gear Selector Lever Position	Tester Connection	Specified Condition
P	4 - 5	Below 1 Ω
N	4 - 5	Below 1 Ω

- Reconnect the PNP switch connector.

Result

Result	Proceed to
OK	A
NG	B

B

REPLACE PARK/NEUTRAL POSITION SWITCH (THEN CHECK CRANKING HOLDING FUNCTION CIRCUIT) (See page [AX-184](#))



A

CHECK CRANKING HOLDING FUNCTION CIRCUIT (See page [ES-449](#))

DTC**P0607****Control Module Performance****DESCRIPTION**

The ECM continuously monitors its main and sub CPUs. This self-check ensures that the ECM is functioning properly. If outputs from the CPUs are different and deviate from the standards, the ECM will illuminate the MIL and set a DTC immediately.

The ECM also monitors the cruise control cancel circuit. If this circuit malfunctions, the ECM will set a DTC immediately (MIL is not illuminated).

DTC No.	DTC Detection Condition	Trouble Area
P0607	- ECM main CPU error - ECM sub CPU error - Cruise control cancel circuit malfunction	ECM

ES**NOTICE:**

First check for an exhaust gas leak around the HO2S if P0606 is present. An exhaust gas leak generates noise in the HO2S output. The ECM may interpret this as an HO2S transistor malfunction.

MONITOR STRATEGY

Related DTC	P0607: ECM CPU malfunction
Required sensors/Components	ECM
Frequency of Operation	Continuous
Duration	Within 1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever this DTC is not present	None
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TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met:	Condition A or B
A. All of the following conditions are met:	Conditions (a), (b) and (c)
(a) CPU reset	1 time or more
(b) Leaned TP - learned APP	0.4 V or more
Throttle actuator	OFF
B. CPU reset	2 times or more

INSPECTION PROCEDURE**1****CHECK WHETHER DTC OUTPUT RECURS (IN ADDITION TO DTC P0607)**

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Clear the DTC.
- (e) Turn the engine switch off.
- (f) Disconnect the battery negative terminal and wait for 1 minute.
- (g) Connect the battery negative terminal.

- (h) Turn the engine switch on (IG).
- (i) Enter the following menus: DIAGNOSIS / ENHANCED II / DTC INFO / CURRENT CODES.
- (j) Read the DTCs.

Result

Display (DTC output)	Proceed to
P0607	A
No output DTC	B

B**CHECK FOR INTERMITTENT PROBLEMS****A****REPLACE ECM (See page [ES-543](#))****ES**

DTC**P0606****ECM / PCM Processor****DESCRIPTION**

The ECM continuously monitors its internal processors (CPUs), A/F sensor transistors and heated oxygen sensor (HO2S) transistors. This self-check ensures that the ECM is functioning properly. These are diagnosed by internal "mirroring" of the main and sub CPUs to detect the processors error. If outputs from the processors deviate from the standards, the ECM will illuminate the MIL and set a DTC immediately.

DTC	DTC Setting Condition	Trouble Area
P0606	- ECM CPUs malfunction - A/F sensor transistors malfunction - HO2S transistors malfunction	- Exhaust gas leak - HO2 Sensor - ECM

MONITOR STRATEGY

Related DTC	P0606: ECM range check
Required sensors/Components (main)	ECM
Required sensors/Components (sub)	APP sensor, TP sensor, Brake switch, Cruise control, A/F sensor HO2S
Frequency of Operation	Continuous
Duration	60 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever this DTC is not present	None
Engine	Running
Estimated A/F sensor temperature	450 to 800°C (842 to 1,472°F)
Estimated HO2S temperature	450 to 800°C (842 to 1,472°F)

TYPICAL MALFUNCTION THRESHOLDS

Difference of main APP and sub APP	0.3 V or more
Difference of main TP and sub TP	0.3 V or more
Difference of main brake switch signal and sub brake switch signal	Different
Cruise control	Fail
A/F sensor transistors	Fail
HO2S transistors	Fail

INSPECTION PROCEDURE**1****CHECK FOR EXHAUST GAS LEAK**

- (a) Allow the engine to idle.
- (b) Check for exhaust gas leak around the heated oxygen sensor.

OK:**No leak from the heated oxygen sensor.****NG****REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT****ES**

OK

2 CHECK HEATED OXYGEN SENSOR**Fuel-Trim and Rear HO2S Voltage Cross-reference**

Fuel-Trim



HO2S Voltage



N

A142077E01

- Connect the intelligent tester to the DLC3.
- Start the engine and turn the tester on.
- Warm up the engine at an engine speed of 2,500rpm for approximately 90 seconds.
- Enter the following menus: DIAGNOSIS / ENHANCED II / ACTIVE TEST / A/F CONTROL.
- Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
- Monitor the voltage outputs of the HO2 sensors (O2S B1S2 or O2S B2S2) displayed on the tester.

HINT:

- The A/F CONTROL operation lowers the fuel injection volume by 12.5 % or increases the injection volume by 25 %.
- Each sensor reacts in accordance with increases in the fuel injection volume.

Standard voltage

Tester Display (Sensor)	Injection Volume	Voltage
O2S B1S2 or O2S B2S2	-12.5 %	Less than 0.2 V
	+25 %	More than 0.8 V

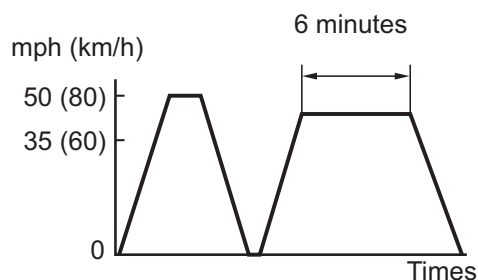
NG

REPLACE HEATED OXYGEN SENSOR (See page EC-21)

OK

3 CHECK WHETHER DTC OUTPUT RECURS (IN ADDITION TO DTC P0606)**Monitor Drive Pattern for P0606**

Engine Coolant Temperature
75°C (167°F) or higher



N

A142078E01

- Connect the intelligent tester to the DLC3.
- Turn the engine switch on (IG).
- Turn the tester on.
- Clear the DTC.
- Turn the engine switch off.
- Disconnect the battery negative terminal and wait for 1 minute.
- Connect the battery negative terminal.
- Start the engine.
- Perform the drive pattern.
 - Warm up the engine.
 - Accelerate the vehicle to 50 mph (80 km/h) and stop the vehicle.
 - Drive the vehicle at 35 to 50 mph (60 to 80 km/h) for 5 minutes or more.
- Enter the following menus: DIAGNOSIS / ENHANCED II / DTC INFO / CURRENT CODES.
- Read the DTCs.

Result

Display (DTC output)	Proceed to
P0606	A
No output DTC	B

B

CHECK FOR INTERMITTENT PROBLEMS

A

REPLACE ECM (See page [ES-543](#))

DTC	P0604	Internal Control Module Random Access Memory (RAM) Error
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DESCRIPTION

The ECM continuously monitors its internal memory status. This self-check ensures that the ECM is functioning properly. It is diagnosed by internal "mirroring" of the main CPU and sub CPU to detect the Random Access Memory (RAM) errors. If outputs from these CPUs are different and deviate from the standards, the ECM will illuminate the MIL and set a DTC immediately.

DTC	DTC Setting Condition	Trouble Area
P0604	ECM RAM errors	ECM

MONITOR STRATEGY

Related DTC	P0604: ECM RAM error
Required sensors/Components	ECM
Frequency of Operation	Continuous
Duration	16 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever this DTC is not present	None
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TYPICAL MALFUNCTION THRESHOLDS

Main CPU and sub CPU mirroring	Fail
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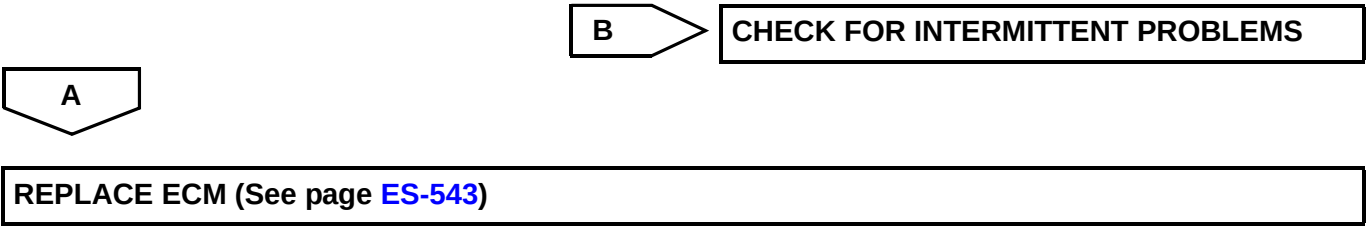
INSPECTION PROCEDURE

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P0604)
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- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Clear the DTC.
- (e) Turn the engine switch off.
- (f) Disconnect the battery negative terminal and wait for 1 minute.
- (g) Connect the battery negative terminal.
- (h) Turn the engine switch on (IG).
- (i) Enter the following menus: DIAGNOSIS / ENHANCED II / DTC INFO / CURRENT CODES.
- (j) Read the DTCs.

Result

Display (DTC output)	Proceed to
P0604	A
No output DTC	B



DTC	P0560	System Voltage
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DESCRIPTION

The battery supplies electricity to the ECM even when the engine switch is off. This power allows the ECM to store data such as DTC history, freeze frame data and fuel trim values. If the battery voltage falls below a minimum level, these memories are cleared and the ECM determines that there is a malfunction in the power supply circuit. When the engine is next started, the ECM illuminates the MIL and sets the DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in ECM back-up power source circuit (1 trip detection logic)	- Open in back-up power source circuit - ECM

HINT:

If DTC P0560 is set, the ECM does not store other DTCs.

MONITOR STRATEGY

Related DTCs	P0560: ECM system voltage
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Sub)	-
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate (MIL illuminated after next engine start)
Sequence of Operation	None

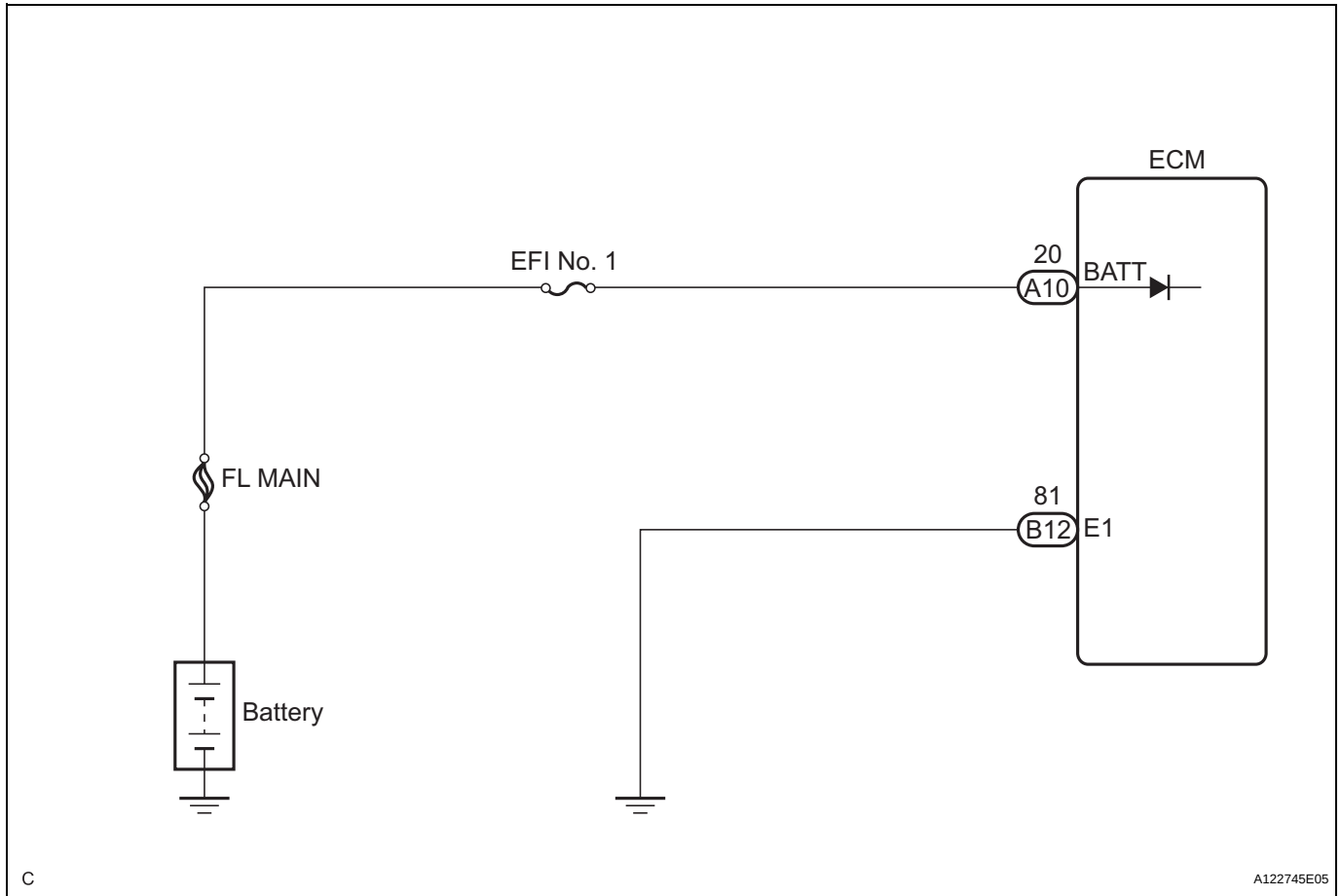
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present:	None
Stand-by RAM	Initialized

TYPICAL MALFUNCTION THRESHOLDS

ECM power source	Less than 3.5 V
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WIRING DIAGRAM

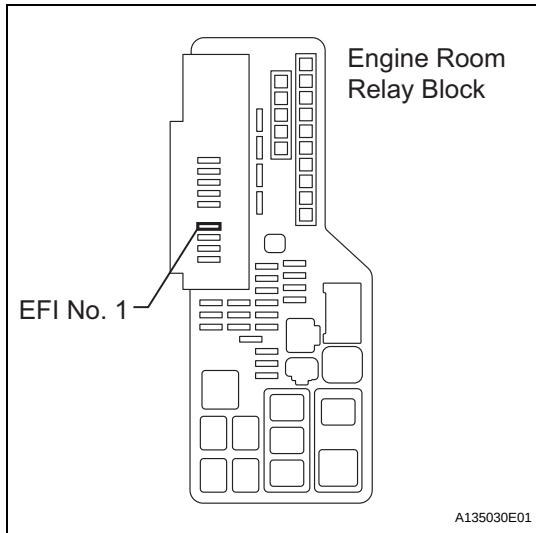


ES

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1 INSPECT FUSE (EFI NO. 1)

- (a) Remove the EFI No. 1 fuse from the engine room R/B.
- (b) Measure the EFI No. 1 fuse resistance.

Standard resistance:

Below 1 Ω

- (c) Reinstall the EFI No. 1 fuse.

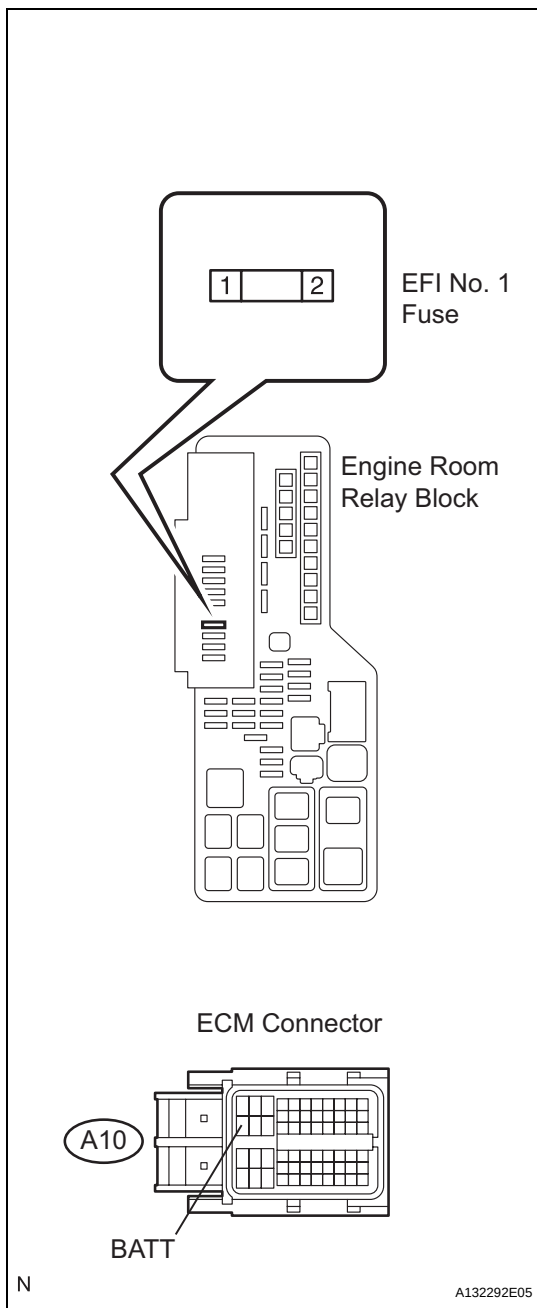
NG

REPLACE EFI NO. 1 FUSE

OK

ES

2 CHECK HARNESS AND CONNECTOR



- (a) Check the harness and connector between the EFI No. 1 fuse and ECM.
- (1) Remove the EFI No. 1 fuse from the engine room R/B.
 - (2) Disconnect the A10 ECM connector.
 - (3) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Engine room R/B EFI No. 1 fuse terminal 2 - BATT (A10-20)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Engine room R/B EFI No. 1 fuse terminal 2 or BATT (A10-20) - Body ground	10 k Ω or higher

- (4) Reinstall the ECM connector.
- (b) Check the harness and the connector between the EFI No. 1 fuse and battery.
- (1) Disconnect the negative battery terminal.
 - (2) Disconnect the positive battery terminal.
 - (3) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Battery positive terminal - Engine room R/B EFI No. 1 fuse terminal 1	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Battery positive terminal or Engine room R/B EFI No. 1 fuse terminal 1 - Body ground	10 k Ω or higher

- (4) Reconnect the positive battery terminal.
- (5) Reconnect the negative battery terminal.
- (6) Reinstall the EFI No. 1 fuse.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3 INSPECT BATTERY

- (a) Check that the battery is not depleted.

OK:

Battery is not depleted.

NG

REPLACE BATTERY

OK

4 CHECK BATTERY TERMINAL

- (a) Check that the battery terminals are not loose or corroded.

OK:
Battery terminals are not loose or corroded.

NG REPAIR OR REPLACE BATTERY TERMINAL

OK

5 CHECK WHETHER DTC OUTPUT RECURS

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the intelligent tester on.
- (d) Clear the DTCs (See page ES-41).
- (e) Turn the intelligent tester off.
- (f) Start the engine and turn the intelligent tester on.
- (g) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- (h) Read the DTCs.

Result

Display (DTC Output)	Proceed to
P0560	A
No output	B

B CHECK FOR INTERMITTENT PROBLEMS

A

REPLACE ECM (See page ES-543)

DTC	P050A	Cold Start Idle Air Control System Performance
DTC	P050B	Cold Start Ignition Timing Performance

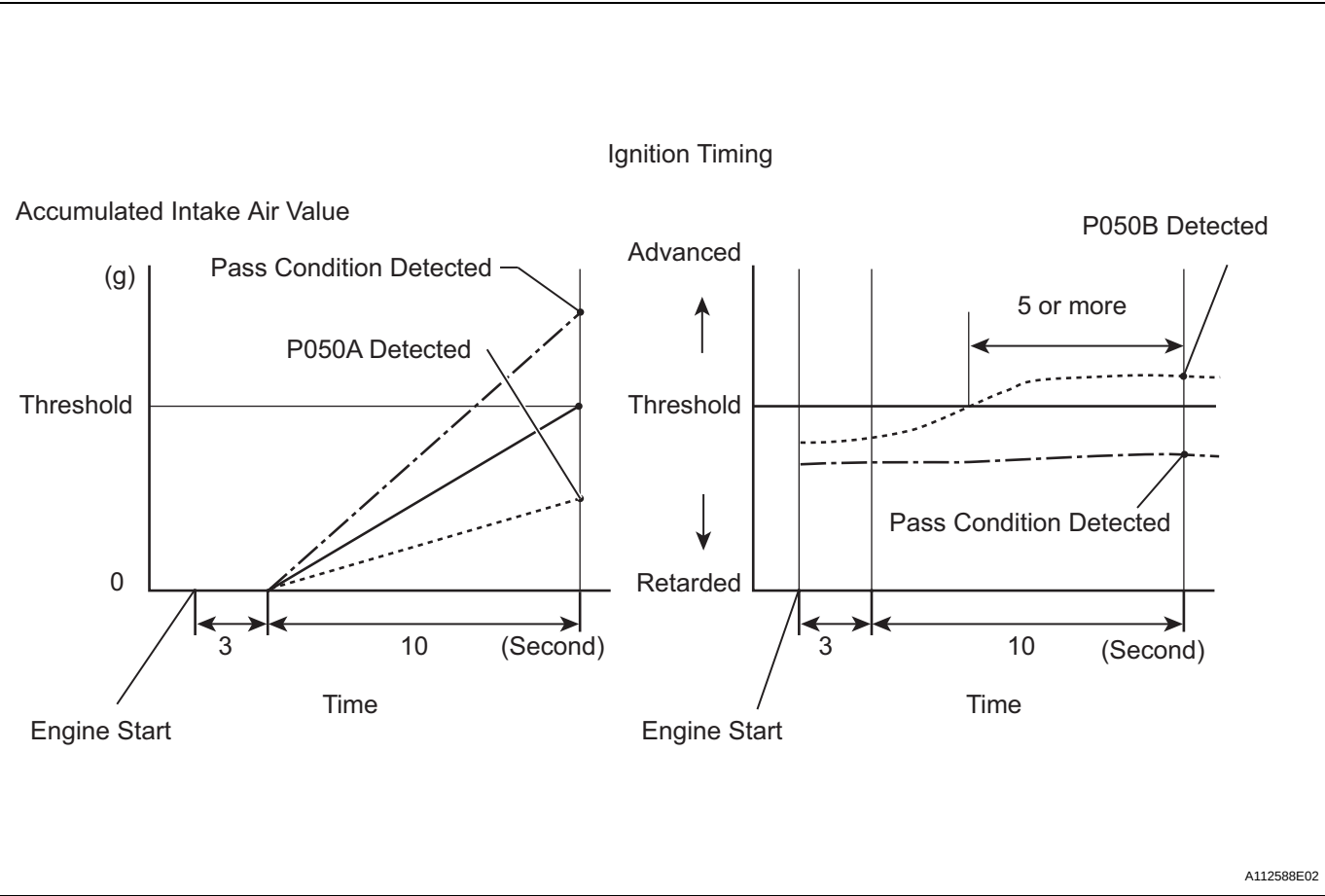
DESCRIPTION

The Electronic Throttle Control System (ETCS) controls the engine idling speed. The ETCS operates the throttle actuator to open and close the throttle valve, and adjusts the intake air amount to achieve the target idling speed.

In addition, the ECM retards the ignition timing and the ETCS increases the intake air amount to quickly increase the catalyst temperature at cold start to reduce emissions.

DTC No.	DTC Detection Conditions	Trouble Areas
P050A	Accumulated intake air amount during 10 seconds of idling after cold start is less than threshold (2 trip detection logic)	- Throttle body assembly - Mass air flow meter - Air induction system - PCV hose connections - VVT system - Air cleaner filter element - ECM
P050B	Ignition timing retard value is insufficient for 5 seconds or more during 10 seconds of P050A monitoring at cold start (2 trip detection logic)	- Throttle body assembly - Mass air flow meter - Air induction system - PCV hose connections - VVT system - Air cleaner filter element - ECM

MONITOR DESCRIPTION



The ECM monitors the intake air amount during idling and the ignition timing.

When the Engine Coolant Temperature (ECT) is between -10°C and 50°C (14°F and 122°F), the ECM calculates the idling intake air amount for 10 seconds, beginning 3 seconds after the engine starts.

When the accumulated value is below the threshold, the ECM interprets this as a malfunction in the Idle Speed Control (ISC) system at cold start.

The ECM also monitors the ignition timing at cold start, and judges it to be incorrect when it is advanced to the same value for a warm engine for 5 seconds or more of the 10 second monitoring period.

Example:

P050A is detected when all conditions below are met (2 trip detection logic).

1. The ECT is between -10°C and 50°C (14°F and 122°F) when the engine starts.
2. The engine idles for 13 seconds after engine start.
3. The accumulated intake air amount is below the threshold.

The ECM sets the DTC and illuminates the MIL 13 seconds after the engine is next started.

NOTICE:

When the negative battery terminal is disconnected during inspection or repairs, the ISC learning values are cleared. The ISC learning must be performed by warming up the engine and idling for 5 minutes with the ECT at 75°C (167°F) or more because DTCs cannot be detected with the ISC learning values cleared.

ES

MONITOR STRATEGY

Related DTCs	P050A: Idle speed control problem at cold P050B: Idle ignition timing problem at cold
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Engine Coolant Temperature (ECT) sensor, Throttle position sensor, Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P050A:

Battery voltage	8 V or more
Time after engine start	3 seconds or more
Starter	OFF
ECT at engine start	-10°C (14°F) or more
ECT	-10°C to 50°C (14°F to 122°F)
Engine idling time	3 seconds or more
Fuel-cut	OFF
Vehicle speed	Less than 1.875 mph (3 km/h)
Time after shift position changed	1 second or more
Atmospheric pressure	76 kPa (570 mmHg) or more

P050B:

Battery voltage	8 V or more
Time after engine start	3 seconds or more
Starter	OFF
ECT at engine start	-10°C (14°F) or more
ECT	-10°C to 50°C (14°F to 122°F)
Engine idling time	3 seconds or more
Fuel-cut	OFF
Vehicle speed	Less than 1.875 mph (3 km/h)

TYPICAL MALFUNCTION THRESHOLDS

P050A:

Accumulated mass air flow	Varies with ECT (Example: Less than 42.5 g)
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P050B:

Accumulated time when ignition timing retard is cut off	5 seconds or more
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INSPECTION PROCEDURE

HINT:

Read freeze frame data using an intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1 CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050A AND/OR P050B)

- (a) Connect an intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- (e) Read the DTCs.

Result

Display (DTC Output)	Proceed to
P050A and/or P050B	A
P050A and/or P050B and other DTCs	B

HINT:

If any DTCs other than P050A and P050B are output, troubleshoot those DTCs first.

B

GO TO DTC CHART (See page [ES-59](#))

A

2 READ VALUE USING INTELLIGENT TESTER (FUEL TRIM)

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter.

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / SHORT FT #1 and LONG FT #1.
- (e) Read the values displayed on the tester.
- (f) Add together the SHORT FT #1 and LONG FT #1 values to obtain the total FUEL TRIM.

OK:

Total of SHORT FT #1 and LONG FT #1 values is between -20 % and 20 %.

OK

Go to step 12

NG

3

PERFORM ACTIVE TEST USING INTELLIGENT TESTER (OPERATE OCV)

- (a) Connect the intelligent tester to the DLC3.
- (b) Start the engine and turn the tester ON.
- (c) Warm up the engine.
- (d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1.
- (e) Check the engine speed while operating the Oil Control Valve (OCV) using the tester.

OK

Tester Operation	Specified Condition
OCV OFF	Normal engine speed
OCV ON	Engine idles roughly or stalls (soon after OCV switched from OFF to ON)

NG

Go to step 8

OK

4

CHECK PCV HOSE CONNECTIONS

OK:

PCV hose is connected correctly and is not damaged.

NG

Go to step 9

OK

5

CHECK AIR INDUCTION SYSTEM

- (a) Check the air induction system for vacuum leakage.

OK:

No leakage from air induction system.

NG

Go to step 10

OK

6

CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

- (a) Visually check that the air cleaner filter element is not excessively contaminated with dirt or oil.

OK:

Air cleaner filter element is not excessively contaminated with dirt or oil.

ES

NG Go to step 11

OK

7 REPLACE MASS AIR FLOW METER

(a) Replace the mass air flow meter (See page [ES-497](#)).

NEXT Go to step 15

8 CHECK AND REPAIR VVT SYSTEM

NEXT Go to step 15

9 REPAIR OR REPLACE PCV HOSE

NEXT Go to step 15

10 REPAIR OR REPLACE AIR INDUCTION SYSTEM

NEXT Go to step 15

11 REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

NEXT Go to step 15

12 CHECK THROTTLE VALVE

(a) Check for deposits around the throttle valve and throttle valve condition.

OK:

No deposits around throttle valve and throttle valve moves smoothly.

NG Go to step 14

OK

13 REPLACE ECM

(a) Replace the ECM (See page [ES-543](#)).

NEXT Go to step 15

ES

14 REPAIR OR REPLACE THROTTLE BODY ASSEMBLY**NEXT****Go to step 15****15 CHECK WHETHER DTC OUTPUT RECURS (DTC P050A AND/OR P050B)****NOTICE:**

In this operation, the engine must be cold (the same level as the engine coolant temperature recorded in the freeze frame data).

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Clear the DTCs (See page [ES-41](#)).
- (e) Switch the ECM from normal mode to check mode using the tester (See page [ES-45](#)).
- (f) Start the engine to idle for a minute.

OK:

Stable fast idling.

- (g) Read the DTCs.

OK:

No DTC output.

NEXT**END****ES**

DTC**P0505****Idle Control System Malfunction****DESCRIPTION**

The idle speed is controlled by the Electronic Throttle Control System (ETCS). The ETCS is comprised of: 1) one valve type throttle body; 2) the throttle actuator, which operates the throttle valve; 3) the throttle position sensor, which detects the opening angle of the throttle valve; 4) the accelerator pedal position sensor, which detects the accelerator pedal position; 5) the ECM, which controls the ETCS. Based on the target idle speed, the ECM controls the throttle actuator to provide the proper throttle valve opening angle.

DTC No.	DTC Detection Condition	Trouble Area
P0505	Idle speed continues to vary greatly from target speed (2 trip detection logic)	- ETCS - Air induction system - PCV hose connection - ECM

ES**MONITOR DESCRIPTION**

The ECM monitors the idling speed and idling air flow volume to conduct Idle Speed Control (ISC). The ECM determines that the ISC system is malfunctioning if the following conditions are met:

- The learned idling air flow volume remains at the maximum or minimum 5 times or more during a driving cycle
- While driving at 6 mph (10 km/h) or more, the actual engine idling speed varies from the target idling speed by between 100 rpm and 200 rpm, 5 times or more during a driving cycle.

Example:

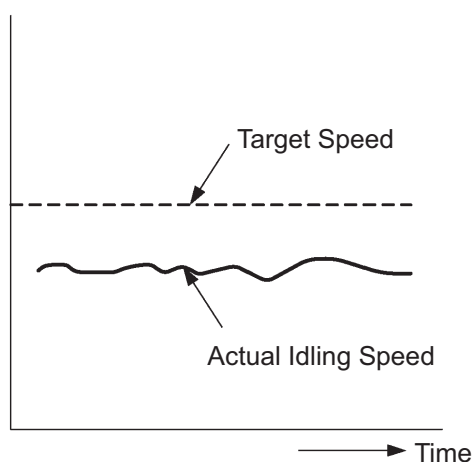
If the actual idling speed varies from the target idling speed by more than 200 rpm* 5 times during a driving cycle, the ECM illuminates the MIL and sets the DTC.

HINT:

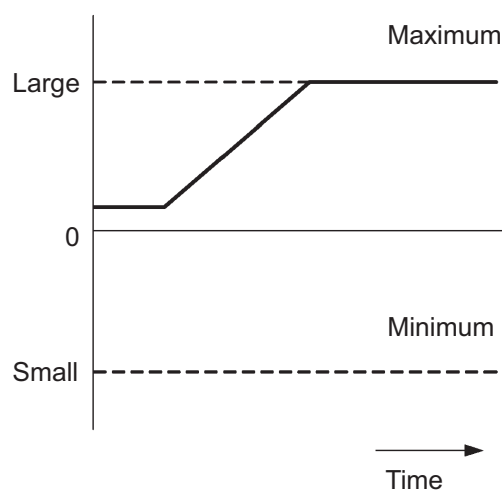
*: Threshold idling speed varies with engine load.

Example

Idling Speed



Learned Idling Air Volume



MONITOR STRATEGY

Related DTCs	P0505: ISC function
Required Sensors/Components (Main)	ETCS
Required Sensors/Components (Sub)	Crankshaft position sensor, Engine coolant temperature sensor, and Vehicle speed sensor
Frequency of Operation	Continuous
Duration	10 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

Functional check:

Monitor will run whenever these DTCs are not present	None
Engine	Running

TYPICAL MALFUNCTION THRESHOLDS

Functional check:

Either the following condition 1 or 2 is met:	-
1. Frequency that following conditions (a) and (b) are met:	5 time or more
(a) Engine RPM - target engine RPM	Below -100 rpm, or 200 rpm or more
(b) Vehicle condition	Stop after vehicle was driven by 6.25 mph (10 km/h) or more
2. Frequency that following conditions (a) and (b) are met:	Once
(a) Engine RPM - target engine RPM	Below -100 rpm, or 200 rpm or more
(b) ISC flow rate learning value	1.3 L/sec. or less. or 8.5 L/sec. or more

INSPECTION PROCEDURE

HINT:

- The following condition may also cause DTC P0505 to be set:
(a) The throttle valve is not fully closed. (e.g. The accelerator pedal is slightly depressed by something such as a floor carpet overlapping the accelerator pedal.)
- Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1

CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0505)

- Connect the intelligent tester to the DLC3.
- Turn the engine switch on (IG).
- Turn the tester on.
- Enter the following the menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- Read the DTCs.

Result

Display (DTC output)	Proceed to
P0505	A
P0505 and other DTCs	B

HINT:

If any DTCs other than P0505 are output, troubleshoot those DTCs first.

B

GO TO DTC CHART (See page [ES-59](#))

A

2

CHECK PCV HOSE (HOSE CONNECTIONS)

OK:

PCV hose is connected correctly and is not damaged.

NG

REPAIR OR REPLACE PCV HOSE

ES

OK

3

CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leakage.

OK:

No leakage from air induction system.

NG

REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

4

CHECK THROTTLE BODY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for contamination between the throttle valve and the housing. If necessary, clean the throttle body. And check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

NG

REPLACE THROTTLE BODY (See page [ES-519](#))

OK

REPLACE ECM (See page [ES-543](#))

DTC	P0504	Brake Switch "A" / "B" Correlation
DTC	P0724	Brake Switch "B" Circuit High

DESCRIPTION

The stop light switch is a duplex system that transmits two signals: STP and ST1-. These two signals are used by the ECM to monitor whether or not the brake system is working properly. If the signals, which indicate the brake pedal is being depressed and released, are detected simultaneously, the ECM interprets this as a malfunction in the stop light switch and sets the DTC.

HINT:

The normal conditions are as shown in the table below. The signals can be read using an intelligent tester.

Signal	Brake Pedal Released	In Transition	Brake Pedal Depressed
STP	OFF	ON	ON
ST1-	ON	ON	OFF

DTC No.	DTC Detection Condition	Trouble Area
P0504	Conditions (a), (b) and (c) continue for 0.5 seconds or more (1 trip detection logic): (a) Engine switch on (IG) (b) Brake pedal released (c) STP signal OFF when ST1- signal OFF	- Short in stop light switch signal circuit - Stop light switch - ECM
P0724	The stop light switch remains ON even when the vehicle is driven in a STOP (less than 2 mph (3 km/h)) and GO (19 mph (30 km/h) or more) fashion 5 times. (2 trip detection logic)	- Short in stop light switch signal circuit - Stop light switch - ECM

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains on. When the stop light switch remains ON during "stop and go" driving, the ECM interprets this as a fault in the stop light switch and the MIL comes on and the ECM stores the DTC. The vehicle must stop (less than 2 mph (3 km/h)) and go (19 mph (30 km/h) or more) 5 times in two driving cycles in order to detect a malfunction.

MONITOR STRATEGY

Related DTCs	P0724: Stop light switch/Rationality
Required sensors/Components	Stop light switch, Vehicle speed sensor
Frequency of operation	Continuous
Duration	GO and STOP 5 times
MIL operation	2 driving cycles
Sequence of operation	None

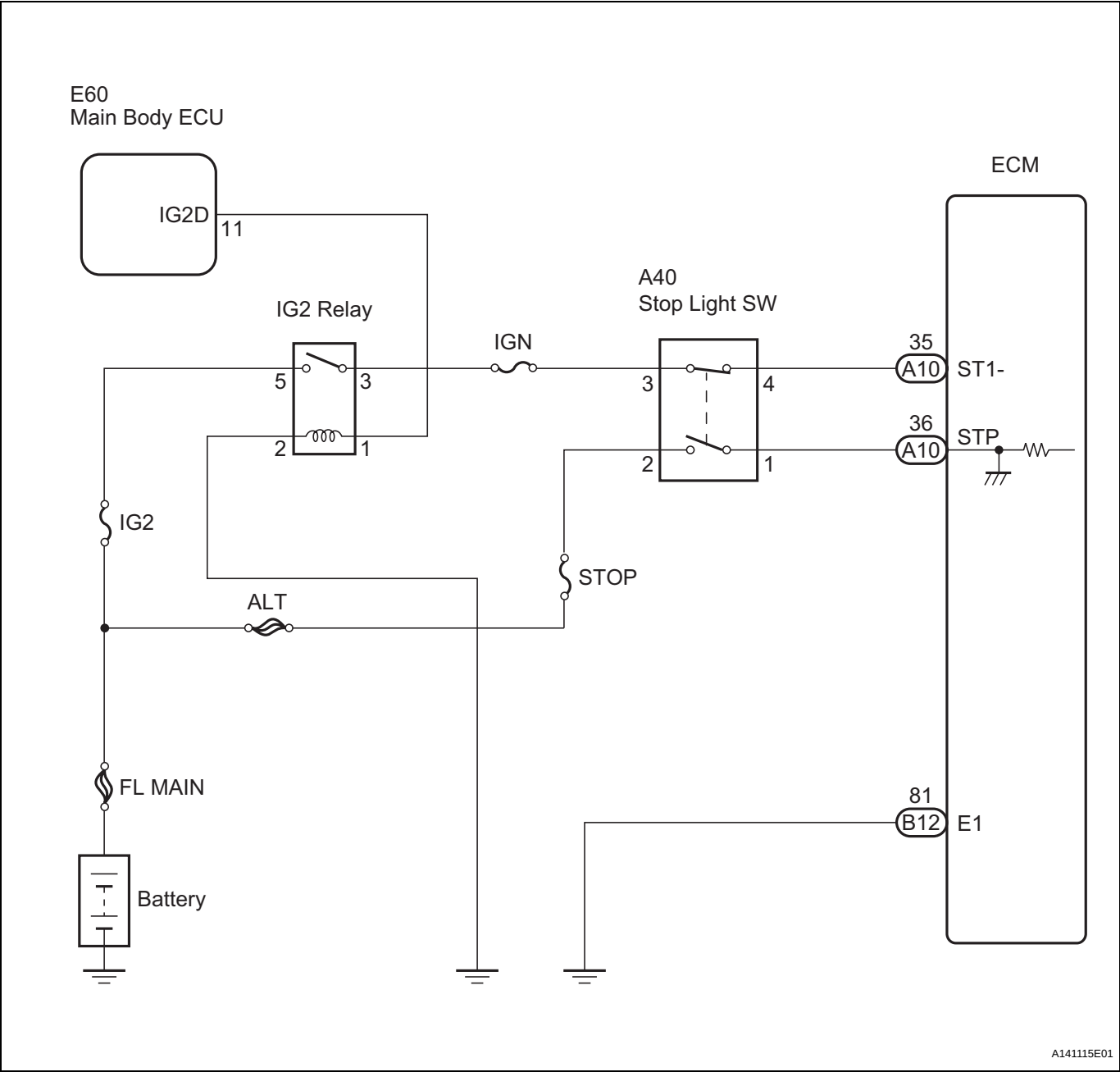
TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
Engine switch	ON
Starter	OFF
Battery voltage	8 V or more
GO (Vehicle speed is 18.65 mph (30 km/h) or more)	Once
STOP (Vehicle speed is less than 1.86 mph (3 km/h))	Once

TYPICAL MALFUNCTION THRESHOLDS

Brake switch	Remain ON during GO and STOP 5 times
--------------	--------------------------------------

WIRING DIAGRAM



A141115E01

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1 CHECK STOP LIGHT (OPERATION OF STOP LIGHT)

- (a) Check whether the stop lights turn on and off normally when the brake pedal is depressed and released.

OK:

Stop lights turn ON when brake pedal is depressed.

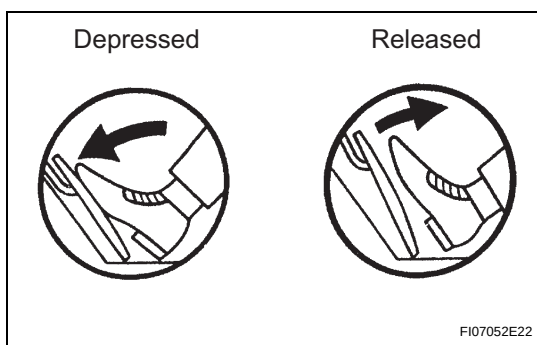
NG

REPAIR OR REPLACE STOP LIGHT SWITCH CIRCUIT

OK

2 READ VALUE OF INTELLIGENT TESTER (STP SIGNAL AND ST1 - VOLTAGE)

ES



- (a) Connect the intelligent tester to the DLC3.
 (b) Turn the engine switch on (IG) and turn the tester on.
 (c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / STOP LIGHT SW.
 (d) Check the STP signal when the brake pedal is depressed and released.

OK

Brake Pedal Condition	Specified Condition
Depressed	STP signal ON
Released	STP signal OFF

- (e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ST1.
 (f) Check the ST1 signal when the brake pedal is depressed and released.

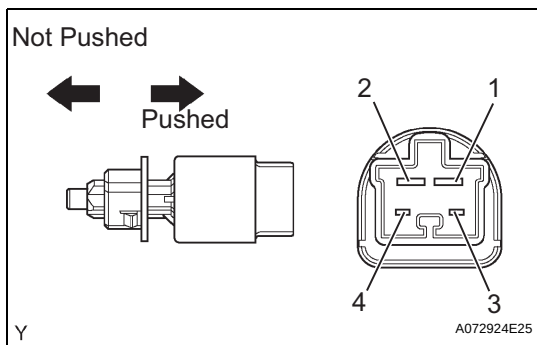
OK

Brake Pedal Condition	Specified Condition
Depressed	ST1 signal OFF
Released	ST1 signal ON

OK

CHECK FOR INTERMITTENT PROBLEMS

NG

3 INSPECT STOP LIGHT SWITCH ASSEMBLY

- (a) Remove the stop light switch assembly.
 (b) Measure the resistance according to the value(s) in the table below.

Standard resistance

Switch Position	Tester Connection	Specified Condition
Switch pin free	1 - 2	Below 1 Ω
Switch pin free	3 - 4	10 k Ω or higher
Switch pin pushed in	1 - 2	10 k Ω or higher
Switch pin pushed in	3 - 4	Below 1 Ω

- (c) Reinstall the stop light switch assembly.

NG

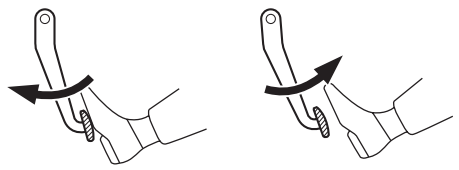
REPLACE STOP LIGHT SWITCH ASSEMBLY
(See page [LI-200](#))

OK

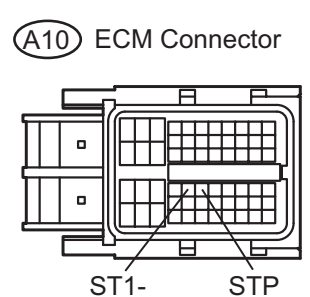
4

CHECK ECM (STP, ST1 - VOLTAGE)

Brake Pedal Depressed
Brake Pedal Released



Wire Harness Side Front View:



A112585E12

- (a) Disconnect the A10 ECM connector.
(b) Measure the voltage according to the value(s) in the table below.

Standard voltage

Tester Connection	Brake Pedal Condition	Specified Condition
STP (A10-36) - Body ground	Depressed	9 to 14 V
STP (A10-36) - Body ground	Released	0 to 3 V
ST1- (A10-35) - Body ground	Depressed	0 to 3 V
ST1- (A10-35) - Body ground	Released	9 to 14 V

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM (See page [ES-543](#))

DTC	P0455	Evaporative Emission Control System Leak Detected (Gross Leak)
DTC	P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection logic
P0455	EVAP gross leak	Vacuum pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak pressure standard measured at start and at end of leak check. If stabilized pressure higher than [second 0.02 inch leak pressure standard x 0.2], ECM determines that EVAP system has a large leak	- Fuel tank cap (loose) - Leakage from EVAP line (Canister - Fuel tank) - Leakage from EVAP line (EVAP VSV - Canister) - Pump module - Leakage from fuel tank - Leakage from canister	While engine switch off	2 trip
P0456	EVAP small leak	Vacuum pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak pressure standard measured at start and at end of leak check. If stabilized pressure higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system has a small leak	Same as above	While engine switch off	2 trip

ES**DESCRIPTION**

The circuit description can be found in the EVAP (Evaporative Emission) system (See page [ES-395](#)).

INSPECTION PROCEDURE

Refer to the EVAP system (See page [ES-395](#)).

MONITOR DESCRIPTION

5 hours* after the engine switch is turned off, the electric vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

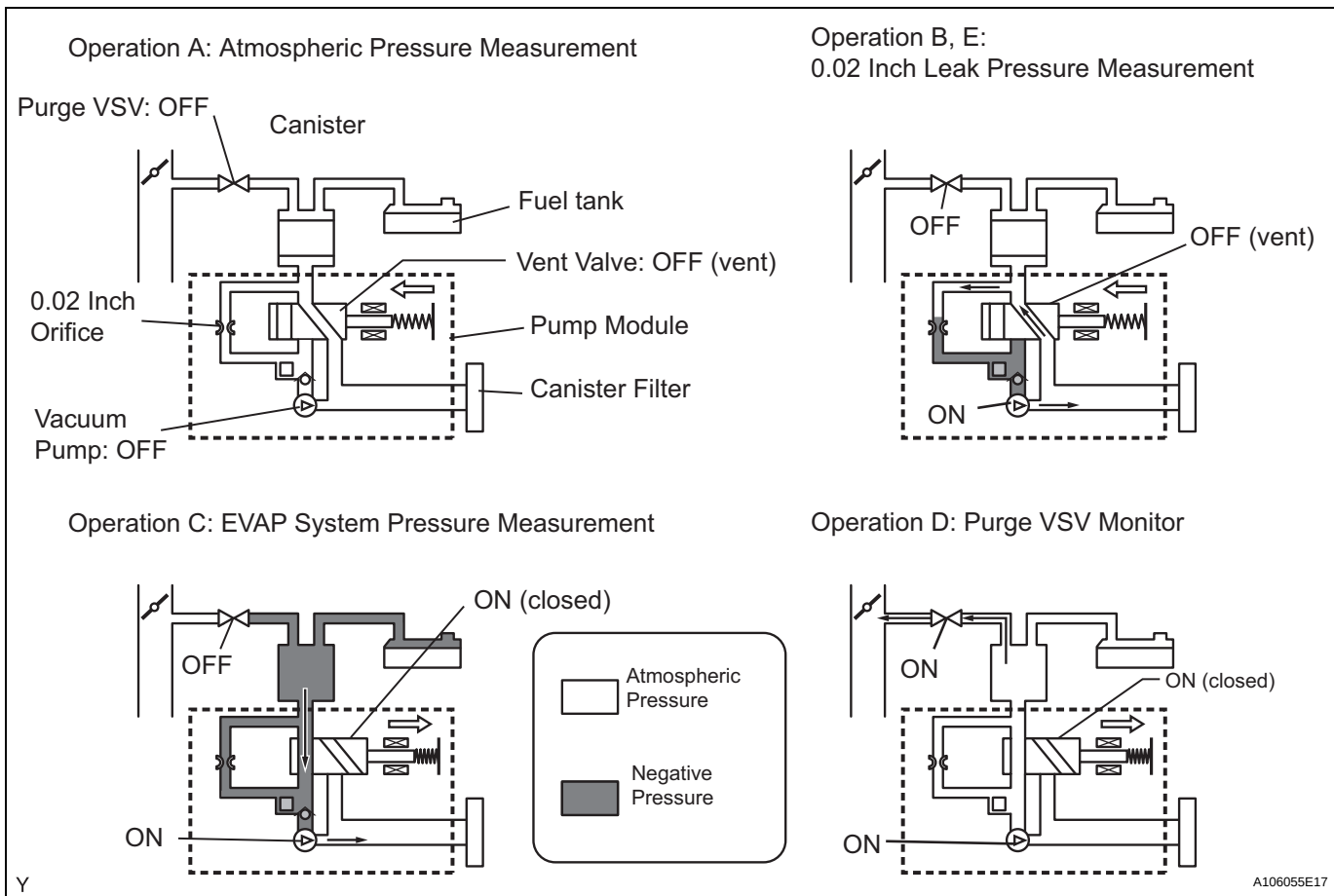
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the engine switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the engine switch is turned off, the monitor check starts 2.5 hours later.

Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5 hours (7 or 9.5 hours) after engine switch is turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds

Sequence	Operation	Description	Duration
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve is turned ON (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as they will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*
D	EVAP VSV monitor	EVAP VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that there is a leak in EVAP system.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

HINT:

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

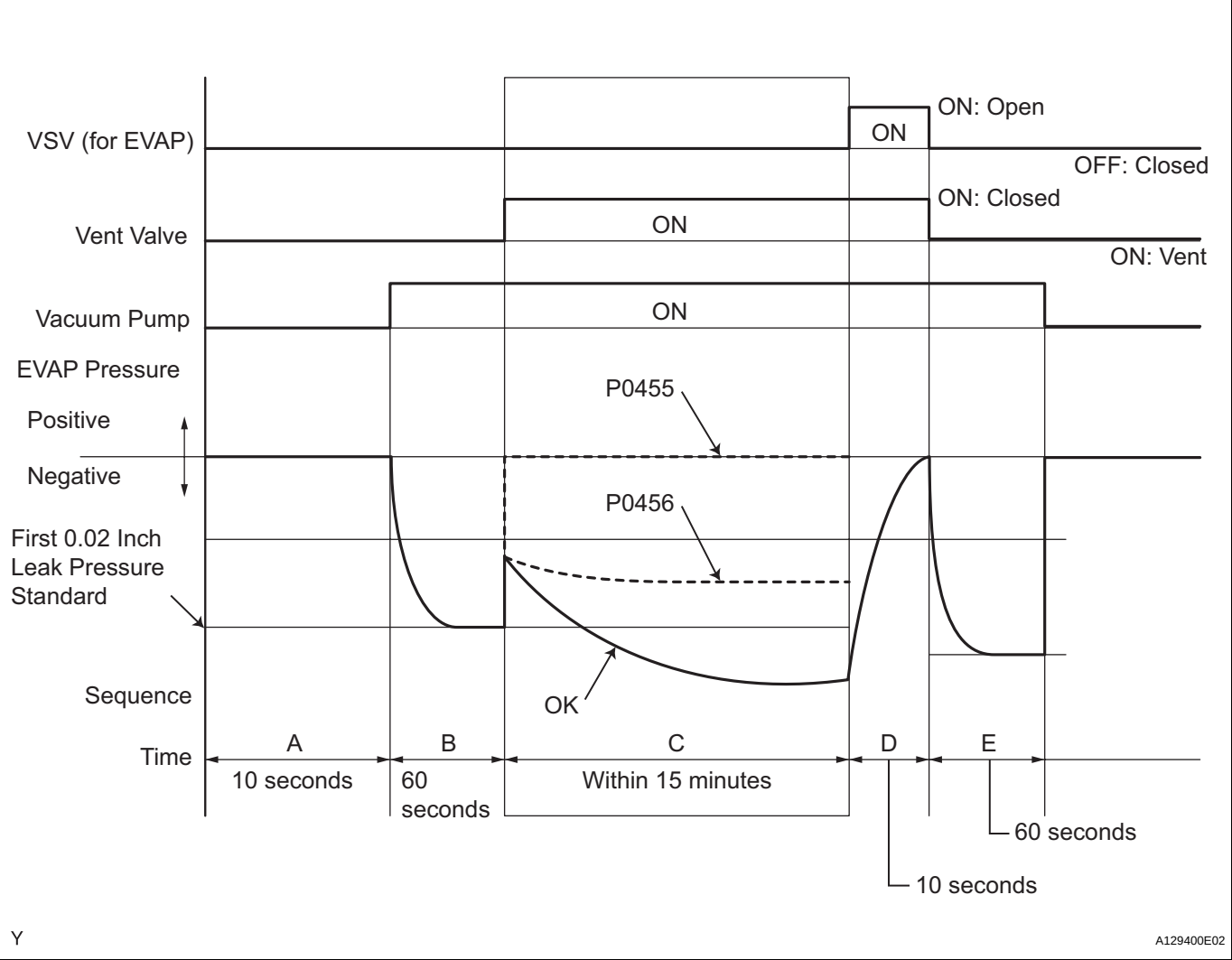


1. P0455: EVAP (Evaporative Emission) gross leak

In operation C, the vacuum pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second 0.02 inch leak pressure standard x 0.2] (near atmospheric pressure), the ECM determines that the EVAP system has a large leak, illuminates the MIL and sets the DTC (2 trip detection logic).

2. P0456: EVAP very small leak
- In operation C, the vacuum pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than the second 0.02 inch leak pressure standard, the ECM determines that the EVAP system has a small leak, illuminates the MIL and sets the DTC (2 trip detection logic).

EVAP Pressure when EVAP System Leaks:



MONITOR STRATEGY

Required Sensors/Components	EVAP VSV and pump module
Frequency of Operation	Once per driving cycle
Duration	Within 15 minutes (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

EVAP key-off monitor runs when all of following conditions are met:	-
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Engine switch	OFF

Time after key off	5, 7 or 9.5 hours
EVAP pressure sensor malfunction (P0450, P0451, P0452 and P0453)	Not detected
EVAP VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions are met before key OFF:	Conditions 1 and 2
1. Duration that vehicle is being driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure

Next sequence is run if following condition is met:	-
Atmospheric pressure change	Less than 0.3 kPa (2.25 mmHg) for 1 second

2. First reference pressure

Next sequence is run if all of following conditions are met:	Conditions 1, 2 and 3
1. EVAP pressure 4 seconds after reference pressure measurement	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.05 kPa (-36.38 to -7.87 mmHg)
3. Reference pressure	Saturated within 1 minute

3. Vent valve stuck closed check

Next sequence is run if following condition is met:	-
EVAP pressure change after vent valve is turned ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction and leak

Next sequence is run if following condition is met:	-
Vacuum introduction time	15 minutes or less

5. EVAP VSV stuck closed check

Next sequence is run if following condition is met:	-
EVAP pressure change after purge VSV is turned ON	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if all of following conditions are met:	Conditions 1, 2, 3 and 4
1. EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.05 kPa (-36.38 to -7.87 mmHg)
3. Reference pressure	Saturated within 1 minute
4. Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if following condition is met:	-
EVAP pressure when vacuum introduction was complete	Less than second reference pressure

8. Atmospheric pressure

Monitor is complete	-
Atmospheric pressure difference between sequence 1 and 8	0.3 kPa (2.25 mmHg) or less

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

P0455: EVAP gross leak

EVAP pressure when vacuum introduction is complete	Higher than reference pressure x 0.2
--	--------------------------------------

P0456: EVAP small leak

EVAP pressure when vacuum introduction is complete	Between reference pressure and reference pressure x 0.2
--	---

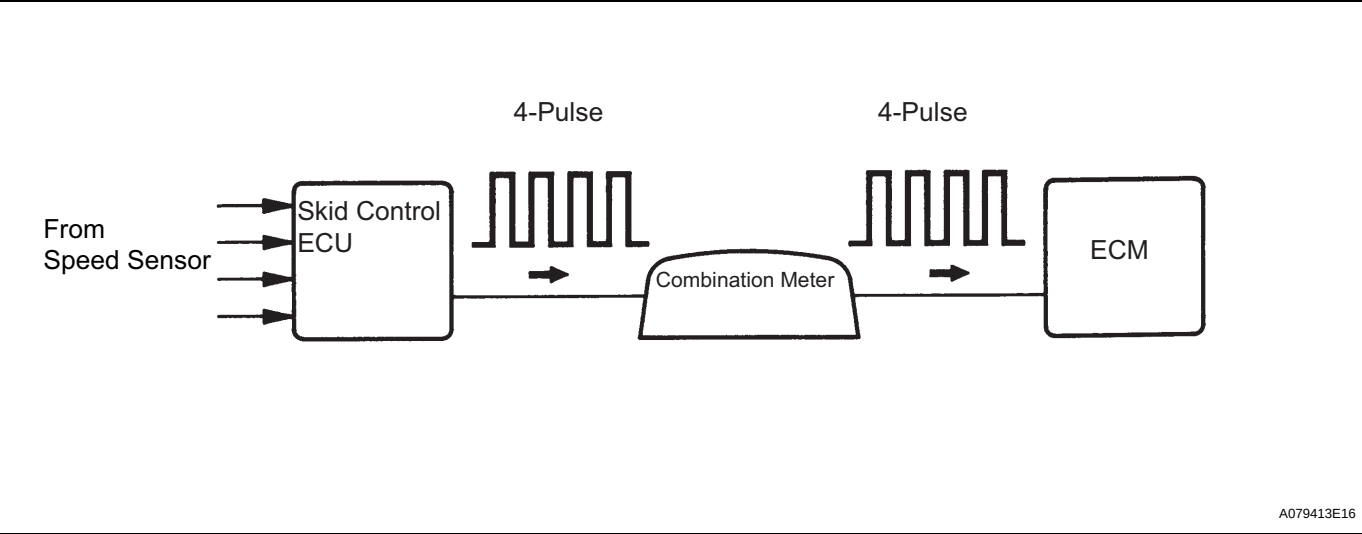
MONITOR RESULT

Refer to CHECKING MONITOR STATUS (See page [ES-20](#)).

DTC	P0500	Vehicle Speed Sensor "A"
-----	-------	--------------------------

DESCRIPTION

The speed sensor detects the wheel speed and sends the appropriate signals to the skid control ECU. The skid control ECU converts these wheel speed signals into a 4-pulse signal and outputs it to the ECM via the combination meter. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detection Condition	Trouble Area
P0500	Vehicle speed signal from vehicle speed sensor is cut for 0.14 sec. or more while cruise control is in operation	- Vehicle speed sensor - Vehicle speed sensor signal circuit - Combination meter - ECM - Skid control ECU

MONITOR DESCRIPTION

The ECM assumes that the vehicle is being driven when the transmission counter gear indicates more than 300 rpm and over 30 seconds have passed since the park/neutral position switch was turned OFF. If there is no signal from the vehicle speed sensor with these conditions satisfied, the ECM concludes that the vehicle speed sensor is malfunctioning. The ECM will turn on the MIL and a DTC will be set.

MONITOR STRATEGY

Related DTCs	P0500: Vehicle Speed Sensor Circuit
Required sensors/components (Main)	Vehicle speed sensor, Combination meter, ABS ECU
Required sensors/components (Sub)	Counter gear Speed (CS) sensor, ECT sensor
Frequency of operation	Continuous
Duration	8 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	P0100 - P0103 (MAF sensor) P0105 - P0108 (MAP sensor) P0115 - P0118 (ECT sensor) P0120 - P02238 (TP sensor) P0125 (VSS/ECT1 sensor, non-ECT)
Engine coolant temperature	70°C (158°F) or more

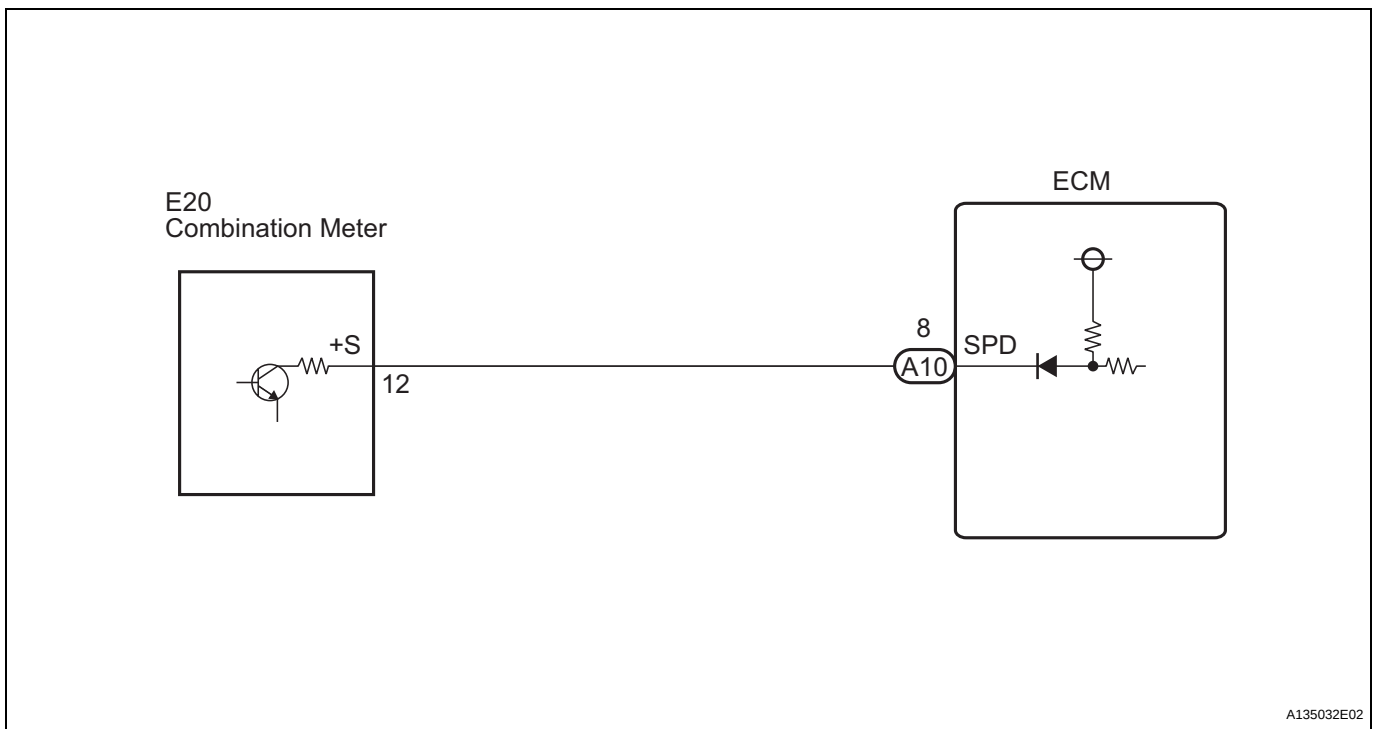
Engine speed	2,000 to 5,000 rpm
Engine load	30.37 % or more
Fuel cut high engine speed	Not executing
Battery voltage	8 V or more
Engine switch	ON
ETC sensor circuit fail	Not detected
MAF sensor circuit fail	Not detected
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Vehicle speed sensor signal	No pulse input
-----------------------------	----------------

ES

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

1

CHECK SPEEDOMETER

- (a) Drive the vehicle and check whether the operation of the speedometer in the combination meter is normal.

HINT:

- The vehicle speed sensor is operating normally if the speedometer reading is normal.

- If the speedometer does not operate, check it by following the procedure described in speedometer circuit.

NG

GO TO SPEEDOMETER CIRCUIT

OK

2

READ VALUE OF INTELLIGENT TESTER (VEHICLE SPEED)

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the engine switch on (IG).
- (c) Turn the tester on.
- (d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / VEHICLE SPD.
- (e) Drive the vehicle.
- (f) Read the value displayed on the tester.

OK:
Vehicle speeds displayed on tester and speedometer display are equal.

NG

CHECK INTERMITTENT PROBLEMS

OK

3

CHECK COMBINATION METER ASSEMBLY (+S VOLTAGE)

Wire Harness Side:

E20

+S

Combination Meter Connector

N

A132286E02

- (a) Disconnect the E20 combination meter connector.
- (b) Turn the engine switch on (IG).
- (c) Measure the voltage between the specified terminal of the combination meter and body ground.

Standard voltage

Tester Connection	Specified Condition
E20-12 (+S) - Body ground	4.5 to 5.5 V

- (d) Reconnect the combination meter connector.

NG

Go to step 5

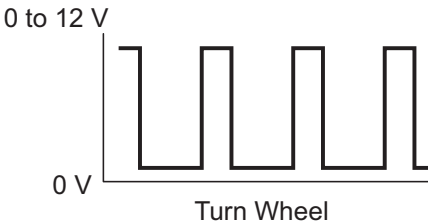
OK

ES

4 CHECK COMBINATION METER ASSEMBLY (SPD SIGNAL WAVEFORM)

Wire Harness Side:

Combination Meter Connector



N

A132287E02

- (a) Shift the transmission gear selector lever to the neutral position.
- (b) Jack up the vehicle.
- (c) Turn the engine switch on (IG).
- (d) Measure the voltage between the specified terminal of the combination meter and body ground while the wheel is turned slowly.

Standard voltage

Tester Connection	Specified Condition
E20-12 (+S) - Body ground	Voltage generated intermittently

HINT:

The output voltage should fluctuate up and down, similarly to the diagram, when the wheel is turned slowly.

NG

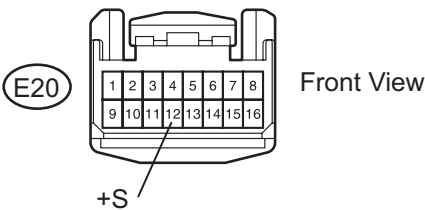
REPLACE COMBINATION METER ASSEMBLY (See page ME-67)

OK

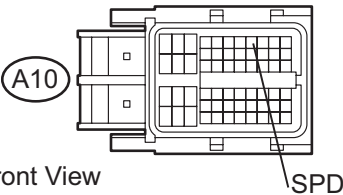
5 CHECK HARNESS AND CONNECTOR (COMBINATION METER ASSEMBLY - ECM)

Wire Harness Side:

Combination Meter Connector



ECM Connector



N

A132288E04

- (a) Disconnect the E20 combination meter connector.
- (b) Disconnect the A10 ECM connector.
- (c) Measure the resistance.

Standard resistance (Check for open)

Tester Connection	Specified Condition
+S (E20-12) - SPD (A10-8)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
+S (E20-12) or SPD (A10-8) - Body ground	10 kΩ or higher

- (d) Reconnect the combination meter connector.
- (e) Reconnect the ECM connector.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

A button with a black border and a downward-pointing arrow shape at the bottom, containing the text "OK".

REPLACE ECM (See page [ES-543](#))

DTC	P0450	Evaporative Emission Control System Pressure Sensor / Switch
DTC	P0451	Evaporative Emission Control System Pressure Sensor Range / Performance
DTC	P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input
DTC	P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input

ES**DTC SUMMARY**

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection logic
P0450	Pressure sensor voltage abnormal fluctuation	Sensor output voltage rapidly fluctuates beyond upper and lower malfunction thresholds for 0.5 seconds.	- Pump module - ECM	- EVAP monitoring (engine switch off) - Engine switch on	1 trip
P0451	Pressure sensor noising	Sensor output voltage fluctuates frequently in a certain time period.	- Pump module - Connector/wire harness (Pump module - ECM) - ECM	- EVAP monitoring (engine switch off) - Engine running	2 trip
P0451	Pressure sensor stuck	Sensor output voltage does not vary in a certain time period.	- Pump module - Connector/wire harness (Pump module - ECM) - ECM	EVAP monitoring (engine switch off)	2 trip
P0452	Pressure sensor voltage low	Sensor output voltage is less than 0.45 V for 0.5 seconds.	- Pump module - Connector/wire harness (Pump module - ECM) - ECM	- EVAP monitoring (engine switch off) - Engine switch on	1 trip
P0453	Pressure sensor voltage high	Sensor output voltage is more than 4.9 V for 0.5 seconds.	- Pump module - Connector/wire harness (Pump module - ECM) - ECM	- EVAP monitoring (engine switch off) - Engine switch on	1 trip

HINT:

The pressure sensor is built into the pump module.

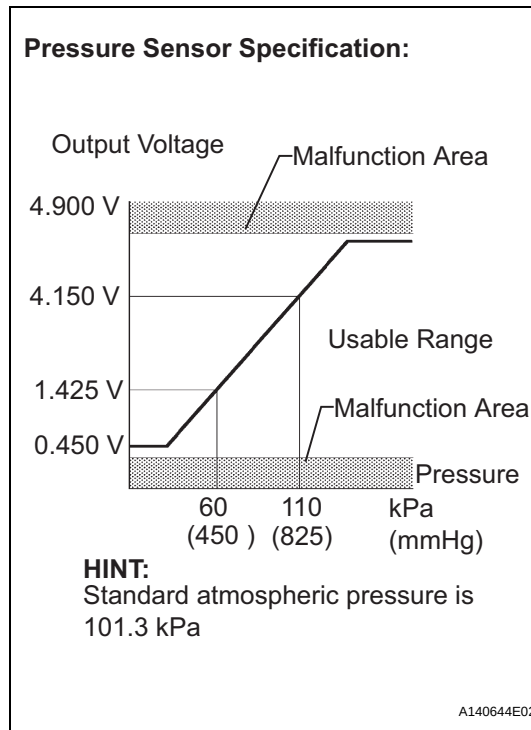
DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) system (See page [ES-395](#)).

MONITOR DESCRIPTION

1. DTC P0450: Pressure sensor voltage abnormal fluctuation

If the pressure sensor output voltage rapidly fluctuates between less than 0.45 V and more than 4.9 V, the ECM interprets this as an open or short circuit in the pressure sensor or its circuit, and stops the EVAP (Evaporative Emission) system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).



2. DTC P0451: Pressure sensor noising or stuck

If the pressure sensor output voltage fluctuates rapidly for 10 seconds, the ECM stops the EVAP system monitor. The ECM interprets this as noise from the pressure sensor, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC.

Alternatively, if the sensor output voltage does not change for 10 seconds, the ECM interprets this as the sensor being stuck, and stops the monitor. The ECM then illuminates the MIL and sets the DTC. (Both the malfunctions are detected by 2 trip detection logic).

3. DTC P0452: Pressure sensor voltage low

If the pressure sensor output voltage is below 0.45 V, the ECM interprets this as an open or short circuit in the pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

4. DTC P0453: Pressure sensor voltage high

If the pressure sensor voltage output is 4.9 V or more, the ECM interprets this as an open or short circuit in the pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

MONITOR STRATEGY

Related DTCs	P0450: Pressure sensor chattering P0451: Pressure sensor noise P0451: Pressure sensor stuck P0452: Pressure sensor low voltage P0453: Pressure sensor high voltage
Required Sensors/Components	Pump module
Frequency of Operation	Once per driving cycle: P0451 sensor stuck Continuous: P0451 sensor noising, P0450, P0452 and P0453
Duration	0.5 seconds: P0450, P0452, P0453 Within 15 seconds: P0451

MIL Operation	Immediate: P0450, P0452, P0453 2 driving cycles: P0451
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0450, P0452 and P0453 (Pressure sensor chattering, low voltage, high voltage):

Monitor runs whenever following DTCs are not present:	None
Battery voltage	8 V or more
Starter	OFF
Engine switch	ON

P0451 (Pressure sensor noise):

Atmospheric pressure	70 kPa (525 mmHg) to 110 kPa (825 mmHg)
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35°C (40 to 95°F)
EVAP pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Either of following conditions is met:	1 or 2
1. Engine	Running
2. Time after key off	5, 7 or 9.5 hours

P0451 (Pressure sensor stuck):

Atmospheric pressure	Less than 70 kPa (525 mmHg), or 110 kPa (825 mmHg) or more
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35°C (40 to 95°F)
EVAP pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Time after key off	5, 7 or 9.5 hours

TYPICAL MALFUNCTION THRESHOLDS

P0450: Pressure sensor chattering

EVAP pressure	Less than 42.11 kPa (315.82 mmHg), or more than 123.761 kPa (928.207 mmHg)
---------------	--

P0451: Pressure sensor noise

Frequency that EVAP pressure change is 0.3 kPa or more	10 times or more in 10 seconds
--	--------------------------------

P0451: Pressure sensor stuck

EVAP pressure change during reference pressure	Less than 0.65 kPa (4.87 mmHg)
--	--------------------------------

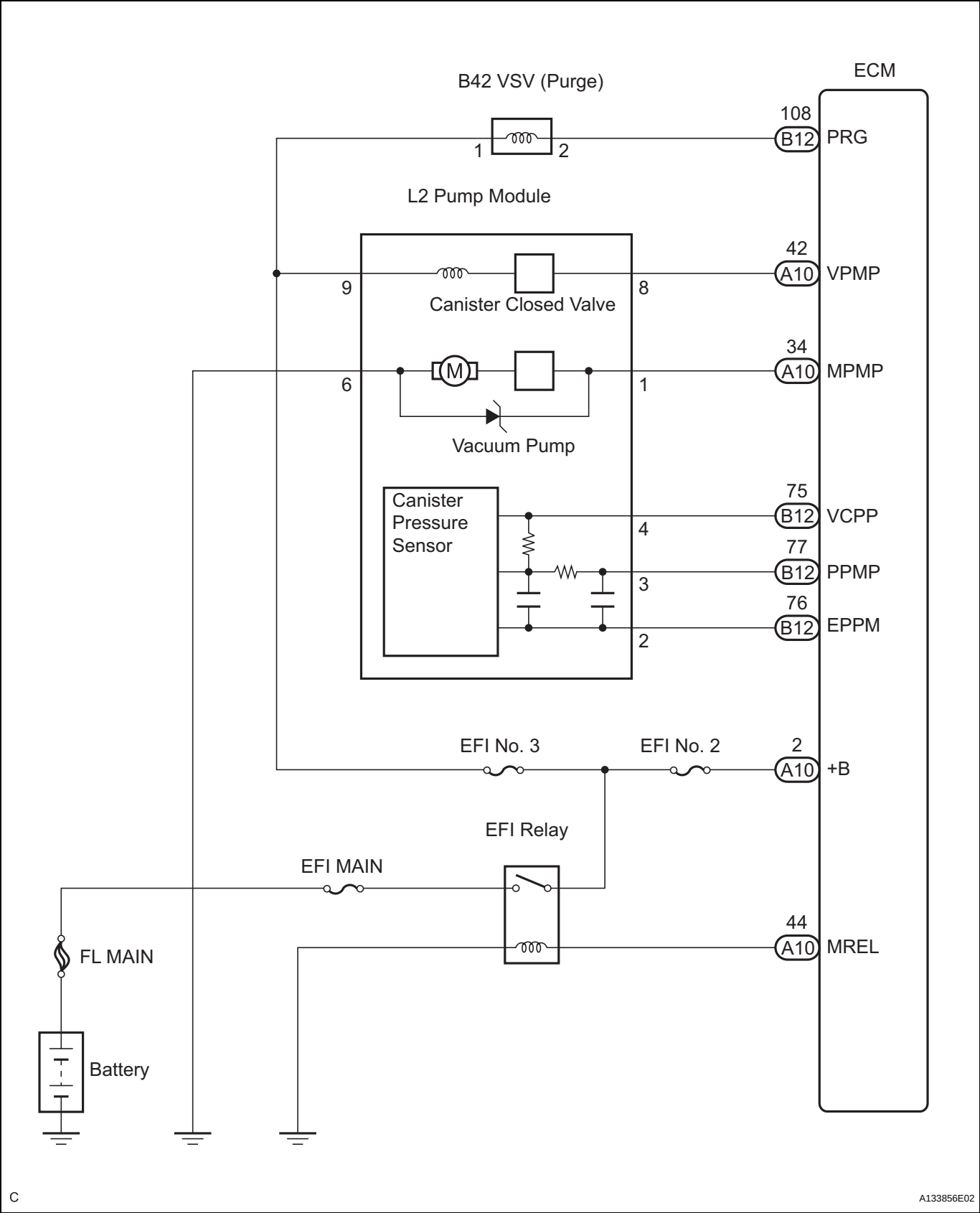
P0452: Pressure sensor low voltage

EVAP pressure	Less than 42.11 kPa (315.82 mmHg)
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P0453: Pressure sensor high voltage

EVAP pressure	More than 123.761 kPa (928.207 mmHg)
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WIRING DIAGRAM



INSPECTION PROCEDURE

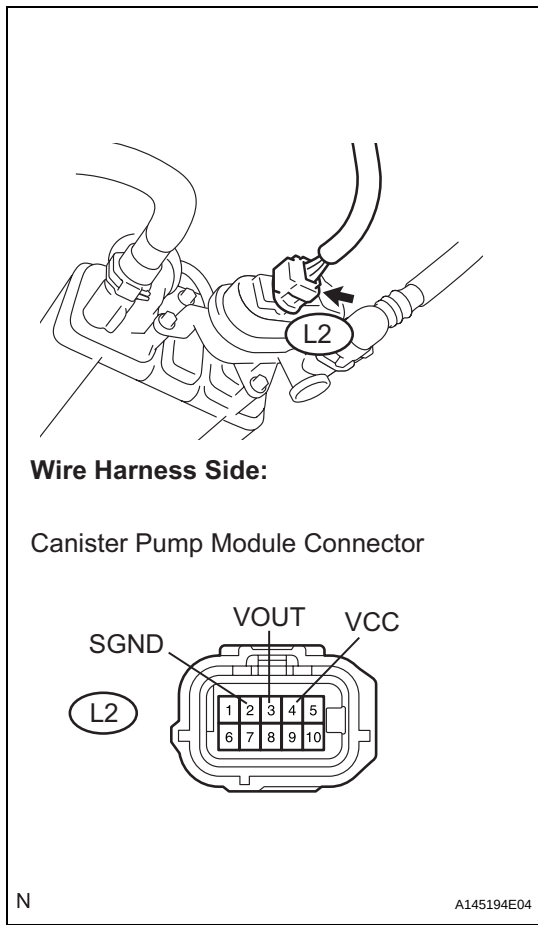
NOTICE:

- When a vehicle is brought into a workshop, leave it as it is. Do not change the vehicle condition. For example, do not tighten the fuel tank cap.
- Do not disassemble the pump module.
- The intelligent tester is required to conduct the following diagnostic troubleshooting procedure.

1

CHECK HARNESS AND CONNECTOR (PUMP MODULE - ECM)

ES



Wire Harness Side:

Canister Pump Module Connector

- (a) Disconnect the L2 canister connector.
(b) Turn the engine switch on (IG).
(c) Measure the voltage and resistance according to the value(s) in the table below.

Standard

Tester Connection	Specified Condition
L2-4 - Body ground	4.5 to 5.0 V
L2-3 - Body ground	4.5 to 5.0 V
L2-2 - Body ground	100 Ω or less

Result

Test Result	Suspected Trouble Area	Proceed to
Voltage and resistance within standard ranges	Open in pressure sensor circuit	A
Voltage and resistance outside standard ranges	Open in wire harness/connector (ECM - pressure sensor)	B

- (d) Reconnect the canister connector.

B

Go to step 3

A

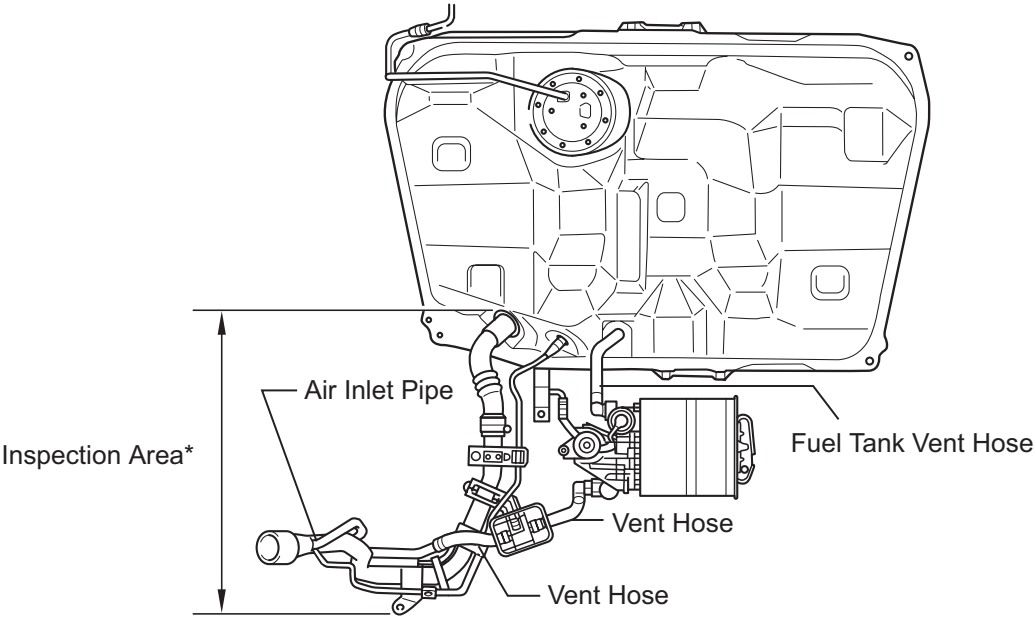
2

REPLACE CHARCOAL CANISTER ASSEMBLY

- (a) Replace the canister assembly (See page EC-9).

NOTICE:

When replacing the canister, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet pipe to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.



*: Check for disconnection and/or crack

N

A132283E05

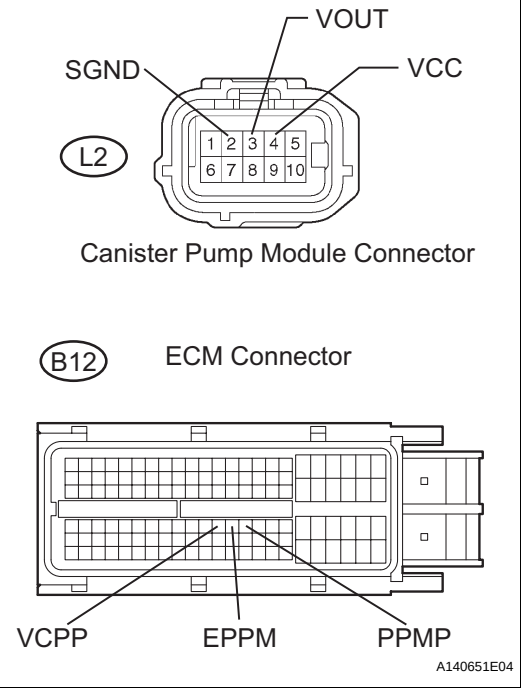
NEXT

Go to step 5

3

CHECK HARNESS AND CONNECTOR

Wire Harness Side:



- (a) Disconnect the L2 canister pump module connector.
- (b) Disconnect the B12 ECM connector.
- (c) Measure the resistance according to the value(s) in the table below.

Standard resistance (Check for open)

Tester Connection	Specified Condition
L2-4 (VCC) - B12-75 (VCPP)	Below 1 Ω
L2-3 (VOUT) - B12-77 (PPMP)	Below 1 Ω
L2-2 (SGND) - B12-76 (EPPM)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
L2-4 (VCC) or B12-75 (VCPP) - Body ground	10 kΩ or higher
L2-3 (VOUT) or B12-77 (PPMP) - Body ground	10 kΩ or higher
L2-2 (SGND) or B12-76 (EPPM) - Body ground	10 kΩ or higher

- (d) Reconnect the canister pump module connector.
- (e) Reconnect the ECM connector.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4

REPLACE ECM

- (a) Replace the ECM (See page [ES-543](#)).

NEXT

5

CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

- (a) Connect the intelligent tester to the DLC3.
(b) Turn the engine switch on (IG) (do not start the engine).
(c) Turn the tester on.
(d) Wait for at least 60 seconds.
(e) Enter the following menus: DIAGNOSIS / ENHANCED
OBD II / DTC INFO / PENDING CODES.

HINT:

If no pending DTCs are displayed on the tester, the repair has been successfully completed.

NEXT

COMPLETED

ES

DTC	P043E	Evaporative Emission System Reference Orifice Clog Up
DTC	P043F	Evaporative Emission System Reference Orifice High Flow
DTC	P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low
DTC	P2402	Evaporative Emission System Leak Detection Pump Control Circuit High
DTC	P2419	Evaporative Emission System Switching Valve Control Circuit Low

DTC SUMMARY

DTCs	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timings	Detection Logic
P043E	0.02 inch orifice clogged	P043E, P043F, P2401, P2402, P2419 are present when one of the following conditions is met during key-off EVAP monitor	- Pump module - Connector/wire harness (Pump module - ECM) - ECM	While engine switch OFF	2 trip
P043F	0.02 inch orifice high-flow				
P2401	Vacuum pump stuck OFF				
P2402	Vacuum pump stuck ON				
P2419	Vent valve stuck open (vent)	- Reference orifice clogged - Reference orifice high-flow - Leak detection pump OFF malfunction - Leak detection pump ON malfunction - Vent valve ON (close) malfunction			

HINT:

The 0.02 inch orifice is located inside the pump module.

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System (See page [ES-395](#)).

INSPECTION PROCEDURE

Refer to the EVAP System (See page [ES-395](#)).

MONITOR DESCRIPTION

5 hours^{*1} after the engine switch is turned off, the electric vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

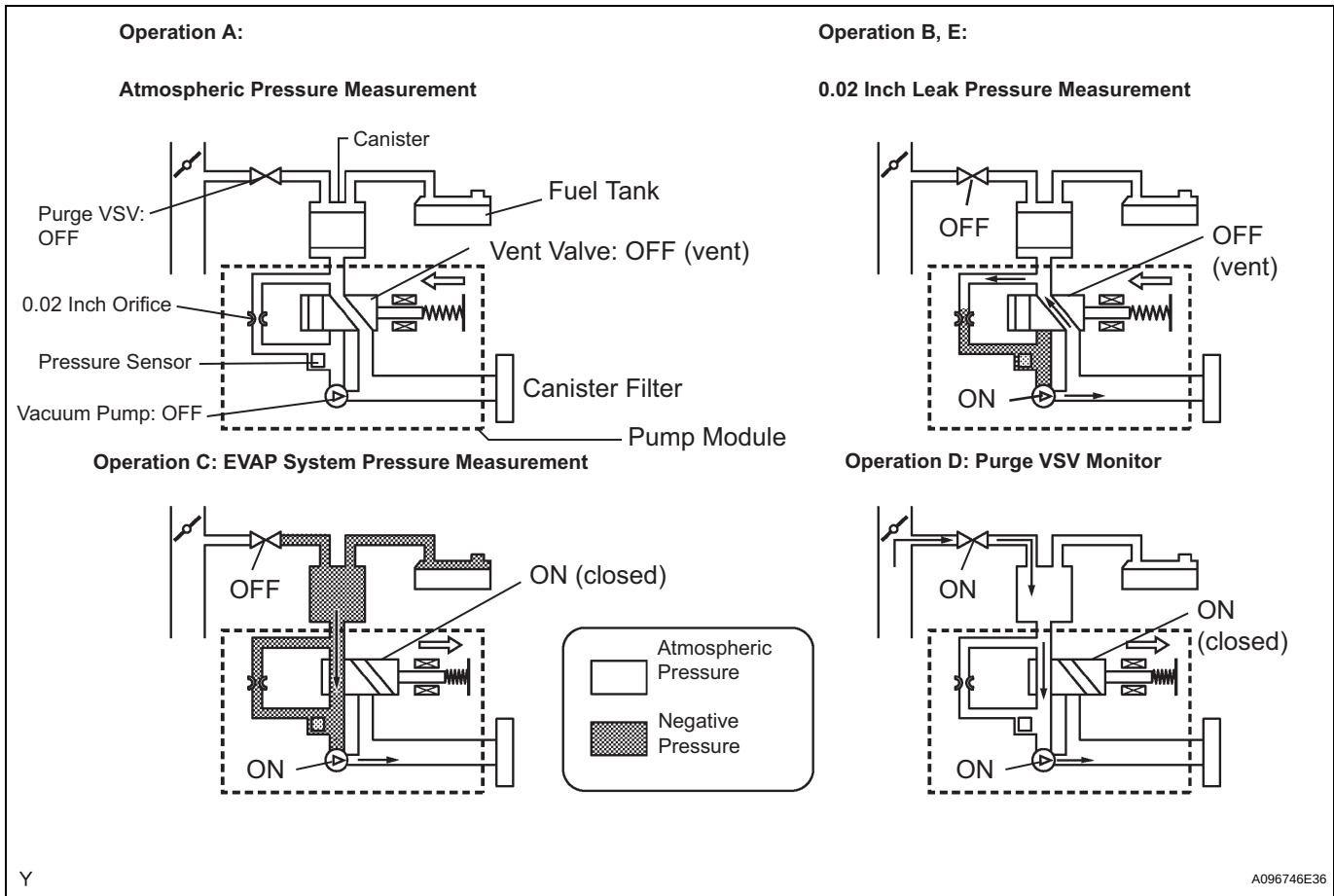
HINT:

^{*1}: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the engine switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the engine switch is turned off, the monitor check starts 2.5 hours later.

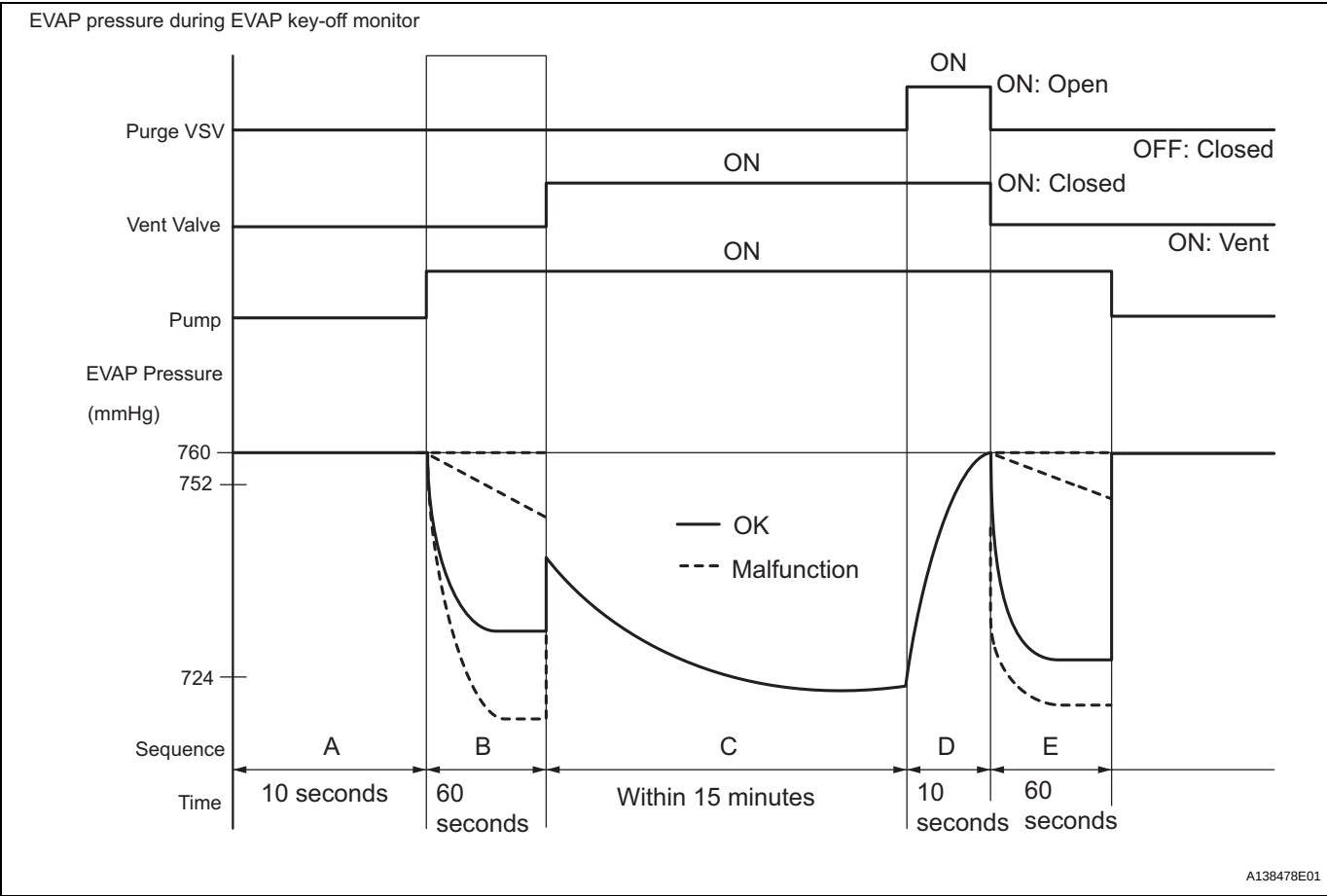
Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer, 5 hours (7 or 9.5 hours) after engine switch is turned off.	-

Sequence	Operations	Descriptions	Duration
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes* ²
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system is leaking.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*²: If there is only a small amount of fuel in the fuel tank, stabilizing the EVAP pressure takes longer than usual.



ES



The leak detection pump creates negative pressure through the reference orifice. When the system is normal, the EVAP pressure is within 724 to 752 mmHg* and saturated within a minute. If not, the ECM interprets this as a malfunction. The ECM will illuminate the MIL and set DTC if this malfunction is detected in a consecutive drive cycle.

*: Typical valve

MONITOR STRATEGY

Related DTCs	P043E: 0.02 inch orifice clog (built-in pump module) P043F: 0.02 inch orifice high-flow (built-in pump module) P2401: Vacuum pump stuck OFF P2402: Vacuum pump stuck ON P2419: Vent valve stuck open (vent)
Required Sensors/Components	Pump module
Frequency of Operation	Once per driving cycle
Duration	Within 2 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
EVAP key-off monitor is run when all of the following conditions are met	-
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)

Engine switch	OFF
Time after key-off	5 or 7 or 9.5 hours
EVAP pressure sensor malfunction (P0450, P0451, P0452, P0453)	Not detected
EVAP canister purge valve	Not operated by scan tool
EVAP canister vent valve	Not operated by scan tool
EVAP leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key-off	Conditions 1 and 2
1. Duration that vehicle is driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met:	-
Atmospheric pressure measurement	Less than 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if all of the following conditions are met:	Conditions 1, 2 and 3
1. EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.057 kPa (-36.384 to -7.929 mmHg)
3. Reference pressure	Saturated within 1 minute

3. EVAP canister vent valve close stuck check

Next sequence is run if the following condition is met:	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met:	-
Vacuum introduction time	Saturated within 15 minutes

5. EVAP canister purge valve close stuck check

Next sequence is run if the following condition is met:	-
EVAP pressure change after purge valve is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if all of the following conditions are met:	Conditions 1, 2, 3 and 4
1. EVAP pressure just after reference pressure	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.057 kPa (-36.384 to -7.929 mmHg)
3. Reference pressure	Saturated
4. Difference between first reference pressure and second reference pressure	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met:	-
EVAP pressure when vacuum introduction was complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met:	-
---	---

Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)
--	----------------------------

TYPICAL MALFUNCTION THRESHOLDS

One of following conditions is met	-
EVAP pressure just after reference pressure measurement start	More than -1 kPa (-7.5 mmHg)
Reference pressure	Less than -4.85 kPa (-36.384 mmHg)
Reference pressure	-1.057 kPa (-7.929 mmHg) or more
Reference pressure	Not saturated
Difference between first reference pressure and second reference pressure	0.7 kPa (5.25 mmHg) or more

ES

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (See page [ES-20](#)).

DTC	P0441	Evaporative Emission Control System Incorrect Purge Flow
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DTC SUMMARY

DTC No.	Monitoring Item	DTC Detection Condition	Trouble Area	Detection Timing	Detection Logic
P0441	EVAP VSV (Vacuum Switching Valve) stuck open	Vacuum pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. 0.02 inch leak pressure standard is measured at start and at end of leak check. If stabilized pressure is higher than [second 0.02 inch leak pressure standard x 0.2], ECM determines that EVAP VSV is stuck open	• EVAP VSV • Connector/wire harness (EVAP VSV - ECM) • ECM • Pump module • Leakage from EVAP system	While engine switch off	2 trip
P0441	EVAP VSV stuck closed	After EVAP leak check is performed, EVAP VSV is turned ON (open), and atmospheric air is introduced into EVAP system. 0.02 inch leak pressure standard is measured at start and at end of the check. If pressure does not return to near atmospheric pressure, ECM determines that purge valve is stuck closed	• EVAP VSV • Connector/wire harness (EVAP VSV - ECM) • ECM • Pump module • Leakage from EVAP system	While engine switch off	2 trip
P0441	Purge flow	While engine is running, following conditions are successively met: • Negative pressure is not created in EVAP system when EVAP VSV is turned ON (open) • EVAP system pressure change is less than 0.5 kPa (3.75 mmHg) when vent valve is turned ON (closed) • Atmospheric pressure change before and after purge flow monitor is less than 0.1 kPa (0.75 mmHg)	• EVAP VSV • Connector/wire harness (EVAP VSV - ECM) • Leakage from EVAP line (EVAP VSV - Intake manifold) • ECM	While engine running	2 trip

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) system (See page [ES-395](#)).

INSPECTION PROCEDURE

Refer to the EVAP system (See page [ES-395](#)).

MONITOR DESCRIPTION

The two monitors, Key-off and Purge Flow, are used to detect malfunctions relating to DTC P0441. The key-off monitor is initiated by the ECM internal timer, known as the soak timer, 5 hours* after the engine switch is turned off. The purge flow monitor runs while the engine is running.

1. KEY-OFF MONITOR

5 hours* after the engine switch is turned off, the electric vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

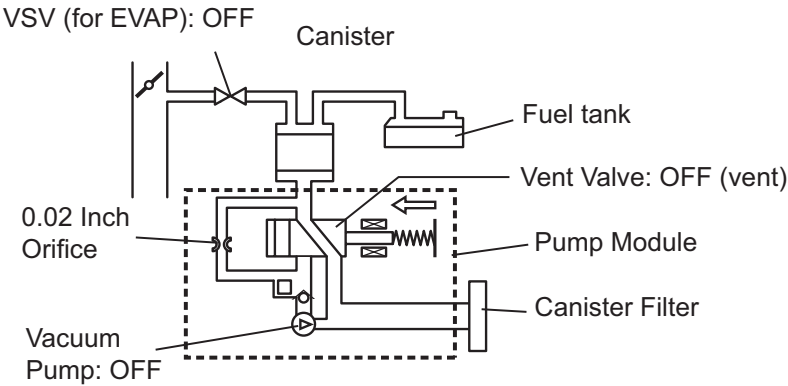
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the engine switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the engine switch is turned off, the monitor check starts 2.5 hours later.

Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5 hours (7 or 9.5 hours) after engine switch turned is off.	-
A	Atmospheric pressure measurement	Vent valve is turned OFF (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve is turned ON (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as they will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 seconds*
D	EVAP VSV monitor	EVAP VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that there is a leak in EVAP system.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

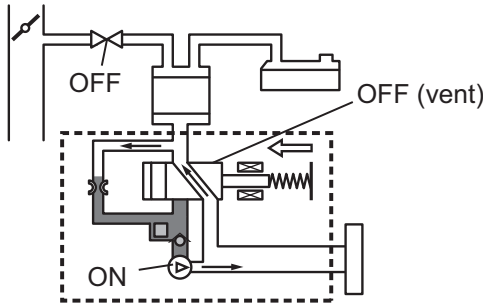
HINT:

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

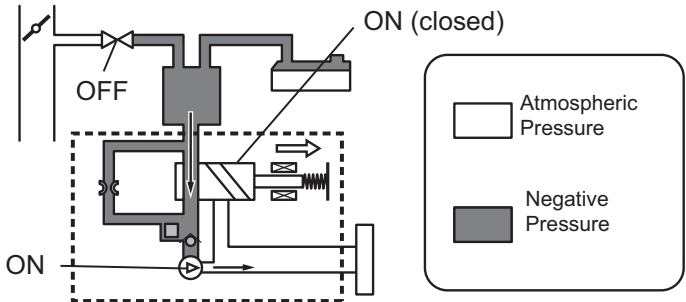
Operation A: Atmospheric Pressure Measurement



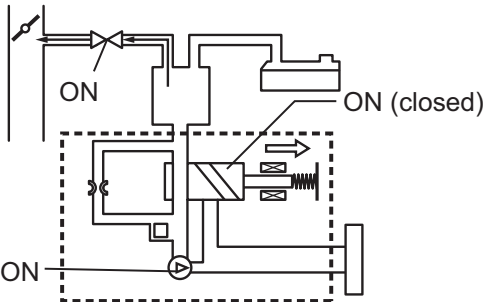
Operation B, E:
0.02 Inch Leak Pressure Measurement



Operation C: EVAP System Pressure Measurement



Operation D: VSV (for EVAP) Monitor



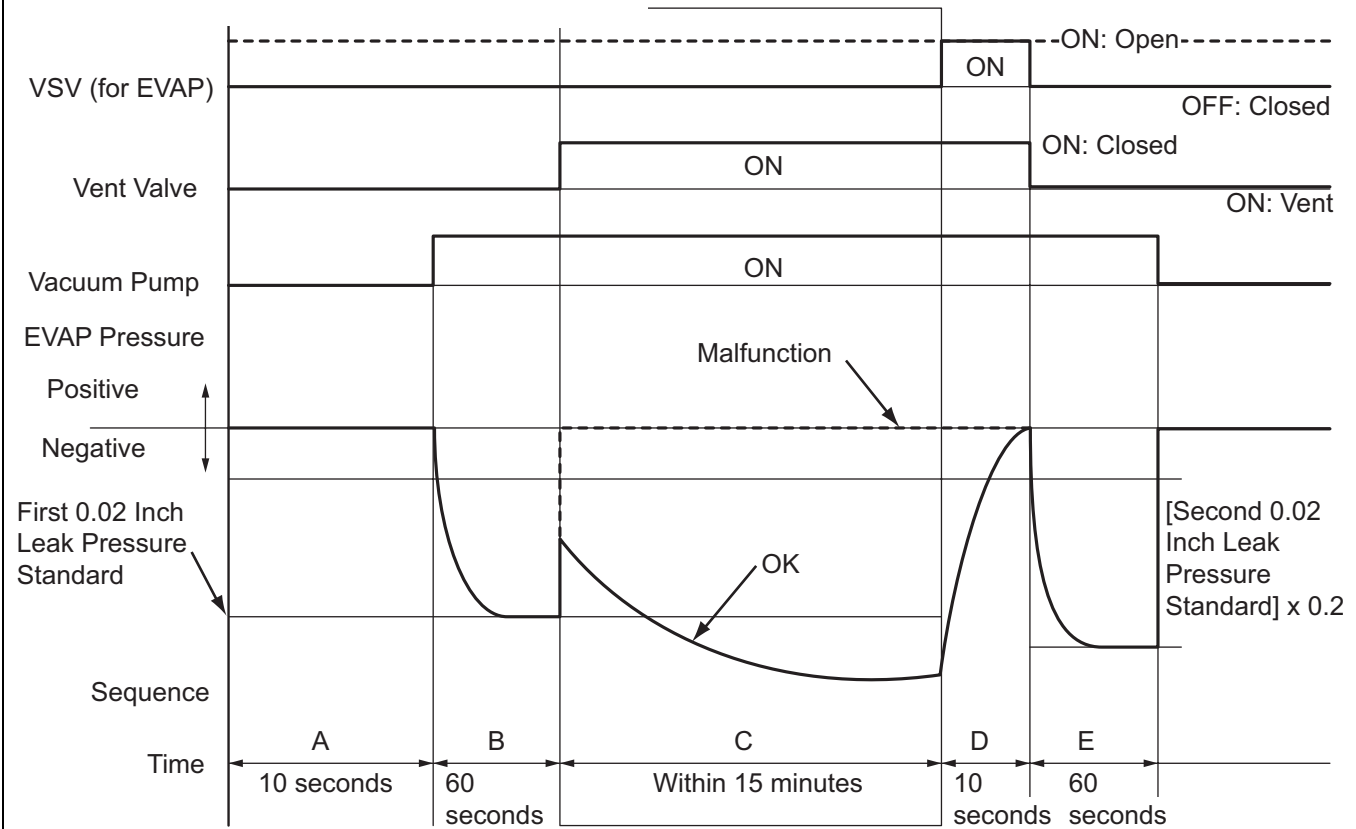
ES

Y

A106055E16

(a) EVAP VSV stuck open

In operation C, the vacuum pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The EVAP system pressure is then measured by the ECM using the pressure sensor. If the stabilized system pressure is higher than [second 0.02 inch leak pressure standard x 0.2], the ECM interprets this as the EVAP VSV (Vacuum Switching Valve) being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

EVAP Pressure when VSV (for EVAP) Stuck Open:

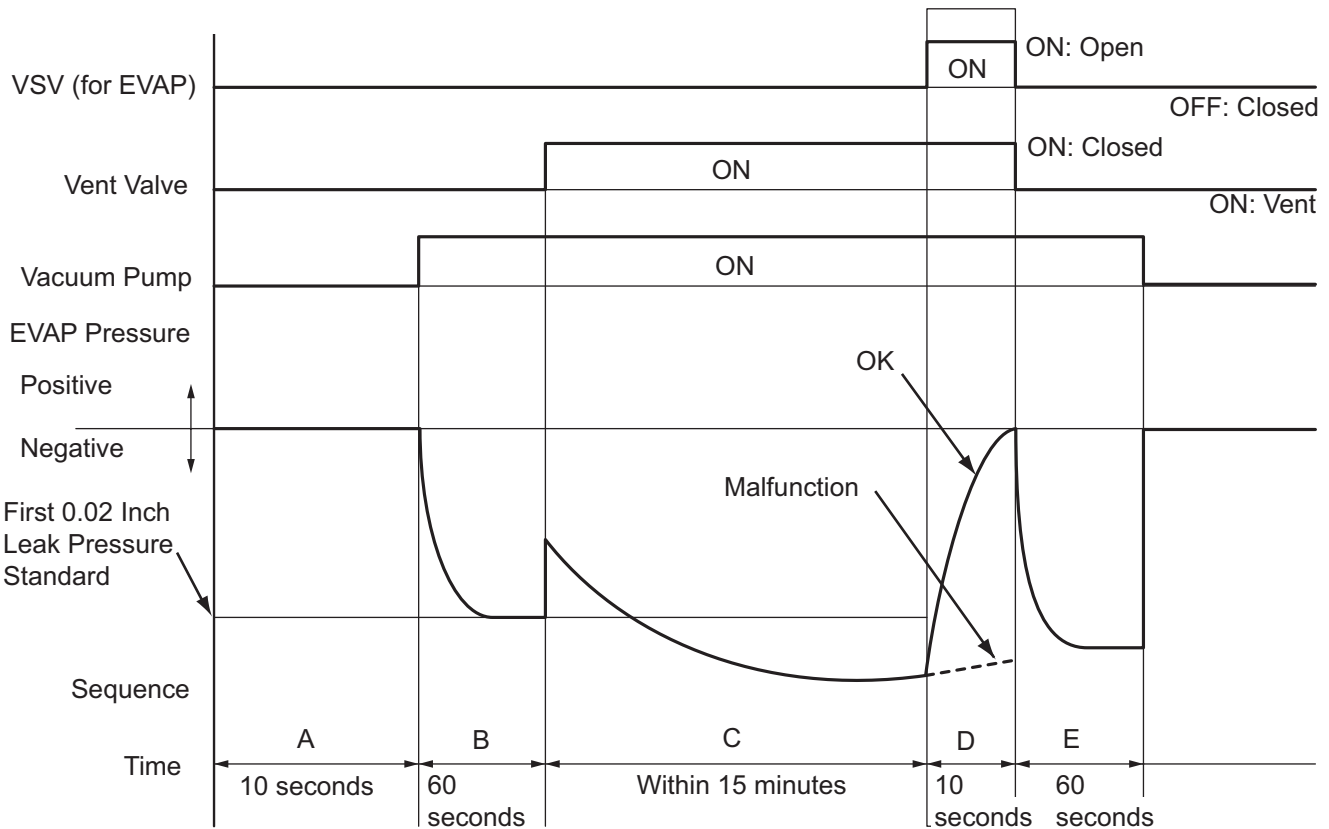
Y

A108008E11

(b) EVAP VSV stuck closed

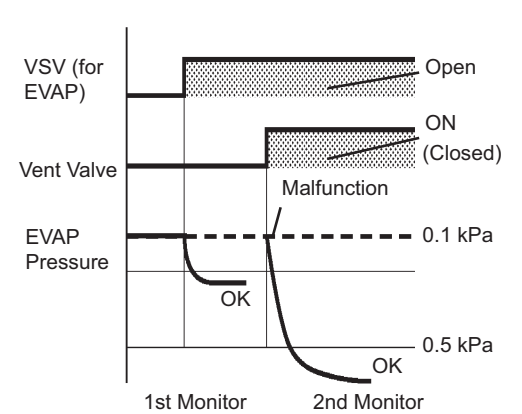
In operation D, the pressure sensor measures the EVAP (Evaporative Emission) system pressure. The pressure measurement for EVAP VSV monitor is begun when the EVAP VSV is turned ON (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa (2.25 mmHg) or more, the EVAP VSV is functioning normally. If the pressure does not increase, the ECM interprets this as the EVAP VSV being stuck closed. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

ES

EVAP Pressure when VSV (for EVAP) Stuck Closed:

Y

A106059E09

EVAP Pressure During Purge Flow Monitor:

A071563E14

2. PURGE FLOW MONITOR

The purge flow monitor consists of the two step monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

- The 1st monitor
While the engine is running and the EVAP VSV (Vacuum Switching Valve) is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
- The 2nd monitor
The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.5 kPa (3.75 mmHg), the ECM interprets this as the EVAP VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressure, before and after conduction of the purge flow monitor, is measured by the ECM.

OBD II MONITOR SPECIFICATIONS

1. Key-off Monitor

Monitor Strategy:

Required Sensors/Components	EVAP VSV and pump module
Frequency of Operation	Once per driving cycle
Duration	Within 15 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

Typical Enabling Conditions:

EVAP key-off monitor runs when all of following conditions are met:	-
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Engine switch	OFF
Time after key off	5, 7 or 9.5 hours
EVAP pressure sensor malfunction (P0450, P0451, P0452 and/or P0453)	Not detected
EVAP VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of following conditions are met before key off:	Conditions 1 and 2
1. Duration that vehicle is being driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

(a) Key-off monitor sequence 1 to 8

1. Atmospheric pressure

Next sequence is run if following condition is met:	-
Atmospheric pressure change	Less than 0.3 kPa (2.25 mmHg) for 1 second

2. First reference pressure

Next sequence is run if all of following conditions are met:	Conditions 1, 2 and 3
1. EVAP pressure 4 seconds after reference pressure measurement	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.05 kPa (-36.38 to -7.87 mmHg)
3. Reference pressure	Saturated within 1 minute

3. Vent valve stuck closed check

Next sequence is run if following condition is met:	-
EVAP pressure change after vent valve is turned ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction and leak

Next sequence is run if both of following condition is met:	-
Vacuum introduction time	15 minutes or less

5. EVAP VSV stuck closed check

Next sequence is run if following condition is met:	-
EVAP pressure change after purge VSV is turned ON	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if all of following conditions are met:	Conditions 1, 2, 3 and 4
1. EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or less
2. Reference pressure	-4.85 to -1.05 kPa (-36.38 to -7.87 mmHg)
3. Reference pressure	Saturated within 1 minute
4. Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if following condition is met:	-
EVAP pressure when vacuum introduction was complete	Less than second reference pressure

8. Atmospheric pressure

Monitor is complete	-
Atmospheric pressure difference between sequence 1 and 8	0.3 kPa (2.25 mmHg) or less

ES**Typical Malfunction Thresholds:**

One of the following conditions is met:	-
(a) EVAP VSV stuck open	-
EVAP pressure when vacuum introduction is complete	Higher than reference pressure x 0.2
(b) EVAP VSV stuck closed	-
EVAP pressure change after EVAP canister purge valve is opened	Less than 0.3 kPa (2.25 mmHg)

2. Purge Flow Monitor**Monitor Strategy:**

Required Sensors/Components	EVAP VSV and pump module
Frequency of Operation	Once per driving cycle
Duration	Within 10 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

Typical Enabling Conditions:

Monitor runs whenever these DTCs are not present	-
Engine	Running
ECT	4.4°C (40°F) or more
IAT	4.4°C (40°F) or more
EVAP pressure sensor malfunction	Not detected
EVAP VSV	Not operated by scan tool
EVAP system check	Not detected by scan tool
Battery voltage	10 V or more
Purge duty cycle	8 % or more

Typical Malfunction Thresholds:

Both of following conditions are met:	Condition 1 or 2
1. EVAP pressure change when purge operation is started	Less than 0.1 kPa (0.75 mmHg)
2. EVAP pressure change during purge operation when vent valve is closed	Less than 0.5 kPa (3.75 mmHg)

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (See page [ES-20](#)).

DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)
DTC	P0430	Catalyst System Efficiency Below Threshold (Bank 2)

MONITOR DESCRIPTION

The ECM uses the sensors mounted in front of and behind the Three-Way Catalytic Converter (TWC) to monitor its efficiency.

The first sensor, the Air-Fuel Ratio (A/F) sensor, sends pre-catalyst information to the ECM. The second sensor, the Heated Oxygen (HO2) sensor, sends post-catalyst information to the ECM.

In order to detect any deterioration in the TWC, the ECM calculates the Oxygen Storage Capacity (OSC) of the TWC. This calculation is based on the voltage output of the HO2 sensor while performing active air-fuel ratio control, rather than the conventional detecting method, which uses the locus ratio.

The OSC value is an indication of the oxygen storage capacity of the TWC. When the vehicle is being driven with a warm engine, active air-fuel ratio control is performed for approximately 15 to 20 seconds. When it is performed, the ECM deliberately sets the air-fuel ratio to lean or rich levels. If a rich-lean cycle of the HO2 sensor is long, the OSC becomes greater. There is a direct correlation between the OSCs of the HO2 sensor and the TWC.

The ECM uses the OSC value to determine the state of the TWC. If any deterioration has occurred, it illuminates the MIL and sets a DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0420	OSC value is smaller than standard value under active air-fuel ratio control (2 trip detection logic)	- Gas leakage from exhaust system - A/F sensor (bank 1 sensor 1) - HO2 sensor (bank 1 sensor 2) - Exhaust manifold (TWC)
P0430	OSC value is smaller than standard value under active air-fuel ratio control (2 trip detection logic)	- Gas leakage from exhaust system - A/F sensor (bank 2 sensor 1) - HO2 sensor (bank 2 sensor 2) - Exhaust manifold (TWC)

HINT:

- Bank 1 refers to the bank that includes cylinder No. 1.
- Bank 2 refers to the bank that does not include cylinder No. 1.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR STRATEGY

Related DTCs	P0420: Catalyst Deterioration P0420: Catalyst Deterioration
Required Sensors/Components (Main)	TWC
Required Sensors/Components (Sub)	A/F sensor, heated oxygen sensor, intake air temperature sensor, mass air flow meter, crankshaft position sensor and engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	Approximately 30 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0011, 14 (VVT System 1 - Advance) P0012, 15 (VVT System 1 - Retard) P0031, 32, 51, 52 (A/F Sensor heater - Sensor 1) P0037, 38, 58, 59 (O2 Sensor heater - Sensor 2) P0100 - P0103 (MAF meter) P0115 - P0118 (ECT sensor) P0120 - P0223, P2135 (TP sensor) P0125 (Insufficient ECT for Closed Loop) P0136, P0156 (O2 Sensor - Sensor 2) P0171, P0172, P0174, P0175 (Fuel system) P0300 - P0304 (Misfire) P0335 (CKP sensor) P0340 (CMP sensor) P0351 - P0354 (Igniter) P0500 (VSS) P2196, P2198 (A/F Sensor - rationality) P2A00, P2A03 (A/F Sensor - slow response)
Battery voltage	11 V or more
IAT	-10°C (14°F) or more
ECT	70 kPa (525 mmHg) or more
Atmospheric pressure	-
Idle	OFF
Engine RPM	Less than 3,200 rpm
A/F sensor	Activated
Fuel system status	Closed loop
Engine load	10 to 70 %
All of the following conditions 1, 2 and 3 are met:	-
1. MAF	5 to 25 g/sec.
2. Front catalyst temperature (estimated)	600 to 750°C (1,112 to 1,382°F)
3. Rear catalyst temperature (estimated)	100 to 900°C (212 to 1,652°F)
EVAP system monitor	The monitor has not run yet or the vacuum introduction has been completed.
A/F sensor monitor	Completed
Rear HO2S monitor	Completed
Shift position	4th or higher

ES

TYPICAL MALFUNCTION THRESHOLDS

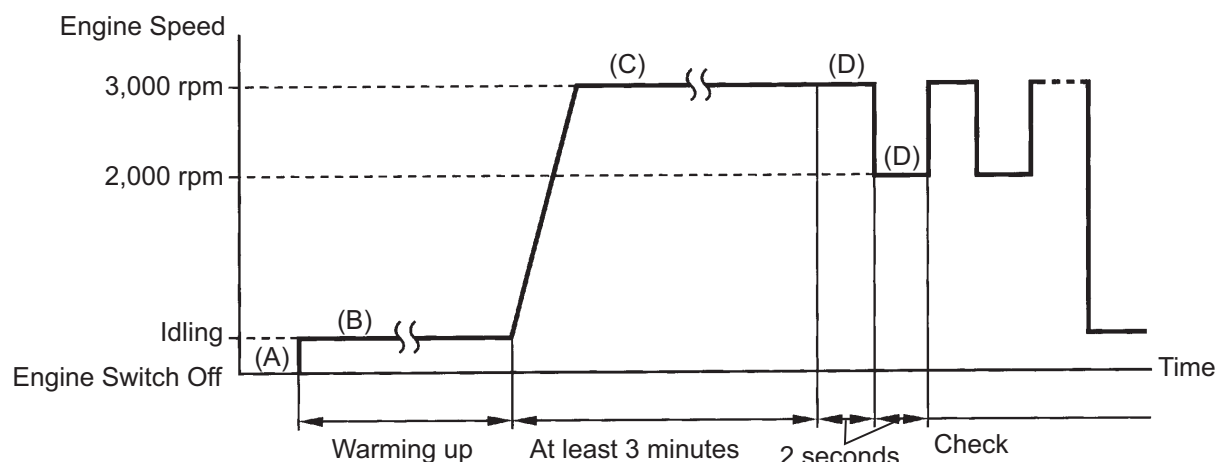
OSC (Oxygen Storage Capacity) of Catalyst	Less than 0.046 g
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MONITOR RESULT

Refer to CHECKING MONITOR STATUS (See page [ES-20](#)).

CONDITIONING FOR SENSOR TESTING

Perform the operation with the engine speeds and time durations described below prior to checking the waveforms of the A/F and HO2 sensors. This is performed in order to heat the sensors sufficiently to obtain the appropriate inspection results.



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1. Connect the intelligent tester to the DLC3 (Procedure "A").
2. Start the engine and warm it up with all the accessories switched off, until the engine coolant temperature stabilizes (Procedure "B").
3. Run the engine at an engine speed of between 2,500 rpm and 3,000 rpm for at least 3 minutes (Procedure "C").
4. While running the engine at 3,000 rpm for 2 seconds and 2,000 rpm for 2 seconds, check the waveforms of the A/F and HO2 sensors using the tester or scan tool (Procedure "D").

NOTICE:

The Air-Fuel Ratio (A/F) sensor has an output delay of a few seconds and the Heated Oxygen (HO2) sensor has a maximum output delay of approximately 20 seconds.

Case	A/F Sensor (Sensor 1) Output Voltage		HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		-
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		• A/F sensor • A/F sensor heater • A/F sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		• HO2 sensor • HO2 sensor heater • HO2 sensor circuit
	Output Voltage More than 3.35 V Less than 3.0 V		Output Voltage Almost no reaction		
4	Injection Volume +25 % -12.5 %		Injection Volume +25 % -12.5 %		• Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the output voltages of both the A/F and HO2 sensors.
- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL / USER DATA / AFS B1 S1 and O2S B1 S2 or AFS B2 S1 and O2S B2 S2, and press the YES button and then the ENTER button followed by the F4 button.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction (See page [ES-41](#)).

ES

1 CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420 AND/OR P0430)

- Connect the intelligent tester to the DLC3.
- Turn the engine switch on (IG) and turn the tester on.
- Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
- Read the DTCs.

Result

Display (DTC output)	Proceed to
P0420 and/or P0430	A
P0420 and/or P0430 and other DTCs	B

HINT:

If any DTCs other than P0420 or P0430 are output, troubleshoot those DTCs first.

B

GO TO DTC CHART (See page [ES-59](#))

A

2 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (A/F CONTROL)

- Connect the intelligent tester to the DLC3.
- Start the engine and turn the tester on.
- Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
- On the tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume.)
- Monitor the output voltages of the A/F and HO2 sensors (AFS B1 S1 and O2S B1 S2 or AFS B2 S1 and O2S B2 S2) displayed on the tester.

HINT:

- The A/F CONTROL operation lowers the fuel injection volume by 12.5 % or increases the injection volume by 25 %.

- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Tester Display (Sensor)	Injection Volume	Status	Voltage
AFS B1 S1 or AFS B2 S1 (A/F)	+25 %	Rich	Less than 3.0 V
AFS B1 S1 or AFS B2 S1 (A/F)	-12.5 %	Lean	More than 3.35 V
O2S B1 S2 or O2S B2 S2 (HO2)	+25 %	Rich	More than 0.55 V
O2S B1 S2 or O2S B2 S2 (HO2)	-12.5 %	Lean	Less than 0.4 V

Result

Status AFS B1 S1 or AFS B2 S1	Status O2S B1 S2 or O2S B2 S2	A/F Condition and A/F and HO2 Sensor Conditions	Misfire	Main Suspected Trouble Areas	Proceed to
Lean/Rich	Lean/Rich	Normal	-	- Three-Way Catalytic Converter (TWC) - Gas leakage from exhaust system	A
Lean	Lean/Rich	A/F sensor malfunction	-	A/F sensor	B
Rich	Lean/Rich	A/F sensor malfunction	May occur	A/F sensor	B
Lean/Rich	Lean	HO2 sensor malfunction	-	- HO2 sensor - Gas leakage from exhaust system	C
Lean/Rich	Rich	HO2 sensor malfunction	-	- HO2 sensor - Gas leakage from exhaust system	C
Lean	Lean	Actual air-fuel ratio lean	May occur	- Extremely rich or lean actual air-fuel ratio - Gas leakage from exhaust system	A
Rich	Rich	Actual air-fuel ratio lean	-	- Extremely rich or lean actual air-fuel ratio - Gas leakage from exhaust system	A

Lean:

During A/F CONTROL, the A/F sensor (AFS) output voltage is consistently more than 3.35 V, and the HO2 sensor output voltage (O2S) is consistently less than 0.4 V.

Rich:

During A/F CONTROL, the AFS is consistently less than 3.0 V, and the O2S is consistently more than 0.55 V.

Lean/Rich:

During A/F CONTROL of the ACTIVE TEST, the output voltage of the HO2 sensor alternates correctly.

B

CHECK AND REPLACE AIR FUEL RATIO SENSOR

C

CHECK AND REPLACE HEATED OXYGEN SENSOR, AND CHECK AND REPAIR EXHAUST GAS LEAKAGE

A

3 CHECK FOR EXHAUST GAS LEAK

OK:
No gas leakage.

NG

REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

ES

OK

REPLACE THREE-WAY CATALYTIC CONVERTER