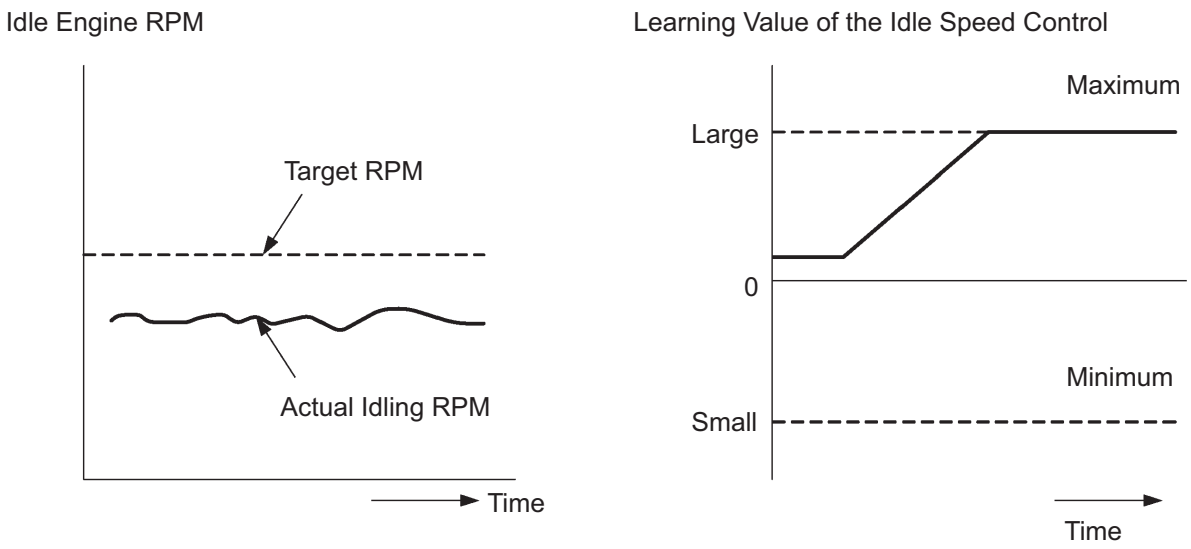
DTC	P0505	Idle Control System Malfunction

MONITOR DESCRIPTION

The idle speed is controlled by the Electronic Throttle Control System (ETCS).
The ETCS is composed of the throttle motor, which operates the throttle valve, and the throttle position sensor, which detects the opening angle of the throttle valve.
The ECM controls the throttle motor to provide the proper throttle valve opening angle to obtain the target idle speed.
The ECM regulates the idle speed by opening and closing the throttle valve using the ETCS. The ECM concludes that the idle speed control ECM function is malfunctioning if: 1) the actual idle RPM varies more than the specified amount 5 times or more during a drive cycle, or 2) a learning value of the idle speed control remains at the maximum or minimum 5 times or more during a drive cycle. The ECM will turn on the MIL and set a DTC.
Example:
If the actual idle RPM varies from the target idle RPM by more than 200 (*1) rpm 5 times during a drive cycle, the ECM will turn on the MIL and a DTC will be set.
*1: RPM threshold varies with engine load.

Example



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DTC No.	DTC Detection Condition	Trouble Area
P0505	Idle speed continues to vary greatly from target speed (1 trip detection logic)	• Electronic throttle control system • Air induction system • PCV hose connection

MONITOR STRATEGY

Related DTCs	P0505: IAC Functional Check P0505: IAC Range Check

Required sensors / components (Main)	ETCS
Required sensors / components (Related)	Crankshaft position sensor, ECT sensor, Vehicle speed sensor
Frequency of operation	Continuous
Duration	10 minutes
MIL operation	2 driving cycles
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever this DTC is not present	None
Engine	Running

ES

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met:	Condition 1 or 2
1. Frequency that both of the following conditions (a) and (b) are met:	5 times or more
(a) Engine RPM - Target engine RPM	Less than -100 rpm, or more than 150 rpm
(b) Vehicle condition	Stop after vehicle was driven at 6.25 mph (10 km/h) or more
2. Frequency that both of the following conditions (a) and (b) are met:	Once
(a) Engine RPM - Target engine RPM	Less than -100 rpm, or more than 150 rpm
(b) IAC flow rate learning value	1.3 L/sec. or less, or 9.03 L/sec. or more

HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

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

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Enter the following the menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(e) Read 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

A

2	CHECK PCV HOSE CONNECTIONS

OK:
PCV hose is connected correctly and is not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

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 VALVE

(a) Check the throttle valve condition.
OK:
No foreign objects between the throttle valve and housing.

NG → **REPLACE THROTTLE BODY ASSEMBLY**

OK ↓

REPLACE ECM

DTC	P0560	System Voltage

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is OFF. This electricity allows the ECM to store data such as DTC history, freeze frame data, fuel trim values, and other data. If the battery voltage falls below a minimum level, the ECM will conclude that there is a fault in the power supply circuit. The next time the engine starts, the ECM will turn on the MIL and a DTC will be set.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in back-up power source circuit	• Open in back-up power source circuit • ECM

HINT:
If DTC P0560 is present, the ECM will not store other DTCs.

MONITOR STRATEGY

Related DTCs	P0560: ECM System Voltage
Required sensors / components (Main)	ECM
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	3 seconds
MIL operation	Immediate (MIL will illuminate after the next engine start)
Sequence operation	None

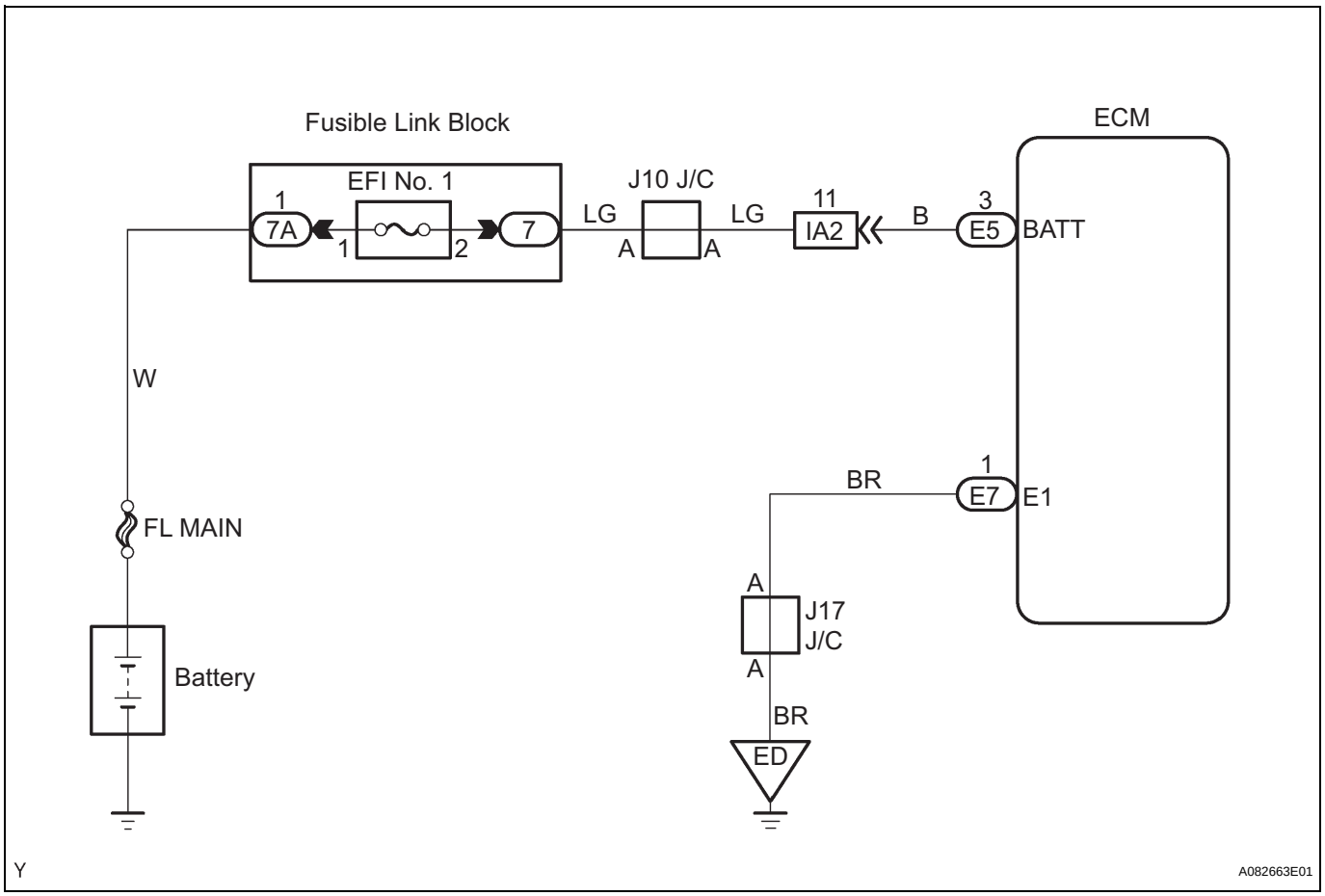
TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

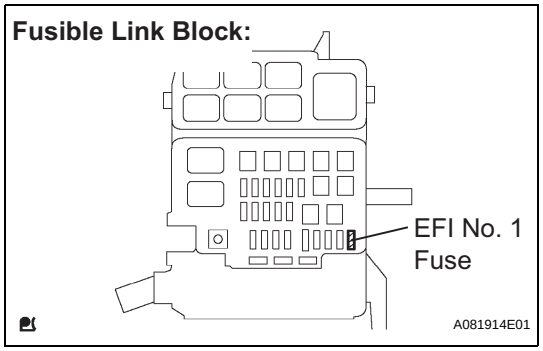
ECM power source	Less than 3.5 V

WIRING DIAGRAM



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 help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK EFI NO. 1 FUSE

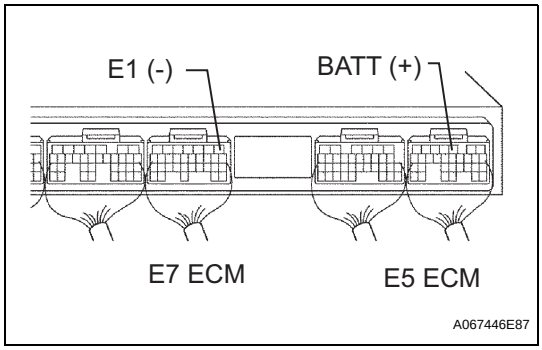


(a) Remove the EFI No. 1 fuse from the fusible link block.
(b) Measure the resistance of the EFI No. 1 fuse.
Standard resistance:
Below 1 Ω

NG → **REPLACE EFI NO. 1 FUSE**

OK

2	INSPECT ECM (BATT VOLTAGE)



(a) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
E5-3 (BATT) - E7-1 (E1)	9 to 14 V

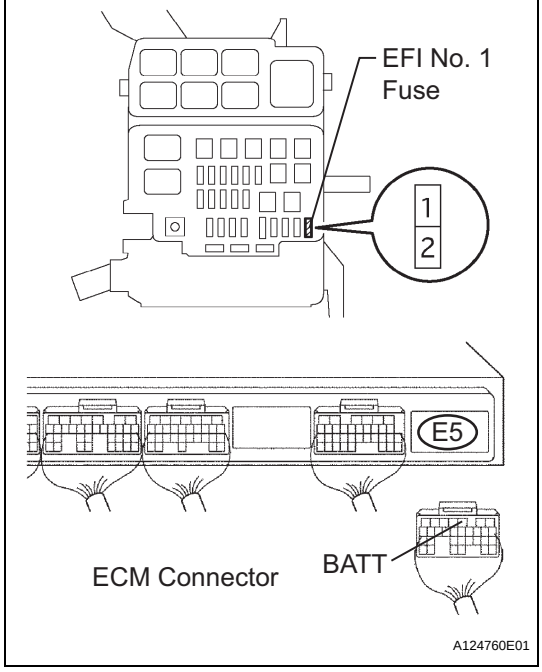
NG → **REPLACE ECM**

ES

OK

3	CHECK HARNESS AND CONNECTOR (ECM - EFI NO. 1 FUSE, EFI NO. 1 FUSE - BATTERY)

Fusible Link Block:



(a) Check the wire harness between the EFI No. 1 fuse and ECM.
(1) Remove the EFI No. 1 fuse from the fusible link block.
(2) Disconnect the E5 ECM connector.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
EFI No. 1 fuse terminal 2 - E5-3 (BATT)	Below 1 Ω
EFI No. 1 fuse terminal 2 or E5-3 (BATT) - Body ground	10 kΩ or higher

(b) Check the wire harness between the EFI No. 1 fuse and battery.
(1) Remove the EFI No. 1 fuse from the fusible link block.
(2) Disconnect the battery positive cable.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
Battery positive cable - EFI No. 1 fuse terminal 1	Below 1 Ω
Battery positive cable or EFI No. 1 fuse terminal 1 - Body ground	10 kΩ or higher

(c) Reconnect the ECM connector.
(d) Reinstall the EFI NO. 1 fuse.

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

OK

CHECK AND REPLACE FUSIBLE LINK BLOCK

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

DTC	P0606	ECM / PCM Processor

DTC	P0607	Control Module Performance

DTC	P0657	Actuator Supply Voltage Circuit / Open

MONITOR DESCRIPTION

The ECM continuously monitors its internal memory status, internal circuits, and output signals to the throttle actuator. This self-check ensures that the ECM is functioning properly. If any malfunction is detected, the ECM will set the appropriate DTC and illuminate the MIL.
The ECM memory status is diagnosed by internal "mirroring" of the main CPU and the sub CPU to detect random access memory (RAM) errors. The 2 CPUs also perform continuous mutual monitoring. The ECM sets a DTC if: 1) outputs from the 2 CPUs are different and deviate from the standards, 2) the signals to the throttle actuator deviate from the standards, 3) a malfunction is found in the throttle actuator supply voltage, and 4) any other ECM malfunction is found.

DTC No.	DTC Detection Condition	Trouble Area
P0604 P0606 P0607 P0657	ECM internal error	ECM

MONITOR STRATEGY

Related DTCs	P0604: RAM Error P0606: CPU Malfunction P0607: ECM Range Check P0657: ETCS Power Supply
Required sensors / components (Main)	ECM
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	Within 1 second
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

RAM Error:

RAM	RAM check failure

CPU Malfunction:

Either of the following conditions is met:	Condition 1 or 2
1. Difference between TP of main CPU and TP of sub CPU	0.3 V or more
2. Difference between APP of main CPU and APP of sub CPU	0.3 V or more

ECM Range Check:

Either of the following conditions is met:	Condition 1 or 2
1. All of the following conditions are met:	Condition (a), (b) and (c)
(a) CPU reset	1 time or more
(b) Difference between TP and APP learning values	0.4 V or more
(c) Electronic throttle actuator	OFF
2. CPU reset	2 times or more

ETCS Power Supply:

ETCS power supply when ignition switch is turned from OFF to ON	7 V or more

HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	**CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P0604/P0606/P0607/P0657)**

(a) Check for DTCs.

OK:

DTC P0604, P0606, P0607 or P0657 is not output.

B → **GO TO DTC CHART**

A

REPLACE ECM

DTC	P0617	Starter Relay Circuit High

MONITOR DESCRIPTION

While the engine is being cranked, the battery positive voltage is applied to terminal STA of the ECM. If the vehicle is being driven and the ECM detects the starter control signal (STA), the ECM concludes that the starter control circuit is malfunctioning. The ECM will turn on the MIL and a DTC will be set.

DTC No.	DTC Detecting Condition	Trouble Area
P0617	When conditions (a), (b) and (c) are met and the battery (+B) voltage 10.5 V or more is applied for 20 seconds: (a) Vehicle speed greater than 12 mph (20 km/h) (b) Engine revolution greater than 1,000 rpm (c) STA signal ON	• Short in PNP switch assembly circuit • PNP switch assembly • Ignition switch • ECM

ES

MONITOR STRATEGY

Related DTCs	P0617: Starter Signal
Required sensors / components (Main)	Starter Relay, PNP Switch
Required sensors / components (Related)	Crankshaft Position Sensor, Vehicle Speed Sensor
Frequency of operation	Continuous
Duration	20 seconds
MIL operation	Immediate
Sequence operation	None

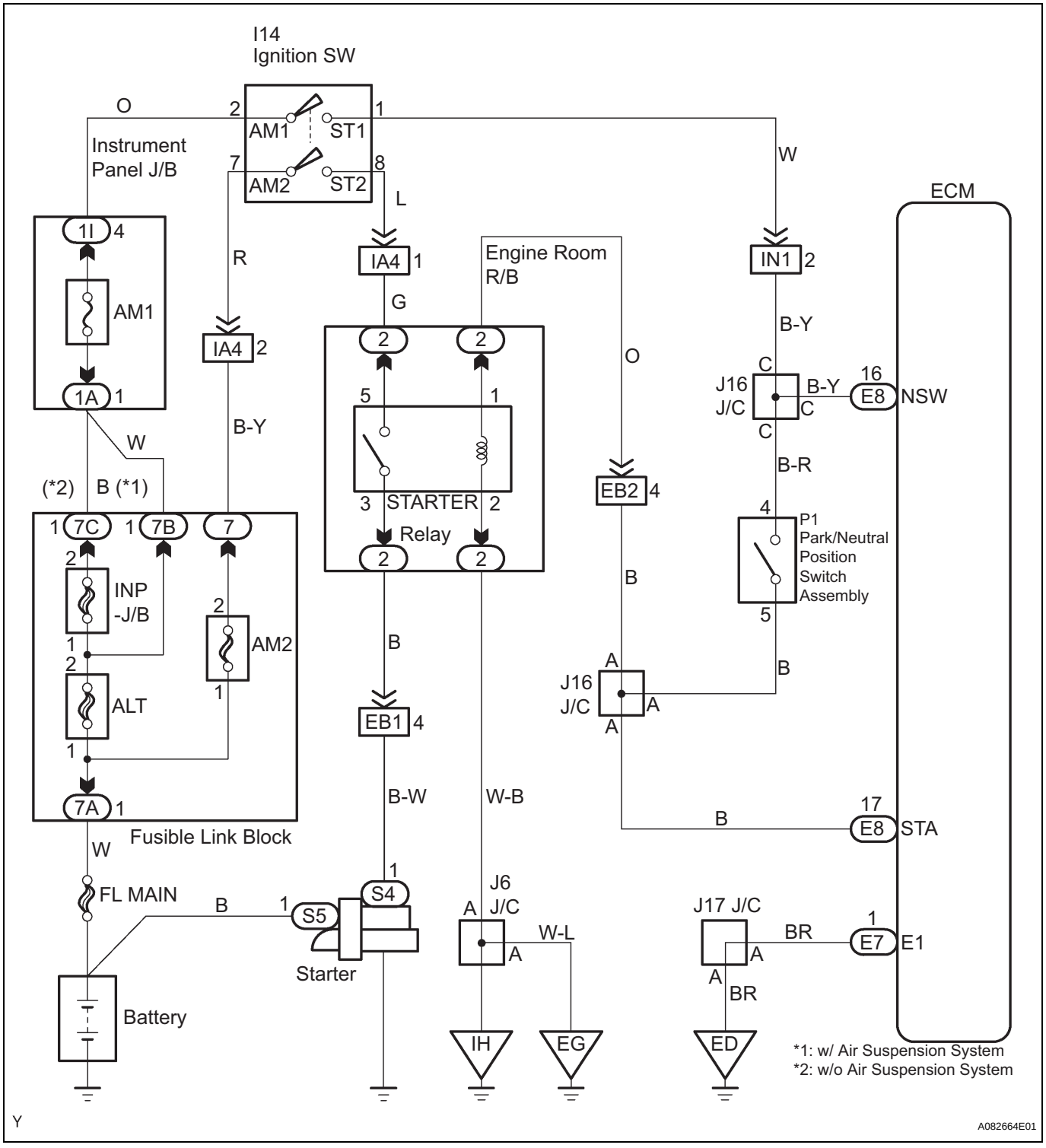
TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
Battery voltage	10.5 V or more
Vehicle speed	12.4 mph (20 km/h) or more
Engine RPM	1,000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Starter signal	ON

WIRING DIAGRAM



HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester main switch ON.
(c) On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG. Read the values.

Result

Ignition Switch Condition	ON	START
STA Signal	OFF	ON

OK → **REPLACE ECM**

NG

2	INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY

OK:
When shift lever is the N position, the PNP switch is ON.
When shift lever is the D position, the PNP switch is OFF.

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY (GO TO NEXT STEP 3 AFTER REPLACEMENT)**

OK

3	READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester main switch ON.
(c) On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG. Read the values.

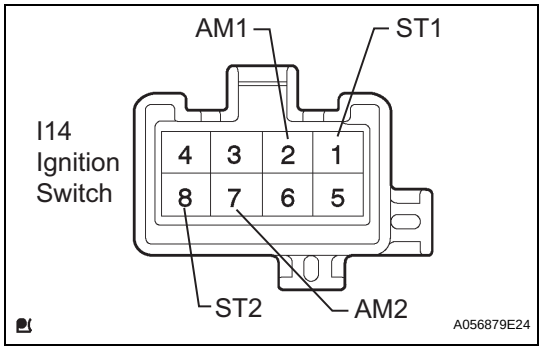
Result

Ignition Switch Condition	ON	START
STA Signal	OFF	ON

OK → **SYSTEM OK**

NG

4 INSPECT IGNITION OR STARTER SWITCH ASSEMBLY



(a) Measure the resistance of the ignition switch terminals.
Standard resistance

Switch Condition	Tester Connection	Specified Condition
LOCK	1 - 2 7 - 8	10 kΩ or higher
START	1 - 2 7 - 8	Below 1 Ω

NG → **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY (GO TO NEXT STEP 5 AFTER REPLACEMENT)**

OK

5 READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester main switch ON.
(c) On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / STARTER SIG. Read the values.
Result

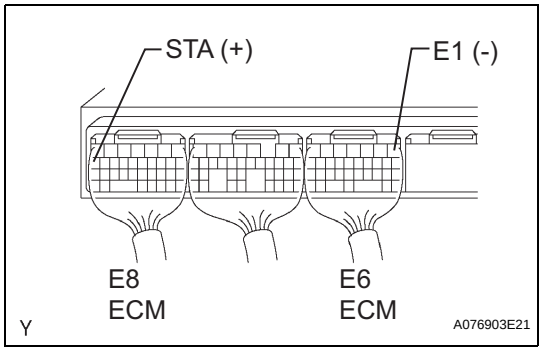
Ignition Switch Condition	ON	START
STA Signal	OFF	ON

OK → **SYSTEM OK**

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

1 INSPECT ECM (STA VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Condition	Specified Condition
E8-17 (STA) - E7-1 (E1)	Ignition switch ON	0 V
E8-17 (STA) - E7-1 (E1)	Engine cranking	6 V or more

OK → **REPLACE ECM**

NG

2	INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY

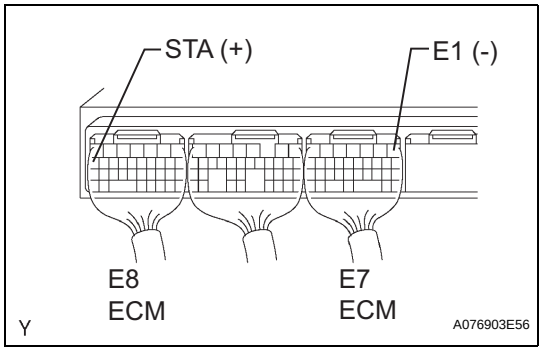
OK:
When shift lever is the N position, the PNP switch is ON.
When shift lever is the D position, the PNP switch is OFF.

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY (GO TO NEXT STEP 3 AFTER REPLACEMENT)**

ES

OK

3	INSPECT ECM (STA VOLTAGE)



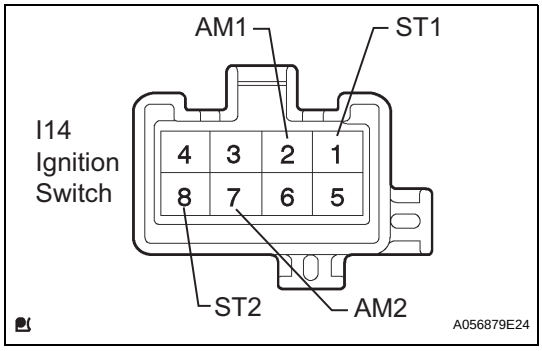
(a) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Condition	Specified Condition
E8-17 (STA) - E7-1 (E1)	Ignition switch ON	0 V
E8-17 (STA) - E7-1 (E1)	Engine cranking	6 V or more

OK → **SYSTEM OK**

NG

4	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY



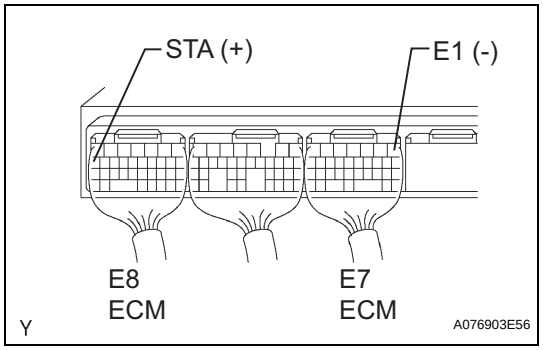
(a) Measure the resistance of the ignition switch terminals.
Standard resistance

Switch Condition	Tester Connection	Specified Condition
LOCK	1 - 2 7 - 8	10 kΩ or higher
START	1 - 2 7 - 8	Below 1 Ω

NG → **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK

5	CHECK ECM (STA VOLTAGE)



(a) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Condition	Specified Condition
E8-17 (STA) - E7-1 (E1)	Ignition switch ON	0 V
E8-17 (STA) - E7-1 (E1)	Engine cranking	6 V or more

OK → **SYSTEM OK**

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

ES

DTC	P0630	VIN not Programmed or Mismatch - ECM / PCM

DESCRIPTION

DTC P0630 is set when the Vehicle Indication Number (VIN) is not stored the ECM or the input VIN is not accurate. Input the VIN with the intelligent tester (See page ES-9).

DTC No.	DTC Detection Conditions	Trouble Areas
P0630	• VIN is not stored in ECM • Input VIN in ECM is not accurate	• ECM

MONITOR STRATEGY

Related DTCs	P0630: VIN not programed
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

VIN code	Not programmed

COMPONENT OPERATING RANGE

VIN code	Programmed

1	READ CURRENT DTC

NOTICE:
If P0630 is present, 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 present, check them first.

NEXT

2	INPUT VIN WITH INTELLIGENT TESTER

NEXT

END

DTC	P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)

DESCRIPTION

When the shift lever is in the N or P position: 1) the Park/Neutral Position (PNP) switch turns ON, and 2) ECM terminal NSW is grounded to the body ground via the starter relay and voltage becomes 0V. When the shift lever is in the D, 2, L or R position: 1) the PNP switch turns OFF, and 2) ECM terminal NSW receives current and becomes the voltage of the ECM internal power source.
If the shift lever is moved from the N position to the D position, this signal is used for air-fuel ratio correction and for idle speed control (estimated control).

ES

DTC No.	DTC Detection Condition	Trouble Area
P0705	2 or more switches are ON simultaneously at P, R, N, D, 2 and L positions (2 trip detection logic)	• Short in PNP switch circuit • PNP switch • ECM

HINT:
After confirming DTC P0705, use the intelligent tester to confirm the PNP switch signal in the ALL menu (to reach the ALL menu: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL).

WIRING DIAGRAM

Refer to DTC P0705 (See page AX-44).

Refer to DTC P0705 (See page AX-46).
HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

DTC	P1645	Gateway ECU Malfunction

DESCRIPTION

The ECM receives the operating condition signal (ON/OFF) of the A/C from A/C ECU, and it also receives the electrical load information from the gateway ECU.
The ECM uses these information to control the engine (idle up, etc.).

DTC No.	DTC Detection Condition	Trouble Area
P1645	Condition (a) or (b) continues for 10 seconds or more: (a) No communication from body ECU (b) No communication from A/C ECU	• Gateway ECU • A/C ECU • Communication bus

Troubleshoot the Multiplex Communication System (See page MP-20).
HINT:
Read freeze frame data using the intelligent tester or the OBD ll scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air-fuel ratio was lean or rich, etc. at the time of the malfunction.

DTC	P2102	Throttle Actuator Control Motor Circuit Low

DTC	P2103	Throttle Actuator Control Motor Circuit High

DESCRIPTION

The throttle actuator is operated by the ECM and it opens and closes the throttle valve.
The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to control the throttle actuator and monitor the throttle opening angle in response to driver inputs.
HINT:
This Electronic Throttle Control System (ETCS) does not use a throttle cable.

ES

DTC No.	DTC Detection Condition	Trouble Area
P2102	Conditions (a) and (b) continue for 2.0 seconds: (a) Throttle actuator output duty 80 % or more (b) Throttle actuator current less than 0.5 A	• Open in throttle control motor circuit • Throttle control motor • ECM
P2103	Throttle actuator current 7 A or more (0.6 seconds)	• Short in throttle control motor circuit • Throttle control motor • ECM

MONITOR DESCRIPTION

The ECM monitors the flow of electrical current through the electronic throttle actuator, and detects malfunctions or open circuits in the throttle actuator based on the value of the electrical current. When the current deviates from the standard values, the ECM concludes that there is a fault in the throttle actuator. Or, if the throttle valve is not functioning properly (for example, stuck ON), the ECM concludes that there is a fault and turns on the MIL and a DTC is set.
Example:
When the current is more than 10 A, or the current is less than 0.5 A when the actuator driving duty ratio is exceeding 80%, the ECM concludes that the current is deviated from the standard values, turns on the MIL and a DTC is set.

FAIL-SAFE

If the ETCS has a malfunction, the ECM cuts off current to the throttle actuator. The throttle control valve returns to a predetermined opening angle (approximately 16°) by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimal speed.
If the accelerator pedal is depressed firmly and slowly, the vehicle can be driven slowly.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal condition.

MONITOR STRATEGY

Related DTCs	P2102: Throttle Actuator Current (Low current) P2103: Throttle Actuator Current (High current)
Required sensors / components (Main)	Throttle actuator
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	P2102: 2 seconds P2103: 0.6 seconds
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	None

P2102:

Throttle actuator duty ratio	80 % or more
Throttle actuator power supply	8 V or more

P2103:

Throttle actuator power supply	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

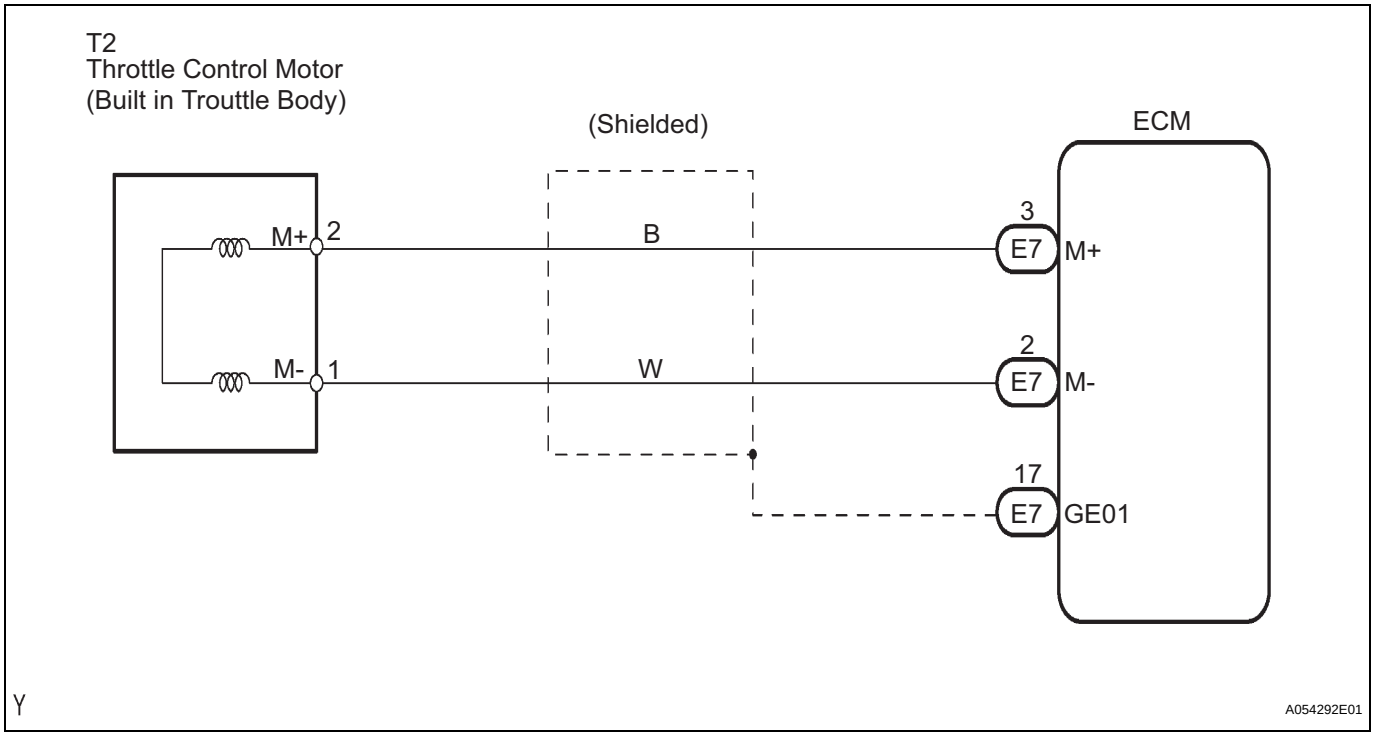
P2102:

Throttle actuator current	Less than 0.5 A

P2103:

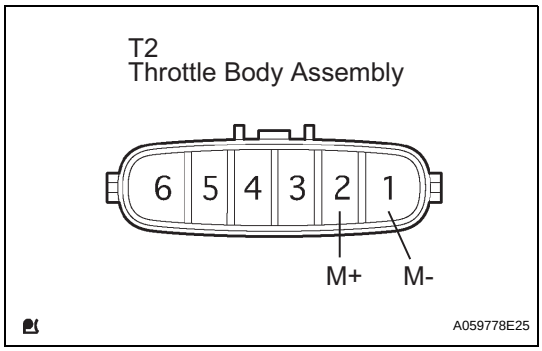
Either of the following conditions is met:	Condition 1 or 2
1. Hybrid IC diagnosis signal	Fail (for 0.1 seconds)
2. Hybrid IC current limiter port	Fail (for 0.6 seconds)

WIRING DIAGRAM



HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	INSPECT THROTTLE BODY ASSEMBLY (RESISTANCE OF THROTTLE CONTROL MOTOR)



(a) Disconnect the T2 throttle body connector.
(b) Measure the resistance of the throttle control motor terminals.

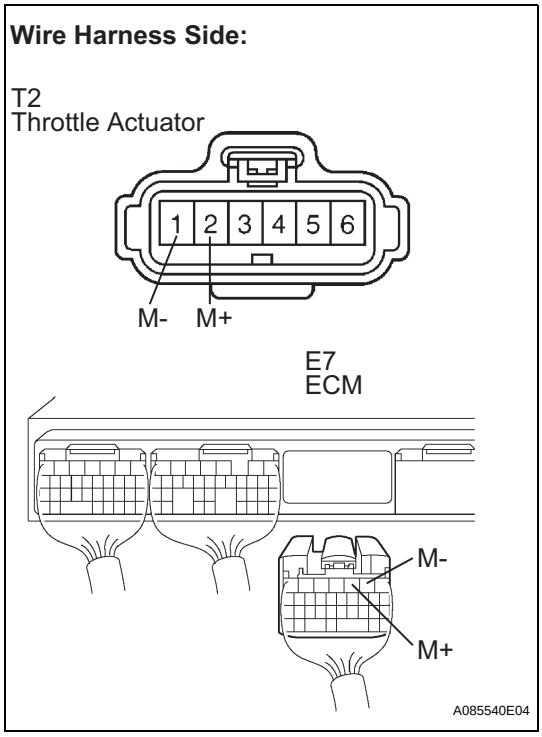
Standard resistance

Tester Connection	Specified Condition
T2-2 (M+) - T2-1 (M-)	0.3 to 100 Ω (20°C (68°F))

NG → **REPLACE THROTTLE BODY ASSEMBLY**

OK

2	CHECK HARNESS AND CONNECTOR (THROTTLE CONTROL MOTOR - ECM)



(a) Disconnect the T2 throttle body connector.
(b) Disconnect the E7 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
T2-2 (M+) - E7-3 (M+) T2-1 (M-) - E7-2 (M-)	Below 1 Ω
T2-2 (M+) or E7-3 (M+) - Body ground T2-1 (M-) or E7-2 (M-) - Body ground	10 kΩ or higher

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

OK

REPLACE ECM

DTC	P2111	Throttle Actuator Control System - Stuck Open

DTC	P2112	Throttle Actuator Control System - Stuck Closed

SYSTEM DESCRIPTION

The throttle actuator is operated by the ECM and it opens and closes the throttle valve using gears. The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle body. The throttle position sensor provides feedback to the ECM to control the throttle actuator and set the throttle valve angle in response to driver inputs.

HINT:

This Electronic Throttle Control System (ETCS) does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2111	Throttle actuator locked during ECM order to close	• Throttle actuator circuit • Throttle actuator • Throttle body • Throttle valve
P2112	Throttle actuator locked during ECM order to open	• Throttle actuator circuit • Throttle actuator • Throttle body • Throttle valve

MONITOR DESCRIPTION

The ECM concludes that there is a malfunction of the ETCS when the throttle valve remains at a fixed angle despite high drive current from the ECM. The ECM will turn on the MIL and a DTC will be set.

FAIL-SAFE

If the ETCS has a malfunction, the ECM cuts off current to the throttle actuator. The throttle control valve returns to a predetermined opening angle (approximately 16°) by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimal speed.

If the accelerator pedal is depressed firmly and slowly, the vehicle can be driven slowly.

If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal.

MONITOR STRATEGY

Related DTCs	P2111: Throttle actuator stuck open P2112: Throttle actuator stuck closed
Required sensors / components (Main)	Throttle actuator
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	None

P2111:

All of the following conditions are met	-
System guard*	ON
Throttle actuator current	2 A or more
Duty cycle to close throttle	80% or more
*: System guard is ON when the following conditions are met	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor	Fail determined
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator	Fail determined

ES

P2112:

All of the following conditions are met	-
System guard*	ON
Throttle actuator current	2 A or more
Duty cycle to open throttle	80% or more
*: System guard is ON when the following conditions are met	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor	Fail determined
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator	Fail determined

TYPICAL MALFUNCTION THRESHOLDS

TP sensor voltage change	Less than 0.1 V

WIRING DIAGRAM

Refer to DTC P2102 (See page ES-247).

HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	**CHECK OTHER DTC OUTPUT**

Result

Display (DTC output)	Proceed to
P2111 or P2112	A
P2111 or P2112 and other DTCs	B

B → **GO TO RELEVANT DTC CHART**

A

2	INSPECT THROTTLE BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

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:
The throttle valve is not contaminated by foreign objects and can move smoothly.

NG → **REPLACE THROTTLE BODY ASSEMBLY**

ES

OK

3	CHECK DTC OUTPUT

(a) Clear the DTC (See page ES-28).
(b) Start the engine, and depress and release the accelerator pedal quickly (fully open and fully close).
(c) Read DTC.
Result

Display (DTC output)	Proceed to
No DTC	A
P2111 and/or P2112	B

B → **REPLACE ECM**

A

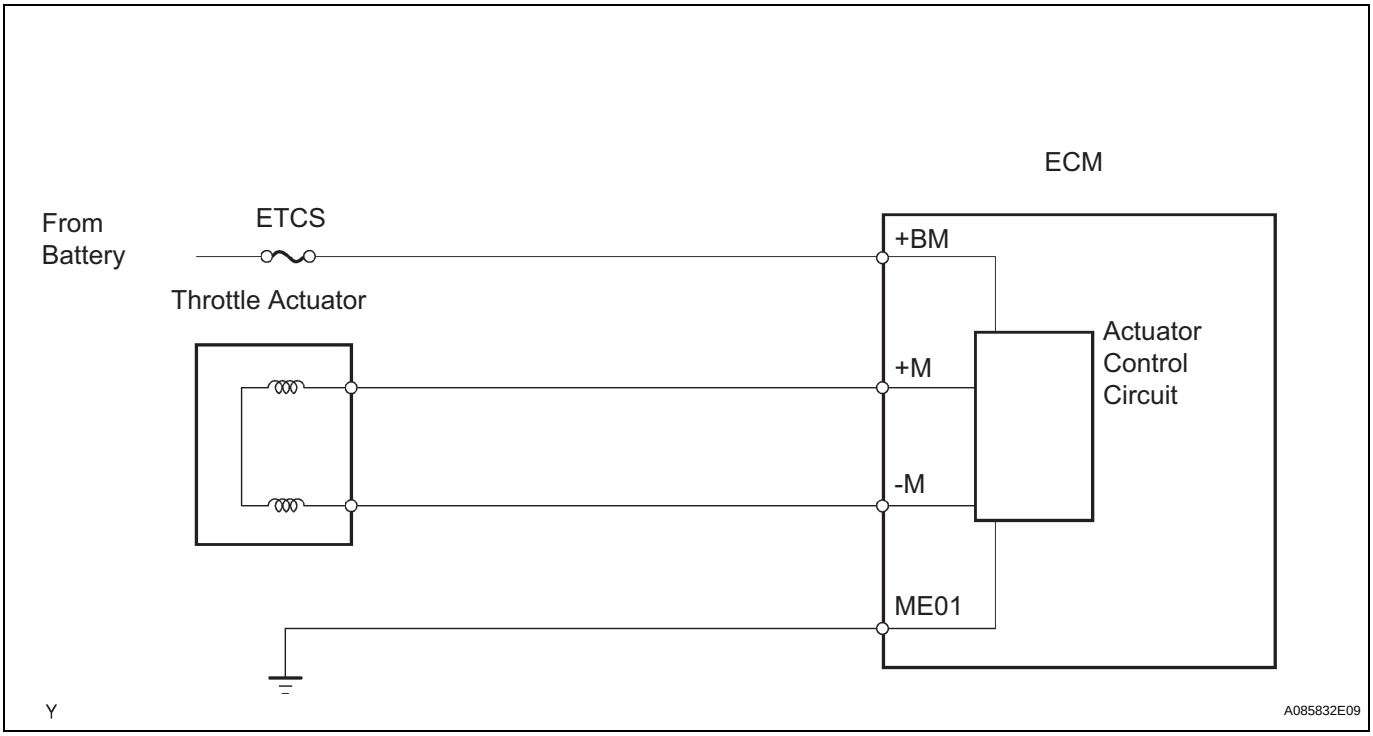
CHECK FOR INTERMITTENT PROBLEMS

DTC	P2118	Throttle Actuator Control Motor Current Range / Performance

DESCRIPTION

The Electronic Throttle Control System (ETCS) has a dedicated power supply circuit. The voltage (+BM) is monitored and when the voltage is low (less than 4V), the ECM concludes that the ETCS has a fault and current to the throttle actuator is cut.
When the voltage becomes unstable, the ETCS condition itself becomes unstable. For this reason, when the voltage is low, the current to the actuator is cut. If repairs are made and the system has returned to normal, turn the ignition switch OFF. The ECM then allows current to flow to the actuator and the actuator can be restarted.

ES



HINT:
This ETCS does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2118	Open in ETCS power source circuit	• Open in ETCS power source circuit • ETCS fuse • ECM

MONITOR DESCRIPTION

The ECM monitors the battery supply voltage applied to the electronic throttle actuator. When the power supply voltage drops below the threshold, the ECM concludes that the power supply circuit has an open circuit. A DTC is set and the MIL is turned on.

FAIL-SAFE

If the ETCS has a malfunction, the ECM cuts off current to the throttle actuator. The throttle control valve returns to a predetermined opening angle (approximately 16°) by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimal speed.
If the accelerator pedal is depressed firmly and slowly, the vehicle can be driven slowly.

If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal.

MONITOR STRATEGY

Related DTCs	P2118: Throttle Actuator Power Supply
Required sensors / components (Main)	Throttle actuator, Throttle valve, ETCS fuse
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	0.8 seconds
MIL operation	Immediate
Sequence operation	None

ES

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
Battery voltage	More than 8 V

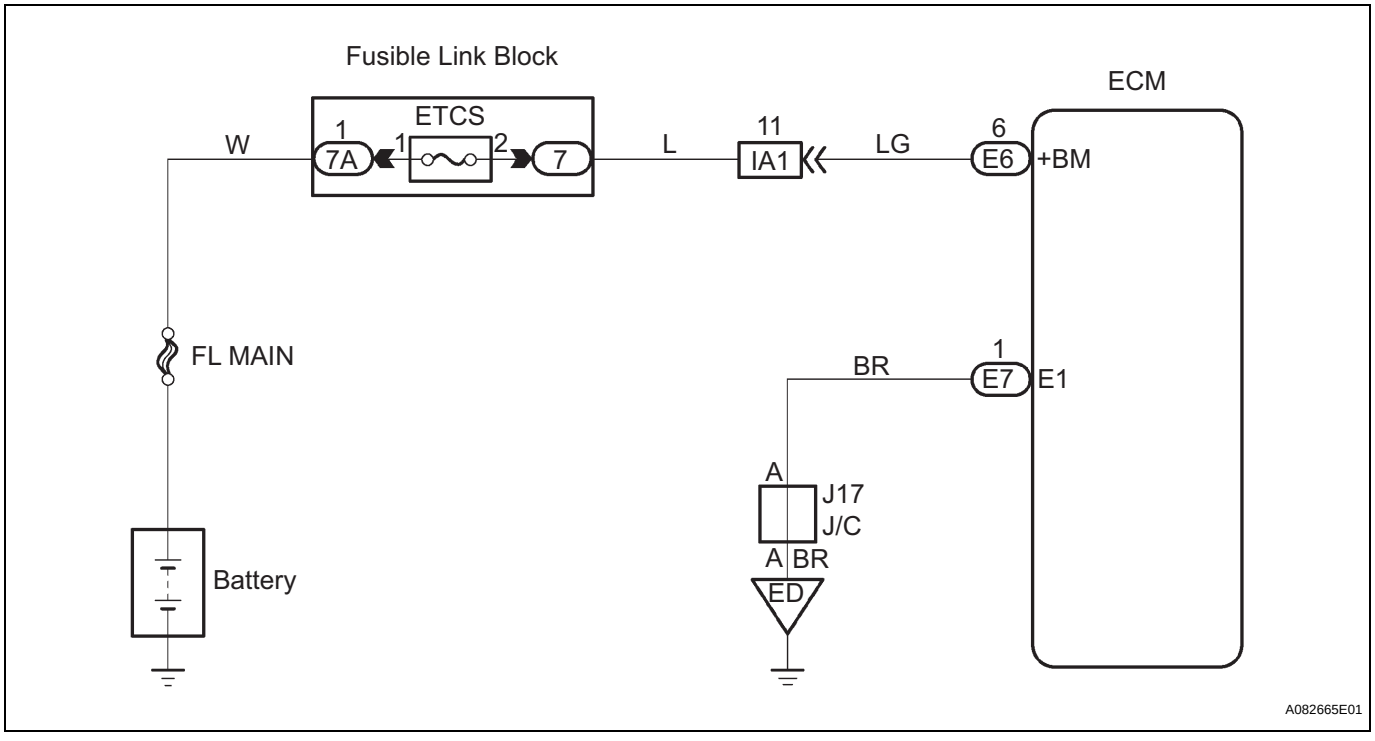
TYPICAL MALFUNCTION THRESHOLDS

Throttle actuator power supply voltage	Less than 4 V

COMPONENT OPERATING RANGE

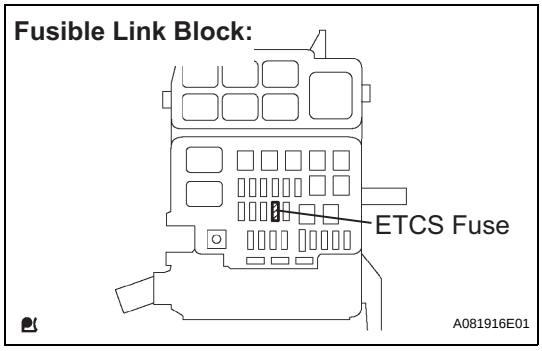
Throttle actuator power supply voltage	9 to 14 V

WIRING DIAGRAM



HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK FUSE (ETCS)

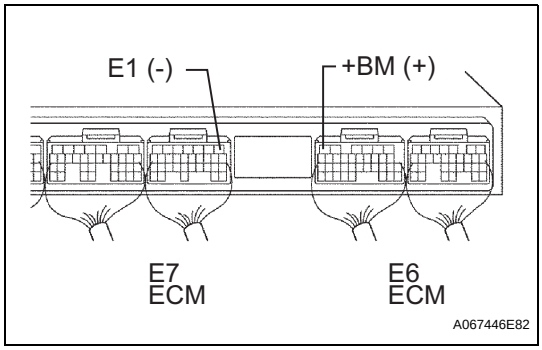


(a) Remove the ETCS fuse from the fusible link block.
(b) Measure the resistance of the ETCS fuse.
Standard resistance:
Below 1 Ω

NG → **REPLACE FUSE**

OK

2 INSPECT ECM (+BM VOLTAGE)



(a) Measure the voltage of the ECM connectors.
Standard voltage

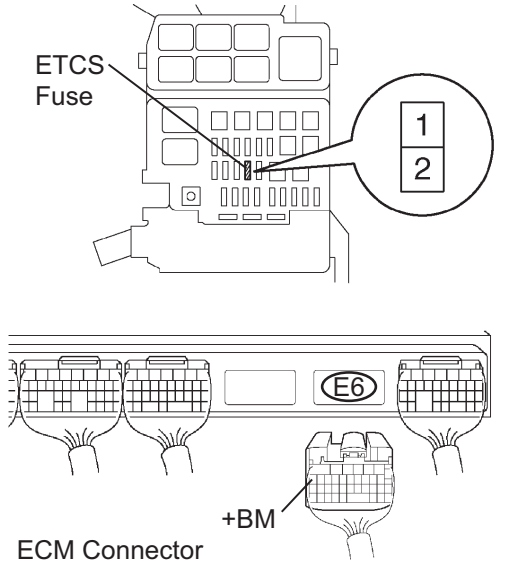
Tester Connection	Specified Condition
E6-6 (+BM) - E7-1 (E1)	9 to 14 V

OK → **REPLACE ECM**

NG

3	CHECK HARNESS AND CONNECTOR (ECM - ETCS FUSE, ETCS FUSE - BATTERY)

Fusible Link Block:



(a) Check the harness and the connector between the ETCS fuse and ECM.
  (1) Remove the ETCS fuse from the fusible link block.
  (2) Disconnect the E6 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
ETCS fuse terminal 2 - E6-6 (+BM)	Below 1 Ω
ETCS fuse terminal 2 or E6-6 (+BM) - Body ground	10 kΩ or higher

(b) Check the harness and the connector between the ETCS fuse and battery.
  (1) Remove the ETCS fuse from the fusible link block.
  (2) Disconnect the battery's positive cable.
  (3) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
Battery positive cable - ETCS fuse terminal 1	Below 1 Ω
Battery positive cable or ETCS fuse terminal 1 - Body ground	10 kΩ or higher

(c) Reinstall the ETCS fuse.
(d) Reconnect the ECM connector.

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

OK

CHECK AND REPLACE FUSIBLE LINK BLOCK ASSEMBLY

ES

DTC	P2119	Throttle Actuator Control Throttle Body Range / Performance

DESCRIPTION

The Electronic Throttle Control System (ETCS) is composed of a throttle actuator that operates the throttle valve, a throttle position sensor that detects the opening angle of the throttle valve, an accelerator pedal position sensor that detects the accelerator pedal position, and the ECM that controls the ETCS system.
The ECM operates the throttle motor to position the throttle valve for proper response to driver inputs. The throttle position sensor, which is mounted on the throttle body, detects the opening angle of the throttle valve and provides this signal to the ECM so that the ECM can regulate the throttle motor.

ES

DTC No.	DTC Detection Condition	Trouble Area
P2119	Throttle opening angle continues to vary greatly from target throttle opening angle	• Electronic throttle control system • ECM

MONITOR DESCRIPTION

The ECM determines the "actual" throttle angle based on the throttle position sensor signal. The "actual" throttle position is compared to the "target" throttle position commanded by the ECM. If the difference between these 2 values exceeds a specified limit, the ECM interprets this as a fault in the ETCS system. The ECM turns on the MIL and a DTC is set.

FAIL-SAFE

If the ETCS has a malfunction, the ECM cuts off current to the throttle actuator. The throttle control valve returns to a predetermined opening angle (approximately 16°) by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimal speed.
If the accelerator pedal is depressed firmly and slowly, the vehicle can be driven slowly.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal.

MONITOR STRATEGY

Related DTCs	P2119: ETCS malfunction
Required sensors / components (Main)	Throttle actuator
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	1 seconds
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
System guard*	ON
*: System guard is ON when the following conditions are met	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor	Fail determined
Throttle actuator current-cut	Not executing

Throttle actuator power supply	4 V or more
Throttle actuator	Fail determined

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions are met	Condition 1 and 2
Commanded closed throttle position - current closed throttle position	0.3 V or more
Commanded open throttle position - current open throttle position	0.3 V or more

WIRING DIAGRAM

Refer to DTC P2102 (See page ES-247).

ES

HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P2119)

Result

Display (DTC output)	Proceed to
Only P2119 is output	A
P2119 and other codes are output	B

B → **GO TO RELEVANT DTC CHART**

A

2 CHECK IF DTC OUTPUT RECURS (DTC P2119)

(a) Clear the DTC (See page ES-28).
(b) Allow the engine to idle for 15 seconds.
(c) Pull the hand brake and shift the gear to D.
(d) Depress the brake pedal securely and the accelerator pedal fully for 5 seconds.
(e) Read the DTC.
HINT:
Actual throttle position (TP) sensor voltage can be confirmed using the intelligent tester [DATA LIST/ALL/ THROTTLE POS #1].
OK:
No DTC output.

NG → **REPLACE THROTTLE BODY ASSEMBLY**

OK

NORMAL

DTC	P2120	Throttle / Pedal Position Sensor / Switch "D" Circuit
DTC	P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input
DTC	P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input
DTC	P2125	Throttle / Pedal Position Sensor / Switch "E" Circuit
DTC	P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input
DTC	P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input
DTC	P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation

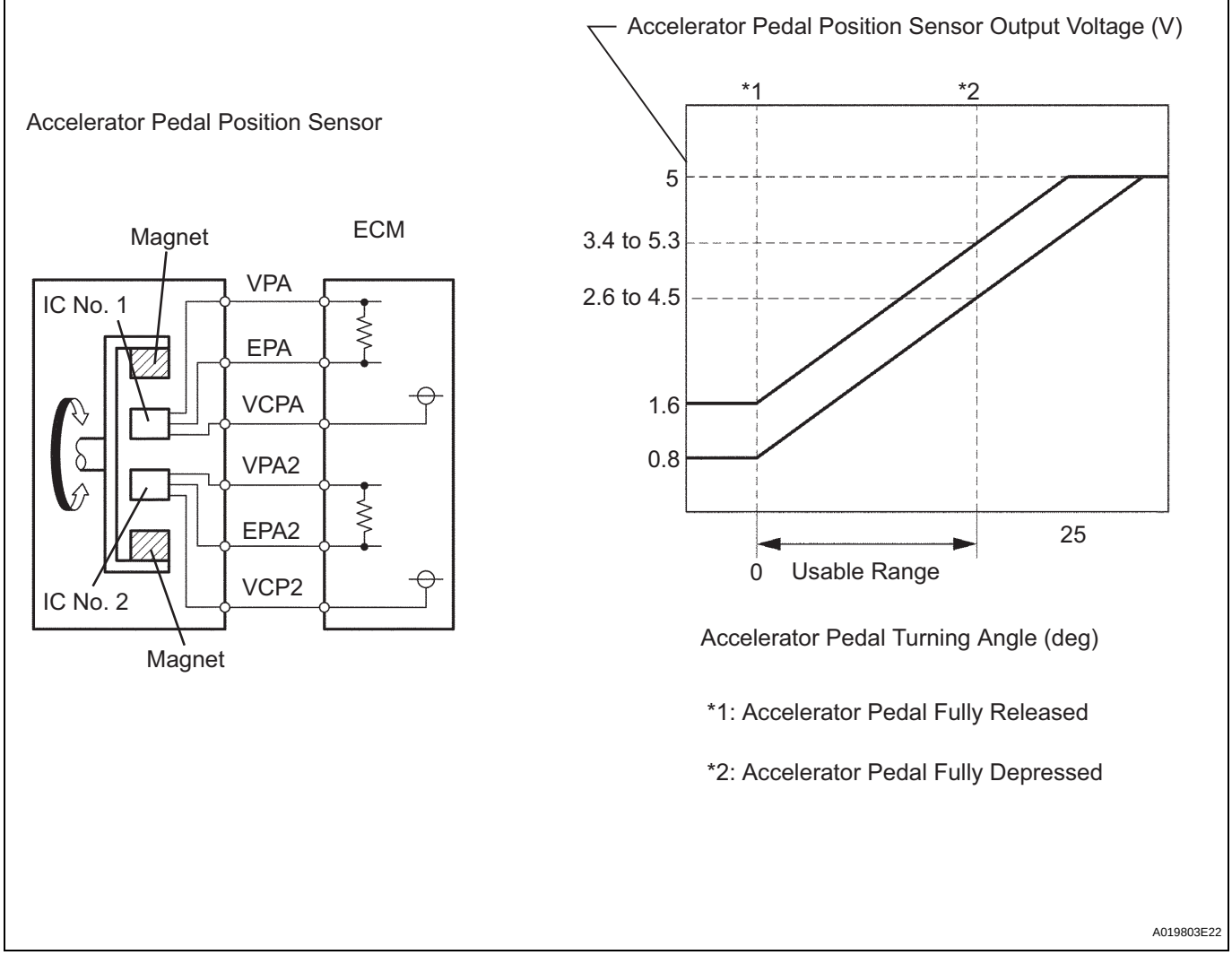
DESCRIPTION

HINT:

- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- This accelerator pedal position sensor is a non-contact type.

The accelerator pedal position sensor is mounted on the accelerator pedal bracket. The accelerator pedal position sensor has 2 sensor elements / signal outputs: VPA1 and VPA2. VPA1 is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA1. Voltage applied to VPA1 and VPA2 changes between 0V and 5V in proportion to the accelerator pedal angle.

The ECM monitors the accelerator pedal angle from VPA1 and VPA2 signal outputs, and controls the throttle motor based on these signals.



DTC No.	DTC Detection Condition	Trouble Area
P2120	Condition (a) continues for 0.5 seconds or more: (a) VPA is 0.4 V or less and VPA2 is 0.04 V or more; or VPA is 4.8 V or more	• Accelerator pedal position sensor • ECM
P2122	Condition (a) continues for 0.5 seconds or more when accelerator pedal is released: (a) VPA is 0.4 V or less	• Accelerator pedal position sensor • Open in VCP1 circuit • Open or short to ground in VPA circuit • ECM
P2123	Condition (a) continues for 2.0 seconds or more: (a) VPA is 4.8 V or more	• Accelerator pedal position sensor • Open in EPA circuit • ECM
P2125	Condition (a) continues for 0.5 seconds or more: (a) VPA2 is 1.2 V or less and VPA is 0.04 V or more: or VPA2 is 4.8 V or more and VPA is between 0.4 V and 3.45 V	• Accelerator pedal position sensor • ECM
P2127	Condition (a) continues for 0.5 seconds or more when accelerator pedal is released: (a) VPA2 is 1.2 V or less	• Accelerator pedal position sensor • Open in VCP2 circuit • Open or short to ground in VPA2 circuit • ECM
P2128	Conditions (a) and (b) continue for 2.0 seconds or more: (a) VPA2 is 4.8 V or more (b) VPA is 0.4 V or more and VPA is 3.45 V or less	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM

DTC No.	DTC Detection Condition	Trouble Area
P2138	Condition (a) or (b) continues for 2.0 seconds or more: (a) Difference between VPA and VPA2 is 0.02 V or less (b) VPA is 0.4 V or less and VPA2 is 1.2 V or less	• VPA and VPA2 circuits are shorted • Accelerator pedal position sensor • ECM

HINT:
After confirming DTCs P2120, P2122, P2123, P2125, P2127, P2128 and P2138, use the intelligent tester or the OBD II scan tool to confirm the accelerator pedal position sensor output voltage.

Trouble Area	Accelerator pedal position expressed as voltage output	Accelerator pedal position expressed as voltage output	Accelerator pedal position expressed as voltage output	Accelerator pedal position expressed as voltage output
	Accelerator pedal released	Accelerator pedal released	Accelerator pedal depressed	Accelerator pedal depressed
	ACCEL POS #1	ACCEL POS #2	ACCEL POS #1	ACCEL POS #2
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
VPA circuit open or ground short	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.3 V
VPA2 circuit open or ground short	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V

ES

MONITOR DESCRIPTION

When VPA or VPA2 deviates from the standard, or the difference between the voltage outputs of the two sensors is less than the threshold, the ECM concludes that there is a defect in the accelerator pedal position sensor. The ECM turns on the MIL and a DTC is set.
Example:
The voltage output of the VPA is below 0.4 V or exceeds 4.8 V.

FAIL-SAFE

The accelerator pedal position sensor has 2 (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the two sensor circuits and switches to fail-safe mode. In fail-safe mode, the functioning circuit is used to calculate the accelerator pedal opening angle to allow the vehicle to continue driving. If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal to be fully closed. In this case, the throttle valve will remain closed as if the engine is idling.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal condition.

MONITOR STRATEGY

Related DTCs	P2120: APP Sensor 1 Range Check (Chattering) P2122: APP Sensor 1 Range Check (Low voltage) P2123: APP Sensor 1 Range Check (High voltage) P2125: APP Sensor 2 Range Check (Chattering) P2127: APP Sensor 2 Range Check (Low voltage) P2128: APP Sensor 2 Range Check (High voltage) P2138: APP Sensor Range Check (Correlation)
Required sensors / components (Main)	APP sensor
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	2 seconds
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P2120:

Either of the following conditions is met:	Condition 1 or 2
1. VPA1 voltage when VPA2 is 0.04 V or more	0.4 V or less
2. VPA1 voltage	4.8 V or more

P2122:

VPA1 voltage when VPA2 is 0.04 V or more	0.4 V or less

P2123:

VPA1 voltage	4.8 V or more

P2125:

Either of the following conditions is met:	Condition 1 or 2
1. VPA2 voltage when VPA1 is 0.04 V or more	1.2 V or less
2. VPA2 voltage when VPA1 is 0.4 to 3.45 V	4.8 V or more

P2127:

VPA2 voltage when VPA1 is 0.04 V or more	1.2 V or less

P2128:

VPA2 voltage when VPA1 is 0.4 to 3.45 V	4.8 V or more

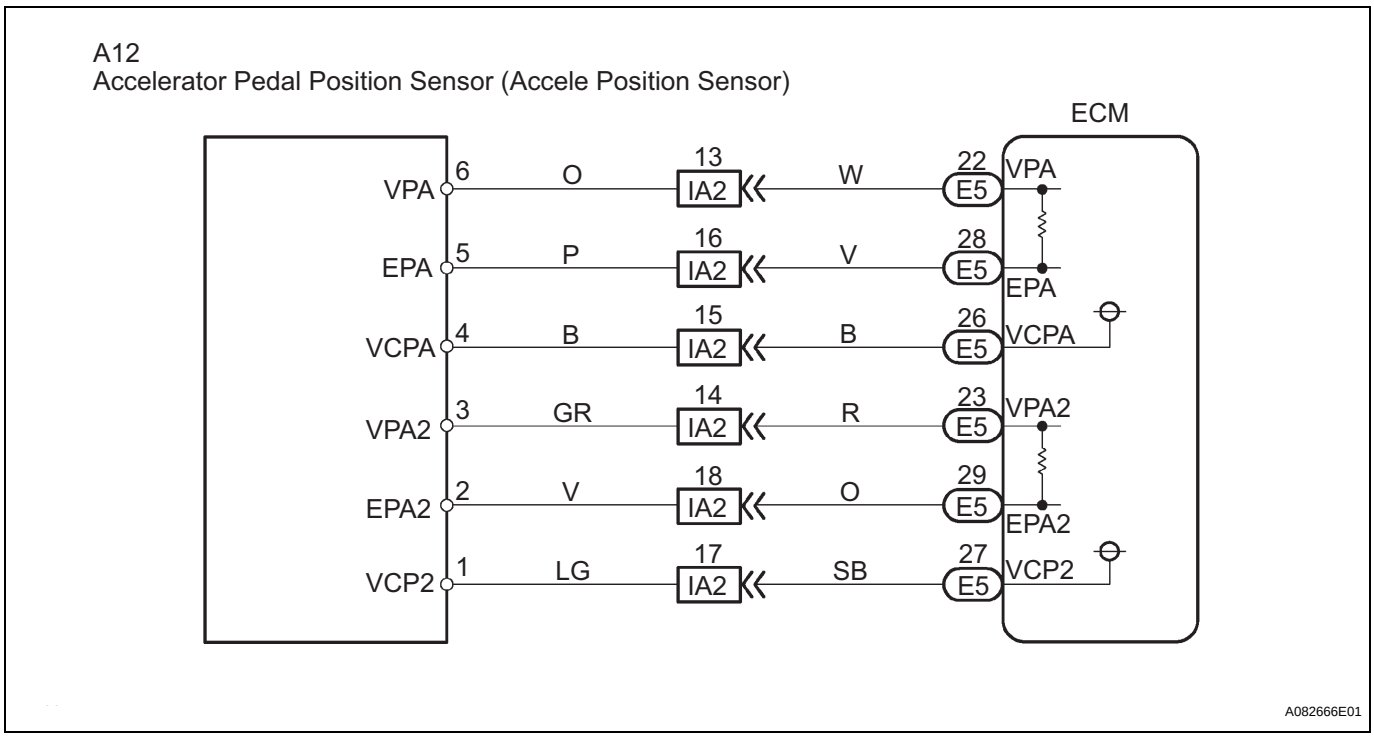
P2138:

Either of the following conditions is met:	Condition 1 or 2
Condition 1	-
Difference between VPA 1 and VPA2 voltages	0.02 V or less
Condition 2	-
VPA1 voltage	0.4 V or less
VPA2 voltage	1.2 V or less

COMPONENT OPERATING RANGE

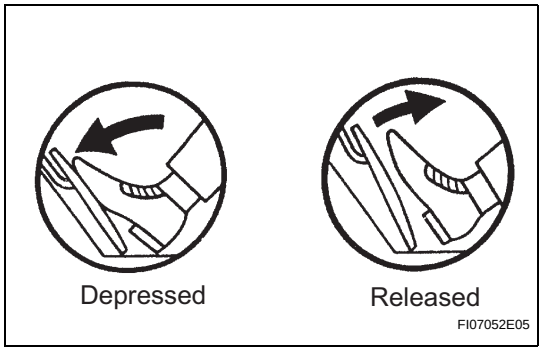
VPA1 voltage	0.5 to 4.5 V
VPA2 voltage	1.2 to 4.8 V

WIRING DIAGRAM



HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (ACCEL POS #1 AND ACCEL POS #2)



(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / ACCEL POS #1 and ACCEL POS #2. Read the values.

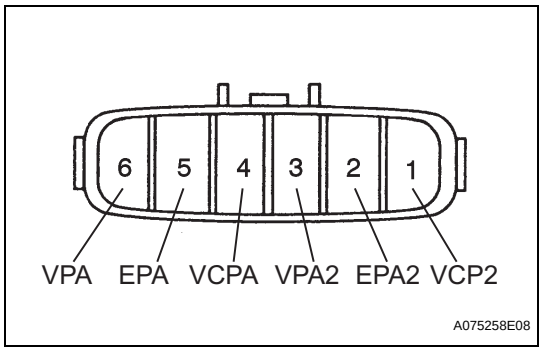
Standard voltage

Accelerator Pedal	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.3 V

OK → **Go to step 6**

NG

2 INSPECT ACCELERATOR PEDAL ROD ASSEMBLY (ACCELERATOR PEDAL POSITION SENSOR)



(a) Disconnect the A12 sensor connector.
(b) Measure the resistance of the sensor terminals.
Standard resistance

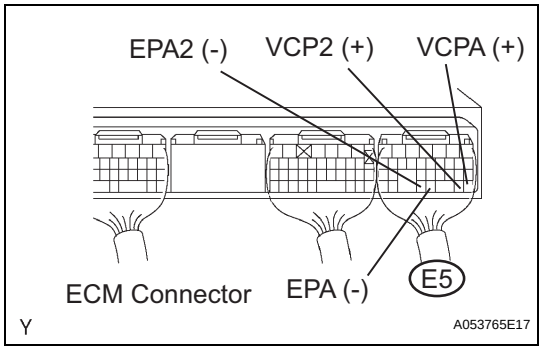
Tester Connection	Specified Condition
3 (VPA2) - 5 (EPA)	5.0 kΩ or less
6 (VPA) - 2 (EP2)	5.0 kΩ or less
4 (VCPA) - 5 (EPA)	2.25 to 4.75 kΩ
1 (VCP) - 2 (EP2)	2.25 to 4.75 kΩ

(c) Reconnect the sensor connector.

NG → **REPLACE ACCELERATOR PEDAL ASSEMBLY**

OK

3 INSPECT ECM (VCPA AND VCP2 VOLTAGE)



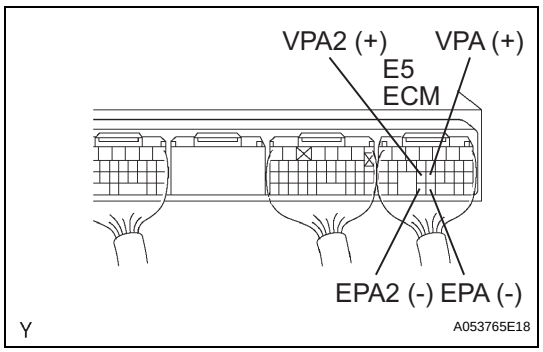
(a) Turn the ignition switch ON.
(b) Measure the voltage of the E5 ECM connector.
Standard voltage

Tester Connection	Specified Condition
E5-26 (VCPA) - E5-28 (EPA) E5-27 (VCP2) - E5-29 (EPA2)	4.5 to 5.5 V

NG → **REPLACE ECM**

OK

4 INSPECT ECM (VPA AND VPA2 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard voltage

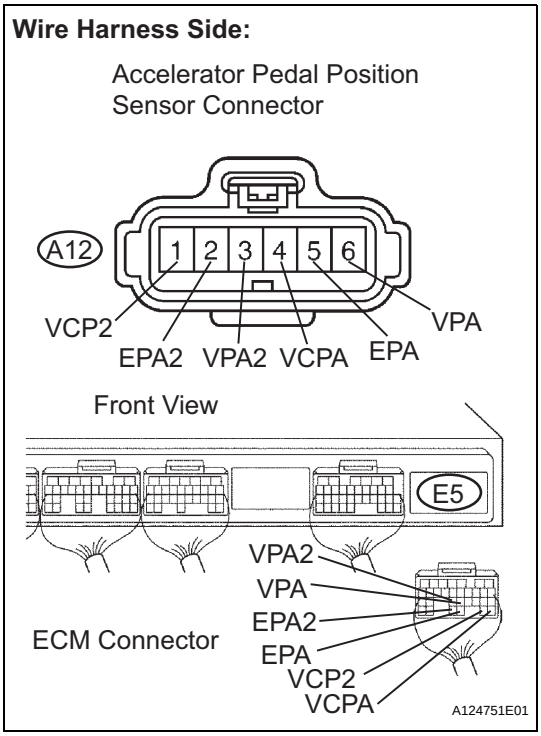
Tester Condition	Accelerator Pedal Condition	Specified Condition
E5-22 (VPA) - E5-28 (EPA)	Released	0.5 to 1.1 V
E5-22 (VPA) - E5-28 (EPA)	Depressed	2.6 to 4.5 V
E5-23 (VPA2) - E5-29 (EPA2)	Released	1.2 to 2.9 V
E5-23 (VPA2) - E5-29 (EPA2)	Depressed	3.4 to 5.5 V

OK → **REPLACE ECM**

ES

NG

5	CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A12 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A12-6 (VCP1) - E5-26 (VCPA) A12-5 (VPA1) - E5-22 (VPA) A12-4 (VCP2) - E5-27 (VCP2) A12-3 (EP1) - E5-28 (EPA) A12-2 (VPA2) - E5-23 (VPA2) A12-1 (EP2) - E5-29 (EPA2)	Below 1 Ω
A12-6 (VCP1) or E5-26 (VCPA) - Body ground A12-5 (VPA1) or E5-22 (VPA) - Body ground A12-4 (VCP2) or E5-27 (VCP2) - Body ground A12-3 (EP1) or E5-28 (EPA) - Body ground A12-2 (VPA2) or E5-23 (VPA2) - Body ground A12-1 (EP2) or E5-29 (EPA2) - Body ground	10 kΩ or higher

(d) Reconnect the sensor connector and ECM connector.

NG → REPAIR OR REPLACE HARNESS AND CONNECTOR

OK

6	READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (See page ES-28).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.

Result

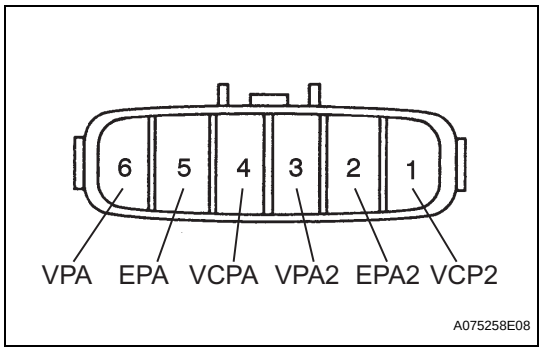
Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output again	A
No DTC output	B

B → SYSTEM OK

A

REPLACE ECM

1 INSPECT ACCELERATOR PEDAL ROD ASSEMBLY (ACCELERATOR PEDAL POSITION SENSOR)



(a) Disconnect the A12 sensor connector.
(b) Measure the resistance of the sensor terminals.
Standard resistance

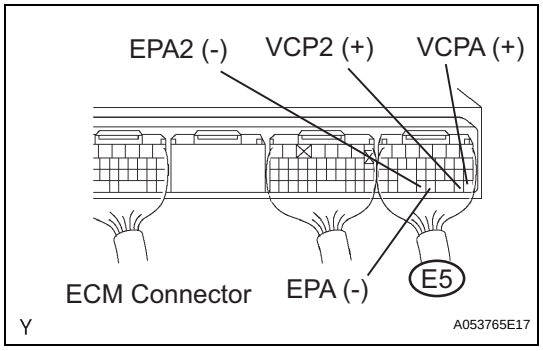
Tester Connection	Specified Condition
3 (VPA2) - 5 (EPA)	5.0 kΩ or less
6 (VPA1) - 2 (EPA2)	5.0 kΩ or less
4 (VCP1) - 5 (EPA)	2.25 to 4.75 kΩ
2 (VCP2) - 2 (EPA2)	2.25 to 4.75 kΩ

(c) Reconnect the sensor connector.

NG → **REPLACE ACCELERATOR PEDAL ASSEMBLY**

OK

2 INSPECT ECM (VCPA AND VCP2 VOLTAGE)



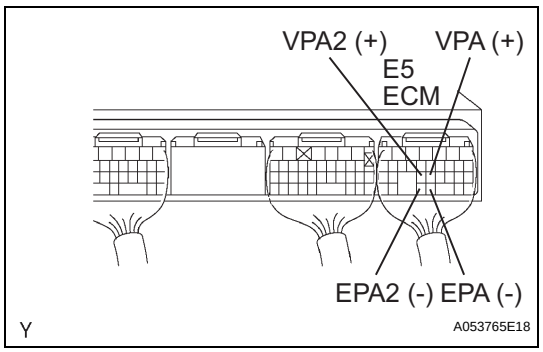
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard voltage

Tester Connection	Specified Condition
E5-26 (VCPA) - E5-28 (EPA) E5-27 (VCP2) - E5-29 (EPA2)	4.5 to 5.5 V

NG → **REPLACE ECM**

OK

3 INSPECT ECM (VPA, VPA2 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard voltage

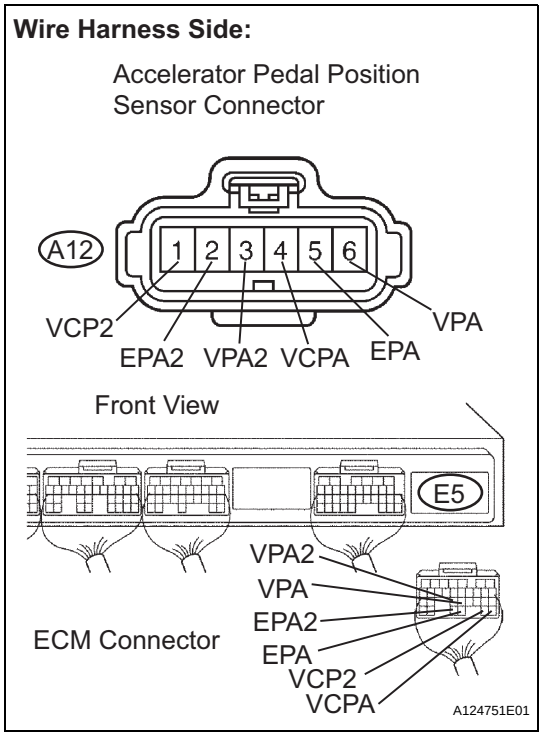
Tester Condition	Accelerator Pedal Condition	Specified Condition
E5-22 (VPA) - E5-28 (EPA)	Released	0.5 to 1.1 V
E5-22 (VPA) - E5-28 (EPA)	Depressed	2.6 to 4.5 V
E5-23 (VPA2) - E5-29 (EPA2)	Released	1.2 to 2.9 V
E5-23 (VPA2) - E5-29 (EPA2)	Depressed	3.4 to 5.5 V

OK → **REPLACE ECM**

ES

NG

4	CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A12 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Condition	Specified Condition
A12-6 (VCP1) - E5-26 (VCPA) A12-5 (VPA1) - E5-22 (VPA) A12-4 (VCP2) - E5-27 (VCP2) A12-3 (EP1) - E5-28 (EPA) A12-2 (VPA2) - E5-23 (VPA2) A12-1 (EP2) - E5-29 (EPA2)	Below 1 Ω
A12-6 (VCP1) or E5-26 (VCPA) - Body ground A12-5 (VPA1) or E5-22 (VPA) - Body ground A12-4 (VCP2) or E5-27 (VCP2) - Body ground A12-3 (EP1) or E5-28 (EPA) - Body ground A12-2 (VPA2) or E5-23 (VPA2) - Body ground A12-1 (EP2) or E5-29 (EPA2) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5	READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (See page ES-28).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.

Result

Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output again	A
No DTC output	B

B → SYSTEM OK

A

REPLACE ECM

DTC	P2121	Throttle / Pedal Position Sensor / Switch "D" Circuit Range / Performance

HINT:
This is the repair procedure for the "accelerator pedal position sensor".

DESCRIPTION

Refer to DTC P2120 (See page ES-258).

DTC No.	DTC Detection Condition	Trouble Area
P2121	Conditions (a) and (b) continue for 0.5 sec.: (a) Difference between VPA and VPA2 deviates from standard (b) IDL is OFF	• Open or short in accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM

ES

FAIL-SAFE

The accelerator pedal position sensor has 2 (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the 2 sensor circuits and switches to fail-safe mode. In fail-safe mode, the functioning circuit is used to calculate the accelerator pedal opening angle to allow the vehicle to continue driving. If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal to be fully closed. In this case, the throttle valve will remain closed as if the engine is idling.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal condition.

MONITOR DESCRIPTION

The accelerator pedal position sensor is mounted on the accelerator pedal bracket. The accelerator pedal position sensor has 2 sensor elements / signal outputs: VPA1 and VPA2. VPA1 is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA1. When the difference between the voltage outputs of VPA1 and VPA2 deviates from the standard, the ECM concludes that the accelerator pedal position sensor has a malfunction. The ECM turns on the MIL and a DTC is set.

MONITOR STRATEGY

Related DTCs	P2121: APP sensor malfunction
Required sensors / components (Main)	APP sensor
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None
Ignition Switch	ON

TYPICAL MALFUNCTION THRESHOLDS

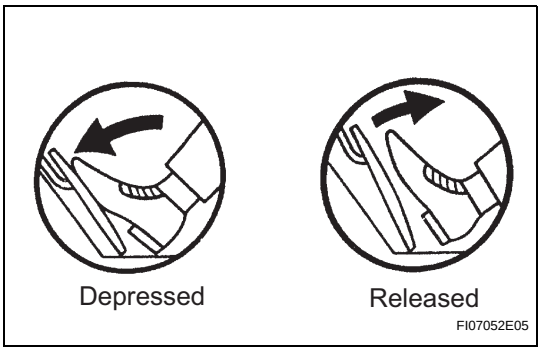
Difference between VPA1 and VPA2 voltages	Less than 0.4 V, or more than 1.2 V

WIRING DIAGRAM

Refer to DTC P2120 (See page ES-262).

HINT:
Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 READ VALUE OF INTELLIGENT TESTER (ACCEL POS #1 AND ACCEL POS #2)



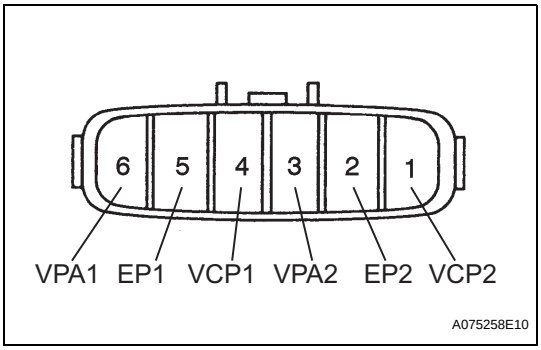
(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / ACCEL POS #1 and ACCEL POS #2. Read the values.
Standard voltage

Accelerator Pedal	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.3 V

OK → **REPLACE ECM**

NG

2 INSPECT ACCELERATOR PEDAL ROD ASSEMBLY (ACCELERATOR PEDAL POSITION SENSOR)



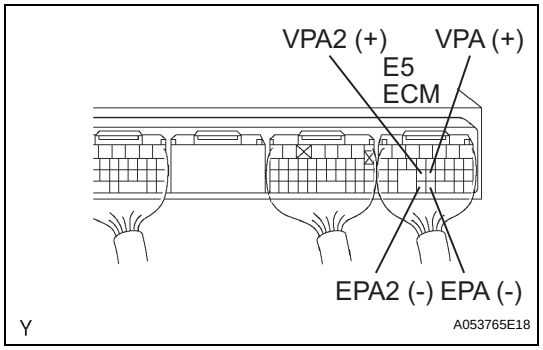
(a) Disconnect the A12 sensor connector.
(b) Measure the resistance of the sensor terminals.
Standard resistance

Tester Connection	Specified Condition
3 (VPA2) - 5 (EPA)	5.0 kΩ or less
6 (VPA1) - 2 (EPA2)	5.0 kΩ or less
4 (VCP1) - 5 (EPA)	2.25 to 4.75 kΩ
1 (VCP2) - 2 (EPA2)	2.25 to 4.75 kΩ

NG → **REPLACE ACCELERATOR PEDAL ROD ASSEMBLY**

OK

3 INSPECT ECM (VPA, VPA2 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard voltage

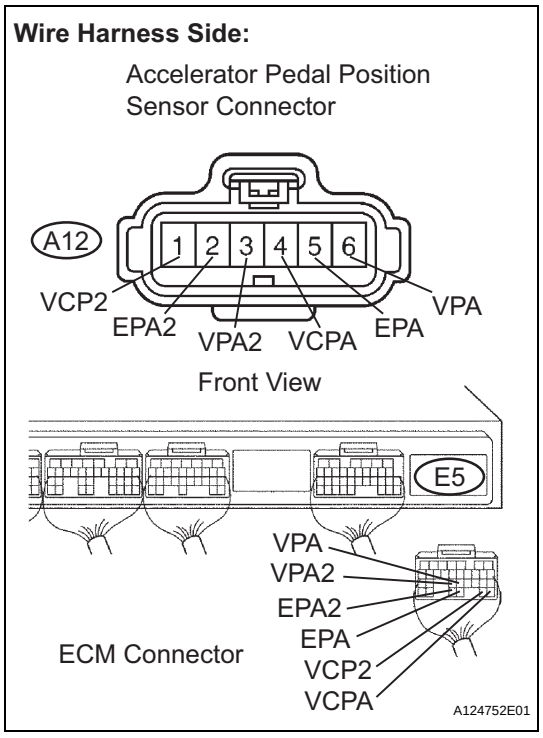
Tester Condition	Accelerator Pedal Condition	Specified Condition
E5-22 (VPA) - E5-28 (EPA)	Released	0.5 to 1.1 V
E5-22 (VPA) - E5-28 (EPA)	Depressed	2.6 to 4.5 V
E5-23 (VPA2) - E5-29 (EPA2)	Released	1.2 to 2.9 V
E5-23 (VPA2) - E5-29 (EPA2)	Depressed	3.4 to 5.5 V

ES

OK → **REPLACE ECM**

NG

4 CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A12 accelerator pedal position sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
A12-6 (VCP1) - E5-26 (VCPA) A12-5 (VPA1) - E5-22 (VPA) A12-4 (VCP2) - E5-27 (VCP2) A12-3 (EP1) - E5-28 (EPA) A12-2 (VPA2) - E5-23 (VPA2) A12-1 (EP2) - E5-29 (EPA2)	Below 1 Ω
A12-6 (VCP1) or E5-26 (VCPA) - Body ground A12-5 (VPA1) or E5-22 (VPA) - Body ground A12-4 (VCP2) or E5-27 (VCP2) - Body ground A12-3 (EP1) or E5-28 (EPA) - Body ground A12-2 (VPA2) or E5-23 (VPA2) - Body ground A12-1 (EP2) or E5-29 (EPA2) - Body ground	10 kΩ or higher

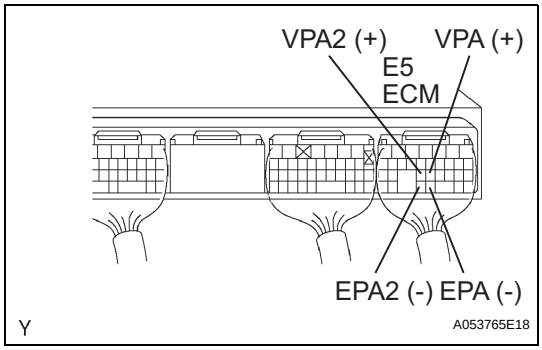
(d) Reconnect the accelerator sensor and ECM connectors.

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

OK

REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

1	INSPECT ECM (VPA, VPA2 VOLTAGE)



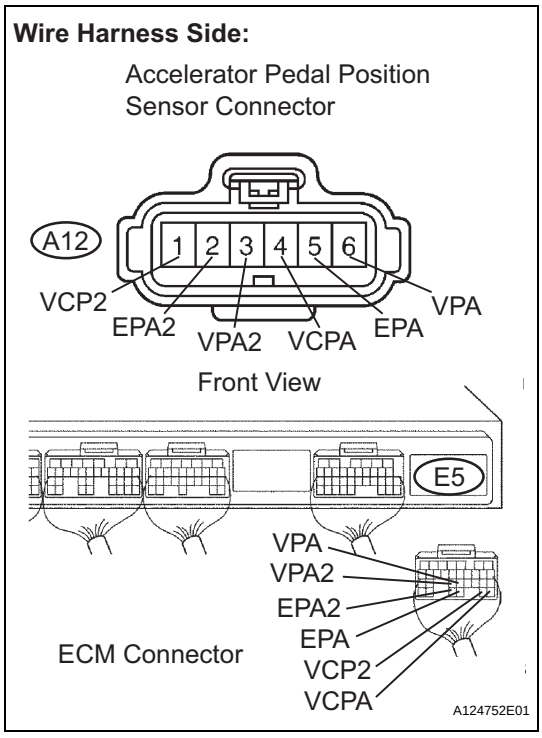
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connector.
Standard voltage

Tester Condition	Accelerator Pedal Condition	Specified Condition
E5-22 (VPA) - E5-28 (EPA)	Released	0.5 to 1.1 V
E5-22 (VPA) - E5-28 (EPA)	Depressed	2.6 to 4.5 V
E5-23 (VPA2) - E5-29 (EPA2)	Released	1.2 to 2.9 V
E5-23 (VPA2) - E5-29 (EPA2)	Depressed	3.4 to 5.5 V

OK → REPLACE ECM

NG

2	CHECK HARNESS AND CONNECTOR (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A12 accelerator pedal position sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
A12-6 (VCP1) - E5-26 (VCPA) A12-5 (VPA1) - E5-22 (VPA) A12-4 (VCP2) - E5-27 (VCP2) A12-3 (EP1) - E5-28 (EPA) A12-2 (VPA2) - E5-23 (VPA2) A12-1 (EP2) - E5-29 (EPA2)	Below 1 Ω
A12-6 (VCP1) or E5-26 (VCPA) - Body ground A12-5 (VPA1) or E5-22 (VPA) - Body ground A12-4 (VCP2) or E5-27 (VCP2) - Body ground A12-3 (EP1) or E5-28 (EPA) - Body ground A12-2 (VPA2) or E5-23 (VPA2) - Body ground A12-1 (EP2) or E5-29 (EPA2) - Body ground	10 kΩ or higher

(d) Reconnect the accelerator pedal position sensor connector and ECM connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ACCELERATOR PEDAL ROD ASSEMBLY

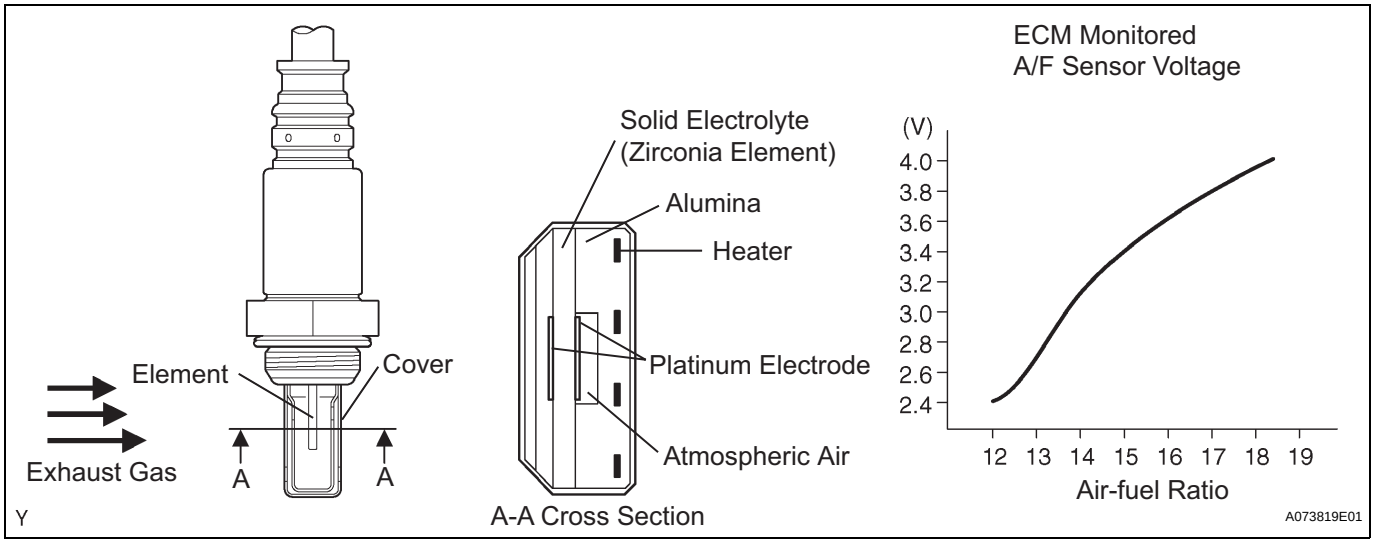
DTC	P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)
DTC	P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)
DTC	P2197	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 2 Sensor 1)
DTC	P2198	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 2 Sensor 1)

ES

HINT:
Although the title (DTC description) says "oxygen sensor", this DTC is related to the "A/F sensor".

DESCRIPTION

The Air-Fuel ratio sensor provides output voltage* approximately equal to the existing air-fuel ratio. The A/F sensor output voltage is used to provide feedback for the ECM to control the air-fuel ratio.
With the A/F sensor output, the ECM can determine deviation from the stoichiometric air-fuel ratio and control proper injection time. If the A/F sensor is malfunctioning, the ECM is unable to accurately control air-fuel ratio.
The A/F sensor is equipped with a heater which heats the zirconia element. The heater is also controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater to heat the sensor to facilitate detection of accurate oxygen concentration.
The A/F sensor is a planar type. Compared to a conventional type, the sensor and heater portions are narrower. Because the heat of the heater is conducted through the alumina to zirconia (of the sensor portion), sensor activation is accelerated.
To obtain a high purification rate of the CO, HC and NOx components of the exhaust gas, a three-way catalytic converter is used. The converter is most efficient when the air-fuel ratio is maintained near the stoichiometric air-fuel ratio.
*: The voltage value changes on the inside of the ECM only.



DTC No.	DTC Detection Condition	Trouble Area
P2195 P2197	• Conditions (a) and (b) continue for 2 sec. or more (a) A/F sensor voltage is more than 3.8 V (b) Rear oxygen sensor voltage is 0.15 V or more • A/F sensor current 3.6 mA or more	• Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • Air induction system • Fuel pressure • Injector • PCV hose connection • ECM
P2196 P2198	• Conditions (a) and (b) continue for 2 sec. or more: (a) A/F sensor voltage is less than 2.8 V (b) Rear oxygen sensor voltage is less than 0.85 V • A/F sensor current less than 1.57 mA	• Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • Air induction system • Fuel pressure • Injector • PCV hose connection • ECM

ES

HINT:
- DTCs P2195 and P2196 indicate a malfunction related to bank 1 of the A/F sensor circuit.
- DTCs P2197 and P2198 indicate a malfunction related to bank 2 of the A/F sensor circuit.
- Bank 1 is the bank that includes cylinder No. 1.
- Bank 2 is the bank that includes cylinder No. 2.
- Sensor 1 is the sensor closest to the engine assembly.
- After confirming DTCs P2195, P2196, P2197 or P2198, use the intelligent tester or the OBD II scan tool to confirm A/F sensor output voltage (AFS B1S1 / AFS B2S1) from the ALL menu (to reach the ALL menu: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL).
- The A/F sensor's output voltage and the short-term fuel trim value can be read using the OBD II scan tool or the intelligent tester.
- The ECM controls the voltage of the A1A+, A2A+, A1A- and A2A- terminals of the ECM to a fixed voltage. Therefore, it is impossible to confirm the A/F sensor output voltage without the OBD II scan tool or the intelligent tester.
- The OBD II scan tool (excluding intelligent tester) displays one fifth of the A/F sensor output voltage which is displayed on the intelligent tester.

MONITOR DESCRIPTION

Under the air-fuel ratio feedback control, if the voltage output of the A/F sensor indicates RICH or LEAN for more than a certain period of time, the ECM concludes that there is a fault in the A/F sensor system. The ECM will turn on the MIL and a DTC will be set.
Example:
If the A/F sensor voltage output is less than 2.8 V (very RICH) for 10 seconds even though voltage output of the heated oxygen sensor output voltage is less than 0.6 V, the ECM sets DTC P2196 or DTC P2198. If the heated oxygen sensor output voltage is 0.15 V or more but the A/F sensor voltage output is more than 3.8 V (very LEAN) for 10 seconds, DTC P2195 or DTC P2197 is set.

MONITOR STRATEGY

Related DTCs	P2195: A/F Sensor (Bank 1) voltage detection monitor (lean side malfunction) P2195: A/F Sensor (Bank 1) high current P2196: A/F Sensor (Bank 1) voltage detection monitor (rich side malfunction) P2196: A/F Sensor (Bank 1) low current P2197: A/F Sensor (Bank 2) voltage detection monitor (lean side malfunction) P2197: A/F Sensor (Bank 2) high current P2198: A/F Sensor (Bank 2) voltage detection monitor (rich side malfunction) P2198: A/F Sensor (Bank 2) low current
Required sensors / components (Main)	A/F sensor
Required sensors / components (Related)	Rear HO2S
Frequency of operation	Continuous
Duration	10 seconds: A/F sensor voltage detection monitor (Lean/Rich side malfunction) 3 seconds: A/F sensor high/low current
MIL operation	2 driving cycles
Sequence operation	None

ES

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	P0031, P0032, P0051, P0052 (A/F sensor heater sensor 1), P0037, P0038, P0057, P0058 (O2 sensor heater sensor 2), P0100, P0101, P0102, P0103 (MAF sensor), P0110, P0112, P0113 (IAT sensor), P0115, P0116, P0117, P0118 (ECT sensor), P0120, P0122, P0123, P0220, P0222, P0223, P2135 (TP sensor), P0125 (Insufficient ECT for closed loop), P0136, P0156 (O2 sensor 2), P0171, P0172, P0174, P0175 (Fuel system), P0300, P0301, P0302, P0303, P0304, P0305, P0306, (Misfire), P0335 (CKP sensor), P0340, P0341 (CMP sensor), P0341 (CMP sensor), P0500 (VSS), P0511 (IAC valve), P0510 (Idle switch)

Sensor voltage detection monitor (Lean side malfunction P2195, P2197):

Duration while all of the following conditions are met	2 seconds or more
Rear HO2S voltage	0.15 V or more
Time after engine start	30 seconds or more
A/F sensor status	Activated
Fuel system status	Closed-loop
Engine	Running

Sensor voltage detection monitor (Rich side malfunction P2196, P2198):

Duration while all of the following conditions are met	2 seconds or more
Rear HO2S voltage	Below 0.6 V
Time after engine start	30 seconds or more
A/F sensor status	Activated
Fuel system status	Closed-loop
Engine	Running

Sensor current high/low current (P2195, P2196, P2197 and P2198):

Battery voltage	11 V or more
Atmospheric pressure	22.5 kPa (570 mmHg) or more
A/F sensor status	Activated
Continuous time of fuel cut	3 to 10 seconds
ECT	75°C (167°F) or more

TYPICAL MALFUNCTION THRESHOLDS

Sensor voltage detection monitor (Lean side malfunction P2195, P2197):

A/F sensor voltage	More than 3.8 V

Sensor voltage detection monitor (Rich side malfunction P2196, P2198):

A/F sensor voltage	Less than 2.8 V

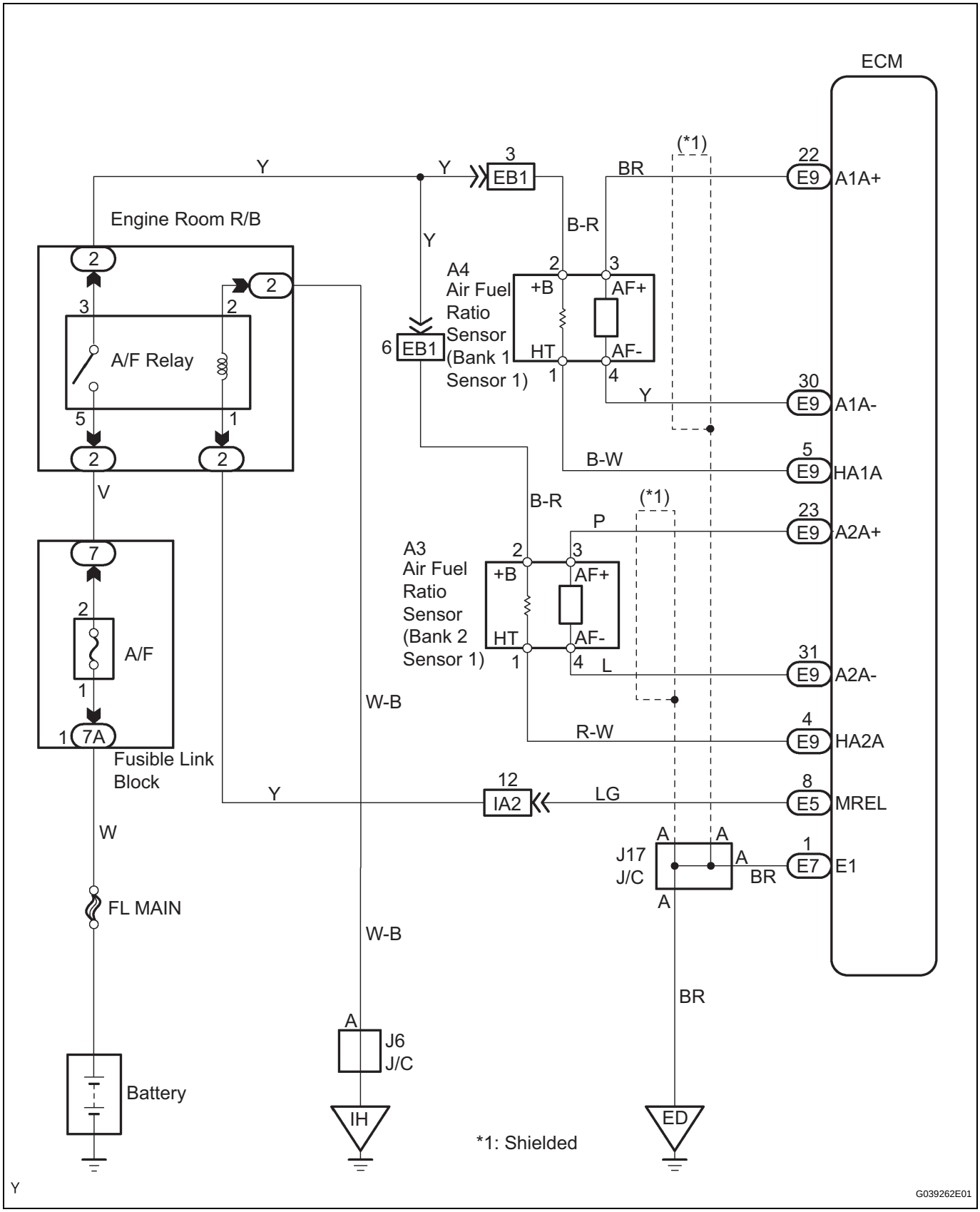
Sensor high current (P2195, P2197):

A/F sensor current	3.6 mA or more

Sensor low current (P2196, P2198):

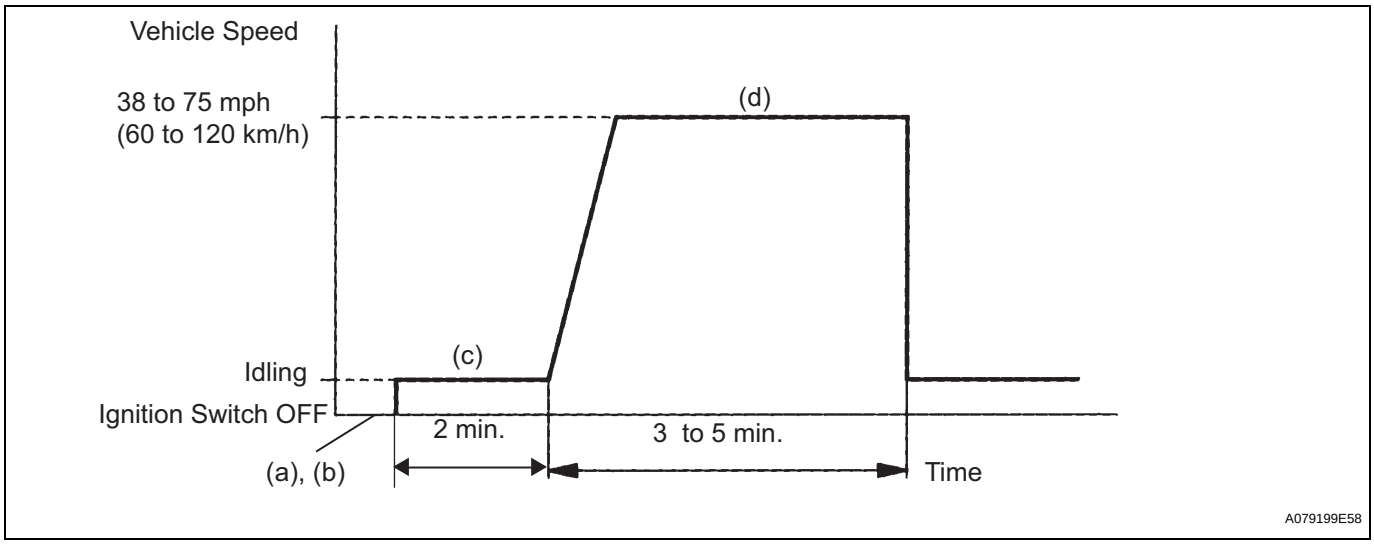
A/F sensor current	Less than 1.57 mA

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Connect the intelligent tester to the DLC3 Step (a).



(b) Switch the intelligent tester from the normal mode to the check mode (See page ES-29) Step (b).
(c) Start the engine and warm it up with all the accessory switches OFF Step (c).
(d) Drive the vehicle at 38 to 75 mph (60 to 120 km/h) and engine speed at 1,400 to 3,200 rpm for 3 to 5 minutes Step (d).
HINT:
If a malfunction exists, the MIL will be illuminated during step (d).
NOTICE:
If the conditions in this test are not strictly followed, detection of a malfunction will not occur. If you do not have a intelligent tester, turn the ignition switch OFF after performing steps (c) and (d), then perform steps (c) and (d) again.

HINT:
Intelligent tester only:
It is possible the malfunctioning area can be found using the ACTIVE TEST A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other potential trouble areas are malfunctioning or not.

1. Perform the ACTIVE TEST A/F CONTROL operation.

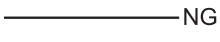
HINT:
The A/F CONTROL operation lowers the injection volume 12.5 % or increases the injection volume 25%.

(a) Connect the intelligent tester to the DLC3 on the vehicle Step (a).
(b) Turn the ignition switch ON Step (b).
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds Step (c).
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL Step (d).
(e) Perform the A/F CONTROL operation with the engine idle (press the right or left button) Step (e).

Result:

A/F sensor reacts in accordance with increase and decrease of injection volume:
+25 % → RICH output: Less than 3.0 V
-12.5 % → LEAN output: More than 3.35 V
Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:
+25 % → RICH output: More than 0.55 V
-12.5 % → LEAN output: Less than 0.4 V

NOTICE:
The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

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 %		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

The following A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the A/F sensor and the heated oxygen sensor.
For displaying the graph, enter "ACTIVE TEST / A/F CONTROL / USER DATA", select "AFS B1S1 and O2S B1S2" by pressing "YES" and push "ENTER". Then press "F4".
HINT:

- If DTC P2195 or P2196 is displayed, check bank 1 sensor 1 circuit.
- If DTC P2197 or P2198 is displayed, check bank 2 sensor 1 circuit.
- A low A/F sensor voltage could be caused by a RICH air-fuel mixture. Check for conditions that would cause the engine to run with a RICH air-fuel mixture.
- A high A/F sensor voltage could be caused by a LEAN air-fuel mixture. Check for conditions that would cause the engine to run with a LEAN air-fuel mixture.
- Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO A/F SENSOR DTC)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.

Result

Display	Proceed to
A/F sensor circuit DTC are output	A
A/F sensor circuit DTC and other codes are output	B

HINT:
If any other DTCs besides A/F sensor DTC are output, perform the troubleshooting for those DTCs first.

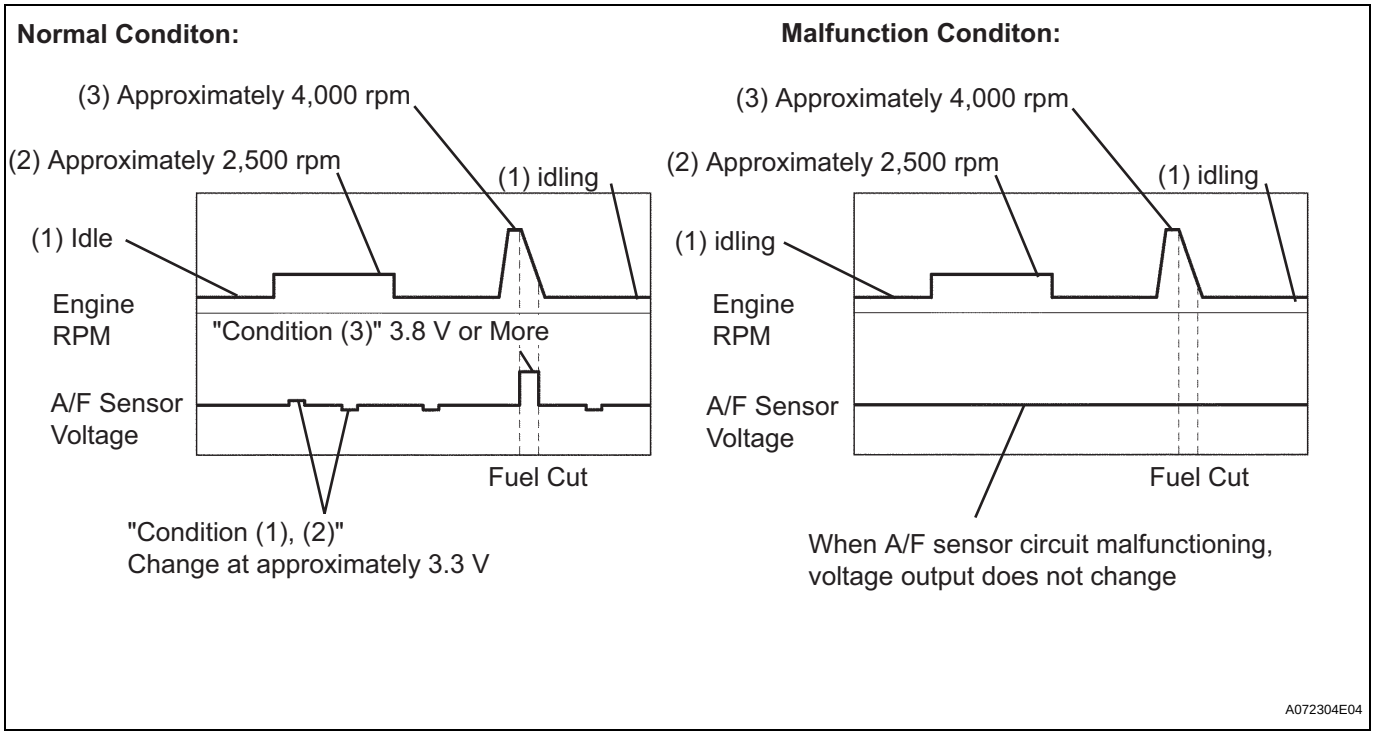
B → **GO TO RELEVANT DTC CHART**

A

ES

2 READ VALUE OF INTELLIGENT TESTER OR OBD II SCAN TOOL (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester or the OBD II scan tool to the DLC 3.
(b) Warm up the A/F sensor (bank 1, 2 sensor 1) by running the engine at 2,500 rpm for approximately 90 seconds.
(c) Read A/F sensor voltage output on the intelligent tester or the OBD II scan tool.
(d) Hand-held tester only:
On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / SNAPSHOT / MANUAL SNAPSHOT / USER DATA. Read the values.
(e) Select "AFS B1 S1 or AFS B2 S1 / ENGINE SPD" and press YES.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage output under the following conditions:
    (1) Allow the engine to idle for 30 seconds (1).
    (2) Run the engine at approximately 2,500 rpm. Do not suddenly change the rpm (2).
    (3) Raise the engine to 4,000 rpm and quickly release the accelerator pedal so that the throttle is fully closed (3).



Standard:

Condition (1) and (2)
Voltage change of 3.3 V (0.66 V)* (between approximately 3.1 to 3.5 V) as shown in the illustration.
Condition (3)
A/F sensor voltage increases to 3.8 V (0.76 V)* or more during engine deceleration when fuel is cut as shown in the illustration.

*: Voltage when using the OBD II scan tool.

HINT:

- Whenever the A/F sensor output voltage remains at approximately 3.3 V (0.660 V)* (see "Malfunction Condition" graphic) under any condition as well as the above conditions, the A/F sensor may have an open circuit. This will happen also when the A/F sensor heater has an open circuit.
- Whenever the A/F sensor output voltage remains at a certain value of approximately 3.8 V (0.76 V)* or more, or 2.8 V (0.56 V)* or less (see "Malfunction Condition" graphic) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel is cut) during engine deceleration. This will cause a LEAN condition and should result in a momentary increase in A/F sensor output voltage.

ES

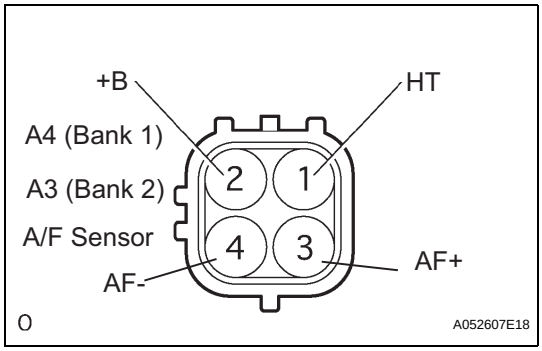
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal has been disconnected, the vehicle must be driven over 10 mph to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V (0.76 V)* during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, and therefore the current is converted into voltage inside the ECM. If measuring voltage at connectors of A/F sensor or ECM, you will observe a constant voltage.

*: Voltage when using the OBD II scan tool.

OK → **Go to step 13**

NG

3 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



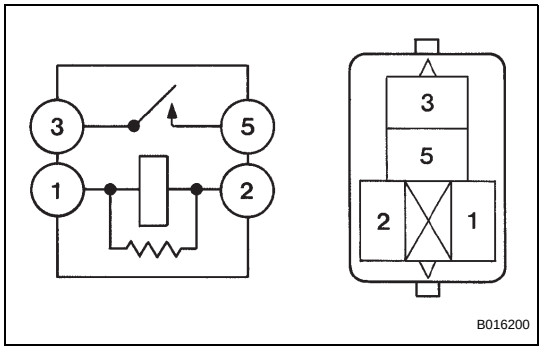
(a) Disconnect the A4 or A3 A/F sensor connector.
(b) Measure the resistance of the A/F sensor terminals.
Standard resistance

Tester Connection	Condition	Specified Condition
1 (HT) - 2 (+B)	20°C (68°F)	1.8 to 3.2 Ω
1 (HT) - 4 (AF-)	-	10 kΩ or higher

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

4 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the engine room R/B.
(b) Measure the resistance of the A/F relay.
Standard resistance

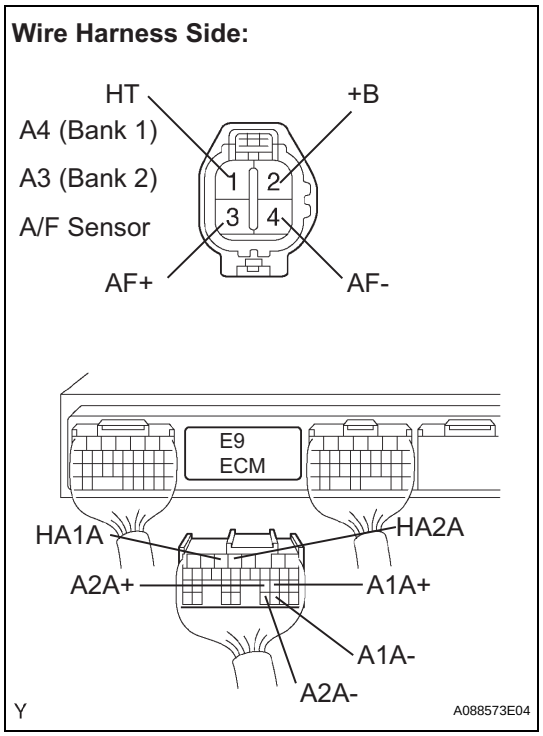
Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

(c) Install the A/F relay.

NG → **REPLACE AIR FUEL RATIO SENSOR RELAY**

OK

5 CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)



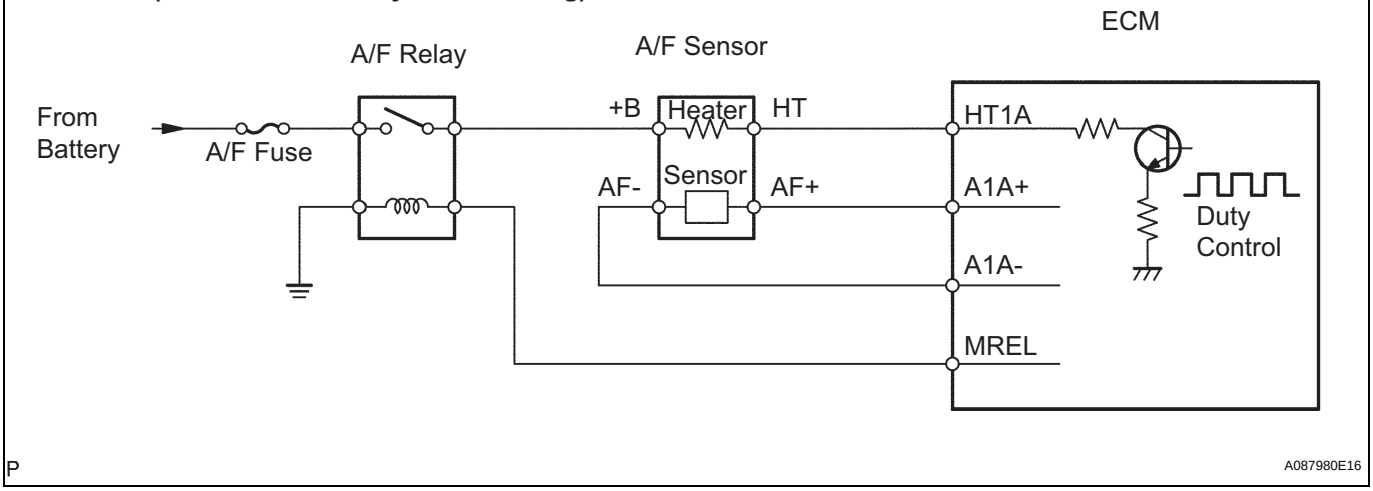
(a) Disconnect the A3 or A4 A/F sensor connector.
(b) Disconnect the E9 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A4-3 (AF+) - E9-22 (A1A+) A4-4 (AF-) - E9-30 (A1A-) A4-1 (HT) - E9-5 (HA1A) A3-3 (AF+) - E9-23 (A2A+) A3-4 (AF-) - E9-31 (A2A-) A3-1 (HT) - E9-4 (HA2A)	Below 1 Ω
A4-3 (AF+) or E9-22 (A1A+) - Body ground A4-4 (AF-) or E9-30 (A1A-) - Body ground A4-1 (HT) or E9-5 (HA1A) - Body ground A3-3 (AF+) or E9-23 (A2A+) - Body ground A3-4 (AF-) or E9-31 (A2A-) - Body ground A3-1 (HT) or E9-4 (HA2A) - Body ground	10 kΩ or higher

ES

Reference (Bank 1 Sensor 1 System Drawing)



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

OK

6 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in air induction system.

OK:

No leak in air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7 CHECK FUEL PRESSURE

(a) Check fuel pressure (See page FU-3).
Standard:
Fuel pressure:
304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2}, 44 to 50 psi).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8 INSPECT FUEL INJECTOR ASSEMBLY

(a) Check injector injection (See page FU-13).
Standard

Injection Volume	Difference between Each Injector
60 to 73 cm^3(3.7 to 4.5 cu in.) per 15 seconds	13 cm^3(0.8 cu in.) or less

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

9 REPLACE AIR FUEL RATIO SENSOR

NEXT

10 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

11 READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
A/F sensor circuit DTC are not output	A
A/F sensor circuit DTC are output	B

B → REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN

A

12 CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

OK:
Vehicle has run out of fuel in past.

NG → CHECK FOR INTERMITTENT PROBLEMS

OK

DTC CAUSED BY RUNNING OUT OF FUEL

13 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

14 READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
A/F sensor circuit DTC are output	A
A/F sensor circuit DTC are not output	B

B → Go to step 18

A

15 REPLACE AIR FUEL RATIO SENSOR

NEXT

16 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

NEXT

17	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
A/F sensor circuit DTC are not output	A
A/F sensor circuit DTC are output	B

B → REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN

ES

A

18	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

OK:
Vehicle has run out of fuel in past.

NG → CHECK FOR INTERMITTENT PROBLEMS

OK

DTC CAUSED BY RUNNING OUT OF FUEL

DTC	P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)
DTC	P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)
DTC	P2241	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 2 Sensor 1)
DTC	P2242	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 2 Sensor 1)
DTC	P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)
DTC	P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)
DTC	P2255	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 2 Sensor 1)
DTC	P2256	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 2 Sensor 1)

ES

HINT:
- Although the title (DTC description) says "oxygen sensor", this DTC is related to the "A/F sensor".
- DTCs P2237, P2238, P2239, P2251, P2252 and P2253 indicate the malfunction related to the bank 1 A/F sensor circuit.
- DTCs P2240, P2241, P2242, P2254, P2255 and P2256 indicate the malfunction related to the bank 2 A/F sensor circuit.

DESCRIPTION

Refer to DTC P2195 (See page ES-271).

DTC No.	DTC Detection Conditions	Trouble Areas
P2238 P2241	• Case 1: Condition (a) or (b) continues for 5.0 seconds or more (1 trip detection logic): (a) AF+ voltage 0.5 V or less (b) Difference between AF+ and AF- terminal voltage: 0.1 V or less • Case 2: A/F sensor admittance: Less than 0.022 1/Ω (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • ECM

DTC No.	DTC Detection Conditions	Trouble Areas
P2239 P2242	AF+ voltage more than 4.5 V for 5.0 seconds or more (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • ECM
P2252 P2255	AF- voltage 0.5 V or less for 5.0 seconds or more (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • ECM
P2253 P2256	AF- voltage more than 4.5 V for 5.0 seconds or more (2 trip detection logic)	• Open or short in A/F sensor (sensor 1) circuit • A/F sensor (sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • ECM

ES

HINT:
- Bank 1 is the bank that includes cylinder No. 1.
- Bank 2 is the bank that includes cylinder No. 2.

MONITOR DESCRIPTION

The air-fuel ratio (A/F) sensor varies its voltage output in proportion to the air-fuel ratio. If impedance (alternating current resistance) or voltage output of the sensor deviates greatly from the standard, the ECM determines that an open or short is in the A/F sensor circuit.

MONITOR STRATEGY

Related DTCs	P2238: A/F sensor (Bank 1) open circuit between AF+ and AF- P2238: A/F sensor (Bank 1) short circuit between AF+ and AF- P2238: A/F sensor (Bank 1) short circuit between AF+ and GND P2239: A/F sensor (Bank 1) short circuit between AF+ and+B P2241: A/F sensor (Bank 2) open circuit between AF+ and AF- P2241: A/F sensor (Bank 2) short circuit between AF+ and AF- P2241: A/F sensor (Bank 2) short circuit between AF+ and GND P2242: A/F sensor (Bank 2) short circuit between AF+ and +B P2252: A/F sensor (Bank 1) short circuit between AF- and GND P2253: A/F sensor (Bank 1) short circuit between AF- and +B P2253: A/F sensor (Bank 2) short circuit between AF- and GND P2256: A/F sensor (Bank 2) short circuit between AF- and +B
Required sensors / components (Main)	A/F sensor
Required sensors / components (Related)	ECT sensor, Crankshaft position sensor
Frequency of operation	Once per driving cycle
Duration	10 seconds: A/F sensor open circuit between AF+ and AF- P2238, P2241 5 seconds: Others
MIL operation	2 driving cycles
Sequence operation	None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	None

P2238, P2241 (open circuit between AF+ and AF-):

Duration while all of the following conditions are met:	10 seconds or more
AF+ terminal voltage	0.5 to 4.5 V

AF- terminal voltage	0.5 to 4.5 V
Difference between AF+ terminal and AF- terminal voltage	0.1 to 0.8 V
ECT	5°C (41°F) or more
Engine condition	Running
Fuel-cut	OFF
Time after fuel-cut OFF	5 seconds or more
A/F sensor heater	ON
Time after A/F sensor heating	20 seconds or more
Battery voltage	11 V or more
Ignition switch	ON
Time after ignition switch is OFF to ON	5 seconds or more

Others:

Battery voltage	10.5 V or more
Ignition switch	ON (5 seconds or more)

ES

TYPICAL MALFUNCTION THRESHOLDS

P2238, P2241 (Open circuit between AF+ and AF-):

A/F sensor admittance	Below 0.022 1/ohm

P2238, P2241 (Short circuit between AF+ and GND):

AF+ terminal voltage	0.5 V or less

P2238, P2241 (Short circuit between AF+ and AF-):

Difference between AF+ and AF- terminal voltages	0.1 V or less

P2239, P2242 (Short circuit between AF+ and +B):

AF+ terminal voltage	More than 4.5 V

P2252, P2255 (Short circuit between AF- and GND):

AF- terminal voltage	0.5 V or less

P2253, P2256 (Short circuit between AF- and +B):

AF- terminal voltage	More than 4.5 V

WIRING DIAGRAM

Refer to DTC P2195 (See page ES-275).

HINT:
Intelligent tester only:
The malfunctioning area can be found by the ACTIVE TEST A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other suspected areas are malfunctioning or not.

1. **Perform the ACTIVE TEST A/F CONTROL operation.**
   HINT:
   The A/F CONTROL operation lowers the injection volume by 12.5% or increases the injection volume by 25%.
   (a) Connect the intelligent tester to the DLC3 on the vehicle.
   (b) Turn the ignition switch ON.
   (c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
   (d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.

(e) Perform the A/F CONTROL operation with the engine idling (press the right or left button).

Result:

A/F sensor reacts in accordance with increase and decrease of injection volume:

+25 % → RICH output: Less than 3.0 V

-12.5 % → LEAN output: More than 3.35 V

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:

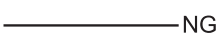
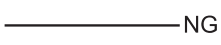
+25 % → RICH output: More than 0.55 V

-12.5 % → LEAN output: Less than 0.4 V

NOTICE:

The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

ES

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 %		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

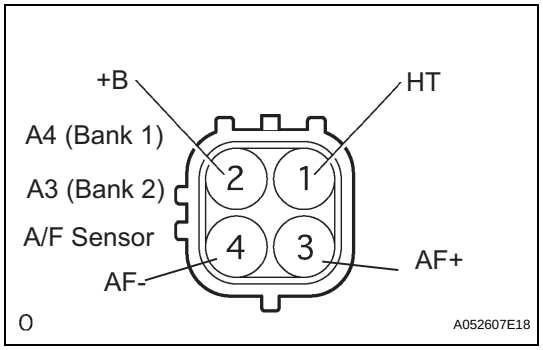
The following A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the A/F sensor and the heated oxygen sensor.

For displaying the graph, enter "ACTIVE TEST / A/F CONTROL / USER DATA", select "AFS B1S1 and O2S B1S2" by pressing "YES" and push "ENTER". Then press "F4".

HINT:

- If DTC P2237, P2238, P2239, P2251, P2252 or P2253 is displayed, check the bank 1 sensor1 circuit.
- If DTC P2240, P2241, P2242, P2254, P2255 or P2256 is displayed, check the bank 2 sensor 1 circuit.
- Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



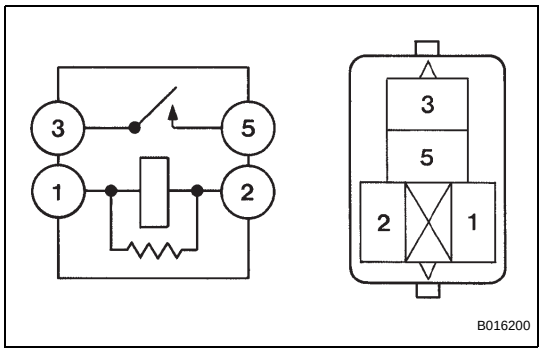
(a) Disconnect the A4 or A3 A/F sensor connector.
(b) Measure the resistance of the A/F sensor terminals.
Standard resistance

Tester Connection	Condition	Specified Condition
1 (HT) - 4 (AF-)	-	10 kΩ or higher
1 (HT) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω

NG → **REPLACE AIR FUEL RATIO SENSOR**

OK

2 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the engine room R/B.
(b) Measure the resistance of the A/F relay.
Standard resistance

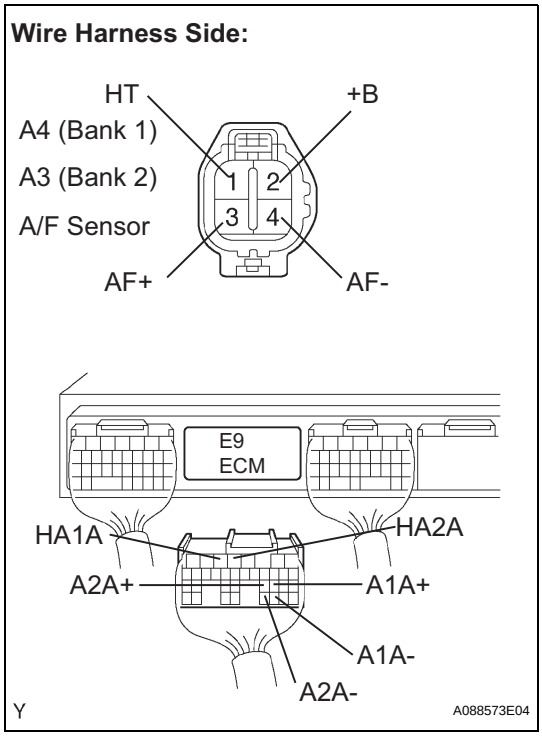
Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE AIR FUEL RATIO SENSOR RELAY**

OK

ES

3	CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)

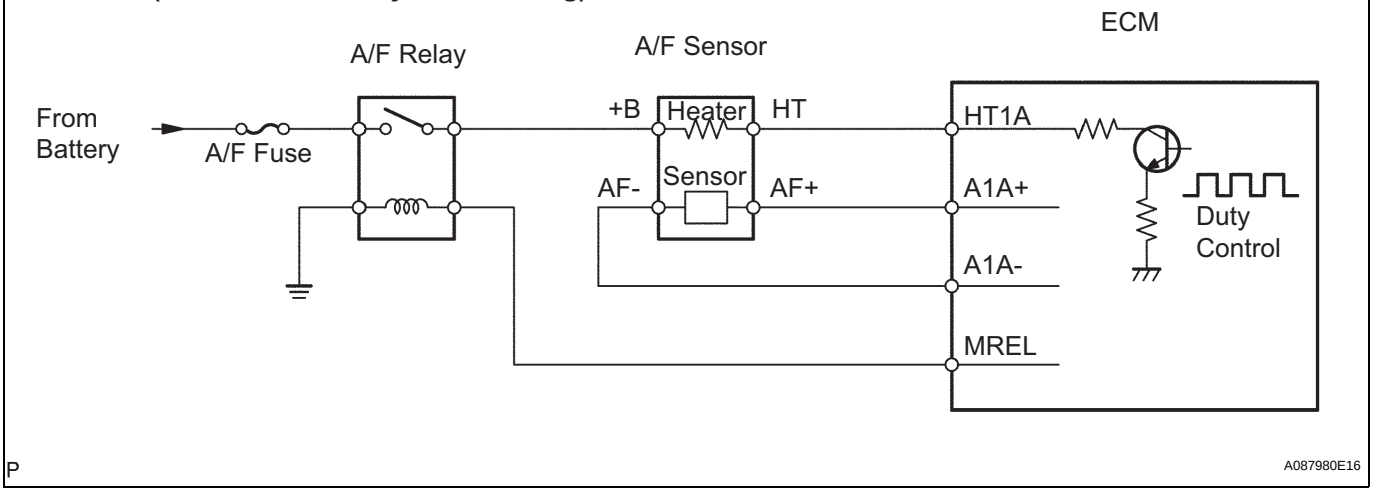


(a) Disconnect the A3 or A4 A/F sensor connector.
(b) Disconnect the E9 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A4-3 (AF+) - E9-22 (A1A+) A4-4 (AF-) - E9-30 (A1A-) A4-1 (HT) - E9-5 (HA1A) A3-3 (AF+) - E9-23 (A2A+) A3-4 (AF-) - E9-31 (A2A-) A3-1 (HT) - E9-4 (HA2A)	Below 1 Ω
A4-3 (AF+) or E9-22 (A1A+) - Body ground A4-4 (AF-) or E9-30 (A1A-) - Body ground A4-1 (HT) or E9-5 (HA1A) - Body ground A3-3 (AF+) or E9-23 (A2A+) - Body ground A3-4 (AF-) or E9-31 (A2A-) - Body ground A3-1 (HT) or E9-4 (HA2A) - Body ground	10 kΩ or higher

Reference (Bank 1 Sensor 1 System Drawing)



(d) Reconnect the A/F sensor connector and ECM connector.

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

OK

REPLACE ECM

DTC	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)

DTC	P2A03	A/F Sensor Circuit Slow Response (Bank 2 Sensor 1)

HINT:
- DTC P2A00 is a malfunction related to the bank 1 A/F sensor.
- DTC P2A03 is a malfunction related to the bank 2 A/F sensor.

DESCRIPTION

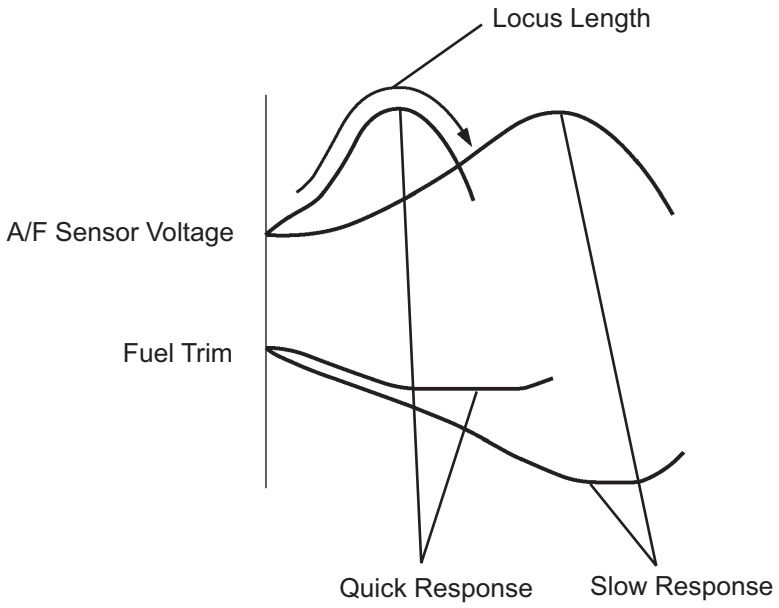
Refer to DTC P2195 (See page ES-271).

DTC No.	DTC Detecting Condition	Trouble Area
P2A00 P2A03	In conditions (a), (b), and (c), when A/F sensor output voltage change is below expected level compared to fuel trim change, ECM judges that A/F sensor circuit has slow response: (2 trip detection logic) (a) After engine is warmed up (b) During vehicle driving with engine speed 1,400 rpm or more (c) Vehicle speed 25 mph (40 km/h) or more	• Open or short in A/F sensor (bank 1, 2 sensor 1) circuit • A/F sensor (bank 1, 2 sensor 1) • A/F sensor heater • A/F relay • Open or short in A/F sensor heater and relay circuits • Air induction system • Fuel pressure • Injector • PCV hose connection • ECM

HINT:
- Bank 1 is the bank that includes cylinder No. 1.
- Bank 2 is the bank that includes cylinder No. 2.
- Sensor 1 is the sensor closest to the engine assembly.

MONITOR DESCRIPTION

The air fuel ratio (A/F) sensor varies its output voltage in proportion to the air-fuel ratio. Based on the output voltage, the ECM determines if the air-fuel ratio is RICH or LEAN and adjusts the stoichiometric air-fuel ratio. The ECM also checks the fuel injection volume compensation value to check if the A/F sensor is deteriorating or not. The output voltage variation, known as locus length, should be high when the air-fuel ratio fluctuates. When the A/F sensor response rate has deteriorated, the locus length should be short. The ECM concludes that there is a malfunction in the ratio of the A/F sensor when the locus length is short and the response rate has deteriorated.



MONITOR STRATEGY

Related DTCs	P2A00: A/F sensor (Bank 1) Slow Response P2A03: A/F sensor (Bank 2) Slow Response
Required sensors / components (Main)	A/F sensor
Required sensors / components (Related)	Vehicle speed sensor, Crankshaft position sensor
Frequency of operation	Once per driving cycle
Duration	60 seconds
MIL operation	2 driving cycles
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	P0031, P0032, P0051, P0052 (A/F sensor heater sensor 1), P0100, P0101, P0102, P0103 (MAF sensor), P0110, P0112, P0113 (IAT sensor), P0120, P0122, P0123, P0220, P0222, P0223, P2135 (TP sensor), P0125 (Insufficient ECT for closed loop), P0171, P0172, P0174, P0175 (Fuel system), P0300, P0301, P0302, P0303, P0304, P0305, P0306 (Misfire), P0340, P0341 (CMP sensor), P0402 (EGR system (Open)), P0442, P0445, P0456 (EVAP system), P0500 (VSS), P2196, P2198 (A/F sensor (Rationality)).
Engine condition	Running
Time after engine start	120 seconds or more
Fuel system status	Closed Loop
A/F sensor status	Activated
Idle	OFF
Time after idle OFF	2 seconds or more
Engine RPM	1,400 to 3,200 rpm

Vehicle speed	37.5 to 75 mph (60 to 120 km/h)
Time after fuel cut is OFF	2 seconds or more
Driving for 20 seconds or more	Vehicle speed is 25 mph (40 km/h) or more and engine speed is 900 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Response rate deterioration level	6.0 or more

MONITOR RESULT

Refer to "Checking Monitor Status" for detailed information (See page ES-14).
The test value and test limit information are described as shown in the following table. Check the monitor result and test values after performing the monitor drive pattern (See page ES-16).

- TID (Test Identification Data) is assigned to each emissions-related component.
- TLT (Test Limit Type):
  If TLT is 0, the component is malfunctioning when the test value is higher than the test limit.
  If TLT is 1, the component is malfunctioning when the test value is lower than the test limit.
- CID (Component Identification Data) is assigned to each test value.
- Unit Conversion is used to calculate the test value indicated on generic OBD II scan tools.

TID $06: A/F sensor

TLT	CID	Unit Conversion	Description of Test Data	Description of Test Limit
0	$01	Multiply by 0.000244 (no dimension)	Parameter for identify A/F sensor response rate (Bank 1)	Malfunction threshold for A/F sensor deterioration
0	$11	Multiply by 0.000244 (no dimension)	Parameter for identify A/F sensor response rate (Bank 2)	Malfunction threshold for A/F sensor deterioration

WIRING DIAGRAM

Refer to DTC P2195 (See page ES-275).

HINT:
Intelligent tester only:
The malfunctioning area can be found by the ACTIVE TEST A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other suspected areas are malfunctioning or not.

1. Perform the ACTIVE TEST A/F CONTROL operation.

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

(a) Connect the intelligent tester to the DLC3 on the vehicle.
(b) Turn the ignition switch ON.
(c) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
(e) Perform the A/F CONTROL operation with the engine idling (press the right or left button).

Result:

A/F sensor reacts in accordance with increase and decrease of injection volume:
+25 % → RICH output: Less than 3.0 V
-12.5 % → LEAN output: More than 3.35 V

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:
+25 % → RICH output: More than 0.55 V
-12.5 % → LEAN output: Less than 0.4 V

NOTICE:
The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

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 %		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely lean or rich)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

ES

The following A/F CONTROL procedure enables the technician to check and graph the voltage outputs of both the A/F sensor and the heated oxygen sensor.
For displaying the graph, enter "ACTIVE TEST / A/F CONTROL / USER DATA", select "AFS B1S1 and O2S B1S2" by pressing "YES" and push "ENTER". Then press "F4".
HINT:

- DTC P2A00 or P2A03 may be also detected, when the air fuel ratio is stuck rich or lean.
- A low A/F sensor voltage could be caused by a RICH air-fuel mixture. Check for conditions that would cause the engine to run with a RICH air-fuel mixture.
- A high A/F sensor voltage could be caused by a LEAN air-fuel mixture. Check for conditions that would cause the engine to run with a LEAN air-fuel mixture.
- Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO A/F SENSOR DTC)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.

Result

Display	Proceed to
DTC P2A00 and/or P2A03 are output.	A
DTC P2A00 and/or P2A03 and other DTCs are output.	B

HINT:
If any other DTCs besides P2A00 and/or P2A03 are output, perform the troubleshooting for those DTCs first.

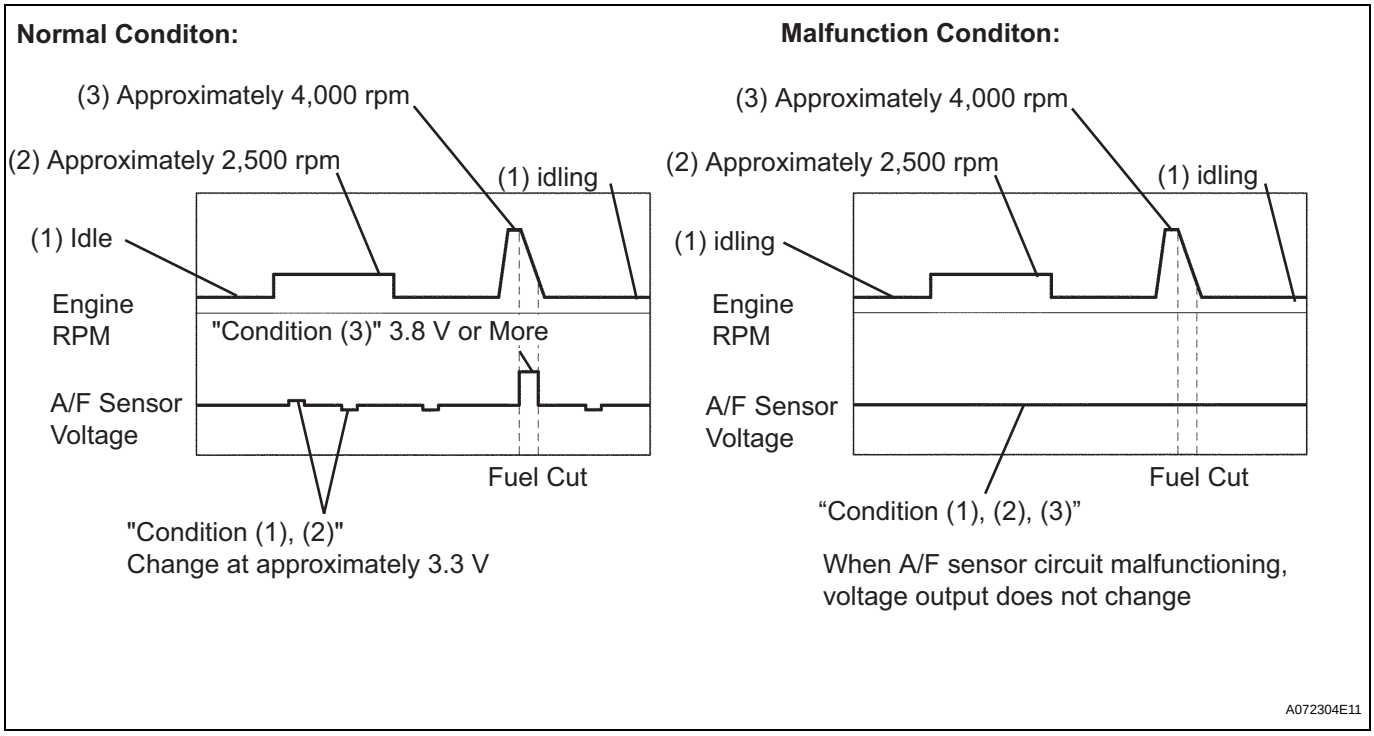
B → GO TO RELEVANT DTC CHART

A

ES

2 READ VALUE OF INTELLIGENT TESTER OR OBD II SCAN TOOL (OUTPUT VOLTAGE OF A/F SENSOR)

(a) Connect the intelligent tester or the OBD II scan tool to the DLC3.
(b) Warm up the A/F sensor (bank 1 sensor 1 and bank 2 sensor 1) by running the engine at 2,500 rpm for approximately 90 seconds.
(c) Read A/F sensor voltage output on the intelligent tester or the OBD II scan tool.
(d) Intelligent tester only:
On the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / SNAPSHOT / MANUAL SNAPSHOT / USER DATA. Read the values.
(e) Select "AFS B1 S1 or AFS B2 S1 / ENGINE SPD" and press YES.
(f) Monitor the A/F sensor voltage carefully.
(g) Check the A/F sensor voltage output under the following conditions:
    (1) Allow the engine to idle for 30 seconds (1).
    (2) Run the engine at approximately 2,500 rpm. Do not suddenly change the rpm (2).
    (3) Raise the engine speed to 4,000 rpm and quickly release the accelerator pedal so that the throttle is fully closed (3).



Standard:

Conditions (1) and (2)
Voltage change of 3.3 V (0.66 V)* (between approximately 3.1 to 3.5 V) as shown in the illustration.
Condition (3)
A/F sensor voltage increases to 3.8 V (0.76 V)* or more when fuel is cut during engine deceleration as shown in the illustration.

*: Voltage when using the OBD II scan tool.

HINT:

- Whenever the A/F sensor output voltage remains at approximately 3.3 V (0.660 V)* (see "Malfunction Condition" graphic) under any condition as well as the above conditions, the A/F sensor may have an open circuit. This will happen also when the A/F sensor heater has an open circuit.
- Whenever the A/F sensor output voltage remains at a certain value of approximately 3.8 V (0.76 V)* or more, or 2.8 V (0.56 V)* or less (see "Malfunction Condition" graphic) under any condition as well as the above conditions, the A/F sensor may have a short circuit.
- The ECM will stop fuel injection (fuel is cut) during engine deceleration. This will cause a LEAN condition and should result in a momentary increase in A/F sensor output voltage.

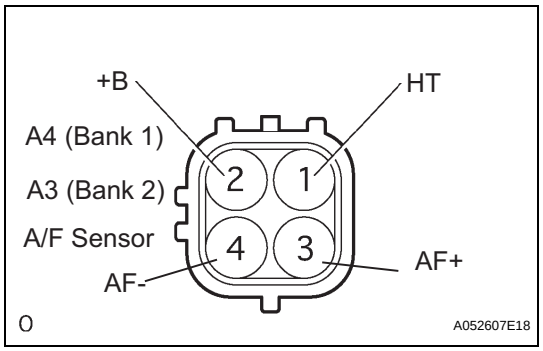
- The ECM must establish a closed throttle position learned value to perform fuel cut. If the battery terminal has been disconnected, the vehicle must be driven over 16 km/h (10 mph) to allow the ECM to learn the closed throttle position.
- When the vehicle is driven:
  The output voltage of the A/F sensor may be below 2.8 V (0.76 V)* during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The A/F sensor is functioning normally.
- The A/F sensor is a current output element, and therefore the current is converted into voltage inside the ECM. If measuring voltage at connectors of A/F sensor or ECM, you will observe a constant voltage.

*: Voltage when using the OBD II scan tool.

OK → Go to step 14

NG

3 INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



(a) Disconnect the A3 or A4 A/F sensor connector.
(b) Measure the resistance of the A/F sensor terminals.
Standard resistance

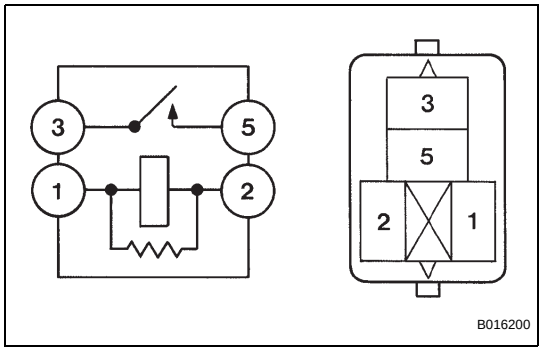
Tester Connection	Condition	Specified Condition
1 (HT) - 4 (AF-)	-	10 kΩ or higher
1 (HT) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω

(c) Reconnect the A/F sensor connector.

NG → REPLACE AIR FUEL RATIO SENSOR

OK

4 INSPECT AIR FUEL RATIO SENSOR RELAY



(a) Remove the A/F relay from the engine room R/B.
(b) Measure the resistance of the A/F relay.
Standard resistance

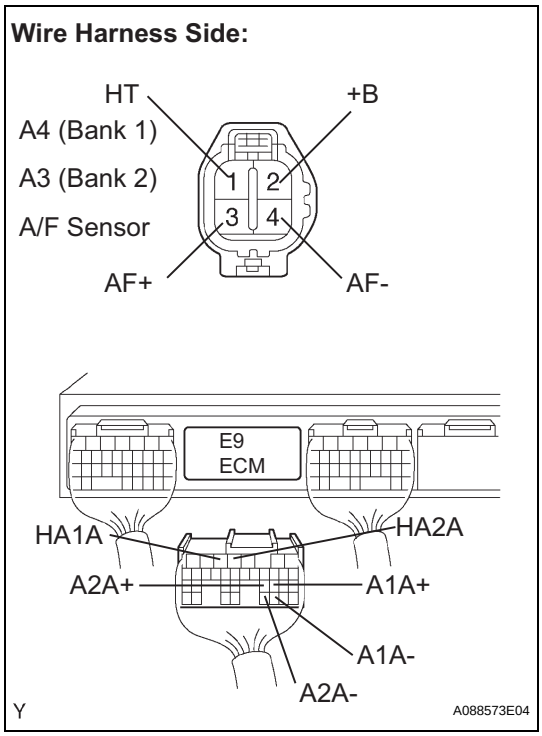
Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

(c) Reinstall the A/F relay.

NG → REPLACE AIR FUEL RATIO SENSOR RELAY

OK

5	CHECK HARNESS AND CONNECTOR (A/F SENSOR - ECM)

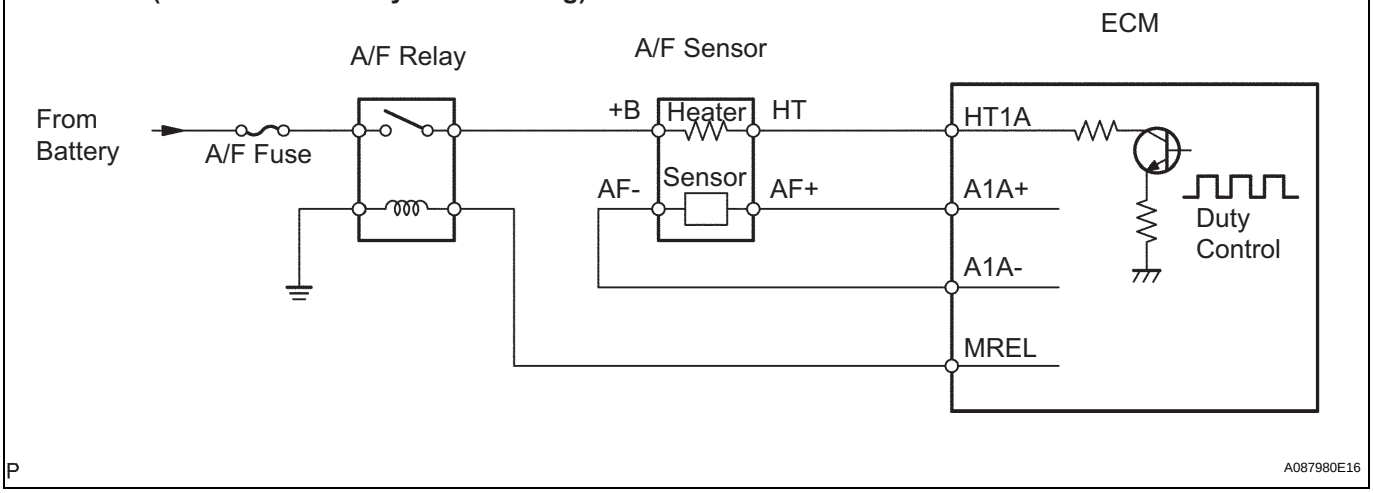


(a) Disconnect the A3 or A4 A/F sensor connector.
(b) Disconnect the E9 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
A4-3 (AF+) - E9-22 (A1A+) A4-4 (AF-) - E9-30 (A1A-) A4-1 (HT) - E9-5 (HA1A) A3-3 (AF+) - E9-23 (A2A+) A3-4 (AF-) - E9-31 (A2A-) A3-1 (HT) - E9-4 (HA2A)	Below 1 Ω
A4-3 (AF+) or E9-22 (A1A+) - Body ground A4-4 (AF-) or E9-30 (A1A-) - Body ground A4-1 (HT) or E9-5 (HA1A) - Body ground A3-3 (AF+) or E9-23 (A2A+) - Body ground A3-4 (AF-) or E9-31 (A2A-) - Body ground A3-1 (HT) or E9-4 (HA2A) - Body ground	10 kΩ or higher

Reference (Bank 1 Sensor 1 System Drawing)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

OK:

There is no leak in air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7 CHECK CONNECTION OF PCV HOSE

OK:
PCV hose is connected correctly. And PCV hose has no damage.

NG → REPAIR OR REPLACE PCV HOSE

OK

8 CHECK FUEL PRESSURE

(a) Check fuel pressure (See page FU-3).
Standard:
Fuel pressure: 304 to 343 kPA (3.1 to 3.5 kgf/cm^2, 44 to 55 psi).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

9 INSPECT FUEL INJECTOR ASSEMBLY

(a) Check injector injection (See page FU-13).
Standard

Injection Volume	Difference between Each Injector
60 to 73 cm^3(3.7 to 4.5 cu in.) per 15 seconds	13 cm^3(0.8 cu in.) or less

NG → REPLACE FUEL INJECTOR ASSEMBLY

OK

10 REPLACE AIR FUEL RATIO SENSOR

NEXT

11 PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

12	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
DTC P2A00 and/or P2A03 are not output	A
DTC P2A00 and/or P2A03 are output again	B

B → REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN

A

13	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC CAUSED BY RUNNING OUT OF FUEL

14	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

15	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
DTC P2A00 and/or P2A03 are not output	A
DTC P2A00 and/or P2A03 are output	B

B → Go to step 19

A

16	REPLACE AIR FUEL RATIO SENSOR

NEXT

17	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (See page ES-16).

NEXT

18	READ OUTPUT DTC (A/F SENSOR DTC OUTPUT AGAIN)

(a) Read the DTC using the intelligent tester or the OBD II scan tool.
Result

Display	Proceed to
DTC P2A00 and/or P2A03 are output	A
DTC P2A00 and/or P2A03 are not output	B

B → REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN

A

19	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

OK:
Vehicle has run out of fuel in past.

NG → CHECK FOR INTERMITTENT PROBLEMS

OK

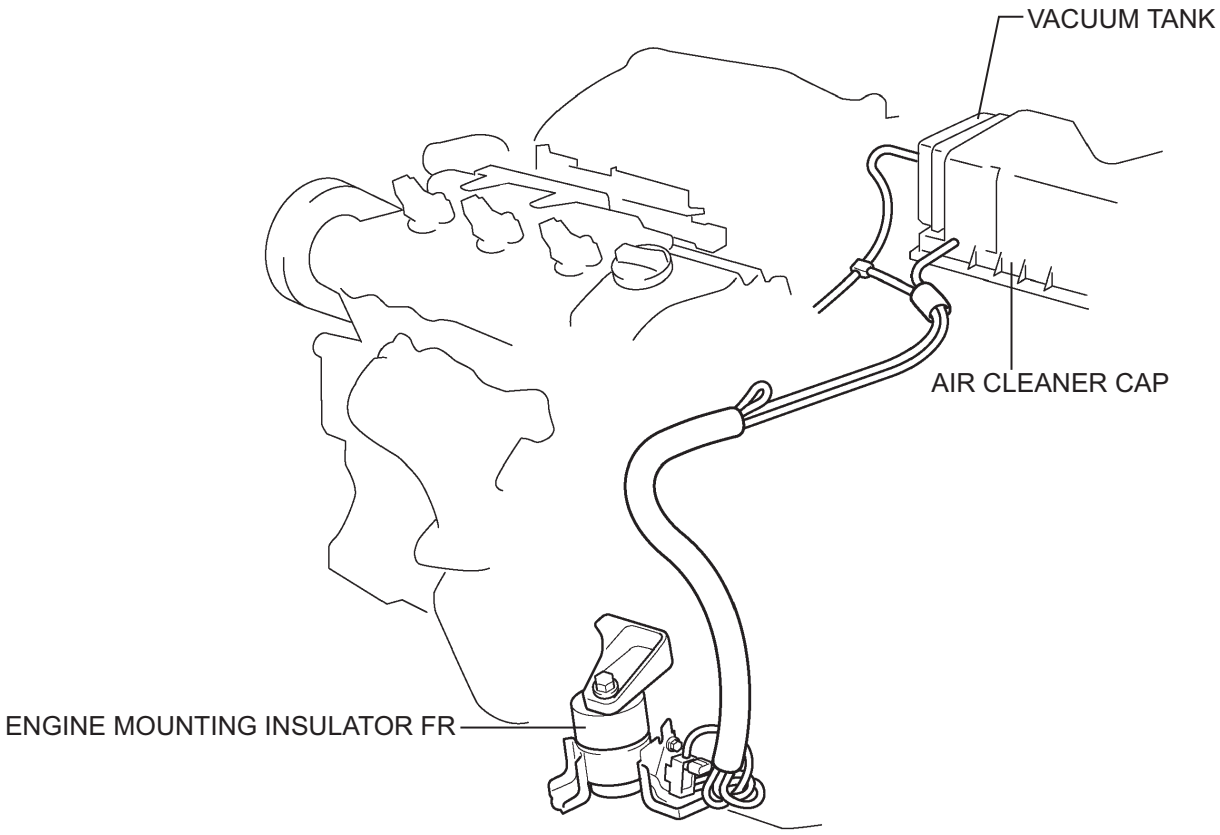
DTC CAUSED BY RUNNING OUT OF FUEL

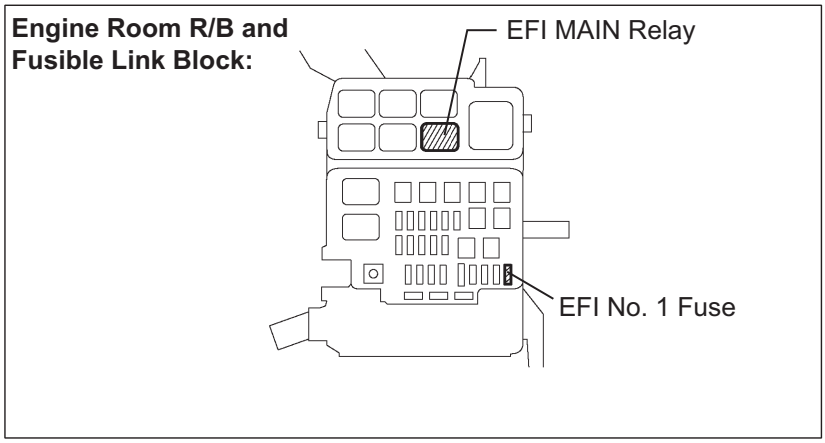
Active Control Engine Mount System

DESCRIPTION

The Active Control Engine Mount (ACM) system decreases engine vibration at low engine speed using the VSV for ACM. The VSV is controlled by a pulse signal transmitted to the VSV from the ECM. The frequency of this pulse signal is matched to the engine speed to decrease engine vibration.

LOCATION

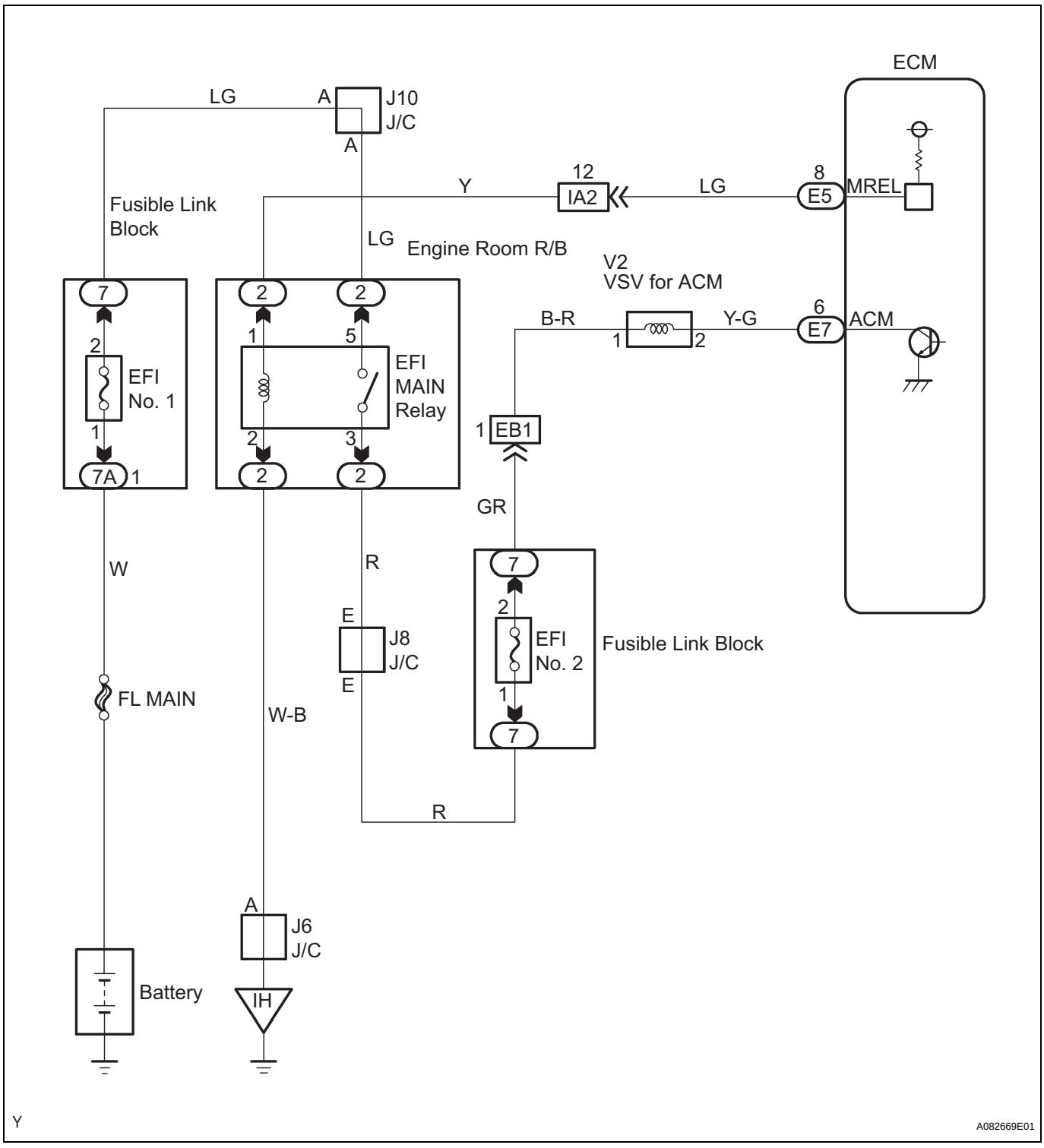




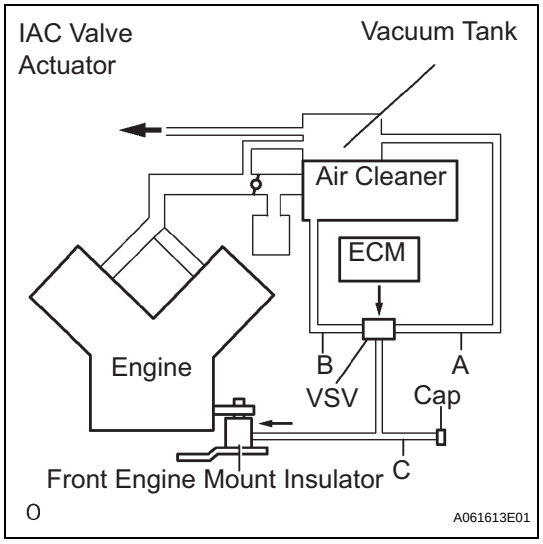
O

A082631E01

WIRING DIAGRAM



1	CHECK VACUUM HOSES

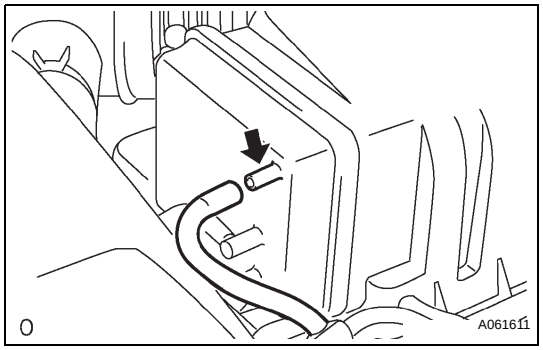


(a) Check if the vacuum hose cap is missing.
(b) If the hose is damaged, replace the vacuum hose assembly.
(c) Check the air and vacuum hoses for looseness, disconnection and blockage.

NG → **REPAIR OR REPLACE VACUUM HOSES**

OK

2	CHECK VACUUM

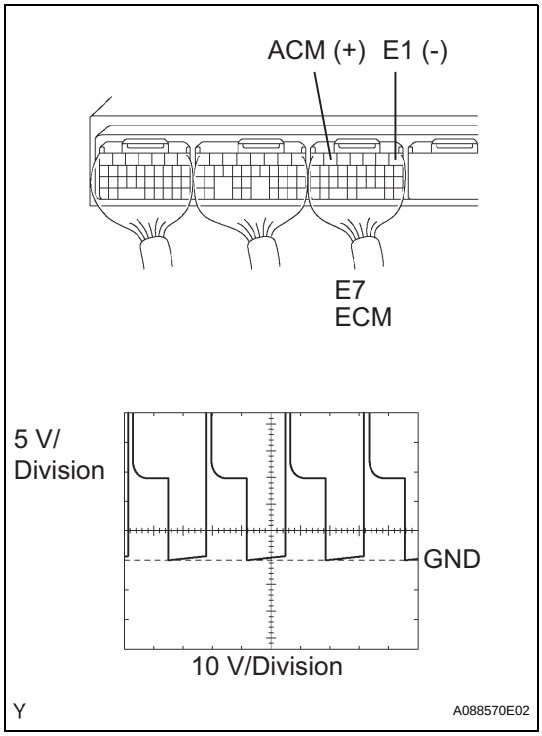


(a) Start the engine.
(b) Disconnect the vacuum hose from the vacuum tank.
(c) Check that the unconnected port located on the vacuum tank applies suction to your finger.
(d) Reconnect the vacuum hose.

NG → **CHECK AND REPLACE VACUUM SOURCE AND HOSES**

OK

3 INSPECT ECM (ACM VOLTAGE)



(a) Connect the oscilloscope between terminals ACM and E1 of the E7 ECM connector.
(b) Warm up engine to normal operating temperature.
(c) Turn the A/C switch on.
(d) Measure the voltage between terminals ACM and E1 of the E7 ECM connector.

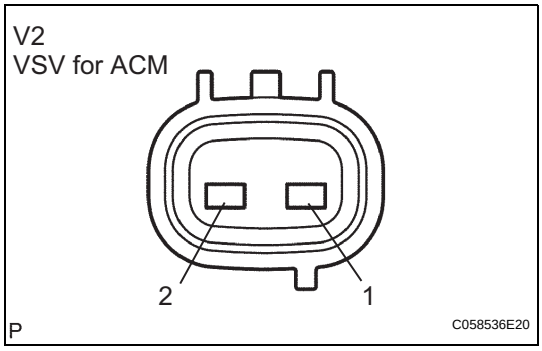
Standard voltage

Condition	Specified Condition
Shift position is D range, and engine speed is 850 rpm or less	Pulse generation
Shift position is D range, and engine speed is 950 rpm or more	9 to 14 V
Shift position is P range	9 to 14 V

OK → **Go to step 6**

NG

4 INSPECT VSV FOR ACM (RESISTANCE)



(a) Disconnect the V2 VSV for ACM connector.
(b) Measure the resistance between the terminals 1 and 2.

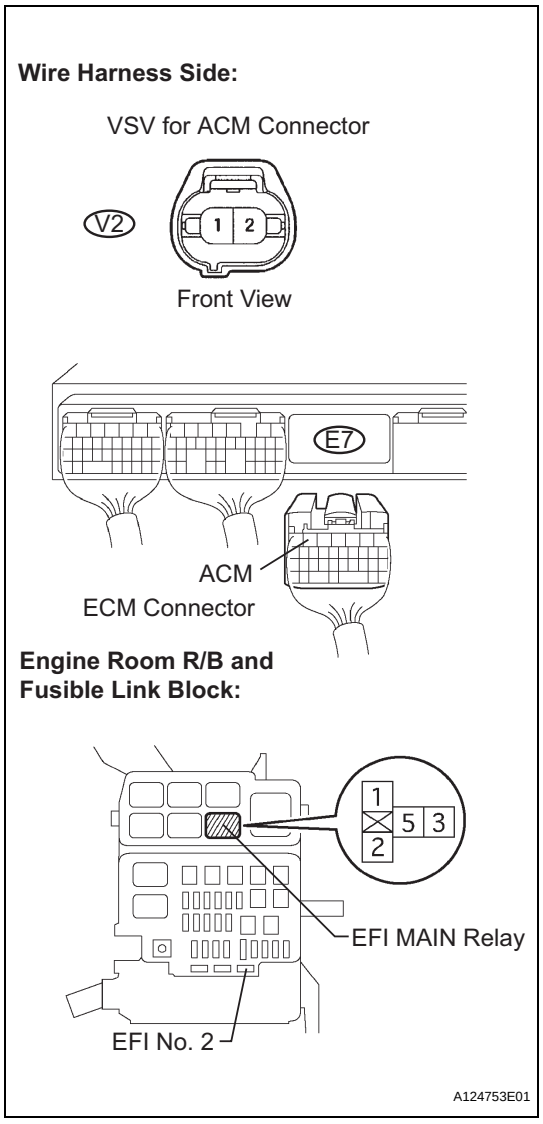
Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	19 to 20 Ω

NG → **REPLACE VSV**

OK

5	CHECK HARNESS AND CONNECTOR (VSV FOR ACM - ECM, VSV FOR ACM - EFI MAIN RELAY)



(a) Check the wire harness between the VSV for ACM and ECM.
  (1) Disconnect the V2 VSV connector for ACM.
  (2) Disconnect the E7 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
V2-2 - E7-6 (ACM)	Below 1 Ω
V2-2 or E7-6 (ACM) - Body ground	10 kΩ or higher

(b) Check the wire harness between the VSV and EFI MAIN relay.
  (1) Check the EFI No. 2 fuse from the fusible link block.
    • Remove the EFI No. 2 fuse from the fusible link block.
    • Measure the resistance of the EFI No. 2 fuse.

Standard resistance:
Below 1 Ω

    • Reinstall the EFI No. 2 fuse.
  (2) Disconnect the V3 VSV for ACM connector.
  (3) Remove the EFI MAIN relay from the engine room J/B.
  (4) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
V2-1 (VSV for ACM) - EFI MAIN relay terminal 3	Below 1 Ω

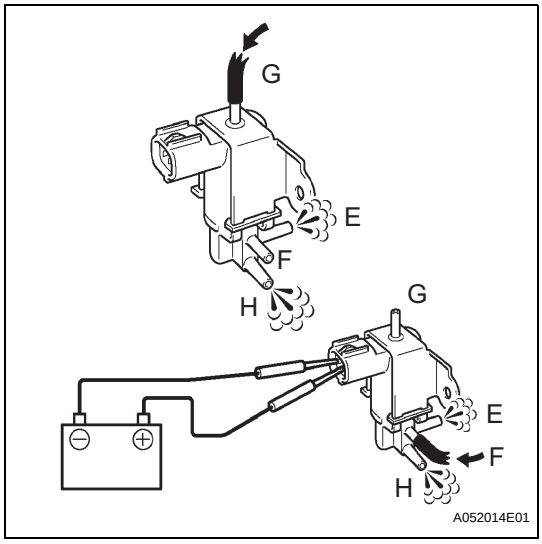
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM

ES

6	INSPECT VSV FOR ACM (OPERATION)

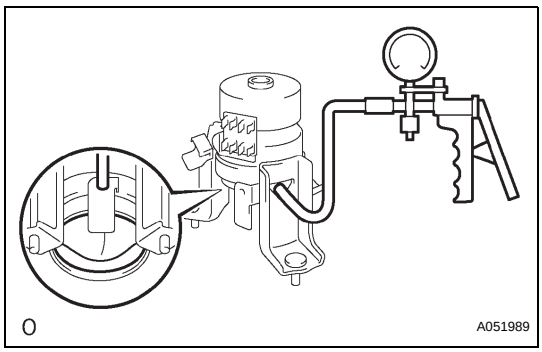


(a) Remove the VSV.
(b) Check operation of the VSV when battery positive voltage is applied to the terminals of the VSV connector.
Battery positive voltage is not applied:
The air from pipe G is flowing out through pipes E and H.
Battery positive voltage is applied:
The air from pipe F is flowing out through pipes E and H.

NG → **REPLACE VSV FOR ACM**

OK

7	INSPECT FRONT ENGINE MOUNT INSULATOR



(a) Disconnect the vacuum hose from the front engine mount insulator.
(b) Using MITYVAC (Hand-held Vacuum Pump), apply a vacuum of 80 kPa (600 mmHg, 25 in.Hg) and wait for 1 minute.
(c) Make sure there is no needle movement on the MITYVAC.
(d) Check that there is no fluid leakage caused by a broken lower diaphragm.

NG → **REPLACE FRONT ENGINE MOUNT INSULATOR**

OK

SYSTEM OK

EVAP System

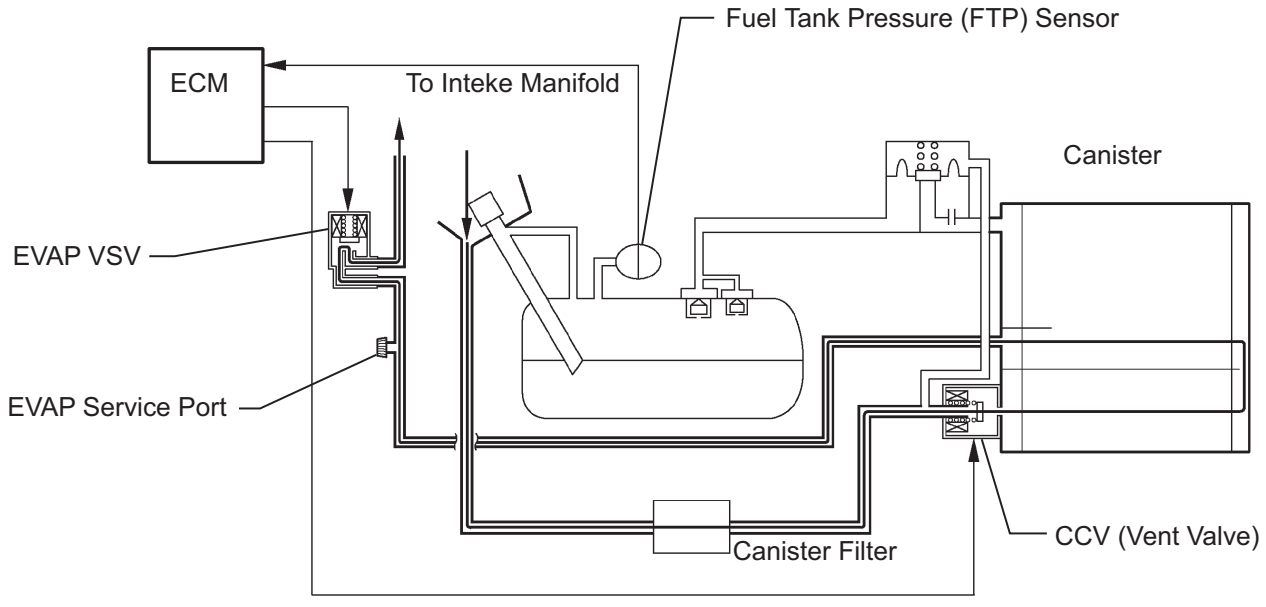
DESCRIPTION

When predetermined conditions (closed loop, etc.) are met, the EVAP VSV is opened and stored fuel vapor in the canister is purged to the intake manifold. The ECM changes duty-cycle to the EVAP VSV to control purge flow volume. Purge flow volume is determined by the intake manifold pressure. Atmospheric pressure is allowed into the canister through the vent valve (CCV) to ensure that purge flow is maintained when negative pressure (vacuum) is applied to the canister. This EVAP system contains following components:

Components

Components	Operation
Canister	Contains activated charcoal to absorb EVAP that is created in fuel tank.
EVAP VSV	Opens or closes line between canister and intake manifold to control EVAP purge flow. EVAP VSV is opened and purges fuel vapor absorbed by canister to intake manifold. ECM changes duty-cycle of purge VSV to control purge volume (ON is open, OFF is closed).
Refueling Valve	Controls EVAP pressure from fuel tank to canister. Valve has diaphragm, spring and restrictor. When fuel tank pressure increase, valve opens. When EVAP is purging, valve closes and restrictor prevents strong of vacuum from affecting pressure in fuel tank. When valve opens, refueling is possible.
Service Port	Used for connecting vacuum gauge for inspecting EVAP system.
Vent Valve (CCV)	Vents and seals EVAP system. When CCV is turned ON, EVAP system is closed. When CCV is turned OFF, EVAP system is vented. When vacuum introduction, EVAP VSV is opened and CCV is closed.
Fuel Tank Pressure (FTP) Sensor	Indicates pressure as voltage. 5 V is supplied by ECM. ECM detects EVAP system pressure using this voltage.

DIAGRAM



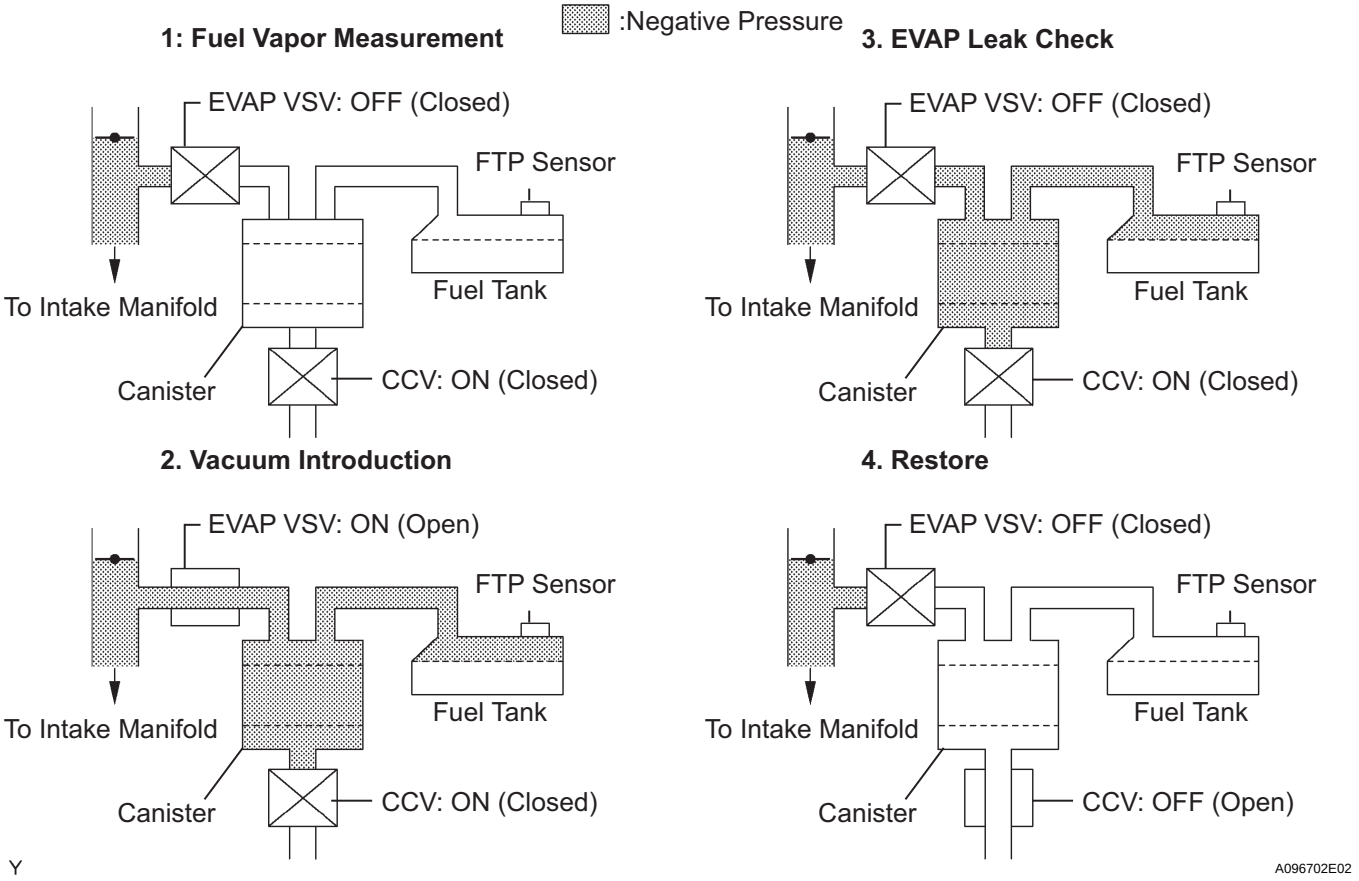
MONITOR DESCRIPTION

The EVAP monitor's purpose is to check for EVAP leaks and EVAP VSV and CCV malfunctions. The monitor performs the check by first introducing the intake manifold's negative pressure (vacuum) to the EVAP system. Then, the monitor records change in the EVAP system's pressure levels. The monitor runs when the following conditions are met:

- The engine coolant and intake air temperatures are 4 to 35°C (40 to 90°C).

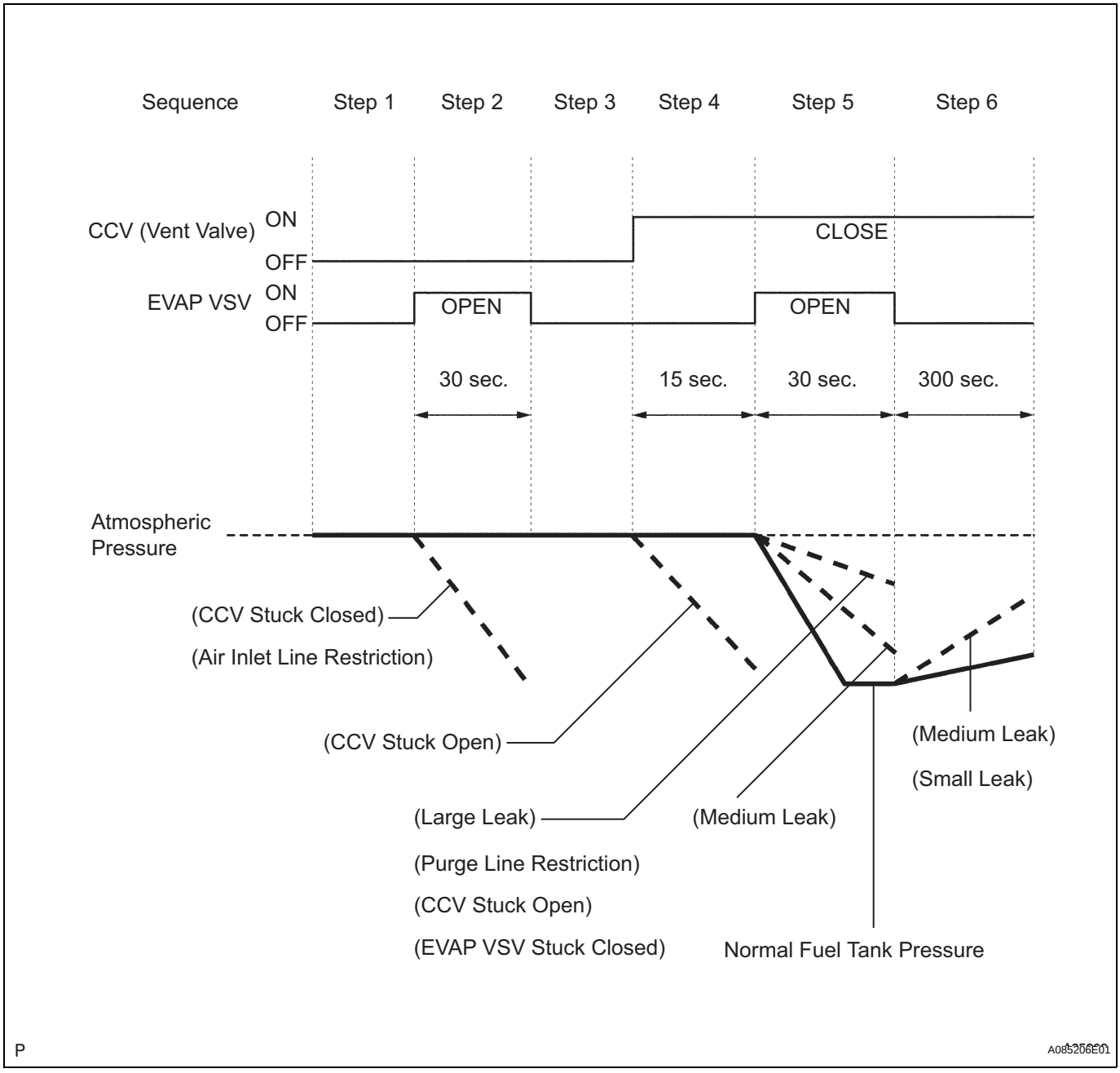
- The engine is idling or the vehicle is being driven at a steady speed.
- The fuel tank pressure is stabilized.

LEV II EVAP Monitor Process



Sequence	Operation	Description
1	Fuel vapor measurement	EVAP VSV is turned OFF (closed) and EVAP pressure is measured. If EVAP pressure is not stable, EVAP monitor is canceled to prevent inaccurate monitor.
2	Vacuum introduction	EVAP VSV is turned ON (open) and CCV is turned ON (closed). As a result, intake manifold pressure (vacuum) is introduced to EVAP system.
3	EVAP leak check	EVAP VSV is turned OFF (closed) to seal EVAP system. EVAP pressure increase is measured for 5 seconds when EVAP pressure is -20 mmHg and -17 mmHg. If increase is large, ECM concludes EVAP system has leak.
4	Restore	CCV is turned OFF (open) to finish EVAP monitor.

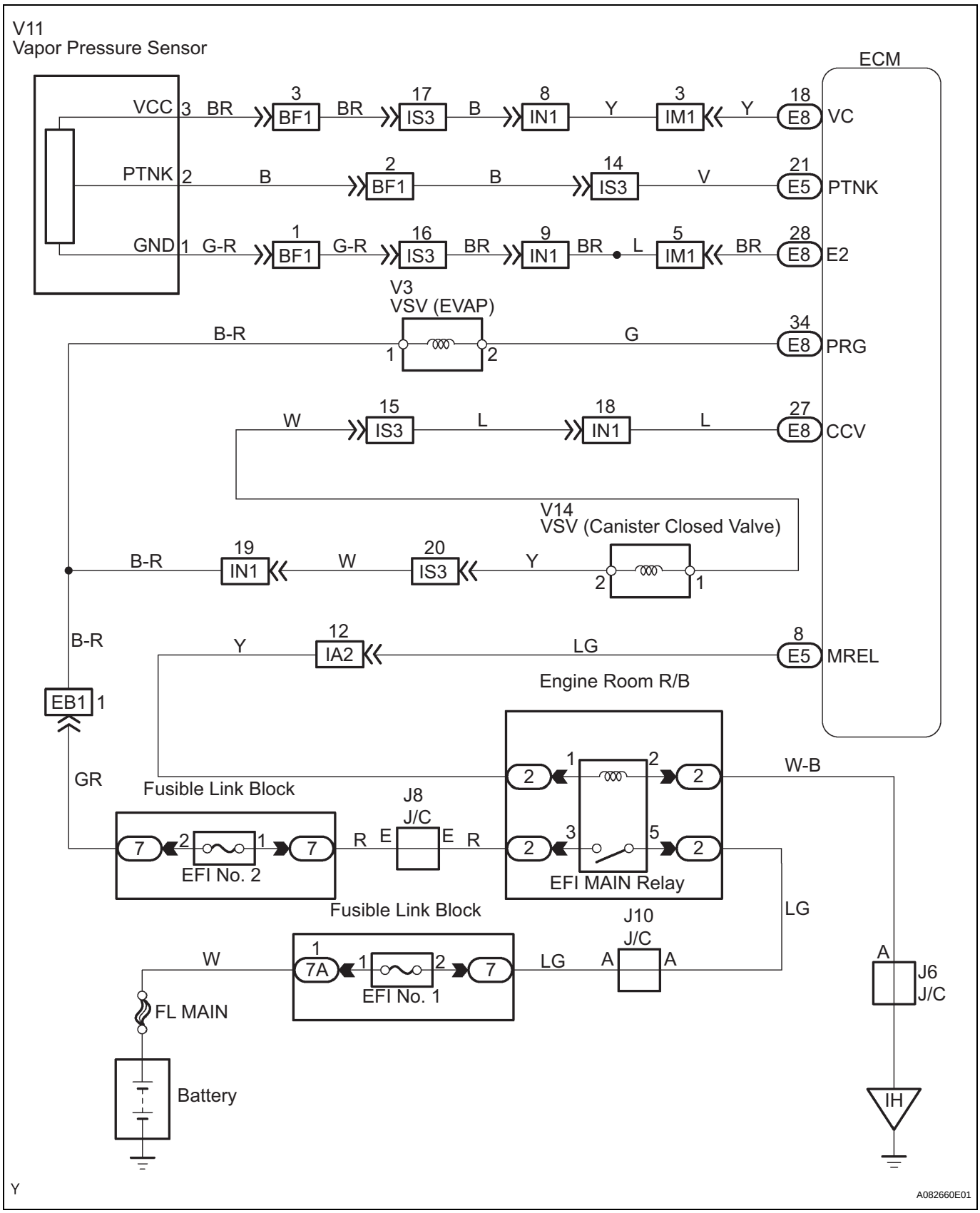
LEV II EVAP Monitor Sequence



Related DTCs

DTCs	Monitoring Item
P0441	EVAP VSV stuck closed EVAP VSV stuck open
P0442	EVAP small leak (0.04 inch)
P0446	Vent valve (CCV) stuck closed CCV stuck open
P0451	Fuel tank pressure (FTP) sensor malfunction
P0452	FTP sensor low output
P0453	FTP sensor high output
P0455	EVAP gross leak
P0456	EVAP small leak (0.02 inch)

WIRING DIAGRAM



HINT:
Read freeze frame data. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P041, P0442, P0446 AND/OR P0456)

Result

Display (DTC output)	Proceed to
Only P0441, P0442, P0446 and /or P0456 are output	A
P0451, P0452 and P453 are output	B

HINT:
If any other DTCs besides P0441, P0442, P0446 and/or P0456 are output, perform the troubleshooting for those DTCs first (reference: P0451, P0452, P0453 are vapor pressure sensor malfunctions).

B → GO TO RELEVANT DTC CHART

A

2 CHECK CURRENT AND PENDING DTC

(a) Check current DTCs. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBDII, DTC INFO and CURRENT DTCS.
(b) Check pending DTCs. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBDII, DTC INFO and PENDING DTCS.

Result

Current DTC	Pending DTC	Conclusion
Set	Set	System has been malfunctioning. Problem can be specified.
Set	-	System was malfunctioning in previous driving cycle. Problem may be specified.
-	Set	System is malfunctioning. This is intermittent problem and caused by fuel tank cap loosening. Otherwise, this problem may be difficult to eliminate.

HINT:
- The ECM stores the current DTC and illuminates the MIL when an emission-related component is malfunctioning in 2 consecutive driving cycles (2 trips). The MIL is turned OFF, if the component is functioning normally in 3 consecutive driving cycles. The ECM erases the current DTC, if the component is functioning normally in 40 consecutive driving cycles.
- The ECM stores the pending DTC when If the component is malfunctioning in present driving cycle (1 trip).
- The ECM erases the pending DTC, if the component is functioning normally in the next driving cycle.

NEXT

3	PREDICT POSSIBLE MALFUNCTION AREA (MANUAL OPERATION)

(a) Predict possible malfunction area using the matrix below.

EVAP DTC Matrix

Malfunction Area	DTCs
EVAP VSV stuck closed	P0441, P0466, P0455
EVAP VSV stuck open	P0441
EVAP small leak (0.04 inch)	P0442
CCV stuck closed	P0446
CCV stuck open	P0441, P0446, P0455
FTP sensor malfunction	P0451
FTP sensor low output	P0452
FTP sensor high output	P0453
Gross leak	P0441, P0455
EVAP small leak (0.02 inch)	P0442, P0456

ES

DTCs	Suspected Malfunction Area
P0441 only	EVAP VSV stuck open
P0446 only	CCV (vent valve) stuck open
P0442 and/or P0456	Small leak

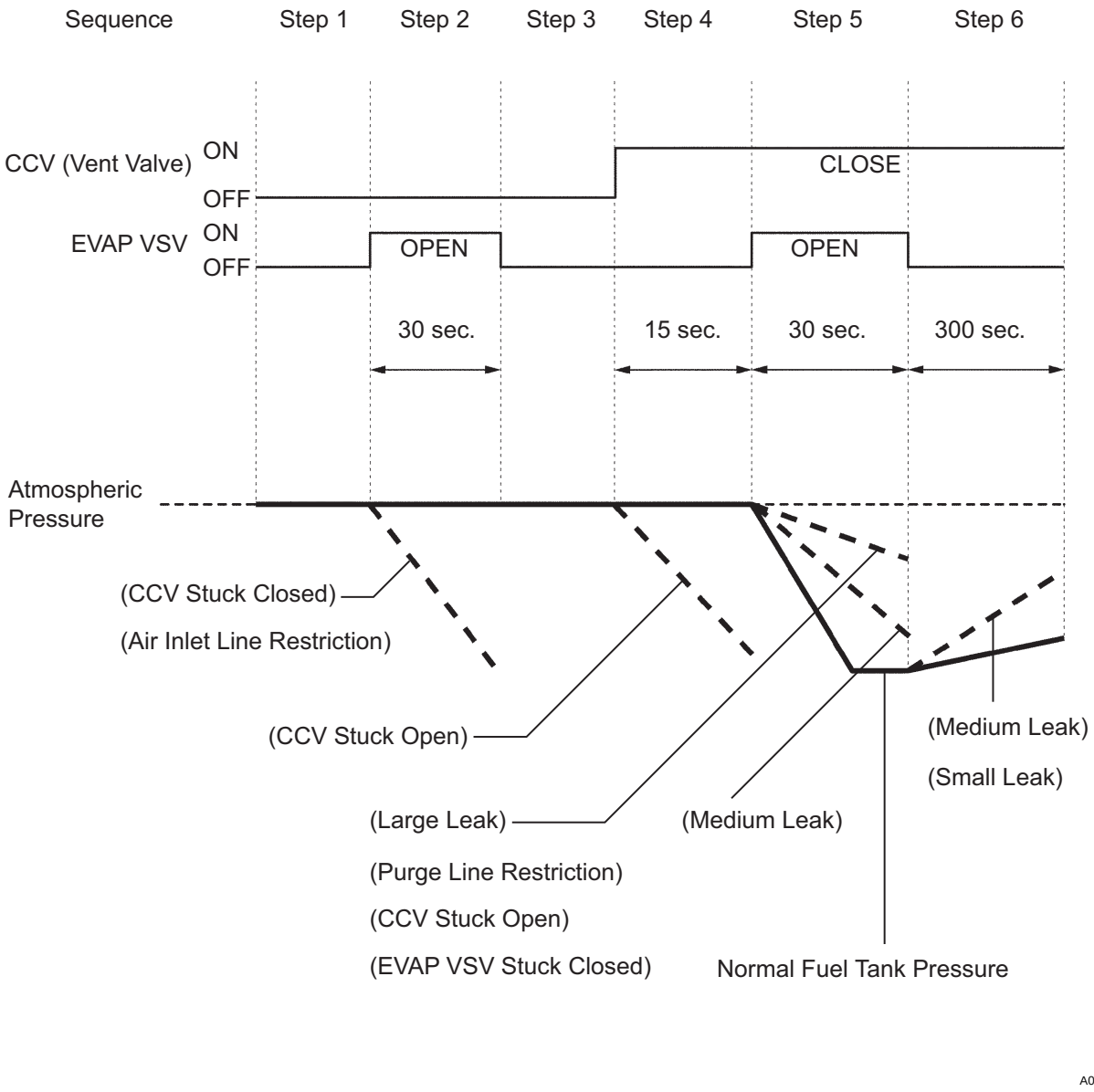
NEXT

4	PERFORM EVAP SYSTEM CHECK

NOTICE:
The EVAP system check can be used for confirmation after the EVAP system repair. Check DTCs after performing the EVAP system check. If no pending DTC is set, the EVAP system is functioning normally and the repair is complete.

(a) Select the "mmHg" unit. Select the intelligent tester menus: DIAGNOSIS, SETUP, UNIT CONVERSION and VAPOR PRESS.
(b) Allow the engine to idle.
(c) Perform the EVAP system check to find a malfunction area. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, SYSTEM CHECK and LEV ll SYS CHECK.
(d) Read NOTICE and press ENTER.

Diagram of LEV II EVAP System Check

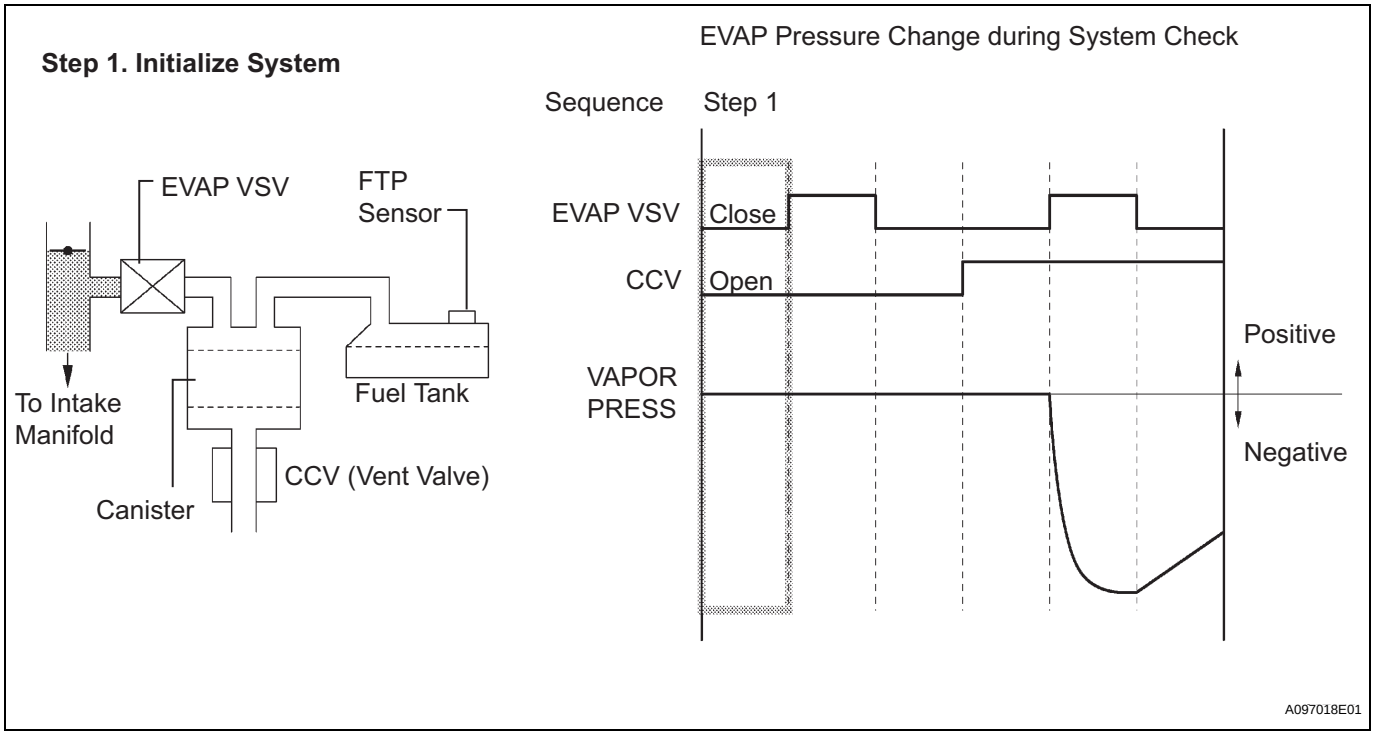


HINT:
The EVAP system check is the most accurate when the following conditions are being set:
- Atmospheric pressure is 762 mmHg (sea level).
- The engine coolant and intake air temperatures are 4 to 35°C (40 to 90°F).
- The fuel tank level is 1/4 to 3/4.

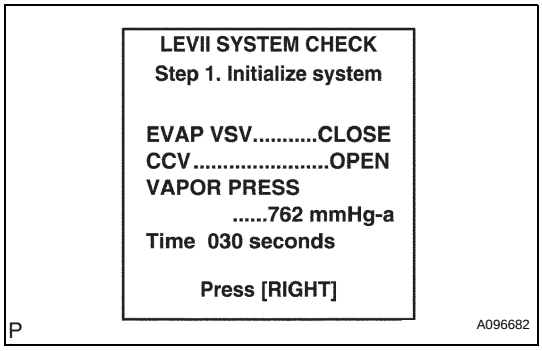
NEXT

5	PERFORM EVAP SYSTEM CHECK STEP 1 (INITIALIZE SYSTEM)

(a) Perform step 1.



(b) Wait for 30 seconds.

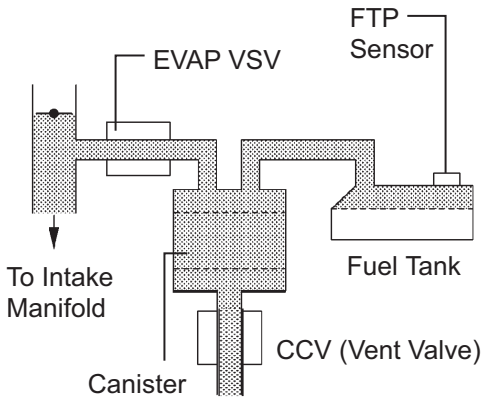


NEXT

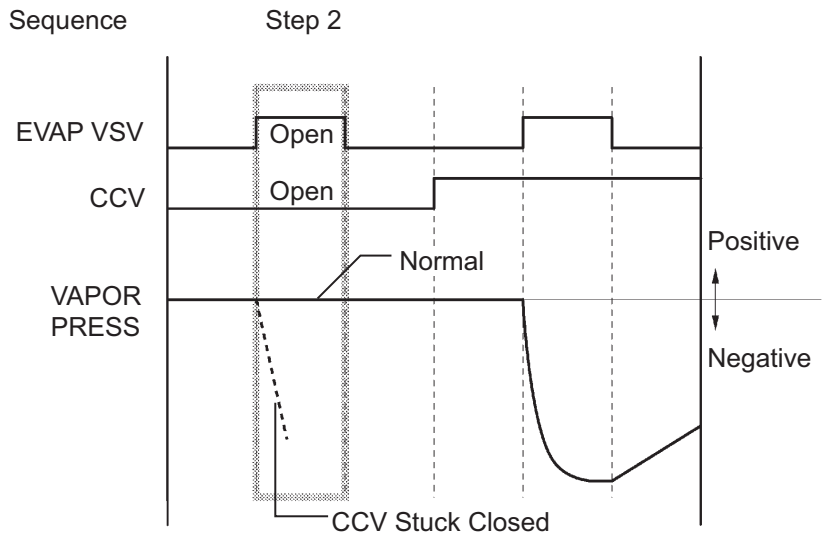
6	PERFORM EVAP SYSTEM CHECK STEP 2 (CHECK FOR CCV)

(a) Press RIGHT to go to step 2.

Step 2. Check for CCV



EVAP Pressure Change during System Check



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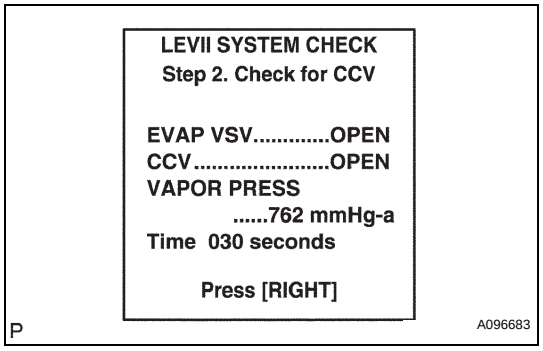


(b) Wait for 30 seconds and check VAPOR PRESS (EVAP pressure).

Result

VAPOR PRESS	Conclusion	Proceed to
Higher than 752 mmHg-a (-10 mmHg-g)	Trouble area has not been found yet.	OK
Lower than 752 mmHg-a (-10 mmHg-g)	Following problems are suspected: • Air inlet line restriction • Canister filter restriction • CCV (vent valve) stuck closed	NG

HINT:
In this step, the intake manifold pressure (vacuum) is applied to the EVAP system. However, the fuel tank pressure does not drop due to the CCV (vent valve) open.

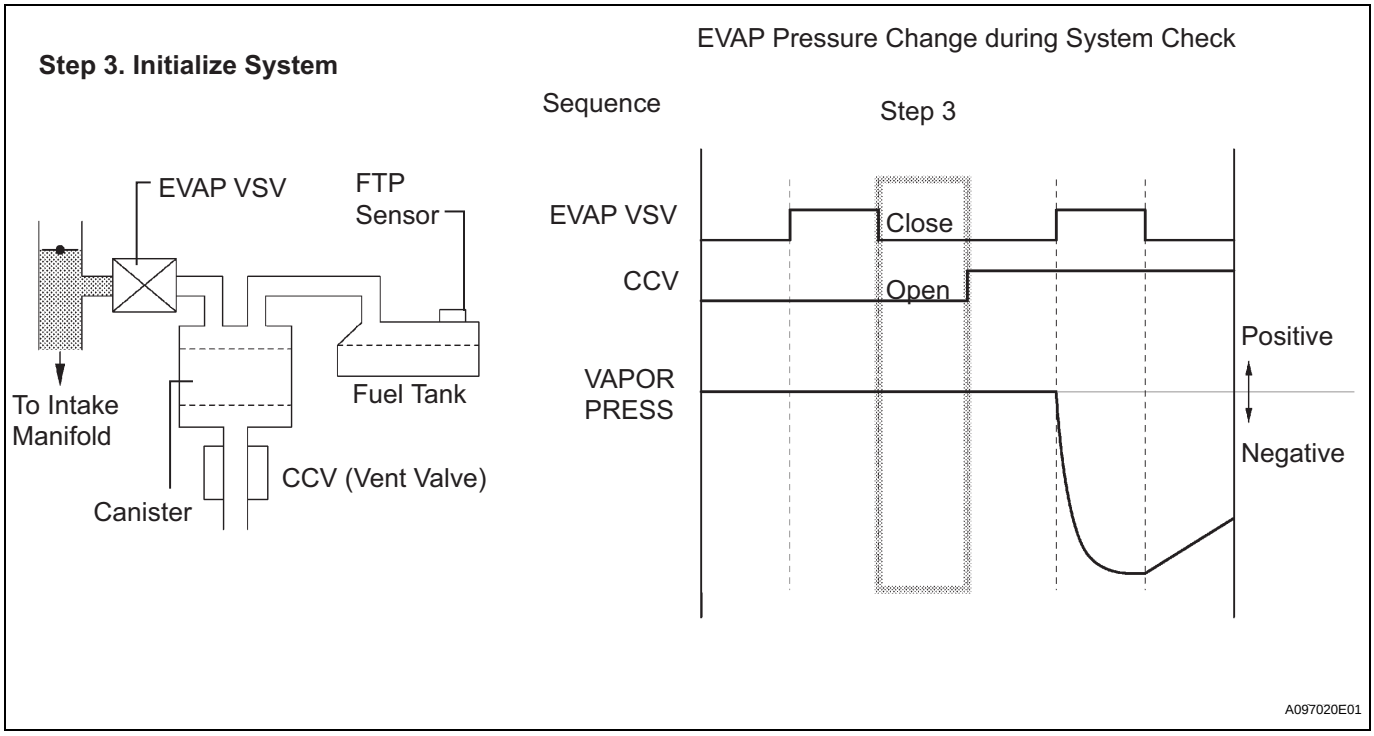
NG → **Go to step 11**

OK

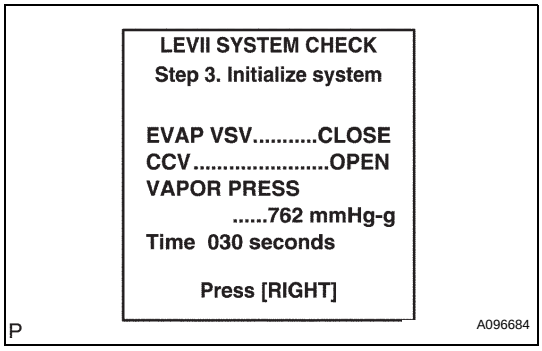
7	PERFORM EVAP SYSTEM CHECK STEP 3 (INITIALIZE SYSTEM)

(a) Press RIGHT to go to step 3.

ES



(b) Wait for 30 seconds.

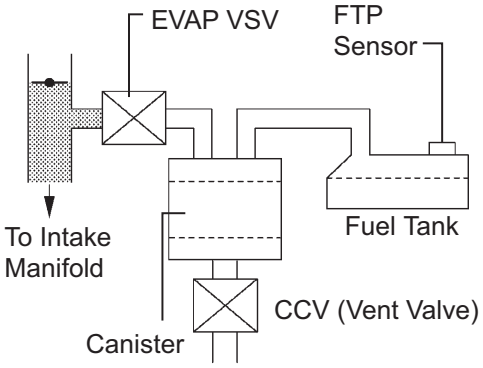


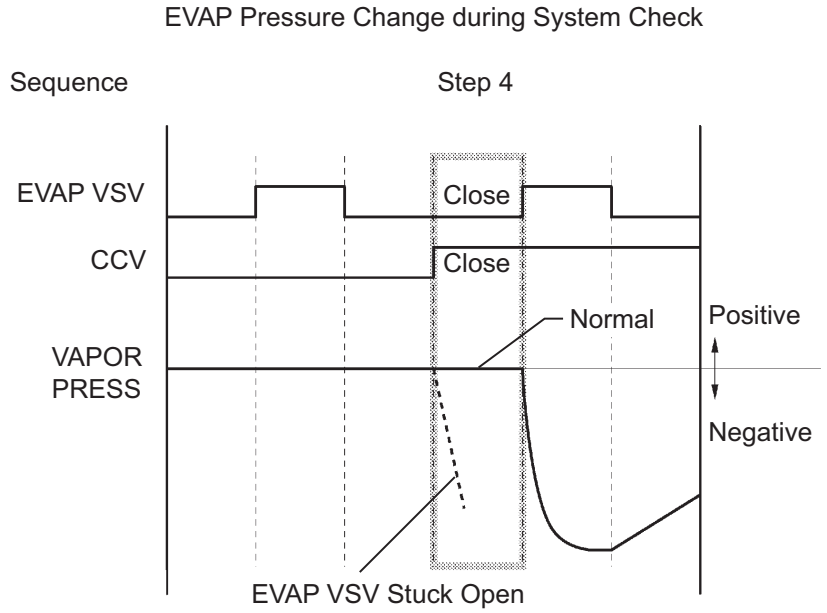
NEXT

8	PERFORM EVAP SYSTEM CHECK STEP 4 (CHECK FOR EVAP VSV STUCK OPEN)

(a) Press RIGHT to go to step 4.

Step 4. Check for EVAP VSV





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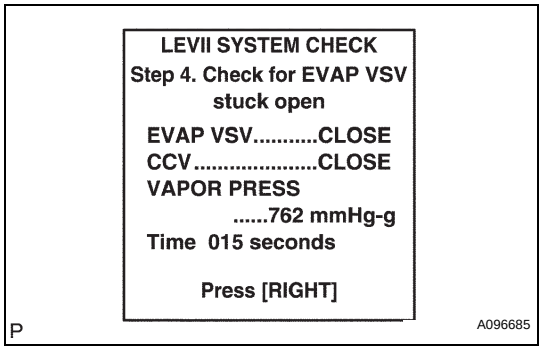


(b) Wait for 15 seconds and check VAPOR PRESS (EVAP pressure).

Result

VAPOR PRESS	Conclusion	Proceed to
Higher than 758 mmHg-a (-4 mmHg-g)	Trouble area has not been found yet	OK
Lower than 758 mmHg-a (-4 mmHg-g)	EVAP VSV stuck open	NG

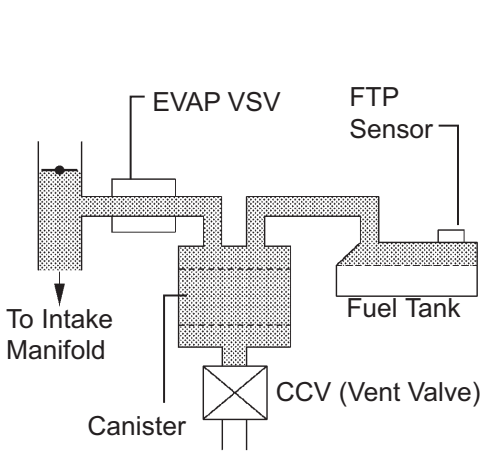
NG → **Go to step 14**

OK

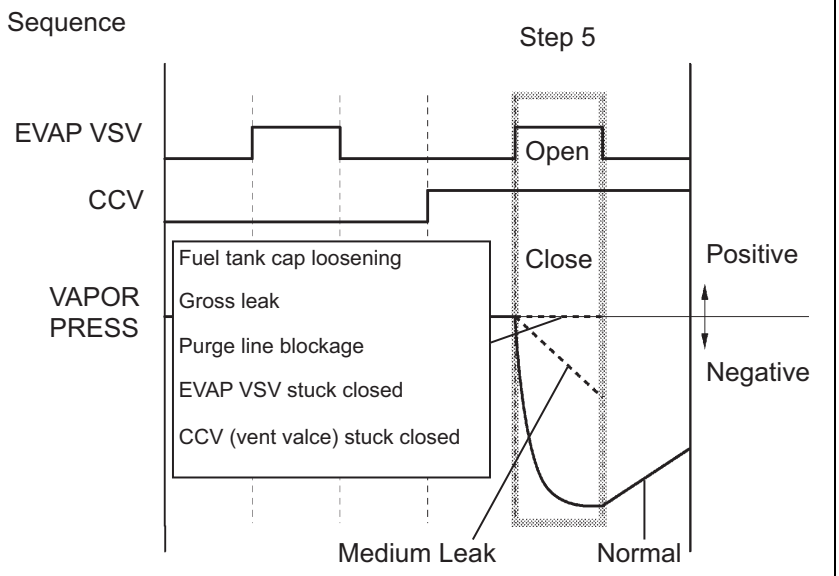
9	PERFORM EVAP SYSTEM CHECK STEP 5 (APPLYING VACUUM)

(a) Press RIGHT to go to step 5.

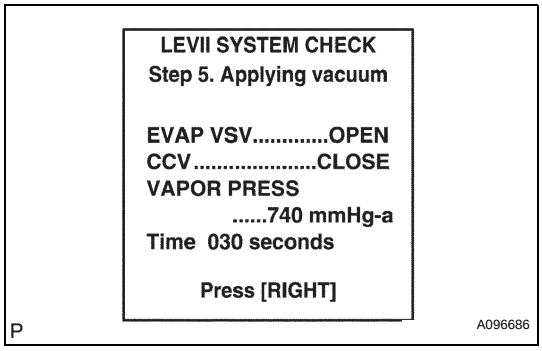
Step 5. Applying Vacuum



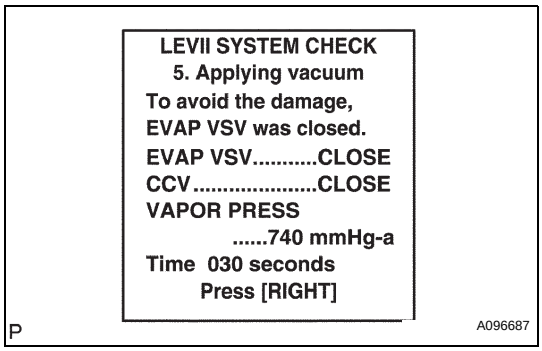
EVAP Pressure Change during System Check



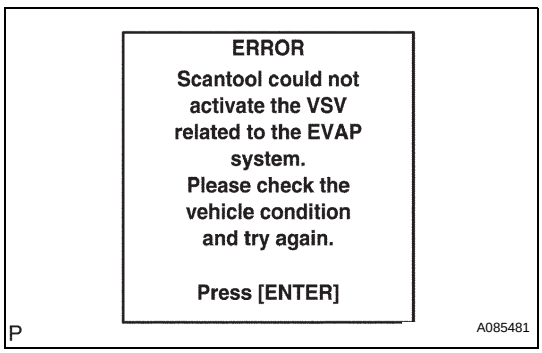
A097022E01



(b) Wait for 30 seconds and check VAPOR PRESS (EVAP pressure).



- If the pressure is lower than 740 mmHg-a (-22 mmHg-g), the intelligent tester closes the EVAP VSV.



- If the pressure is lower than 735 mmHg-a (-27 mmHg-g), the intelligent tester cancels the EVAP system check.

Result

VAPOR PRESS	Conclusion	Proceed to
Lower than 748 mmHg-a (-14 mmHg-g)	Trouble area has not been found yet.	A

VAPOR PRESS	Conclusion	Proceed to
756 to 768 mmHg-a (-6 to 6 mmHg-g)	Following problems are suspected: • Fuel tank cap loosening • Gross leak • ?EVAP VSV stuck closed • CCV (vent valve) stuck open • Purge line blockage between fuel tank and canister	B
748 to 755 mmHg-a (-14 to -7 mmHg-g)	Medium leak	C

B → Go to step 15

C → Go to step 18

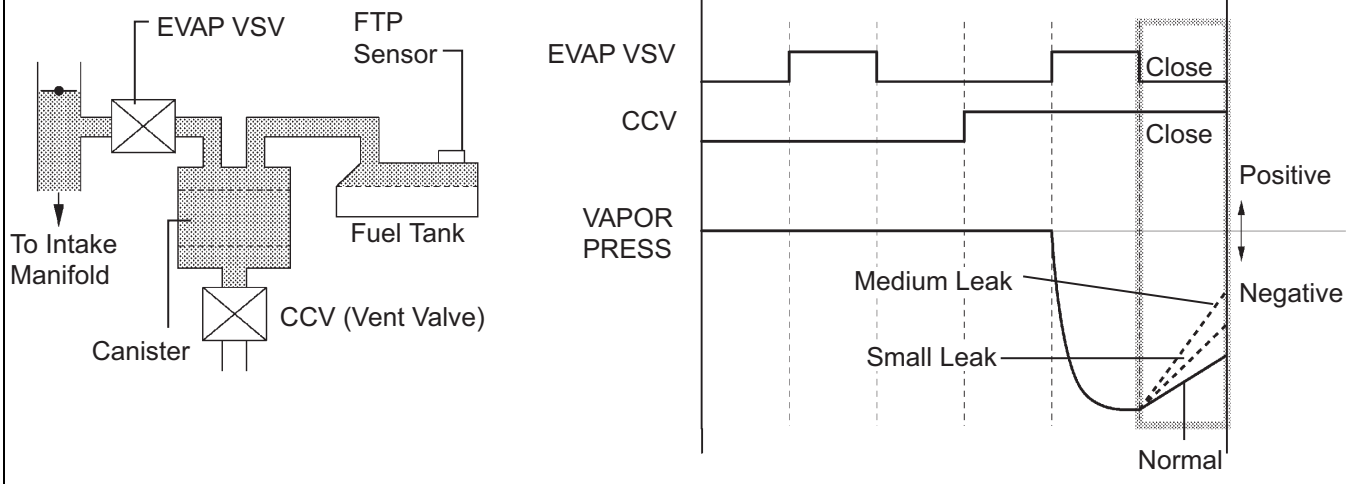
ES

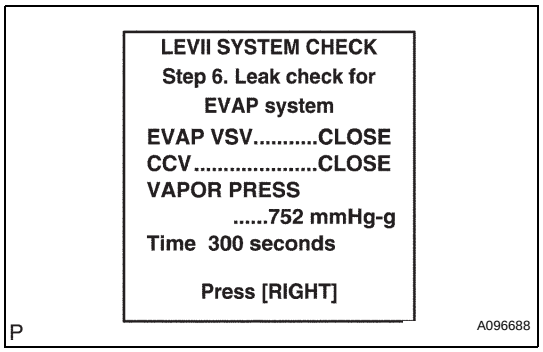
A

10 PERFORM EVAP SYSTEM CHECK STEP 6 (LEAK CHECK FOR EVAP SYSTEM)

(a) Press RIGHT to go to step 6 when the VAPOR PRESS (EVAP pressure) is lower than 742 mmHg-a (-20 mmHg-g).

Step 6. Leak Check for EVAP System





(b) Wait for 300 seconds and check VAPOR PRESS (EVAP pressure).

Result

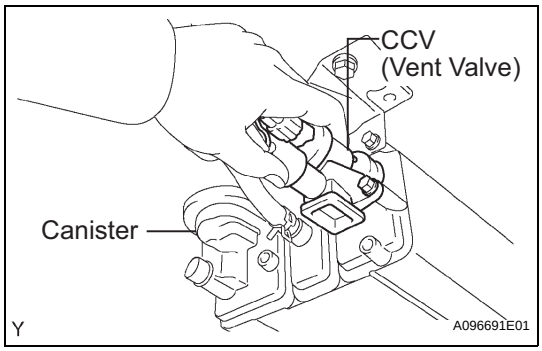
VAPOR PRESS	Conclusion	Proceed to
Less than 758 mmHg-a (-4 mmHg-g)	EVAP system is functioning normally	OK
Higher than 758 mmHg-a (-4 mmHg-g)	Leakage	NG

NG → Go to step 18

OK

GO TO STEP 40

11 CHECK CCV



(a) Turn the ignition switch OFF.
(b) Turn the ignition switch ON.
(c) Switch the CCV (vent valve) using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and CAN CTRL VSV.
(d) Touch the CCV and check the operation during switching the CCV.

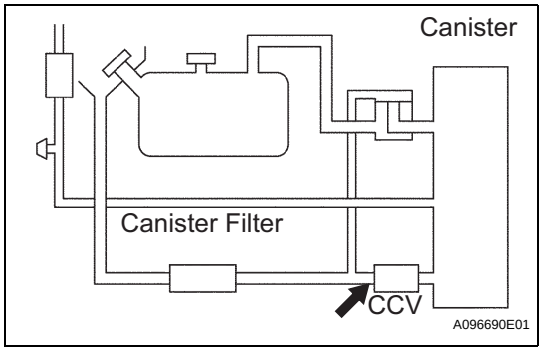
Result

CCV (Vent Valve)	Conclusion	Proceed to
CCV is operated	CCV is functioning normally.	OK
CCV is not operated	CCV is malfunctioning.	NG

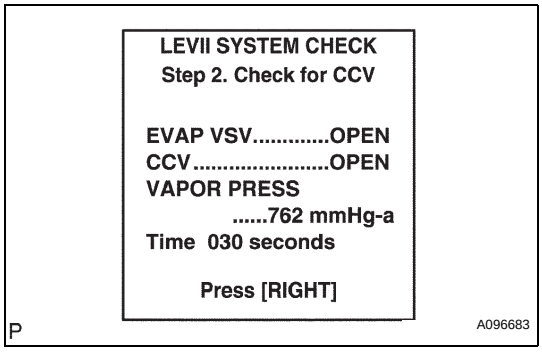
NG → **Go to step 25**

OK

12 CHECK AIR INLET LINE RESTRICTION



(a) Disconnect the air inlet line from the CCV.
(b) Remove and reinstall the fuel tank cap to release the fuel tank pressure.
(c) Allow the engine to idle.



(d) Perform step 2 of the EVAP system check.
(e) Wait for 30 seconds and check VAPOR PRESS (EVAP pressure).

Result

VAPOR PRESS	Conclusion	Proceed to
Higher than 752 mmHg-a (-10 mmHg-g)	Blockage in canister filter	A
Lower than 752 mmHg-a (-10 mmHg-g)	Blockage in CCV (vent valve) or canister	B

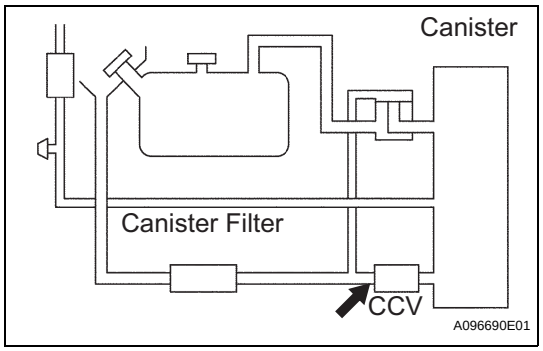
(f) Reconnect the air inlet line to the CCV.

B → **Go to step 13**

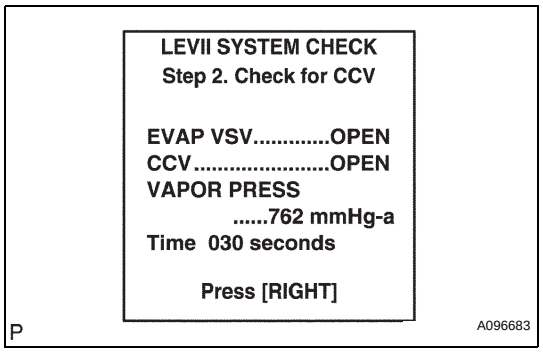
A

REPLACE CANISTER FILTER

13 CHECK CANISTER BLOCKAGE



(a) Turn the ignition switch OFF.
(b) Remove the CCV from the canister.
(c) Remove and reinstall the fuel tank cap to release the fuel tank pressure.
(d) Allow the engine to idle.



(e) Perform step 2 of the EVAP system check.
(f) Wait for 30 seconds and check VAPOR PRESS (EVAP pressure).

Result

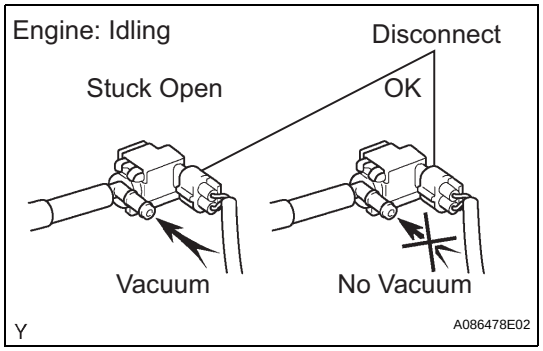
VAPOR PRESS	Conclusion	Proceed to
Higher than 752 mmHg-a (-10 mmHg-g)	CCV (vent valve) stuck closed	A
Lower than 752 mmHg-a (-10 mmHg-g)	Blockage in canister	B

B → **CHECK AND REPLACE CHARCOAL CANISTER ASSEMBLY**

A

REPLACE CCV (VENT VALVE)

14 CHECK EVAP VSV (FOR EVAP VSV STUCK OPEN)



(a) Turn the ignition switch OFF.
(b) Disconnect the purge hose of the canister from the EVAP VSV.
(c) Disconnect the EVAP VSV connector.
(d) Allow the engine to idle.
(e) Touch the EVAP VSV port to check the vacuum.

Result

EVAP VSV	Conclusion	Proceed to
Vacuum is applied.	EVAP VSV is malfunctioning.	A
No vacuum is applied.	Electrical circuit of EVAP VSV is malfunctioning.	B

B → Go to step 29

A

REPLACE EVAP VSV

15 CHECK FUEL TANK CAP ASSEMBLY

(a) Remove the fuel tank cap and reinstall it until a few click sound is heard.
(b) Clear the DTCs.
(c) Check pending DTCs after the EVAP system check if no pending DTC is set, the DTC(s) was set due to the fuel cap loosening.
If necessary, replace the fuel cap.

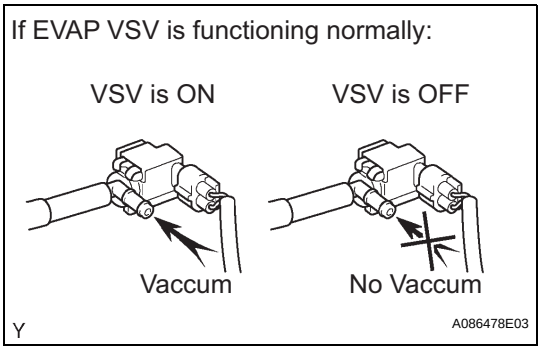
NG → Go to step 16

OK

REPAIR IS COMPLETE

16 CHECK EVAP VSV (FOR EVAP VSV STUCK CLOSED)

If EVAP VSV is functioning normally:



(a) Disconnect the purge hose of the canister from the EVAP VSV.
(b) Allow the engine to idle.
(c) Switch the EVAP VSV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and EVAP VSV.
(d) Touch the EVAP VSV port to check the vacuum.
Result

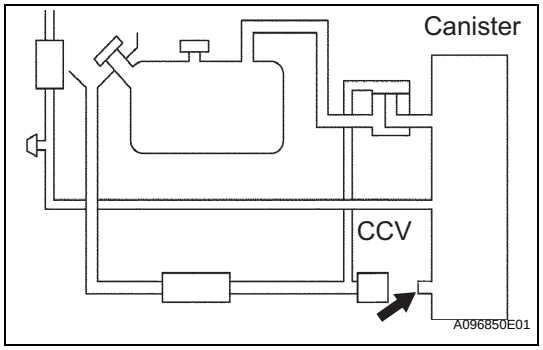
EVAP VSV	Conclusion	Proceed to
Vacuum is applied when EVAP VSV is ON. No vacuum is applied when EVAP VSV is OFF.	EVAP VSV is functioning normally.	OK
No vacuum is applied when EVAP VSV is ON.	Electrical circuit of EVAP VSV is malfunctioning.	NG

HINT:
The EVAP VSV can be tested with the EVAP Test Equipment (go to step 39).

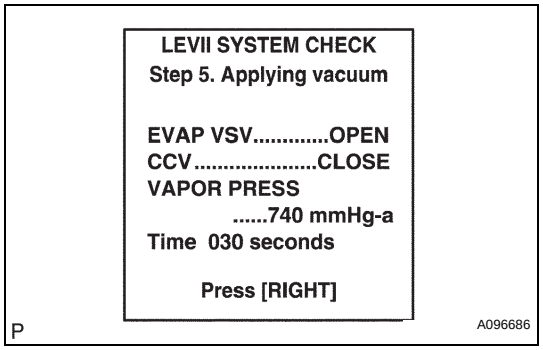
NG → Go to step 31

OK

17 CHECK CCV (FOR CCV STUCK OPEN)



(a) Turn the ignition switch OFF.
(b) Remove the CCV (vent valve) and plug the canister.
(c) Allow the engine to idle.



(d) Apply vacuum to the EVAP system with the EVAP system check. Perform step 5 "Applying Vacuum".
(e) Wait for 30 seconds and check the VAPOR PRESS (EVAP pressure).

Result

VAPOR PRESS	Conclusion	Proceed to
Lower than 747 mmHg-a (-15 mmHg-g)	CCV (vent valve) stuck open	A
Higher than 747 mmHg-a (-15 mmHg-g)	Blockage in canister Blockage in purge line (Fuel tank - Canister) Blockage in purge line (Fuel tank - EVAP VSV)	B

B → **Go to step 20**

A

GO TO STEP 24

18 CHECK FUEL TANK CAP ASSEMBLY

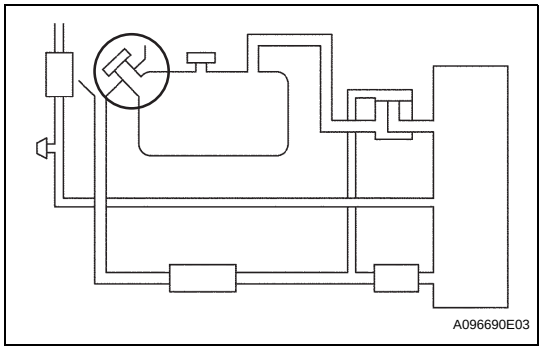
(a) Remove the fuel tank cap and reinstall it until a few click sound is heard.
(b) Clear the DTCs.
(c) Check pending DTCs after the EVAP system check If no pending DTC is set, the DTC(s) was set due to the fuel cap loosening.
If necessary, replace the fuel cap.

NG → **Go to step 19**

OK

REPAIR IS COMPLETE

19	CHECK FILLER NECK DAMAGE

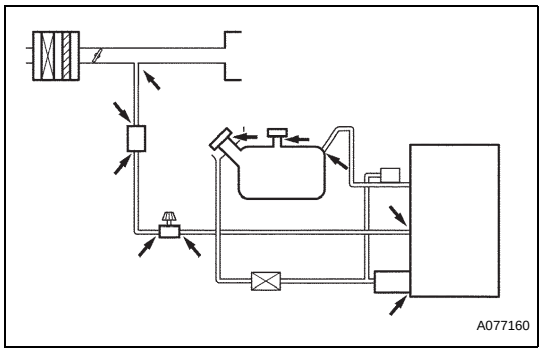


(a) Remove the fuel tank cap.
(b) Visually inspect the filler neck for damage.
(c) Reinstall the fuel tank cap.
HINT:
A leak point may be found with the EVAP Test Equipment (go to step 36).

NG → **REPLACE FUEL TANK INLET PIPE**

OK

20	CHECK PURGE LINE (CANISTER - FUEL TANK)



(a) Check that the pipes and hoses are connected correctly.
(b) Check that the pipes and hoses are not loose or disconnected.
(c) Check the pipes and hoses have no damage or blockage.

NG → **REPLACE PURGE HOSE**

OK

21	CHECK PURGE LINE (CANISTER - EVAP VSV)

(a) Check that the pipes and hoses are connected correctly.
(b) Check that the pipes and hoses are not loose or disconnected.
(c) Check the pipes and hoses have no damage or blockage.

B → **REPLACE PURGE HOSE**

OK

22	INSPECT CANISTER

NG → **REPLACE CANISTER**

OK

23	INSPECT FUEL TANK ASSEMBLY

(a) Check that the fuel tank has no damage.
(b) Check the fuel inlet pipe has no damage.
(c) Check leakage from the fuel pump unit

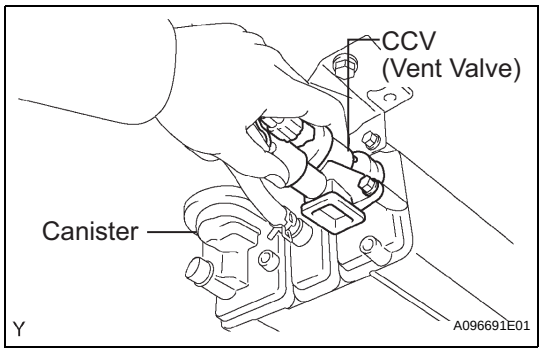
NG → **REPAIR OR REPLACE DEFECTIVE OR DAMAGED PARTS**

OK

GO TO STEP 40

ES

24	CHECK CCV



(a) Stop the engine and turn the ignition switch ON.
(b) Switch the CCV (vent valve) using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and CAN CTRL VSV.
(c) Touch the CCV and check the operation during switching the CCV.

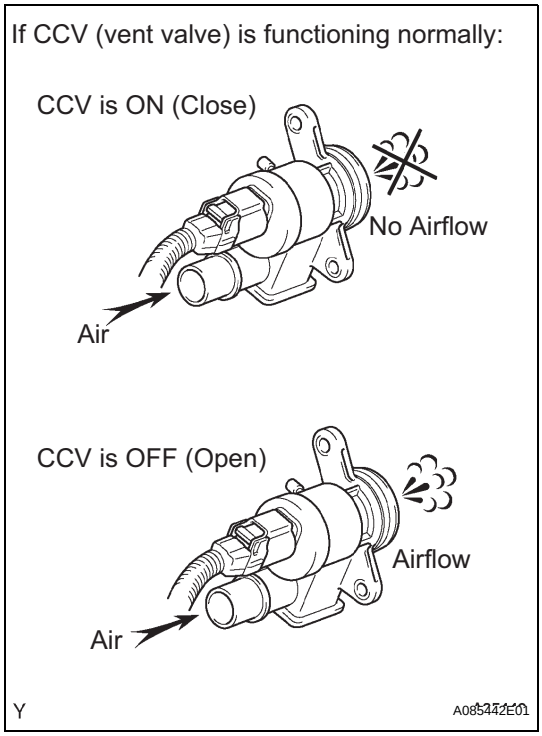
Result

CCV (Vent Valve)	Conclusion	Proceed to
CCV is operated	Electrical circuit of CCV is functioning normally.	A
CCV is not operated	Electrical circuit of CCV is malfunctioning.	B

B → **Go to step 26**

A

25 CHECK CCV



(a) Turn the ignition switch OFF.
(b) Remove the CCV (vent valve).
(c) Connect the CCV connector.
(d) Turn the ignition switch ON.
(e) Switch the CCV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD II, ACTIVE TEST and CAN CTRL VSV.
(f) Apply air to the CCV port using an air gun and check the airflow.

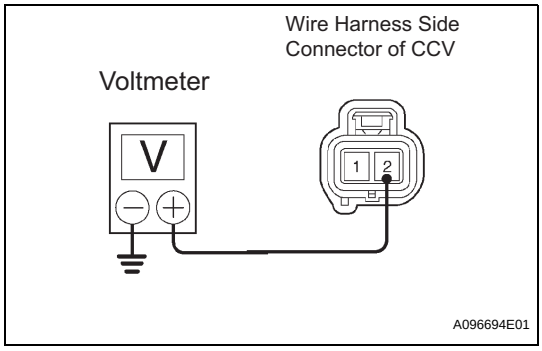
Result

CCV (Vent Valve)	Conclusion	Proceed to
Air flows when CCV is OFF (open). Air does not flows when CCV is ON (close).	CCV is functioning normally. Electrical circuit of CCV is malfunctioning.	A
Air flows when CCV is ON (close). Air does not flows when CCV is OFF (open).	CCV is malfunctioning.	B

B → REPLACE CCV

A

26 CHECK WIRE HARNESS (CCV - POWER SOURCE)



(a) Turn the ignition switch OFF.
(b) Disconnect the CCV connector.
(c) Turn the ignition switch ON.
(d) Measure the voltage between terminal 2 of the wire harness side connector and body ground.

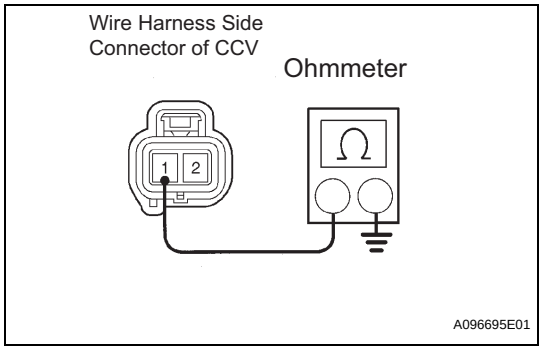
Result

Voltage	Conclusion	Proceed to
Battery voltage	Wire harness (CCV - Power source) is OK.	OK
0 to 3 V	Wire harness (CCV - Power source) is short circuit.	NG

B → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

27 CHECK WIRE HARNESS AND CONNECTOR (CCV - ECM)



(a) Switch the CCV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD II, ACTIVE TEST and CAN CTRL VSV.
(b) Measure the resistance between terminal 1 of the wire harness side connector and body ground.

Result

Resistance	Conclusion	Proceed to
More than 10 kΩ when CCV is OFF. Less than 10 Ω when CCV is ON.	ECM and wire harness (CCV - ECM) are OK. CCV is malfunctioning.	OK
No change	Either of wire harness (CCV - ECM) or ECM is malfunctioning.	NG

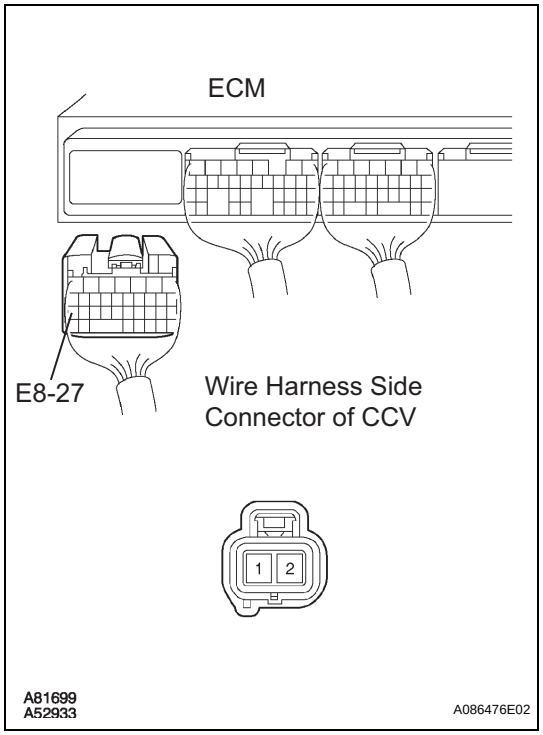
ES

NG → **Go to step 28**

OK

REPLACE CCV

28 CHECK HARNESS AND CONNECTOR (CCV - ECM)



(a) Check the wire harness between the ECM and CCV.
(b) Turn the ignition switch OFF.
(c) Disconnect the E8 ECM connector.
(d) Measure the resistance between the CCV and ECM wire harness side connectors.

Standard resistance

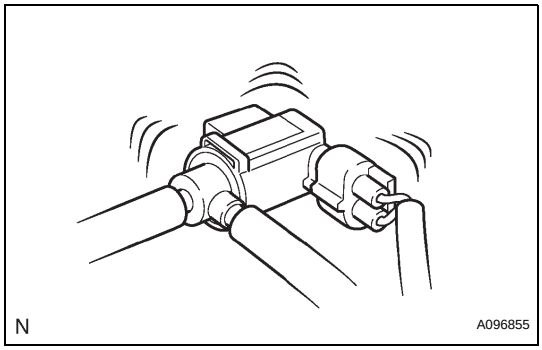
Tester Connection	Specified Condition
1 (CCV) - E8-27 (ECM)	Less than 10 Ω
1 (CCV) - Body ground	More than 10 kΩ

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

OK

REPLACE ECM

29 CHECK EVAP VSV



(a) Turn the ignition switch ON.
(b) Switch the EVAP VSV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and EVAP VSV (Alone).
(c) Listen to click sounds to check the EVAP VSV operation.

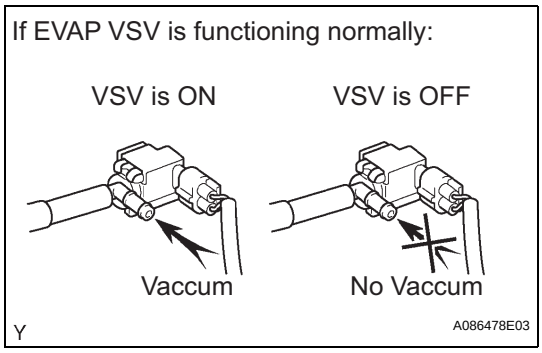
Result

EVAP VSV	Conclusion	Proceed to
Operated	Electrical circuit of EVAP VSV is functioning normally.	OK
Not operated	Electrical circuit of EVAP VSV is malfunctioning.	NG

NG → **Go to step 32**

OK

30 CHECK EVAP VSV



(a) Disconnect the purge hose of the canister from the EVAP VSV.
(b) Start the engine.
(c) Switch the EVAP VSV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and EVAP VSV.
(d) Touch the EVAP VSV port to check the vacuum.

Result

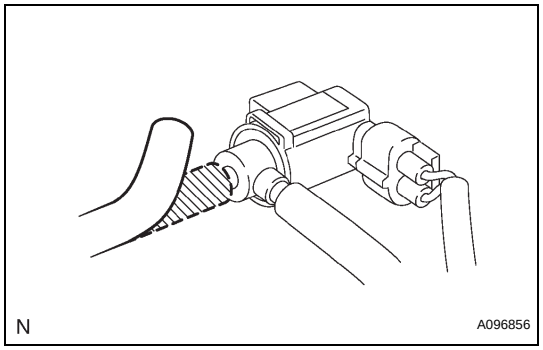
EVAP VSV	Conclusion	Proceed to
Vacuum is applied when EVAP VSV is ON. No vacuum is applied when EVAP VSV is OFF.	EVAP VSV is functioning normally.	OK
No vacuum is applied when EVAP VSV is ON.	Electrical circuit of EVAP VSV is malfunctioning.	NG

HINT:
The EVAP VSV can be tested with the EVAP Test Equipment (go to step 39).

NG → **Go to step 32**

OK

31 CHECK PURGE LINE (EVAP VSV - THROTTLE BODY)



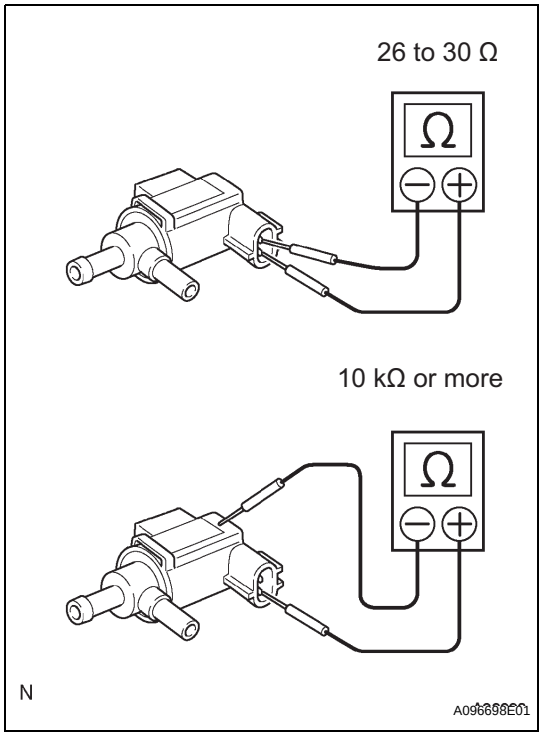
(a) Check that the vacuum hoses are connected correctly.
(b) Check that the vacuum hoses are not loose or disconnected.
(c) Check the vacuum hoses and tubes for cracks, holes, damage, or blockage.

NG → **REPLACE PURGE HOSE**

OK

REPLACE EVAP VSV

32 INSPECT EVAP VSV



(a) Turn the ignition switch OFF.
(b) Disconnect the EVAP VSV connector.
(c) Measure the resistance of the EVAP VSV.
Standard resistance

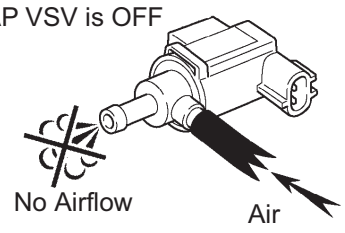
Tester Connection	Specified Condition
Between terminals	26 to 30 Ω at 20°C (68°F)
Each terminal - Body ground	10 kΩ or more

NG → **REPLACE EVAP VSV**

OK

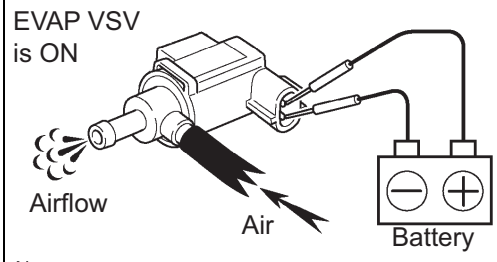
33 INSPECT EVAP VSV

If EVAP VSV is functioning normally:



(a) Remove the EVAP VSV.
(b) Apply air to the EVAP VSV using an air gun, check the airflow.

If EVAP VSV is functioning normally:



(c) Apply battery positive voltage across the terminals.
(d) Apply air to the EVAP VSV using an air gun, check the airflow.

Result

EVAP VSV	Conclusion	Proceed to
Air does not flow when EVAP VSV is OFF. Air flows when EVAP VSV is ON.	EVAP VSV is functioning normally.	OK
Air flows when EVAP VSV is OFF. Air does not flow when EVAP VSV is ON.	Electrical circuit of EVAP VSV is malfunctioning.	NG

NG → REPLACE EVAP VSV

OK

34 CHECK HARNESS AND CONNECTOR (EVAP VSV - POWER SOURCE)

Wire Harness Side Connector of EVAP VSV

(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminal 1 of the wire harness side and body ground.

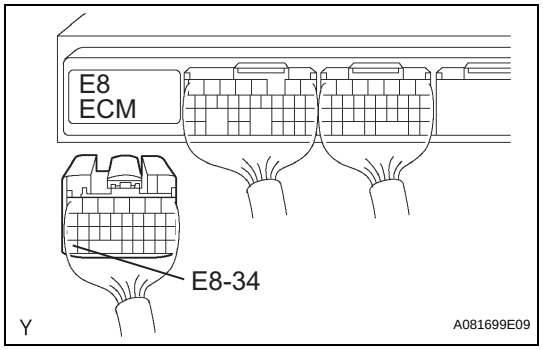
Result

Voltage	Conclusion	Proceed to
Battery voltage	Wire harness (EVAP VSV - Power source) is OK.	OK
0 to 3 V	Wire harness (EVAP VSV - Power source) is short circuit.	NG

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

35 **CHECK HARNESS AND CONNECTOR (EVAP VSV - ECM)**



(a) Turn the ignition switch OFF.
(b) Disconnect the E8 ECM connector.
(c) Turn the ignition switch ON.
(d) Measure the voltage between the terminal 34 of the wire harness side and body ground.

Result

Voltage	Conclusion	Proceed to
Battery voltage	Wire harness (EVAP VSV - ECM) is OK.	OK
0 to 3 V	Wire harness (EVAP VSV - ECM) is short circuit.	NG

ES

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

OK ↓

REPLACE ECM

36 **CHECK FUEL TANK CAP ASSEMBLY**

(a) Connect the fuel tank cap to the gas cap adaptor.
(b) Connect the pressure hose from the pump to the gas cap adaptor.
(c) Plug the gas cap adaptor port.
(d) Turn the pump ON and pressurize the gas cap adaptor by 24 - 28 mmHg. If the pressure does not reach to 24 mmHg within 45 seconds, stop the pump. The fuel tank cap is malfunctioning.
(e) Turn the pump OFF and seal the pressure line to maintain the pressure.
(f) Measure the pressure change for 2 minutes. If the pressure drops to lower than 15 mmHg, the fuel tank cap is malfunctioning.

Standard:

The fuel tank cap keeps the pressure that is 15 mmHg or higher.

NG → **REPLACE FUEL TANK CAP ASSEMBLY**

OK ↓

37 **CHECK LEAK**

NOTICE:
DO NOT apply the EVAP system to the pressure that is higher than 35 mmHg. The EVAP system will be damaged.

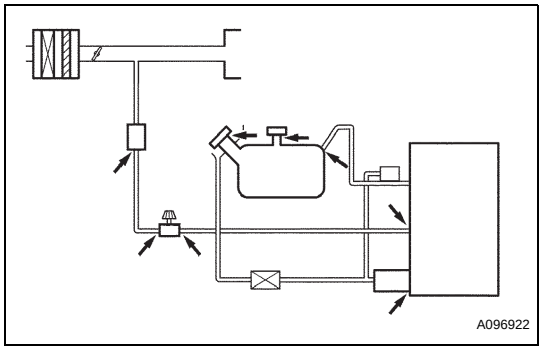
(a) Connect the pressure line from the pump to the EVAP service port.
(b) Turn the ignition switch ON but the engine is not running.
(c) Turn the CCV (vent valve) is ON (close) using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and CAN CTRL VSV.
(d) Turn the pump ON and pressurize the EVAP system by 24 - 28 mmHg.
(e) Turn the pump OFF and seal the pressure line to maintain the pressure. If the pressure does not reach to 24 mmHg within 45 seconds, stop the pump. A leakage is in the EVAP system. If the system has a small leak, a whistling sound may be heard.
(f) Measure the pressure change for 2 minutes. If the pressure drops to lower than 15 mmHg, a leakage is in the EVAP system.
Standard:
The EVAP system keeps the pressure that is 15 mmHg or higher.

NG → **Go to step 38**

OK

NO LEAKAGE IN EVAP SYSTEM

38	**LOOK FOR LEAK POINT**



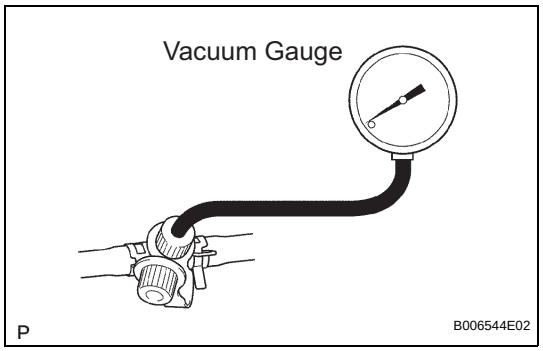
(a) Apply the soapy water on suspected components.
(b) Turn the CCV (vent valve) is ON (close) using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and CAN CTRL VSV.
(c) Turn the pump ON and pressurize the EVAP system by 24 - 28 mmHg.
(d) Turn the pump OFF and seal the pressure line to maintain the pressure. If the pressure does not reach to 24 mmHg within 45 seconds, stop the pump.
(e) Check bubbles to find the leak point:
- EVAP service port
- Canister
- Hose connections/Lines
- Fuel cap
- Fuel filler neck
- Purge line
- EVAP VSV
- CCV (vent valve)
- Fuel pump sending unit

(f) Repair or replace the leak component.
(g) Perform the EVAP system check to confirm no leak.

NEXT

GO TO STEP 4

39	CHECK EVAP VSV



(a) Connect the vacuum gauge to the EVAP service port.
  (1) Start the engine.
  (2) Switch the EVAP VSV using the intelligent tester. Select the intelligent tester menus: DIAGNOSIS, ENHANCED OBD ll, ACTIVE TEST and EVAP VSV.
  (3) Check the vacuum when switching the EVAP VSV. If the vacuum gauge indicates negative value when the EVAP VSV is ON, the EVAP VSV is functioning normally.

OK:

The vacuum gauge indicates negative value when the EVAP VSV is ON.

NG → **Go to step 31**

OK

GO TO STEP 17

40	CHECK MONITOR STATUS AND DTC

(a) Clear DTCs.
(b) Perform a drive pattern test (See page ES-16)
(c) Check that the monitor result is PASS.
(d) Confirm no pending DTC.

NEXT

REPAIR IS COMPLETE

ES

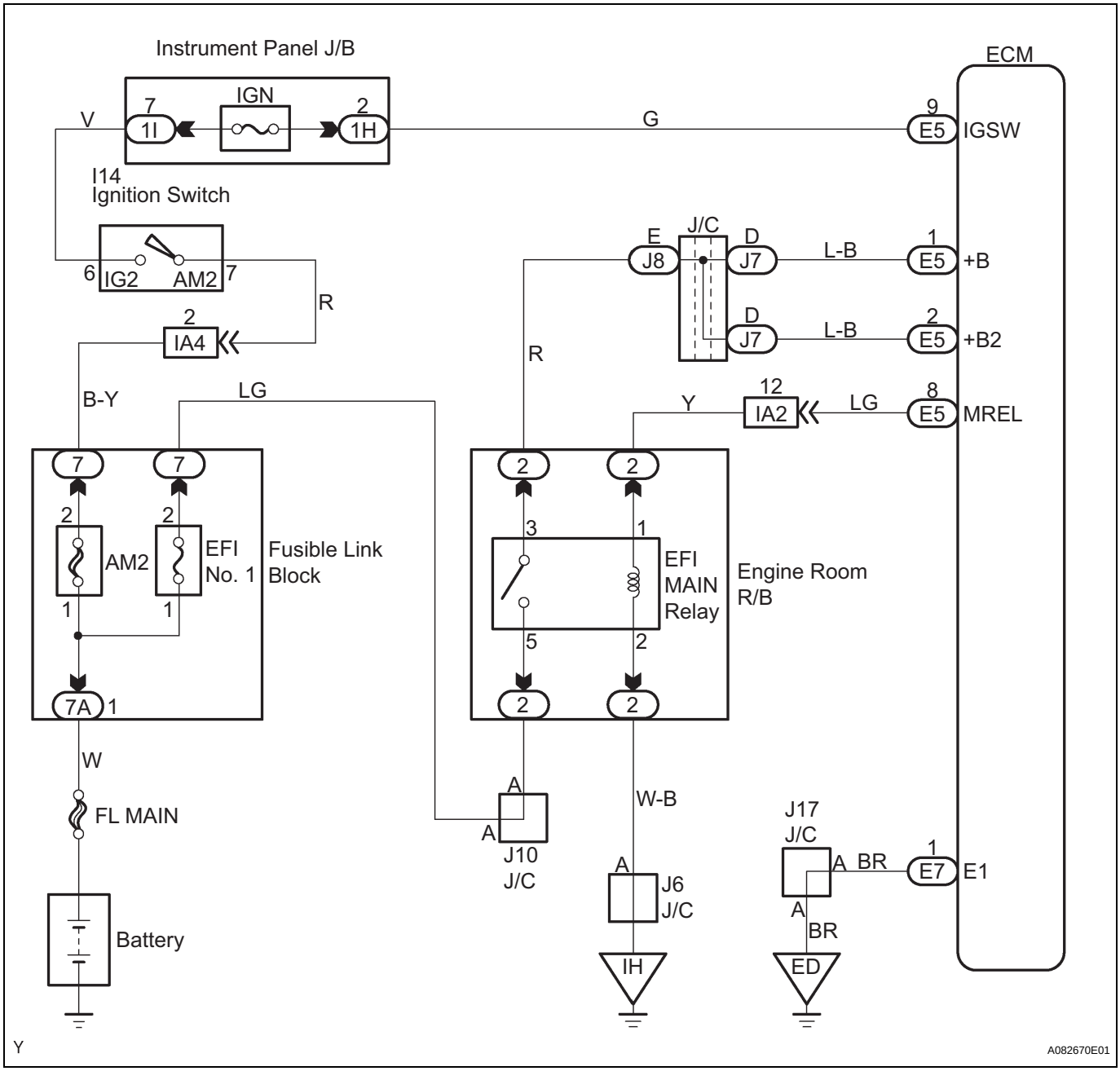
ECM Power Source Circuit

DESCRIPTION

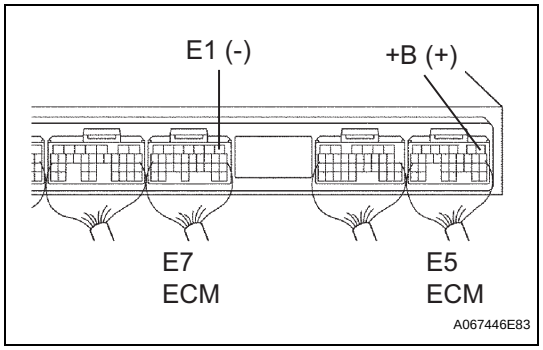
When the ignition switch is turned ON, battery voltage is applied to terminal IGSW of the ECM. The ECM "MREL" output signal causes current to flow to the coil, closing the contacts of the EFI relay (marked: EFI) and supplying power to terminal +B of the ECM.
If the ignition switch is turned OFF, the ECM holds the EFI relay ON for a maximum of 2 seconds to allow the initial setting of the throttle valve.

WIRING DIAGRAM

ES



1 INSPECT ECM (+B VOLTAGE)



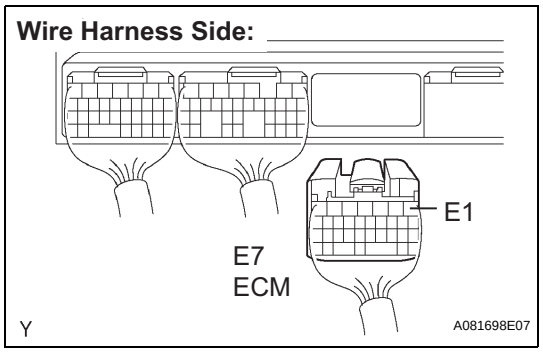
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
E5-1 (+B) - E7-1 (E1)	9 to 14 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE**

NG

2 CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)



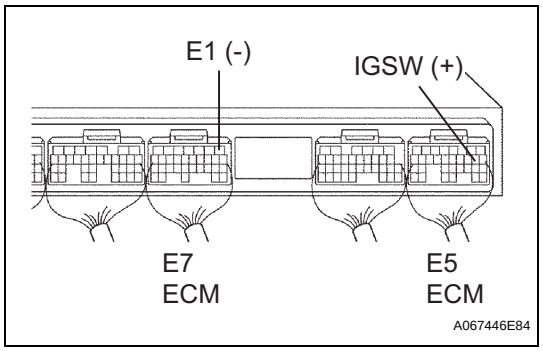
(a) Disconnect the E7 ECM connector.
(b) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
E7-1 (E1) - Body ground	Below 1 Ω

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

OK

3 INSPECT ECM (IGSW VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

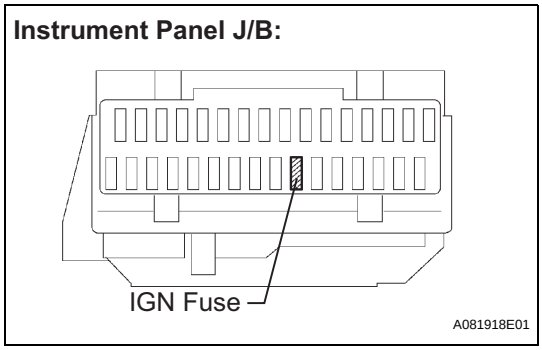
Tester Connection	Specified Condition
E5-9 (IGSW) - E7-1 (E1)	9 to 14 V

OK → **Go to step 6**

NG

ES

4	CHECK IGN FUSE

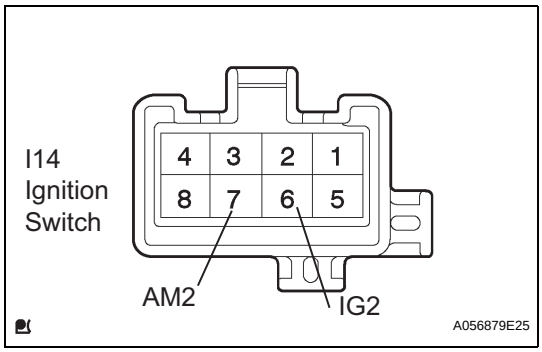


(a) Remove the IGN fuse from the instrument panel J/B.
(b) Measure the resistance of the IGN fuse.
Standard resistance:
Below 1 Ω

NG → **REPLACE IGN FUSE**

OK

5	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY



(a) Measure the resistance of the switch terminals shown in the chart below.
Standard resistance

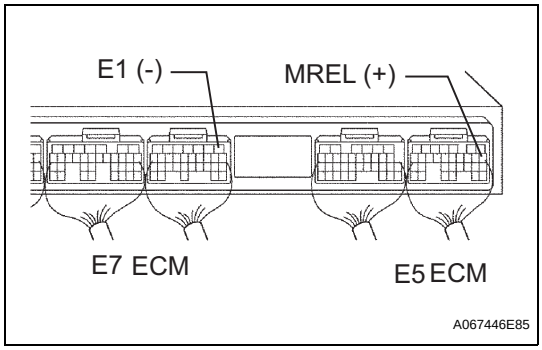
Tester Connection	Switch Condition	Specified Condition
6 (IG2) - 7 (AM2)	LOCK	10 kΩor higher
6 (IG2) - 7 (AM2)	ON	Below 1 Ω

NG → **REPLACE IGNITION OR STARTER SWITCH ASSEMBLY**

OK

CHECK AND REPLACE HARNESS AND CONNECTOR (BATTERY - IGNITION SWITCH, IGNITION SWITCH - ECM)

6	INSPECT ECM (MREL VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

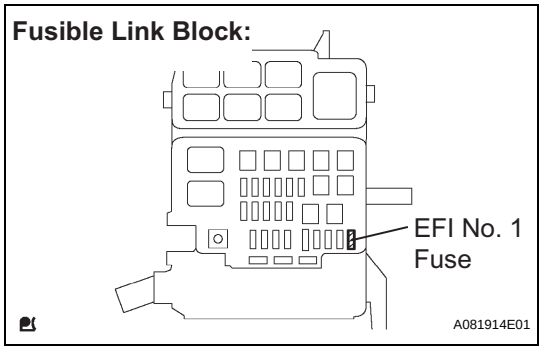
Tester Connection	Specified Condition
E5-8 (MREL) - E7-1 (E1)	9 to 14 V

NG → **REPLACE ECM**

OK

ES

7	CHECK EFI NO.1 FUSE

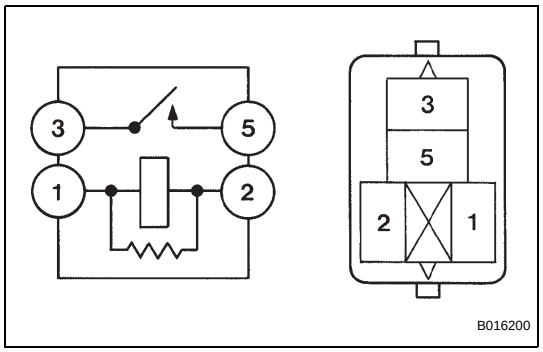


(a) Remove the EFI No. 1 fuse from the fusible link block.
(b) Measure the resistance of the EFI No. 1 fuse.
Standard resistance:
Below 1 Ω
(c) Install the EFI NO. 1 fuse.

NG → **REPLACE EFI NO.1 FUSE**

OK

8	INSPECT EFI MAIN RELAY



(a) Remove the EFI MAIN relay from the engine room R/B.
(b) Measure the resistance of the EFI MAIN relay.
Standard resistance

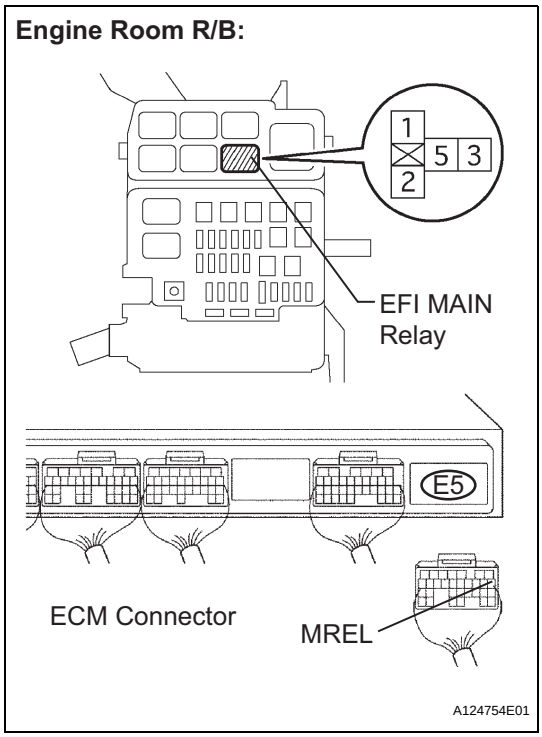
Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE EFI MAIN RELAY**

OK

ES

9	CHECK HARNESS AND CONNECTOR (EFI MAIN RELAY- ECM, EFI MAIN RELAY - BODY GROUND)



(a) Check the wire harness between the EFI MAIN relay and ECM.
  (1) Remove the EFI MAIN relay from the engine room R/B.
  (2) Disconnect the E5 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
R/B EFI MAIN relay terminal 1 - E5-8 (MREL)	Below 1 Ω
R/B EFI MAIN relay terminal 1 or E5-8 (MREL) - Body ground	10 kΩ or higher

(b) Check the wire harness between the EFI MAIN relay and body ground.
  (1) Remove the EFI MAIN relay from the engine room R/B.
  (2) Measure the resistance between the wire harness side connector.
  Standard resistance

Tester Connection	Specified Condition
R/B EFI MAIN relay terminal 2 - Body ground	Below 1 Ω

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

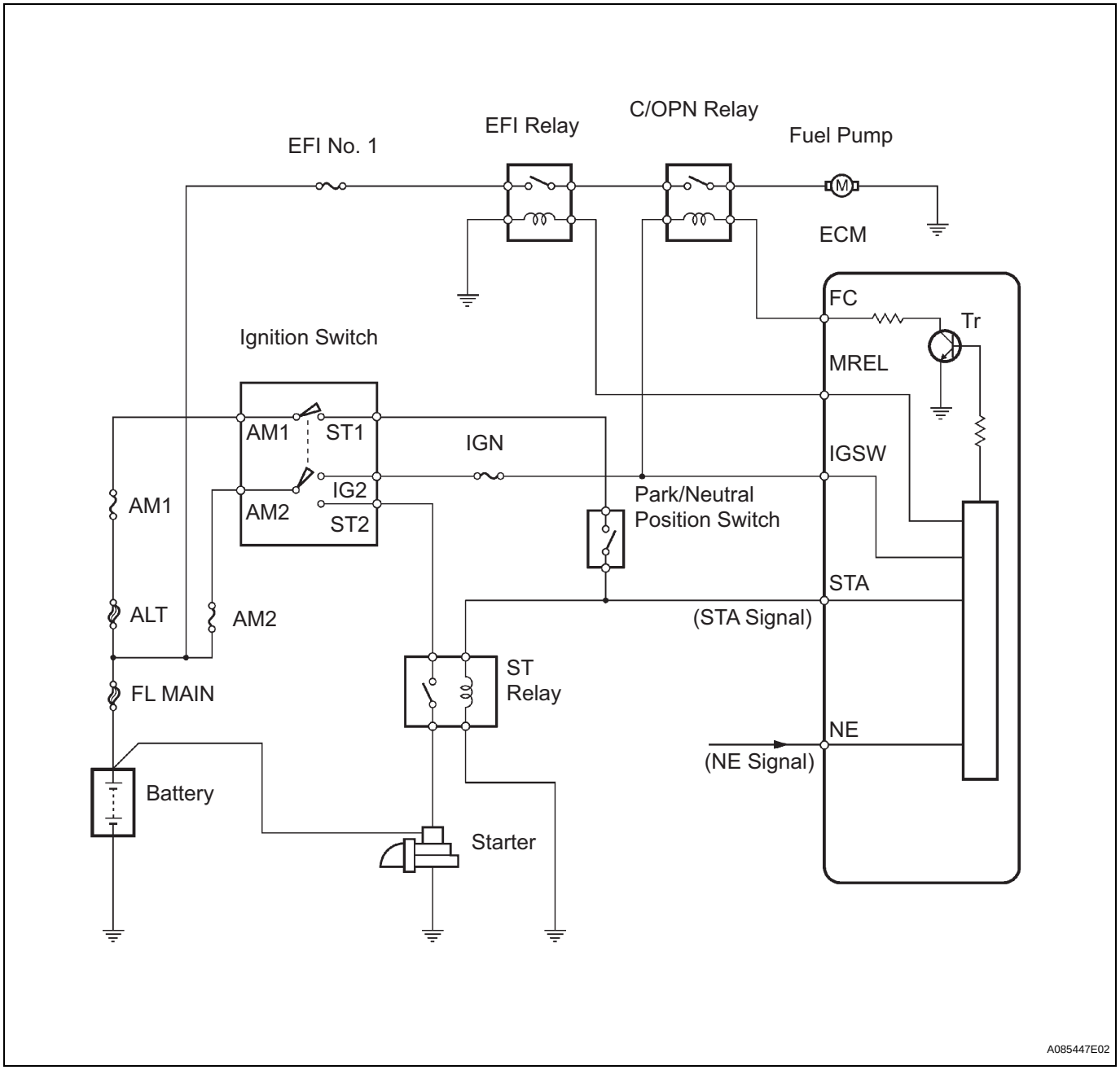
OK

CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM - BATTERY POSITIVE TERMINAL)

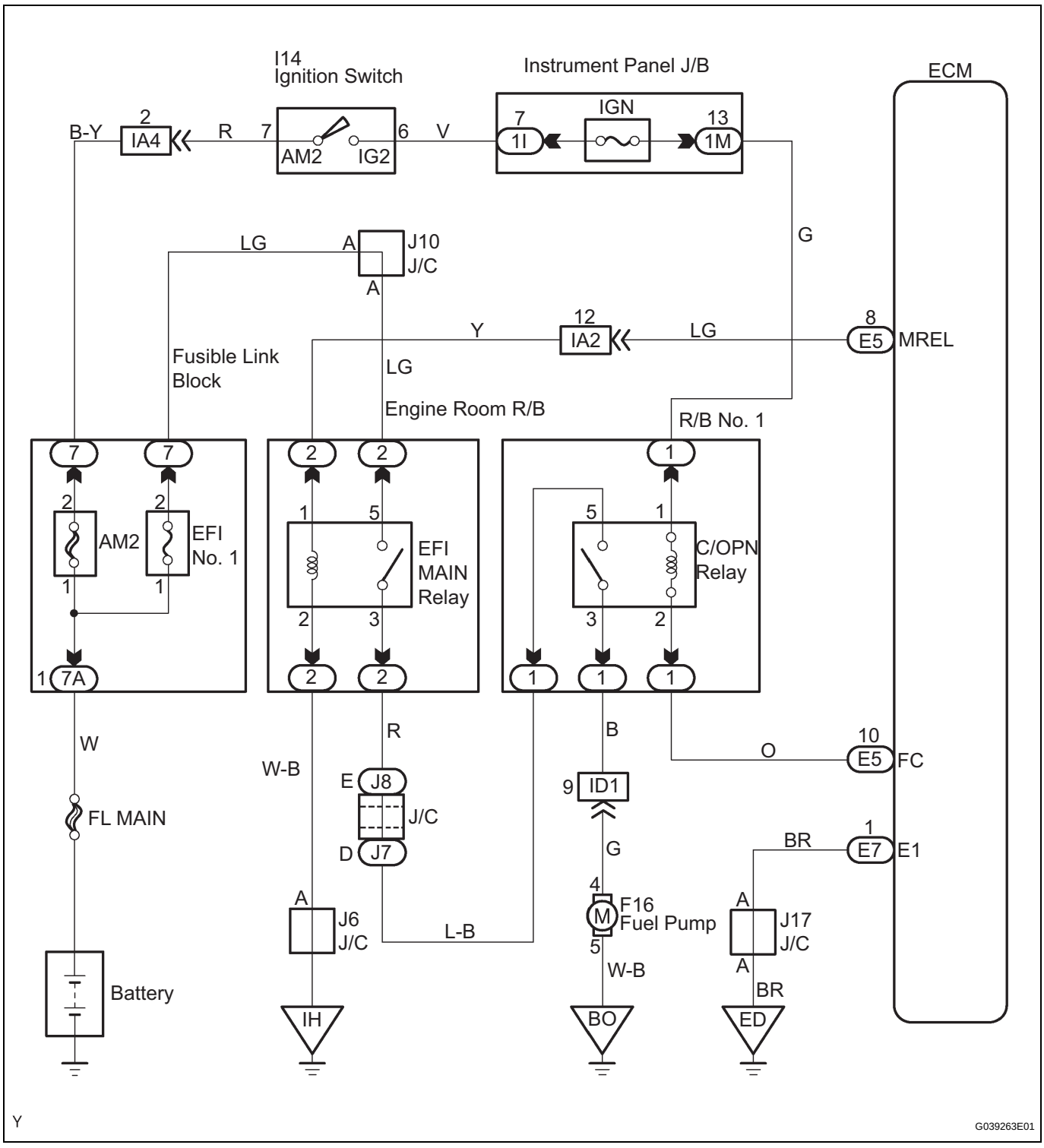
Fuel Pump Control Circuit

DESCRIPTION

When the engine is cranked, current flows from the IG2ition switch terminal ST1 to the starter relay coil (marking: ST), and current flows to terminal STA of ECM (STA signal).
When the STA signal and NE signal are input to the ECM, Tr is turned ON, current flows to coil of the circuit opening relay (marking: C/OPN), the relay switches ON, power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is generated and the engine is running, the ECM keeps Tr ON (C/OPN relay ON) and the fuel pump also keeps operating.



WIRING DIAGRAM



1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE C/OPN RELAY)

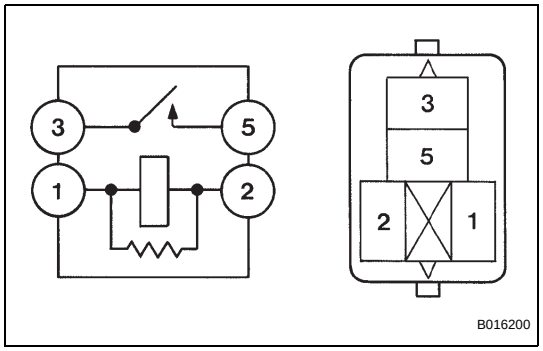
(a) Connect the intelligent tester to the DLC3.
(b) Turn ON the ignition switch, push the intelligent tester or the OBD II scan tool main switch ON.

(c) Enter the following menus :DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / FUEL PUMP / SPD.
(d) Check the relay operation while operating it using the intelligent tester.
Standard:
Operating noise can be heard from the relay.

OK → **Go to step 5**

NG

2 INSPECT C/OPN RELAY



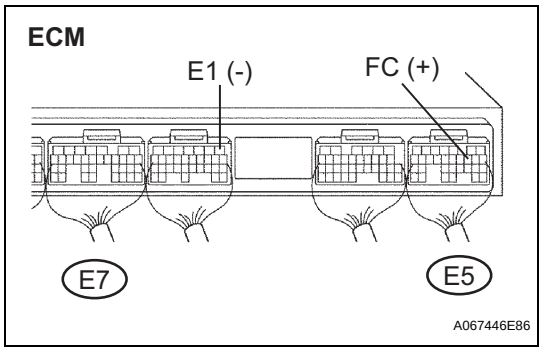
(a) Remove the C/OPN relay from the R/B No. 1.
(b) Measure the resistance of the C/OPN relay.
Standard resistance

Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage is applied to terminals 1 and 2)

NG → **REPLACE C/OPN RELAY**

OK

3 INSPECT ECM (FC VOLTAGE)



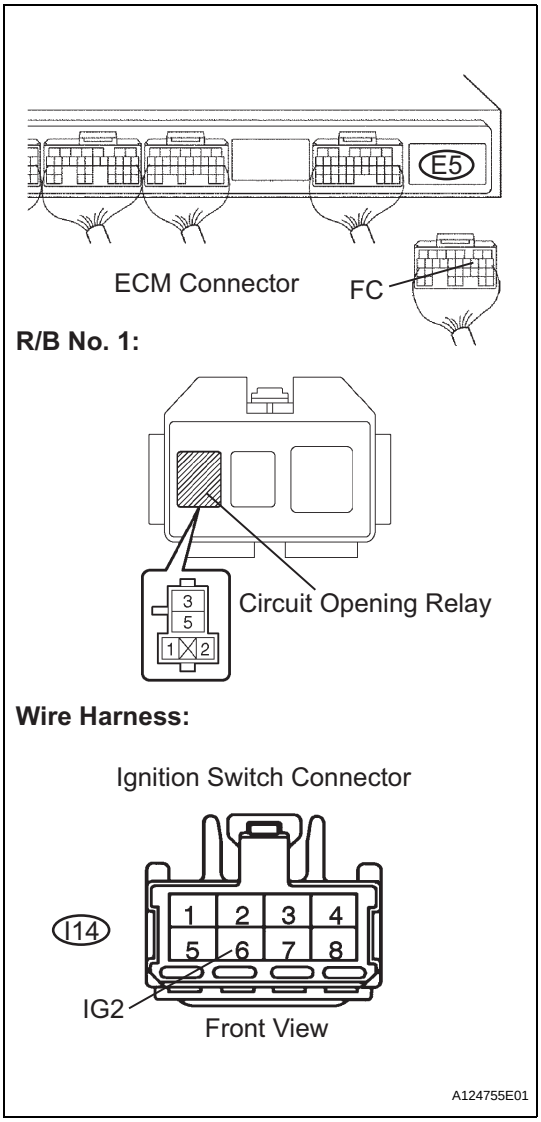
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
E5-10 (FC) - E7-1 (E1)	9 to 14 V

OK → **REPLACE ECM**

NG

4	CHECK HARNESS AND CONNECTOR (ECM - C/OPN RELAY, C/OPN RELAY - IGNITION)



(a) Check the wire harness between the ECM and C/OPN relay.
  (1) Disconnect the E5 ECM connector.
  (2) Remove the C/OPN relay from the R/B No. 1.
  (3) Measure the resistance of the wire harness side connectors.
  Standard resistance

Terminal Connections	Specified Condition
E5-10 (FC) - 2 of C/OPN relay	Below 1 Ω
E5-10 (FC) or 2 of C/OPN relay - Body ground	10 kΩ or higher

(b) Check the wire harness between the C/OPN relay and ignition switch.
  (1) Inspect the IGN fuse.
    • Remove the IGN fuse from the instrument panel J/B.
    • Check the resistance of the IGN fuse.
    Standard resistance:
    Below 1 Ω
    • Reinstall the IG2 fuse.
  (2) Remove the C/OPN relay from the R/B No. 1.
  (3) Disconnect the I14 ignition switch connector.
  (4) Measure the resistance of the wire harness side connectors.
  Standard resistance

Terminal Connections	Specified Condition
C/OPN relay terminal 1 - I14-6	Below 1 Ω
C/OPN relay terminal 1 or I14-6 - Body ground	10 kΩ or higher

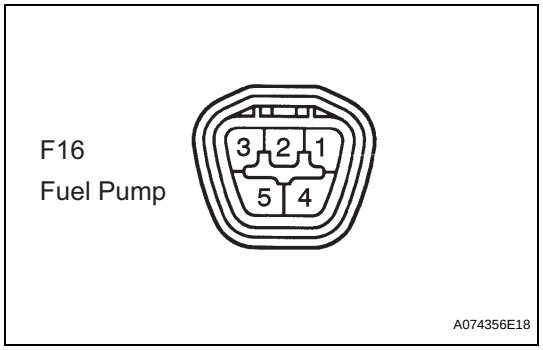
(c) Install the C/OPN relay.
(d) Reconnect the ECM connector and ignition switch connector.

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

OK

REPLACE ECM

5 INSPECT FUEL PUMP



(a) Measure the resistance of the fuel pump.
(1) Measure the resistance between terminals 4 and 5.
Standard resistance

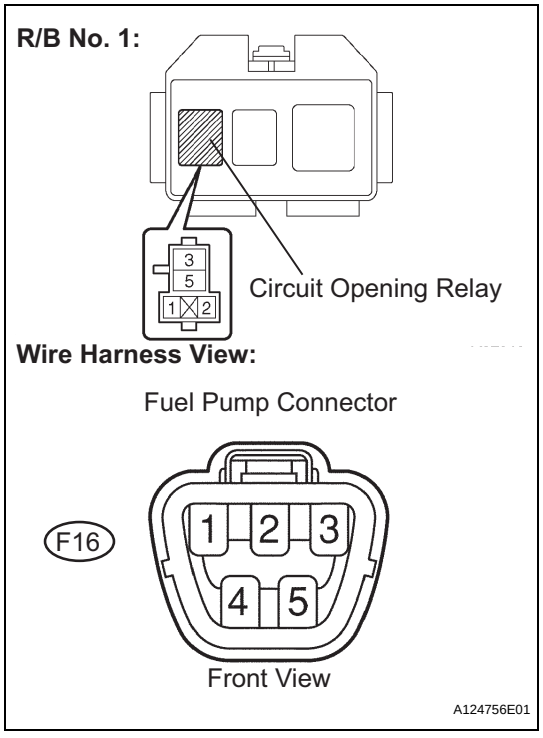
Terminal Connections	Condition	Specified Condition
4-5	20°C (68°F)	0.2 to 0.3 Ω

(b) Check operation of the fuel pump.
(1) Apply battery voltage to both terminals. Check that the pump operates.
NOTICE:
- **These tests must be done quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always turn ON and OFF the voltage on the battery side, not the fuel pump side.**

NG → **REPLACE FUEL PUMP**

OK

6 CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL PUMP, FUEL PUMP - BODY GROUND)



(a) Check the wire harness between the C/OPN relay and fuel pump.
(1) Remove the C/OPN relay from the R/B No. 1.
(2) Disconnect the F16 fuel pump connector.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
C/OPN relay terminal 3 - F16-4	Below 1 Ω
C/OPN relay terminal 3 or F16-4 - Body ground	10 kΩ or higher

(b) Check the wire harness between the fuel pump and body ground.
(1) Disconnect the F16 fuel pump connector.
(2) Measure the resistance of the wire harness side connector and body ground.
Standard resistance

Tester Connection	Specified Condition
F16-5 (Fuel pump) - Body ground	Below 1 Ω

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

OK

REPLACE ECM

1	CHECK FUEL PUMP OPERATION

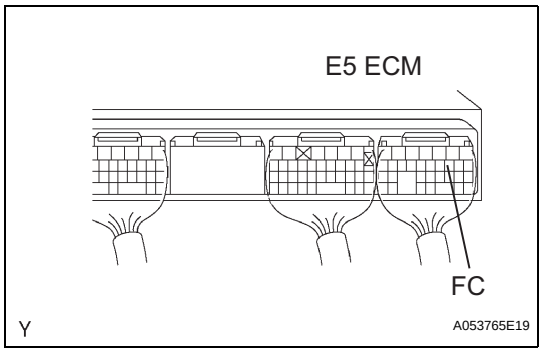
(a) Check if there is pressure in the fuel inlet hose.
HINT:
The pump has fuel pressure if the sound of fuel flowing can be heard.

ES

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE**

NG

2	CHECK RELAY OPERATION (C/OPN)

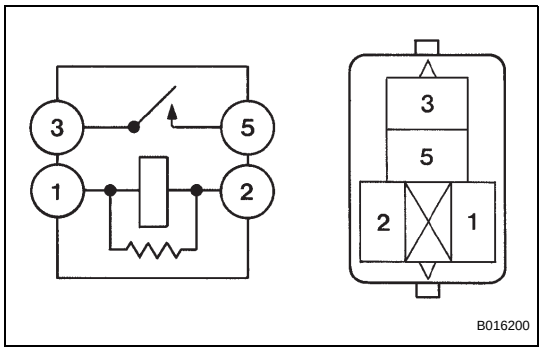


(a) Connect terminal FC of the E5 ECM connector and body ground, and check relay operation.
Standard:
Noise can be heard from the C/OPN relay.

OK → **Go to step 6**

NG

3	INSPECT C/OPN RELAY



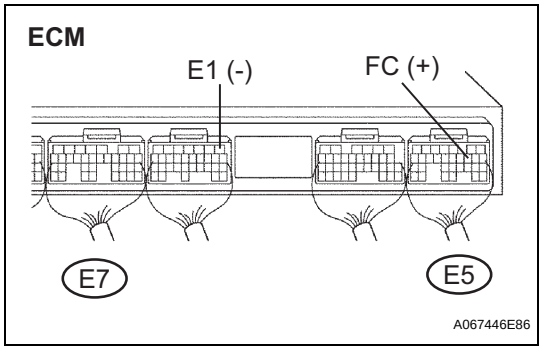
(a) Remove the C/OPN relay from the R/B No. 1.
(b) Measure the resistance of the C/OPN relay.
Standard resistance

Tester Connection	Specified Condition
1 - 2	Below 1 Ω
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → **REPLACE RELAY**

OK

4 INSPECT ECM (FC VOLTAGE)



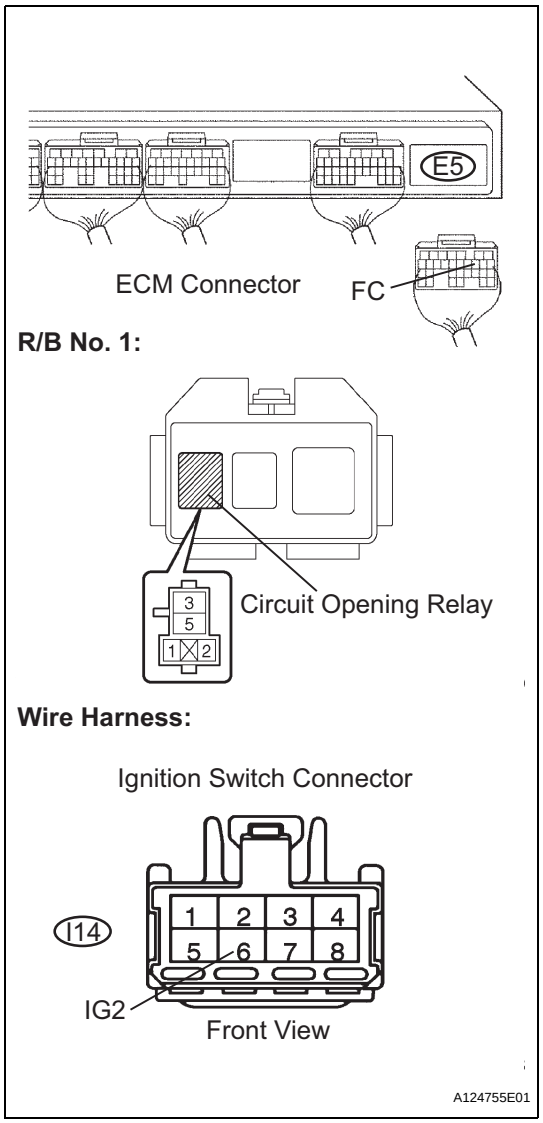
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
E5-10 (FC) - E7-1 (E1)	9 to 14 V

NG → **REPLACE ECM**

OK

5 CHECK HARNESS AND CONNECTOR (ECM - C/PN RELAY , C/OPN RELAY IGNITION)



(a) Check the wire harness between the ECM and C/OPN relay.
(1) Disconnect the E5 ECM connector.
(2) Remove the C/OPN relay from the R/B No. 1.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
E5-10 (FC) - C/OPN relay terminal 2	Below 1 Ω
E5-10 (FC) or C/OPN relay terminal 2 - Body ground	10 kΩ or higher

(b) Check the wire harness between the C/OPN relay and ignition switch.
(1) Check the IGN fuse.
- Remove the IGN fuse from the engine room J/B.
- Measure the resistance of the IGN fuse.
Standard resistance:
Below 1 Ω
- Reinstall the IGN fuse.

(2) Remove the C/OPN relay from the R/B No. 1.
(3) Disconnect the I14 ignition switch connector.
(4) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
C/OPN relay terminal 1 - I14-6 (Ignition switch)	Below 1 Ω
C/OPN relay terminal 1 or I14-6 (Ignition switch) - Body ground	10 kΩ or higher

(c) Install the C/OPN relay.
(d) Reconnect the ECM connector and ignition switch connector.

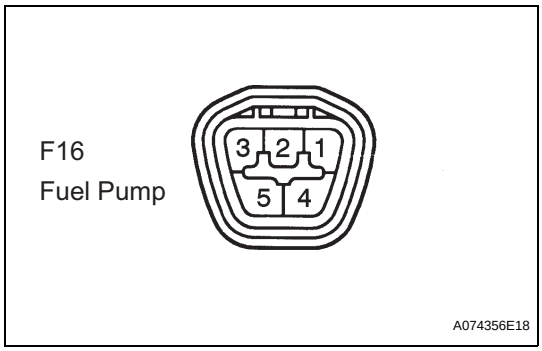
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

ES

OK

REPLACE ECM

6	INSPECT FUEL PUMP



(a) Measure the resistance of the fuel pump.
(1) Measure the resistance between terminals 4 and 5.
Standard resistance

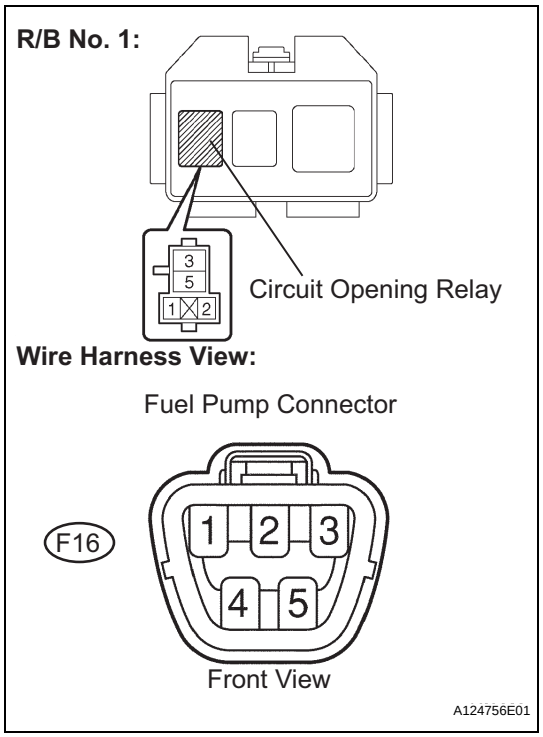
Tester Connection	Condition	Specified Condition
4-5	20°C (68°F)	0.2 to 0.3 Ω

(b) Check operation of the fuel pump.
(1) Apply battery voltage to both the terminals. Check that the pump operates.
NOTICE:
- **These tests must be done quickly (within 10 seconds) to prevent the coil from burning out.**
- **Keep the fuel pump as far away from the battery as possible.**
- **Always turns ON and OFF the voltage on the battery side, not the fuel pump side.**

NG → REPLACE FUEL PUMP

OK

7	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL PUMP, FUEL PUMP - BODY GROUND)



(a) Check the wire harness between the C/OPN relay and fuel pump.
  (1) Remove the C/OPN relay from the R/B No. 1.
  (2) Disconnect the F16 fuel pump connector.
  (3) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
C/OPN relay terminal 3 - F16-4	Below 1 Ω
C/OPN relay terminal 3 or F16-4 - Body ground	10 kΩ or higher

(b) Check the wire harness between the fuel pump and body ground.
  (1) Disconnect the F16 fuel pump connector.
  (2) Measure the resistance of the wire harness side connector.

Standard resistance

Tester Connection	Specified Condition
F16-5 - Body ground	Below 1 Ω

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

OK

REPLACE ECM

ES

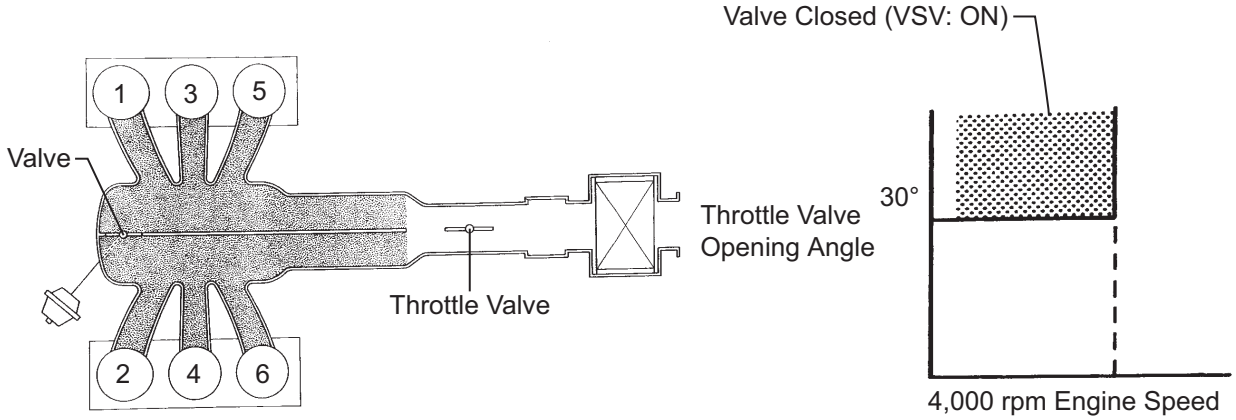
ACIS Control Circuit

DESCRIPTION

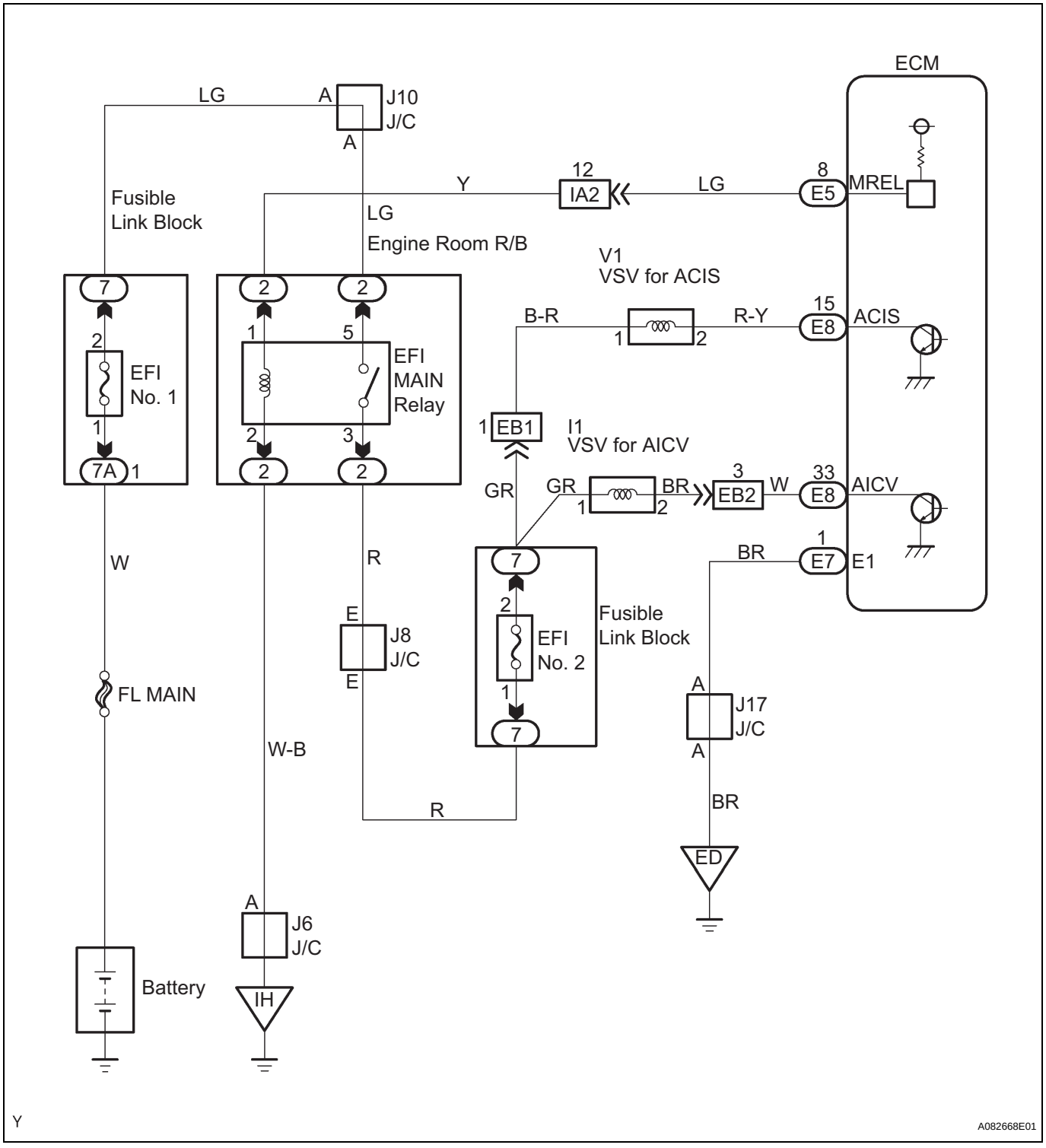
HINT:

ACIS stands for "Acoustic Control Induction System".

The ECM opens and closes the Intake Air Control (IAC) valve No.2 in response to engine speed (RPM/NE). This system improves intake manifold tuning for better efficiency at low and high engine rpm. When the engine speed is 4,000 rpm or less and the throttle valve opening angle is 30° or more, the ECM turns the VSV ON to operate the IAC valve.

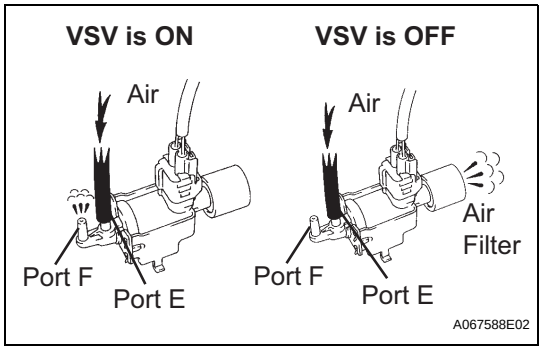


WIRING DIAGRAM



ES

1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE VSV FOR ACIS)



(a) Disconnect the vacuum hose.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON and push the intelligent tester main switch ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / INTAKE CTL VSV1. Operate the VSV.
(e) Check the VSV operation when it is operated by the intelligent tester.

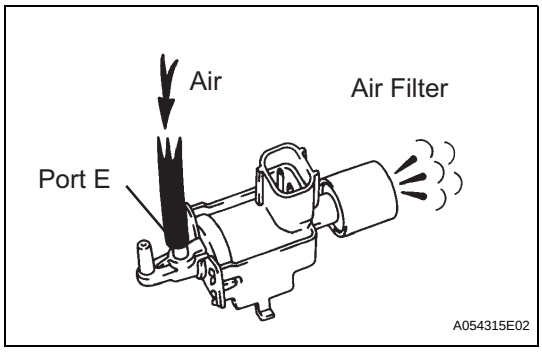
Standard

Tester Operation	Specified Condition
VSV is ON	Air from port E flows out through port F
VSV is OFF	Air from port E flows out through the air filter

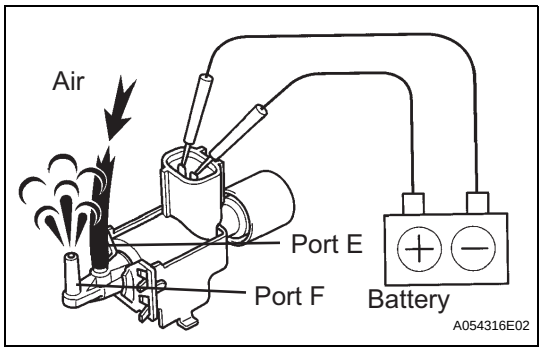
OK → **Go to step 4**

NG

2	CHECK VSV FOR ACIS (OPERATION)



(a) Check that air flows from port E to the air filter.

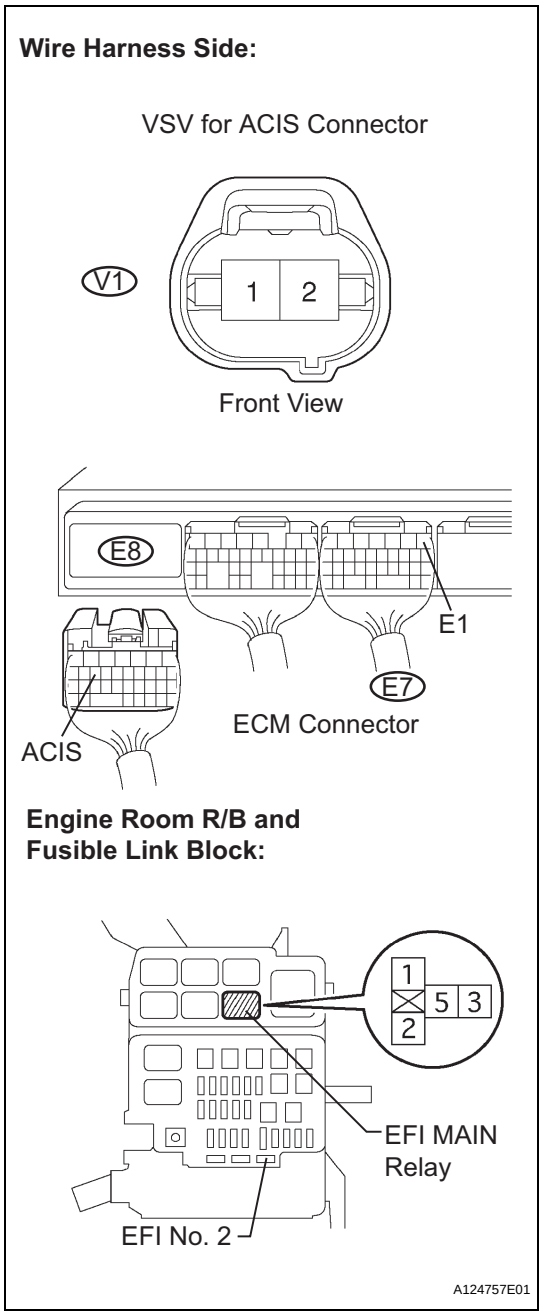


(b) Apply battery positive voltage across the terminals.
(c) Check that air flows from port E to port F.

NG → **REPLACE VSV FOR ACIS**

OK

3	CHECK HARNESS AND CONNECTOR (VSV FOR ACIS - ECM, VSV FOR ACIS - EFI MAIN RELAY)



(a) Check the wire harness between the VSV and the ECM.
  (1) Disconnect the V1 VSV connector.
  (2) Disconnect the E8 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
V1-2 - E8-15 (ACIS)	Below 1 Ω
V1-2 or E8-15 (ACIS) - Body ground	10 kΩ or higher

(b) Check the wire harness between the VSV and EFI MAIN relay.
  (1) Check the EFI No. 2 fuse.
    • Remove the EFI No. 2 fuse from the fusible link block.
    • Measure the resistance of the EFI No. 2 fuse.
    Standard resistance:
    Below 1 Ω
    • Reinstall the EFI No. 2 fuse.
  (2) Disconnect the V2 VSV connector.
  (3) Remove the EFI MAIN relay from the engine room R/B.
  (4) Measure the resistance of the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
V1-1 - EFI MAIN relay terminal 3	Below 1 Ω

(c) Install the EFI MAIN relay.
(d) Reconnect the VSV connector and ECM connector.

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

OK

4	CHECK VACUUM HOSES (INTAKE MANIFOLD - INTAKE AIR CONTROL VALVE)

Check that the vacuum hoses are:
- Connected correctly.
- Are not loose or disconnected.
- Do not have cracks, holes or damage.

NG → **REPAIR OR REPLACE VACUUM HOSES**

ES

OK

5	INSPECT INTAKE AIR CONTROL VALVE

(a) Inspect the intake air control valve. (See page IT-2)

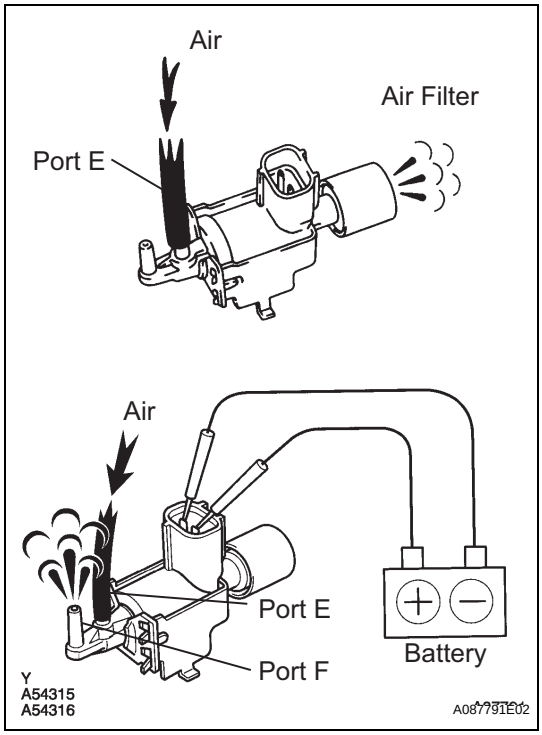
NG → REPLACE INTAKE AIR CONTROL VALVE

OK

REPLACE ECM

ES

1	INSPECT VSV FOR ACIS (OPERATION)

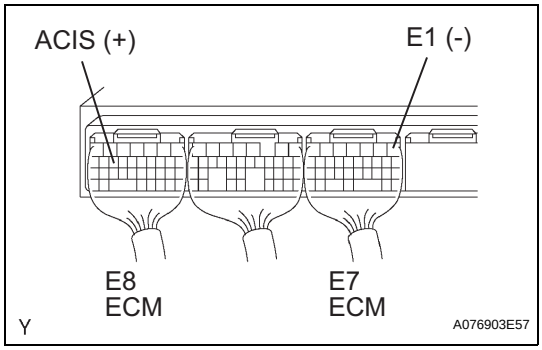


(a) Disconnect the VSV for ACIS connector.
(b) Check operation of the VSV for ACIS when battery positive voltage is applied to the terminals of the VSV for ACIS.
Standard:
Battery positive voltage is not applied:
Air from port E flows out through the air filter.
Battery positive voltage is applied:
Air from port E flows out through port F.

NG → REPLACE VSV FOR ACIS

OK

2	INSPECT ECM (ACIS VOLTAGE)



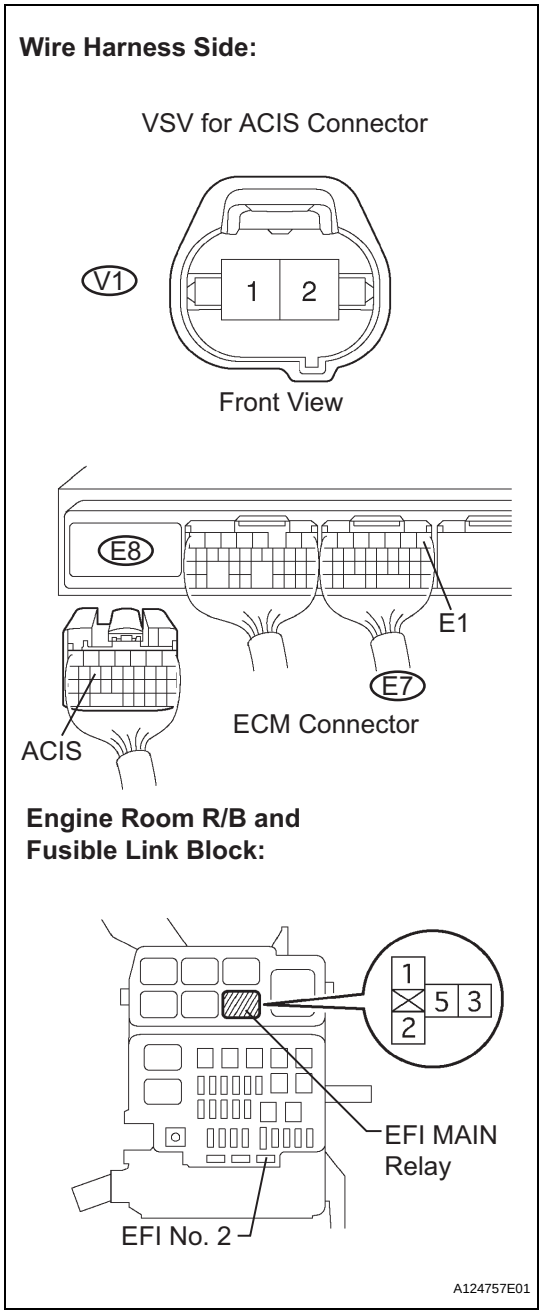
(a) Start the engine.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Condition	Specified Condition
E8-15 (ACIS) - E7-1 (E1)	• Engine speed is 4,000 rpm or less • Throttle valve opening angle is 30° or more	9 to 14 V

OK → Go to step 4

NG

3	CHECK HARNESS AND CONNECTOR (VSV FOR ACIS - ECM, VSV FOR ACIS - EFI MAIN RELAY)



(a) Check the wire harness between the VSV for ACIS and the ECM.
  (1) Disconnect the V1 VSV for ACIS connector.
  (2) Disconnect the E8 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
V1-2 - E8-15 (ACIS)	Below 1 Ω
V1-2 or E8-15 (ACIS) - Body ground	10 kΩ or higher

(b) Check the wire harness between the VSV and EFI MAIN relay.
  (1) Check the EFI No. 2 fuse.
    • Remove the EFI No. 2 fuse from the fusible link block.
    • Measure the resistance of the EFI No. 2 fuse.
  Standard resistance:
  Below 1 Ω
    • Reinstall the EFI No. 2 fuse.
  (2) Disconnect the V1 VSV connector.
  (3) Remove the EFI MAIN relay from the engine room R/B.
  (4) Measure the resistance OF the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
V1-1 (VSV for ACIS) - EFI MAIN relay terminal 3	Below 1 Ω

(c) Install the EFI MAIN relay.
(d) Reconnect the VSV connector and ECM connector.

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

OK

4	CHECK VACUUM HOSES (INTAKE MANIFOLD - INTAKE AIR CONTROL VALVE)

Check that the vacuum hoses are:
- Connected correctly.
- Are not loose or disconnected.
- Do not have cracks, holes or damage.

ES

NG → REPAIR OR REPLACE VACUUM HOSES

OK

5	INSPECT INTAKE AIR CONTROL VALVE

(a) Inspect the intake air control valve. (See page IT-2)

NG → REPLACE INTAKE AIR CONTROL VALVE

OK

ES

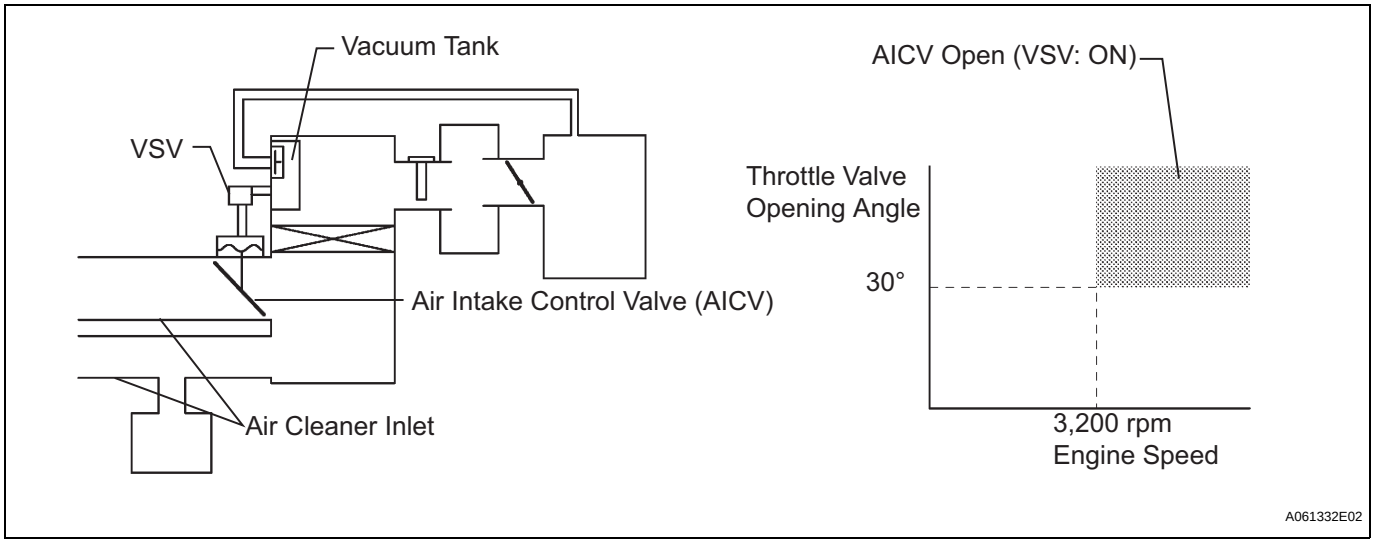
REPLACE ECM

Air Intake Control Circuit

DESCRIPTION

The air cleaner is equipped with two inlets, one of which is opened or closed by the Intake Air Control (IAC) valve No. 3. This system reduces intake noise and increases engine power at low to high speed engine speeds.

When the engine is operating at low to mid speeds, this system operates the IAC valve to close one of the air cleaner inlets. When the engine speed is more than 3,200 rpm and the opening angle of the throttle valve is more than 30°, the ECM activates the VSV and opens the IAC valve No. 3.

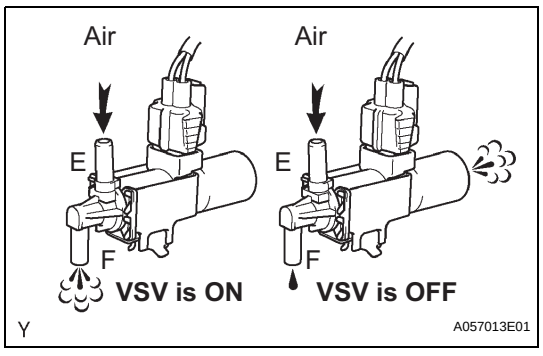


ES

WIRING DIAGRAM

Refer to ACIS CONTROL CIRCUIT (See page ES-351).

1	READ VALUE OF INTELLIGENT TESTER (VSV FOR AICV)



(a) Turn the ignition switch ON and push the intelligent tester main switch ON.

(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / INTAKE CTL VSV1. Operate the VSV.

(c) Check the operation of the VSV when the VSV is operated by the intelligent tester.

Standard

Tester Operation	Specified Condition
VSV is ON	Air from port E flows out through port F
VSV is OFF	Air from port E flows out through the air filter

OK → **Go to step 4**

NG

2	CHECK VSV FOR AICV

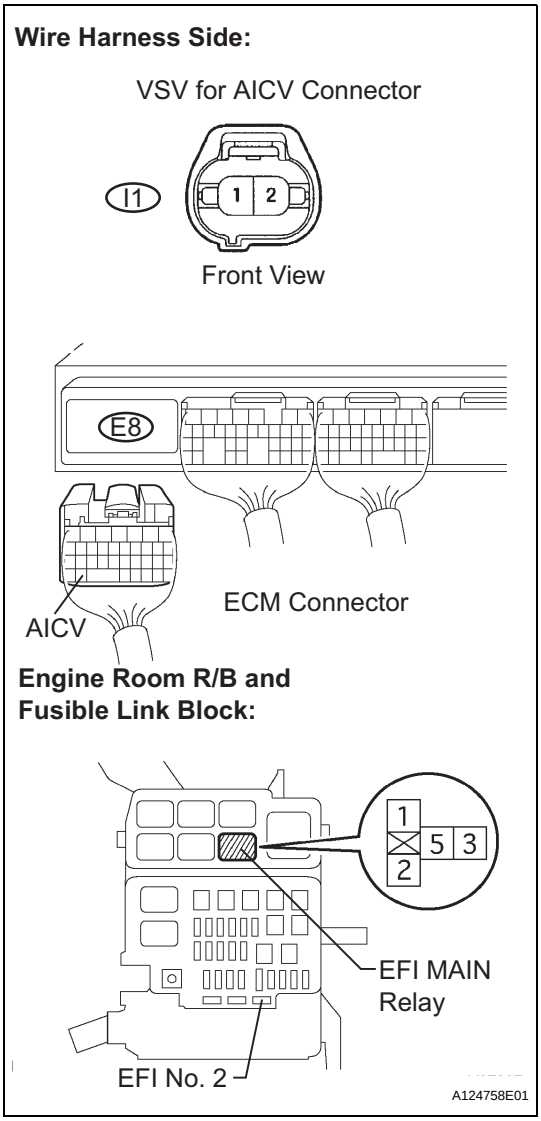
(a) Inspect the VSV for AICV. (See page IT-2)

NG → REPLACE VSV FOR AICV

OK

3	CHECK HARNESS AND CONNECTOR (VSV FOR AICV - ECM, VSV FOR AICV - EFI MAIN RELAY)

ES



(a) Check the wire harness between the VSV and ECM.
(1) Disconnect the I1 VSV connector for AICV.
(2) Disconnect the E8 ECM connector.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
I1-1 - E8-33 (AICV)	Below 1 Ω
I1-1 or E8-33 (AICV) - Body ground	10 kΩ or higher

(b) Check the wire harness between the VSV and the EFI MAIN relay.
(1) Check the EFI No. 2 fuse.
- Remove the EFI No. 2 fuse from the fusible link block.
- Measure the resistance of the EFI No. 2 fuse.

Standard resistance:
Below 1 Ω
- Reinstall the EFI No. 2 fuse.

(2) Disconnect the I1 VSV for AICV connector.
(3) Remove the EFI MAIN relay from the engine room R/B.
(4) Measure the resistance of the wire harness side connectors.
Standard resistance

Tester Connection	Specified Condition
I1-2 (VSV for AICV) - EFI MAIN relay terminal 3	Below 1 Ω

(c) Install the EFI MAIN relay.
(d) Reconnect the VSV connector and ECM connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	INSPECT VACUUM TANK

(a) Inspect the vacuum tank. (See page IT-2)

NG → REPLACE VACUUM TANK

OK

REPLACE ECM

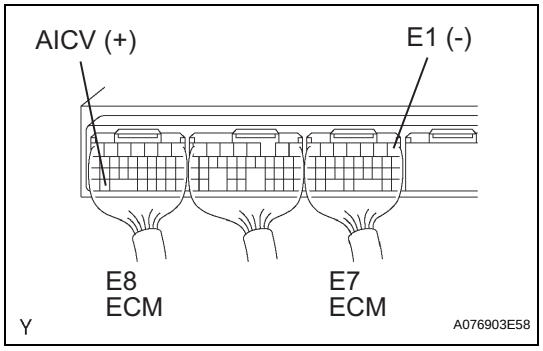
1	CHECK VSV FOR AICV

NG → **REPLACE INTAKE AIR CONTROL VALVE ASSEMBLY NO.3**

OK

ES

2	INSPECT ECM



(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
E8-33 (AICV) - E7-1 (E1)	9 to 14 V

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

OK

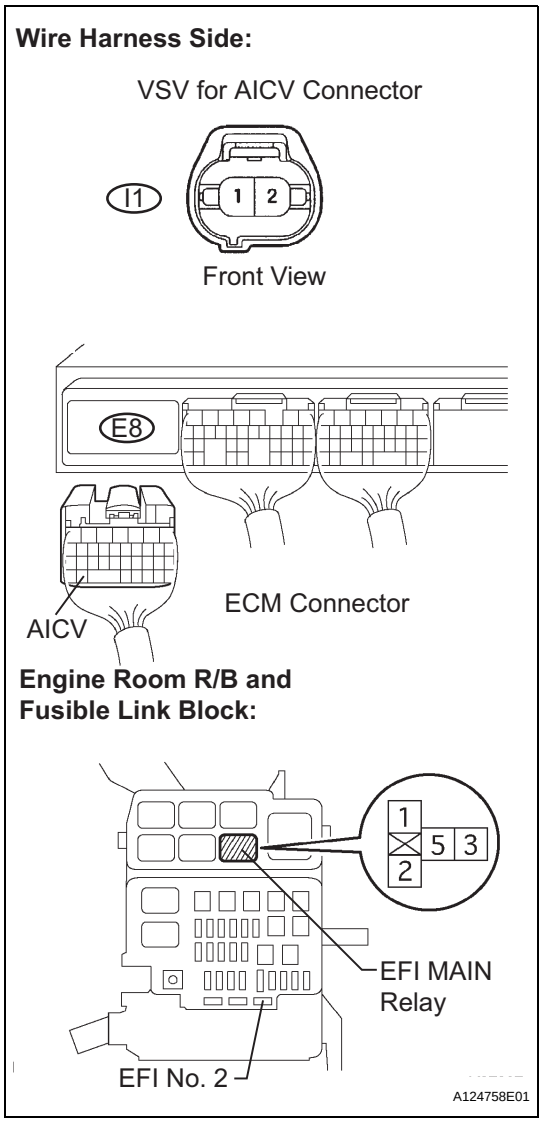
3	INSPECT VACUUM TANK

(a) Inspect the vacuum tank. (See page IT-2)

NG → **REPLACE VACUUM TANK**

OK

4	CHECK HARNESS AND CONNECTOR (VSV FOR AICV - ECM, VSV FOR AICV - EFI MAIN RELAY)



(a) Check the wire harness between the VSV for AICV and ECM.
  (1) Disconnect the I1 VSV for AICV connector.
  (2) Disconnect the E8 ECM connector.
  (3) Measure the resistance of the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
I1-1 - E8-33 (AICV)	Below 1 Ω
I1-1 or E8-33 (AICV) - Body ground	10 kΩ or higher

(b) Check the wire harness between the VSV for AICV and EFI MAIN relay.
  (1) Check the EFI No. 2 fuse.
    • Remove the EFI No. 2 fuse from the fusible link block.
    • Measure the resistance of the EFI No. 2 fuse.
  Standard resistance:
  Below 1 Ω
    • Reinstall the EFI No. 2 fuse.
  (2) Disconnect the I1 VSV for AICV connector.
  (3) Remove the EFI MAIN relay from the engine room R/B.
  (4) Measure the resistance of the wire harness side connectors.
  Standard resistance

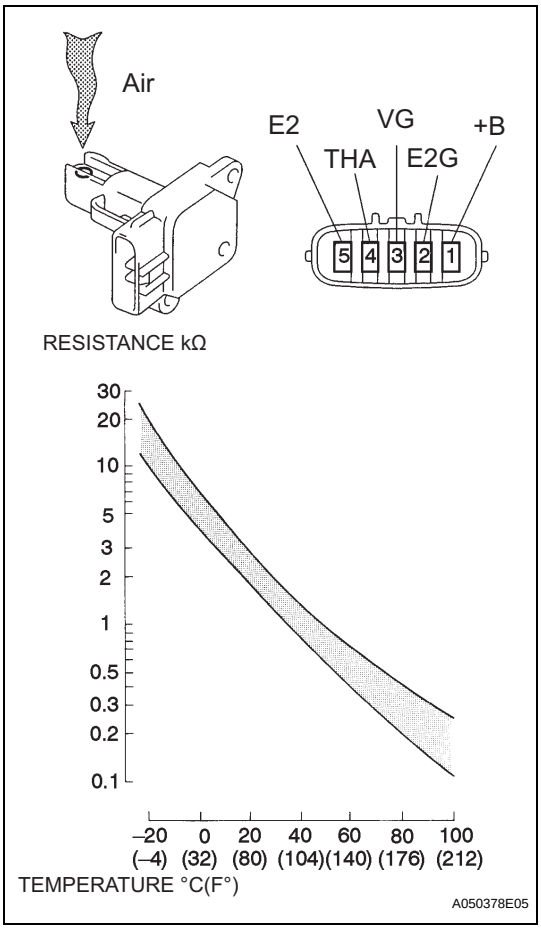
Tester Connection	Specified Condition
I1-2 (VSV for AICV) - EFI MAIN relay terminal 3	Below 1 Ω

(c) Install the EFI MAIN relay.
(d) Reconnect the VSV connector and ECM connector.

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

OK

REPLACE ECM



MASS AIR FLOW METER

INSPECTION

1. INSPECT MASS AIR FLOW METER

(a) Output voltage inspection.

(1) Apply battery voltage across terminals 1 (+B) and 2 (E2G).

(2) Connect the position (+) tester probe to terminal VG, and negative (-) tester probe to terminal E2G.

(3) Blow air into the MAF meter, and check that the voltage output fluctuates.

(b) Resistance inspection.

(1) Using an ohmmeter, measure the resistance between terminals 4 (THA) and 5 (E2).

Resistance

Symbols (Terminal No.)	Resistance	Temperature
THA (4) - E2 (5)	13.6 to 18.4 kΩ	-20°C (-4°F)
	2.21 to 2.69 kΩ	20°C (68°F)
	0.493 to 0.667 kΩ	60°C (140°F)

CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

ON-VEHICLE INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Connect the intelligent tester or OBD II scan tool to the DLC3.

(b) Turn the ignition switch ON.

(c) Start the engine and warm it up.

(d) Connect the intelligent tester and select the VVT from the ACTIVE TEST menu.

(e) Check the engine speed when the OCV is operated by the intelligent tester.

Standard:

VVT system is OFF (OCV is OFF):

Normal engine speed

VVT system is ON (OCV is ON):

Rough idle or engine stalled

INSPECTION

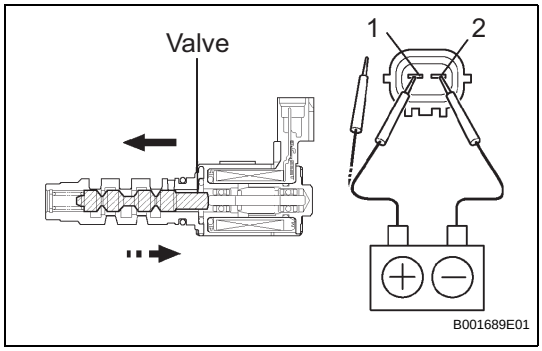
1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Resistance inspection.

(1) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

6.9 to 7.9 Ω at 20°C (68°F)



(b) Movement inspection.

(1) Connect the positive (+) lead from the battery to terminal 1 and negative (-) lead to terminal 2, and check the movement of the valve.

NOTICE:

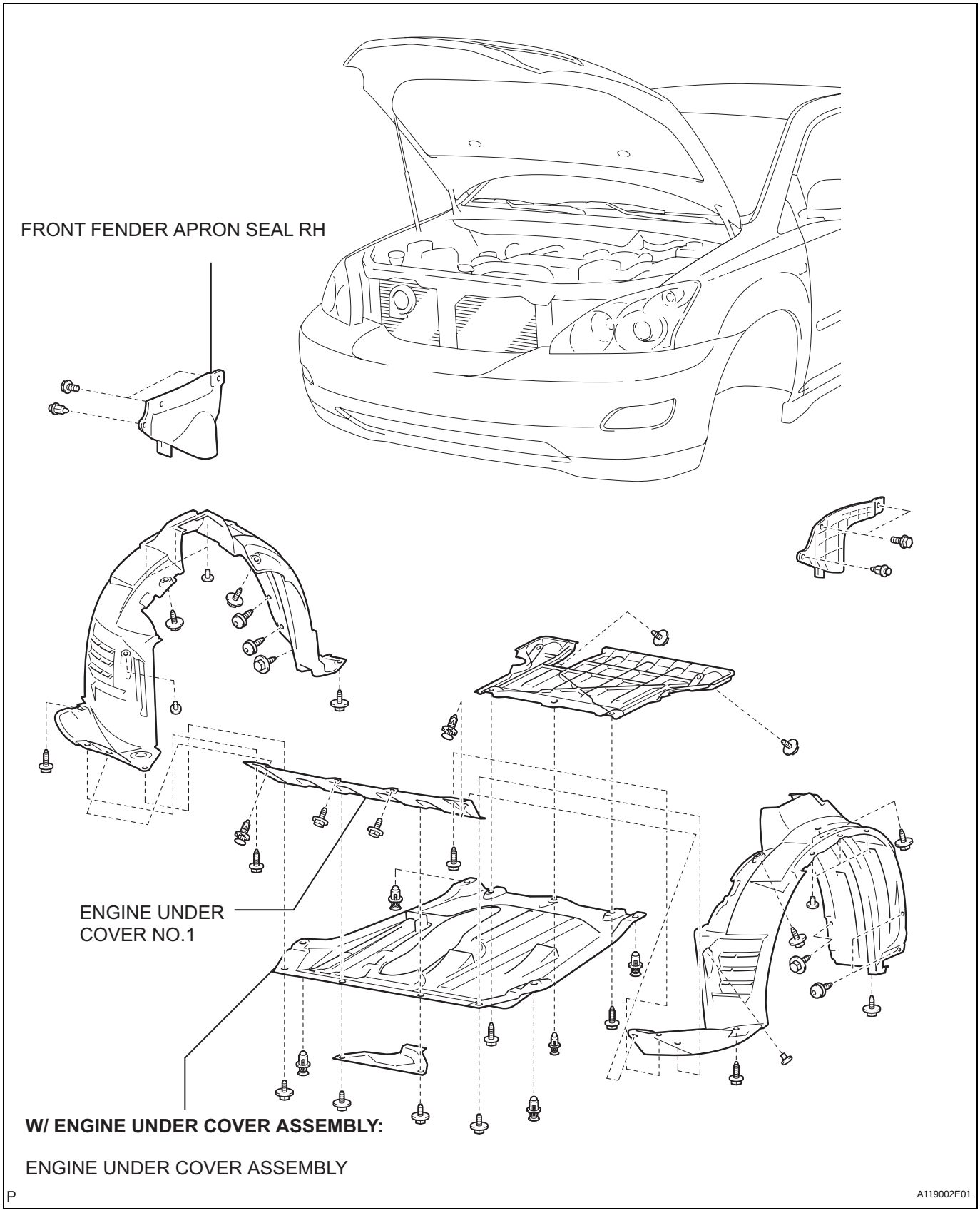
Confirm the valve moves freely and does not stick in any position.

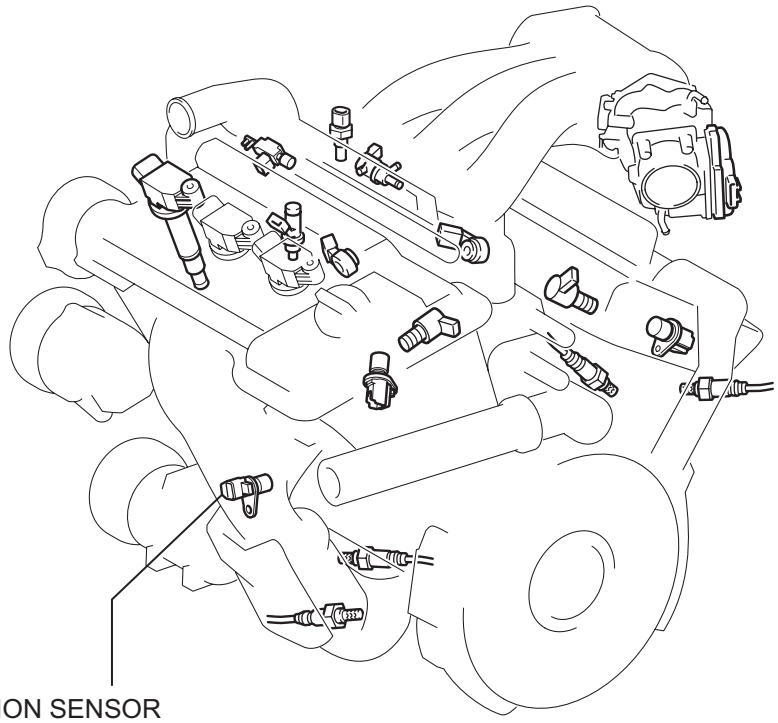
HINT:

Bad returning of the valve by catching foreign objects causes subtle pressure leak. The subtle pressure leaks will cause the cam to advance, and this condition will set a DTC.

CRANKSHAFT POSITION SENSOR

COMPONENTS





CRANKSHAFT POSITION SENSOR

Y

A118988E02

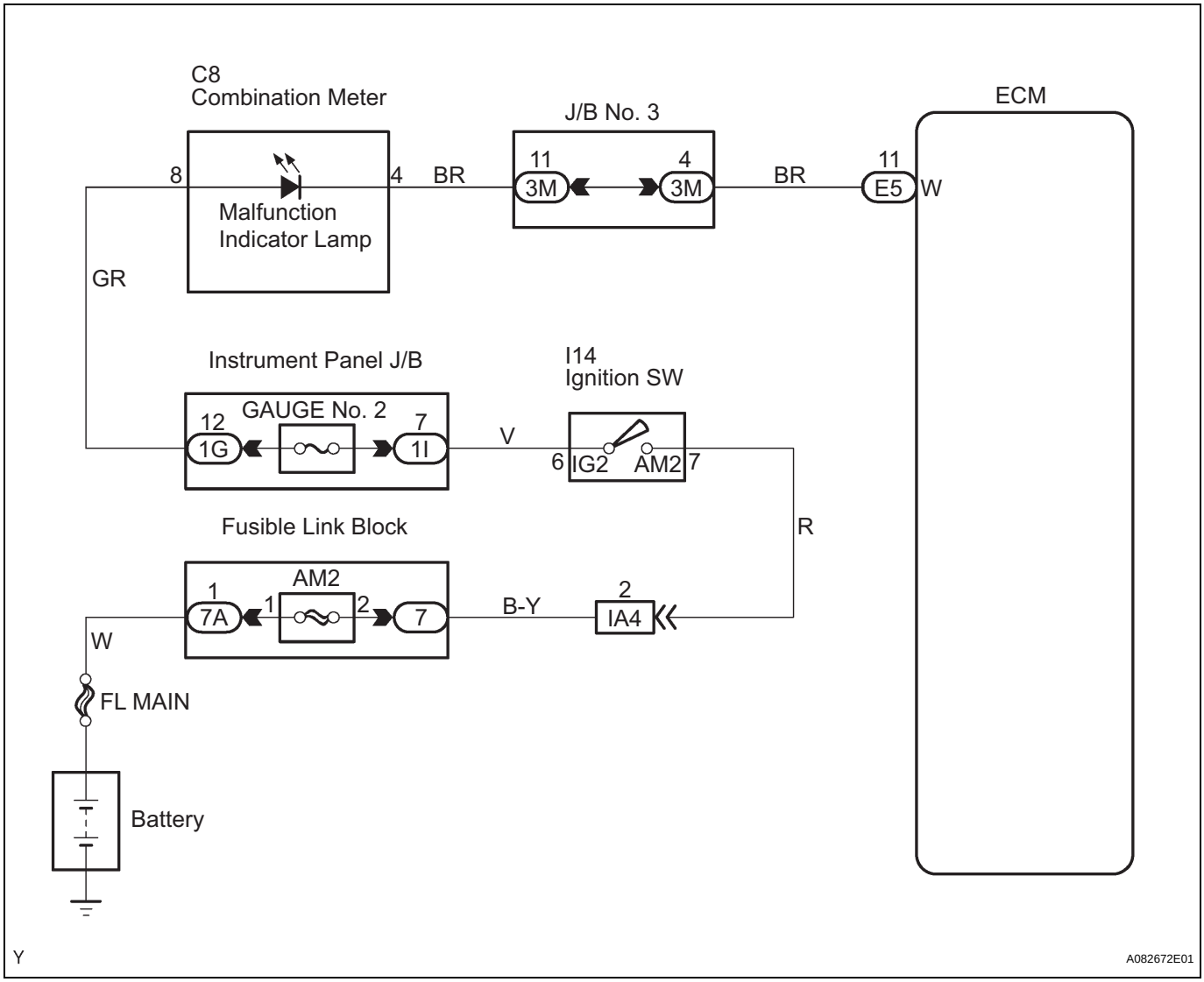
MIL Circuit

DESCRIPTION

The MIL is used to indicate the ECM's detection of a vehicle malfunction.
The instrument panel GAUGE fuse provides the circuit power and the ECM provides the circuit ground that illuminates the MIL.
MIL operations should be checked visually:
The MIL should be illuminated when the ignition switch is first turned ON. If the MIL is always ON or OFF, use the intelligent tester or OBD II scan tool and follow the procedures below to determine the cause of the problem.

WIRING DIAGRAM

ES



HINT:
Troubleshoot each problem symptom in accordance with the chart below.

MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

1	CLEAR DTC

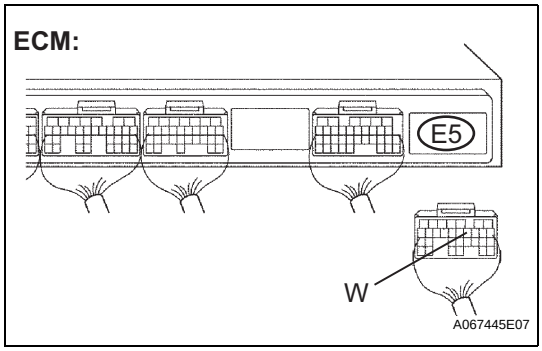
(a) Connect the intelligent tester or OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester or the OBD II scan tool main switch ON.
(c) Read the DTC.
(d) Clear the DTC (See page ES-28).
(e) Check that the MIL is not illuminated.
OK:
MIL is not illuminated.

ES

OK → **REPAIR CIRCUIT INDICATED BY OUTPUT DTC**

NG

2	CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E5 ECM connector.
(b) Turn the ignition switch ON.
(c) Check that the MIL is not illuminated.
OK:
MIL is not illuminated.

OK → **REPLACE ECM**

NG

CHECK AND REPAIR HARNESS AND CONNECTOR (COMBINATION METER - ECM)

3	CHECK THAT MIL IS ILLUMINATED

(a) Check that the MIL is illuminated when turning the engine switch ON.
Standard:
MIL is illuminated.

OK → **SYSTEM OK**

NG

4	INSPECT COMBINATION METER (MIL CIRCUIT)

(a) See the combination meter troubleshooting (See page ME-5).

NG → REPAIR OR REPLACE BULB OR COMBINATION METER

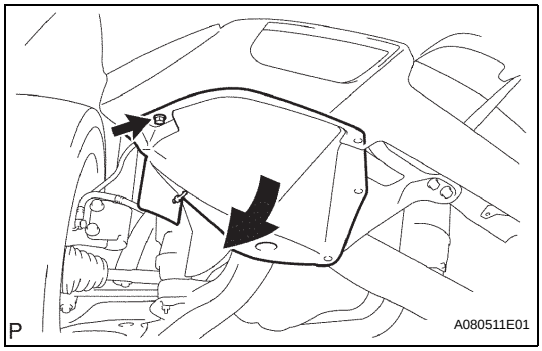
OK

CHECK AND REPLACE HARNESS AND CONNECTOR (COMBINATION METER - ECM)

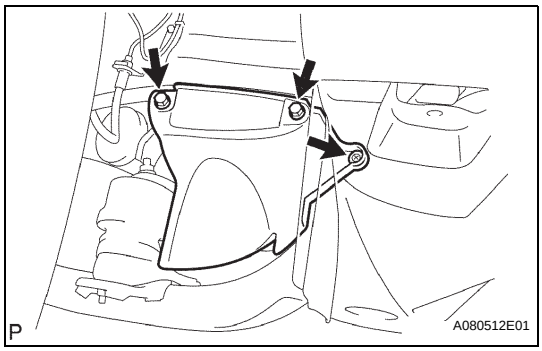
ES

REMOVAL

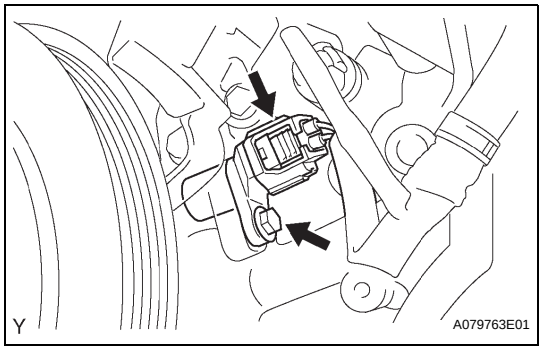
1. **REMOVE ENGINE UNDER COVER ASSEMBLY (See page EX-3)**
2. **REMOVE ENGINE UNDER COVER NO.1 (See page EX-3)**
3. **REMOVE FRONT FENDER APRON SEAL RH**
   (a) Remove the screw, and then open the front fender liner.



   (b) Remove the clip and 2 bolts, and then remove the front fender apron seal.



4. **REMOVE CRANKSHAFT POSITION SENSOR**
   (a) Disconnect the crankshaft position sensor connector.
   (b) Remove the bolt, and then remove the crankshaft position sensor.



INSPECTION

1. INSPECT CRANKSHAFT POSITION SENSOR

(a) Using an ohmmeter, measure the resistance between the terminals.

Resistance:

Cold:

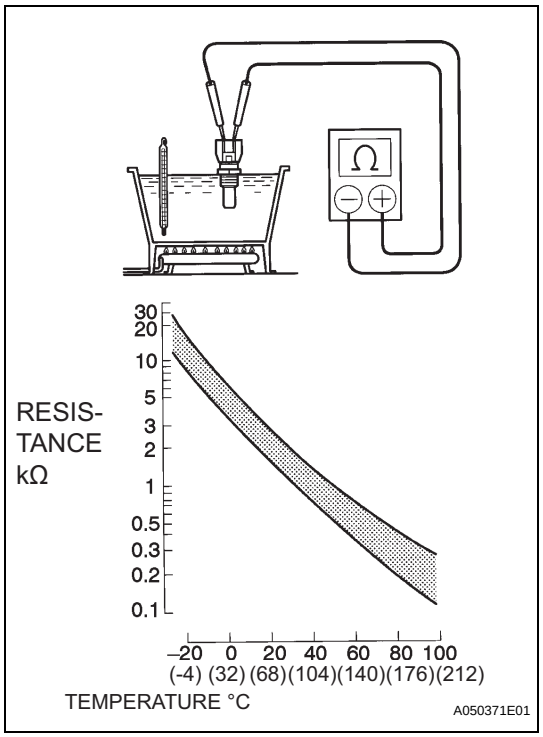
1,630 to 2,740 Ω

Hot:

2,065 to 3,225 Ω

NOTICE:

- **"Cold" and "Hot" mean the temperature of the coils themselves.**
- **"Cold" is from -10°C (14°F) to 50°C (122°F) and "Hot" is from 50°C (122°F) to 100°C (212°F).**



ENGINE COOLANT TEMPERATURE SENSOR

INSPECTION

1. INSPECT E.F.I. ENGINE COOLANT TEMPERATURE SENSOR

(a) Resistance inspection.

(1) Using an ohmmeter, measure the resistance between each terminals.

Resistance:

Approx. 20°C (68°F):

2.32 to 2.59 kΩ

Approx. 80°C (176°F):

0.310 to 0.326 kΩ

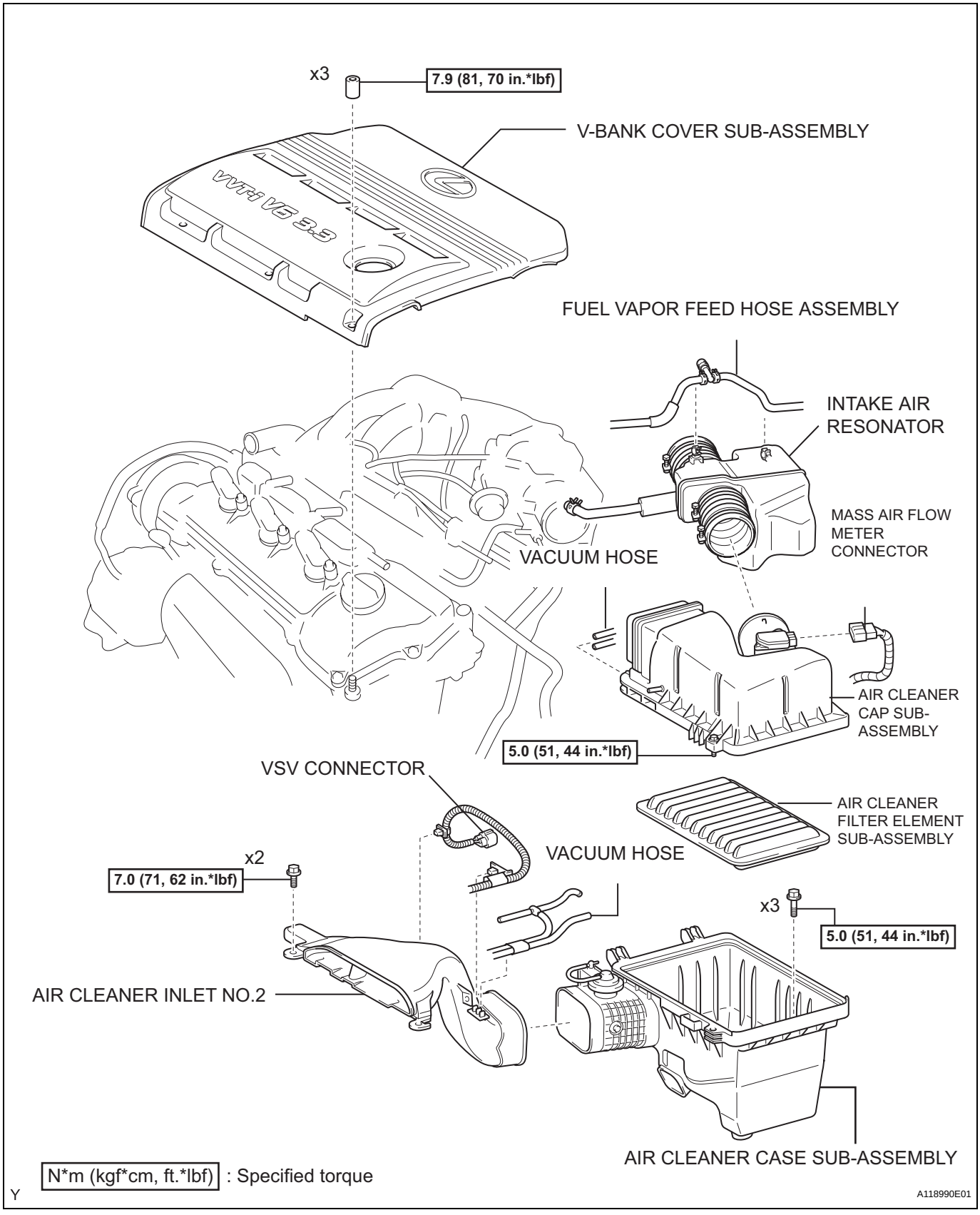
NOTICE:

In case of checking the water temperature sensor in the water, be careful not to allow water to go into the terminals, and after checking, dry the sensor.

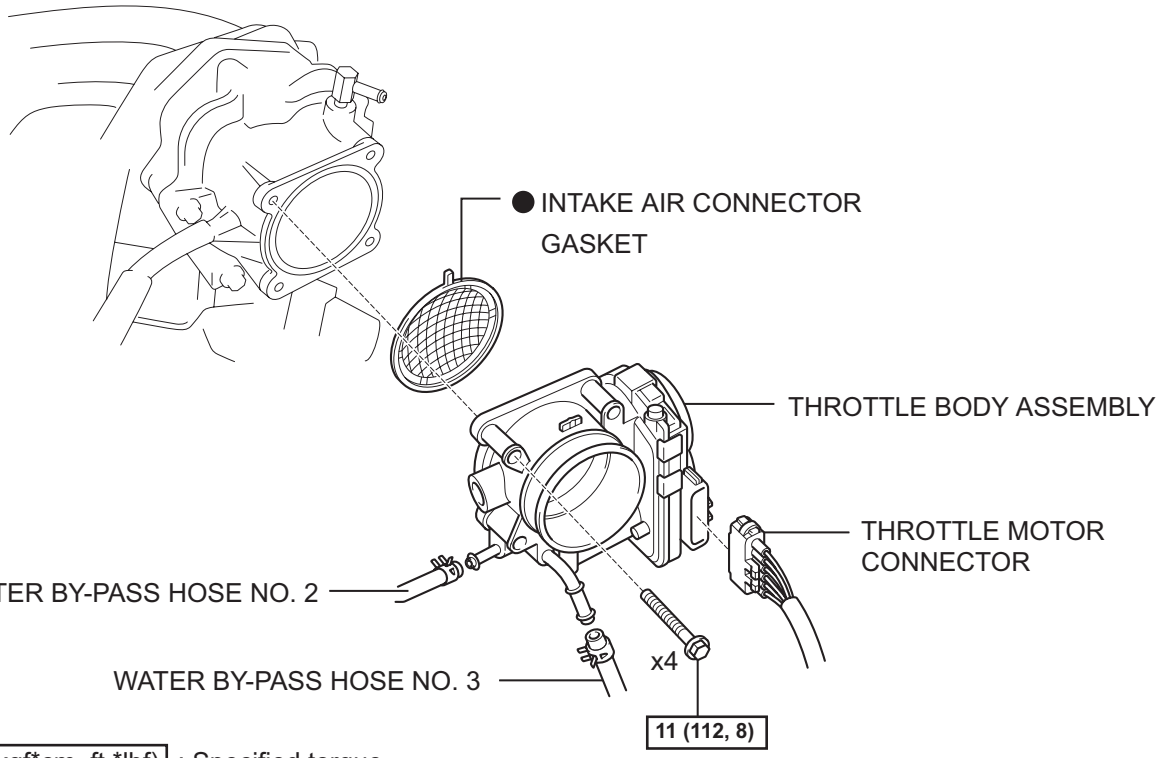
ES

THROTTLE BODY

COMPONENTS



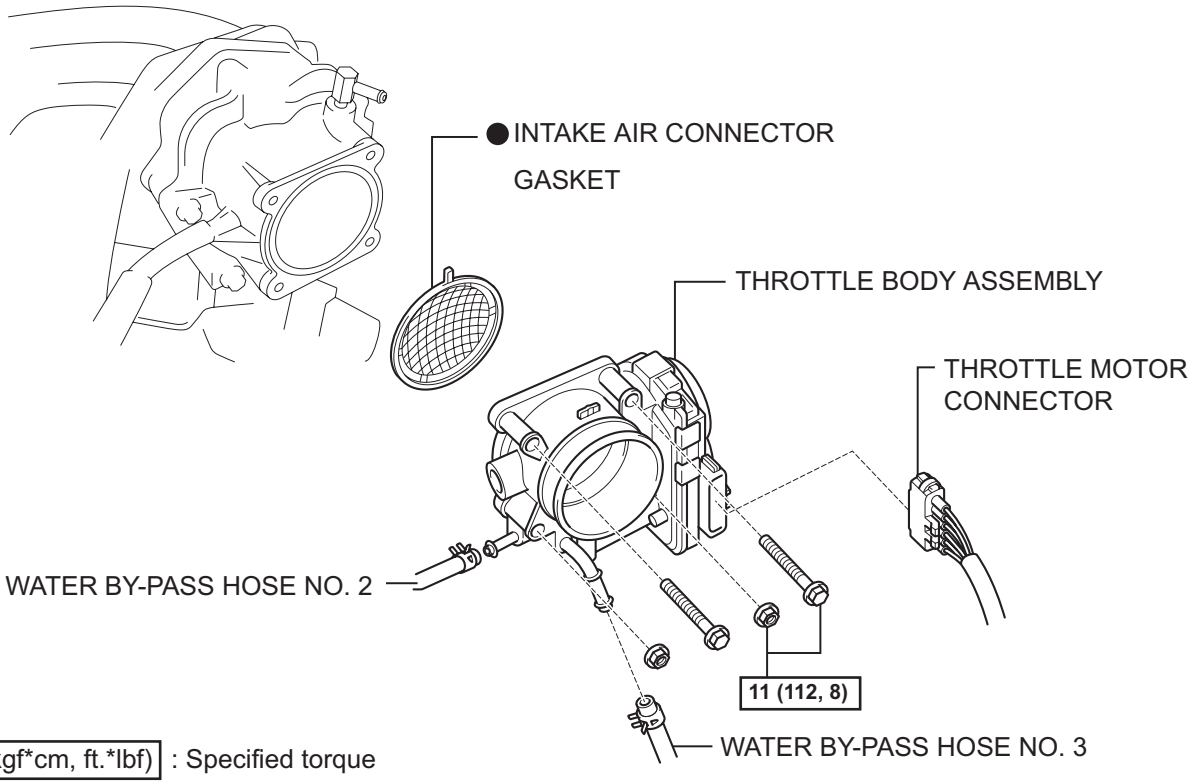
TMC MADE:



N*m (kgf*cm, ft.*lbf) : Specified torque

C ● Non-reusable part

A118991E01



N*m (kgf*cm, ft.*lbf) : Specified torque

C ● Non-reusable part

A118992E01

ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

(a) Listen to the throttle control motor operating sounds.
  (1) Turn the ignition switch ON.
  (2) When turning the accelerator pedal position sensor lever, check the running sound of the motor. Also, check that there is no friction noise.

(b) Inspect the throttle position sensor.
  (1) Connect the intelligent tester or OBD II scan tool to the DLC3.
  (2) Turn the ignition switch ON.
  (3) Check that the MIL is off.
  (4) Check that the throttle valve opening percentage (THROTTLE POS) in the DATA LIST shows the standard value.

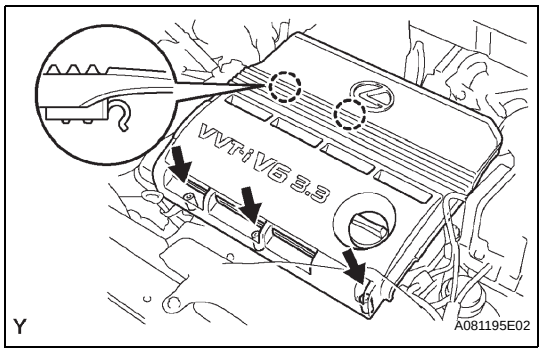
Standard throttle valve opening percentage:
60 % or more

NOTICE:
When checking the standard throttle valve opening percentage, the transmission is in the neutral position.

REMOVAL

1. **DRAIN ENGINE COOLANT (See page CO-7)**

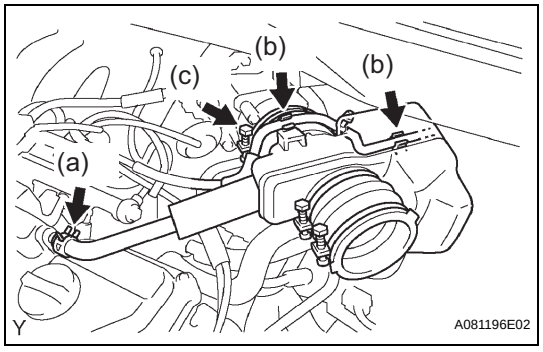
2. **REMOVE V-BANK COVER SUB-ASSEMBLY**
   (a) Using a socket hexagon wrench 5, remove the 3 nuts.
   (b) Remove the V-bank cover.



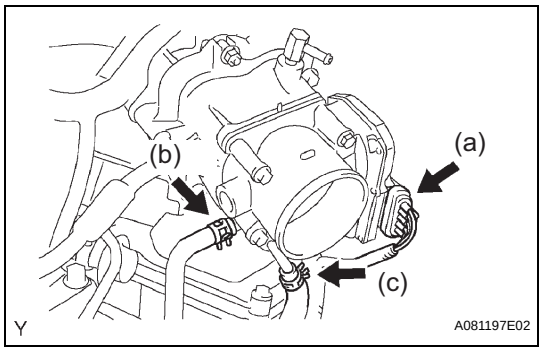
3. **REMOVE AIR CLEANER INLET NO.2 (See page ST-5)**

4. **REMOVE AIR CLEANER ASSEMBLY (See page ST-5)**

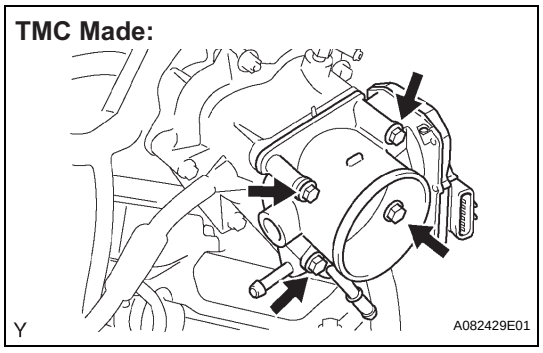
5. **REMOVE INTAKE AIR RESONATOR**
   (a) Remove the ventilation hose No. 2.
   (b) Remove the fuel vapor feed hose from the 2 hose clamps.
   (c) Loosen the are cleaner hose clamp bolt, and then remove the intake air resonator.

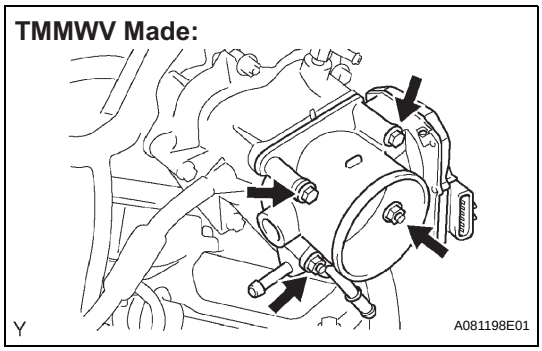


6. **REMOVE THROTTLE BODY ASSEMBLY**
   (a) Disconnect the throttle motor connector.
   (b) Disconnect the water by-pass hose No.2.
   (c) Disconnect the water by-pass hose No.3.

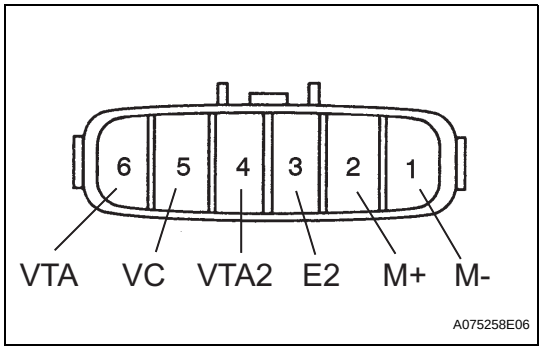


   (d) TMC Made
      (1) Remove the 4 bolts, and then remove the throttle body.





(e) TMMWV Made
  (1) Remove the 2 bolts and 2 nuts, and then remove the throttle body.
(f) Remove the gasket from the intake air connector.



INSPECTION

1. INSPECT THROTTLE BODY ASSEMBLY

(a) Resistance inspection
  (1) Using an ohmmeter, measure the resistance between terminals.
  Resistance

Symbols (terminal No.)	Resistance	Temperature
M+ (2) - M- (1)	0.3 to 100 Ω	20°C (68°F)
VC (5) - E2 (3)	1.2 to 3.2 kΩ	20°C (68°F)

INSTALLATION

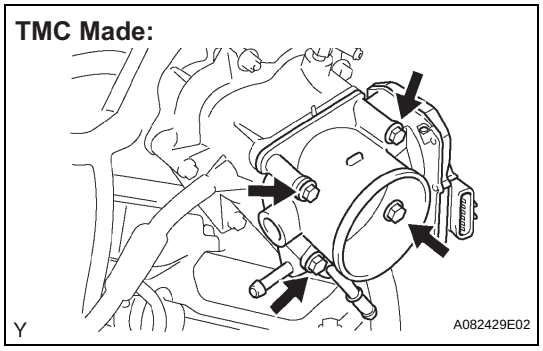
1. INSTALL THROTTLE BODY ASSEMBLY

(a) Install a new gasket to the intake air connector.

(b) TMC Made

(1) Install the throttle body with the 4 bolts.
Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

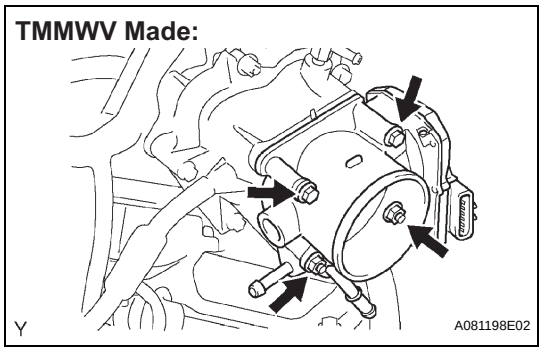
TMC Made:



(c) TMMWV Made

(1) Install the throttle body with the 2 bolts and 2 nuts.
Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

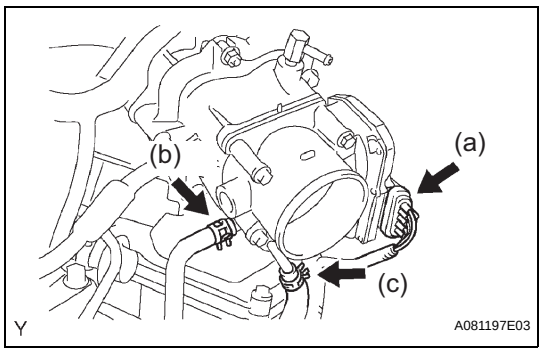
TMMWV Made:



(d) Connect the water by-pass hose No.3.

(e) Connect the water by-pass hose No.2.

(f) Connect the throttle motor connector.



2. INSTALL INTAKE AIR RESONATOR

3. INSTALL AIR CLEANER ASSEMBLY (See page ST-12)

4. INSTALL AIR CLEANER INLET NO.2 (See page ST-12)

5. CHECK CONNECTION OF VACUUM HOSE (See page EM-127)

6. ADD ENGINE COOLANT (See page CO-7)

7. CHECK FOR ENGINE COOLANT LEAKS (See page CO-1)

8. INSTALL V-BANK COVER SUB-ASSEMBLY

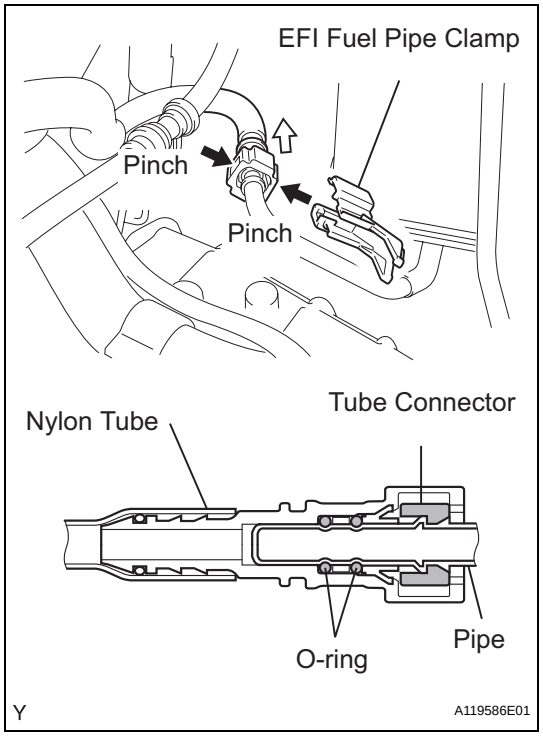
(a) Fit the 2 retainers and install the V-bank cover.

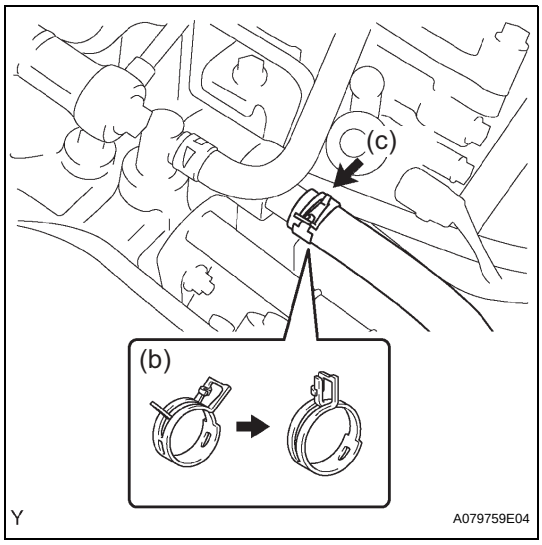
(b) Using a socket hexagon wrench 5, tighten the 3 nuts.
Torque: 7.9 N*m (81 kgf*cm, 70 in.*lbf)

ES

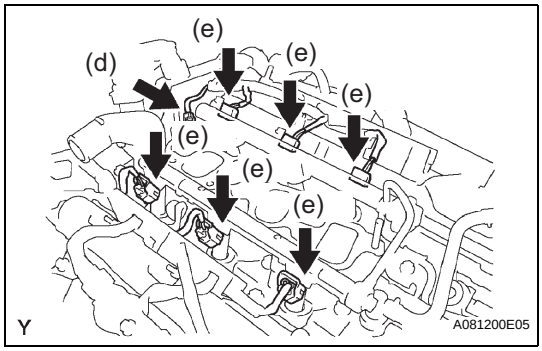
REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE**
   HINT:
   (See page FU-1)
2. **DRAIN ENGINE COOLANT (See page CO-7)**
3. **REMOVE FR WIPER ARM LH (See page WW-37)**
4. **REMOVE FR WIPER ARM RH (See page WW-37)**
5. **REMOVE FRONT FENDER TO COWL SIDE SEAL LH**
6. **REMOVE FRONT FENDER TO COWL SIDE SEAL RH**
7. **REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY (See page WW-37)**
8. **REMOVE WINDSHIELD WIPER LINK ASSEMBLY (See page WW-37)**
9. **REMOVE COWL TOP PANEL SUB-ASSEMBLY OUTER (See page FU-10)**
10. **REMOVE V-BANK COVER SUB-ASSEMBLY (See page ES-372)**
11. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY (See page FU-10)**
12. **REMOVE EMISSION CONTROL VALVE SET (See page FU-11)**
13. **REMOVE INTAKE AIR SURGE TANK (See page FU-11)**
14. **REMOVE INTAKE MANIFOLD**
    (a) Disconnect the fuel pipe No. 1.
    (1) Remove the EFI fuel pipe clamp.
    (2) Pinch the tube connector and then pull out the fuel pipe No. 1.
    NOTICE:
    - **Check if there is any dirt or mud around the connector before this operation and remove the dirt as necessary.**
    - **Be careful of mud because the quick connector has an O-ring which seals the pipe and connector that can be contaminated.**
    - **Do not use any tool in this operation.**
    - **Do not bend or twist the nylon tube. Protect the connector by covering it with a vinyl or plastic bag.**
    - **When the pipe and the connector are stuck, push and pull the connector to release and pull the connector out carefully.**

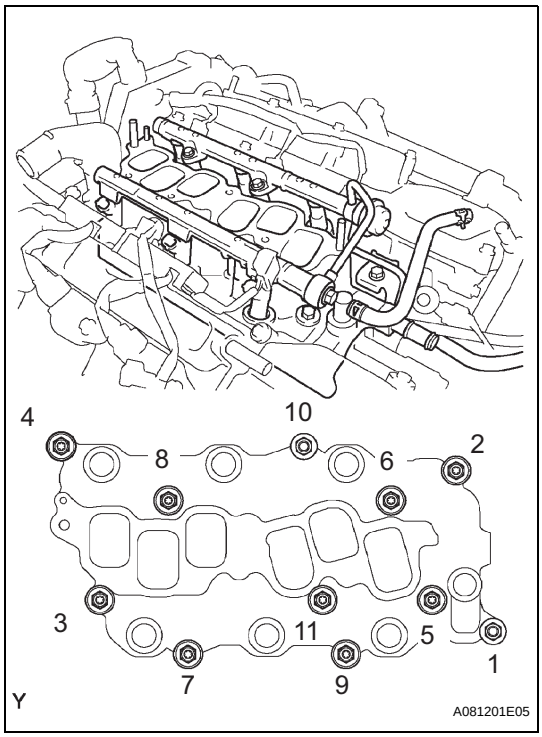




(b) Lock the hose clamp as shown in the illustration.
(c) Disconnect the heater inlet water hose.

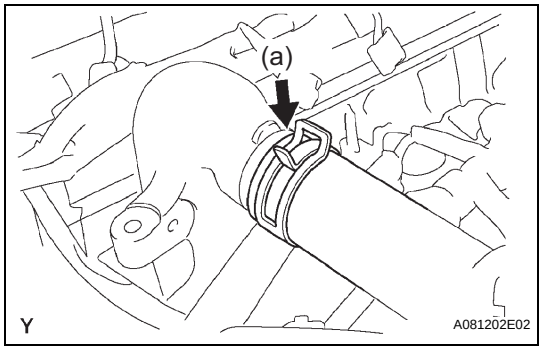


(d) Remove the nut and disconnect the ground cable.
(e) Disconnect the 6 fuel injector connectors.



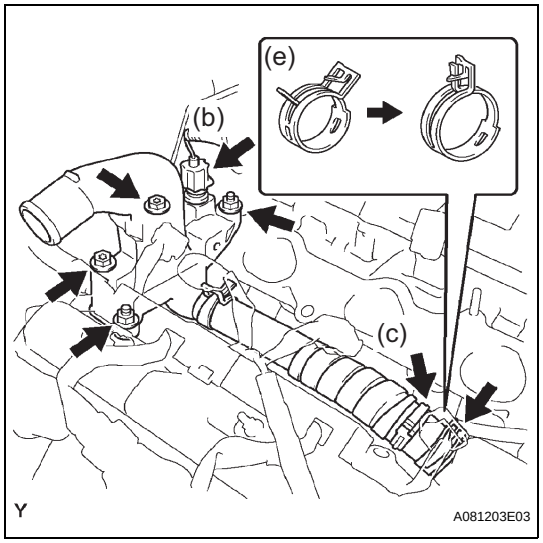
(f) In order to remove the intake manifold, using several steps, remove the 9 bolts and 2 nuts in the sequence shown in the illustration.

15. REMOVE ENGINE MOVING CONTROL ROD (See page EM-22)

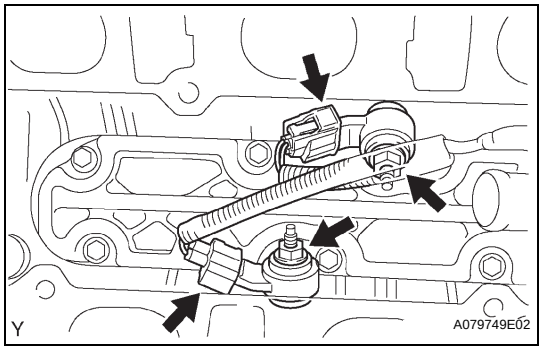


16. REMOVE WATER OUTLET

(a) Disconnect the radiator hose inlet.

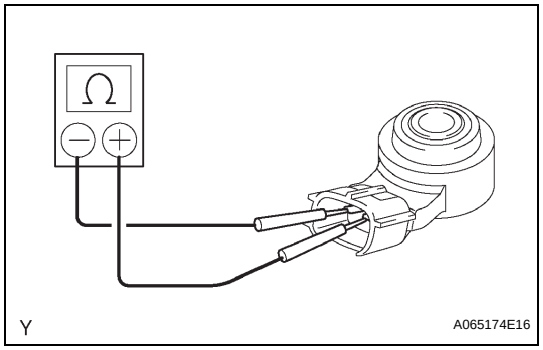


(b) Disconnect the engine coolant temperature sensor connector.
(c) Remove the clamp.
(d) Remove the 2 bolts, 2 nuts and 2 washers.
(e) Lock the hose clamp as shown in the illustration and remove the water outlet together with water by-pass hose No. 1.
(f) Remove the 2 gaskets from the 2 cylinder heads.



17. REMOVE KNOCK SENSOR

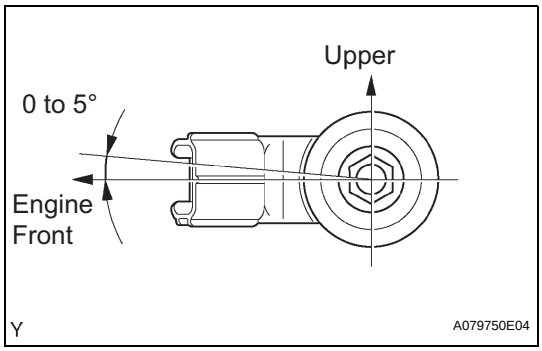
(a) Disconnect the 2 knock sensor connectors.
(b) Remove the 2 nuts, and then remove the 2 knock sensors.



INSPECTION

1. INSPECT KNOCK SENSOR

(a) Continuity inspection.
  (1) Using an ohmmeter, measure the resistance between the terminals.
  Resistance:
  120 to 280 kΩ at 20°C (68°F)
  HINT:
  If the resistance is not specified, replace the sensor.



INSTALLATION

1. INSTALL KNOCK SENSOR

(a) Install the 2 knock sensors with the 2 nuts as shown in the illustration.
Torque: 20 N*m (199 kgf*cm, 14 ft.*lbf)

(b) Connect the 2 knock sensor connectors.

2. INSTALL WATER OUTLET

(a) Install 2 new gaskets to the 2 cylinder heads.

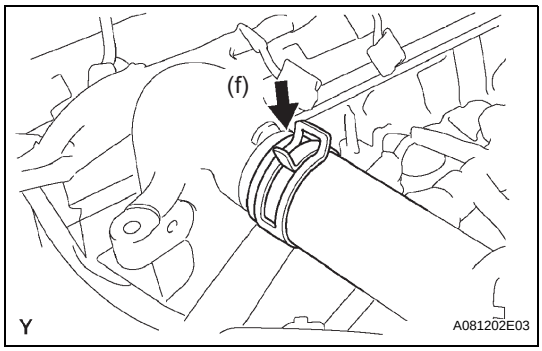
(b) Install the water outlet together with water by-pass hose No. 1 and unlock the hose clamp.

(c) Tighten the 2 bolts, 2 nuts and 2 washers.
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

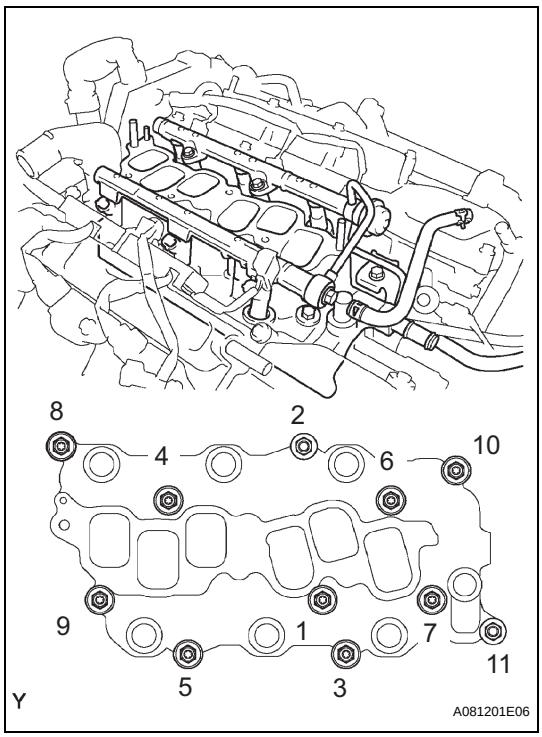
(d) Install the clamp.

(e) Connect the engine coolant temperature sensor connector.

(f) Connect the radiator hose inlet.



3. INSTALL ENGINE MOVING CONTROL ROD (See page EM-29)



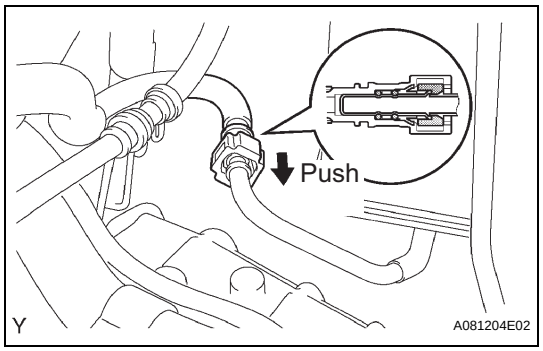
4. INSTALL INTAKE MANIFOLD

(a) Install the intake manifold with the 9 bolts, 2 nuts and 2 washers. Using several steps, tighten the bolts and nuts uniformly in the sequence shown in the illustration.
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

(b) Retighten the water outlet mounting bolts and nuts.
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

(c) Install the ground cable with the nut.
Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)

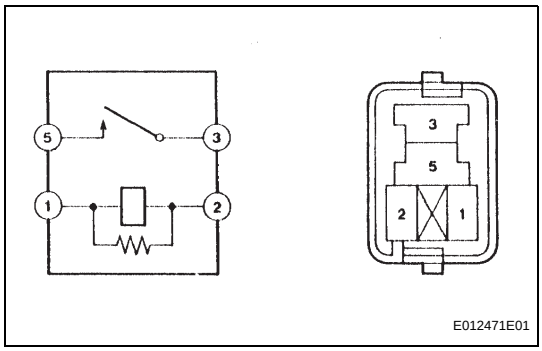
(d) Connect the heater inlet water hose.



(e) Connect the fuel pipe No. 1.
(1) Push in the quick connector to the pipe until it makes "click" sound.
NOTICE:
- **Check if there is any damage or foreign objects on the connected part.**
- **After connecting, check if the connector and pipe are securely connected by pulling them.**

(2) Install the EFI fuel pipe clamp.

5. **INSTALL INTAKE AIR SURGE TANK (See page FU-15)**
6. **INSTALL EMISSION CONTROL VALVE SET (See page FU-16)**
7. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See page FU-16)**
8. **CHECK CONNECTION OF VACUUM HOSE (See page EM-127)**
9. **ADD ENGINE COOLANT (See page CO-7)**
10. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-1)**
11. **CHECK FOR FUEL LEAKS (See page FU-4)**
12. **INSTALL V-BANK COVER SUB-ASSEMBLY (See page ES-374)**
13. **INSTALL COWL TOP PANEL SUB-ASSEMBLY OUTER (See page FU-16)**
14. **INSTALL WINDSHIELD WIPER LINK ASSEMBLY (See page WW-38)**
15. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY**
16. **INSTALL FRONT FENDER TO COWL SIDE SEAL RH**
17. **INSTALL FRONT FENDER TO COWL SIDE SEAL LH**
18. **INSTALL FR WIPER ARM RH (See page WW-40)**
19. **INSTALL FR WIPER ARM LH (See page WW-39)**



EFI RELAY

INSPECTION

1. INSPECT EFI RELAY

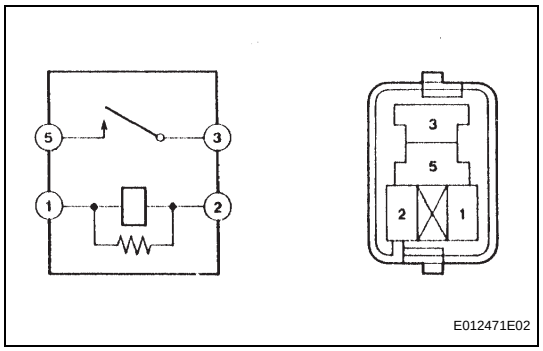
(a) Continuity inspection.

(1) Using an ohmmeter, check for resistance between the terminals.

Resistance

Terminals	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage terminals 1 and 2)

ES



CIRCUIT OPENING RELAY

INSPECTION

1. INSPECT CIRCUIT OPENING RELAY

(a) Continuity inspection.

(1) Using an ohmmeter, check for resistance between the terminals.

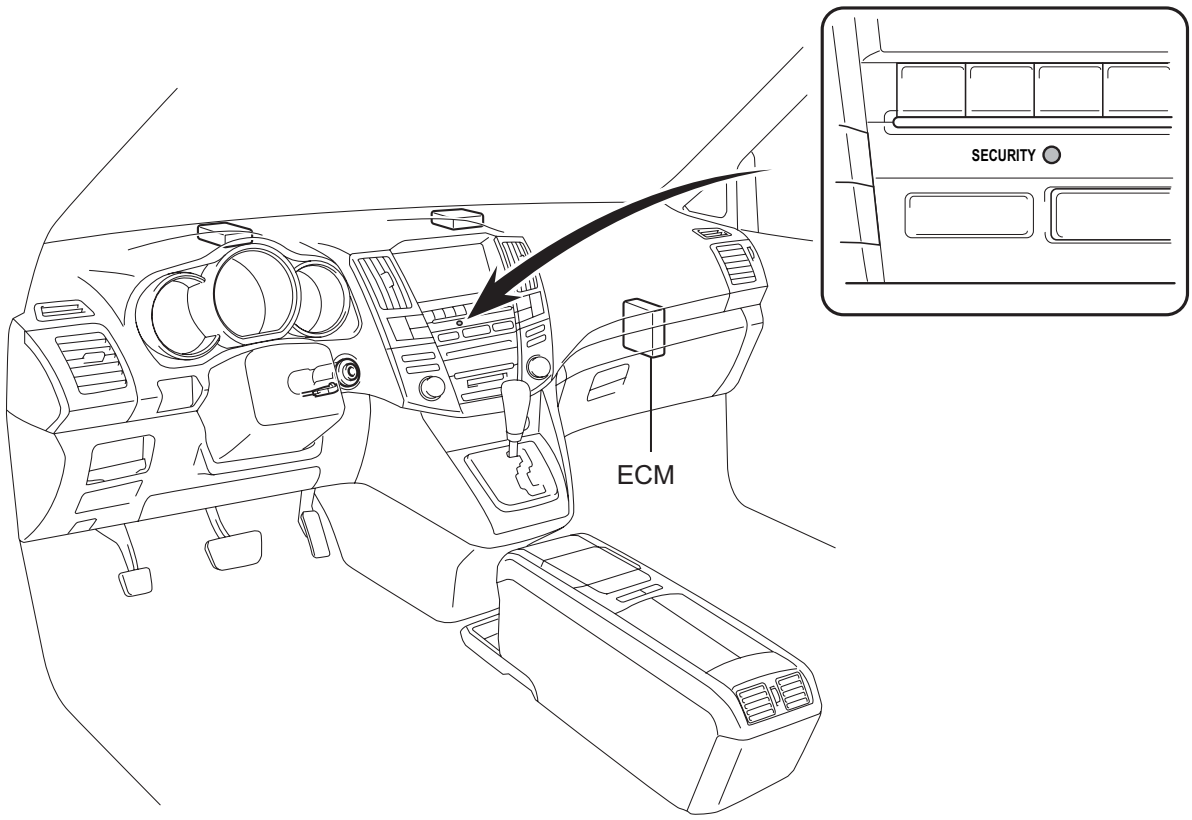
Resistance

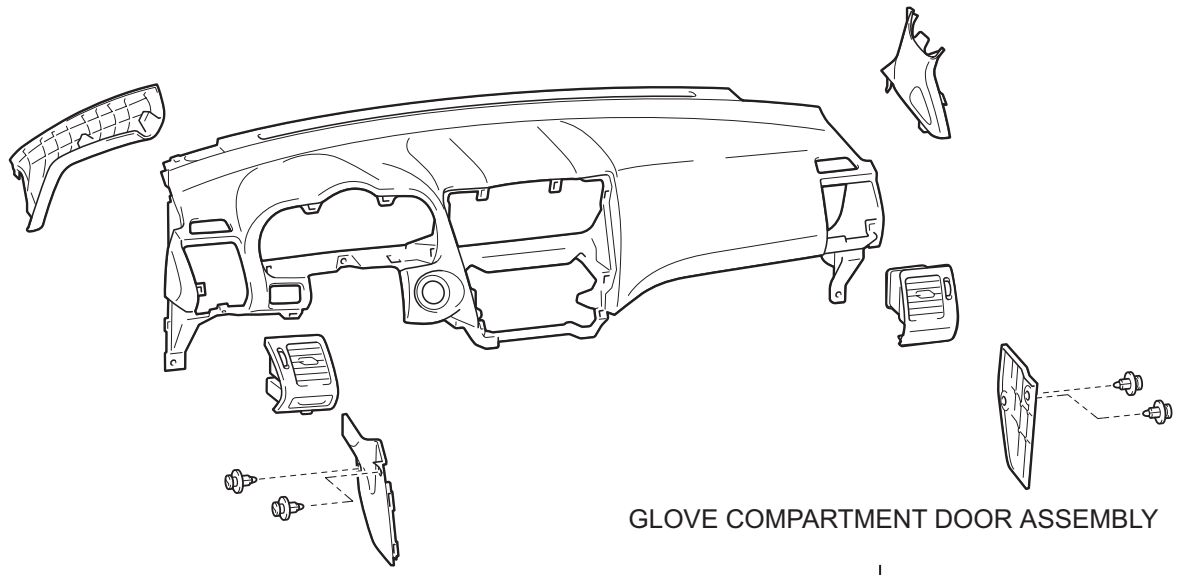
Terminals	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (Apply battery voltage terminals 1 and 2)

ES

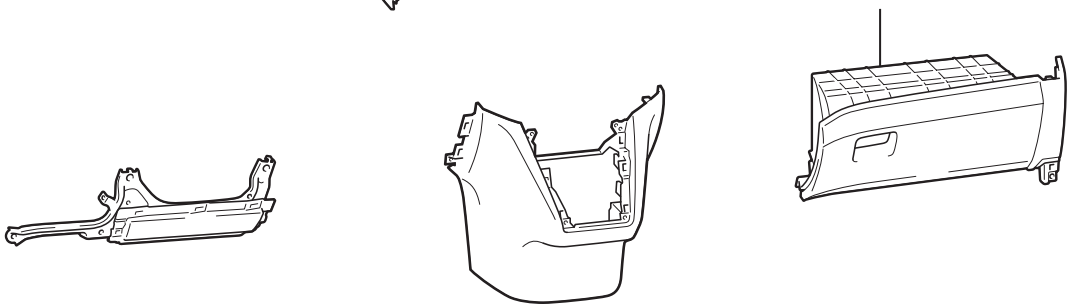
ECM

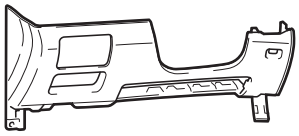
COMPONENTS

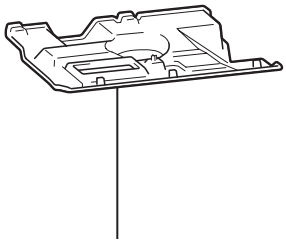




GLOVE COMPARTMENT DOOR ASSEMBLY







INSTRUMENT PANEL UNDER COVER SUB-ASSEMBLY NO.2

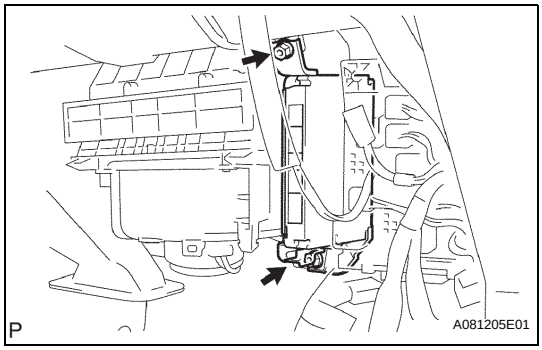
P

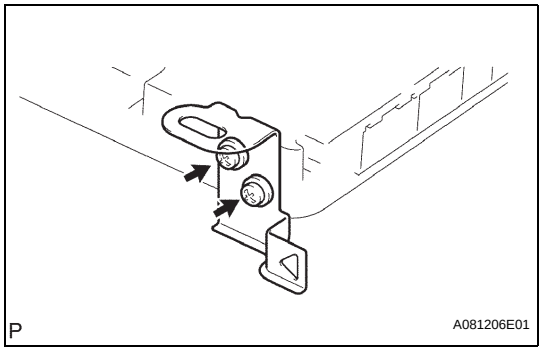
B115086E01

ES

REMOVAL

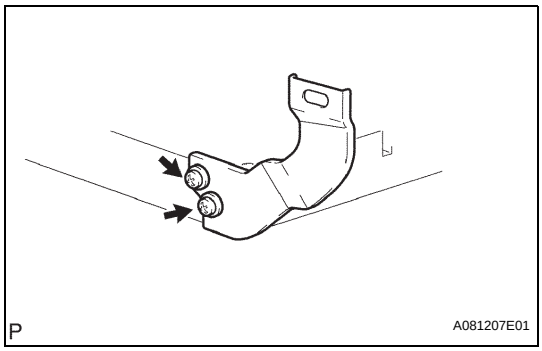
1. **REMOVE FRONT DOOR SCUFF PLATE RH (See page IR-6)**
2. **REMOVE INSTRUMENT PANEL UNDER COVER SUB-ASSEMBLY NO.2 (See page IP-13)**
3. **REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-13)**
4. **REMOVE ECM**
   (a) Remove the 2 wire harness clamps.
   (b) Disconnect the 5 ECM connectors.
   (c) Remove the 2 nuts, and then remove the ECM.



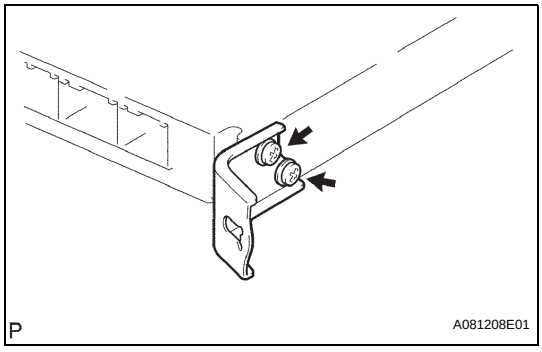


   (d) Remove the 2 screws, and then remove the wire harness clamp bracket.

5. **REMOVE ECM BRACKET**
   (a) Remove the 2 screws, and then remove the ECM bracket.



6. **REMOVE ECM BRACKET NO.2**
   (a) Remove the 2 screws, and then remove the ECM bracket.



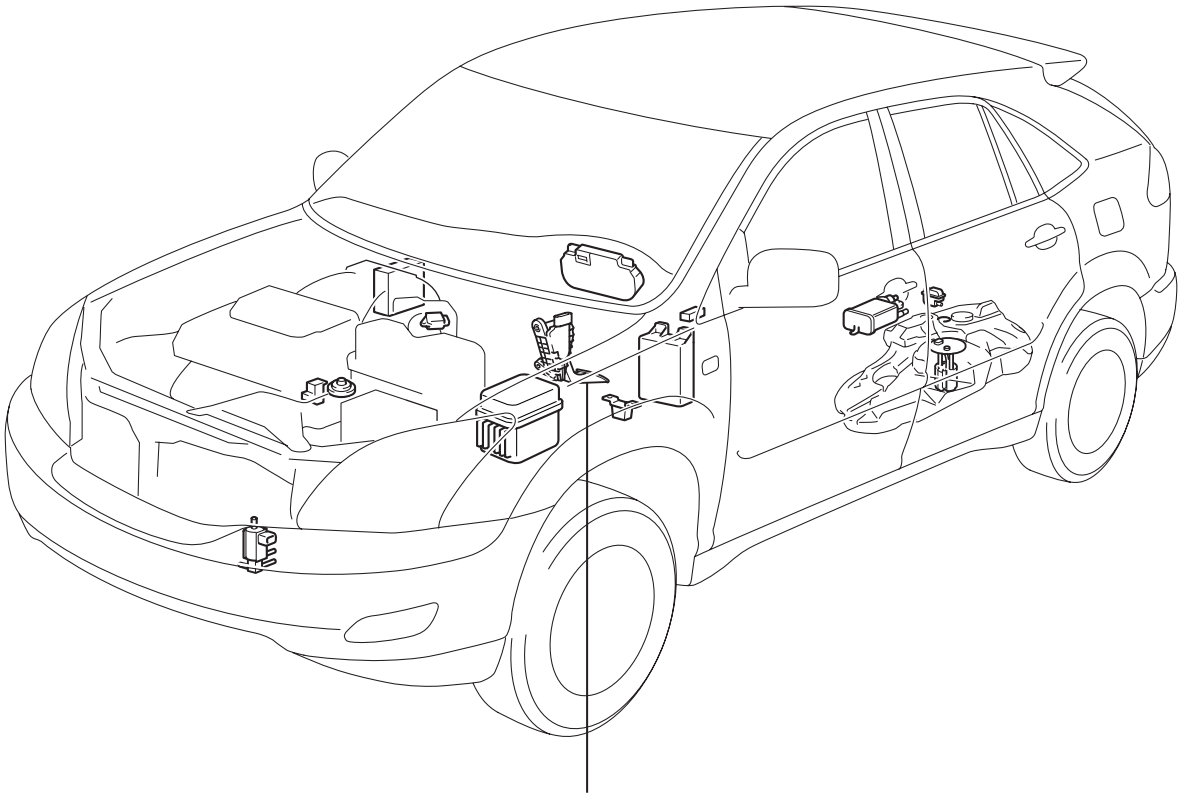
INSTALLATION

1. **INSTALL ECM BRACKET NO.2**
2. **INSTALL ECM BRACKET**
3. **INSTALL ECM**
   Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)
4. **INSTALL GLOVE COMPARTMENT DOOR ASSEMBLY**
5. **INSTALL INSTRUMENT PANEL UNDER COVER SUB-ASSEMBLY NO.2**
6. **INSTALL FRONT DOOR SCUFF PLATE RH**

ACCELERATOR PEDAL ROD

COMPONENTS

ES



ACCELERATOR PEDAL ROD ASSEMBLY

(ACCELERATOR PEDAL POSITION SENSOR)

Y

A118987E02

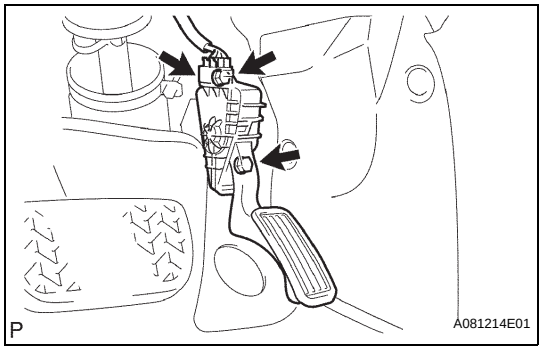
ON-VEHICLE INSPECTION

1. INSPECT ACCELERATOR PEDAL POSITION SENSOR

(a) After turning the ignition switch ON, check that the voltage of the throttle position sensor of the CURRENT DATA is within the standard value.

Standard voltage:

0.6 to 1.0 V

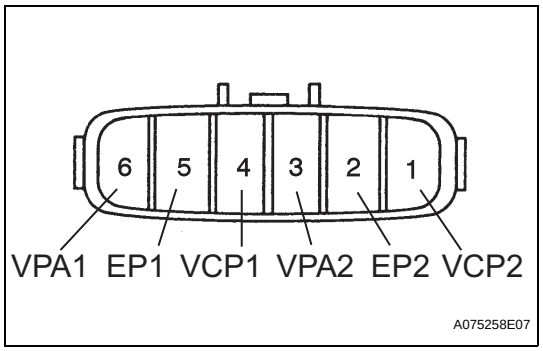


REMOVAL

1. REMOVE ACCELERATOR PEDAL ROD ASSEMBLY

(a) Disconnect the accelerator position sensor connector.

(b) Remove the 2 bolts, and then remove the accelerator pedal rod.



INSPECTION

1. INSPECT ACCELERATOR PEDAL ROD ASSEMBLY

(a) Resistance inspection

(1) Using an ohmmeter, measure the resistance between the terminals.

Resistance

Symbols (Terminal No.)	Resistance
VPA2 (3) - EP1 (5)	5.0 kΩ or less
VPA1 (6) - EP2 (2)	5.0 kΩ or less
VCP1 (4) - EP1 (5)	2.25 to 4.75 kΩ
VCP2 (1) - EP2 (2)	2.25 to 4.75 kΩ

INSTALLATION

1. INSTALL ACCELERATOR PEDAL ROD ASSEMBLY
Torque: 4.9 N*m (50 kgf*cm, 43 in.*lbf)